ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Tuesday, September 14, 2010 6:11 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); KOWALSKI David (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 361, FSARCh. 9, Supplement 3
Attachments: RAI 361 Supplement 3 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the eleven questions in RAI No. 361 on April 2, 2010. Supplement 1 and Supplement 2 responses to RAI No. 361 were sent on July 1, 2010 and August 31, 2010, respectively, to provide a revised schedule.

The attached file, "RAI 361 Supplement 3 Response US EPR DC.pdf" provides technically correct and complete responses to seven of the eleven questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the responses to RAI 361 Questions 09.02.02-94, 09.02.02-96, 09.02.02-98, 09.02.02-99, 09.02.02-100, 09.02.02-102 and 09.02.02-104.

The following table indicates the respective pages in the response document, "RAI 361 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 361 — 09.02.02-94	2	2
RAI 361 — 09.02.02-96	3	3
RAI 361 — 09.02.02-98	4	5
RAI 361 — 09.02.02-99	6	7
RAI 361 — 09.02.02-100	8	8
RAI 361 — 09.02.02-102	9	9
RAI 361 — 09.02.02-104	10	10

Since the remaining responses are being processed, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the questions has been revised as provided below.

Question #	Response Date
RAI 361 — 09.02.02-95	September 30, 2010
RAI 361 — 09.02.02-97	September 30, 2010
RAI 361 — 09.02.02-101	September 30, 2010
RAI 361 — 09.02.02-103	September 30, 2010

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
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From: BRYAN Martin (External RS/NB)
Sent: Tuesday, August 31, 2010 4:03 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 361, FSARCh. 9, Supplement 2

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the eleven questions in RAI No. 361 on April 2, 2010. Supplement 1 of RAI No. 361 was sent on July 1, 2010 to revise the schedule. Since responses to the remaining questions are being processed, a revised schedule is provided in this email.

The schedule for technically correct and complete responses to these questions is provided below.

Question #	Response Date
RAI 361 — 09.02.02-94	September 14, 2010
RAI 361 — 09.02.02-95	September 14, 2010
RAI 361 — 09.02.02-96	September 14, 2010
RAI 361 — 09.02.02-97	September 14, 2010
RAI 361 — 09.02.02-98	September 14, 2010
RAI 361 — 09.02.02-99	September 14, 2010
RAI 361 — 09.02.02-100	September 14, 2010
RAI 361 — 09.02.02-101	September 14, 2010
RAI 361 — 09.02.02-102	September 14, 2010
RAI 361 — 09.02.02-103	September 14, 2010
RAI 361 — 09.02.02-104	September 14, 2010

Sincerely,

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From: BRYAN Martin (EXT)
Sent: Thursday, July 01, 2010 4:40 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC); 'Carneal, Jason'
Subject: Response to U.S. EPR Design Certification Application RAI No. 361, FSARCh. 9, Supplement 1

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the eleven questions in RAI No. 361 on April 2, 2010.

To allow time for interaction between AREVA and the NRC staff, a revised schedule is provided in this e-mail.

The schedule for technically correct and complete responses to the eleven questions has been revised and is provided below.

Question #	Response Date
RAI 361 — 09.02.02-94	August 31, 2010
RAI 361 — 09.02.02-95	August 31, 2010
RAI 361 — 09.02.02-96	August 31, 2010
RAI 361 — 09.02.02-97	August 31, 2010
RAI 361 — 09.02.02-98	August 31, 2010
RAI 361 — 09.02.02-99	August 31, 2010
RAI 361 — 09.02.02-100	August 31, 2010
RAI 361 — 09.02.02-101	August 31, 2010
RAI 361 — 09.02.02-102	August 31, 2010
RAI 361 — 09.02.02-103	August 31, 2010
RAI 361 — 09.02.02-104	August 31, 2010

Sincerely,

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From: BRYAN Martin (EXT)
Sent: Friday, April 02, 2010 5:24 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); KOWALSKI David J (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 361, FSARCh. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 361 Response US EPR DC," provides a schedule since technically correct and complete responses to the eleven questions are not provided.

The following table indicates the respective pages in the response document, "RAI 361 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 361 — 09.02.02-94	2	2
RAI 361 — 09.02.02-95	3	3
RAI 361 — 09.02.02-96	4	4
RAI 361 — 09.02.02-97	5	5
RAI 361 — 09.02.02-98	6	6
RAI 361 — 09.02.02-99	7	7
RAI 361 — 09.02.02-100	8	8
RAI 361 — 09.02.02-101	9	9
RAI 361 — 09.02.02-102	10	10

RAI 361 — 09.02.02-103	11	11
RAI 361 — 09.02.02-104	12	12

The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 361 — 09.02.02-94	July 1, 2010
RAI 361 — 09.02.02-95	July 1, 2010
RAI 361 — 09.02.02-96	July 1, 2010
RAI 361 — 09.02.02-97	July 1, 2010
RAI 361 — 09.02.02-98	July 1, 2010
RAI 361 — 09.02.02-99	July 1, 2010
RAI 361 — 09.02.02-100	July 1, 2010
RAI 361 — 09.02.02-101	July 1, 2010
RAI 361 — 09.02.02-102	July 1, 2010
RAI 361 — 09.02.02-103	July 1, 2010
RAI 361 — 09.02.02-104	July 1, 2010

Sincerely,

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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, March 04, 2010 2:27 PM
To: ZZ-DL-A-USEPR-DL
Cc: Eul, Ryan; Wheeler, Larry; Lee, Samuel; Segala, John; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 361 (4260), FSARCh. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on January 26, 2010, and discussed with your staff on March 4, 2010. Drat RAI Question 09.02.02-98 was modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2000

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71078D6A01)

Subject: Response to U.S. EPR Design Certification Application RAI No. 361, FSARCh. 9, Supplement 3
Sent Date: 9/14/2010 6:10:46 PM
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From: BRYAN Martin (EXTERNAL AREVA)

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MESSAGE	8096	9/14/2010 6:10:49 PM
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Recipients Received:

Response to

Request for Additional Information No. 361, Supplement 3

3/04/2010

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: 09.02.08

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

Question 09.02.02-94:

Follow-up to RAI 174, Question 09.02.02-53

Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53, Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design.

a. Describe the reason for making this change since it is a departure from the independent four train system structure utilized in the original design.

b. In the applicant's response, the word "division" is replaced with the word "train" when referring to the SWCS, but not in all instances. Add a note clarifying the differences, if any, between the words used throughout this section and provide consistency in their usage. For example, FSAR Section 9.2.8.1 says "Each SCWS train…" and 9.2.8.2.2 says "Each SCWS division…"

Response to Question 09.02.02-94:

a. The change from an independent four train system structure to a cross-tied structure provides improved reliability and additional operational and maintenance flexibility. The change allows more favorable technical specifications for the safety chilled water system (SCWS).

b. The word "division" as used for the U.S. EPR project means redundant safety systems (one per Safeguard Building) strictly separated within the Safeguard Buildings into four divisions. The word "division" is used in U.S. EPR FSAR Tier 2, Section 9.2.8 to describe global systems such as an SCWS train and its associated Safeguard Building or its associated emergency diesel generator.

   The word "train" is now more appropriate due to the change from an SCWS independent four train system structure to a cross-tied structure. As indicated in the Response to RAI 174, Supplement 5, Question 09.02.02-53, an SCWS train consists of a refrigeration chiller unit, two pumps, expansion tank, and associated piping and controls.

   U.S. EPR FSAR Tier 2, Section 9.2.8 will be revised to provide consistent wording throughout the section.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.2.8 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.02-96:

Follow-up to RAI 174, Question 09.02.02-53

The safety chilled water system (SCWS) must be able to withstand natural phenomena such as hurricanes, tornadoes, floods, and earthquakes without the loss of function in accordance with General Design Criteria (GDC) 2 requirements. Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53, Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design. While the SCWS cross-tie valves are properly classified as Seismic Category I and located inside Seismic Category I structures, it lacks a description of the capability of the cross-tie piping that runs between safeguards building meeting the GDC 2 requirements. The staff requests the applicant describe the capability of the cross-tie piping to meet GDC 2 requirements.

Response to Question 09.02.02-96:

The cross-tie piping is routed through the stair tower structures between Safeguard Building 1 and Safeguard Building 2, and between Safeguard Building 3 and Safeguard Building 4. The stair tower structures are classified Seismic Category I and are designed to withstand natural phenomena the same as Safeguard Building 1 and Safeguard Building 4. The stair tower structures are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other natural phenomena. The stair towers are shown on U.S. EPR FSAR Tier 2, Figures 3.8-64 through 3.8-69.

U.S. EPR FSAR Tier 2, Section 9.2.8.1 will be revised to indicate that GDC 2 is satisfied.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.2.8.1 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.02-98:

Follow-up to RAI 174, Question 09.02.02-53

General Design Criteria (GDC) 4 requires safety systems be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects of flow instabilities and attendant loads (i.e. water hammer). Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53 (ID1810/6769), Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design.

a. The staff requests that the applicant describe the capability of the safety chilled water system (SCWS) cross-tie piping connecting the two divisions meeting GDC 4 requirements.

b. Depending on which division is in operation, SCWS flow could occur in either direction of the cross-tie piping. Upon a loss of one safety chilled water train, the other train would start and flow would reverse in cross-tie piping. Address how the SCWS design will mitigate the effects of water-hammer and flow instabilities with a particular focus on the cross-tie piping.

c. Address the evaluation of any intra-building impacts, such as internal flooding, for the safeguard buildings (SB) in view of the cross-ties that remove the independent nature of four SBs with four separate systems.

Response to Question 09.02.02-98:

a. The cross-tie feature does not affect the ability of the safety chilled water system (SCWS) to satisfy the requirements of GDC 4. Refer to U.S. EPR FSAR Tier 2, Section 9.2.8.1 for additional information.

b. Refer to the Response to RAI 356, Supplement 4, Question 09.02.02-90 for information concerning the mitigation of waterhammer.

   The cross-tie piping and piping supports are designed to withstand the effects of flow in either direction.

   U.S. EPR FSAR Tier 2, Section 14.2.12.6 (Safety Chilled Water System - Test #052) will be revised to include testing to verify that auto train swap to standby train due to pump/chiller failure does not indicate evidence of water hammer.

c. The addition of the SCWS cross-ties between Trains 1 and 2, and between Trains 3 and 4 does not have a significant impact on the internal flooding analysis for the SB. The SCWS is a closed system with manual makeup and therefore contains a limited volume of water. In the lower levels of the SBs, the contents of two cross-tied SCWS trains is assumed to be released in the event of a pipe failure and directed within the division to the lowest building level through large openings and staircases. At higher building elevations (e.g., elevation +69 feet in SB 2 and SB 3) the released water volume from a pipe failure is also conservatively assumed to be the contents of two cross-tied SCWS trains. A common loss of the main control room air conditioning system (CRACS) in SB 2 or SB 3 is prevented by placing equipment sensitive to flooding above the expected flood water height resulting from the water released remaining in the area of the CRACS equipment rooms and adjoining service corridor.

U.S. EPR FSAR Tier 2, Section 3.4.3.4 will be revised to reflect this information.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.4.3.4 and 14.2.12.6 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.02-99:

Follow-up to RAI 174, Question 09.02.02-53

The safety chilled water system (SCWS) must be capable of removing heat from structures, system and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53, Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design. In order for the staff to confirm that the SCWS has been adequately sized, the applicant needs to clarify the FSAR and Technical Specifications (TS) with regards to sizing of the pumps, compressors, and chillers.

a. With regards to percent capacity for the SCWS pumps, chillers, and compressors, identify whether the percent capacity references supplying two divisions or just one division considering the "normal" alignment is cross-tied. For example, TS Bases B3.7.9 states each chiller contains three 50% compressors. It is unclear whether this value is based on maximum cross-connected loadings. If so, the total chiller capacity would be capable of 150% of the accident heat loads from two safeguards buildings and therefore, 300% of heat loads from a single building.
b. Describe the chiller capacities in tons of refrigeration. In addition, no changes were proposed for FSAR Table 9.2.8-1, "Safety Chilled Water Design Parameters," in the applicant's response. Address whether the stated evaporator capacities (275 ton air-cooled/250 ton water-cooled) are single train capacities or need to be modified for cross-tie (2-train) capacity and update Table 9.2.8-1, "Safety Chilled Water Design Parameters," as necessary.
c. Address the removal of the 100% values (for both pumps and chillers) from Section 9.2.8.2.2 but maintaining them in TS Bases B3.7.9. Also, TS Bases B3.7.9 states the four trains are independent. The staff requests the applicant address if the word "independent" still applies.

Response to Question 09.02.02-99:

a. The capacity is based on the maximum cross-connected loading. The capacity of each safety chilled water system (SCWS) train is sufficient to provide the maximum demand of the user heat exchangers in two divisions. For example, if SCWS Train 1 is the operating train in divisional pair 1 & 2, then Train 1 supplies chilled water to the user heat exchangers in Safeguard Building (SB) 1, SB 2 and Division 1 of the fuel building ventilation system. Likewise, if SCWS Train 3 is the operating train in divisional pair 3 & 4, then Train 3 supplies chilled water to the user heat exchangers in Safeguard Building 3, Safeguard Building 4, and second of two divisions (Division 4) of the fuel building ventilation system. There are three compressors in each train. Two compressors operate to supply the required capacity. Both pumps in the operating train operate to provide the required capacity.

   U.S. EPR FSAR Tier 2, Section 9.2.8.2.1 will be revised to include this information.

b. Refer to the Response to RAI 356, Supplement 4, Question 09.02.02-88 for information related to the capacities of the SCWS.

c. U.S. EPR FSAR Tier 2, Chapter 16, TS Bases B 3.7.9 will be revised to maintain consistency.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.2.8.2.1 and Chapter 16, TS Bases B 3.7.9 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.02-100:

Follow-up to RAI 174, Question 09.02.02-53

The safety chilled water system (SCWS) must be capable of removing heat from structures, system and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53, Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design. In order for the staff to confirm that the SCWS has been adequately sized, address the following:

a. Final Safety Analysis Report (FSAR) Section 9.2.8.2.2 states that SCWS pump head is based on dynamic pressure losses and head losses of the mechanical equipment of the associated SCWS at full load operation. The staff requests the applicant describe in the FSAR whether full load operation assumes a cross-connected configuration (i.e. loads from two safeguard buildings) or a single SCW train.

b. Based on the fact that now multiple SCWS pumps will be running simultaneously during normal and accident conditions, the staff requests that the applicant readdress and respond to the issue of "strong pump vs. weak pump" testing in ITAAC that was originally addressed in RAI 9.2.2-55 Areva #174 Supplement 4, Item (d).

Response to Question 09.02.02-100:

a. Refer to the response to Question 09.02.02-99.

b. The parallel pump operation in cross-tie operation involves two pumps in one SCWS train. The two pumps are of the same size and have the same hydraulic design. The development of a new ITAAC is not necessary because there is an existing U.S. EPR FSAR Tier 1, Table 2.7.2-3—Safety Chilled Water System ITAAC for SCWS design flowrate.

   U.S. EPR FSAR Tier 2, Section 14.2.12.6 (Safety Chilled Water System - Test #052) will be revised to include parallel pump testing as part of the initial test program.

   Refer to the Response to RAI 356, Supplement 4, Question 09.02.02-86, which addresses the change in design flow value in U.S. EPR FSAR Tier 1, Table 2.7.2-3—Safety Chilled Water System ITAAC, ITAAC 7.3.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2.12.6 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.02-102:

Follow-up to RAI 174, Question 09.02.02-53

The safety chilled water system (SCWS) must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. Under seismic or post-accident conditions with the demineralized water unavailable for safety chilled water system (SCWS) makeup, the expansion tanks should contain sufficient water volume to assure reliable system operation without makeup for at least seven days. Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53, Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design. In the cross-tied configuration, the staff requests the applicant describe whether the expansion tank in the non-operating train is isolated from the system. If not, address precluding of the SCWS design from the sluicing of water between the two expansion-tanks as system loads cycle (or on trip of a chiller and start of the standby unit) and describe the tanks volume requirements to account for sluicing. If isolated, describe the operation of the expansion tank isolation valves during operation and accident conditions.

Response to Question 09.02.02-102:

In the cross-tie operation, the expansion tank in the standby train is not mechanically isolated.

Sluicing is precluded in the SCWS because the two cross-tied expansion tanks are not located close together. One tank is in one Safeguard Building and the other tank in the pair is in another Safeguard Building. The cross-tied expansion tanks are not at the same elevation. The Train 2 tank is several floor elevations lower than the Train 1 tank, and the Train 3 tank is several floor elevations lower than the Train 4 tank. The pipe size (2 inches) connecting each tank to the system is small relative to the system pipe size. The elastomeric material of the expansion tank diaphragm and the compressed nitrogen confined above the diaphragm have a dampening effect on pressure pulsations in the system. Should momentary instability between two cross-connected expansion tanks occur, the instability would be quickly dampened due to the effects of the diaphragm, the compressed nitrogen, resistance of the long length of piping between tanks, and resistance of the small diameter piping at the tank connection.

U.S. EPR FSAR Tier 2, Section 9.2.8.2.2 will be revised to reflect this information.

Refer to the Response to RAI 356, Supplement 6, Question 09.02.02-91 for information concerning sizing of the expansion tank.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.2.8.2.2 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.02-104:

Follow-up to RAI 174, Question 09.02.02-53

Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53, Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design. In reviewing the modified Technical Specifications (TS) for the safety chilled water system (SCWS), the staff requests that the applicant address the following:

a. The staff noticed that the limiting-condition-for-operation (LCO) for TS 3.7.9 states that "Four SCW trains shall be OPERABLE and in operation." Provide the definition of "in operation" for the cross-tie alignment. In addition, if 4 trains are OPERABLE and one train is not "in operation," the TS (as currently written) would require the applicant to enter LCO 3.0.3 because the associated action (one train not in operation) is no longer provided. Justify having one of four SCWS trains not in operation requiring entry into LCO 3.0.3 or remove the term "in operation" from the LCO.

b. The note under the "Actions" for TS 3.7.9 states to enter LCO 3.4.6 for any residual heat removal loops made inoperable by the SCWS. With the divisions cross-tied, explain the basis for this note in TS 3.7.9.

c. Surveillance Requirement (SR) 3.7.9.3 says to verify each SCW train has the capability to remove the design heat load every 24 months. Explain the basis for removing this surveillance from the TS.

Response to Question 09.02.02-104:

a. With the cross-tie alignment, all four safety chilled water system (SCWS) trains do not need to be in operation. U.S. EPR FSAR Tier 2, Chapter 16, TS LCO 3.7.9 will be revised to delete the phrase "and in operation."

b. With the cross-tie alignment, the note under the "Actions" for TS LCO 3.7.9 is not required. U.S. EPR FSAR Tier 2, Chapter 16, TS LCO 3.7.9 will be revised to delete this note.

c. The surveillance requirements for the SCWS have been reviewed. U.S. EPR FSAR Tier 2, Chapter 16, TS LCO 3.7.9 will be revised to include SR 3.7.9.3, which was previously deleted.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, TS Section 3.7.9 and Bases will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

controlled area ventilation system which maintains sub-pressure in the SBs, and the recirculation mode of the SB controlled area ventilation system which maintains ambient conditions in the SBs.

Leak detection inside the annulus consists of safety-related Seismic Category I level measurements in the NIDVS sump located on elevation -14 feet, 1-1/4 inches. These level measurements initiate an alarm in the MCR for a filled sump (considered as the first alarm for initiating the operator action time for isolation) and an alarm for a flooding event above floor level -14 feet, 1-1/4 inches.

The hydrostatic water loads corresponding to an elevation of +0 feet are taken into account in the structural design of the annulus walls and for the watertight design of cable and piping penetrations below this elevation.

The annulus is not divisionally separated; however, redundant divisions are separated in fire zones. In case of fire fighting or a postulated piping failure, overlapping areas exist where redundancies belonging to another division could be indirectly impacted by water flow through the horizontally arranged fire separation structures on the inner and outer walls of the annulus. In these cases, the plug boxes of cable penetrations for electrical and instrumentation and control equipment are designed to withstand this water flow.

3.4.3.4 Safeguard Buildings Flooding Analysis

The arrangement of the SBs provides physical separation of the redundant safe shutdown systems and components using structural barriers. The building layout directs released water within one SB to building levels below elevation +0 feet.

Below Elevation +0 Feet, 0 Inches

Division walls below elevation +0 feet, 0 inches provide separation and serve as flood barriers to prevent the spread of flood water to the adjacent SB. Below elevation +0 feet, SB-1 and SB-4 are connected to the Fuel Building (FB) via passageways. Postulated piping failures below elevation +0 feet could lead to consequential failures in only one division. Common flooding of SB-1 and the left hand side of the FB (i.e., FB-1, see Section 3.4.3.5 and the general arrangement drawings in Section 1.2), or of SB-4 and the right hand side of the FB (i.e., FB-2, see Section 3.4.3.5 and the general arrangement drawings in Section 1.2), is acceptable, because they belong to the same division.

Relevant component and system piping failures considered in the analysis of these building levels include loss of one demineralized water pool, a leak in the SIS suction line from the IRWST, a pipe leak in the SIS/RHRS during normal operation, and a break in the fire water distribution system piping. The bounding flooding source below elevation +0 feet is considered to be a postulated break in the main piping of the fire water distribution system. The volume of released water is based on an assumed full break in the piping, a flow rate limited by the maximum pump capacity, and an operator action time of thirty minutes to isolate the system after receiving the first alarm in the MCR. At these levels, the rooms within one division have sufficient interconnections so that the maximum released water volume can be stored within the division. Based on the available free volume of these building levels in each division, the maximum released water volume can be contained within the affected division.

Elevation +0 Feet, 0 Inches

At elevation +0 feet, 0 inches there is no physical separation of divisions with respect to flooding. A corridor connects the SBs and the FB. To avoid water ingress into adjacent divisions at this elevation and above, a combination of watertight doors, existing openings (e.g., stairwells), and designed openings for water flow to the lower building levels are provided.

Relevant component and system piping failures considered in the analysis for this elevation include failures in the essential service water system (ESWS) and component cooling water system (CCWS) heat exchangers, leaks in the emergency feedwater system, leaks in the CCWS, and pipe failure in the fire water distribution system.

A postulated pipe break or erroneous valve alignment in the ESWS has the potential to impact more than one division. The ESWS piping penetrates the SBs at elevation -14 feet, 9-1/4 inches and is routed to the CCWS heat exchangers at elevation +0 feet. The worst case scenario assumed in the analysis is an erroneous valve alignment where the CCW heat exchanger is left open after plant maintenance, resulting in the entire cross section of the associated ESW line releasing water at elevation +0 feet. To cope with nonclosure of the heat exchanger or a large break in the ESWS piping, the pump must be stopped and the isolation valve in the discharge line of the affected ESWS train must be closed to limit the flooding volume in the affected SB.

Safety-related detection and isolation signals are provided in the nuclear island drain and vent system in each SB to isolate the ESWS. The level sensors that actuate the isolation are above the floor level so only large flooding events can initiate an isolation.

Flooding protection measures mitigate consequences resulting from a postulated failure in the fire water distribution system. A watertight physical protection door prevents water ingress into neighboring divisions through the interconnecting passageway between SB-1 and SB-2. This door is provided with position indication and monitoring of the locking and bolting status for control of the closed position. In the event of flooding, the door is considered closed. A flooding pit with a burst panel below the interconnecting passageway allows water to flow to lower building levels. This arrangement also exists for the passageways between SB-3 and SB-4 and between SB-2 and SB-3.

Elevation +15 Feet and Above

Physical separation for flooding is not provided for elevations +15 feet and above. Therefore, protection measures restrict flooding to the SB where the flooding event was initiated. Sufficient openings and thresholds direct water flow to the lower building levels.

Potential sources of flooding located on these building levels include the demineralized water distribution system, safety chilled water system (SCWS), fire water distribution system, CCWS including surge tank, and the potable and sanitary water disposal system. These systems have been reviewed for possible effects on the MCR and remote shutdown station (RSS) because they are located above the MCR, and measures are provided to protect the MCR and RSS from flooding. No water-carrying piping systems are located in the MCR or RSS. Thresholds are provided for doors entering the MCR and water resistant doors are provided for entry doors to the RSS. For the fire water distribution system, demineralized water distribution system, and the CCWS, multiple openings and flow paths direct flood water from pipe breaks to lower building levels. Surge tank water tightness is provided by a steel liner and leak detection system.

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~~Each division of the SCWS contains a limited volume of water that can either be stored in the area where it was released or drained to the building sump or to the lowest building level. At higher building elevations (e.g., elevation +69 feet), the pumps are automatically stopped on loss of system pressure, limiting the volume of water released at these elevations. A common loss of the heating, ventilation, and air conditioning (HVAC) system trains for the MCR due to flooding from a pipe break in the SCWS is avoided by flow paths, and by placing equipment that is sensitive to flooding above the expected flood water height. Consequences of a pipe failure of a SCWS drain in Division 1 on safety-related equipment in SB 2 are avoided because the drain of Division 1 is located in areas where there are no safety-related components of Division 2 that are sensitive to flooding. Therefore, the consequences of a flooding event from the SCWS are restricted to one redundant division.~~The SCWS is a closed system with manual makeup and, therefore, contains a limited volume of water. In the lower levels of the Safeguard Buildings the contents of two cross-tied SCWS trains is assumed to be released in the event of a pipe failure and directed within the division to the lowest building level through large openings and staircases. At higher building elevations (e.g., elevation +69 feet in SB 2 and SB 3) the released water volume from a pipe failure is also conservatively assumed to be the contents of two cross-tied SCWS trains. A common loss of the main control room air conditioning system (CRACS) in SB 2 or SB 3 is prevented by placing equipment sensitive to flooding above the expected flood water height resulting from the water released remaining in the area of the CRACS equipment rooms and adjoining service corridor.

9.2.8 Safety Chilled Water System

The safety chilled water system (SCWS) supplies refrigerated chilled water to the safety-related heating, ventilation and air conditioning (HVAC) systems and the low head safety injection system (LHSI) pumps and motors in Safeguard Buildings (SB) 1 and 4 and the fuel building ventilation system (FBVS). The SCWS consists of four trains, numbered 1 to 4. Train 1 and Train 2 can be interconnected and Train 3 and Train 4 can be interconnected.

9.2.8.1 Design Bases

The SCWS provides chilled water as a heat sink to the LHSI pumps and the safety-related HVAC systems, which in turn provides an acceptable environment for safety-related equipment and main control room (MCR) habitability in the event of a design basis accident (DBA) (GDC 44). The SCWS is classified as a safety-related system and has safety-related design functions. The system is designed Seismic Category I. Safety-related systems are required to function following a DBA and are required to achieve and maintain a safe shutdown condition.

- Each SCWS train is protected from the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, and floods (GDC 2). The SCWS are located in Seismic Category I Safeguard Buildings, which are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other natural phenomena. The SCWS cross-tie piping will be routed through the stair tower structures between SB 1 and SB 2, and between SB 3 and SB 4. The stair tower structures are Seismic Category I and designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other natural phenomena.

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- Each train remains functional and performs its intended functions for all postulated environmental conditions or dynamic effects, such as pipe breaks (GDC 4).
- Safety functions are performed assuming a single active component failure coincident with the loss of offsite power (GDC 44).
- The SCWS is not shared with any other plant unit (GDC 5).
- Active components of the SCWS trains are capable of being periodically tested and required inspections can be performed during plant operation (GDC 45 and GDC 46).

The SCWS trains use design and fabrication codes consistent with the safety classification and seismic design criteria provided in Section 3.2. The quality group classification meets the requirements of RG 1.26. The seismic design of the system components meets the guidance of RG 1.29. The power and control functions are designed in accordance with RG 1.32.

The SCWS operates continuously as described for the safety-related function when the plant is in normal conditions of startup, shutdown, power operation, and outages.

9.2.8.2 System Description

9.2.8.2.1 General Description

The SCWS consists of four trains numbered 1 to 4. Each is located in one of the four SBs. Each SCWS train is a closed loop system that supplies chilled cooling water for specified area HVAC air handling units (AHU) and Division 1 and 4 low head safety injection system (LHSI) pump seal coolers and motor coolers, where required, process systems cooling. Each train consists of a refrigeration chiller unit, two pumps, expansion tank, user loads, and the associated piping and controls.

Normally, open motor operated cross-tie valves (MOV) interconnect the supply and return piping of Train 1 with Train 2, and the supply and return piping of Train 3 with Train 4. Each SCWS train chiller is sized to meet the system load requirements of two divisional trains.

The SCWS provides chilled water to the HVAC cooling coils of the main control room (MCR), the electrical division rooms (SBVSE) in the SBs, SB controlled-area ventilation system (SBVS), FBVS, and the low head safety injection system (LHSI) pump seal coolers and motor coolersmotors in SB Divisions 1 and 4.

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Bounding system design parameters for all operating conditions are listed on Table 9.2.8-1—Safety Chilled Water Design Parameters for Cross-Tied Operation and Table 9.2.8-2—Safety Chilled Water Design Parameters Each Division Isolated. The SCWS flow diagram is shown in Figure 9.2.8-1—Safety Chilled Water System Diagram. Pipe diameters for the SCWS are based on limiting the flow velocity to a range of 4 to 10 ft/second for normal modes of operation that are expected to occur frequently.

Refer to Section 12.3.6.5.9 for safety chilled water system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.2.8.2.2 Component Description

The general description of the component design features for the SCWS is provided below. Refer to Section 3.2 for details of the seismic and system quality group classification of the SCWS.

Chilled Water Pumps

Two SCWS pumps in each of the four trains in the operating train in each SCWS divisional pair circulate chilled water between the SCWS users in two divisions and the evaporator of the chiller refrigeration unit in each train.

The required flow rate of each SCWS pump is defined by the heat to be removed from the system loads. As a minimum, the pumps are designed to fulfill the corresponding minimal required design mass flow rate under the following conditions:

- Fluctuations in the supplied electrical frequency.
- Increased pipe roughness due to aging and fouling.
- Fouled debris filters.
- Maximum pressure drop through the system heat exchangers.
- Minimum water level in the expansion tank considers net positive suction head to prevent cavitation of the SCWS pump and prevent vortex effects.

Determination of the discharge head of the pumps is based on dynamic pressure losses and head losses of the mechanical equipment of the associated SCWS at full load operation.

Air-Cooled Chiller Refrigeration Unit

SCWS, Trains 1 and 4, each contain one air-cooled chiller refrigeration unit that functions to refrigerate chilled water to its design basis temperature of 41°F for supply to the system users. These chillers are located in dedicated rooms of the SBs. Each chiller contains a condenser, compressors, evaporator, and associated piping and controls. Environmentally safe refrigerants are used in these chillers.

Water-Cooled Chiller Refrigeration Unit

SCWS, Trains 2 and 3, each contain one water-cooled chiller refrigeration unit that functions to refrigerate chilled water to its design bases temperature of 41°F for supply to the HVAC users. These chillers are located in dedicated rooms of the SBs. Each chiller contains a condenser, compressors, evaporator, and associated piping and controls. Environmentally safe refrigerants are used in these chillers.

Diaphragm Expansion Tank

Each SCWS train contains a diaphragm expansion tank with a nitrogen fill connection in each of the SBs. The expansion tank provides for changes in volume pump NPSH, and establishes a point of reference pressure for the closed-loop system. These tanks are provided with relief valve overpressure protection. The expansion tank nitrogen maintains the operating static pressure to keep the highest point in the SCWS filled. The expansion tank pressure also keeps the SCWS pump suction pressure well above the fluid vapor pressure to enhance available NPSH. The normal water volume in the expansion tank allows for volume displacement due to temperature changes and operating transitions. A complete loss of nitrogen or water volume in an expansion tank will close the cross-tie valves on MIN-2 pressure and trip the SCWS operating pumps of the affected chiller train after reaching MIN-3 pressure.

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In cross-tie operation, the expansion tank in the standby train in a divisional pair is not isolated from the system. Sluicing of water between two expansion tanks as system loads cycle or on trip of a chiller and start of the standby unit is precluded in the design due to the dampening effect of the diaphragm and the compressed nitrogen, resistance of the long length of piping between tanks, and resistance of the small diameter piping at the tank connection.

Cooling Coils

Multiple HVAC cooling coils in each train receive chilled water for heat removal from selected HVAC users. The SCWS also cools Train 1 and Train 4 LHSI motor cooler and pump ~~sealing~~ seal cooler.

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Relief Valves

A relief valve located in each SCWS train protects the chilled water closed loop against high pressure. The relief valve set point will prevent the SCWS pressure from exceeding the system design pressure. The design pressure is based on the total of pump shut-off head, the operating static pressure, and the lowest elevation in the SCWS. The setpoint is established in accordance with ASME Boiler and Pressure Vessel Code, Section III, Class 3 (Reference 1).

Chiller Bypass Valve

The chiller bypass valve installed in the operating SWCS train varies flow returning to the chiller to prevent freezing at the evaporator coil. Upstream filters are provided as a precaution to protect downstream control valves which contain internals sensitive to particle trapping.

Cross-Tie Valves

A cross-tie is established for normal operation between the supply and the return piping of each divisional pair (1/2 or 3/4) of SCWS trains that includes MOVs and associated controls. There are two isolation valves per train (one supply and one return) that are located in their respective Safeguards Buildings. The valves are divisionally powered. During normal operations the cross-tie isolation valves are normally open and only one chiller train is operating.

HVAC Cooling Coil Flow Control Valves

The flow rate through the cooling coils for the electrical division of the safeguards building ventilation system and the ventilation of the main control room air conditioning system are each regulated by a flow control valve positioned by room tank will close the cross-tie valves on MIN-2 pressure and trip the SCWS operating pumps of the affected chiller train after reaching MIN-3 pressure.

Cooling Coils

Multiple HVAC cooling coils in each train receive chilled water for heat removal from selected HVAC users. The SCWS also cools Train 1 and Train 4 LHSI motor cooler and pump seal~~ing~~ cooler.

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Relief Valves

A relief valve located in each SCWS train protects the chilled water closed loop against high pressure. The relief valve set point will prevent the SCWS pressure from exceeding the system design pressure. The design pressure is based on the total of pump shut-off head, the operating static pressure, and the lowest elevation in the SCWS. The setpoint is established in accordance with ASME Boiler and Pressure Vessel Code, Section III, Class 3 (Reference 1).

Chiller Bypass Valve

The chiller bypass valve installed in the operating SWCS train varies flow returning to the chiller to prevent freezing at the evaporator coil. Upstream filters are provided as a precaution to protect downstream control valves which contain internals sensitive to particle trapping.

Cross-Tie Valves

A cross-tie is established for normal operation between the supply and the return piping of each divisional pair (1/2 or 3/4) of SCWS trains that includes MOVs and associated controls. There are two isolation valves per train (one supply and one return) that are located in their respective Safeguards Buildings. The valves are divisionally powered. During normal operations the cross-tie isolation valves are normally open and only one chiller train is operating.

HVAC Cooling Coil Flow Control Valves

The flow rate through the cooling coils for the electrical division of the safeguards building ventilation system and the ventilation of the main control room air conditioning system are each regulated by a flow control valve positioned by room temperature or manually from the control room to provide the required flow. All other HVAC cooling coils and LHSI are supplied by fixed SCWS flow rates to confirm operability of all loads.

Filters

Liquid filters are installed upstream of the modulating flow control valves to protect throttling surfaces from minor corrosion debris, or debris from maintenance activities. A differential pressure limit across the filter, to allow for 30 days of operation post DBA, is maintained by normal maintenance.

9.2.8.3 System Operation

9.2.8.3.1 Normal Operation

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During normal operation, at least one train of the divisional pair is in operation. Either Train 1 or Train 2 chiller provides safety chilled water cooling for all SCW loads within Safeguard Building Divisions 1 and 2, and the associated FBVS load. Likewise, the chiller from either Train 3 or 4 provides safety chilled water cooling for both Safeguard Divisions 3 and 4 and the associated FBVS load. During normal operation, the cross-tie isolation valves (supply and return for both divisions) are normally open. The non-operating chiller and pump(s) are maintained in standby. This configuration also allows for maintenance on the non-operating chiller and pump(s). If the normal operating train pump or chiller fails, a switchover sequence to the standby train is automatically initiated. A planned switchover of the operating train is manually initiated from the MCR.

The chilled water distribution circuit operates with a variable flow rate that is governed by the position of the control valves associated with supplied user loads. A regulated chilled water bypass line is provided between the refrigeration–evaporator outlet line and the return line to prevent freezing. A diaphragm expansion tank is used for equalization of pressure and volumetric expansion and helps maintain the requisite static system pressure. A relief valve on the connecting line prevents the line design pressure from being exceeded. Piping voids associated with potential waterhammer are precluded by the constant pressure maintained in the nitrogen-charged expansion tank in each ~~division~~train.

The SCWS design minimizes the potential for dynamic flow instabilities and water hammer by avoiding high line velocities and has specified closing valve speeds that are slow enough to prevent damaging pressure increases. Vents are provided to vent to fully fill components and piping at high points in which voids could occur. The Nitrogen pressurized expansion tank confirms system high points are retained at positive pressure.

A manually operated make up demineralized water supply is used when water loss resulting from operational measures (e.g., venting and draining) is indicated by an expansion tank pressure instrument.

The SCWS is treated with hydrazine in low concentration for corrosion control. Monitoring of the water chemistry is provided by means of local sampling.

9.2.8.3.2 Abnormal Operation

In the event of a DBA with concurrent loss of offsite power (LOOP) the operating train of a divisional pair receives a "Start" signal to return the operating train to operation after load shed. If an active single failure occurs (assume either the EDG fails to start or the SCW train pump or chiller does not re-start), then the standby train receives a "Start" signal. This sequence confirms that one train of a divisional pair is operating. At or before the end of 24 hours post DBA, the cross-tie isolation valves are manually isolated to protect against a passive failure.

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The SCWS is powered from the emergency diesel generators (EDG) and continues to function during a DBA. Trains 1 and 4 of the SCWS provide a heat sink to system users andDivision 1 and 4 LHSI pumps and HVAC systems in the event of a severe accident or station blackout (SBO). Trains 1 and 4 are powered from motor control centers that are re-powered by the station blackout diesels during an SBO event.

Under seismic or post-accident conditions, when demineralized water may be unavailable for SCWS makeup, a manual connection to the fire water distribution system is available to provide a seismic makeup source within a time frame consistent with the SCWS expansion tank capacity to accommodate expected out-leakage from the system for seven days.

A mechanical or electrical failure of the running SCWS pump results in a transfer to the standby pump.

Each refrigeration chiller in the four trains of the SCWS has three 50 percent capacity compressors to provide sufficient operating redundancy and flexibility in the event of a compressor failure. The two remaining chiller compressors provide 100 percent capacity as described in Section 9.2.8.2.1.

To allow divisional maintenance (e.g., maintenance on emergency diesel generators), the required SCWS safety-related components are alternately fed from the adjacent division to provide adequate cooling of certain safety-related components during a design basis event.

9.2.8.4 Safety Evaluation

- The SCWS is designed as Seismic Category I as described in Section 3.2 to operate in all plant modes of operation including design basis events. The SCWS divisions are located in SBs 1 to 4, respectively. The SBs are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other natural phenomena. Section 3.3, Section 3.4, Section 3.5, Section 3.7, and

Section 3.8 provide the bases for the adequacy of the structural design of these buildings.

- The SCWS is designed to remain functional after a safe shutdown earthquake. Section 3.7 provides the design loading conditions that were considered. Section 3.5, Section 3.6, and Section 9.5.1 provide the hazards analyses to make sure that a safe shutdown, as outlined in Section 7.4, can be achieved and maintained.

- A four train design with interconnection of Train 1 and Train 2, orand interconnection of Train 3 and Train 4 of the SCWS fulfills the single failure criteria. The four trains of safety-related systems are consistent with an N+2 safety concept. The four SCWS trains are backed up by the EDGs. Two of these trains, in Divisions 1 and 4, are also backed up by the SBO diesels.

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- Structures, systems and components important to safety in the SCWS are not shared with any other co-located nuclear reactor units.

- Preoperational testing of the SCWS is performed as described in Chapter 14.0. Periodic inservice functional testing is done in accordance with Section 9.2.8.5.

- Section 6.6 provides the ASME Boiler and Pressure Vessel Code, Section XI (Reference 1) requirements that are appropriate for the SCWS.

- Section 3.2 delineates the quality group classification and seismic category applicable to the safety-related portion of this system. Table 9.5.4-1 shows that the components meet the design and fabrication codes given in Section 3.2. All the power supplies and control functions necessary for safe function of the SCWS are Class IE, as described in Chapter 7 and Chapter 8.

- Cooling diversity is created between the load heat sinks of DivisionsTrain 1 and Train 4, and DivisionsTrain 2 and Train 3. DivisionTrain 1 and Train 4 chillers are air cooled, and DivisionTrain 2 and Train 3 chillers are water cooled by the component cooling water system (CCWS).

- A process radiation monitor is provided in Trains 1 and 4 of the SCWS, downstream of the LHSI pump mechanical seal heat exchangercooler to monitor for possible leakage of radioactive fluid from the heat exchanger. Otherwise, migration of radioactive material from potentially radioactive systems is prevented with a minimum of two heat exchanger barriers. Radiation monitors are in the CCWS to detect radioactive contamination entering and exiting the system.

9.2.8.5 Inspection and Testing Requirements

Prior to initial plant startup, a comprehensive performance test will be performed to verify that the design performance of the system and individual components is attained. Refer to Section 14.2, Test #052, for initial plant testing of the SCWS.

4.0 DATA REQUIRED

4.1 UHS makeup and blowdown flow rates.

4.2 Valve performance data, where required.

4.3 Valve position indication.

4.4 Temperature and relative humidity trend data.

4.5 Setpoints at which alarms and interlocks occur.

4.6 Cooling fan air flow rates.

5.0 ACCEPTANCE CRITERIA

5.1 The UHS meets design requirements (refer to Section 9.2.5):

5.1.1 Verify that control logic starts forced draft fans and aligns critical components for UHS operation for the entire design range.

5.1.2 Verify that valve performance tests (e.g., valve position response of valves to loss of motive power, thrust, stroke time) meet design requirements.

5.1.3 Verify that UHS makeup flow rate meets design flow requirements.

5.1.4 Verify that UHS blowdown flow rate meets design flow requirements.

5.1.5 Verify that the operation of UHS level and temperature instruments and alarms meet design requirements.

5.1.6 Verify that the UHS tower bypass function meets design requirements.

5.1.7 Verify that the chemical treatment system meets design requirements.

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

14.2.12.5.9 Reserved (Test #050)

14.2.12.6 General Supply Systems

14.2.12.6.1 Reserved (Test #051)

14.2.12.6.2 Safety Chilled Water System (Test #052)

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the safety chilled water system (SCWS).

1.2 To demonstrate electrical independence and redundancy of power supplies.

1.3 To demonstrate proper operation of safety chilled water pumps in single and parallel operation.

2.0 PREREQUISITES

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2.1 Construction activities on the SCWS have been completed.

2.2 SCWS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation available and calibrated per applicable procedures.

2.4 The flow instrumentaion downstream of each SCWS pump is functional.

2.5 The CCWS is available for chiller operation, where necessary.

2.6 Appropriate AC and DC power sources are available.

2.7 Interfacing system loads are connected and available.

2.8 SCWS support systems (makeup, nitrogen) are available.

2.9 SCWS has been filled and pressurized.

3.0 TEST METHOD

3.1 Verify pump performance characteristics (e.g., head versus flow, motor current) for the SCWS pumps.

3.1.1 $NPSH_a \geq NPSH_R$.

3.1.2 Discharge head.

3.1.3 Flow corresponding to head at each point.

3.1.4 Starting time (motor start time and time to reach flow).

3.2 Demonstrate that each SCWS division can be operated from its local and remote manual control station.

3.3 Demonstrate that each SCWS division starts automatically in response to each appropriate signal.

3.4 Verify that the chillers supply chilled water at the rated flow and design conditions.

3.5 Verify chilled water flow to each supplied component.

3.6 Verify alarms, interlocks, indicating instruments, and status lights are functional.

3.7 Verify system baseline performance during HFT.

3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

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3.9 Operate the SCWS pumps in each division in parallel and throttle system flow over the entire design range using a single common throttle valve while recording individual pump flow data.

3.10 Verify that pump starts/stops, valve realignments, closing of the cross-connects occur without introducing water hammer.

4.0 DATA REQUIRED

4.1 Record flows as required to components and throttle valve positions.

4.2 Record alarm, interlocks, and control setpoints.

4.3 Record chiller normal operating parameters.

4.4 Record pump head versus flow and operating data for single and parallel pump operation.

4.5 System operating parameters during HFT.

4.6 Record pressure transients for system evolutions such as valve closure and pump starts and stops.

5.0 ACCEPTANCE CRITERIA

5.1 The SCWS operates as described in Section 9.2.8.

5.1.1 Verify pump performance characteristics for the SCWS pumps meets design requirements for single and parallel pump operation.

5.1.2 Verify that each SCWS division controls meet design requirements.

5.1.3 Verify that each SCWS division starts automatically in response to each appropriate signal.

5.1.4 Verify that the chillers supply chilled water at the rated flow and design conditions.

5.1.5 Verify chilled water flow to each supplied component.

5.1.6 Verify alarms, interlocks, indicating instruments, and status lights meet design requirements.

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

5.3 Verify that SCWS pumps do not indicate evidence of water hammer when flow is initiated or terminated.

5.4 Verify that closing of the cross-connect valves during pump operation does not indicate evidence of water hammer.

5.5 Verify that closing of the electrical division of safeguard building ventilation system and main control room air conditioning system flow control valves during pump operation do not indicate evidence of water hammer.

09.02.02-98b → 5.6 Verify that auto train swap to standby train due to pump/chiller failure does not indicate evidence of water hammer.

14.2.12.6.3 Reserved (Test #053)

14.2.12.6.4 Fire Water Distribution System (Test #054)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the fire water distribution system (FWDS) to provide water at acceptable flows and pressures to protected areas.

2.0 PREREQUISITES

2.1 Construction activities on the FWDS have been completed.

2.2 FWDS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the FWDS are complete and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Verify that the fire water distribution system has two separate fresh water storage tanks that meet design requirements.

2.5.1 Table 14.3-3 Item 3-7.

3.0 TEST METHOD

3.1 Demonstrate the head and flow characteristics of the fire water pumps and the operation of auxiliaries.

3.2 Verify control logic.

3.3 Measure developed head and flow rates in the various flow paths of the underground FWDS by measuring flow at appropriate discharge points.

3.3.1 $NPSH_a \geq NPSH_R$.

3.3.2 Discharge head.

3.3.3 Flow corresponding to head at each point.

3.3.4 Starting time (motor start time and time to reach flow).

3.4 Verify alarms, indicating instruments, and status lights are functional.

3.5 Verify that the fire water pumps can be manually actuated, refer to Section 9.5.1.2.1.

3.6 Verify as-built FWDS drawings for above ground piping and equipment.

3.7 Verify that FWDS $NPSH_a$ is greater than the $NPSH_R$.

3.8 Verify the failed position of FWDS valves to loss of motive power.

3.7 PLANT SYSTEMS

3.7.9 Safety Chilled Water (SCW) System

LCO 3.7.9 Four SCW trains shall be OPERABLE ~~and in operation~~.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One SCW train inoperable.	A.1	Restore SCW train to OPERABLE status.	30 days
B. Required Action and associated Completion Time not met.	C.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	C.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.9.1	------------------------------NOTE------------------------------ Isolation of SCW flow to individual components does not render the SCW System inoperable. -- Verify each SCW 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 3.7.9.2	Verify each SCW train has the capability to remove the design heat load.	24 months
SR 3.7.9.23	Verify, on an actual or simulated loss of offsite power signal, each SCW train restarts following re-energization of the associated AC electrical power division.	24 months

09.02.02-104

B 3.7 PLANT SYSTEMS

B 3.7.9 Safety Chilled Water (SCW) System

BASES

BACKGROUND

The SCW System provides a heat sink for the removal of process and operating heat from safety related components during an anticipated operational occurrence (AOO) or postulated accident. During normal operation, and a normal shutdown, the SCW System also provides this function for the associated safety related systems. The safety related function is covered by this LCO.

09.02.02-99c

The SCW System consists of four ~~independent~~ trains. Each train consists of a chiller refrigeration unit (three 50% compressors per unit), chilled water pumps (two ~~100%~~ pumps), surge tank, piping, valving, and instrumentation. Normally open motor operated cross-tie valves interconnect the supply and return of Train 1 with Train 2 and interconnect the supply and return of Train 3 with Train 4. Each SCW System chiller is sized to meet the system load requirements of two divisional trains. Heat is rejected to the system chilled water as it passes through the cooling coils of the system users. This heat is rejected from the system as it is pumped through the train chiller refrigeration units. Trains 1 and 4 reject this energy to ambient via air cooled condensers while trains 2 and 3 have condensers cooled by the Component Cooling Water (CCW) System. Each refrigeration chiller in the four divisions of the SCWS has three 50 percent capacity compressors to provide sufficient operating redundancy and flexibility in the event of a compressor failure. The two remaining chiller compressors provide 100 percent capacity.

09.02.02-99c

During normal operation, at least one train of the divisional pair is in operation. Either Train 1 or Train 2 chiller provides safety chilled water cooling for all SCW loads within Safeguard Building Divisions 1 and 2, and the associated Fuel Building Ventilation System (FBVS) load. Likewise, the chiller from either Train 3 or 4 provides safety chilled water cooling for both Safeguard Divisions 3 and 4 and the associated FBVS load. During normal operation, the cross-tie isolation valves (supply and return for both divisions) are normally open. The non-operating chiller and pump(s) are maintained in standby. This configuration also allows for maintenance on the non-operating chiller and pump(s). If the normal operating train pump or chiller fails, a switchover sequence to the standby train is automatically initiated. A planned switchover of the operating train is manually initiated from the MCR.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.9.1

This SR is modified by a Note indicating that the isolation of the SCW components or systems may render those components inoperable, but does not affect the OPERABILITY of the SCW System.

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

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

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

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SR 3.7.9.2

The SR verifies that the heat removal capability of the system is sufficient to remove the heat load assumed in the system heat load calculation. This SR consists of a combination of testing and calculations. The 24 month Frequency is appropriate since significant degradation of the SCW system is slow and is not expected over this time period.

SR 3.7.9.~~2~~3

This SR verifies proper automatic operation of the SCW train on an actual or simulated actuation signal. The SCW 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. 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.