AREVAEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Monday, August 23, 2010 11:22 AM
To: Tesfaye, Getachew
Cc: Hearn, Peter; KOWALSKI David (AREVA); ROMINE Judy (AREVA)
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 406 Q.09.02.02-112.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: Monday, August 23, 2010 11:13 AM
To: BRYAN Martin (External RS/NB)
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 questions. This response will be discussed at tomorrow's (8/24/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC.

Attached are the following DRAFT response(s):

- Response to RAI 406 - Question 09.02.02-112.

Note that this DRAFT response has not been through the final Licensing review/approval process; nor does it 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: 1874

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71074C83BF)

Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Sent Date: 8/23/2010 11:21:53 AM
Received Date: 8/23/2010 11:22:32 AM
From: BRYAN Martin (EXTERNAL AREVA)

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

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

Post Office: AUSLYNCMX02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	1457	8/23/2010 11:22:32 AM
Blank Bkgrd.gif	210	
DRAFT RESPONSE RAI 406 Q.09.02.02-112.pdf	886684	

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)

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

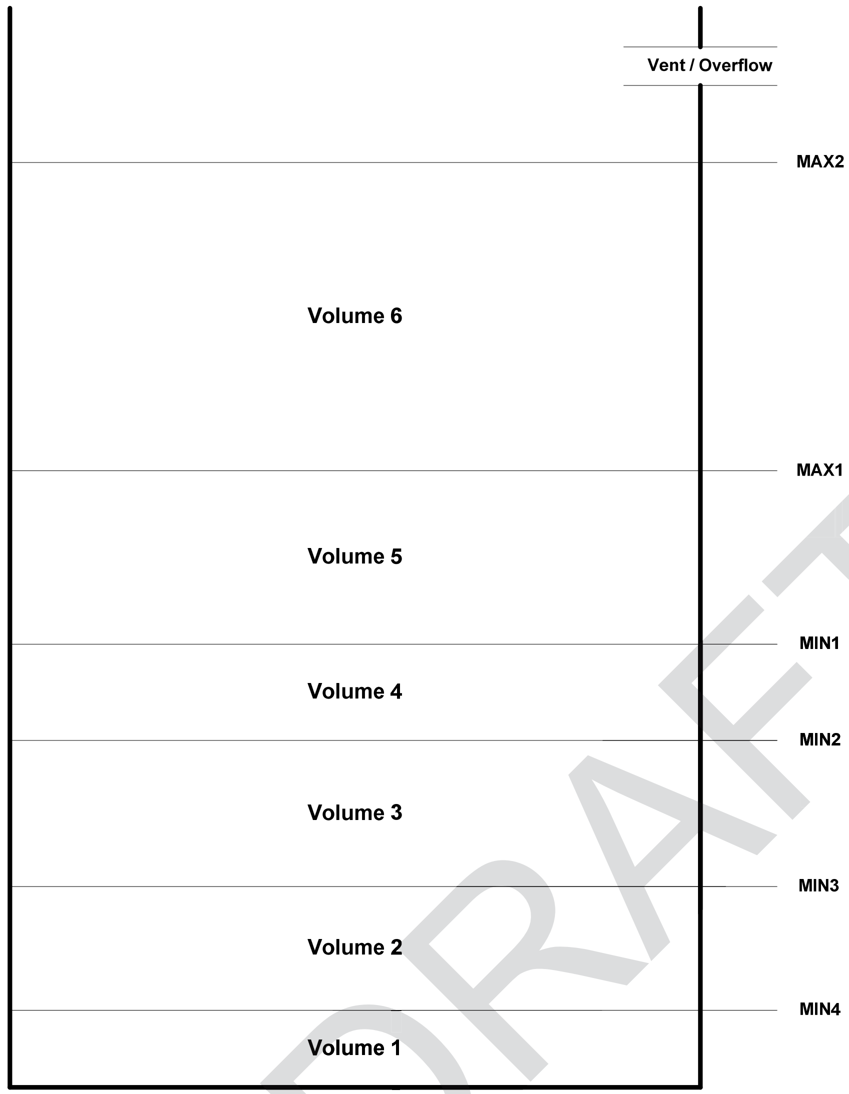
The design of the CCWS includes an Operating Experience review for valves of a like design and service. One particular O/E considered is NRC: EA-96-367 – Perry 1 and NRC: EA-97-430 – Perry 1. In this O/E, a particular motor operated butterfly isolation valve was found to leak at a rate in excess of the 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 first 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 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 due to CVCS being available.

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 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 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. 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).

<u>Insert "B"</u>

<u>SR 3.7.7.2</u>

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.

FSAR Section 9.2.2.6.1.5 Insert "C" for RAI 406; 9.2.2-112

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

Next File