ArevaEPRDCPEm Resource

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Sent: Wednesday, August 25, 2010 3:20 PM
To: Tesfaye, Getachew
Cc: KOWALSKI David (AREVA)
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 417 Q.09.02.02-120 R3.pdf; DRAFT RESPONSE RAI 406 Q.09.02.02-114 R5.pdf; DRAFT RESPONSE RAI 406 Q.09.02.02-112 R8.pdf

Importance: High

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From: KOWALSKI David (RS/NB)
Sent: Wednesday, August 25, 2010 1:02 PM
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Cc: BALLARD Bob (EP/PE); CONNELL Kevin (EP/PP); HUDDLESTON Stephen (EP/PE); BROUGHTON Ronnie (EP/PE); GARDNER Darrell (RS/NB); SLOAN Sandra (RS/NB); MCINTYRE Brian (RS/NB)
Subject: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Importance: High

Marty:

Please transmit to Getachew Tesfaye the attached partial set of DRAFT responses to RAI 406 and 417 questions. Responses to these questions were shared with the NRC reviewers during Tuesday's (8/24/10) FSAR Chapter 9 Weekly Telecon. The attached responses reflect comments made by the technical reviewers. Absent a Thursday telecon with the NRC, the reviewers requested that AREVA provide an updated response to these questions so that the responses could be approved for FINAL submittal rather than waiting until the next scheduled telecon (8/31/10).

Attached are the following DRAFT response(s):

- Response to RAI 406 - Question 09.02.02-112.
- Response to RAI 406 - Question 09.02.02-114.
- Response to RAI 417 - Question 09.02.02-120.

Note that these DRAFT responses have not been through the final Licensing review/approval process; nor do they reflect technical editing.

Please call me if you have any questions. Thanks.

David J. Kowalski, P.E.
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Request for Additional Information No. 417(4741), Revision 0

6/8/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
Application Section: 9.2.2

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

09.02.02-120

Follow-up to RAI 334, Question 9.2.2-75 and RAI 174, Question 9.2.2-29:

Part (c)- In Part (c) of follow-up RAI 9.2.2-75 to RAI 9.2.2-29 the staff asked the applicant to add a discussion to FSAR Tier 2 Section 9.2.2 relative to the intended use of common header manual isolation valves (e.g. 20/30KAA30 AA013 and AA014 for 1b and 2b common header). The staff also requested the applicant to include a discussion in the RAI response of potential Technical Specifications that may apply if these valves must be closed during power operation. In response to RAI 334 Supplement 1, the applicant stated that these valves were provided only for maintenance isolation purpose to provide the capability for isolation of a common headers (1b or 2b) while still maintaining flow to the Safety Chilled Water System (SCWS).

However, the staff review noted that the applicant's response did not address the potential applicability of Technical Specifications (TS) when the valves are closed (e.g. note A-1 of TS 3.7.7) and no FSAR text markup of Section 9.2.2 was included. The staff noted that closure of these valves would prevent automatic train switchover of the 1b or 2b headers to the opposite pump and the plant would then be forced to shutdown since the 1b or 2b header would be isolated to the reactor coolant pumps for two pumps. Accordingly, the staff considers the capability provided by these valves of sufficient importance to warrant a description in the FSAR Tier 2 Section 9.2.2. The staff also requests that the applicant explain what is meant by the portion of the response that states "This configuration confirms the availability of the safety chillers during normal plant operation when only two CCWS trains are operating."

In summary, the applicant should address the following:

a. The applicant should address the meaning of: "This configuration confirms the availability of the safety chillers during normal plant operation when only two CCWS trains are operating."
b. Since credit is taken for these manual valves to isolate either the 1b or 2b header and provide CCWS flow to the SCWS to maintain operability, this should be discussed in the FSAR in Section 9.2.2.
c. For manual valves 20/30KAA30 AA013 and AA014 for the 1b and 2b common headers, which are required to be manually closed (for example, during maintenance conditions) to maintain system operability, testing should be included that these valves are able to be closed and provide proper isolation.

d. The applicant should include a discussion of potential Technical Specifications that may apply if these valves must be closed in the applicable TS modes.
e. The applicant should explain (from RAI 9.2.2-29) the equalizing of runtimes of each CCWS pumpby the closing of these maintenance valves.

Response to Question 09.02.02-120:

a. Valves KAA20/30 AA013 and AA014 are manual isolation valves that are normally open in all CCWS operating modes. These valves are intended for use only when the common header requires isolation for maintenance and the water cooled Safety Chilled Water System Divisions 2 and 3 are required for operation. Closing these manual isolation valves for common header maintenance allows the operator the option of supplying CCWS flow to division 2 of the SCWS via the CCWS train 2 pump and division 3 of the SCWS via the CCWS train 3 pump. Note that divisions 1 and 4 of the SCWS are air cooled while divisions 2 and 3 are water cooled with the supply provided from the Common “B” portions of each CCWS common header. For division 2 or 3 of the SCWS to require CCWS flow while the CCWS common header is isolated for maintenance, both of the air cooled divisions of SCWS would also have to be out of service. Valves KAA20/30 AA013/014 are only closed during plant shutdown (for example Modes 5 and 6) for maintenance activities on the 1B or 2B headers where the water cooled divisions of the Safety Chilled Water System are needed.

   These manual isolation valves do not confirm the availability of the safety chillers during normal plant operation when only two CCWS trains are operating. If only two CCWS trains are operating and those two trains supply the same common header, these manual isolation valves give the operator the option of supplying the SCWS division from one of the two available CCWS trains. In all normal operations, the SCWS is supplied from the Common “B” header along with all other common loads. These manual isolation valves only provide the operator an additional option to isolate and supply all of the common “B” header from one train and supply the SCWS water cooled division from the other available CCWS train.

   Due to the limited use of these valves, they will be added to FSAR table 3.9.6-2 for exercise testing in five year intervals.

b. The information in Part “a” will be added to the FSAR in section 9.2.2

c. These valves are not required to maintain CCWS operability. These valves are intended to provide the operators the option to provide CCWS cooling to the water cooled divisions of the SCWS in the event that a CCWS common header is isolated for maintenance and both of the air cooled divisions of SCWS are out of service.

d. Refer to the Response to Part “a” above. There are no Technical Specifications that would be applicable during a closure of these valves in Modes 5 and 6.

e. Refer to the Response to Part “a” and “d” above.

FSAR Impact:

U.S. EPR FSAR Tier 2 Section 9.2.2 and Table 3.9.6-2 will be revised as described in the response and indicated on the enclosed markup.

- Isolation valves to separate the safety-related train from the common load set.

Each CCWS safety-related train supplies cooling to its respective CCWS and medium head safety injection (MHSI) pumps and motors and associated LHSI/RHR HXs, and trains 2 and 3 cool their respective LHSI pumps and motors. The LHSI pumps and motors of trains 1 and 4 are cooled by the SCWS.

The SCWS chillers for divisions 2 and 3 are supplied by CCWS trains 1 or 2, and 3 or 4, respectively. This enables continuous availability of the safety chillers during testing or maintenance activity and allows for equitable distribution of operating time for each of the CCWS safety-related trains. The CCWS safety-related trains are shown in Figure 9.2.2-1—Component Cooling Water System Trains 1 through 4.

The non-safety-related operational loads are supplied by two separate isolable headers designated common 1 and common 2. Common 1 may be aligned for service from either safety-related trains 1 or 2, and common 2 may be aligned to safety-related trains 3 or 4. Each common header branches into subheaders further designated "a" and "b" (i.e., common 1.a, 1.b, 2.a, and 2.b). Headers 1.a and 2.a, which cool FPCS trains 1 and 2, respectively, are separate from the other operational loads to provide continued cooling of the spent fuel. Headers 1.b and 2.b cool the remaining operational CCWS loads. Each of the common b-loops is isolable from the associated safety train by two fast-acting hydraulic valves, one installed in each train supply line and the other in the return line.

Common 1.b or 2.b headers cool~~s~~ multiple loads throughout the plant. The loads for each (b) header are summarized in Table 9.2.2-3—CCWS Common Header Users. ~~RB CCWS loads through two branches. One branch cools RCP 1, RCP 2, and CVCS high pressure (HP) cooler 1. The other branch cools heating ventilation and air conditioning (HVAC) coolers 1, 2, 3, and 4 and the RCDT cooler. Common 1.b also cools CVCS charging pump 1 and sampling system coolers in the FB, and the first chiller of both OCWS subsystems in the NAB.~~

~~Common 2.b cools RCP 3, RCP 4, and CVCS HP cooler 2 in the RB; CVCS charging pump 2 and sampling system coolers in the FB; and the second chiller of both OCWS subsystem, liquid, waste, coolant treatment, and boron recycle system users in the NAB and RWB.~~

RCP 1, 2, 3 and 4 thermal barriers are capable of being cooled from either common header.

~~To maintain CCWS train separation for the RCP thermal barrier cooling, an interlocking function is required. Either CCWS Common 1b or 2b headers can provide cooling to the thermal barriers. To maintain strict separation, the containment isolation valves on the RCP thermal barrier cooling path on the supply and return side of CCWS Common 1b cannot be opened unless the CIVs on both the~~

Table 3.9.6-2—Inservice Valve Testing Program Requirements
Sheet 48 of 97

Valve Identification Number[1]	Description/ Valve Function	Valve Type[2]	Valve Actuator[3]	ASME Code Class[4]	ASME OM Code Category[5]	Active / Passive[6]	Safety Position[7]	Test Required[8,10]	Test Frequency[9]	Comments
30KAA40AA032	Quick Closing Valve for KAA40 to Common2A	BF	HO	3	A	A	O/C	ET ST LT PI	Q Q 2Y 2Y	
30KAA40AA033	Quick Closing Valve for Common2A to KAA40	BF	HO	3	A	A	O/C	ET ST LT PI	Q Q 2Y 2Y	
30KAA40AA112	Bypass Control Valve for KAA40 AC001	BF	MO	3	A	A	O/C	ET ST LT PI	Q Q 2Y 2Y	
30KAA42AA005	CCW Isolation Valve for LHSI HX 4	BF	MO	3	A	A	O	ET ST LT PI	Q Q 2Y 2Y	
30KAA42AA012	Check Valve Downstream LHSI HX 40	CK	SA	3	C	A	O	ET	Q	
30KAB10AA192	RV Downstream Common 1B	RV	SA	3	C	A	O/C	ET LT	10Y 10Y	
30KAB80AA015	Supply Isolation Operational Chilled Water Users	BF	HO	3	A	A	C	ET ST LT PI	Q Q 2Y 2Y	

RAI 417, Q 9.2.2-120 Insert 'A'

Valve Identification Number	Description/Valve Function	Valve Type	Valve Actuator	ASME Code Class	ASME OM Code Category	Active / Passive	Safety Position	Test Required	Test Frequency	Comments
30KAA20AA013	Common 1.B Supply Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5Y	
30KAA20AA014	Common 1.B Return Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5Y	
30KAA30AA013	Common 2.B Supply Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5Y	
30KAA30AA014	Common 2.B Return Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5Y	

Request for Additional Information No. 406(4683, 4664, 4707), Revision 0

5/14/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
SRP Section: 09.04.01 - Control Room Area Ventilation System
SRP Section: 09.05.01 - Fire Protection Program

Application Section: FSAR Chapter 9

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)
QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Balance of Plant Branch 1 (SBPA)

09.02.02-114

Follow-up to RAI 334, Question 9.2.2-69 and RAI 174, Question 9.2.2-20

In follow-up RAI 9.2.2-69 the staff concluded that the response and markup of FSAR Tier 2 Section 9.2.2 provided by the applicant for RAI 9.2.2-20 did not specifically demonstrate satisfying the guidance of SRP 9.2.2 Section II 4.G ii. In follow-up RAI 9.2.2-69 the staff noted examples of information needed in the FSAR markup to more completely identify the CCWS thermal barrier cooling design including; (1) Specifically state the CCWS associated with the RCPs can withstand a single, active failure or a moderate-energy crack as defined in Branch Technical Position ASB 3-1, (2) Also credit Seismic Category I, Quality Group C, and ASME Section III Class 3 requirements and (3) to identify that future RCP seal SBO testing would be performed.

The applicant's response to RAI 9.2.2-69 included a detailed explanation and revised markup of FSAR Tier 2 Section 9.2.2. However, the staff's review of this response identified the follow-up questions listed below:

a. In regard to the discussion in the response about mid position failure of a thermal barrier containment isolation valve (CIV) upon attempting transfer of thermal barrier cooling to the other common header:

    1. Describe the type of actions (and priority) that would be needed if the failure occurred with the valve nearly closed resulting in insufficient cooling to all thermal barriers while still preventing transfer to the other common header, that is, permissive not satisfied. Describe if this is considered a common mode loss of thermal barrier cooling.

    2. Describe in the FSAR the acceptability of taking credit for CVCS seal injection in this scenario when the CVCS is only considered an operational system that may not be present in post accident conditions.

3. Describe in the FSAR if the plant design basis requires CCWS thermal barrier cooling to be functional in post accident conditions (besides during all plant operating modes when the RCPs are running).

4. The applicant's response stated that failure of a CCWS CIV to fully close does not place the plant in a four hour TS action statement to close the other CIV in that flowpath but TS 3.6.3 Containment Isolation does apply. The applicant should provide the basis for these conclusions and explain the aspect of TS 3.6.3 that does apply including the applicable LCO duration.

5. Describe in the FSAR if the RCP standstill seal (discussed in the original response) is credited as a safety-related design basis accident mitigation feature or is it intended only for conditions that are beyond the normal design basis.

b. Provide an explanation in the RAI response that demonstrates that the guidance of SRP 9.2.2, Section II 4.G is satisfied by testing that the RCPs can withstand a complete loss of cooling water for 20 minutes without operator action or state that in lieu of testing the CCWS meets Section ii.4.G, item ii. This was not addressed as requested by RAI 9.2.2-69.

Response to Question 09.02.02-114:

a.

1. The RCP Thermal Barrier Cooling Transfer is a Non-Safety Manual function. The Non-safety designation results from single failure criteria and TS requirements to have two OPERABLE CCWS trains aligned to thermal barrier cooling, and the fact that operators would not need to perform the function during an accident. It is an operational function to align the loads to a common header which is fully supported by two trains. The transfer of thermal barrier cooling from one common header to the other common header would be needed if one of the two available trains on the initial common header providing thermal barrier cooling is being placed in maintenance. Per Tech Spec 3.7.7 Required Action A.1, RCP thermal barrier cooling is to be aligned to the common header with two operable CCWS trains within 72 hours if one CCW train is inoperable. In this case, the transfer could occur during normal power operation or during a shutdown. The sequence of closing the first set of CIVs and opening the second set of CIVs determines the time that flow will be interrupted to the RCP thermal barriers. From FSAR Table 6.2.4-1, the closure time of the CIVs for RCP thermal barrier cooling is ≤15 seconds for each valve. Because of the valve interlock associated with the supply of cooling to the loads and the short duration desired to have cooling flow interrupted, a group command is provided. The group command will close all four of the CIVs of the off-going common header simultaneously and open all four of the CIVs of the on-coming header simultaneously. The 15 second closure time of the off-going header CIVs combined with a 15 second opening time of the on-coming header CIVs results in a flow disruption of approximately 30 seconds for the RCP thermal barriers.

   The RCP thermal barrier cooling for each common header (1.B and 2.B) contains two (2) motor operated CIVs on the supply and two (2) motor operated CIVs on the return. Each of the four (4) CIVs inside containment has an uninterruptible emergency power supply. The two outer containment isolation valves on the common 1.B header are normally powered from IEEE division 1. These two valves have a standby emergency power supply of Diesel Generator 1 with Diesel Generator 2 as the alternate emergency power supply. The two outer containment isolation valves on the common 2.B header are normally powered from IEEE division 4. These two valves have a standby emergency power supply of Diesel Generator 4 with Diesel Generator 3 as the alternate emergency power supply. Refer to FSAR Chapter 8 for the discussion related to normal and emergency power supplies.

The RCP thermal barrier cooling transfer consists of closing the open group of CIVs (KAB30 AA049/050/051/052 (Common 1.b) or KAB30 AA053/054/055/056 (Common 2.b)) and as soon as one of the two supply valves (KAB30 AA049/050 (Common 1.b) KAB30 AA053/054 (Common 2.b)) and one of the two return valves (KAB30 AA051/052 (Common 1.b) or KAB30 AA055/056 (Common 2.b)) indicate valve closure, the other group of CIVs (KAB30 AA049/050/051/052 (Common 1.b) or KAB30 AA053/054/055/056 (Common 2.b)) is automatically opened. In case a CIV fails to open on the final header, another transfer is automatically performed back to the initial configuration. This automatic feature to revert back to the initial configuration is built into the thermal barrier cooling transfer command. Refer to U.S. EPR FSAR Section 9.2.2.6.1.3 for a description of the RCP Thermal Barrier Cooling Transfer.

In the scenario where the thermal barrier cooling transfer is initiated and there is a LOOP within the 15 second valve closure window of time with a mechanical single failure of one of the four valves to close, the transfer permissive requirement of 1 out of 2 of the initial supply valves to close and 1 out of 2 of the initial return valves to close would still be satisfied and the thermal barrier transfer would be completed with the second set of CIVs valves opening.

In the scenario where the thermal barrier cooling transfer is initiated and there is a LOOP with a single failure of the Diesel Generator supplying the outer containment isolation valve, the 1 out of 2 permissive on the initial valves would be completed by the inside containment isolation valves that have uninterruptible power supplies. The thermal barrier transfer would be completed with the second set of CIVs opening.

The CCWS Containment Isolation Valves (CIVs) for RCP Thermal Barrier Cooling are not actuated upon receipt of SI, CI-1 or CI-2 signals so they remain open during and after a DBA. The containment isolation valves associated with each of the common headers providing this cooling flow to the thermal barriers would not be cycled to test Containment Isolation operability during normal power operation because of the potential impact on operating RCPs.

The RCP shaft seal system is made up of a series of three seals and a standstill seal. During normal plant operation, water from the CVCS provides normal seal cooling. CCWS is continuously aligned to the thermal barrier coolers as the safety related backup to CVCS. The CVCS injects directly into the #1 seal and the flow goes down, past the thermal barrier and into the RCS. If seal injection is lost, then reactor coolant flows up through the thermal barrier and into the seal. CVCS water cools the seal when CVCS is operable. When CVCS is not operable, Reactor Coolant (cooled by the thermal barrier) provides cooling to the seal. The standstill seal is not credited as a safety-related design basis accident mitigation feature. It intended only for conditions that are beyond DBA.

The RCP shaft seal system is designed to withstand without damage, the following three operating conditions so that additional margins are provided to recover service water in efforts to minimize plant down time:

- Loss of CVCS water injection to the #1 shaft during continuous operation or pump shutdown with seal cooling provided by the thermal barrier
- Loss of CCWS cooling water to the thermal barrier heat exchanger during continuous operation or with the pump shutdown, with seal cooling provided by CVCS seal injection
- Concurrent loss of #1 shaft seal injection from CVCS and thermal barrier cooling from CCWS if one of the two functions is recovered in 2 minutes or less

In the absence of RCP seal injection via CVCS and RCP thermal barrier cooling via CCWS the RCP shaft seal average leakage is assumed to be ≤ 25 gpm until the standstill seal system closes (Refer to the Response to RAI 174 Question 9.2.2-20). The RCP shaft seal system is designed to withstand a concurrent loss of CVCS seal injection and CCWS flow to the thermal barriers for two minutes provided one of the two functions is recovered in two minutes. A reduction or loss of CCWS flow to any of the RCP thermal barriers is recognized in the control room by individual flow indication devices in the return piping from each thermal barrier (refer to FSAR Figure 9.2.2-2 sheets 3 and 4 of 7 and Figure 9.2.2-3 sheets 3 and 4 of 8). A reduction or loss if CVCS seal injection flow to the RCPs is recognized in the control room by a totaling flow indication device outside containment and individual flow indication devices for each RCP seal (refer to FSAR figure 9.3.4-1). Refer to the Response to RAI 53 Question 19-206 for the discussion related to simultaneous loss of thermal barrier cooling and seal injection flow. If CCWS flow to the thermal barriers is not recovered after two minutes, the seals will heat up and the discussion above related to seal leakage and the standstill seal closure would be in effect. Refer to FSAR section 15.6 for the U.S. EPR LOCA Analysis.

2. In accordance with Section B 3.7.7 in the FSAR, Action Item A.1 requires that if one CCW train is inoperable, action must be taken to align the RCP thermal barrier cooling common loop to a common header capable of being supplied by two operable CCW trains within 72 hours. In this condition, the CCWS can perform the RCP thermal barrier cooling function given a single failure. The 72 hour completion time is reasonable, based on the low probability of a postulated accident occurring during this period.

   In accordance with Action Items B.1, if two CCW trains are inoperable, action must be taken to restore one train to operable status within 72 hours. In accordance with Action Item C.1 and C.2, if a CCW train cannot be restored to operable status within the associated completion time, the unit must be placed in at least Mode 3 with 6 hours and in Mode 5 within 36 hours.

   Prior to an accident, it is expected that CCWS cooling to the Reactor Coolant Pumps is available. This is ensured by Tech Spec 3.7.7. Credit is not taken for the CVCS to ensure cooling to the RCP shaft seals. During a LOOP, there is no need for the operator to transfer cooling to another CCWS train. Power to the previously running CCWS train will be restored based on EDG load sequencing. Since the CIVs for thermal barrier cooling remain open during and after a DBA, there is no need for the operator to transfer thermal barrier cooling.

Based on the above, a loss of CCW cooling to the RCP thermal barriers will not create a loss of CVCS seal injection to the RCPs and if the CCWS flow is restored within the specified LCO action times it is not necessary to assume a DBA in combination with a loss of CCW cooling to the RCP thermal barriers.

3. Thermal Barrier cooling is required for all modes of operation, including DBA, where the RCS is pressurized and therefore relying on RCP seal integrity to maintain the Reactor Coolant Pressure Boundary. This is an initial condition in the accident analysis and is ensured by Tech Spec 3.7.7. CCWS is the only safety-related cooling to the RCP thermal barriers. Technical Specifications require thermal barrier cooling to be supplied to the RCP's to ensure this initial condition (i.e. thermal barrier cooling is active) prior to an accident. U.S. EPR FSAR Tier 2, Section 9.2.2 will be revised to include this information.

4. Refer to the Response to part a1 above for the discussion related to the RCP thermal barrier transfer.

   Related to Tech Spec 3.6.3, the Containment Isolation function on the RCP thermal barrier supply side is maintained by one of the two motor operated CIVs if one of the two fails to close. The Containment Isolation function is maintained on the RCP thermal barrier return piping by one of the two motor operated CIVs if one of the two fails to close.

5. The RCP standstill seal is not credited as a safety-related design basis accident mitigation feature. It intended only for conditions that are beyond DBA.

b. As previously stated in the Response to RAI 174, Question 9.2.2-20 the RCP shaft seal will be SBO tested to determine the average leakage prior to closure of the standstill seal system. An SBO test on the standstill seal will be done separately. Refer to U.S. EPR FSAR Section 5.4.1.2.1 for information related to the RCP seal design as it relates to a loss of seal cooling and the conditions under which the standstill seal is normally used.

   The CCWS meets the guidance of SRP 9.2.2 as being designed for single failure and built to ASME III Class 3. Refer to U.S. EPR FSAR Sections 9.2.2.1 and 9.2.2.2.1. The CCWS piping, valves and components supplying the RCP thermal barriers is Seismic Category I, Quality Group C, ASME III Class 3 with the exception of the CIVs and piping between the CIVs, which are Seismic Category I, Quality Group B, ASME III Class 2.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.2.2, 7.6, 14.2, Table 6.2.4-1, Table 3.9.6-2 and Tier 1 Section 2.7.1 will be revised as described in the response and indicated on the enclosed markup.

containment isolation valves (CIVs) in the RCP thermal barrier cooling path on the supply and return side of CCWS common 1b cannot be opened unless the CIVs on both the supply and return side of common 2b are closed and vice-versa.

The CCWS piping, valves and components supplying the RCP thermal barriers is Seismic Category I, Quality Group C, ASME III Class 3 with the exception of the CIVs and the piping between the CIVs, which are Seismic Category I, Quality Group B, ASME III Class 2.

The non-safety-related CCWS loads in the NAB and RWB can be quickly isolated from the rest of the CCWS by fast-closing hydraulic valves, as required. The non-safety-related common branches of the CCWS trains are shown in Figure 9.2.2-2—Component Cooling Water System Common Loop 1, and Figure 9.2.2-3—Component Cooling Water System Common Loop 2.

The design of the Component Cooling Water System (CCWS) minimizes and withstands adverse transients (i.e., water hammer) and meets functional performance requirements for all operating modes including postulated DBA consistent with the guidance for water hammer prevention and mitigation found in NUREG-0927 (Reference 6).

The CCW system design minimizes the potential for dynamic flow instabilities by avoiding high line velocities and specifying valve opening and closing speeds that are low enough to prevent damaging pressure increases.

Vents are provided for venting components and piping at high points in liquid filled systems that can become normally idle and in which voids could occur. These vents are located for ease of operation and testing on a periodic basis. All drains and vents of the CCWS including surge tank overflow are routed to the nuclear island drain and vent systems.

Consideration has been made to avoid voiding, which can occur following pump shutdown or during standby by placing the pumps and CCWS users at an elevation below the water level of the surge tanks. Means are provided for a slow and controlled fill of those portions of the CCW system where voiding could occur after pump shutdown or during standby.

The design incorporates controls and instrumentation to support operating and maintenance procedures to provide adequate measures to avoid water hammer.

One non-safety-related train comprises the dedicated CCWS. This train cools the SAHRS train, is supplied demineralized makeup water by the dedicated CCWS injection pump, is cooled by its assigned dedicated ESWS train, and is provided backup power from its assigned station blackout diesel generator (SBODG). The dedicated CCWS train consists of one main pump, one dedicated ESWS-cooled HX, one surge

CCWS Response to a LOOP

In case of LOOP, operating CCWS trains are de-energized. Previously operating CCWS trains return to operation according to the EDG load sequencing and standby trains remain idle, unless other start signals are received during EDG load sequencing.

CCWS Switchover Valve Interlock

Train separation of redundant CCWS divisions confirms that a fault affects no more than one train via a switchover valve interlock. To prohibit more than one train from being connected to a common header, the following groupings of valves cannot be simultaneously opened:

- Common 1.a – KAA10AA032/033 with KAA20AA032/033.
- Common 2.a – KAA30AA032/033 with KAA40AA032/033.
- Common 1.b – KAA10AA006/010 and KAA20AA006/010.
- Common 2.b – KAA30AA006/010 and KAA40AA006/010.

Thermal Barrier Isolation

The following actions indicate a fault of a RCP thermal barrier:

- A high flow above a threshold value measured with a flow element in the CCWS piping on the return from each RCP thermal barrier.
- A high pressure above a threshold value measured with a pressure sensor in the RCS piping on the return from each RCP thermal barrier.

Isolation valves at inlet (JEB10/20/30/40 AA021) and outlet (JEB10/20/30/40 AA003) of each RCP thermal barrier (as shown in Figure 5.1-4) are used to automatically isolate the faulted thermal barrier from the CCWS. High radiation in the CCWS does not initiate automatic isolation of CCWS cooling to the RCP thermal barriers. Isolation of faulted RCP thermal barrier only affects that RCP; it does not affect the CCWS cooling of the other three RCP thermal barriers or thermal barrier cross tie.

CCWS Containment Isolation Valve Interlock

Either the common 1.b or 2.b headers can provide cooling to the RCP thermal barriers. To maintain strict train separation of the redundant CCWS division supplying either common header to confirm that a fault affects no more than one train, the CIVs (KAB30 AA049/051/052/053/055/056) are interlocked. The CCWS CIVs from the common 1.b header (KAB30 AA049/051/052) must be closed prior to opening the CIVs from the common 2.b header (KAB30 AA053/055/056), and vice versa.

- Start ESWS pump (PEB10/20/30/40 AP001).
- Start CCWS pump (KAA10/20/30/40 AP001).
- Open LHSI heat exchanger isolation valve on the on-coming train as mini flow line (KAA12/22/32/42 AA005).
- Close switchover valves (KAA10/20/30/40 AA006/010/032/033) on the off-going train and open of the train associated LHSI heat exchanger isolation valve (KAA12/22/32/42 AA005).
- Open switchover valves (KAA10/20/30/40 AA006/010/032/033) on the on-coming train.

Unavailability of a CCWS train (low level on the surge tank, loss of pump) inhibits the common user switchover to this train.

In case of a failure to close of a switchover valve on the initial train or lack of opening of a switchover valves on the final train, another switchover is automatically done to the initial configuration. Refer to Section 7.6.1.2.3 for a more detailed description.

CCWS Surge Tank Makeup

A CCWS train can operate as long as the water level in the CCWS surge tank is maintained between the MIN1 and MAX1 levels. This non-safety-related function maintains the CCWS surge tank level within design limits during normal plant operation.

Small CCWS leakage is compensated for with demineralized water via operation of the DWDS supply isolation valve (KAA10/20/30/40 AA027):

- When the surge tank water level lowers to the MIN1 level, the DWDS supply isolation valve (KAA10/20/30/40 AA027) is automatically opened.
- When the surge tank water level reaches the MAX1 level, the DWDS supply isolation valve is automatically closed.

RCP Thermal Barrier Cooling Transfer

Either the common 1.b or 2.b headers can provide cooling to the RCP thermal barriers. Because of the valve interlock associated with the supply of cooling to these loads and the short duration desired to have cooling flow isolated, a group command is provided. The RCP thermal barrier cooling transfer consists of closing the open group of CIVs (KAB30 AA049/051/052, common 1.b or KAB30 AA053/055/056, common 2.b) and as soon as all valves indicate closure, the other group of CIVs (KAB30 AA049/051/052, common 1.b or KAB30 AA053/055/056, common 2.b) are opened.

In case a CIV fails to close on the initial common header or lack of valve opening of a CIV on the final header, another transfer is automatically performed back to the initial configuration.

In the event that one CCWS train is inoperable, RCP thermal barrier cooling is aligned to the CCWS common header that is supported by two operable CCWS trains within 72 hours per Chapter 16, Technical Specification 3.7.7.

CCWS Temperature Control

Normally, the CCWS heat exchanger bypass control valve (KAA10/20/30/40 AA112) is manually positioned in order to maintain a CCWS normal temperature greater than 59°F and less than 100.4°F. An alarm is relayed to the operator in the MCR when the temperature is near the MIN2 or MAX2 temperature limit.

To avoid a CCWS temperature less than 59°F, the bypass control valve of the CCWS heat exchanger (KAA10 AA112) is automatically stepped opened when the heat exchanger outlet is near the low temperature threshold (MIN1). The valve is stepped open in 10 percent increments every one minute until the temperature measured at the heat exchanger outlet is above the threshold value or the bypass valve is fully open.

During normal plant operation, an open CCWS heat exchanger bypass line can cause CCWS temperature to be greater than 100.4°F. To prevent this condition, the bypass control valve of the CCWS heat exchanger (KAA10 AA112) is automatically stepped closed when the heat exchanger outlet is near the high temperature threshold (MAX1).

Manual Start and Trip of a Train

During normal operation, the CCWS trains are started to align the CCWS configuration to meet the operational needs of the plant.

When the pump is shutdown, the LHSI heat exchanger isolation valve (KAA12/22/32/42 AA005) is closed after a time delay to avoid risks of leakage from a CCWS train through the corresponding SIS train.

Dedicated CCWS Control

The dedicated CCWS train is manually actuated from the MCR when needed during severe accident conditions. Control is provided for the follow components:

- Dedicated CCWS pump (KAA80 AP001).
- Dedicated CCWS makeup pump (KAA80 AP201).
- Dedicated CCWS tank outlet valve (KAA80 AA020).

- CCWS Train 1 common 1.a supply and return switchover valves close.
- CCWS Train 1 common 1.b supply and return switchover valves close.

3.30 Perform step 3.29 for CCWS Train 2 supplying common 2.b header to verify appropriate responses.

3.31 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Surge Tank Makeup function. Verify the following action occurs:

- DWDS supply isolation valve responds to CCWS surge tank level changes.

3.32 Perform step 3.31 for CCWS Trains 2, 3, and 4 to verify appropriate responses.

3.33 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Temperature Control function.

3.33.1 Simulate two of three CCWS Train 1 temperature sensors less than MIN1. Verify that the Train 1 heat exchanger bypass valve opens by 10 percent of its 0-100 percent range at 1 minute intervals until 2 of 3 temperature measurements are greater than MIN1, or the valve is fully open.

3.33.2 Simulate two out of three CCWS Train 1 temperature sensors greater than MAX1. Verify that the Train 1 heat exchanger bypass valve closes by 10 percent of its 0-100 percent range at 1 minute intervals until 2 of 3 temperature measurements are less than MAX1, or the valve is fully closed.

3.34 Perform step 3.33 for CCWS Trains 2, 3, and 4 to verify appropriate responses~~Perform Steps 3.14 through 3.24 for CCWS Trains 2, 3, and 4 to verify appropriate responses~~.

3.35 Verify that CCWS common 1.b header is supplying RCP thermal barrier cooling, then perform test of RCP thermal barrier isolation function.

3.35.1 Simulate high flow above threshold value on the return of RCP1 thermal barrier. Verify that RCP1 thermal barrier isolation valves close.

3.35.2 Simulate high pressure above threshold value on the return of RCP1 thermal barrier. Verify that RCP1 thermal barrier isolation valves close.

3.35.3 Perform steps 3.35.1 and 3.35.2 for RCP 2, 3, and 4 thermal barriers.

3.36 Perform step 3.35 for common 2.b header supplying RCP thermal barrier cooling to verify appropriate responses.

RAI 406, Question 9.2.2-114 FSAR Insert "A"

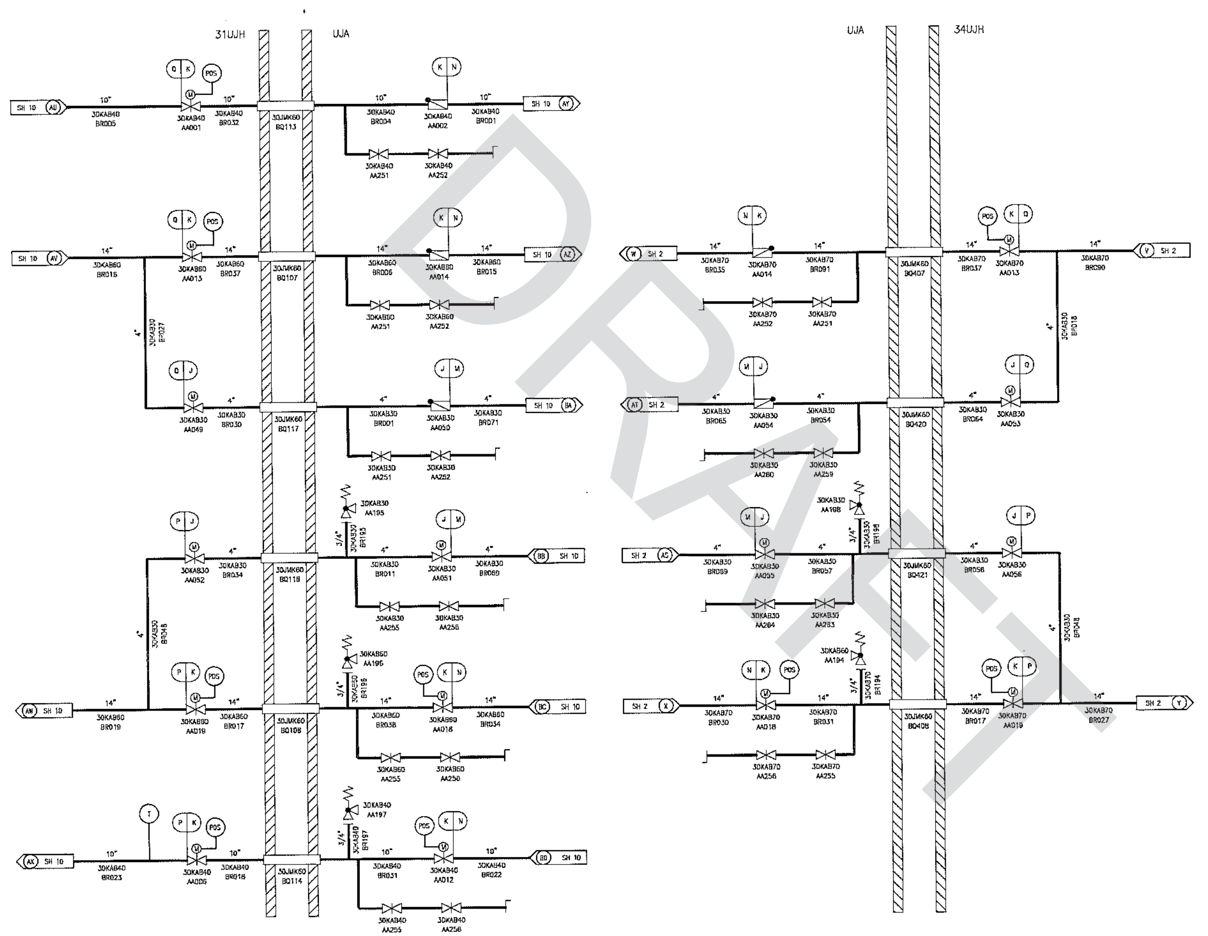
3.37 Verify that CCWS common 1.b header is supplying RCP thermal barrier cooling, then perform test of thermal barrier transfer revert back feature.

3.37.1 Simulate closure of Common 1.B RCP thermal barrier CIVs and failure of one or more Common 2.B RCP thermal barrier CIVs to open. Verify that RCP thermal barrier transfer reverts back to Common 1.B supplying cooling flow to all four RCP thermal barriers.

3.38 Verify that CCWS common 2.b header is supplying RCP thermal barrier cooling, then perform test of thermal barrier transfer revert back feature.

3.38.1 Simulate closure of Common 2.B RCP thermal barrier CIVs and failure of one or more Common 1.B RCP thermal barrier CIVs to open. Verify that RCP thermal barrier transfer reverts back to Common 2.B supplying cooling flow to all four RCP thermal barriers.

Figure 9.2.2-2—Component Cooling Water System Common Loop 1
Sheet 7 of 7



JMK – PIPING PENETRATIONS
KAB – COMPONENT COOLING WATER SYSTEM COMMON HEADER

UJA – REACTOR BUILDING
31UJH – SAFEGUARD BUILDING MECHANICAL, DIVISION 1
34UJH – SAFEGUARD BUILDING MECHANICAL, DIVISION 4

NOTE: COMMON 1 AND 2 CONTAINMENT PENETRATION DETAILS.

DESIGN AREA	SSC QUALITY GROUP	DESIGN PRESSURE PSIG	DESIGN TEMPERATURE °F	SSC SEISMIC CLASS
J	B	2535	664	I
M	C	2535	664	I
K	B	175	338	I
N	C	175	338	I
P	C	175	225	I
Q	C	175	225	I

KAB15T2

Figure 2.7.1-1—Component Cooling Water System Functional Arrangement Sheet 7 of 11

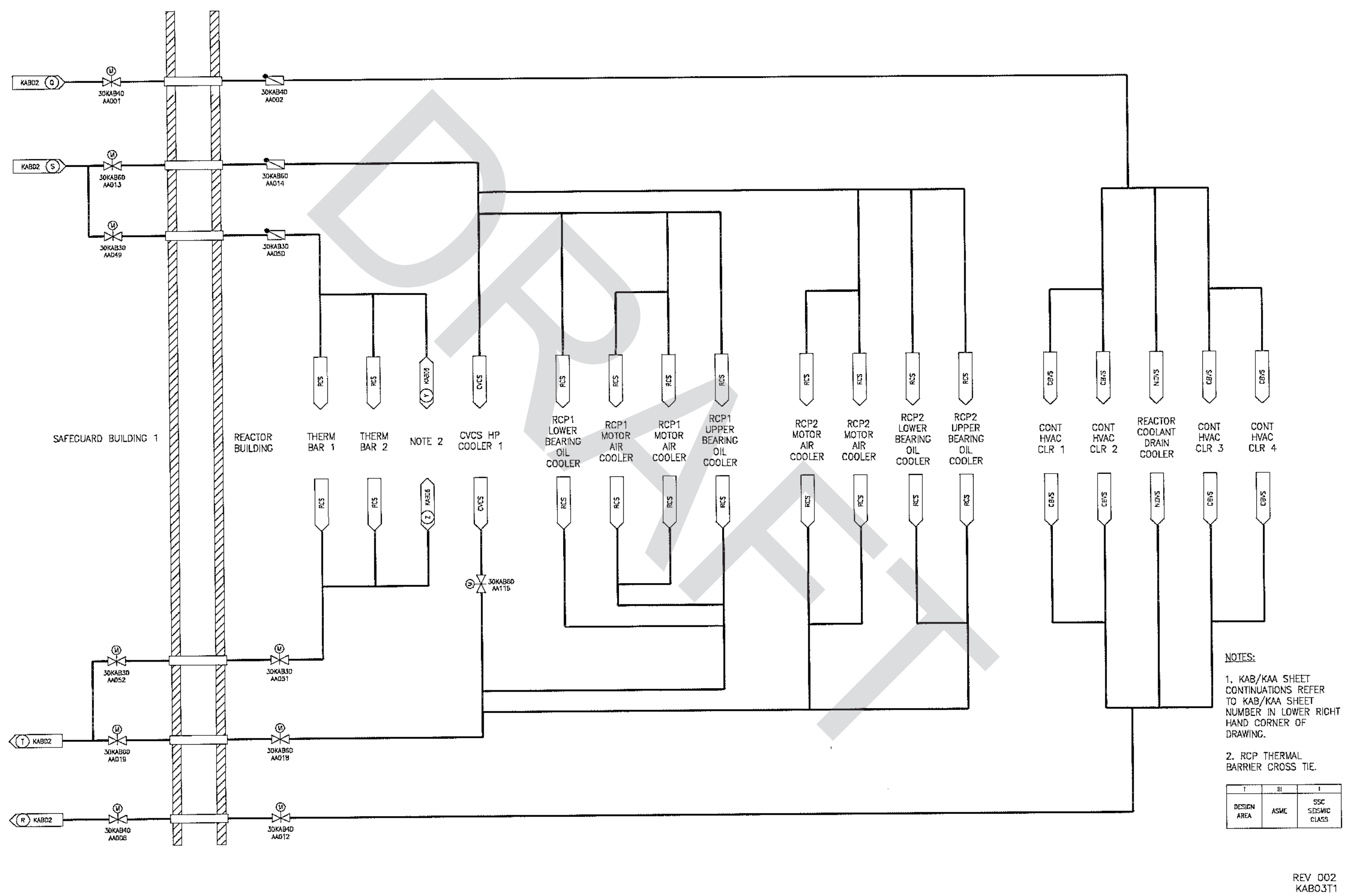


Figure 2.7.1-1—Component Cooling Water System Functional Arrangement Sheet 10 of 11

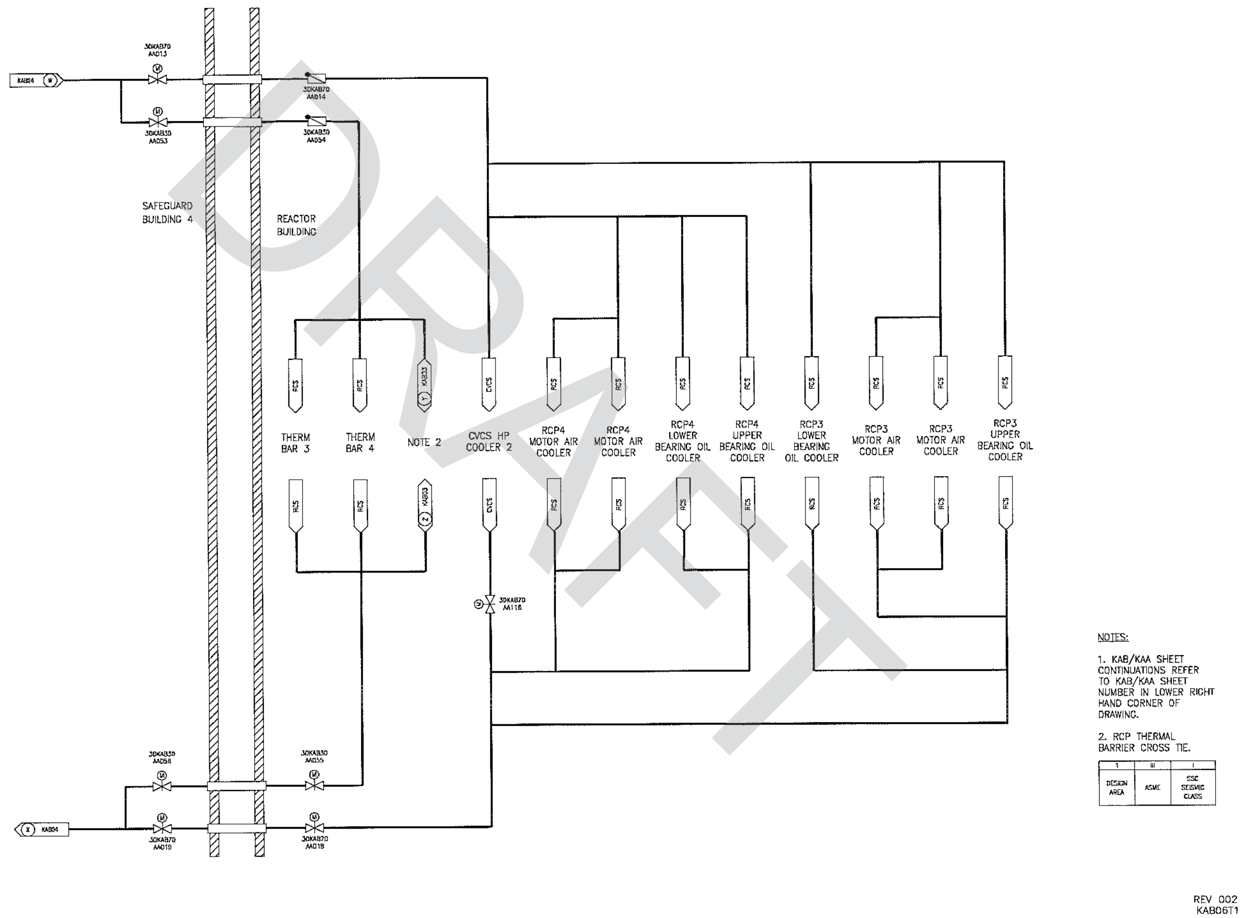


Table 2.7.1-1—Component Cooling Water System Equipment Mechanical Design (7 Sheets)

Description	Tag Number [(1)]	Location	ASME Code Section III	Function	Seismic Category
Common Header 1b RCP Thermal Barriers Containment Isolation Valves	KAB30AA049 KAB30AA051 KAB30AA052	Safeguard Building 1 Reactor Building Safeguard Building 1	Yes	Close (Manually Initiated)	I
Common Header 1b RCP Thermal Barriers 1/2 Upstream Containment Isolation Check Valve	KAB30AA050	Reactor Building	Yes	Prevent Backflow	I
Common Header 2b RCP Thermal Barriers Containment Isolation Valves	KAB30AA053 KAB30AA055 KAB30AA056	Safeguard Building 4 Reactor Building Safeguard Building 4	Yes	Close (Manually Initiated)	I
Common Header 2b Containment Supply Isolation Check Valve	KAB30AA054	Reactor Building	Yes	Close	I
Common Header 1b Non-Safety Loads Containment Isolation Valves	KAB40AA001 KAB40AA006 KAB40AA012	Safeguard Building 1 Reactor Building Safeguard Building 1	Yes	Close	I
Common Header 1b Containment Supply Isolation Check Valve	KAB40AA002	Reactor Building	Yes	Close	I
Common Header 2b Auxiliary Building and Waste Building Isolation Valves	KAB50AA001 KAB50AA006 KAB50AA004	Safeguard Building 4 Safeguard Building 4 Safeguard Building 4	Yes	Close	I
Common Header 2b Auxiliary and Waste Building Return Isolation Check Valve	KAB50AA008	Safeguard Building 4	Yes	Close	I

Table 2.7.1-2—Component Cooling Water System Equipment I&C and Electrical Design (7 Sheets)

Description	Tag Number (1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Common Header 1b Safety Related Loads Containment Isolation Valves	KAB60AA013	Safeguard Building 1	1^N 2^A	Yes	Yes	Pos	Open-Close
	KAB60AA018	Reactor Building	4^N 3^A				
	KAB60AA019	Safeguard Building 1	1^N 2^A				
Common Header 2b Safety Related Loads Containment Isolation Valves	KAB70AA013	Safeguard Building 4	4^N 3^A	Yes	Yes	Pos	Open-Close
	KAB70AA018	Reactor Building	1^N 2^A				
	KAB70AA019	Safeguard Building 4	4^N 3^A				
Common Header 1b RCP Thermal Barriers Containment Isolation Valves	KAB30AA049	Safeguard Building 1	1^N 2^A	Yes	Yes	Pos	Open-Close
	KAB30AA051	Reactor Building	4^N 3^A				
	KAB30AA052	Safeguard Building 1	1^N 2^A				

Table 2.7.1-2—Component Cooling Water System Equipment I&C and Electrical Design (7 Sheets)

Description	Tag Number (1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Common Header 2b RCP Thermal Barriers Containment Isolation Valves	KAB30AA053	Safeguard Building 4	4^N 3^A	Yes	Yes	Pos	Open-Close
	KAB30AA055	Reactor Building	1^N 2^A				
	KAB30AA056	Safeguard Building 4	4^N 3^A				
Surge Tank Demin. Water Makeup Isolation Valves	KAA10AA027	Safeguard Building 1	1^N 2^A	N/A	Yes	Pos	Open-Close
	KAA20AA027	Safeguard Building 2	2^N 1^A				
	KAA30AA027	Safeguard Building 3	3^N 4^A				
	KAA40AA027	Safeguard Building 4	4^N 3^A				
Common Header 1a Fuel Pool Cooling Heat Exchanger 1 Downstream Control Valve	KAB10AA134	Fuel Building	1^N 2^A	N/A	Yes	NA / NA	NA / NA
Common Header 2a Fuel Pool Cooling Heat Exchanger 2 Downstream Control Valve	KAB20AA134	Fuel Building	4^N 3^A	N/A	Yes	NA / NA	NA / NA

Table 6.2.4-1—Containment Penetration, Isolation Valve, and Actuator Data
Sheet 9 of 22

Penetration No.	GDC Req.	System Name	Fluid	Line Size (in)	Essent System	Potent Bypass Path	Valve Number	Valve Location	LLRT	Valve Type and Operator	Primary Actuation	Secondary Actuation	Normal Position	Shut-down Position	Post Accident Position	Power Failure Position	Cont. Isolation Signal	Valve Closure Time	Power Source
60BQ114	57	CCWS return HVAC & PEH	water	10.0	no	no	KAB40 AA006	outside	C	gate/ MOV	PS	RM	open	o/c	close	as-is	stage 1	≤ 50 sec	31BNB03
60BQ117	57	CCWS supply to RCP	water	4.0	yes	no	KAB30 AA050	inside	C	swing check	self	self	open	open	open	n/a	n/a	n/a	n/a
60BQ117	57	CCWS supply to RCP	water	4.0	yes	no	KAB30 AA049	outside	C	gate/ MOV	RM	RM	open	open	open	as-is	no	≤ 15 sec	31BNB03
60BQ118	57	CCWS return RCP	water	4.0	yes	no	KAB30 AA052	outside	C	gate/ MOV	RM	RM	open	open	open	as-is	no	≤ 15 sec	31BNB03
60BQ118	57	CCWS return RCP	water	4.0	yes	no	KAB30 AA051	inside	C	gate/ MOV	RM	RM	open	open	open	as-is	no	≤ 15 sec	34BRA
60BQ407	57	CCWS & CVCS to RCP	water	12.0	no	no	KAB70 AA014	inside	C	swing check	self	self	open	o/c	close	n/a	n/a	n/a	n/a
60BQ407	57	CCWS & CVCS to RCP	water	12.0	no	no	KAB70 AA013	outside	C	gate/ MOV	PS	RM	open	o/c	close	as-is	stage 2	≤ 60 sec	34BNB03
60BQ408	57	CCWS & CVCS return RCP	water	12.0	no	no	KAB70 AA018	inside	C	gate/ MOV	PS	RM	open	o/c	close	as-is	stage 2	≤ 60 sec	31BRA
60BQ408	57	CCWS & CVCS return RCP	water	12.0	no	no	KAB70 AA019	outside	C	gate/ MOV	PS	RM	open	o/c	close	as-is	stage 2	≤ 60 sec	34BNB03
60BQ420	57	CCWS supply to RCP	water	4.0	yes	no	KAB30 AA054	inside	C	swing check	self	self	open	open	open	n/a	n/a	n/a	n/a
60BQ420	57	CCWS supply to RCP	water	4.0	yes	no	KAB30 AA053	outside	C	gate/ MOV	RM	RM	open	open	open	as-is	no	≤ 15 sec	34BNB03
60BQ421	57	CCWS return RCP	water	4.0	yes	no	KAB30 AA055	inside	C	gate/ MOV	RM	RM	open	open	open	as-is	no	≤ 15 sec	31BRA

return) on train one must be closed before either valve on train two can be opened. Likewise, both valves on train two must be closed before either valve on train one can be opened. The same valve arrangement and interlocks are provided relative to Common 1b to provide separation between trains one and two, and on Common 2a and 2b to provide separation between trains three and four. The functional logic for the switchover valve interlock is shown in Figure 7.6-1.

Another interlocking function is required concerning the cooling paths of the Common 1b and Common 2b headers toward the reactor coolant pump (RCP) thermal barriers. Either the Common 1b or 2b headers can provide cooling to the RCP thermal barriers. To maintain strict CCWS train separation, the containment isolation valves (CIV) on the RCP thermal barriers cooling path on the supply and return side of Common 1b cannot be opened unless the CIVs on both the supply and return side of Common 2b are closed, and vice versa. The functional logic for the CIV interlock is shown in Figure 7.6-2.

The interlock functions maintaining separation between redundant CCWS trains are performed by the SAS. Each switchover valve is assigned to a SAS division based on the CCWS train it belongs to (i.e., switchover valves on train one are assigned to SAS division one). Each division of SAS acquires position information from the valves to which it is assigned, and controls those same valves. In any SAS division, the information about the position of valves in other trains that is needed to control a switchover valve is provided via network connection by the SAS division which acquires the information. For example, the positions of the train two valves on the supply and return of Common 1a are acquired by SAS division two. This information is transmitted to SAS division one to perform the interlock function for the train one valves on the supply and return of Common-1a.

The interlock function concerning the CIVs is also performed by the SAS, but is only performed in divisions one and four. The CIVs are assigned to SAS divisions for control based on which electrical division provides power to the valves (i.e., valves powered by electrical division one are controlled by SAS division one). The closed position indications of the CIVs on Common-1b are used to allow opening of the CIVs on Common 1a, and vice versa.

Redundant SAS controllers are provided in each division, and redundant networks are used between the divisions so that no single failure within the SAS can result in inadvertent connection of redundant CCWS trains. Each valve is equipped with redundant open/closed position sensors so that a single sensor failure does not result in inadvertent connection of redundant CCWS trains. While each switchover valve is controlled by one I&C division, multiple PACS modules in that division, acting on multiple solenoid devices, are required in order to change the position of a switchover valve. Therefore, a single PACS module failure does not result in inadvertent connection of redundant CCWS trains. For the CIV interlock, redundancy is obtained

Table 3.9.6-2—Inservice Valve Testing Program Requirements
Sheet 49 of 97

Valve Identification Number[1]	Description/ Valve Function	Valve Type[2]	Valve Actuator[3]	ASME Code Class[4]	ASME OM Code Category[5]	Active / Passive[6]	Safety Position[7]	Test Required[8,10]	Test Frequency[9]	Comments
30KAB80AA016	Supply Isolation Operational Chilled Water Users	BF	HO	3	A	A	C	ET ST LT PI	Q Q 2Y 2Y	
30KAB80AA019	Return Isolation Operational Chilled Water Users	BF	HO	3	A	A	C	ET ST LT PI	Q Q 2Y 2Y	
30KAB80AA020	Return Common 1B	CK	SA	3	C	A	C	ET	Q	
30KAB30AA049	RCP Thermal Barrier 1 and 2 Supply Outside CIV	GT	MO	2	A	A	C	ET ST LT PI	Q Q 2Y 2Y	LT per 10 CFR 50, Appendix J
30KAB30AA050	Supply Thermal Barrier 1 and 2 Inside CIV	CK	SA	2	A/C	A	C	ET LT PI	CS RF 2Y	LT per 10 CFR 50, Appendix J
30KAB30AA051	RCP Thermal Barrier 1 and 2 Return Inside CIV	GT	MO	2	A	A	C	ET ST LT PI	Q Q 2Y 2Y	LT per 10 CFR 50, Appendix J
30KAB30AA052	RCP Thermal Barrier 1 and 2 Return Outside CIV	GT	MO	2	A	A	C	ET ST LT PI	Q Q 2Y 2Y	LT per 10 CFR 50, Appendix J

Table 3.9.6-2—Inservice Valve Testing Program Requirements
Sheet 51 of 97

Valve Identification Number[1]	Description/ Valve Function	Valve Type[2]	Valve Actuator[3]	ASME Code Class[4]	ASME OM Code Category[5]	Active / Passive[6]	Safety Position[7]	Test Required[8,10]	Test Frequency[9]	Comments
30KAB60AA018	Return KBA, RCP 1 and 2 Inside CIV	GT	MO	2	A	A	C	ET ST LT PI	Q Q 2Y 2Y	LT per 10 CFR 50, Appendix J
30KAB60AA019	Return KBA, RCP 1 and 2 Outside CIV	GT	MO	2	A	A	C	ET ST LT PI	Q Q 2Y 2Y	LT per 10 CFR 50, Appendix J
30KAB60AA191	RV Return CVCS HP CL1	RV	SA	3	C	A	O/C	ET LT	10Y 10Y	
30KAB10AA193	RV Downstream FPCS HX1	RV	SA	3	C	A	O/C	ET LT	10Y 10Y	
30KAB20AA192	RV Downstream Common 2B	RV	SA	3	C	A	O/C	ET LT	10Y 10Y	
30KAB30AA054	Supply Thermal Barrier 3 and 4 Inside CIV	CK	SA	2	A/C	A	C	ET LT PI	CS RF 2Y	LT per 10 CFR 50, Appendix J
30KAB30AA055	RCP Thermal Barrier 3 and 4 Return Inside CIV	GT	MO	2	A	A	C	ET ST LT PI	Q Q 2Y 2Y	LT per 10 CFR 50, Appendix J
30KAB30AA056	RCP Thermal Barrier 3 and 4 Return Outside CIV	GT	MO	2	A	A	C	ET ST LT PI	Q Q 2Y 2Y	LT per 10 CFR 50, Appendix J

Request for Additional Information No. 406(4683, 4664, 4707), Revision 0

5/14/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
SRP Section: 09.04.01 - Control Room Area Ventilation System
SRP Section: 09.05.01 - Fire Protection Program

Application Section: FSAR Chapter 9

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)
QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Balance of Plant Branch 1 (SBPA)

09.02.02-112

Follow-up to RAI 334, Question 9.2.2-67 and RAI 174, Question 9.2.2-18

In RAI 174, RAI 9.2.2-18 the staff requested that the applicant provide the bases for the design of the CCWS Surge Tanks including details such as pump NPSH available, level setpoints. Internal volume, inleakage thermal expansion and contraction volumes accounted for and the leakage rate assumptions. In general, the applicant's response to various parts of RAI 9.2.2-18 discussed considerations that would be taken into account by calculations later in the design. Consequently, the staff initiated follow-up RAI 9.2.2-67. The following items remain open based on the staff's review of the applicant's response to RAI 9.2.2-67 provided by Supplement 1 of RAI 334.

Part (c)1 and (c)2: In Part (c)1 of follow-up RAI 9.2.2-67 the applicant was asked to provide justification for the assumed 1 gpm leak rate and to consider the need to account for leakage through large diameter closed switchover valves. For Part (c)2 the applicant was asked to similarly consider the impact of any revised leak rate from (c)1 on volume loss from the tank until the initiation of emergency makeup. In response the applicant identified a revised position that assumed leakage of 5 gpm through each of four closed switchover valves (2-24" and 2-16" diameter valves) for a total of 20 gpm per train. This equated to an one hour surge tank leak rate of 1200 gallon.

As previously identified in RAI 9.2.2-107 (4644/17637), the staff concluded that the use of a NSR/ Seismic Category II surge tank makeup water source is inconsistent with guidance provided in SRP 9.2.2 paragraph III.3C for a safety related seismic makeup source. Accordingly, the applicant needs to specify that the makeup water source is safety related, seismic category I. The applicant should also identify the flow rate and water volume that is available from the finally selected makeup source to confirm that the requirements of the CCWS system can be met. Based on a 20 GPM loss for valve seat leakage only for 7 days 201,600 gallons is required for make-up for one train.

Other considerations for this water make-up should include;

a. Describe the surge tank level at the start of the scenario knowing that the non-safety make-up starts to make-up at MIN1 (if available) as described in Tier 2 FSAR Section 9.2.2.6.1 and that the non safety users isolate at MIN2 (based on delta flow) and switchover valves do not isolate until MIN3 is reached in the surge tank.

b. For Item (C)2, describe the basis for total required makeup volume for 7 days and that continuous outleakage must be assumed for the 7 day period as discussed in SRP 9.2.2.

c. The applicant should also discuss pump seal and valve packing leakage.

<u>Part (c)3</u>- See the follow-up to RAI 9.2.2-59 Part (d) In regard to the proposed use of the fire protection system as the source of Surge Tank Emergency Makeup.

<u>Part (c)4</u>- See the follow-up to RAI 9.2.2-59 Part (d) In regard to the proposed use of the fire protection system as the source of Surge Tank Emergency Makeup.

<u>Parts (d and e)</u>- In Parts (d) and (e) of follow-up RAI 9.2.2-67 in regard to loss of a common header the applicant was requested to provide a description of the necessary operator actions to transfer thermal barrier cooling to the common header that remains operable, the time available to complete these actions before overheating and to address the impact on continued plant operation due to loss of CCWS cooling to other important common header loads that may impact continued plant operation (e.g. RCP motor and bearing oil coolers). In response the applicant provided a detailed explanation which included the potential for RCP trips on high bearing temperature due to loss of CCWS to bearing oil coolers on two RCPs supplied by the common header that was lost. The staff found the applicant's response needed to be clarified.

In response to Parts d and e of RAI 9.2.2-67, the applicant stated "In the event that two CCWS trains supplying the same common header are inoperable, reactor coolant pump (RCP) thermal barrier cooling must be aligned to the CCWS common header that has two operable CCWS trains. There is no time requirement to transfer the thermal barrier cooling in this event since the non-safety chemical and volume control system (CVCS) seal injection to the RCPs is available from the CVCS train that is supplied by the available CCWS common header."

The applicant's positions is that "there is no time requirement to transfer the thermal barrier cooling in this event since the non-safety chemical and volume control system (CVCS) seal injection to the RCPs is available…" does not appear consistent with the plant design. While CVCS seal injection and CCWS thermal barrier cooling provide equivalent thermal barrier cooling (FSAR Tier 2 Section 5.4.1), only CCWS is safety related and relied upon to remain operable under post accident conditions. For an accident the CVCS pumps are not automatically loaded on the EDGs (FSAR Tier 2 Section 7.3.1.2) and seal injection is isolated on a Stage 2 Containment Isolation signal (FSAR Tier 2 Section 9.3.4). RCP seal cooling is necessary to provide assurance of seal integrity during accident conditions. Furthermore the staff noted that the 72 hour LCO condition identified in Technical Specification 3.7.7 Note A-1 appeared only to be intended to minimize the unavailability time of the automatic switchover feature of the two CCWS trains that support the common header supplying the RCP thermal barriers. In other words flow to all RCP thermal barriers is still present when Note A-1 is applicable. In contrast, with both trains inoperable no RCP thermal barrier cooling would be present until operators took manual action to swap the thermal barrier supply to the other common header. These actions would also need to be performed if an accident were to occur during this condition. In conclusion, the staff requests that the applicant clarify the response to Parts d and e of RAI 9.2.2-67 based on the preceding discussion related to time requirements to transfer the thermal barrier cooling if CVCS in not available.

Response to Question 09.02.02-112:

Part (c)1, (c)2, (c)3 and (c)4: A review of the CCWS design confirmed that the emergency post-seismic makeup from the Seismic II Fire Water Distribution System is not required. The primary means to satisfy NRC Standard Review Plan Section 9.2.2, Section 3C guidance will be the retention of a reserve volume in each CCWS surge tank to accommodate 7 days of leakage.

A review of the CCWS design confirmed the assumed valve seat leakage of 5 gpm for isolated portions of the system that resulted in the need for post-seismic makeup was conservative. This value was based on the ASME OM Code ISTC-3630 - Leakage Rate for Other Than Containment Isolation Valves, Part (e) which states “If leakage rates are not specified by the Owner, the following rates shall be permissible: (1), for water, 0.5D gal/min (12.4d ml/sec) or 5 gal/min (315ml/sec), whichever is less, at functional pressure differential”.

For the CCWS, the assumed leakage paths are through each of the (2) 16” Common “a” header isolation valves and the (2) 24” Common “b” header isolation valves. Pump seal leakage and miscellaneous valve packing leakage is also considered for each CCWS train. The leakage rate for the CCWS valves will be based on ASME QME-1-2007 for flow control valves that are also intended to serve as isolation valves. Operational Experience will be included in the design of the surge tank volumetric allotment for post-seismic leakage in addition to code calculated valve seat leakage rates. ASME QME-1-2007 identifies a low leakage rate of 0.1 in.^{3}/hr/NPS of nominal valve size and a nominal leakage rate of 0.6 in.^{3}/hr/NPS of nominal valve size. Assumed pump seal leakage of 100 cubic centimeters per hour and miscellaneous valve packing leakage of 250 cubic centimeters per hour is included in the leakage calculation for each train. The following table summarizes the total train leakage and the total required volume to accommodate continuous leakage for 24 hours/day for 7 days when the nominal rate of 0.6 in^3/hr/NPS of nominal valve size is applied. For valve seat leakage, the worst case pressure delta resulting from one CCWS train in service with the associated train for the same common header depressurized is considered.

	Leakage Rate (ASME QME-1-2007 Nominal Rate for Valves)
(2) 16" Valves (gal/hour)	0.083
(2) 24" Valves (gal/hour)	0.125
Pump Seal (gal/hour)	0.026
Miscellaneous Valve Packing (gal/hour)	0.066
Train Total (gal/hour)	0.3
Train Total (gal/day) (@ constant for 24 hrs/day)	7.2
7 Day Required Volume (gallons)	50.4

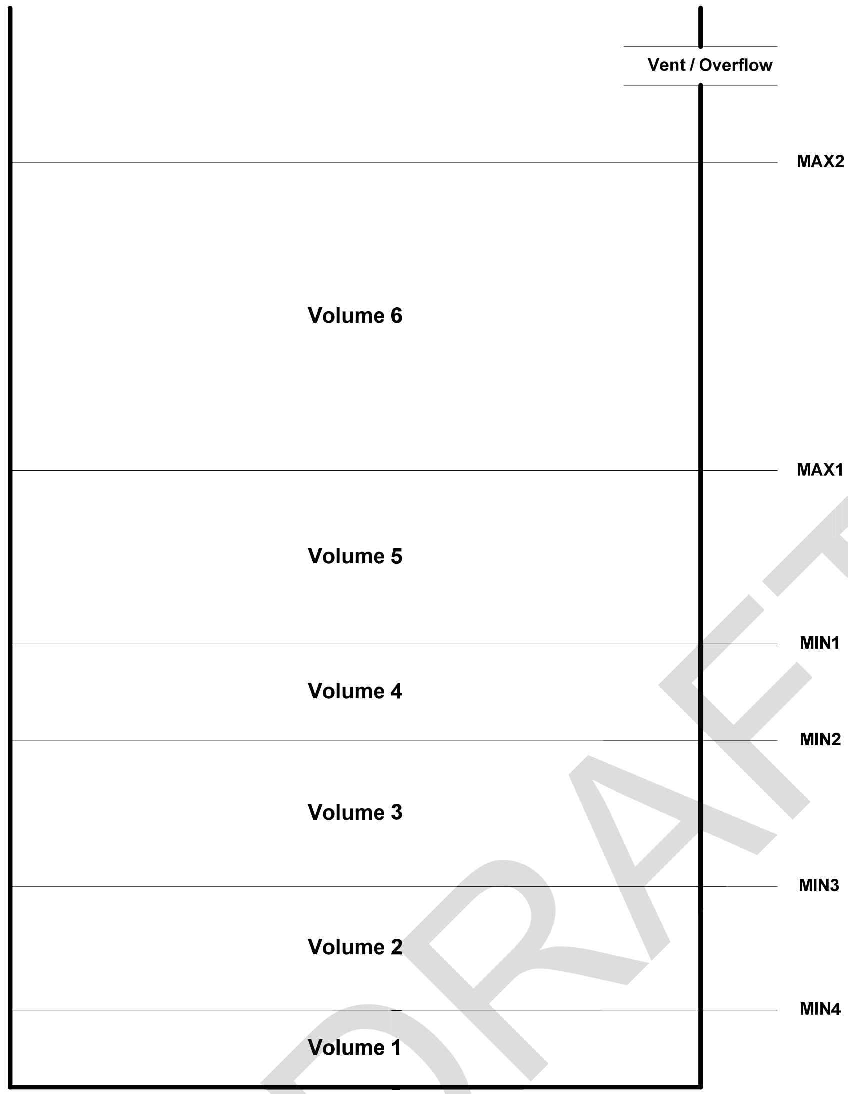
The design of the CCWS includes an Operating Experience review for valves of a like design and service. One particular O/E considered is NRC: EA-96-367 – Perry 1 and NRC: EA-97-430 – Perry 1. In this O/E, a particular motor operated butterfly isolation valve was found to leak at a rate in excess of the analyzed value. The root cause of the evaluation determined that personnel error, weak procedural direction for setting MOV limit switches and mechanical stops and a failure to classify the valves in question as ASME Section XI, Category A for which seat leakage is limited to a specific maximum amount.

To incorporate this O/E, the Safety Related Common Header isolation valves that are considered for post-seismic leakage are included in the IST program. These valves will be tested in accordance with the ASME OM Code, ISTC-3630 (e) which states, “leakage rate measurements shall be compared with permissible leakage rates specified by the plant Owner for a specific valve or valve combination.” Per the ASME OM Code, these valves will be stroke tested quarterly and leak tested every 24 months. The IST program includes pre-service testing to establish baseline criteria for these valves, therefore additional testing will not be included in Chapter 14. Leak rate verification will be included in Tier 1 ITAAC (FSAR Section 2.7.1).

To account for the potential for these valves to leak more than expected, each CCWS surge tank is designed to include a minimum water volume of 750 gallons to accommodate potential system leakage for 7 days continuous for 24 hours with no makeup source in post-seismic conditions. This reserve volume of 750 gallons per train allows the system to accommodate a per valve leakage of 1.08 gallons per hour (26 gallons per day) continuous for 24 hour per day for 7 days in the event that normal Demineralized Water makeup is not available. This reserve volume of 750 gallons for each CCWS surge tank allows each train to accommodate a total train leakage of approximately 4.46 gallons per hour (107 gallons per day) continuous for 24 hours per day for 7 days in the event that normal Demineralized Water makeup is not available. A review of operating experience has confirmed low leakage valves have been installed and maintained seat leakage values below the allowed leakage values for this reserve surge tank volume.

For defense in depth each CCWS surge tank will maintain a post-seismic emergency makeup connection for water supply from the Seismic II Fire Water Distribution System inside the Nuclear Island. The Fire Water Distribution System is designed to remain functional after a SSE (Refer to the Response to RAI 169 Question 9.5.1-66 and FSAR Tier 2 Section 9.5.1.2.1).

The CCWS surge tank volume and level design is as shown in the figure below.



To set the levels for operating volumes in each surge tank, the following considerations are applied:

- Normal Operating level is between MIN1 and MAX1
- Normal Demineralized Water makeup initiates at MIN1
- Non-Safety users outside of the Reactor Building automatically isolate at MIN2
- Common Header Switchover valves automatically isolate at MIN3
- CCWS Pump trip is at MIN4
- The minimum water level in any CCWS surge tank is calculated per ANSI/HI 9.8 (1998). This level is used to determine Volume 1 for each tank. Volume 1 will vary by tank due to slight variations in dimensions for each tank.
- Volume 2 between MIN3 and MIN4 is a water volume equal to 750 gallons per tank. This is the Post-Seismic 7 day leakage volume. This volume of water between MIN3 and MIN4 allows a CCWS train to run for 7 days on safety injection cooling with no surge tank make-up
- Volume 3 between MIN2 and MIN3 is equal to the system fluid lost during automatic isolation of a pipe rupture.

- Setting MIN1 level in each tank will provide Volume 4. Volume 4 will vary by tank due to varying sizes for each tank.
- Volume 5 is an open space volume allocated for thermal expansion of the CCWS system fluid.
- Volume 6 is an open space volume allocated for in-leakage from a HX tube rupture and offer time for operators to diagnose the malfunction and take action.

Per SRP 9.2.2, III, 3.C time zero for consideration of this post seismic leakage value begins at the low level alarm. For the CCWS design, the low level alarm in the tank is MIN3. MIN3 is the level at which “time zero” begins. At MIN3, seat leakage through the isolation valves for the non-safety related users is not a concern because those valves isolate at MIN2. Those valves are inside of the boundary created by closing the switchover valves at MIN3. Accounting for this post-seismic leakage allowance between MIN3 and MIN4 provides the CCWS with adequate capacity to operate for 7 days without reaching the MIN4 level which trips the CCWS pump.

The CCWS system is designed with redundant level indication for each surge tank that is transmitted to the control room. The Demineralized Water makeup line for each CCWS surge tank contains a flow indication device that transmits to the control room. The combination of continuously monitored tank level and demineralized water makeup flow in real time provides the operators the ability to retrieve trending data on surge tank levels and normal makeup flow at any time and for any range of operating time. The ability to retrieve and analyze this data in real time from the MCR provides operators the ability to realize when 7 day train leakage is trending near a threshold value. This provides the operators the ability to take corrective action prior to exceeding the maximum allowed 7 day train leakage.

Parts (d and e): In normal plant operation all four RCP thermal barriers are aligned to one of the two common headers. An interlock on the RCP thermal barrier CIV’s prevents both common headers being aligned simultaneously. If thermal barrier cooling is aligned to Common header 1, the CIV’s for common header 2 are locked closed. In the event one CCWS train becomes inoperable, operators have 72 hours to align RCP thermal barrier cooling to the common header that has two CCWS trains operable per Tech Spec 3.7.7 Required Action A.1. If there is one inoperable train in each common header pair, Action A.1 no longer applies and the plant enters condition B which requires one train of CCWS to be restored to Operable status in 72 hours.

The RCP shaft seal system is made up of a series of three seals and a standstill seal. During normal plant operation, water from the CVCS provides normal seal cooling. CCWS is continuously aligned to the thermal barrier coolers as the safety related backup to CVCS. The CVCS injects directly into the #1 seal and the flow goes down, past the thermal barrier and into the RCS. If seal injection is lost, then reactor coolant flows up through the thermal barrier and into the seal. CVCS water cools the seal when CVCS in operable. When CVCS is not operable, Reactor Coolant (cooled by the thermal barrier) provides cooling to the seal). The standstill seal is not credited as a safety-related design basis accident mitigation feature. It intended only for conditions that are beyond DBA.

The RCP shaft seal system is designed to withstand without damage, the following three operating conditions so that additional margins are provided to recover service water in efforts to minimize plant down time:

- Loss of CVCS water injection to the #1 shaft during continuous operation or pump shutdown with seal cooling provided by the thermal barrier

- Loss of CCWS cooling water to the thermal barrier heat exchanger during continuous operation or with the pump shutdown, with seal cooling provided by CVCS seal injection

- Concurrent loss of #1 shaft seal injection from CVCS and thermal barrier cooling from CCWS if one of the two functions is recovered in 2 minutes or less

To switchover thermal barrier cooling from one CCWS common header to the other, the operators initiate a group command to close the CIV's for the off-going common header. Once these CIV's are closed, the CIV's for the on-coming header are automatically opened. During normal plant operation, a failure of the first set of CIV's to close does not put the operators under a time requirement to restore CCWS flow to the thermal barriers. There is no time requirement in normal operations due to CVCS being available for RCP seal injection. In the event there is a LOOP during the closure of the initial valves with an EDG single failure or a valve single failure, the 1 out of 2 logic on the supply and return valves to close allows the CIVs on the other side to open to provide CCWS flow to the thermal barriers. Refer to the Response to RAI 406, Question 9.2.2-114 for information related to the thermal barrier transfer CIV logic.

If only the CCW flow to a RCP thermal barrier is lost (i.e. other CCW flows to the RCP are functional), the CVCS will supply seal injection to the affected RCP so that normal RCP operation will continue indefinitely without increased risk of seal damage. The COL applicant will establish procedures for restoration of CCW flow to the thermal barriers. A total loss of CCW flow to an RCP (e.g. motor or bearing heat exchangers and thermal barrier) will result in a trip of the affected RCP. A trip of one RCP could cause a partial reactor trip. If the partial reactor trip fails, the RCP trip will result in a full reactor trip. A total loss of CCW flow to more than one RCP will result in a trip of the affected RCPs and a full reactor trip (Refer to FSAR Tier 2, Figure 7.2-10 – Low RCS Flow).

Seal injection via the CVCS, thermal barrier cooling, and RCP heat exchanger flow to the RCPs are not Isolated on a Containment isolation stage 1 signal to prevent RCP seal degradation. A Containment Isolation stage 2 signal will isolate seal injection and all CCW cooling to the RCP except for thermal barrier cooling.

If a LOOP occurs and seal injection via the CVCS and thermal barrier cooling via the CCW is lost, the RCP seals are designed to maintain their integrity for 2 minutes. Upon a LOOP, the CCW pumps are automatically loaded onto the EDGs within 30 seconds (refer to FSAR Tier 2, Table 8.3.4-Division 1 Emergency Diesel Generator Nominal Loads).

If neither CVCS seal injection nor CCWS flow to the thermal barriers is restored after 2 minutes, it is assumed that seal leakage increases because there is no design requirement that they last longer than 2 minutes (Refer to FSAR Section 8.4.2.6.2). If the seals fail, the leak rate is covered in the SBLOCA and LOCA analysis. This condition would be treated as a LOCA.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 9.2.2 and 9.5.1, Tier 1, Section 2.7.1 and Tech Spec 3.7.7 will be revised as described in the response and indicated on the enclosed markup.

containment isolation valves (CIVs) in the RCP thermal barrier cooling path on the supply and return side of CCWS common 1b cannot be opened unless the CIVs on both the supply and return side of common 2b are closed and vice-versa.

The CCWS piping, valves and components supplying the RCP thermal barriers is Seismic Category I, Quality Group C, ASME III Class 3 with the exception of the CIVs and the piping between the CIVs, which are Seismic Category I, Quality Group B, ASME III Class 2.

The non-safety-related CCWS loads in the NAB and RWB can be quickly isolated from the rest of the CCWS by fast-closing hydraulic valves, as required. The non-safety-related common branches of the CCWS trains are shown in Figure 9.2.2-2—Component Cooling Water System Common Loop 1, and Figure 9.2.2-3—Component Cooling Water System Common Loop 2.

The design of the Component Cooling Water System (CCWS) minimizes and withstands adverse transients (i.e., water hammer) and meets functional performance requirements for all operating modes including postulated DBA consistent with the guidance for water hammer prevention and mitigation found in NUREG-0927 (Reference 6).

The CCW system design minimizes the potential for dynamic flow instabilities by avoiding high line velocities and specifying valve opening and closing speeds that are low enough to prevent damaging pressure increases.

Vents are provided for venting components and piping at high points in liquid filled systems that can become normally idle and in which voids could occur. These vents are located for ease of operation and testing on a periodic basis. All drains and vents of the CCWS including surge tank overflow are routed to the nuclear island drain and vent systems.

Consideration has been made to avoid voiding, which can occur following pump shutdown or during standby by placing the pumps and CCWS users at an elevation below the water level of the surge tanks. Means are provided for a slow and controlled fill of those portions of the CCW system where voiding could occur after pump shutdown or during standby.

The design incorporates controls and instrumentation to support operating and maintenance procedures to provide adequate measures to avoid water hammer.

One non-safety-related train comprises the dedicated CCWS. This train cools the SAHRS train, is supplied demineralized makeup water by the dedicated CCWS injection pump, is cooled by its assigned dedicated ESWS train, and is provided backup power from its assigned station blackout diesel generator (SBODG). The dedicated CCWS train consists of one main pump, one dedicated ESWS-cooled HX, one surge

During normal operating conditions, two of the four pumps are operating.

Dedicated CCWS Pump

The dedicated CCWS pump is non-safety-related and is in standby during normal plant operation.

The pump is centrifugal type. The pump motor is cooled by an air-water cooler supplied by the CCWS itself. The pump and motor are horizontally mounted on a common base plate. The pump and motor bearings are oil lubricated and are air cooled.

A motor heater is provided on the motor and is energized when the pump is not in operation to prevent the formation of condensation.

Dedicated CCWS Makeup Pump

The water supply pump is a positive displacement piston type to increase the head of the demineralized water distribution system (DWDS) supply to adjust the level of the pressurized surge tanks. To prevent flow pulses and to limit system vibration a pulsation damper is installed just downstream of the piston pump.

CCWS Heat Exchangers

The CCWS HXs are horizontal tube and shell type HXs. The CCW is circulated on the shell side and the ESWS supplies cooling water on the tube side.

Dedicated CCWS Heat Exchanger

The dedicated CCWS HX is a horizontal tube and shell type HX. CCWS circulates on the shell side and the ESWS supplies cooling water on the tube side.

CCWS Surge Tanks

The CCWS surge tanks are concrete structures with a steel liner. Each tank is connected to the suction side of its respective train CCWS pump.

Each surge tank has sufficient storage capacity to compensate for normal system leaks or component draining. Makeup water is supplied from the DWDS.

An additional makeup source of water to each surge tank originates from the seismically qualified portion of the fire water distribution system inside the Nuclear Island. This makeup source provides sufficient post seismic event surge tank capacity to accommodate an assumed system leakage of 20 gpm for seven days. Emergency makeup to the surge tanks is a manual operation performed by inserting a spool piece between valves AA141 and AA142. The manual valves AA141 and AA142 are then opened to provide the emergency makeup.

Plant procedures and controls associated with the installation of the spool piece will be implemented by the COL applicant.

Dedicated CCWS Surge Tank

The dedicated CCWS surge tank is connected to the dedicated CCWS pump suction line.

The surge tank makeup is provided from the DWDS and nitrogen overpressure is provided to prevent a leak of radioactive fluids into the dedicated CCWS from the SAHRS.

The surge tank is provided with overpressure protection.

Common Header Switchover Valves

The common header switchover valves are fast-acting, hydraulically operated valves.

The valves provide the physical train separation for the support of the common cooling loads. They are used to transfer cooling of the common users during normal plant operation or in the event of a failure during a design basis event.

The valves are interlocked so that two trains may not be simultaneously connected to the same common header. The stroke time of these fast-acting valves is sufficient to minimize the interruption of cooling to the CCWS loads.

To provide reliability of the switchover function, each hydraulically operated common header switchover valve has multiple solenoid operated pilot valves and hydraulic fluid pumps. The solenoid operated pilot valves and hydraulic fluid pumps are each powered from different Class 1E divisions.~~an uninterruptible power supply (UPS) is provided to the hydraulic actuation pilot valves. A failure of the electrical distribution system does not inhibit the transfer of the common header to the non-faulted train~~.

The non-safety load isolation valves are also fast-acting, hydraulically-operated valves. Each hydraulically-operated valve has multiple solenoid-operated pilot valves and hydraulic fluid pumps. Pilot valves and hydraulic fluid pumps are powered from different Class 1E divisions to provide redundancy. ~~Each pilot valve is powered from a different Class 1E uninterruptible power supply division to provide redundancy~~.

LHSI Heat Exchanger Isolation Valves

These valves are motor-operated valves. The valves are normally closed to prevent dilution of the LHSI fluid and may be opened when necessary to provide an adequate

9.2.2.6.1.4 CCWS Pump Control, Protection and Monitoring

High Bearings Temperatures

An alarm is relayed to the operator in the MCR when the pump bearing temperature or the motor bearing temperature is near the first threshold value. The second threshold value trips the pump.

High Windings Temperatures

An alarm is relayed to the operator in the MCR when the motor stator windings temperature is near the first threshold value. The second threshold value trips the pump.

9.2.2.6.1.5 Additional Control Features and Interlocks

- Each CCWS pump is interlocked with its associated LHSI/RHR HX supply valve so that when the pump is stopped the supply valve closes, following a delay to allow for pump coast down. This action prevents potential leakage of the CCWS into the SIS train.

- In the event of a pump low flow condition, the associated LHSI HX isolation valve automatically opens to provide a minimum flow path for CCWS pump protection. In the event of a pump high flow condition, the FPCS HX outlet flow control valve is closed to its minimum opening mechanical stop position to reduce the CCWS flow rate and to maintain normal pump operation.

- The CCWS surge tanks are instrumented with level indication and graduated level control and equipment protection set points designated from lowest to highest level (MIN4, MIN3, MIN2, MIN1, MAX1, MAX2, MAX3 and MAX4). A CCWS train can operate continuously so long as the water level in its surge tank is maintained between MIN1 and MAX1.

- Detection of increasing radiation in the CCWS from the CVCS HP coolers indicates leakage and triggers automatic isolation of the affected CVCS HP cooler via motor-operated valves (KBA11/12 AA001/003) in the CVCS. Leakage of reactor coolant into the CCWS from such users as the LHSI HXs is also indicated by increasing radiation in the CCWS and prompts isolation of the user. Only the RCP thermal barrier and CVCS HP cooler leaks result in automatic isolation of the failed users.

- Manual or automatic actuation of a CCWS pump automatically actuates the corresponding ESWS pump.

9.2.2.7 References

1. ASME Boiler and Pressure Vessel Code, Section III: "Rules for Construction of Nuclear Facility Components," Class 2 and 3 Components, The American Society of Mechanical Engineers, 2004.

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1	Be in MODE 3.	6 hours
	AND		
	C.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1	-------------------------------NOTE------------------------------- Isolation of CCW flow to individual components, other than the RCP thermal barrier cooling common loop, does not render the CCW System inoperable. --	
	Verify each CCW manual, power operated, and automatic valve in the flow path servicing safety related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.7.2 3	Verify each CCW automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	24 months
SR 3.7.7.3 4	Verify each CCW pump starts automatically on an actual or simulated actuation signal.	24 months
SR 3.7.7.2	Verify train leakage for each CCW train less than 4 gallons per hour	31 days

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.7.1

This SR is modified by a Note indicating that the isolation of the CCW flow to individual components may render those components inoperable but does not affect the OPERABILITY of the CCW System.

Verifying the correct alignment for manual, power operated, and automatic valves in the CCW flow path provides assurance that the proper flow paths exist for CCW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves are verified to be in the correct position prior to locking, sealing, or securing. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This Surveillance does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position.

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

3

SR 3.7.7.2

This SR verifies proper automatic operation of the CCW valves on an actual or simulated actuation signal. The CCW System is a normally operating system that cannot be fully actuated as part of routine testing during normal operation. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

FSAR Section 9.2.2.2.2 Insert "A" for RAI 406; 9.2.2-112

The required surge tank water volume to account for system leakage in a post-seismic event with no available makeup is dependent on the assumed system alignment. For the CCWS, the assumed leakage paths are through each of the (2) 16" Common A header isolation valves and the (2) 24" Common B header isolation valves. Pump seal leakage and miscellaneous valve packing leakage is also considered for each CCWS train. The leakage rate for the CCWS valves is be based on ASME QME-1 for flow control valves that are also intended to serve as isolation valves. ASME QME-1 identifies a nominal leakage rate of 0.6 $in.^3$/hr/NPS of nominal valve size. Pump seal leakage of 100 cubic centimeters per hour and miscellaneous valve packing leakage of 250 cubic centimeters per hour is included in the leakage calculation for each train.

The total required volume of water for 7 days of operation with no make-up system is 50.4 gallons. Each CCWS surge tank is designed to include a required water volume of 750 gallons to accommodate potential system leakage for 7 days continuous for 24 hours with no makeup source in post-seismic conditions. This reserve volume of 750 gallons for each CCWS surge tank allows each train to accommodate a total train leakage of approximately 4 gallons per hour continuous for 24 hours per day for 7 days in the event that normal Demineralized Water makeup is not available.

For defense in depth each CCWS surge tank will maintain a post-seismic emergency makeup connection for water supply from the Seismic II Fire Water Distribution System inside the Nuclear Island. The Fire Water Distribution System is designed to remain functional after a SSE (Refer to FSAR Tier 2 Section 9.5.1.2.1).

Insert "B"

SR 3.7.7.2

Verifying CCW train leakage is within limits assures an adequate volume of water is maintained for each CCW train for cooling of SIS loads for 7 days in post-seismic operation with no make water source available. The 31 day Frequency is based on the need to perform this Surveillance under normal operating and shutdown conditions for each CCW train. Operating experience has shown that these components usually pass the Surveillance when performed at the 31 day Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

The leakage value of 4 gallons per hour considers the worst case pressure delta resulting from one CCWS train operating with the associated train for the same common header depressurized. This alignment would result in the greatest potential seat leakage across the isolated common header switchover valves.

If the train leakage surveillance is not within allowable limits for a CCW train, that train and the associated train for the common header will be declared inoperable if the associated train is not already out of service. When two CCW trains are inoperable, one train must be restored to operable status within 72 hours per LCO 3.7.7 Action B.1.

The duration of SR 3.7.7.2 test should be long enough for the installed instrumentation to accurately measure the system losses with considerations to environmental changes in temperatures effecting the thermal contractions and expansion of water in the surge tanks.

Plant procedures and controls associated with SR 3.7.7.2 will be implemented by the COL applicant.

<u>FSAR Section 9.2.2.6.1.5 Insert “C” for RAI 406; 9.2.2-112</u>

The CCWS system is designed with redundant level indication for each surge tank that is transmitted to the control room. The Demineralized Water makeup line for each CCWS surge tank contains a flow indication device that transmits to the control room. The combination of continuously monitored tank level and demineralized water makeup flow in real time provides the operators the ability to retrieve trending data on surge tank levels and normal makeup flow at any time and for any range of operating time. The ability to retrieve and analyze this data in real time from the MCR provides operators the ability to realize when 7 day train leakage is trending near a threshold value. This provides the operators the ability to take corrective action prior to exceeding the maximum allowed 7 day train leakage. Trending CCWS surge tank levels is important to the operation of the system in post-seismic operation because the CCWS is designed to maintain a reserve volume of water in each tank to allow the system to operate for 7 days after an earthquake with no operator action if normal makeup from Demineralized water is not available.

BASES

SURVEILLANCE REQUIREMENTS (continued)

4
SR 3.7.7.3

This SR verifies proper automatic operation of the CCW pumps on an actual or simulated actuation signal. The CCW System is a normally operating system that cannot be fully actuated as part of routine testing during normal operation. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

REFERENCES

1. FSAR Section 9.2.2.
2. FSAR Section 6.2.

- Isolate combustible materials and limit the spread of fire by subdividing plant buildings into fire areas separated by fire barriers.

- Provide the capability to rapidly detect, control, and promptly extinguish fires that do occur.

- Provide protection for structures, systems, and components (SSC) important to safety so that a fire, not promptly extinguished, will not prevent the safe shutdown of the plant or result in the release of radioactive materials to the environment.

- Maintain one success path of SSC necessary to achieve safe shutdown conditions (i.e., cold shutdown) free of fire damage assuming all equipment in any one fire area will be rendered inoperable by fire, and post-fire re-entry for repairs or operator actions is not possible. Because of its physical configuration, the main control room (MCR) is excluded from this approach, but an independent alternative shutdown capability that is physically and electrically independent of the MCR is included in the design.

- Provide fire protection features for redundant shutdown systems in the Reactor Building (RB) that will make sure to the extent practicable that one success path of SSC necessary to achieve safe shutdown conditions (i.e., cold shutdown) is free of fire damage.

- Separate redundant trains of safety-related equipment used to mitigate the consequences of a design basis accident (but not required for safe shutdown following a fire) so that a fire within one train will not damage a redundant train.

- Prevent smoke, hot gases, or fire suppressant agents from migrating from one fire area to another to the extent they could adversely affect safe shutdown capabilities, including operator actions.

- Prevent failure or inadvertent operation of the FPS from impairing the safety capability of SSC important to safety.

- Preclude the loss of structural support, due to warping or distortion of building structural members caused by the heat from a fire, to the extent that such a failure could adversely affect safe shutdown capabilities.

- Provide floor drains sized to remove expected firefighting water flow without flooding safety-related equipment.

- Provide firefighting personnel access and life safety escape routes for each fire area.

- Provide emergency lighting and communications to facilitate safe shutdown following a fire.

- Limit the radiological release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) to as low as reasonably achievable and to not exceed applicable regulatory limits.

7.0 Equipment and System Performance

7.1 The CCWS heat exchangers as listed in Table 2.7.1-1 have the capacity to transfer the design heat load to the ESWS.

7.2 The pumps listed in Table 2.7.1-1 have ~~sufficient~~ net positive suction head ~~absolute~~available (NPSHA) that is greater than net positive suction head required (NPSHR) at system run-out flow.

7.3 The CCWS delivers water to the LHSI/RHRS heat exchangers ~~at the design flowrate~~ to provide cooling.

7.4 The CCWS delivers water to the RCP thermal barrier seals~~ at the required flow~~.

7.5 The CCWS delivers water to Divisions 2 and 3 of the SCWS chiller heat exchangers~~ at the required flow to confirm availability of the SCWS system during design basis events~~.

7.6 The CCWS delivers water to the spent fuel pool cooling heat exchangers~~ at the required flow to confirm cooling of the spent fuel pool during all plant conditions when spent fuel is in the pool~~.

7.7 Class 1E valves listed in Table 2.7.1-2 can perform the function listed in Table 2.7.1-1 under system operating ~~design~~ conditions.

7.8 The CCWS provides for flow testing of CCWS pumps during plant operation.

7.9 Containment isolation valves listed in Table 2.7.1-1 close within the containment isolation response time following initiation of a containment isolation signal.

7.10 The CCWS surge tanks provide adequate capacity for system operation.

8.0 System Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.7.1-3 lists the CCWS ITAAC.

Table 2.7.1-3—Component Cooling Water System ITAAC (7 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
7.6	The CCWS delivers water to the spent fuel pool heat exchangers.	Tests and analyses will be performed to determine the CCWS delivery rate under ~~design~~ operating conditions.	~~A report exists and concludes that t~~The CCWS delivers at least ~~the following design~~ a flowrate to the spent fuel pool cooling heat exchangers of ~~(~~0.8818 x 10^6 lb/hr~~)~~.
7.7	Class 1E valves listed in Table 2.7.1-2 perform the function listed in Table 2.7.1-1 under system operating ~~design~~ conditions.	Tests and analyses or a combination of tests and analyses will be performed to demonstrate the ability of the valves listed in Table 2.7.1-2 to change position as listed in Table 2.7.1-1 under system operating ~~design~~ conditions.	The ~~as-installed~~ valves change position as listed in Table 2.7.1-1 under system operating ~~design~~ conditions.
7.8	The CCWS provides for flow testing of CCWS pumps during plant operation.	A test will be performed.	~~A flow test line~~Normal system alignment allows testing of each CCWS pump during plant operation.
7.9	Containment isolation valves listed in Table 2.7.1-1 close within the containment isolation response time following initiation of a containment isolation signal.	Tests will be performed to demonstrate the ability of the containment isolation valves listed in Table 2.7.1-1 to close within the containment isolation response time following initiation of a containment isolation signal.	Containment isolation valves listed in Table 2.7.1-1 close within 60 seconds following initiation of a containment isolation signal.
7.10	The CCWS surge tanks provide adequate capacity for system operation.	Tests and analysis will be performed to determine the CCWS surge tank capacity.	The CCWS surge tank capacity is equal to or greater than 950 ft^3

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