ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Friday, August 06, 2010 9:53 AM
To: Tesfaye, Getachew
Cc: KOWALSKI David (AREVA); Hearn, Peter
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 406 Q.09.02.02-114.pdf; DRAFT FSAR Insert RAI 406 Q.09.02.02-112.pdf; DRAFT RESPONSE RAI 417 Q.09.02.02-121.pdf

Importance: High

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: KOWALSKI David (RS/NB)
Sent: Friday, August 06, 2010 9:46 AM
To: BRYAN Martin (EXT)
Cc: BALLARD Bob (EP/PE); CONNELL Kevin J (AREVA NP INC); HUDDLESTON Stephen (EP/PE); HARTSELL Jody (EP/PE); BROUGHTON Ronnie (EP/PE); GARDNER Darrell (RS/NB); MCINTYRE Brian (RS/NB); SLOAN Sandra (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. These responses will be discussed at next week's (8/10/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC.

Attached are the following DRAFT responses:

- Response to RAI 406 - Question 09.02.02-112 (FSAR Insert Only).
- Response to RAI 406 - Question 09.02.02-114.
- Response to RAI 417 - Question 09.02.02-121.

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.

Principal Engineer
New Plants Regulatory Affairs

AREVA NP Inc.
An AREVA and Siemens company

7207 IBM Drive, Mail Code CLT-2A
Charlotte, NC 28262
Phone: 704-805-2590
Mobile: 704-293-3346

Fax: 704-805-2675
Email: David.Kowalski@areva.com

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 1790

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71071F7335)

Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Sent Date: 8/6/2010 9:53:15 AM
Received Date: 8/6/2010 9:53:25 AM
From: BRYAN Martin (EXTERNAL AREVA)

Created By: Martin.Bryan.ext@areva.com

Recipients:
"KOWALSKI David (AREVA)" <David.Kowalski@areva.com>
Tracking Status: None
"Hearn, Peter" <Peter.Hearn@nrc.gov>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	1601	8/6/2010 9:53:25 AM
Blank Bkgrd.gif	210	
DRAFT RESPONSE RAI 406 Q.09.02.02-114.pdf		493752
DRAFT FSAR Insert RAI 406 Q.09.02.02-112.pdf		406119
DRAFT RESPONSE RAI 417 Q.09.02.02-121.pdf		658512

Options
Priority: High
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

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)

DRAFT

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 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 three of the CIVs of the off-going common header simultaneously and open all three 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 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 valve closure, the other group of CIVs (KAB30 AA049/051/052 (Common 1.b) or KAB30 AA053/055/056 (Common 2.b)) is opened. In case a CIV fails to close on the initial common header or lack of valve opening 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

DRAFT

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.

Within the Tech Spec LCO to transfer RCP thermal barrier cooling a CIV of the off-going header failing in mid position and not fully closing or restoring to the original full open position, the CVCS seal injection will continue to operate and there is no immediate concern for the operator to restore full CCW flow to the RCP thermal barrier coolers. In this condition, the partially open CCW CIV valve could limit CCW flow to the RCP thermal barrier coolers however, it will not impact the operability of the CCWS to cool other components or the ability of the CVCS to supply seal injection to the RCP shaft seals. This same scenario is true if the initial CCW common header RCP thermal barrier CIVs close and a CIV of the on-coming common header is stuck in a partially open position. This condition would put the CCW system in an LCO condition and full CCW flow would need to be restored to the RCP thermal barrier coolers or the unit must be placed in at least Mode 3 within 6 hours and in Mode 5 within 36 hours in accordance with Section B 3.7.7 - Actions C.1 and C.2 of the FSAR.

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). In the scenario of a failed RCP thermal barrier CIV in mid-position with another initiating event that causes a LOOP, the RCPs trip and CVCS seal injection is lost. When CCWS is restarted on the EDGs, the RCP thermal barriers will have reduced flow through the mechanically failed valve in mid-position. As stated above, 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. If CCWS flow to the thermal barriers is not recovered after two minutes, the

DRAFT

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.

The scenario of a failed RCP thermal barrier CIV in mid-position as an initiating event with a LOOP at that exact instance is a highly unlikely event that can be considered Beyond Design Basis. This is not considered a credible event for the AREVA EPR.

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.

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. U.S. EPR FSAR Section 3.7.7 will be revised to include a confirmation of CVCS flow to the RCP seals prior to RCP thermal barrier transfer within the CCWS.

   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.

DRAFT

4. Failure of a CCWS CIV for RCP Thermal Barrier cooling to close renders the CCWS system inoperable per Tech Spec 3.7.7 as this condition would degrade flow to the RCP thermal barriers. In effect, this would render each of the two trains capable of supplying the common header aligned to thermal barrier cooling inoperable for thermal barrier cooling because neither of the trains could provide thermal barrier cooling. This condition would put the CCW system in an LCO condition and full CCW flow would need to be restored to the RCP thermal barrier coolers or the unit must be placed in at least Mode 3 within 6 hours and in Mode 5 within 36 hours in accordance with Section B 3.7.7 - Actions C.1 and C.2 of the FSAR. LCO 3.6.3 Note 3 under Actions states "Enter applicable conditions and Required Actions for systems made inoperable by Containment Isolation Valves". This again would go back to Tech Spec LCO 3.7.7 as stated above.

   In the event that a CIV of the off-going header fails in mid position and is not restored to the original full open position or closed to allow the CIVs of the on-coming header to open and CVCS seal injection is available, there is no priority requirement for the operator. If a CIV of the off-going header fails in mid-position and is not restored to full open position or closed to allow the CIVs of the on-coming header to open and CVCS seal injection is not available, one of the two flows (CCWS or CVCS) must be restored within two minutes. Loss of CCW cooling to the RCP thermal barrier coolers does not impact the operation of the CVCS. Therefore, assuming a concurrent loss of seal injection to the RCPs should not be required in the short term.

   Related to Tech Spec 3.6.3, the Containment Isolation function on the RCP thermal barrier supply side is maintained by the check valve inside containment if there is a failure of the RCP thermal barrier CIV outside containment 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, and prior to the SBO test, an analysis will be performed to evaluate o-ring extrusion gaps and clearances within the shaft seal in SBO conditions. 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, Section 9.2.2 and 3.7.7 will be revised as described in the response and indicated on the enclosed markup.

DRAFT

~~supply and return side of Common 2b are closed, and vice-versa. If one CCWS train is inoperable, RCP thermal barrier cooling will be aligned to the CCWS common header with two operable CCWS trains.~~

Either CCWS common 1b or 2b headers can provide cooling to the RCP thermal barriers. CCWS supply to the RCP thermal barriers is able to withstand a single, active failure or a moderate-energy crack because of the thermal barrier cross tie that provides cooling from either common header, thus allowing cooling supply from any of the four CCWS trains. To meet single failure criteria for the RCP thermal barrier cooling function, the thermal barrier load is required to be cooled by a CCWS common header, which is capable of being connected to two operable CCWS trains. If a CCWS train is out of service for maintenance or because of a single failure, the operators have 72 hours to align RCP thermal barrier cooling to the CCWS common header that has two CCWS supply trains available. If a single failure removes one of the two trains available for that common header, the operator does not have the option to align RCP thermal barrier cooling to a common header with two operable CCWS trains, but there are still two operable CCWS trains available (one for each common header) for thermal barrier cooling. In the event of an RCP thermal barrier fault such as a tube rupture, this single RCP thermal barrier is isolated via inlet and outlet isolation valves in the RCS. A fault of a single RCP thermal barrier does not isolate the entire common header supply to the remaining operable thermal barriers. To maintain strict CCWS train separation for thermal barrier cooling, an interlocking function is required. The 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).

DRAFT

3.7 PLANT SYSTEMS

3.7.7 Component Cooling Water (CCW) System

LCO 3.7.7 Four CCW trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

----------NOTE----------
Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," for residual heat removal loops made inoperable by CCW System.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One CCW train inoperable.	A.1	----------NOTE---------- Required Action A.1 is not applicable if CCW trains are inoperable in both CCW headers supplying the reactor coolant pump (RCP) thermal barrier cooling common loop and Condition B is entered. ---------- Align RCP thermal barrier cooling common loop to the CCW header with two OPERABLE CCW trains.	72 hours
	<u>AND</u>		
	A.2	Restore CCW train to OPERABLE status.	120 days
B. Two CCW trains inoperable.	B.1	Restore one CCW train to OPERABLE status.	72 hours

DRAFT

BASES

LCO

The CCW System consists of four trains. Four CCW trains are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post accident heat loads.

A CCW train is considered OPERABLE when:

a. The pump and associated surge tank are OPERABLE; and

b. The associated piping, valves, heat exchanger, and instrumentation and controls required to perform the safety related function are OPERABLE.

With the exception of the RCP thermal barrier cooling common loop, the isolation of CCW from other components or systems not required for safety may render those components or systems inoperable but does not affect the OPERABILITY of the CCW System.

APPLICABILITY

In MODES 1, 2, 3, and 4, the CCW System is a normally operating system, which must be prepared to perform its post accident safety functions, primarily RCS heat removal, which is achieved by cooling the Low Head Safety Injection heat exchanger.

In MODE 5 or 6, the OPERABILITY requirements of the CCW System are determined by the systems it supports.

ACTIONS

A Note has been added to indicate that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," be entered if an inoperable CCW train results in an inoperable RHR loop. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

A.1

Required Action A.1 is modified by a Note indicating that the Required Action of A.1 is not applicable if CCW trains are inoperable in both common headers. In this condition, the RCP thermal barrier cooling common loop cannot be aligned to common header capable of being connected to two OPERABLE trains.

DRAFT

BASES

ACTIONS (continued)

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 hrs. In this condition, the CCW System 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.

A.2

If one CCW train is inoperable, action must be taken to restore OPERABLE status within 120 days. In this condition, the remaining OPERABLE CCW trains are adequate to perform the heat removal function.

B.1

If two CCW trains are inoperable, action must be taken to restore one train to OPERABLE status within 72 hours. In this condition, the remaining OPERABLE CCW trains are adequate to perform the heat removal function. The 72 hour Completion Time is reasonable, based on the redundant capabilities afforded by the OPERABLE trains, and the low probability of a postulated accident occurring during this period.

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 a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems.

DRAFT

~~supply and return side of Common 2b are closed, and vice-versa. If one CCWS train is inoperable, RCP thermal barrier cooling will be aligned to the CCWS common header with two operable CCWS trains.~~

Either CCWS common 1b or 2b headers can provide cooling to the RCP thermal barriers. CCWS supply to the RCP thermal barriers is able to withstand a single, active failure or a moderate-energy crack because of the thermal barrier cross tie that provides cooling from either common header, thus allowing cooling supply from any of the four CCWS trains. To meet single failure criteria for the RCP thermal barrier cooling function, the thermal barrier load is required to be cooled by a CCWS common header, which is capable of being connected to two operable CCWS trains. If a CCWS train is out of service for maintenance or because of a single failure, the operators have 72 hours to align RCP thermal barrier cooling to the CCWS common header that has two CCWS supply trains available. If a single failure removes one of the two trains available for that common header, the operator does not have the option to align RCP thermal barrier cooling to a common header with two operable CCWS trains, but there are still two operable CCWS trains available (one for each common header) for thermal barrier cooling. In the event of an RCP thermal barrier fault such as a tube rupture, this single RCP thermal barrier is isolated via inlet and outlet isolation valves in the RCS. A fault of a single RCP thermal barrier does not isolate the entire common header supply to the remaining operable thermal barriers. To maintain strict CCWS train separation for thermal barrier cooling, an interlocking function is required. The 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).

DRAFT

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 ~~(Seismic II)~~ 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. Actuation of the valves is provided by a hydraulic circuit. A normally closed pilot valve blocks the hydraulic fluid path to the reservoir and the associated hydraulic pump generates the motive force to compress the valve actuator spring to open the valve. Closure of the valve is accomplished by energizing the pilot valve to bleed off the hydraulic fluid pressure, while the actuator spring closes the valve.

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.

DRAFT

FSAR Section 9.2.2.2.2 Insert 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 low leakage rate of 0.1 in.^{3}/hr/NPS of nominal valve size and a nominal 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.

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.

DRAFT

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)

09.02.02-121

Follow-up to RAI 334, Question 9.2.2-76 and RAI 174, Question 9.2.2-31:

Part (i)2 and Part i(3)- In Parts (i)2 and (i)3 of follow-up RAI 9.2.2-76 the staff asked the applicant to resolve discrepancies with the alternate power source for ESWS and CCWS Dedicated Train Components identified in U.S. EPR FSAR Tier 1 Tables 2.7.1-2 (CCWS) and 2.7.11-2 (ESWS). In Part (i)2 the staff noted that the FSAR markup provided by the applicant in the response to RAI 174, Supplement 3 of Table 2.7.1-2 identified normal power for the Dedicated Train was provided by Class 1E Division 4 with alternate power from Division 3 for some components but not for others. In Part (i)3 the staff asked the applicant to resolve differences in the power source identified in dedicated train components between CCWS Tier 1 Table 2.7.1-2 (markup for RAI 174, Supplement 3) and ESWS Tier 1 Table 2.7.11-2 (From FSAR Rev. 1). For some Dedicated Train components ESWS Table 2.7.11-2 identified Division 4 normal power with alternate power from the SBO EDG while the markup of CCWS Table 2.7.1-2 identified alternate power from division 3.

The response provided by the applicant in RAI 334, Supplement 1 included markups of Tier 1 Tables 2.7.1-2 and Table 2.7.11-2 as well as Tier 2 Sections 9.2.1 (ESWS) and 9.2.2 (CCWS). The staff's review of the applicant's response and markup of Tier 1 Tables 3.7.1-2 and 2.7.11-2 found them acceptable since only normal power was identified from Class 1E Division 4 and the conflicting alternate power sources were deleted. However, the staff review of the markups provided for FSAR Tier 2 Sections 9.2.1 and 9.2.2 noted a difference in the description of the power source for the Dedicated ESWS Train when compared to the markup for CCWS. The staff believes the FSAR description for the power source for the Dedicated ESWS and CCWS trains should be consistent. Accordingly, the applicant is requested to revise the markup provided for FSAR Tier 2, Section 9.2.1 and 9.2.2 to provide consistency. The subject descriptions from the markup are provided below followed by a list of items that require clarification.

From the markup of ESWS Tier 2 Section 9.2.1, Page 9.2-3

> The dedicated ESWS pump is powered by Class 1E electrical buses and is capable of being supplied by an EDG or a station blackout diesel generators (SBODG).

From the markup of CCWS Tier 2 Section 9.2.2, Page 9.2-20

The dedicated CCWS train … is normally fed from offsite power and is capable of being supplied by the onsite electrical power supplies that are backed by an EDG or SBO diesel generator.

The applicant should provide clarifications as shown below:

1. The FSAR description should state that the identified power sources are applicable to the entire dedicated train (pump, valves, components etc.) not just the pump as stated in the ESWS markup.

2. The FSAR description should be corrected since Tier 1 Table 2.7.1-2 and Table 2.7.11-2 which identified normal power for the dedicated train is from Class 1E Division 4, conflicts with the CCWS markup of Section 9.2.2 states that the normal source is off-site power.

3. The FSAR description should state the dedicated trains are also capable of being powered by the Division 4 EDG or the SBO DG.

Part (i)5- In Part (i)5 the applicant was asked to describe the basis for CCWS equipment that is provided with alternate power supplies in Tier 2, Section 9.2.2 In RAI 334 Supplement 1 the applicant responded by including new Table 9.2.2-4 "Power Supplies for CCWS Valves" in the markup of U.S. EPR FSAR Tier 2 Section 9.2.2 which is consistent with Tier 1. The Table identifies CCWS motor operated valves that are provided with normal and alternate Class 1E power supplies. The staff noted that Tier 2 Section 8.3.1.1.1, "Emergency Power Supply System," describes the alternate feed alignments which addressed the basis for alternate power in the EPR design for added power flexibility. However, the staff noted that the markup of Tier 1 Table 2.7.1-2 should identify a Class 1E power source for hydraulic fluid pumps that are associated with each hydraulic valve and associated pilot valves. This information should be added to the FSAR.

Part (m)- In Part (m) the staff requested that the applicant define the ESWS/CCWS design heat load in Tier 1 and cited examples of comparable FSAR Tier 1 Sections where this information was provided. In RAI 334 Supplement 1 the applicant responded by referring to the response to RAI 9.2.2-77 for revised CCWS ITAAC. However, the staff's review of the response to RAI 9.2.2-77 found no information was provided in regard to the addition of ITAAC for ESWS/ CCWS Hx heat load. The applicant should provide this information in Tier 1.

DRAFT

Response to Question 09.02.02-121:

Part (i)2 and (i)3:

1. A review of the CCWS and ESWS confirmed the identified power sources are applicable to the entire dedicated train for each system. U.S. EPR FSAR Section 9.2.1 will be revised to include this information. Refer to the Response to RAI 345 Question 9.2.1-26 for additional information and Tier 2 revisions related to the Dedicated ESWS.
2. A review of the CCWS and ESWS confirmed normal power for the dedicated train of each system is from Class 1E Division 4. U.S. EPR FSAR Section 9.2.2 will be revised to include this information.
3. Refer to the Response to 1 and 2 above for the Tier 2 Sections 9.2.1 and 9.2.2 addition of the description related to alternate power from an EDG or SBODG. Refer to the Response to RAI 345 Question 9.2.1-26 for the addition of this information in Tier 1 Section 2.7.11. U.S. EPR FSAR Tier 1 Table 2.7.1-3 will be revised to include this information.

Part (i)5:

A review of the CCWS confirmed the Class 1E power source for hydraulic fluid pumps that are associated with each hydraulic valve. The common header switchover valves (KAA10/20/30/40 AA006/010/032/033) will be designed to fail as is on loss of power to their hydraulic pilot circuits. The Safety Related isolation valves used to isolate the non-safety related portions of the system (KAB50 AA001/004/006 and KAB80 AA015/016/019) will be designed to fail closed on loss of power to their hydraulic pilot circuits. U.S. EPR FSAR Tier 1, Table 2.7.1-2 will be revised to add hydraulic fluid pumps to the current discussion related to pilot valves for the hydraulically operated valves.

Part (m):

A review of the CCWS confirmed the DBA heat load for the CCWS heat exchanger of 291.8E+06 BTU/hr. Refer to the Response to RAI 406 Question 9.2.2-110 for details related to the CCWS heat exchanger design data. U.S. EPR FSAR Tier 1 Table 2.7.1-3 will be revised to include this information.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.7.1 and Tier 2 Sections 9.2.1 and 9.2.2 will be revised as described in the response and indicated on the enclosed markup.

DRAFT

ESWS are powered by Class 1E electrical buses and are emergency powered by the EDGs.

The non-safety-related dedicated division contains a dedicated ESWS pump, debris filter, piping, valves, controls, and instrumentation. The non-safety related ESWS pumps cooling water from the division four UHS cooling tower basin to the dedicated CCWS HX and back to the division four UHS cooling tower during severe accidents (SA). The dedicated ESWS pump is powered by Class 1E electrical buses and is capable of being supplied ~~emergency powered~~ by an EDG or a ~~the~~ station blackout diesel generators (SBODG).

Refer to Section 12.3.6.5.7 for essential service water system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.2.1.3 Component Description

9.2.1.3.1 Safety-Related Essential Service Water Pumps

Each of the four safety-related cooling divisions contains one 100 percent capacity pump. During normal operating conditions, two of the four divisions are operating. The required flow rate of each ESWS pump is defined by the heat to be removed from the system loads. Design parameters are listed in Table 9.2.1-1. The pumps are designed to fulfill the corresponding minimal required design mass flow rate under the following conditions:

- Minimal water level without cavitation.
- Head losses in the cooling water inlet piping according to full power plant operation.
- Fluctuations in the supplied electrical frequency.
- Increased pipe roughness due to aging and fouling.
- Fouled debris filters.
- Maximum pressure drop through the system HXs.
- Minimum water level in cooling tower basin considers minimum submergence requirements to prevent vortex effects, and net positive suction head to prevent cavitation of the ESWS pump.

Determination of the discharge head of the pumps is based on the dynamic pressure losses, the minimum/maximum water levels of the water source, and the head losses of the mechanical equipment of the associated ESWS at full load operation.

DRAFT

which performs a containment isolation function is classified Seismic Category I. This equipment is located in buildings designed to Seismic Category I requirements.

~~CCWS equipment that does not serve safety-related functions but is routed proximate to other safety-related structures, systems and components (SSC) is classified Seismic Category II to prevent loss of function of safety-related SSC.~~

CCWS users, which are not classified Seismic Category I, can be isolated by Seismic Category I fast-acting isolation valves in case of external hazards.

The Seismic Category I fast-acting isolation valves for non-safety-related CCWS users are hydraulically operated and designed to close in less than 10 seconds. The CCWS common header switchover valves are also fast-acting hydraulically operated valves with a closure time of less than 10 seconds. These switchover valves can be used to isolate the common headers to conserve the system capacity to cool the safety-related SIS users directly associated with the CCWS train.

The four separate, independently powered safety cooling trains of the CCWS, combined with high standards for system design, installation and maintenance, provides assurance that the system will fulfill its safety-related function under the most demanding postulated conditions in spite of its most limiting credible single failure.

During severe accidents, containment heat is removed by the dedicated cooling chain, consisting of the SAHRS, dedicated CCWS, and dedicated ESWS. This dedicated CCWS train is normally in standby operation and is manually started if needed. In case of loss of the dedicated CCWS or ESWS division, the SAHRS cooling chain is lost. This condition is outside the DBA. The dedicated CCWS train supports beyond design basis accident mitigation and is normally fed from offsite power and is capable of being supplied by the onsite electrical power supplies that are backed by an EDG or SBO diesel generator.

Each physically separated CCWS safety-related train includes:

- A main system pump fitted with a recirculation line and pump motor cooling line.
- An HX, cooled by ESWS, with a parallel flow bypass line with control valve to maintain CCW minimum temperature during cold weather and low-load operation.
- A concrete, steel lined surge tank connected to the pump suction line with sufficient capacity to compensate for CCWS normal leaks or component draining.
- A sampling line with continuous radiation monitor.
- A chemical additive supply line.

DRAFT

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 CVCS HP Cooler 1 Downstream Control Valve	KAB60AA116	Reactor Building	NA	N/A	Yes	Pos	Open-Close
Common Header 2b Safety Related Loads CVCS HP Cooler 2 Downstream Control Valve	KAB70AA116	Reactor Building	NA	N/A	Yes	Pos	Open-Close
Dedicated CCWS Surge Tank Isolation Valve	KAA80AA020	Safeguards Building 4	4	N/A	Yes	Pos	Open-Close
Dedicated CCWS Surge Tank Nitrogen Supply Valve	KAA80AA021	Safeguards Building 4	4	N/A	Yes	Pos	Open-Close
Dedicated CCWS Demin Water Makeup Water Supply Valve	KAA80AA202	Safeguards Building 4	4	N/A	Yes	Pos	Open-Close
Dedicated CCWS Pump	KAA80AP001	Safeguards Building 4	4	N/A	Yes	On-Off / NA	Start-Stop / NA
Dedicated CCWS Demin Water Makeup Pump	KAA80AP201	Safeguards Building 4	4	N/A	Yes	On-Off / NA	Start-Stop / NA

DRAFT

To provide reliability of the switchover function, 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. Each pilot valve is powered from a different Class 1E uninterruptible power supply division to provide redundancy.~~The difference between the isolation and switchover valves is in the actuation of the pilot valves. The pilot valves for the non-safety load isolation valves are de-energized to open and bleed off the hydraulic fluid pressure.~~

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 flow path to support long term pump operation. The valves automatically open when the train associated LHSI system is placed into service.

LHSI Pump Seal Fluid Cooler Isolation Valves

These valves are motor-operated valves. The valves are normally closed to prevent dilution of the LHSI fluid and automatically open when the train associated LHSI system is placed into service.

Containment Isolation Valves

The CCWS containment isolation valves are motor-operated valves. The normally open valves provide the means for containment isolation to maintain the integrity of the containment penetrations and thus prevent the release of potentially radioactive material during a design based accident. The containment isolation valves for non-safety-related loads are automatically closed by containment isolation actuation signals. The containment isolation valves for the RCP thermal barrier coolers are not provided with a containment isolation signal but may be remote manually closed from the control room if required.

9.2.2.3 System Operation

9.2.2.3.1 Normal System Operation

The safety-related CCWS is a four train concept which allows sharing of operational and safety users during normal operation and to separate them in case of design and beyond design based accidents. Each physically separated train consists of a main pump, motor cooler, an HX, surge tank, sample piping with permanently installed radiation monitor, a chemical addition tank and pairs of common header isolation valves. Each train also supplies cooling to the associated MHSI pump motor cooler and

DRAFT

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
Safety Chilled Water Chiller CCWS Flow Control Valve	KAA22AA101	Safeguards Building 2	2^N 1^A	N/A	Yes	NA / NA	NA / NA
Safety Chilled Water Chiller CCWS Flow Control Valve	KAA32AA101	Safeguards Building 3	3^N 4^A	N/A	Yes	NA / NA	NA / NA

1) Equipment tag numbers are provided for information only and are not part of the certified design.

2) ^{N} denotes the division the component is normally powered from; ^{A} denotes the division the component is powered from when alternate feed is implemented.

3) Each hydraulically operated valve has multiple solenoid-operated pilot valves. Each pilot valve is powered from a different Class 1E uninterruptible power supply division to provide redundancy.

DRAFT

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

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		b. Components listed as harsh environment in Table 2.7.1-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.~~b. For equipment listed for harsh environment in Table 2.7.1-2, an inspection will be performed of the as-installed Class 1E equipment and the associated wiring, cables and terminations.~~	b. Inspection reports exists and conclude that the components listed in Table 2.7.1-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.~~b. Inspection concludes the as-installed Class 1E equipment and associated wiring, cables, and terminations as listed in Table 2.7.1-2 for harsh environment conform to the design.~~
7.1	The CCWS heat exchanger as listed in Table 2.7.1-1 has the capacity to transfer the design heat load to the ESWS system.	Tests and analyses will be performed to demonstrate the capability of the CCWS heat exchanger as listed in Table 2.7.1-1 to transfer the heat load to the ESWS.	~~A report exists and concludes that the ESWS has the capacity to remove the design heat load via the heat exchanger listed in Table 2.7.1-1.~~The CCW heat exchanger satisfies the required heat transfer of an equivalent combined product of the heat exchanger area of 39963 ft^2 and the overall heat transfer coefficient of 360 $BTU/hr*ft^2*°F$.
7.2	The pumps listed in Table 2.7.1-1 have sufficient NPSHA.	Testing and analyses will be performed to verify NPSHA for pumps listed in Table 2.7.1-1.	~~A report exists and concludes that t~~The pumps listed in Table 2.7.1-1 have NPSHA that is greater than net positive suction head required (NPSHR) at system run-out flow with consideration for minimum allowable surge tank water level (as corrected to account for actual temperature and atmospheric conditions).

DRAFT