ArevaEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Thursday, June 10, 2010 3:16 PM
To: Tesfaye, Getachew
Cc: Hearn, Peter; KOWALSKI David J (AREVA NP INC)
Subject: FW: DRAFT RESPONSES for FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; RESPONSE RAI 345 Supp 1 Q.09.02.01-49(c+d).pdf; RESPONSE RAI 345 Supp 1 Q.09.02.01-33.pdf; RESPONSE RAI 345 Supp 1 Q.09.02.01-44.pdf; RESPONSE RAI 345 Supp 1 Q.09.02.01-47.pdf; RESPONSE RAI 356 Supp 1 Various Questions.pdf; RESPONSE RAI 345 Supp 1 Q.09.02.01-31(j).pdf

Importance: High

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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 345 and 356 questions. These responses will be discussed at tomorrow's (6/11/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC.

These responses include the following:

- Response to RAI 345 Question 09.02.01-31(j).
- Response to RAI 345 Question 09.02.01-33.
- Response to RAI 345 Question 09.02.01-44.
- Response to RAI 345 Question 09.02.01-47.
- Response to RAI 345 Question 09.02.01-49(c+d).
- Response to RAI 356 Questions (Discussed during Tuesday's telecon).

Note that none of these DRAFT responses has been through the final Licensing review/approval process; nor do any responses reflect technical editing.

Please call me if you have any questions. Thanks.

David J. Kowalski, P.E.
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Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71067BB58A)

Subject: FW: DRAFT RESPONSES for FSAR Chapter 9 Weekly NRC Telecon
Sent Date: 6/10/2010 3:16:03 PM
Received Date: 6/10/2010 3:16:26 PM
From: BRYAN Martin (EXT)

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

Question 09.02.01-49:

Follow-up to RAI 119, Question 9.2.1-25

Flooding isolation of the Essential Service Water System (ESWS) pumps is discussed in two sections of the Final Safety Analysis Report (FSAR) (see below); however, Tier 2, Section 9.2.1 makes no mention of this important feature to mitigate a flood in the Safeguard Building (SB) or Fuel Building (FB). Provide a detailed discussion in the appropriate sections of 9.2.1 related to the flood signals and ESWS isolation. Clarify how the logic will isolate each division of ESWS pumps (or all ESWS pumps) and clarify if any pump receives a lockout from starting. Provide schematic diagrams showing all inputs (i.e., logic inputs , sensor inputs, all variables, actuation logic, binary limitation signals), with input types (i.e., hardwired, fiber, type of isolation used), ESWS circuit components, and all ESWS control signal outputs of the ESWS control system. The schematic provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in "Response to Second Request for Additional information", Attachment A, ANP-10284Q2P, dated June 13, 2008. In addition, describe operator actions that are required and justify the non-safety-related classification for the ESWS flooding isolation logic.

From Tier 2 FSAR 19.1.5.2.2.5

"Floods caused by a break in a system with very large flooding potential (ESWS or DWS) are assumed to be contained below ground level of the affected buildings (SB or FB). This is a reasonable assumption since those systems are automatically isolated if the building sump detects a large flooding event. Moreover, expansive time is needed to flood a building up to ground level, so operator isolation is likely to succeed if automatic isolation failed."

From Tier 2 FSAR 3.4.3.4.

"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 feed water 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 non-closure 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.

Non safety-related detection and isolation signals are provided in the nuclear island drain and vent system in each SB to isolate the ESWS. The alarm that actuates the isolation is above the floor level so only large flooding events can activate the alarm. Two level sensors in a one-of-two logic activate the alarm. If a level instrument fails, that sensor is not considered for the voting, and the signal is activated when one sensor alarms.

Based on the staff's review of response to RAI 119, Question 9.2.1-25 and an audit by the staff conducted on October 27, 2009, this item remains open and requires further resolution and/or

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clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

a. The corresponding markup of FSAR Tier 2 Section 3.4.3.4 should recognize that a control room alarm is provided (removed in the markup) and that no operator actions are required for this scenario to trip the associated ESWS pump and isolate the pump discharge.

b. The end of the last sentence in the FSAR markup appears to be incomplete, Tier 2 FSAR Revision 1, page 3.4-9 (i.e. when one sensor detects). The sentence should be revised for Tier 2, Section 3.4.3.4.

c. The applicant should provide a markup of FSAR Tier 2 Section 9.3.3 "Equipment and Floor Drains" to recognize that safety-related controls are provided in the SB non-controlled area sumps to support the flood protection design features for the scenario described above. The applicant should consider for Section 9.2.1.7.2, "System Alarms", a discussion related to this feature, namely the ESWS pump discharge valve isolation and pump trip due to flooding.

d. The applicant stated that the control details requested by the staff will not be available until later in the design process. The applicant should provide a date when this material will be available for the staff to review.

Response to Question 09.02.01-49:

Part (c)

Refer to FSAR Tier 2 Sections 9.3.3.3, "Safety Evaluation" and 9.3.3.5, "Instrumentation Requirements" for a description of the safety-related instrumentation provided in the SB non-controlled area sumps as a flood protection design feature. The MCR alarm associated with this flood protection design feature is provided by NIDVS instrumentation as described in U.S. EPR FSAR Tier 2, Section 9.3.3.3, and is not part of the ESWS. Therefore, a discussion of this flooding alarm in U.S. EPR FSAR Tier 2, Section 9.2.1.7.2, "System Alarms" of the ESWS is not appropriate.

Part (d)

In lieu of detailed schematic diagrams, the following narrative based on FSAR Tier 2 Sections 3.4.3.4, 9.2.1.3.5, and 9.3.3.3 is provided describing the flood protection design feature provided by NIDVS and ESWS.

In a large flooding event in a SB, safety-related level instrumentation located above floor level in the NIDVS non-controlled area sumps sends a MAX alarm signal to the MCR and provides a signal to the associated ESWS train to automatically trip the pump, close the associated motor-driven pump discharge isolation valve, and to start another ESWS train. No operator action is required to isolate the ESWS in a large flooding event.

FSAR Impact:

Part (c)

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U.S. EPR FSAR Tier 2 Sections 9.3.3 "Equipment and Floor Drains" and 9.2.1.7.2 "System Alarms will not be revised as a result of this question.

Part (d)

U.S. EPR FSAR will not be revised as a result of this question.

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Question 09.02.01-33:

Follow-up to RAI 119, Question 9.2.1-07

The ESWS must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. With respect to ESWS flow requirements, Tier 2 FSAR Table 9.2.1-1 states that the safety related ESWS pump normal flow rate is 73.2 m3/min (19,340 gpm) at 0.55 MPa (185 feet) of water. Each ESWS train includes parallel connected flow paths to one CCWS heat exchanger (HX), one emergency diesel generator (EDG) and an ESWS pump room cooler. ESWS flow appears to be continuously supplied to all components for both normal and accident conditions. Tier 2 FSAR Table 9.2.5-1 indicates that nominal CCWS HX flow is 4.31x106 Kg/hr (9.504x106 lbm/hr) and EDG flow is 0.48x106 Kg/hr (1.06x106 lbm/hr). No flow rate information (or heat load) is provided for the pump room cooler. However, the total ESWS flow rate for the EDG plus the CCW HX at <32.2 °C (90 °F) converts roughly to 80.25 m3/min (21,200 gpm), which exceeds the normal pump flow of 73.2 m3/min (19,340 gpm). In order for the staff to confirm that the ESWS has been adequately sized, the applicant needs to provide additional information in the FSAR to address this apparent inconsistency.

Based on the staff's review of response to RAI 119, Question 9.2.1-07 and an audit by the staff conducted on October 27, 2009, this item remains open and requires further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

> The staff noted an inconsistency with the new flow rate units (gpm) for the ESW Pump Room Coolers, which do not match the mass flow units identified for other components in the Table or the units (106 lbm/hr) identified by the column heading. The applicant should revise the FSAR to address this inconsistency in the units.

Response to Question 09.02.01-33:

The flow rate units for the ESW pump room coolers have been revised to match the mass flow units (10^6 lbm/hr) identified for other components in the table by the column heading.

The flow rate value for the ESW pump room coolers for 31/32/33/34 UQB has been revised to 0.0685×10^6 lbm/hr for Normal Operations, Shutdown/Cool down, and DBA. The flow rate value for the ESW pump room cooler for 34 UQB has been revised to 0.0347×10^6 lbm/hr for Severe Accident – ESW flow supplied by the dedicated ESW pump.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 9.2.5-1, will be revised as described in the response and indicated on the enclosed markup.

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Table 9.2.5-1—Ultimate Heat Sink System Interface

Component	Max Heat Load MBTU/hr	Total Required ESW Flow (10^6 lb_m/hr)	Required ESW Temperature	Comments
CCWS heat exchanger	128.1	7.540 min	≤92°F	Normal Operation
	120.1	7.540 min	≤90°F	Spring/Fall Outage Cooldown
	291.3	7.540 min	≤95°F	DBA
Dedicated CCWS heat exchanger	48.64	1.205 min	≤95°F	Severe Accident
EDG heat exchanger	22.0	1.06	≤95°F	
ESW pump room cooler for 31/32/ 33/34 UQB	0.619	~~137.6 gpm~~ 0.0685	≤ 95°F	Normal Operations Shutdown/ Cooldown and DBA
ESW pump room cooler for 34 UQB	0.314	~~69.8 gpm~~ 0.0347	≤ 95°F	Severe Accident - ESW flow supplied by dedicated ESW pump

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Question 09.02.01-44:

Follow-up to RAI 119, Question 9.2.1-20

Applications for standard plant design approval must contain proposed inspections, tests, analyses, and acceptance criteria (ITAAC) in accordance with 10 CFR 52.47(b)(1) requirements. Tier 1 FSAR Section 2.7.11, "Essential Service Water System," provides EPR design certification information and ITAAC for the ESWS and UHS. The staff noted that the title for Tier 1 FSAR Section 2.7.11 is misleading in that it includes requirements for the UHS along with those that are specified for the ESWS. However, the ESWS and the UHS each involve significant safety considerations that are described separately in Tier 2 of the FSAR and are reviewed separately by the staff in this report. Therefore, consistent with the approach that is used in Tier 2 of the FSAR, the applicant needs to provide the required Tier 1 information for the ESWS and the UHS in their own respective sections.

Based on the staff's review of response to RAI 119, Question 9.2.1-20 and an audit by the staff conducted on October 27, 2009, this item remains open and requires further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

a. Tier 1 Section 2.7.11 title, "Essential Service Water System," is still misleading since it includes "PEB" and "PED" equipment.
b. UHS equipment such as the UHS fans (for example 30PED10 AN001 and AN002) are not listed or described in any Tier 1 tables.
c. UHS is not fully discussed in Tier 1, Section 2.7.11, Section 1.0, "Description," Section 2.0, "Arrangement," Section 3.0. Mechanical Design Features," and etc for the UHS fans.

Response to Question 09.02.01-44:

Part (a)

The U.S. EPR FSAR Tier 1 Section 2.7.11 title, "Essential Service Water System," will not be changed to add Ultimate Heat Sink to the title. PEB and PED equipment both have PE (Essential Service Water) designations. Additionally, many references throughout the FSAR to this section would be impacted.

Part (b)

The UHS cooling tower fans were added to U.S. EPR FSAR Tier 1, Table 2.7.11-2 per Response to RAI 175, Question 09.02.05-17(g). Correspondingly, the UHS cooling tower fans have been added to U.S. EPR FSAR Tier 1, Tables 2.7.11-1 as shown in the enclosed markups. U.S. EPR FSAR Tier 1, Table 2.7.11-3 does not require revision.

Cooling tower fans are components in the U.S. EPR ultimate heat sink, which is subject to requirements of RG1.27 Rev 2 "Ultimate Heat Sink at Nuclear Power Plants." RG 1.27 Rev 2 does not directly discuss cooling tower fans, nor does it identify any quality standards pertinent to cooling tower fans. Cooling tower fans do not form part of the pressure boundary for any fluid system; further, their mechanical function and location in cooling towers is analogous to the

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function and location of pump impellers, which are explicitly excluded from quality group classification review by SRP 3.2.2 Rev 4, Part I Areas of Review, paragraph 1. Therefore, no quality standard is identified in U.S. EPR FSAR Tier 2 Table 3.2.2-1 for the cooling tower fans. Thus, ASME Code Section III is entered as "No" in Table 2.7.11-1. Refer to Response to RAI 72, Question 03.02.02-5.

Part (c)

Revise U.S. EPR FSAR Section 2.7.11, Subsection 1.0, Description, Para.2, first line as follows:

"The ESWS and UHS provide the following safety related functions:"

Add the following to U.S. EPR FSAR Section 2.7.11, Subsection 1.0, Description, Para.2, as Bullet 3:

"The UHS provides heat removal from the ESWS during normal operation and accident conditions, and transfers that energy to the environment."

Revise U.S. EPR FSAR Section 2.7.11, Subsection 2.1 as follows:

"The functional arrangement of the ESWS and UHS is as shown in Figure 2.7.11-1—Essential Service Water System Functional Arrangement."

The UHS cooling tower fans have been added to U.S. EPR FSAR Tier 1, Tables 2.7.11-1. UHS components listed in Table 2.7.11-1 are subject to the applicable design feature requirements of Section 3.0. No revision to Section 3.0 Mechanical Design Features is required.

FSAR Impact:

U.S. EPR FSAR Tier 1 Section 2.7.11 will be revised as described in the response and indicated on the enclosed markup.

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Table 2.7.11-1—Essential Service Water System Equipment Mechanical Design (8 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	ASME Code Section III	Function	Seismic Category
Makeup Water Check Valve Division 4	30PED40AA220	ESW Pump Structure Division 4	Yes	Close	I
Isolation Valve Upstr KAA80AC001	30PEB80AA003	ESW Dedicated Division Safeguards Building 4	No	Open	N/A
Isolation Valve Dnstr KAA80AC001	30PEB80AA004	ESW Dedicated Division Safeguards Building 4	Yes	Open	I
Dedicated ESW Pump	30PEB80AP001	ESW Pump Structure Division 4	No	Run	N/A
Dedicated Blowdown Isolation Valve	30PEB80AA009	ESW Pump Structure Division 4	No	Close	N/A
Dedicated Filter Blowdown Isolation Valve	30PEB80AA016	ESW Pump Structure Division 4	No	Close	N/A
Dedicated Recirc Isolation Valve	30PEB80AA015	ESW Pump Structure Division 4	No	Close	N/A
Dedicated Filter Blowdown Isolation Check Valve	30PEB80AA211	ESW Pump Structure Division 4	No	Close	N/A
Dedicated Pump Isolation Check Valve	30PEB80AA002	ESW Pump Structure Division 4	No	Open	N/A
Dedicated Emergency Blowdown Isolation Valve	30PEB80AA003	ESW Pump Structure Division 4	No	Close	N/A

INSERT A — RAI 345 09.02.01-44(b)

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2.7.11 Essential Service Water System

1.0 Description

The essential service water system (ESWS) is a safety-related system that provides cooling water to the component cooling water system (CCWS) heat exchangers, the emergency diesel generator (EDG) heat exchangers, and the essential service water pump building ventilation system (ESWPBVS) room coolers under normal operating, shutdown/cooldown, design basis events. The Ultimate Heat Sink (UHS) dissipates heat rejected from the ESW during normal operation and post accident shutdown.

INSERT B → The ESWS provides the following safety related functions:

- The ESWS provides the capability to transfer heat from CCWS to the environment following an anticipated operational occurrence (AOO) or postulated accident.
- The ESWS provides continued heat transfer from the fuel pool cooling system (FPCPS) via the CCWS as long as any fuel assemblies are in the spent fuel storage pool located outside containment.

INSERT C →

- ~~The ESW normal and emergency makeup water systems and blowdown system piping from pump discharge piping up to and including the isolation valves provided for isolation of the tower basins to prevent loss of tower water inventory.~~
- The ESW emergency makeup water system and blowdown system isolation valves provide automatic isolation of the tower basins under DBA conditions to prevent loss of tower water inventory.
- ~~Pursuant to NRC Regulatory Guide 1.27 requirements,~~ Each UHS cooling tower basin is sized to contain sufficient water to allow for 72 hours of ESW train operation under DBE conditions without addition of makeup water. The water level in the basin at the end of the 72 hour period is sufficient to meet pump minimum suction head (NPSH) requirements.
- After 72 hours have elapsed since the initiation of design basis event, the ESW emergency makeup water system provides water to the ESW system to replenish cooling water lost to evaporation, drift, blowdown and other losses in order to ensure cooling tower basin water levels remain within established limits under DBE conditions.
- The site specific ESW emergency makeup water system will provide this makeup water for at least 27 days following the initial 72 hour post-accident period (balance of 30 day scenario).

The ESWS provides the following non-safety-related functions:

- The ESWS provides the cooling of the system users during all normal plant operating conditions.
- Deleted.

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- The ESW normal makeup water system provides makeup water to the ESW system to replenish cooling water lost to evaporation, drift, and other losses in order to ensure cooling tower basin water levels remain within established limits.

- The ESW system provides the means of transferring heat loads from the dedicated CCW heat exchanger under severe accident conditions to ensure containment integrity.

- Freeze protection is provided by diverting ESW return flow directly to the tower basin and controlling fan operation under low load/low ambient temperature conditions.

The non-safety-related dedicated ESWS train provides water as a cooling medium to the non-safety-related dedicated CCWS train heat exchanger and to the division 4 ESWS ESWPBVS room cooler for the removal of reject heat under severe accident conditions.

2.0 Arrangement

INSERT D

2.1 The functional arrangement of the ESWS is as shown in Figure 2.7.11-1—Essential Service Water System Functional Arrangement.

2.2 The location of the ESWS equipment is as listed in Table 2.7.11-1—Essential Service Water System Equipment Mechanical Design.

2.3 Physical separation exists between divisions of the ESWS.

2.4 Deleted.

2.5 Deleted.

3.0 Mechanical Design Features

3.1 Deleted.~~Equipment listed in Table 2.7.11-1 as ASME Code Section III is designed, welded, and hydrostatically tested in accordance with ASME Code Section III.~~

3.2 Check valves listed in Table 2.7.11-1 will function as listed in Table 2.7.11-1.

3.3 Deleted.

3.4 Components identified as Seismic Category I in Table 2.7.11-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.7.11-1.~~Equipment identified as Seismic Category I in Table 2.7.11-1 can withstand seismic design basis loads without loss of safety function as listed in Table 2.7.11-1.~~

3.5 Components listed in Table 2.7.11-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.~~Deleted.~~

3.6 Components listed in Table 2.7.11-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.~~Deleted.~~

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INSERT for RAI 345, Question 09.02.01-44 (b)

INSERT A (for Table 2.7.11-1)

Description	Tag Number	Location	ASME Code Section III	Function	Seismic Category
Cooling Tower Fan	30PED10AN001	ESW Cooling Tower Division 1	No	Run	I
Cooling Tower Fan	30PED10AN002	ESW Cooling Tower Division 1	No	Run	I
Cooling Tower Fan	30PED20AN001	ESW Cooling Tower Division 2	No	Run	I
Cooling Tower Fan	30PED20AN002	ESW Cooling Tower Division 2	No	Run	I
Cooling Tower Fan	30PED30AN001	ESW Cooling Tower Division 3	No	Run	I
Cooling Tower Fan	30PED30AN002	ESW Cooling Tower Division 3	No	Run	I
Cooling Tower Fan	30PED40AN001	ESW Cooling Tower Division 4	No	Run	I
Cooling Tower Fan	30PED40AN002	ESW Cooling Tower Division 4	No	Run	I

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INSERTS for RAI Question 9.2.1-44 (c)

INSERT B

"The ESWS and UHS provide the following safety related functions:"

INSERT C

"The UHS provides heat removal from the ESWS during normal operation and accident conditions, and transfers that energy to the environment."

INSERT D

"The functional arrangement of the ESWS and UHS is as shown in Figure 2.7.11-1—Essential Service Water System Functional Arrangement.

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Question 09.02.01-47:

Follow-up to RAI 119, Question 9.2.1-22

Applications for standard plant design approval must contain proposed ITAAC in accordance with 10 CFR 52.47(b)(1) requirements. Proposed ITAAC for the ESWS are provided in Tier 1 FSAR Section 2.7.11. The staff reviewed the information provided in Table 2.7.11-3, "Essential Service Water System Inspections, Tests, Analyses, and Acceptance Criteria," to confirm that the proposed ITAAC are adequate for EPR design certification. In addition to the items referred to in RAI 9.2.1-1 through -9 and RAI 9.2.1-21, some of which involve ITAAC considerations, the staff found that the proposed ITAAC are incomplete, inconsistent, inaccurate, or that clarification is needed and the applicant needs to revise the Tier 1 information to address the following considerations in this regard:

Part 3- Item 7.2 needs to specify that ESWS pump testing to demonstrate adequate net positive suction head will be completed at the maximum ESWS flow rate conditions, with the inventory in the cooling tower basin at the lowest allowable level (as corrected to account for actual temperature and atmospheric pressure conditions). The maximum ESWS flow rate and minimum allowable cooling tower basin water level, along with the corresponding design basis water temperature and atmospheric pressure that apply need to be listed to assure that test conditions are properly established. The acceptance criteria for an acceptable test need to be specified.

Based on the staff's review of response to RAI 119, Question 9.2.1-22 and an audit by the staff conducted on October 27, 2009, this item remains open and requires further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

> The applicant's response to part 3 of RAI 9.2.1-22 stated that ITAAC Item 7.2 would be revised to specify that ESWS pump testing to demonstrate adequate net positive suction head—net positive suction head actual (NPSHA) must be greater than net positive suction head required (NPSHR). The testing will be completed at the maximum ESWS flow rate conditions, with consideration for the inventory in the cooling tower basin at the lowest allowable level (as corrected to account for actual temperature and atmospheric pressure conditions).The applicant did not identify the ESWS pump NPSH design conditions as requested for this ITAAC. These parameters are necessary to enable comparison with test data obtained at actual conditions. These parameters include maximum ESWS pump flow rate and minimum cooling tower basin water level, along with the corresponding design basis water temperature and atmospheric pressure.

Response to Question 09.02.01-47:

Refer to RAI 345, Responses 09.02.01-34 and 41 for information related to NPSH design conditions. The maximum ESWS pump flow rate corresponds to the normal ESWS pump flow rate (19,340 gpm).

The maximum ESW pump flow rate, minimum cooling tower basin water level, corresponding design basis water temperature, and atmospheric pressure will be added to the U.S.EPR FSAR Table 2.7.11-3, ITAAC Item 7.2.

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FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.7.11 will be revised as described in the response and indicated on the enclosed markup.

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Table 2.7.11-3—Essential Service Water System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
5.1	The components designated as Class 1E in Table 2.7.11-2 are powered from the Class 1E division as listed in Table 2.7.11-2 in a normal or alternate feed condition.	a. Testing will be performed for components designated as Class 1E in Table 2.7.11-2 by providing a test signal in each normally aligned division.	a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.7.11-2.
		b. Testing will be performed for components designated as Class 1E in Table 2.7.11-2 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E component identified in Table 2.7.11-2.
5.2	Valves listed in Table 2.7.11-2 fail as-is on loss of power.	Testing will be performed for the valves listed in Table 2.7.11-2 to fail as-is on loss of power.	Following loss of power, the valves listed in Table 2.7.11-2 fail as-is.
5.3	Deleted.	Deleted.	Deleted.
6.1	Deleted.	Deleted.	Deleted.
7.1	The ESW UHS as listed in Table 2.7.11-1 has the capacity to remove the design heat load from the CCWS.	Tests and analyses will be performed to demonstrate the capability of the ESWS UHS as listed in Table 2.7.11-1 to remove the design heat load from CCWS.	The ESWS UHS has the capacity to remove the design heat load from the CCWS of 2.913 E+08 BTU/hr.
7.2	The pumps listed in Table 2.7.11-1 have sufficient NPSHA.	Testing and analyses will be performed to verify NPSHA for pumps listed in Table 2.7.11-1.	A report exists and concludes that the pumps listed in Table 2.7.11-1 have NPSHA that is greater than net positive suction head required (NPSHR) at system run-out flow with consideration for minimum allowable cooling tower basin water level (as corrected to account for actual temperature and atmospheric conditions).

INSERT

RAI 345
09.02.01-47

DRAFT

INSERT for RAI 345, Question 09.02.01-47

Insert for Table 2.7.11-3

INSERT

7.2	The pumps listed in Table 2.7.11-1 have sufficient NPSHA.	Testing and analyses will be performed to verify NPSHA for pumps listed in Table 2.7.11-1.	A report exists and concludes that the pumps listed in Table 2.7.11-1 have NPSHA that is greater than net positive suction head required (NPSHR) at the maximum ESWS flow rate with consideration for minimum allowable cooling tower basin water level (as corrected to account for actual temperature and atmospheric conditions). • Max. ESWS flow rate = 19,340 gpm. • Min. allowable cooling tower basin water level = elev. -6.08 ft. (72 hours post DBA) • Max. Basin Water temp = 95°F (72 hours post DBA) • Atm. Pressure $_{\text{SEA LEVEL}}$ = 14.69 psia (33.93 ft)

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Response to

Request for Additional Information No. 356 (4232), Revision 0

02/01/2010

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)

DRAFT

Question 09.02.02-86:

Follow-up to RAI 174, Question 9.2.2-39:

Standard Review Plan (SRP) 9.2.2 Section III, requires confirmation of the overall arrangement of the component cooling system (CCWS) which is being utilized as guidance for the review of the Safety Chilled Water System (SCWS). The SCWS description and piping and instrumentation diagrams (P&ID), Tier 2, FSAR Figure 9.2.8-1, were reviewed to assess the design adequacy of the SCWS for performing its heat removal functions. While the P&ID shows the SCWS components and identifies the boundaries between safety-related and non-safety-related parts of the system, some of the information is incomplete, inaccurate, or inconsistent. Consequently, the applicant needs to revise the Final Safety Analysis Report (FSAR) to address the following considerations in this regard:

a. Pipe sizes are not shown on the Tier 2, FSAR Figure 9.2.8-1, and the system description does not explain the criteria that were used in establishing the appropriate bounding pipe sizes (such as limiting flow velocities from conceptual/preliminary design studies).

b. The system description does not provide bounding details such as system operating temperatures, pressures, and flow rates for all operating modes and alignments.

c. Tier 2, FSAR Figure 9.2.8-1 does not show the location of the indications display (e.g., local, remote panel, control room), and does not identify the instruments that provide input to a process computer and/or have alarm and automatic actuation functions.

d. Tier 2, FSAR Figure 9.2.8-1 does not identify the normal valve positions, the valves that are locked in position, and the valves that have automatic functions. These design features should be described.

e. Tier 2, FSAR Figure 9.2.8-1 does not show specific set point for system alarms (including head tank) and relief and the bases for these set points are not explained in the system description.

f. Isolation valves for taking components out of service for maintenance are not shown on the Tier 2, FSAR Figure 9.2.8-1.

g. Describe in Section 9.2.8 showing the filters in the return lines for some but not all HVAC units.

Based on the staff's review of the applicant's response to RAI 9.2.2-39 (ID1810/6769) AREVA #174 Supplements 1 and 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The information described above is required by the staff in order to complete their review. Consequently, these items will remain open pending submittal of the information that was requested and a schedule for providing this information needs to be established.

Response to Question 09.02.02-86:

a. Pipe sizes will be added to Tier 2, FSAR Figure 9.2.8-1. Tier 2 FSAR section 9.2.8.1 will be revised to explain the criteria that were used in establishing the appropriate bounding pipe sizes.

DRAFT

b. System operating temperatures, pressures, and flow rates for cross-tie and single division operation will be provided in revised Tier 2, FSAR Table 9.2.8-1 and added Table 9.2.8-2.
c. Location of the indications display, input to a process computer and/or alarm and automatic actuation functions, for instruments on Tier 2, FSAR Figure 9.2.8-1 will be provided in Tier 2, FSAR Table 9.2.8-3
d. Tier 2 FSAR section 9.2.8 currently contains functional descriptions of the valve positions for the cross-tie valves and the chiller by-pass valve.

   Tier 2 FSAR section 9.2.8.2.2 describes the function of the cross-tie valves for normal operation and Tier 2 FSAR section 9.2.8.6 describes their closure in the event of excess leakage. Tier 2 FSAR Section 9.2.8.2.2 describes the chiller by-pass function to vary by-pass flow returning to the chiller to prevent freezing at the evaporator coil.

   A description of the SAC and SAB HVAC coil flow control valves function will be added to 9.2.8.2.2.

   All other SCWS valves are manual and do not change position.

e. The SCWS 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. This description of the basis for the relief valve setpoint will be added to Tier 2, FSAR Section 9.2.8.2.2.

   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. This description of the basis for the expansion tank size will be added to Tier 2, FSAR Section 9.2.8.2.2.

f. Isolation valves for taking components out of service for maintenance are shown on the Tier 2, FSAR Figure 9.2.8-1 including the addition of isolation valves for the cross-tie MOVs.
g. A description of the filters for the flow control valves has been added to Tier 2, FSAR Section 9.2.8.

FSAR Impact:

The FSAR will be revised as indicated in the response and enclosed mark-up.

DRAFT

Inserts for 09.02.02-86a,b,c:

Insert 1

Pipe diameters for the SCWS are based on limiting the flow velocity to a range of 4 to 10 ft/sec for normal modes of operation that are expected to occur frequently.

Insert 2

Table 9.2.8-1 Safety Chilled Water Design Parameters
For Cross-tied Operation

Description	Technical Data
QKA 10/20/30/40 Evaporator refrigeration capacity	4,388,200 Btu/h
QKA 10/40 Condensing capacity	5,705,000 Btu/h
QKA 20/30 Condensing capacity	5,705,000 Btu/h
QKA 10/40 Condenser Air Flow	586,100 ft^3/min
QKA 10/40 Condenser Fan Power (3-50% capacity fans per condenser)	95 hp
QKA 20/30 Condenser CCW cooling flow	1140 gpm
QKA 10/20/30/40 Required Evaporator Chilled Water Flow	1130 gpm
QKA 10/20/30/40 Required Evaporator Chilled Water Outlet Temperature	41 °F
QKA 10/20/30/40 Required Evaporator Chilled Water Inlet Temperature	50 °F
QKA 10/20/30/40 Chilled Water Pump AP-107 Required Operating Flow (including margin)	565 gpm
QKA 10/20/30/40 Chilled Water Pump AP-107 Required Operating Head	171 ft
QKA 10/20/30/40 Chilled Water Pump AP-107 Shutoff Head	222 ft
QKA 10/20/30/40 Required Chilled Water Pump AP-107 Hydraulic Horsepower	25 hp
SCWS Design Pressure	254 psig

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Table 9.2.8-2 Safety Chilled Water Design Parameters

Each Division Isolated

Description	Technical Data
QKA 10/40 Evaporator refrigeration capacity	2,394,200 Btu/h
QKA 20/30 Evaporator refrigeration capacity	1,994,000 Btu/h
QKA 10/40 Condensing capacity	3,112,500 Btu/h
QKA 20/30 Condensing capacity	2,592,200 Btu/h
QKA 10/40 Condenser Air Flow	319,740 ft^3/min
QKA 10/40 Condenser Fan Power (3-50% capacity fans per condenser)	52 hp
QKA 20/30 Condenser CCW cooling flow	475 gpm
QKA 10/20/30/40 Required Evaporator Chilled Water Flow	565 gpm
QKA 10/20/30/40 Required Evaporator Chilled Water Outlet Temperature	41 °F
QKA 10/20/30/40 Required Evaporator Chilled Water Inlet Temperature	50 °F
QKA 10/20/30/40 Chilled Water Pump AP-107 Required Operating Flow (including margin)	565 gpm
QKA 10/20/30/40 Chilled Water Pump AP-107 Required Operating Head	131.93 ft
QKA 10/20/30/40 Chilled Water Pump AP-107 Shutoff Head	172 ft
QKA 10/20/30/40 Required Chilled Water Pump AP-107 Hydraulic Horsepower	19 hp
Design Pressure	254 psig

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Insert 3

Instrument display location, and input to alarm and automatic or manual functions, for instruments shown in Figure 9.2.8-1 are provided in Table 9.2.8-3

Insert 4

Table 9.2.8-3 Safety Chilled Water Instrumentation

MCR/RSS Display	Alarm	Function	Purpose
Expansion Tank Humidity Div 1	MAX-1	N/A	Max-1 alarm alerts operator to leaking or failed tank diaphragm
System Pressure #1 Div 1	MAX-1 MAX-2 MIN-1 MIN-2 MIN-3	MIN-2 Manual Isolation Div. 1 and 2 MIN-3 Div 1 Chiller and Pump shutdown	MAX-2 relief/alarm prevent exceeding design pressure MAX-1 alarm alert operator to high inventory MIN-1 alert operator to add inventory MIN-2 close cross-tie valves for inventory protection of a division MIN-3 trips operating pumps at pump min NPSH
System Pressure #2 Div 1			
Evaporator ΔP Div 1	MIN-1 MIN-2 MAX-1	MODULATE Chiller Bypass Valve 30QKA10CG101 MIN-2 Train 1 to Train 2 Switchover	MIN-1 chiller freeze protection – incrementally opens valve MAX-1 incrementally close valve to control flow MIN-2 indicates normal flow loss in division and need to switch to alternate division
Chiller Bypass Valve Position Div 1	N/A	Evaporator Flow Control	Valve position status
Tank Humidity Measurement Div 2	MAX-1		MAX-1 alarm alerts operator to leaking or failed tank diaphragm
System Pressure Measurement #1 Div 2	MAX-1 MAX-2 MIN-1	MIN-2 Isolation Div. 1 and 2 MIN-3 Div 2 Chiller	MAX-2 Relief/alarm prevent exceeding design pressure MAX-1 alarm alert operator

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System Pressure Measurement #2 Div 2	MIN-2 MIN-3	and Pump shutdown	to high inventory MIN-1 alert operator to add inventory MIN-2 close cross-tie valves for inventory protection of a division MIN-3 trips operating pumps at pump min NPSH
Evaporator ΔP Measurement Div 2	MAX-1 MIN-1 MIN-2	MODULATE Chiller Bypass Valve 30QKA20CG101 MIN-2 Train 2 to Train 1 Switchover	MIN-1 chiller freeze protection – incrementally opens valve MAX-1 incrementally close valve to control flow MIN-2 indicates normal flow loss in division and need to switch to alternate division
Chiller Bypass Valve Position Div 2	N/A	Evaporator Flow Control	Valve position status
Tank Humidity Measurement Div 3	MAX-1	N/A	Max-1 alarm alerts operator to leaking or failed tank diaphragm
System Pressure Measurement #1 Div 3	MAX-1 MAX-2 MIN-1 MIN-2 MIN-3	MIN-2 Manual Isolation Div. 3 and 4 MIN-3 Chiller & Pump shutdown	MAX-2 relief/alarm prevent exceeding design pressure MAX-1 alarm alert operator to high inventory MIN-1 alert operator to add inventory MIN-2 close cross-tie valves for inventory protection of a division MIN-3 trips operating pumps at pump min NPSH
System Pressure Measurement #2 Div 3			
Evaporator ΔP Measurement Div 3	MAX-1 MIN-1 MIN-2	MODULATE Chiller Bypass Valve 30QKA30CG101 MIN-2 Train 3 to Train 4 Switchover	MIN-1 chiller freeze protection – incrementally opens valve MAX-1 incrementally close valve to control flow MIN-2 indicates normal flow loss in division and need to switch to alternate division
Chiller Bypass Valve Position Div 3	N/A	Evaporator Flow Control	Valve position status
Tank Humidity Measurement Div 4	MAX-1	N/A	Max-1 alarm alerts operator to leaking or failed tank diaphragm

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System Pressure Measurement #1 Div 4	MAX-1 MAX-2 MIN-1 MIN-2 MIN-3	MIN-2 Manual Isolation Div. 3 and 4 MIN-3 Div 4 Chiller and Pump shutdown	MAX-2 relief/alarm prevent exceeding design pressure MAX-1 alarm alert operator to high inventory MIN-1 alert operator to add inventory MIN-2 close cross-tie valves for inventory protection of a division MIN-3 trips operating pumps at pump min NPSH
System Pressure Measurement #2 Div 4			
Evaporator ΔP Measurement Div 4	MAX-1 MIN-1 MIN-2	MODULATE Chiller Bypass Valve 30QKA40CG101 MIN-2 Train 4 to Train 3 Switchover	MIN-1 chiller freeze protection – incrementally opens valve MAX-1 incrementally close valve to control flow MIN-2 indicates normal flow loss in division and need to switch to alternate division
Chiller Bypass Valve Position Div 4	N/A	Evaporator Flow Control	Valve position status
SAC Coil Throttle Valve Position Div1	N/A	HVAC Coil Flow Control	Valve position status
SAC Coil Throttle Valve Position Div2	N/A	HVAC Coil Flow Control	Valve position status
SAC Coil Throttle Valve Position Div3	N/A	HVAC Coil Flow Control	Valve position status
SAC Coil Throttle Valve Position Div4	N/A	HVAC Coil Flow Control	Valve position status
SAB Coil Throttle Valve Position Div1	N/A	HVAC Coil Flow Control	Valve position status
SAB Coil Throttle Valve Position Div2	N/A	HVAC Coil Flow Control	Valve position status
SAB Coil Throttle Valve Position Div3	N/A	HVAC Coil Flow Control	Valve position status
SAB Coil Throttle Valve Position Div4	N/A	HVAC Coil Flow Control	Valve position status
Division 1 To 2 Cross-connect Supply MOV Position	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status
Division 1to 2 Cross-connect Return MOV Position	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status
Div 2 To 1 Cross-connect Supply MOV POS	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status

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Div 2 To 1 Cross-connect Return MOV POS	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status
Div 3 To 4 Cross-connect Supply MOV POS	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status
Div 3 To 4 Cross-connect Return MOV Position	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status
Div 4 To 3 Cross-connect Supply MOV POS	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status
Div 4 To 3 Cross-connect Return MOV POS	N/A	Switchover Valve OPEN/CLOSE Confirmation	Valve position status

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Inserts for 09.02.02-86 e:

Insert 5

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.

Insert 6

An automatic switchover to operation of the opposite chiller train occurs if the chill water flow differential pressure across the evaporator reaches a MIN-2 set point for the running train. Then, if the cross-tie valves are open and the opposite chiller is in stand-by, the opposite (non-running) chiller pumps are started. When differential pressure across the opposite chiller evaporator is greater than MIN-1, then the opposite chiller is automatically started and the initial running chiller train is stopped manually from the MCR.

Inserts for 09.02.02-86 e:

Insert 7

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 shut the cross-tie valves on MIN-2 pressure and trip the SCWS operating pumps of the effected chiller train after reaching MIN-3 pressure.

Inserts for 09.02.02-86 d:

Insert 8

HVAC Cooling Coil Flow Control Valves

The flow rate through the cooling coils for the ventilation of the SAC Electrical Division of the Safeguards Building and the ventilation of the SAB Safeguards Building Main Control Room 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 are supplied by fixed SCWS flow rates to insure operability of all loads.

Inserts for 09.02.02-86 g:

Insert 9

Filters

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

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Question 09.02.02-87:

Follow-up to RAI 174, Question 9.2.2-40:

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. In order for the staff to confirm that the SCWS has been adequately sized, the applicant needs to include additional information in Tier 2 of the Final Safety Analysis Report (FSAR), Section 9.2.8, to fully describe and explain the bounding requirements for the minimum system heat transfer and flow for normal operating, refueling, and accident conditions, the bases for these requirements including limiting assumptions that apply (such as temperature considerations), to provide the excess margin that is available and the method for determining this margin, and to provide the limiting system temperatures and pressures that are assumed with supporting basis.

Based on the staff's review of the applicant's response to RAI 9.2.2-40 (ID1810/6770) AREVA #174 Supplement 1 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated the major SCWS users for each division but stated that the specific details of the SCWS minimum heat transfer and flow requirements for the various plant operating modes and accident conditions will be identified later in the design process. The applicant stated that the final determination of these design values depends on SCWS user heat loads and flow requirements and that the SCWS will be designed to satisfy these minimum heat transfers and flow requirements for each user under plant operating scenarios (after the plant is built). In order to complete its review the staff requires: (a.) Committment by the aplicant that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the operating data to determine and to calculate the minimum heat transfer and flow requirements; or (b.) provide the bounding values for the minimum heat transfer and flow requirements that were used for the Conceptual/Preliminary design for the US EPR.

The information described above is required by the staff in order to complete their review. Consequently, these items will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

Response to Question 09.02.02-87:

Bounding values for the minimum heat transfer and flow requirements that were used for the US EPR™ SCWS design are provided in the response for 9.2.2-86 b. with revised Tier 2, FSAR Table 9.2.8-1 and added Table 9.2.8-2.

FSAR Impact:

The FSAR will not be revised for this response except as noted for 9.2.2-86 b.

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Question 09.02.02-88:

Follow-up to RAI 174, Question 9.2.2-41:

General design criteria (GDC) 44 requires the transfer of heat from systems, structures and components (SSC) important to safety to a heat sink during both normal and accident conditions assuming a single active component failure coincident with the loss of offsite power. The Final Safety Analysis Report (FSAR) indicates that the safety chilled water system (SCWS) chillers are rated at 275 tons (Divisions 1 and 4) and 250 tons (divisions 2 and 3) but does not provide a basis for these capacities.

- Provide the bounding heat loads in the various SCWS divisions for which the chillers have been sized during the Conceptual/Preliminary Design for the US EPR. Information should include both normal operations and postulated accident conditions.

Based on the staff's review of the applicant's response to RAI 9.2.2-41 (ID1810/6772) AREVA #174 Supplement 1 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated that specific details of the SCWS chiller sizing will be identified later in the design process and that the final chiller sizing determination depends on a number of factors. SCWS user (after the plant is built) heat removal and flow requirements, developed after the US EPR is built, under all operating modes and alignments will form the basis for the SCWS chiller sizing.

In order to complete its review the staff requires: (a.) Committment by the aplicant that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the operating data to determine and to calculate the heat removal and flow requirements; or (b.) provide the bounding values for the heat removal and flow requirements that were used for the Conceptual/Preliminary design for the US EPR.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

Response to Question 09.02.02-88:

Bounding values for the minimum heat transfer, SCWS chiller sizing, and flow requirements that were used for the US EPR™ SCWS design are provided in the response for 9.2.2-86 b. with revised Tier 2, FSAR Table 9.2.8-1 and added Table 9.2.8-2.

FSAR Impact:

The FSAR will not be revised for this response except as noted for 9.2.2- 86 b.

DRAFT

Question 09.02.02-89:

Follow-up to RAI 174, Question 9.2.2-43:

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. In order to satisfy system flow requirements, the SCWS design must assure that the minimum net positive suction head (NPSH) for the SCWS pumps will be met for all postulated conditions, including consideration of vortex formation. The staff found that the NPSH requirement for the SCWS pumps was not specified and Tier 2 Final safety Analysis Report (FSAR) Section 9.2.8 did not provide information that the SCWS design will assure that the NPSH requirement for the SCWS pumps is satisfied (including consideration of vortex formation) and identify the bounding margin provided by the SCWS design for the most limiting assumptions. Consequently, the applicant needs to provide additional information in Tier 2 FSAR Section 9.2.8 to specify the bounding value for the minimum net positive suction head (NPSH) requirement for the SCWS pumps and to demonstrate the compliance of this minimum NPSH requirement with the system design when taking vortex formation into consideration, and identify the bounding margin that is available for the most limiting case. Sufficient information is needed to enable the staff to independently confirm that the design is adequate in this regard, including bounding assumptions that were used along with supporting justification.

Based on the staff's review of the applicant's response to RAI 9.2.2-43 (ID1810/6776) AREVA #174 Supplement 3 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated that pump sizing, including NPSH requirements, will be determined after the final pump pressures and flow rates are determined, later in the design process, after the plant is built. The applicant also stated NPSH-available, as well as excess margin, will be based on pump NPSH-required for the limiting line up at the minimum expansion tank level. The possibility of vortex formation will also be considered in the NPSH evaluation.

In order to complete its review the staff requires: (a.) Committment by the aplicant that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the operating data to determine and to calculate the final pump pressures, flow rates and the NPSH information requested above or (b.) provide the bounding values for the the final pump pressure, flow rates and NPSH information requested above, that were used for the Conceptual/Preliminary design for the US EPR.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

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Response to Question 09.02.02-89:

Tier 2 FSAR Section 14.2.12.6.2, Safety Chilled Water System (Test #052), Item 3.1 states that SCWS pump performance characteristics (e.g., head versus flow, motor current) for the SCWS pumps will be verified including NPSHa ≥ NPSHR, Discharge head, and Flow corresponding to head at each point. Item 7.2 in Tier 1 FSAR Table 2.7.2-3 requires the performance of NPSH testing.

In addition the Tier 2 FSAR Section 9.2.8.6 will be modified to add that the MIN-3 system pressure chiller and pump trip setpoint occurs before the pressure correspond to the minimum required available NPSH is reached.

FSAR Impact:

The FSAR will be revised as indicated in the response and enclosed mark-up.

Insert 10

The MIN-3 system pressure setpoint trip occurs before the pressure corresponding to the minimum required available NPSH is reached.

DRAFT

Question 09.02.02-90:

Follow-up to RAI 174, Question 9.2.2-44:

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. Based on Final safety Analysis Report (FSAR) Tier 2 Section 9.2.8.2, a diaphragm expansion tank is utilized with a nitrogen fill connection with relief valve protection for each division. Piping voids are precluded by the constant pressure from the divisionalized nitrogen-charged expansion tank; however, there is no FSAR detailed description of waterhammer consideration in the design.

Based on the staff's review of the applicant's response to RAI 9.2.2-44 (ID1810/6777) AREVA #174 Supplement 3 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated piping voids associated with potential water-hammer are precluded by the constant pressure maintained in the nitrogen charged expansion tank in each division. In addition, the diaphragm expansion tank is also used for the equalization of pressure and volumetric expansion and maintains the requisite static system pressure. A relief valve on the connecting line prevents exceeding the line design pressure.

The applicant also stated that a hydraulic analysis of the SCWS will be performed later in the design process to identify the system requirements during normal startup, normal shutdown and abnormal conditions to confirm the minimum and maximum system pressures for various system mechanical and piping components. This analysis will consider pump details, as well as the pipe sizes and piping physical arrangement. Based on the analysis, an evaluation of water-hammer concerns will be performed to confirm that the system pressures are within the maximum allowed internal pressures. Sizing of the permanent surge control devices will also be confirmed. Provide the standards, guidelines and bounding requirements from the Conceptual/Preliminary Design that were used to address the the water-hammer concerns. Provide a committment that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the system requirements for various system mechanical and piping components to evaluate the concerns involving the system pressures being within the allowed internal pressure.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending completion and submittal of the water-hammer analysis and a schedule for providing this information needs to be established.

Response to Question 09.02.02-90:

A US EPR™ water hammer technical guide is used to perform a water hammer evaluation of the design of the SCWS. The technical guide provides standard methods to avoid the potential for water hammer with a general description of the characteristic causes of water hammer. The evaluation uses the system boundary conditions, component elevations, and operating modes to establish

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that no transient conditions can occur that could lead to a water hammer. Operating state transitions are examined to establish that changing parameters will not lead to a water hammer. The evaluation establishes that the SCWS design minimizes the potential for dynamic flow instabilities by avoiding high line velocities and has specified valve speeds that are slow 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 monitoring on a periodic basis. Consideration has been made to avoid voiding which can occur following shutdown, or during standby periods. Means are provided for a slow and controlled bottom fill of those portions of the system where voiding could occur after shutdown or during standby. The design incorporates controls and instrumentation to support operating and maintenance procedures to provide adequate measures to avoid water hammer.

FSAR Tier 2 Section 14.2.12.6.2 Safety Chilled Water System (Test #052) will be revised to include testing to insure system pressures are within the allowed internal pressure and to specifically address verification of water hammer during normal and emergency system evolutions. This will include but is not limited to valve realignments, pump starts/stops, operation of valves that change position such as the cross-connects.

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FSAR Impact:

The FSAR will be revised as indicated in the response and enclosed mark-up.

Insert 11

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

Insert 12

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 SAC and SAB flow control valves during pump operation does not indicate evidence of water hammer.

Insert 13

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

Insert 13.1

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 for venting to fully fill components and piping at high points in which voids could occur. The Nitrogen pressurized expansion tank insures system high points are retained at positive pressure.

Insert 13.2
The setpoint is established in accordance with ASME III Class 3

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Question 09.02.02-91:

Follow-up to RAI 174, Question 9.2.2-45:

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 where demineralized water may be 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. The Final Safety Analysis Report (FSAR) does not discuss expansion tank capabilities in the event of a makeup source interruption.

a. Describe the bounding system leak rate that is assumed during normal operating and accident conditions, the bases for these assumptions, and the number of days of operation that the expansion tank is sized for should the makeup source be unavailable.

b. Describe the treatent of these line with regard to expansion tank capabilities, and the routing of the nitrogen relief valves to safe areas for discharge. Verify hose connections are safety related and seismic at the interface of the pump suction.

Based on the staff's review of the applicant's response to RAI 9.2.2-45 (ID1810/6782) AREVA #174 Supplement 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

With regards to part (a), the applicant responded that a seismically qualified makeup source will be used to feed the SCWS and satisfy NRC Standard Review Plan Section 9.2.2, Section 3C requirements for makeup water in closed loop cooling systems but did not modify Tier 1 drawings to show this connection stating that the connection does not perform a significant safety function. The staff requests the applicant provide amplifying information to support this conclusion.

In addition, the applicant stated that SCWS expansion tank sizing details will be developed later in the design process noting that expansion tank sizing and internal volume determination are dependent on several factors. Provide a committment that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to confirm that the expansion tank sizing and internal volume determination are acceptable.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

Response to Question 09.02.02-91:

Although as indicated in the response provided in RAI 9.2.2-45 AREVA #174 Supplement 4, part (a) that the SCWS would include a seismically qualified makeup source, because that source does not meet the requirements of R.G. 1.29 Part C.1, the primary means to satisfy NRC Standard Review Plan Section 9.2.2, Section 3C requirements for 7 day makeup water in closed loop cooling systems will be the retention of reserve volume in the SCWS expansion tank to

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accommodate 7 days of leakage. This will require a leakage rate more stringent then that indicated in our previous response for RAI 9.2.2-45 AREVA #174 Supplement 4 in which stated a leakage rate of 0.5D gal/min (12.4d ml/s) or 5 gal/min (315 ml/s), whichever is less based on ASME OM Code, subparagraph ISTC-3630 (e) when leakage is not otherwise specified.

The leakage rate for the SCWS will 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. The reserve volume in the expansion tank will be based on each of two 6" cross-tie isolation valves leaking at 0.1 gal/hr (23.1 in^3/hr) each, which requires 33.6 gallons. The limit for 7 day leakage will be set at 50 gallons to allow margin for valve stem packing, pump seal, tank diaphragm, and any remaining undefined leakage. The actual leakage reserve will be set at 100 gallons.

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The nitrogen pressurized expansion tank level and corresponding pressures will be established for the following bands:

Top of Tank
Relief Valve Set Point (MAX-2) – Setpoint to prevent exceeding SCWS design pressure at lowest elevation in SCWS
High Pressure Alarm (MAX-1) - Setpoint to prevent spurious alarm during normal operation
Normal band – band based on operating minimum temperature and max shutdown ambient temperature.
Low Pressure Alarm (MIN-1) – Setpoint to prevent spurious alarm and allow for normal makeup
Low Pressure Alarm (MIN-2) – Close cross-tie valves for inventory protection
7-day Leakage reserve (100 gallons)
Low Pressure Alarm (MIN-3) – Low setpoint to protect pumps, trips operating pumps.
Bottom of tank – Static head reference for SCWS minimum pressure in expansion tank set to maintain pressure above atmospheric at highest elevation in system.

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FSAR Impact:

FSAR Tier 2 Section 9.2.8.3.2 and Figure 9.2.8-1 will be revised to add requirements for makeup storage in the expansion tank as indicated in the attached mark-ups.

FSAR Tier 2 Section 14.2.12.6.2 Safety Chilled Water System (Test #052) will be revised to include requirements to confirm that the expansion tank sizing and internal volume determination are acceptable.

FSAR Tier 2 Table 3.9.6-2 will be revised as indicated for leak testing

Insert 14

3.10 Verify Expansion tank operating parameters and performance
3.10.1 Operating pressure retained in the normal band with temperature changes from high to low.
3.10.2 Alarm set points
3.10.3 SCWS pressure leak rate

Insert 15
4.7 Record Expansion tank Pressures

Insert 16
5.6 Verify that the expansion tank meets design requirements

Insert 17

30QKA10AA102	Div 1 Cross Tie Supply Valve	BF	MO	3	A	A	O	LT PI ST	2Y	
30QKA10AA103	Div 1 Cross Tie Return Valve	BF	MO	3	A	A	O	LT PI ST	2Y	
30QKA20AA102	Div 2 Cross Tie Supply Valve	BF	MO	3	A	A	O	LT PI ST	2Y	
30QKA20AA103	Div 2 Cross Tie Return Valve	BF	MO	3	A	A	O	LT PI ST	2Y	
30QKA30AA102	Div 3 Cross Tie Supply Valve	BF	MO	3	A	A	O	LT PI ST	2Y	
30QKA30AA103	Div 3 Cross Tie Return Valve	BF	MO	3	A	A	O	LT PI ST	2Y	
30QKA40AA102	Div 4 Cross Tie Supply Valve	BF	MO	3	A	A	O	LT PI ST	2Y	
30QKA40AA103	Div 1 Cross Tie Return Valve	BF	MO	3	A	A	O	LT PI ST	2Y	

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Question 09.02.02-92:

Follow-up to RAI 174, Question 9.2.2-46:

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. The Final Safety Analysis Report (FSAR) does not adequately describe the various operating modes and operator actions that are required and the initiation of the SCWS control system functions, such as the operation of protective measures (i.e., chilled water system "Protection OFF" alarms, refrigeration unit shuts down, chilled water circulating pump shuts down). These considerations need to be fully described in FSAR Tier 2 Section 9.2.8, including (for example):

a. The process of selecting a particular system by the safety chilled water system (SCWS) system to initiate when the pressure falls below the second set limit,

b. schematics showing all circuit process components with associated signal inputs and control signal outputs (the schematic provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in "Response to Second Request for Additional information", Attachment A, ANP-10284Q2P),

c. failure positions for the flow control valves,

d. a discussion of normal power and alternate power (as shown in Tier 1 FSAR Table 2.7.2-2),

e. a discussion of implementing the alternate supplies while maintaining divisional separation,

f. the bases for the trip setpoint for low expansion tank pressure,

g. SBO operation (FSAR Tier 2 Section 8.4 indicates that the Division 1 and 4 compressors are powered, but the SCWS pumps are not listed), and

h. instrumentation and controls (I&C) related to SCWS operation such as starts signals, trip signals, and permissives (the schematic that is provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in "Response to Second Request for Additional information", Attachment A, ANP-10284Q2P).

Based on the staff's review of the applicant's response to RAI 9.2.2-46 (ID1810/6785) AREVA #174 Supplement 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

With regards to part (a), the applicant stated that FSAR Tier 2, Section 9.2.8.6 describes the SCWS pressure control. If the pressure falls below a set limit, an alarm is annunciated. If the pressure falls below a second set limit, one of the following measures is automatically initiated:

- Chilled water system "Protection OFF" alarms.
- Refrigeration unit shuts down.
- Chilled water circulating pump shuts down.

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The staff requests the applicant provide the two pressure setpoints and supporting bases for those setpoints. In addition, the staff requests that the applicant identify and describe which of the three automatic measures initiate (one, two, or all) upon reaching the second set pressure limit. Finally, describe which trip would encompass a loss of component cooling water to Division 2 and 3 chillers.

With regards to parts (b), (c), (f), and (h), the applicant stated that the information requested will be identified later in the design process.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

Response to Question 09.02.02-92:

a. See response to 9.2.2-86 for system pressure MIN-2 and MIN-3 actions described in Table 9.2.8-3. The MIN-1 alarm is below the lowest normal system operating pressure with some margin to avoid a spurious alarm. MIN-2 is below MIN-1 but above the inventory margin required for 7 days of normal operation. MIN-3 is below the 7 day normal makeup margin but high enough to provide sufficient NPSH and prevent pump cavitation and still retain some inventory margin in the expansion tank. At MIN-3 the pump and chiller are shutdown in the effected division as described in 9.2.8.6.
b. Schematics not required, see response 9.2.2-92 (a) and 9.2.2-93 for SCWS logic functions and setpoints.
c. The flow control valves are motor operated and fail as-is.
f. See response 9.2.2-92 (a) above.
h. In the event of a DBA with LOOP the operating chiller and pumps will restart automatically after power is restored. In the event the operating train fails, the opposite stand-by train starts. In the case that the cross-tie valves are closed with one pump running in the operating SCWS division, the second standby pump will start within 1 minute in the event of failure of the running pump.

FSAR Impact:

FSAR Tier 2 Section 9.2.8.6 will be revised as indicated in the response

Insert 17.1

> The SCWS expansion tank MIN-1 pressure alarm is below the lowest normal system operating pressure with some margin to avoid a spurious alarm. SCWS expansion tank MIN-2 pressure is below MIN-1 but above the inventory margin required for 7 days of normal operation. SCWS expansion tank MIN-3 pressure is below the 7 day normal makeup margin but high enough to provide sufficient NPSH and prevent pump cavitation and still retain some inventory margin in the expansion tank.

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Insert 17.2

In the event of a DBA with LOOP the operating chiller and pumps will restart automatically after power is restored. In the event the operating train fails, the opposite stand-by train starts within 1 minute. In the case that the cross-tie valves are closed with one pump running in the operating SCWS division, the second standby pump will start within 1 minute in the event of failure of the running pump.

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Question 09.02.02-93:

Follow-up to RAI 174, Question 9.2.2-47:

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. The Final Safety Analysis Report (FSAR) states that each of the four SCWS trains circulates chilled water to the user heat exchangers with one of the two chilled water circulating pumps. The other pump remains in standby and starts automatically upon failure of the running pump. However, FSAR Tier 2 Section 9.2.8 does not explain the operation the automatic start of the standby pump and the protection-off signal based on pump failure are coordinated (note that automatic start of the standby pump is mentioned in FSAR Tier 1 Table 2.7.2-3, Item 4.4 of the inspections, tests, analyses, and acceptance criteria, but this feature is not described in Tier 2 of the system description).. The following information needs to be included in FSAR Tier 2 Section 9.2.8:

a. Explain the operation by which the SCWS system automatically starts a standby pump upon failure of the running pump. Provide schematic diagrams showing all inputs (i.e., PS, logic inputs , sensor inputs, all variables, actuation logic, binary limitation signals), with input types (i.e. PS, hardwired, fiber, type of isolation used), SCWS circuit components, and all SCWS control signal outputs of the SCWS control system. The schematic provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in "Response to Second Request for Additional information", Attachment A, ANP-10284Q2P.

b. Provide a discussion of these pump trips and coordination of signals in FSAR Tier 2 Section 9.2.8. Similarly, a discussion of the heating, ventilation and cooling (HVAC) system backup by the non-safety related 100% capacity maintenance train (cooled by operational chilled water) is discussed in the Technical Specification Bases (B 3.7.9) but is not described in FSAR Tier 2 Section 9.2.8.

Based on the staff's review of the applicant's response to RAI 9.2.2-47 (ID1810/6786) AREVA #174 Supplement 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

With regards to parts (a) and (b), the applicant responded the details of the pump interlocks, protection off trips, and SCWS I&C controls would be identified later in the design process.

The information described above is required by the staff in order to complete their review.

Consequently, these items will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

Response to Question 09.02.02-93:

The SCWS pumps can be started manually with the SCWS filled to the normal operating pressure band in the expansion tank, and if the crosstie valves are open and the pumps in the opposite division of the pair are not running. If the cross-tie valves are shut and the paired divisions are isolated, then a pump in either or both divisions can be started. Running pumps

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will trip on a pump fault, chiller fault, low evaporator flow (MIN-3), or MIN-3 pressure in the expansion tank. In the case of a running pump trip on a pump fault when the cross tie valves are shut and the division train is operating separate from the other division pair, then the second pump is in stand-by and will start.

In the event of a DBA with LOOP, the running pumps will automatically restart under the EDG loading sequence. The pumps in the opposite train will start if the running pumps fail to start.

FSAR Impact:

FSAR Tier 2 Section 9.2.8.6 will be revised as indicated in the response

Insert 18

The SCWS pumps and chiller can be started manually assuming the SCWS is filled and pressurized to the normal operating range in the expansion tank, and if the crosstie valves are open and the pumps in the opposite division of the pair are not running. If the cross-tie valves are shut and the paired divisions are isolated, then a pump in either or both divisions can be started. Running pumps will trip on a pump fault, chiller fault, low evaporator flow (MIN-3), or MIN-3 pressure in the expansion tank. In the case of a running pump trip on a pump fault when the cross tie valves are shut and the division train is operating separate from the other division pair, then the second pump is in stand-by and will start.

In the event of a DBA with LOOP, the running pumps will automatically restart under the EDG loading sequence. The pumps in the opposite train will start if the running pumps fail to start.

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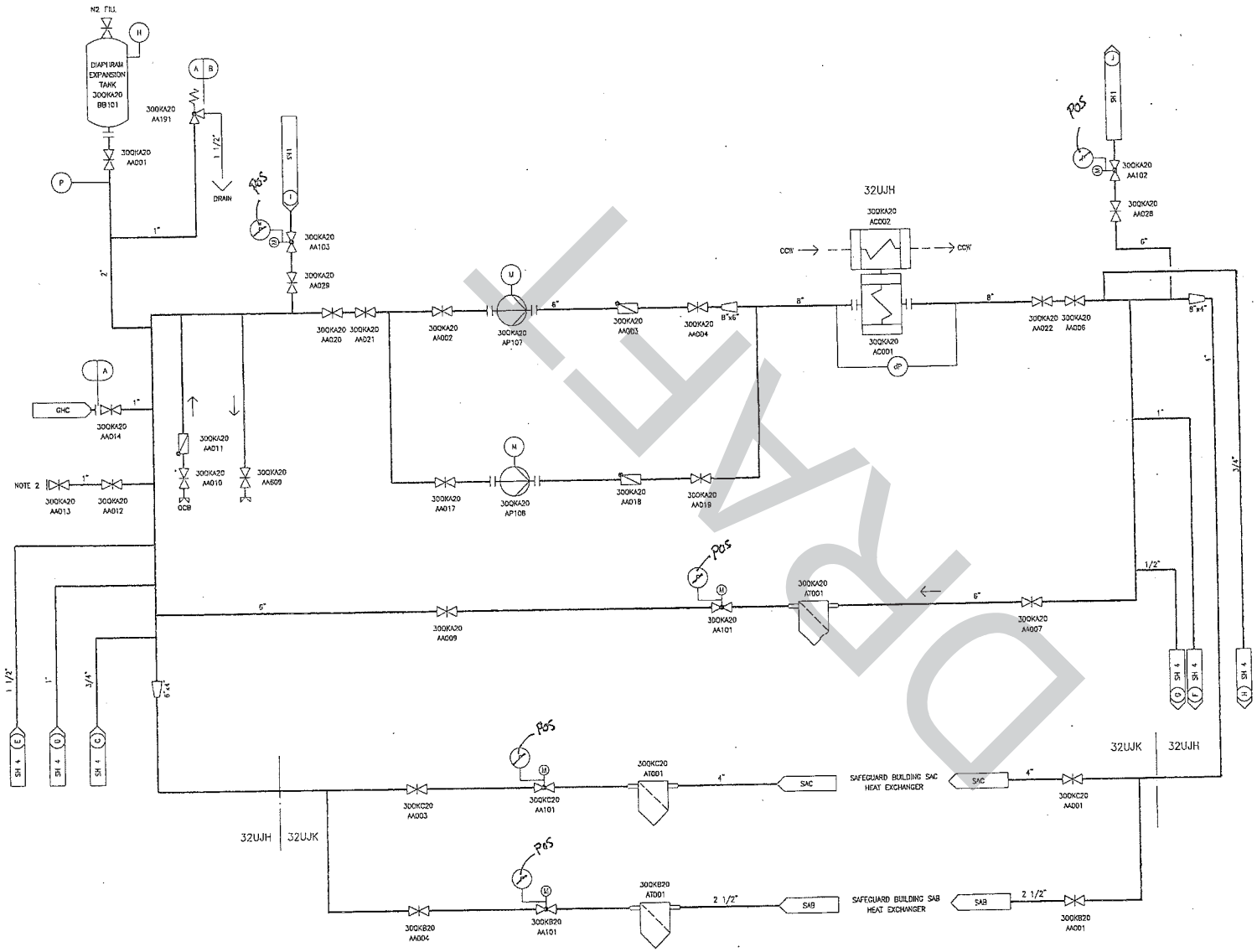
CHC – DEMINERALIZED WATER DISTRIBUTION SYSTEM
QCB – MOBILE HYDRAZINE INJECTION SYSTEM FOR NUCLEAR ISLAND
QKA – SAFETY CHILLED WATER SYSTEM MAIN COMPONENTS
QKB – SAFETY CHILLED WATER DISTRIBUTION LINES TO MAIN CONTROL ROOM AIR CONDITIONING
QKC – SAFETY CHILLED WATER DISTRIBUTION LINES TO SAFEGUARD BUILDINGS
SAB – MAIN CONTROL ROOM AIR CONDITION SYSTEM
SAC – ELECTRICAL DIVISION OF SAFEGUARD BUILDINGS VENTILATION SYSTEM

32UJH – SAFEGUARD BUILDING MECHANICAL DIVISION 2
32UJK – SAFEGUARD BUILDING ELECTRICAL DIVISION 2

NOTES:
1. TRAIN 2 SHOWN IS REPRESENTATIVE OF TRAIN 3.
2. FOR MANUAL CONNECTION TO SEISMIC MAKEUP WATER SOURCE.

RAI 356
9.2.2-86



B	C	1
A	C	1
DESIGN AREA	SSC QUALITY GROUP	SSC SEISMIC CLASS

REV 002
QKA02T2

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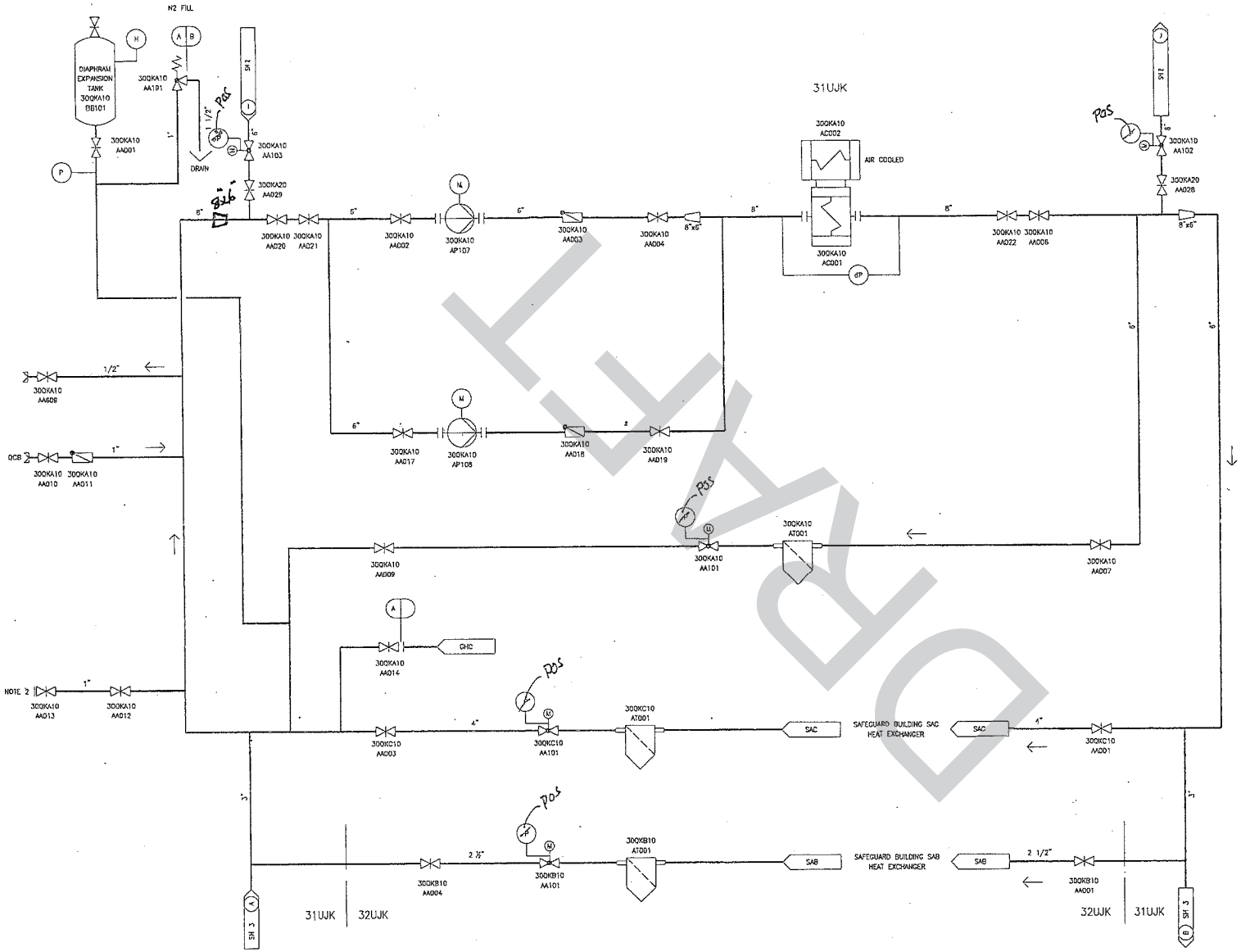
GHC – DEMINERALIZED WATER DISTRIBUTION SYSTEM
QCB – MOBILE HYDRAZINE INJECTION SYSTEM FOR NUCLEAR ISLAND
QKA – SAFETY CHILLED WATER SYSTEM MAIN COMPONENTS
QKB – SAFETY CHILLED WATER DISTRIBUTION LINES TO MAIN CONTROL ROOM AIR CONDITIONING
QKC – SAFETY CHILLED WATER DISTRIBUTION LINES TO SAFEGUARD BUILDINGS
SAB – MAIN CONTROL ROOM AIR CONDITION SYSTEM
SAC – ELECTRICAL DIVISION OF SAFEGUARD BUILDING VENTILATION SYSTEM

31UJK – SAFEGUARD BUILDING ELECTRICAL DIVISION 1
32UJK – SAFEGUARD BUILDING ELECTRICAL DIVISION 2



NOTES:

1. TRAIN 1 SHOWN IS REPRESENTATIVE OF TRAIN 4 WITH EXCEPTIONS AS NOTED.
2. FOR MANUAL CONNECTION TO SEISMIC MAKEUP WATER SOURCE.

RAI 356
9.2.2-86

B	C	I
A	C	I
DESIGN AREA	SSC QUALITY GROUP	SSC SEISMIC CLASS

REV 002
QKA01T2

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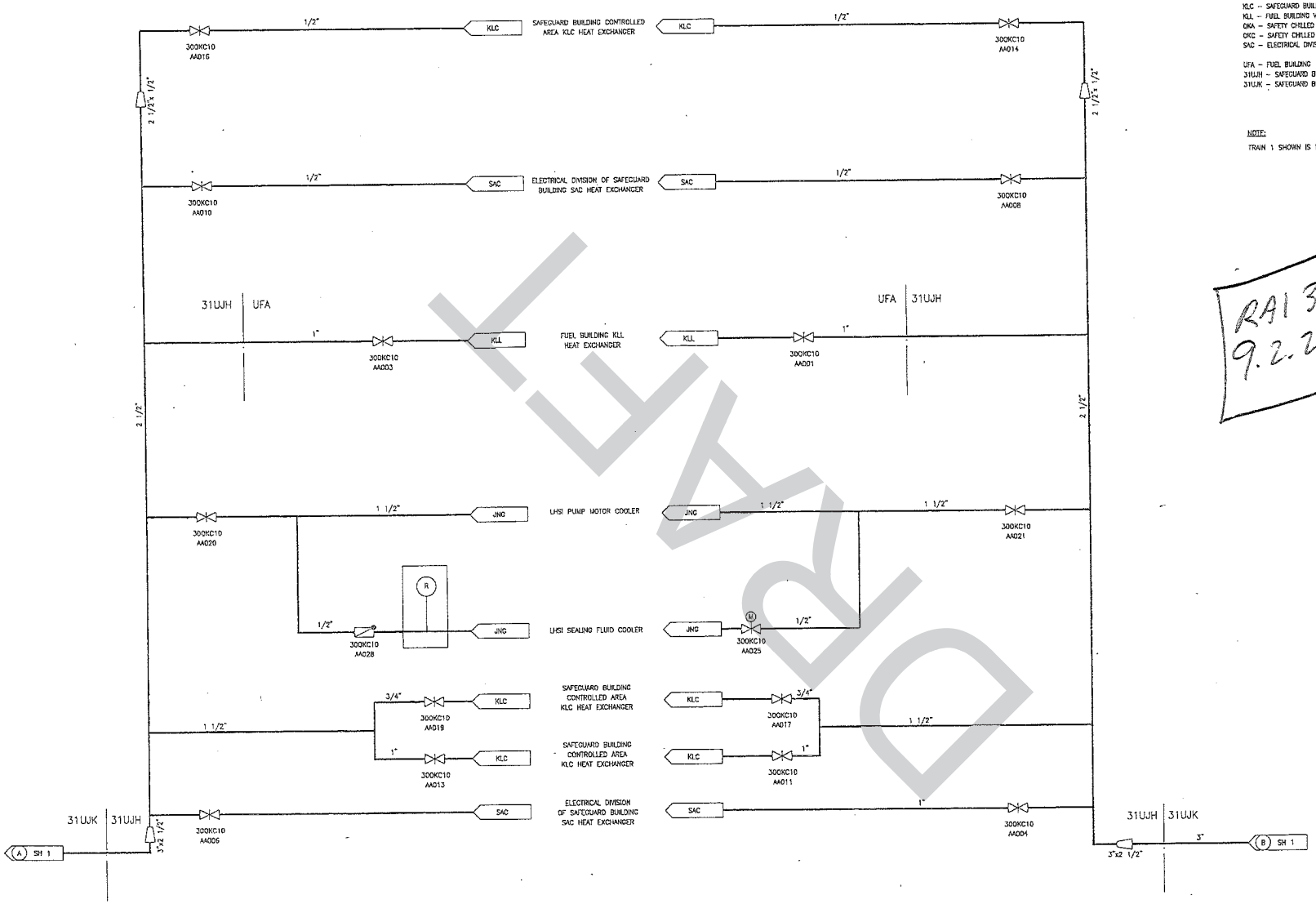
JNG – LOW HEAD SAFETY INJECTION SYSTEM
KLC – SAFEGUARD BUILDING CONTROLLED AREA VENTILATION SYSTEM
KLL – FUEL BUILDING VENTILATION SYSTEM
QKA – SAFETY CHILLED WATER SYSTEM MAIN COMPONENTS
QKC – SAFETY CHILLED WATER DISTRIBUTION LINES TO SAFEGUARD BUILDINGS
SAC – ELECTRICAL DIVISION OF SAFEGUARD BUILDING VENTILATION SYSTEM

UFA – FUEL BUILDING
31UJH – SAFEGUARD BUILDING MECHANICAL DIVISION 1
31UJK – SAFEGUARD BUILDING ELECTRICAL DIVISION 1

NOTE:

TRAIN 1 SHOWN IS REPRESENTATIVE OF REDUNDANT TRAIN 4.

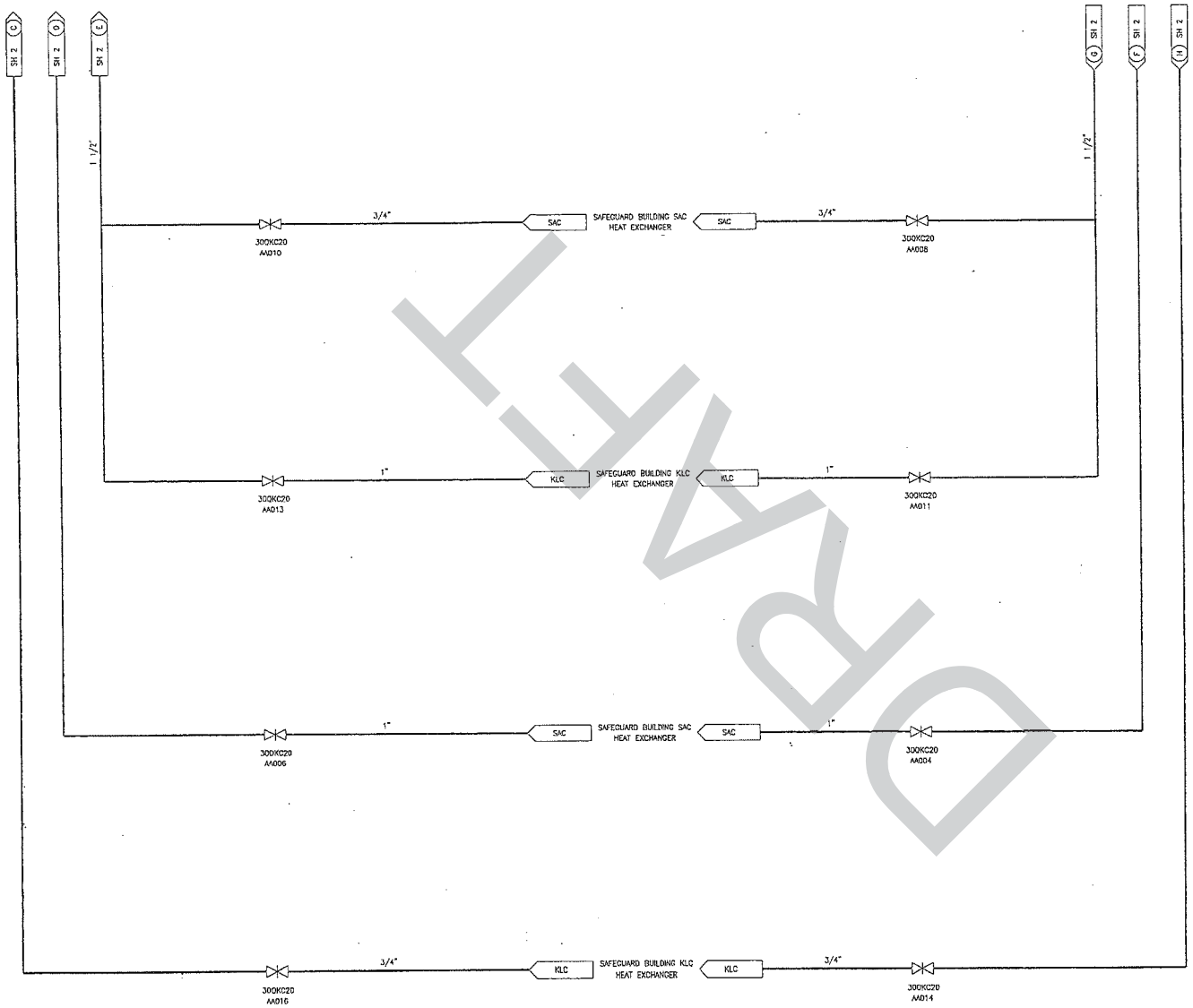
RAI 356
9.2.2-86



A	C	I
DESIGN AREA	SSC QUALITY GROUP	SSC SEISMIC CLASS

REV 002
QKA03T2

DRAFT



KLC – SAFEGUARD BUILDING CONTROLLED AREA VENTILATION SYSTEM
QKA – SAFETY CHILLED WATER SYSTEM MAIN COMPONENTS
DXC – SAFETY CHILLED WATER DISTRIBUTION LINES TO SAFEGUARD BUILDINGS
SAC – ELECTRICAL DIVISION OF SAFEGUARD BUILDING VENTILATION SYSTEM

32UJH – SAFEGUARD BUILDING MECHANICAL DIVISION 2

NOTE:

TRAIN 2 SHOWN IS REPRESENTATIVE OF REDUNDANT TRAIN 3.

RAI 356
9.2.2-86

A	C	I
DESIGN AREA	SSC QUALITY GROUP	SSC SEISMIC CLASS

REV 002
QKA04T2

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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. ~~The SCWS consists of four separate and independent divisions, numbered 1 to 4.~~

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 ~~division~~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.
- Each ~~division~~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 ~~divisions~~trains are capable of being periodically tested and required inspections can be performed during plant operation (GDC 45 and GDC 46).

The SCWS ~~divisions~~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.

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9.2.8.2 System Description

9.2.8.2.1 General Description

The SCWS consists of four ~~separate, physically separated independent divisions,~~trains numbered 1 to 4. Each is located in one of the four SBs. Each SCWS ~~division~~train is a closed loop system that supplies chilled cooling water for specified area HVAC air handling units (AHU) and, where required, process systems cooling. Each ~~division~~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 chiller is sized to meet the system load requirements of two divisional trains.

Bounding

RAI 356 9.2.2-86

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), ~~Fuel Building (FB) ventilation system (~~FBVS~~)~~, and the low head safety injection system (LHSI) pump motors in SB ~~Divisions 1 and 4~~.

and 9.2.8-2

System design parameters are listed on Table 9.2.8-1—Safety Chill Water Design Parameters. The SCWS flow diagram is shown in Figure 9.2.8-1—Safety Chilled Water System Diagram.

INSERT 1

for all operating conditions

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 100 percent SCWS pumps, with one in standby, in each of the four divisions circulates chilled water between the HVAC users and the evaporator of the chiller refrigeration unit in each division.~~Two SCWS pumps in each of the four trains circulate chilled water between the SCWS users and the evaporator of the chiller refrigeration unit in each division.

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:

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- 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, Divisions 1 and 4, each contain one ~~100 percent~~ air-cooled chiller refrigeration unit that functions to refrigerate chilled water to its design basis temperature of 41°F for supply to the ~~HVAC users~~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, Divisions 2 and 3, each contain one ~~100 percent~~ 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 division contains a diaphragm expansion tank with a nitrogen fill connection in each of the SBs. The expansion tank provides for changes in volume and establishes a point of reference pressure for the closed-loop system. These tanks are provided with overpressure protection.

Pump NPSH

relief valve

INSERT 7

RAI 356
9.2.2-86

Cooling Coils

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

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~~Safety~~Relief Valves

INSERT 13.2

RAI 356 9.2.2-90

A ~~safety~~relief valve located in each SCWS division protects the chilled water closed loop against high pressure.

INSERT 5

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Chiller Bypass Valve

The chiller bypass valve installed in the ~~closed loop of each~~ operating SWCS ~~division~~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.

RAI 356 9.2.2-86

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 division (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.

INSERT 8

INSERT 9

9.2.8.3 System Operation

9.2.8.3.1 Normal Operation

~~All four SCWS divisions supply chilled water to plant components when the plant is in power operation under normal conditions. Each of the four SBs is supplied by one of four divisions of the SCWS. Each SCWS division is designed with a closed single pumping loop and one refrigeration unit for chilled water production. Chilled water production and chilled water distribution are grouped together to form a single closed system.~~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 FBVS. 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.

~~Each of the four divisions has one SCWS pump in service and one in standby, to circulate the chilled water in a closed loop between the HVAC users and the evaporator of the refrigeration unit.~~ The chilled water distribution circuit operates

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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 ~~safety~~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.

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RAI 356 9.2.2-90

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 ~~at the central chilled water station~~.

9.2.8.3.2 Abnormal Operation

~~In the event of a DBA, with one SCWS safety-related train down for maintenance, and in case of failure of a second SCWS safety-related train (e.g., refrigeration units or pumps), the back up is provided by the two remaining SCWS 100 percent trains of the corresponding divisions.~~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.

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

RAI 356 9.2.2-91

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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~~ WILL accommodate expected out-leakage from the system for seven days.

REVISE

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

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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.

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~~(B)~~, 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~~(B).2 and Section 3.9(B)~~ provide 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 or interconnection of Train 3 and Train 4 of the SCWS fulfills the single failure criteria. ~~Redundant safety systems (one per SB) are strictly separated within the SBs into four divisions. This divisional separation is provided for electrical and mechanical safety systems.~~ The four ~~divisions~~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.

- 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 (BPV) 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.

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- Cooling diversity is created between the load heat sinks of Divisions 1 and 4, and Divisions 2 and 3. Division 1 and 4 chillers are air cooled, and Division 2 and 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 exchanger 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.

After the plant is brought into operation, periodic tests and inspections of the SCWS components and subsystems are performed to verify proper operation. Scheduled tests and inspections are necessary to verify system operability.

The installation and design of the SCWS provides accessibility for the performance of periodic inservice inspection and testing. Periodic inspection and testing of safety-related equipment verifies its structural and leak tight integrity and its availability and ability to fulfill its functions.

Inservice inspection and testing requirements are in accordance with Section XI of the ASME BPV Code and the ASME OM Code.

Section 3.9.6 and Section 6.6 describe the inservice testing and inspection requirements, respectively. Refer to Section 16.0, Surveillance Requirement (SR) 3.7.9 for surveillance requirements that verify continued operability of the SCWS.

RAI 356 9.2.2-86

9.2.8.6 Instrumentation Requirements

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The SCWS system is controlled by the safety automation system (SAS). The normal indication, manual control, and alarm functions are provided by the process information and control system (PICS).

TO MIN-1

System pressure is monitored with the aid of two pressure measurements for each train. The two measurements are combined in one measuring point. If the pressure falls ~~below a set limit~~, an alarm is issued for operators to check nitrogen charge or provide makeup with demineralized water.

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RAI 356 9.2.2-92

If the system experiences excessive leakage in excess of system makeup capability, the cross-tie isolation MOVs close on Low-2 system pressure. The non-operating standby train automatically starts on Low-2 pressure. The train without excessive leakage

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returns to pressure and the train with excessive leakage is manually stopped from the DCS.

If the pressure falls ~~below a second~~ ~~third set limit, one~~ To MIN-3 of the following measures ~~is~~ are initiated automatically for the affected train:

- Chilled water system "Protection OFF" alarms. INSERT 10
- Refrigeration unit shuts down.
- Chilled water circulating pump shuts down.

RAI 356 9.2.2-89

A humidity sensor is installed in the nitrogen region of the diaphragm expansion tank. This sensor issues ~~an~~ a MAX 1 alarm indicating a leaky diaphragm if humidity exceeds a set limit.

To provide a constant water flow through the evaporator for the refrigeration unit, a controlled bypass is implemented between chilled water feed and chilled water return by means of a control valve. The controlled variable is differential pressure across the chiller evaporator.

The affected chilled water system ~~train~~ Pump and Chiller is deactivated by a "Protection OFF" command in the case of the following faults:

- Pump failure.
- ~~High differential pressure.~~
- ~~Minimum~~ MIN-3 pressure limit for the system.
- Emergency power condition–under-voltage shutdown.

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RAI 356 9.2.2-92

9.2.8.7 References

1. ASME Boiler and Pressure Vessel Code, Section XI: "Rules for Inservice Inspection of Nuclear Power Plant Components," The American Society of Mechanical Engineers, 2004.

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RAI 356 9.2.2-93

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Table 9.2.8-1—Safety Chill Water Design Parameters

Description	Technical Data
QKA 10/40 Evaporator Refrigeration capacity	3.3034 E+06 Btu/hr (275 Tons)
QTA 10/40 Condensing capacity	4.4046 E+06 Btu/hr
QKA 10/40 Condenser Air Flow	167,047 ft^3/min
QKA 10/40 Required Evaporator Chilled Water Flow	736 gpm
QKA 10/40 Required Evaporator Chilled Water Outlet Temperature	41°F
QKA 10/40 Chilled Water Pump AP-107 Required Operating Flow	825 gpm
QKA 10/40 Chilled Water Pump AP-107 Required Operating Head	269 ft
QKA 10/40 Chilled Water Pump AP-107 Shutoff Head	338 ft
QKA 20/30 Evaporator Refrigeration capacity	2.9951 E+06 Btu/hr (250 Tons)
QKA 20/30 Condensing capacity	4.1227 E+06 Btu/hr (344 Tons)
QKA 20/30 Required Evaporator Chilled Water Flow	665 gpm
QKA 20/30 Required Evaporator Chilled Water Outlet Temperature	41°F
QKA 20/30 Chilled Water Pump AP-107 Required Operating Flow	745 gpm
QKA 20/30 Chilled Water Pump AP-107 Required Operating Head	270 ft
QKA 20/30 Chilled Water Pump AP-107 Shutoff Head	309 ft

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RAI 356
9.2.2-86

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 CCWS is available for chiller operation, where necessary.

2.5 Appropriate AC and DC power sources are available.

2.6 Interfacing system loads are connected and available.

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

2.8 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.

RAI 356 9.2.2-90

RAI 356 9.2.2-91

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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.

4.5 System operating parameters during HFT.

RAI 356 9.2.2-91

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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.

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.

RAI 356 9.2.2-90

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14.2.12.6.3 Reserved (Test #053)

14.2.12.6.4 Fire Water Distribution System (Test #054)

RAI 356 9.2.2-91

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.

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Table 3.9.6-2—Inservice Valve Testing Program Requirements
Sheet 91 of 100

Valve Identification Number[1]	Description/ Valve Function	Valve Type[2]	Valve Actuator[3]	ASME Code Class[4]	ASME OM Code Category[5]	Active / Passive[6]	Safety Position[7]	Test Required[8,10]	Test Frequency[9]	Comments
30QKA10AA017	Pump Isolation Valve, Div 1	PL	MA	3	B	P	O/C	ET	5Y	
30QKA10AA019	Pump Isolation Valve, Div 1	PL	MA	3	B	P	O/C	ET	5Y	
30QKA20AA002	Pump Isolation Valve, Div 2	PL	MA	3	B	P	O/C	ET	5Y	
30QKA20AA004	Pump Isolation Valve, Div 2	PL	MA	3	B	P	O/C	ET	5Y	
30QKA20AA006	Pump Isolation Valve, Div 2	PL	MA	3	B	P	O/C	ET	5Y	
30QKA20AA017	Pump Isolation Valve, Div 2	PL	MA	3	B	P	O/C	ET	5Y	
30QKA20AA019	Pump Isolation Valve, Div 2	PL	MA	3	B	P	O/C	ET	5Y	
30QKA30AA002	Pump Isolation Valve, Div 3	PL	MA	3	B	P	O/C	ET	5Y	
30QKA30AA004	Pump Isolation Valve, Div 3	PL	MA	3	B	P	O/C	ET	5Y	
30QKA30AA017	Pump Isolation Valve, Div 3	PL	MA	3	B	P	O/C	ET	5Y	
30QKA30AA019	Pump Isolation Valve, Div 3	PL	MA	3	B	P	O/C	ET	5Y	

RAI 356 9.2.2-91

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Question 09.02.01-31:

Follow-up to RAI 119, Question 9.2.1-04(j)

The ESWS 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 GDC 44 requirements. The ESWS description and P&ID were reviewed to assess the design adequacy of the ESWS for performing its heat removal functions. While the P&ID shows the ESWS components and identifies the boundaries between safety-related and non-safety-related parts of the system, some of the information is incomplete, inaccurate, or inconsistent. Consequently, the applicant needs to revise the FSAR to address the following considerations in this regard:

> Part (j)- Confirm that the ESWS backwash filter motor and power supply are classified as safety-related, Class1E.

Based on the staff's review of response Response to RAI 119, Question 9.2.1-04 and an audit by the staff conducted on October 27, 2009, Part (j) remains open and requires further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

> In part (j) of RAI 9.2.1-04, the staff requested that the applicant confirm that the ESWS filter motor and its power source are classified as safety-related, class 1E. The applicant's response confirmed this information, however Tier 1 Table 2.7.11-2 was not updated to reflect this information, as the filter motor should be listed as an IEEE Class 1E component for the four divisions.

Response to Question 09.02.01-31:

U.S. EPR FSAR Tier 1, Table 2.7.11-2, has been updated to reflect the filter motor associated with the ESW Debris Filter is listed as an IEEE Class 1E component for the four divisions. U.S EPR FSAR Tier 1 Table 2.7.11-1 and Tier 2 Table 3.10-1 have correspondingly been updated to add the ESW Debris Filters 30PEB10/20/30/40 AT002.

FSAR Impact:

U.S. EPR FSAR Tier 1 Tables 2.7.11-2 and 2.7.11-1, and Tier 2 Table 3.10-1, will be revised as described in the response and indicated on the enclosed markup.

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Table 2.7.11-1—Essential Service Water System Equipment Mechanical Design (8 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	ASME Code Section III	Function	Seismic Category
ESWS Pump Division 1	30PEB10AP001	ESW Pump Structure Division 1	Yes	Run	I
Recirc Isolation Valve Division 1	30PEB10AA002	ESW Pump Structure Division 1	Yes	Close	I
Emer. Blowdown Isolation Valve Division 1	30PEB10AA003	ESW Pump Structure Division 1	Yes	Close	I
Pump Discharge Isolation Valve Division 1	30PEB10AA005	ESW Pump Structure Division 1	Yes	Open	I
Filter Blowdown Isolation Valve Division 1	30PEB10AA015	ESW Pump Structure Division 1	Yes	Close	I
Blowdown Isolation Valve Division 1	30PEB10AA016	ESW Pump Structure Division 1	Yes	Close	I
Pump Discharge Check Valve Division 1	30PEB10AA204	ESW Pump Structure Division 1	Yes	Open	I
Tower Isolation Valve Division 1	30PED10AA010	ESW Pump Structure Division 1	Yes	Open	I
Tower Bypass Isolation Valve Division 1	30PED10AA011	ESW Pump Structure Division 1	Yes	Close	I
Makeup Water Isolation Valve Division 1	30PED10AA019	ESW Pump Structure Division 1	Yes	Close	I
ESW Debris Filter Division 1	30PEB10AT002	ESW Pump Structure Division 1	Yes	Backwash	I

RAI 345
09.02.01-31

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Table 2.7.11-1—Essential Service Water System Equipment Mechanical Design (8 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	ASME Code Section III	Function	Seismic Category
Emer. Makeup Water Isolation Valve Division 1	30PED10AA021	ESW Pump Structure Division 1	Yes	Open	I
Makeup Water Check Valve Division 1	30PED10AA220	ESW Pump Structure Division 1	Yes	Close	I
ESWS Pump Division 2	30PEB20AP001	ESW Pump Structure Division 2	Yes	Run	I
Recirc Isolation Valve Division 2	30PEB20AA002	ESW Pump Structure Division 2	Yes	Close	I
Emer. Blowdown Isolation Valve Division 2	30PEB20AA003	ESW Pump Structure Division 2	Yes	Close	I
Pump Discharge Isolation Valve Division 2	30PEB20AA005	ESW Pump Structure Division 2	Yes	Open	I
Filter Blowdown Isolation Valve Division 2	30PEB20AA015	ESW Pump Structure Division 2	Yes	Close	I
Blowdown Isolation Valve Division 2	30PEB20AA016	ESW Pump Structure Division 2	Yes	Close	I
Pump Discharge Check Valve Division 2	30PEB20AA204	ESW Pump Structure Division 2	Yes	Open	I
Tower Isolation Valve Division 2	30PED20AA010	ESW Pump Structure Division 2	Yes	Open	I
ESW Debris Filter Division 2	30PEB20AT002	ESW Pump Structure Division 2	Yes	Backwash	I

RAI 345
09.02.01-31

DRAFT

Table 2.7.11-1—Essential Service Water System Equipment Mechanical Design (8 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	ASME Code Section III	Function	Seismic Category
Blowdown Isolation Valve Division 3	30PEB30AA016	ESW Pump Structure Division 3	Yes	Close	I
Pump Discharge Check Valve Division 3	30PEB30AA204	ESW Pump Structure Division 3	Yes	Open	I
Tower Isolation Valve Division 3	30PED30AA010	ESW Pump Structure Division 3	Yes	Open	I
Tower Bypass Isolation Valve Division 3	30PED30AA011	ESW Pump Structure Division 3	Yes	Close	I
Makeup Water Isolation Valve Division 3	30PED30AA019	ESW Pump Structure Division 3	Yes	Close	I
Emer. Makeup Water Isolation Valve Division 3	30PED30AA021	ESW Pump Structure Division 3	Yes	Open	I
Makeup Water Check Valve Division 3	30PED30AA220	ESW Pump Structure Division 3	Yes	Close	I
ESWS Pump Division 4	30PEB40AP001	ESW Pump Structure Division 4	Yes	Run	I
Recirc Isolation Valve Division 4	30PEB40AA002	ESW Pump Structure Division 4	Yes	Close	I
Emer. Blowdown Isolation Valve Division 4	30PEB40AA003	ESW Pump Structure Division 4	Yes	Close	I
ESW Debris Filter Division 3	30PEB30AT002	ESW Pump Structure Division 3	Yes	Backwash	I

RAI 345
09.02.01-31

DRAFT

Table 2.7.11-1—Essential Service Water System Equipment Mechanical Design (8 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	ASME Code Section III	Function	Seismic Category
Pump Discharge Isolation Valve Division 4	30PEB40AA005	ESW Pump Structure Division 4	Yes	Open	I
Filter Blowdown Isolation Valve Division 4	30PEB40AA015	ESW Pump Structure Division 4	Yes	Close	I
Blowdown Isolation Valve Division 4	30PEB40AA016	ESW Pump Structure Division 4	Yes	Close	I
Pump Discharge Check Valve Division 4	30PEB40AA204	ESW Pump Structure Division 4	Yes	Open	I
Dedicated System Check Valve Upstr 30saq40 Ac001 Division 4	30PEB41AA011	ESW Pump Structure Division 4	Yes	Open	I
Tower Isolation Valve Division 4	30PED40AA010	ESW Pump Structure Division 4	Yes	Open	I
Tower Bypass Isolation Valve Division 4	30PED40AA011	ESW Pump Structure Division 4	Yes	Close	I
Makeup Water Isolation Valve Division 4	30PED40AA019	ESW Pump Structure Division 4	Yes	Close	I
Emer. Makeup Water Isolation Valve Division 4	30PED40AA021	ESW Pump Structure Division 4	Yes	Open	I
ESW Debris Filter Division 4	30PEB40 AT002	ESW Pump Structure Division 4	Yes	Backwash	I

RAI 345
09.02.01-31

DRAFT

Table 2.7.11-2—Essential Service Water System Equipment I&C and Electrical Design (6 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	IEEE Class 1E (2)	PACS	MCR/RSS Displays	MCR/RSS Controls
ESWS Pump Division 1	30PEB10AP001	ESW Pump Structure Division 1	Division 1	Yes	On-Off/ On-Off	Start-Stop/ Start-Stop
Recirc Isolation Valve Division 1	30PEB10AA002	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
Emer. Blowdown Isolation Valve Division 1	30PEB10AA003	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
Pump Discharge Isolation Valve Division 1	30PEB10AA005	ESW Pump Structure Division 1	Division 1	Yes	Pos/Pos	Open-Close/Open-Close
Filter Blowdown Isolation Valve Division 1	30PEB10AA015	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
Blowdown Isolation Valve Division 1	30PEB10AA016	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
Tower Isolation Valve Division 1	30PED10AA010	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
Tower Bypass Isolation Valve Division 1	30PED10AA011	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
Makeup Water Isolation Valve Division 1	30PED10AA019	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
ESW Debris Filter Division 1	30PEB10 AT002	ESW Pump Structure Division 1	Division 1	Yes	On-Off/On-Off	Start-Stop / Start-Stop

RAI 345
09.02.01-31

DRAFT

Table 2.7.11-2—Essential Service Water System Equipment I&C and Electrical Design (6 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	IEEE Class 1E (2)	PACS	MCR/RSS Displays	MCR/RSS Controls
Emer. Makeup Water Isolation Valve Division 1	30PED10AA021	ESW Pump Structure Division 1	Division 1	Yes~~No~~	Pos/N/A	Open-Close/N/A
ESWS Pump Division 2	30PEB20AP001	ESW Pump Structure Division 2	Division 2	Yes~~Yes~~	On-Off/ On-Off	Start-Stop/ Start-Stop
Recirc Isolation Valve Division 2	30PEB20AA002	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
Emer. Blowdown Isolation Valve Division 2	30PEB20AA003	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
Pump Discharge Isolation Valve Division 2	30PEB20AA005	ESW Pump Structure Division 2	Division 2	Yes	Pos/Pos	Open-Close/Open-Close
Filter Blowdown Isolation Valve Division 2	30PEB20AA015	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
Blowdown Isolation Valve Division 2	30PEB20AA016	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
Tower Isolation Valve Division 2	30PED20AA010	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
Tower Bypass Isolation Valve Division 2	30PED20AA011	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
ESW Debris Filter Division 2	30PEB20AT002	ESW Pump Structure Division 2	Division 2	Yes	On-Off/ On-Off	Start-Stop/ Start-Stop

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Table 2.7.11-2—Essential Service Water System Equipment I&C and Electrical Design (6 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	IEEE Class 1E (2)	PACS	MCR/RSS Displays	MCR/RSS Controls
Makeup Water Isolation Valve Division 2	30PED20AA019	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
Emer. Makeup Water Isolation Valve Division 2	30PED20AA021	ESW Pump Structure Division 2	Division 2	Yes~~No~~	Pos/N/A	Open-Close/N/A
ESWS Pump Division 3	30PEB30AP001	ESW Pump Structure Division 3	Division 3	Yes	On-Off/ On-Off	Start-Stop/ Start-Stop
Recirc Isolation Valve Division 3	30PEB30AA002	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
Emer. Blowdown Isolation Valve Division 3	30PEB30AA003	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
Pump Discharge Isolation Valve Division 3	30PEB30AA005	ESW Pump Structure Division 3	Division 3	Yes~~Yes~~	Pos/Pos	Open-Close/Open-Close
Filter Blowdown Isolation Valve Division 3	30PEB30AA015	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
Blowdown Isolation Valve Division 3	30PEB30AA016	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
Tower Isolation Valve Division 3	30PED30AA010	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
ESW Debris Filter Division 3	30PEB30AT002	ESW Pump Structure Division 3	Division 3	Yes	On-Off/ On-Off	Start-Stop / Start-Stop

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Table 2.7.11-2—Essential Service Water System Equipment I&C and Electrical Design (6 Sheets)

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	IEEE Class 1E (2)	PACS	MCR/RSS Displays	MCR/RSS Controls
Tower Bypass Isolation Valve Division 3	30PED30AA011	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
Makeup Water Isolation Valve Division 3	30PED30AA019	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
Emer. Makeup Water Isolation Valve Division 3	30PED30AA021	ESW Pump Structure Division 3	Division 3	Yes~~No~~	Pos/N/A	Open-Close/N/A
ESWS Pump Division 4	30PEB40AP001	ESW Pump Structure Division 4	Division 4	Yes~~Yes~~	On-Off/ On-Off	Start-Stop/ Start-Stop
Recirc Isolation Valve Division 4	30PEB40AA002	ESW Pump Structure Division 4	Division 4	Yes~~No~~	Pos/N/A	Open-Close/N/A
Emer. Blowdown Isolation Valve Division 4	30PEB40AA003	ESW Pump Structure Division 4	Division 4	Yes~~No~~	Pos/N/A	Open-Close/N/A
Pump Discharge Isolation Valve Division 4	30PEB40AA005	ESW Pump Structure Division 4	Division 4	Yes	Pos/Pos	Open-Close/Open-Close
Filter Blowdown Isolation Valve Division 4	30PEB40AA015	ESW Pump Structure Division 4	Division 4	Yes~~No~~	Pos/N/A	Open-Close/N/A
Blowdown Isolation Valve Division 4	30PEB40AA016	ESW Pump Structure Division 4	Division 4	Yes~~No~~	Pos/N/A	Open-Close/N/A
ESW Debris Filter Division 4	30PEB40AT002	ESW Pump Structure Division 4	Division 4	Yes	On-Off/ On-Off	Start-Stop/ Start-Stop

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Table 3.10-1 List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment

cription)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)		EQ Program Designation (Note 5)	
	30KAB80AA016	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA019	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA020	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA314	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA315	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA316	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA317	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA403	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA406	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA407	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA501	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80AA504	31UJH10004	M	H	ES	SI	S	C/NM	Y (3)	Y (5)
	30KAB80CF060	31UJH10004	M	H		SI	S	C/NM	Y (3)	Y (5)
	30KAB80CF061	31UJH10004	M	H		SI	S	C/NM	Y (3)	Y (5)
Essential Service Water System (ESWS)										
	30PEB10AA007	31UJH05026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA009	31UJH05026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA192	31UJH05026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA306	31UJH10026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA307	31UJH10026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA401	31UJH01026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA402	31UJH10026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA403	31UJH01026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA405	31UJH01026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA407	31UJH01026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA408	31UJH01026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA508	31UJH10026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10AA509	31UJH10026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10BP002	31UJH05026	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB10CP004	31UJH05026	M	H		SI	S			Y (5)
	30PEB10CT002	31UJH05026	M	H		SI	S			Y (5)
	30PEB20AA007	32UJH05020	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB20AA009	32UJH05020	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB20AA192	32UJH05020	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB20AA306	32UJH10020	M	H		SI	S	C/NM	Y (3)	Y (5)
	30PEB20AA307	32UJH10020	M	H		SI	S	C/NM	Y (3)	Y (5)

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INSERT

RAI 345
09.02.01-31

INSERT FOR RAI 345, QUESTION 09.02.01-31 RESPONSE

Name Tag (Equipment Description)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment	Radiation Environment (Zone)	EQ Designated Function	EQ Post-Accident Period of Operability	Safety Class	EQ Program Designation
ESW Debris Filter	30PEB10AT002	31UQB02001	M	M	ES SI	MEDIUM TERM	S SI C/NM	Y (5)
ESW Debris Filter	30PEB20AT002	32UQB02001	M	M	ES SI	MEDIUM TERM	S SI C/NM	Y (5)
ESW Debris Filter	30PEB30AT002	33UQB02001	M	M	ES SI	MEDIUM TERM	S SI C/NM	Y (5)
ESW Debris Filter	30PEB40AT002	34UQB02001	M	M	ES SI	MEDIUM TERM	S SI C/NM	Y (5)

RAI 345
09.02.01-31

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