ArevaEPRDCPEm Resource

From: Tesfaye, Getachew
Sent: Tuesday, May 04, 2010 7:49 AM
To: Wheeler, Larry; Eul, Ryan; Lee, Samuel; Segala, John; Hearn, Peter; ArevaEPRDCPEm Resource
Subject: FW: DRAFT Responses for FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFTRESPONSE RAI 356 Supp 1 Q.09.02.02-86(a-c).pdf; DRAFTRESPONSE RAI 345 Supp 1 Q.09.02.01-34.pdf; DRAFTRESPONSE RAI 345 Supp 1 Q.09.02.01-41 (b-d).pdf; DRAFTRESPONSE RAI 345 Supp 1 Q.09.02.01-44.pdf

Importance: High

All,

Attached are draft responses for the call this afternoon.

From: BRYAN Martin (EXT) [mailto:Martin.Bryan.ext@areva.com]
Sent: Tuesday, May 04, 2010 6:31 AM
To: Tesfaye, Getachew
Cc: KOWALSKI David J (AREVA NP INC)
Subject: FW: DRAFT Responses for FSAR Chapter 9 Weekly NRC Telecon
Importance: High

Getachew,

See David's note below regarding the attached DRAFT responses to be discussed in today's Ch9 weekly telecon. These responses have not been through final review and processing but are being provided to facilitate a common understanding prior to final submittal submittal.

Thanks,

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

From: KOWALSKI David J (AREVA NP INC)
Sent: Tuesday, May 04, 2010 5:58 AM
To: BRYAN Martin (EXT)
Cc: BALLARD Robert W (AREVA NP INC); CONNELL Kevin J (AREVA NP INC); HUDDLESTON Stephen C (AREVA NP INC); GARDNER George Darrell (AREVA NP INC)
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 RAI 356 questions. These responses will be discussed at today's (5/4/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC.

These responses represent the following:

- Responses to RAI 345 Supp 1 Questions 09.02.01-34, -41 (b thru d) and -44.
- Response to RAI 356 Supp 1 Question 09.02.02-86 (a thru c).

Note that none of these DRAFT responses have 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.
Principal Engineer
New Plants Regulatory Affairs

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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 1375

Mail Envelope Properties (0A64B42AAA8FD4418CE1EB5240A6FED11293D2B5DB)

Subject: FW: DRAFT Responses for FSAR Chapter 9 Weekly NRC Telecon
Sent Date: 5/4/2010 7:49:26 AM
Received Date: 5/4/2010 7:49:30 AM
From: Tesfaye, Getachew

Created By: Getachew.Tesfaye@nrc.gov

Recipients:
"Wheeler, Larry" <Larry.Wheeler@nrc.gov>
Tracking Status: None
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DRAFTRESPONSE RAI 345 Supp 1 Q.09.02.01-41 (b-d).pdf	467848	
DRAFTRESPONSE RAI 345 Supp 1 Q.09.02.01-44.pdf	585797	

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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)

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.

DRAFT

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.
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

FSAR Impact:

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

DRAFT

Inserts for 09.02.02-86:

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.

DRAFT

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	4388182 Btu/h
QKA 10/40 Condensing capacity	5704637 Btu/h
QKA 20/30 Condensing capacity	5704637 Btu/h
QKA 10/40 Condenser Air Flow	585163 ft^3/min
QKA 10/40 Condenser Fan Power (3-50% capacity fans per condenser)	95 hp
QKA 20/30 Condenser KAA cooling flow	513931.2 Lb/hr
QKA 10/20/30/40 Required Evaporator Chilled Water Flow	975 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)	564.7 gpm
QKA 10/20/30/40 Chilled Water Pump AP-107 Required Operating Head	100.5 ft
QKA 10/20/30/40 Chilled Water Pump AP-107 Shutoff Head	130.6 ft
QKA 10/20/30/40 Required Chilled Water Pump AP-107 Hydraulic Horsepower	14.33 hp

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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	2394195 Btu/h
QKA 20/30 Evaporator refrigeration capacity	1993987 Btu/h
QKA 10/40 Condensing capacity	3112454 Btu/h
QKA 20/30 Condensing capacity	1993987 Btu/h
QKA 10/40 Condenser Air Flow	319265.3 ft^3/min
QKA 10/40 Condenser Fan Power (3-50% capacity fans per condenser)	51.87 hp
QKA 20/30 Condenser KAA cooling flow	233530 Lb/hr
QKA 10/20/30/40 Required Evaporator Chilled Water Flow	487.5 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)	564.7 gpm
QKA 10/20/30/40 Chilled Water Pump AP-107 Required Operating Head	98.3 ft
QKA 10/20/30/40 Chilled Water Pump AP-107 Shutoff Head	127.8 ft
QKA 10/20/30/40 Required Chilled Water Pump AP-107 Hydraulic Horsepower	14 hp

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Insert 3

Table 9.2.8-3 Safety Chilled Water Instrumentation

MCR/RSS Display	Alarm	Function
Expansion Tank Humidity Div 1	HIGH-1	N/A
System Pressure #1 Div 1	HIGH-1 HIGH-2 LOW-1 LOW-2	LOW-2 Manual Isolation Div. 1 and 2
System Pressure #2 Div 1		
Evaporator ΔP Div 1	LOW-1 LOW-2	MODULATE Chiller Bypass Valve 30QKA10CG101 LOW-2 Train 1 to Train 2 Switchover
Chiller Bypass Valve Position Div 1	N/A	Evaporator Flow Control
Tank Humidity Measurement Div 2	HIGH-1	
System Pressure Measurement #1 Div 2	HIGH-1 HIGH-2 LOW-1 LOW-2	LOW-2 Isolation Div. 1 and 2
System Pressure Measurement #2 Div 2		
Evaporator ΔP Measurement Div 2	LOW-1 LOW-2	MODULATE Chiller Bypass Valve 30QKA20CG101 LOW-2 Train 2 to Train 1 Switchover
Chiller Bypass Valve Position Div 2	N/A	Evaporator Flow Control
Tank Humidity Measurement Div 2	HIGH-1	N/A

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MCR/RSS Display	Alarm	Function
System Pressure Measurement #1 Div 3	HIGH-1 HIGH-2 LOW-1 LOW-2	LOW-2 Manual Isolation Div. 3 and 4
System Pressure Measurement #2 Div 3		
Evaporator ΔP Measurement Div 3	LOW-1 LOW-2	MODULATE Chiller Bypass Valve 30QKA30CG101 LOW-2 Train 3 to Train 4 Switchover
Chiller Bypass Valve Position Div 3	N/A	Evaporator Flow Control
Tank Humidity Measurement Div 4	HIGH-1	N/A
System Pressure Measurement #1 Div 4	HIGH-1 HIGH-2 LOW-1 LOW-2	LOW-2 Manual Isolation Div. 3 and 4
System Pressure Measurement #2 Div 4		
Evaporator ΔP Measurement Div 4	LOW-1 LOW-2	MODULATE Chiller Bypass Valve 30QKA40CG101 LOW-2 Train 4 to Train 3 Switchover
Chiller Bypass Valve Position Div 4	N/A	Evaporator Flow Control
SAC Coil Throttle Valve Position Div1	N/A	HVAC Coil Flow Control
SAC Coil Throttle Valve Position Div2	N/A	HVAC Coil Flow Control
SAC Coil Throttle Valve Position Div3	N/A	HVAC Coil Flow Control

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MCR/RSS Display	Alarm	Function
SAC Coil Throttle Valve Position Div4	N/A	HVAC Coil Flow Control
SAB Coil Throttle Valve Position Div1	N/A	HVAC Coil Flow Control
SAB Coil Throttle Valve Position Div2	N/A	HVAC Coil Flow Control
SAB Coil Throttle Valve Position Div3	N/A	HVAC Coil Flow Control
SAB Coil Throttle Valve Position Div4	N/A	HVAC Coil Flow Control
Division 1 To 2 Cross-connect Supply MOV Position	N/A	Switchover Valve OPEN Confirmation
Division 1to 2 Cross-connect Return MOV Position	N/A	Switchover Valve OPEN Confirmation
Div 2 To 1 Cross-connect Supply MOV POS	N/A	Switchover Valve OPEN Confirmation
Div 2 To 1 Cross-connect Return MOV POS	N/A	Switchover Valve OPEN Confirmation
Div 3 To 4 Cross-connect Supply MOV POS	N/A	Switchover Valve OPEN Confirmation
Div 3 To 4 Cross-connect Return MOV Position	N/A	Switchover Valve OPEN Confirmation
Div 4 To 3 Cross-connect Supply MOV POS	N/A	Switchover Valve OPEN Confirmation
Div 4 To 3 Cross-connect Return MOV POS	N/A	Switchover Valve OPEN Confirmation

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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.

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.

System design parameters are listed on Table 9.2.8-1 and 9.2.8-2—Safety Chill Water Design Parameters. The SCWS flow diagram is shown in Figure 9.2.8-1—Safety Chilled Water System Diagram. INSERT 1

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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- 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.

9.2.8.6 Instrumentation Requirements

INSERT 3

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).

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.

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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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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INSERT 2

INSERT 4

Figure 9.2.8-1—Safety Chilled Water System Diagram
Sheet 1 of 4

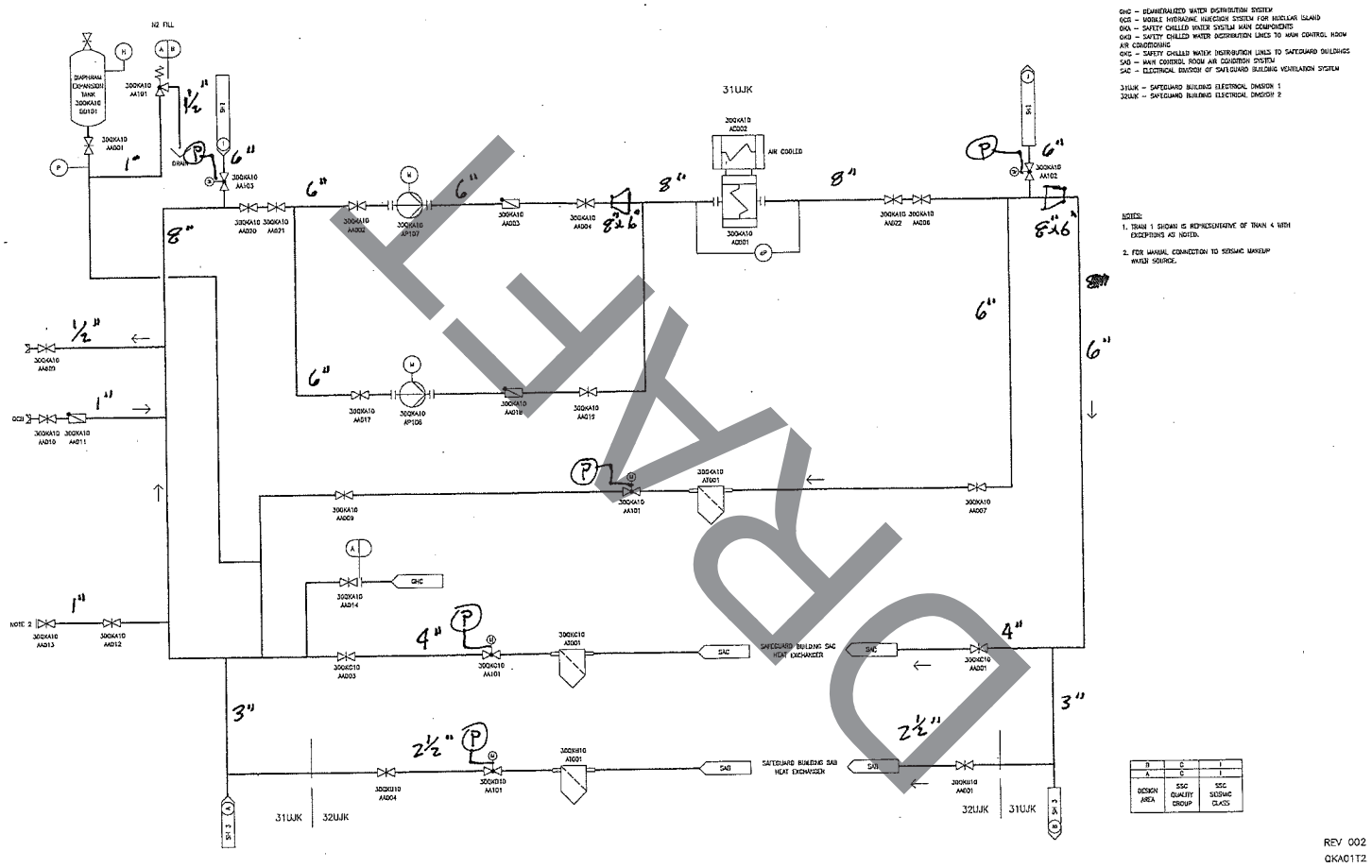

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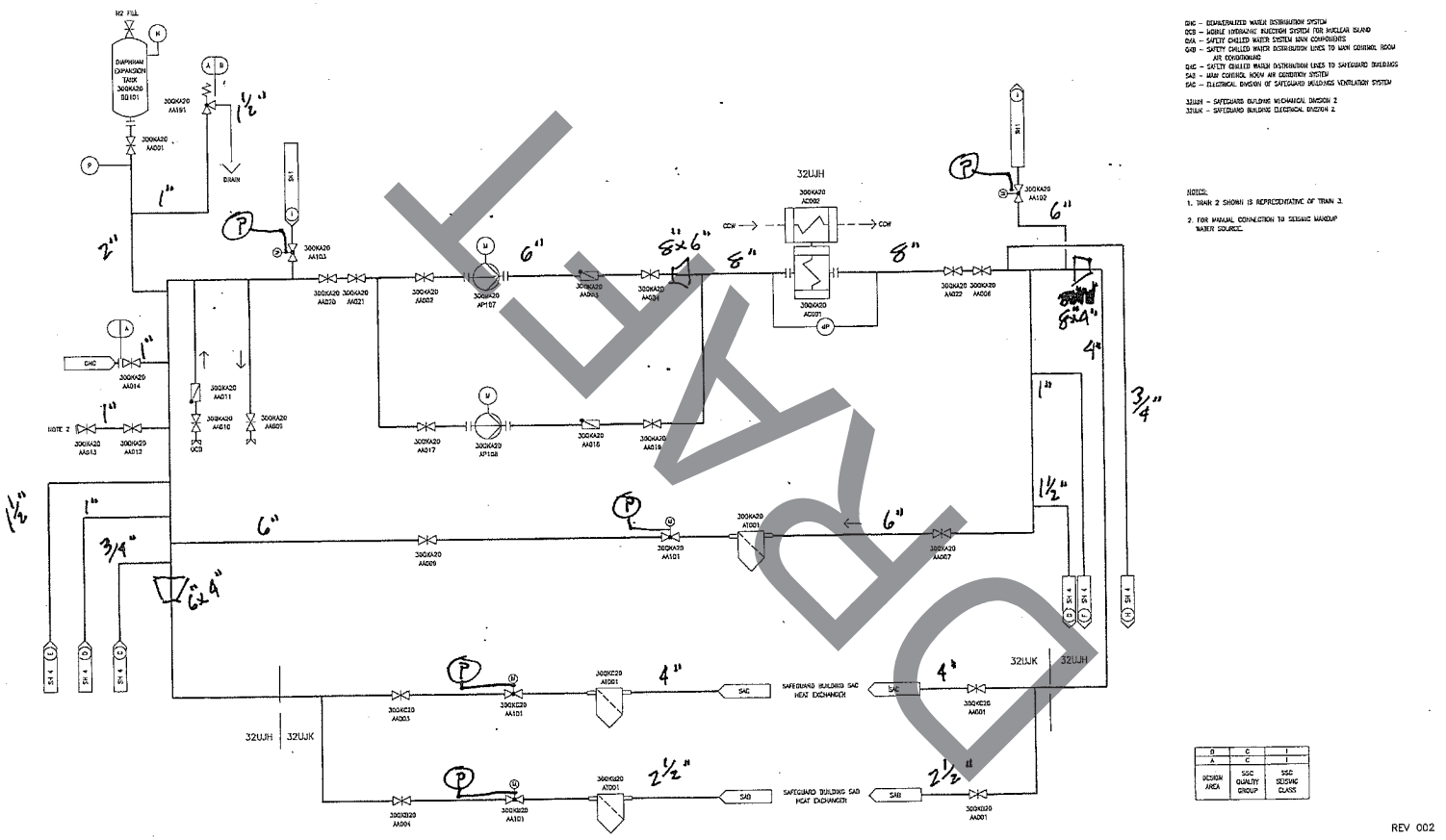
Figure 9.2.8-1—Safety Chilled Water System Diagram
Sheet 2 of 4



GHC – DEMINERALIZED WATER DISTRIBUTION SYSTEM
DCB – MOBILE HYDRAZINE INJECTION SYSTEM FOR NUCLEAR ISLAND
GVA – SAFETY CHILLED WATER SYSTEM MAIN COMPONENTS
GAB – SAFETY CHILLED WATER DISTRIBUTION LINES TO MAIN CONTROL ROOM AIR CONDITIONING
SAC – 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

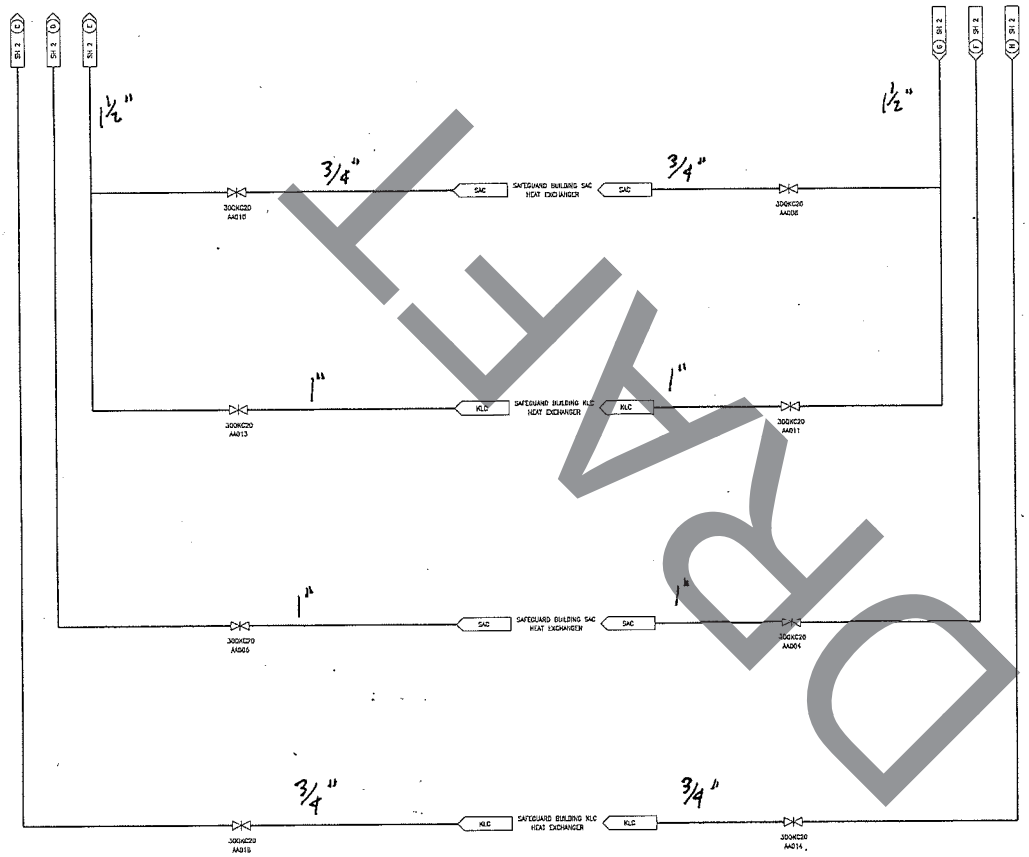
NOTES:
1. TRAIN 2 SHOWN IS REPRESENTATIVE OF TRAIN 3.
2. FOR MANUAL CONNECTION TO SEISMIC MAKEUP WATER SOURCE.

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

REV 002
QKA02T2

DRAFT

Figure 9.2.8-1—Safety Chilled Water System Diagram
Sheet 4 of 4



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

JZUH – SAFEGUARD BUILDING MECHANICAL DIVISION 2

NOTE:
TRAIN 2 SHOWN IS REPRESENTATIVE OF REDUNDANT TRAIN 3.

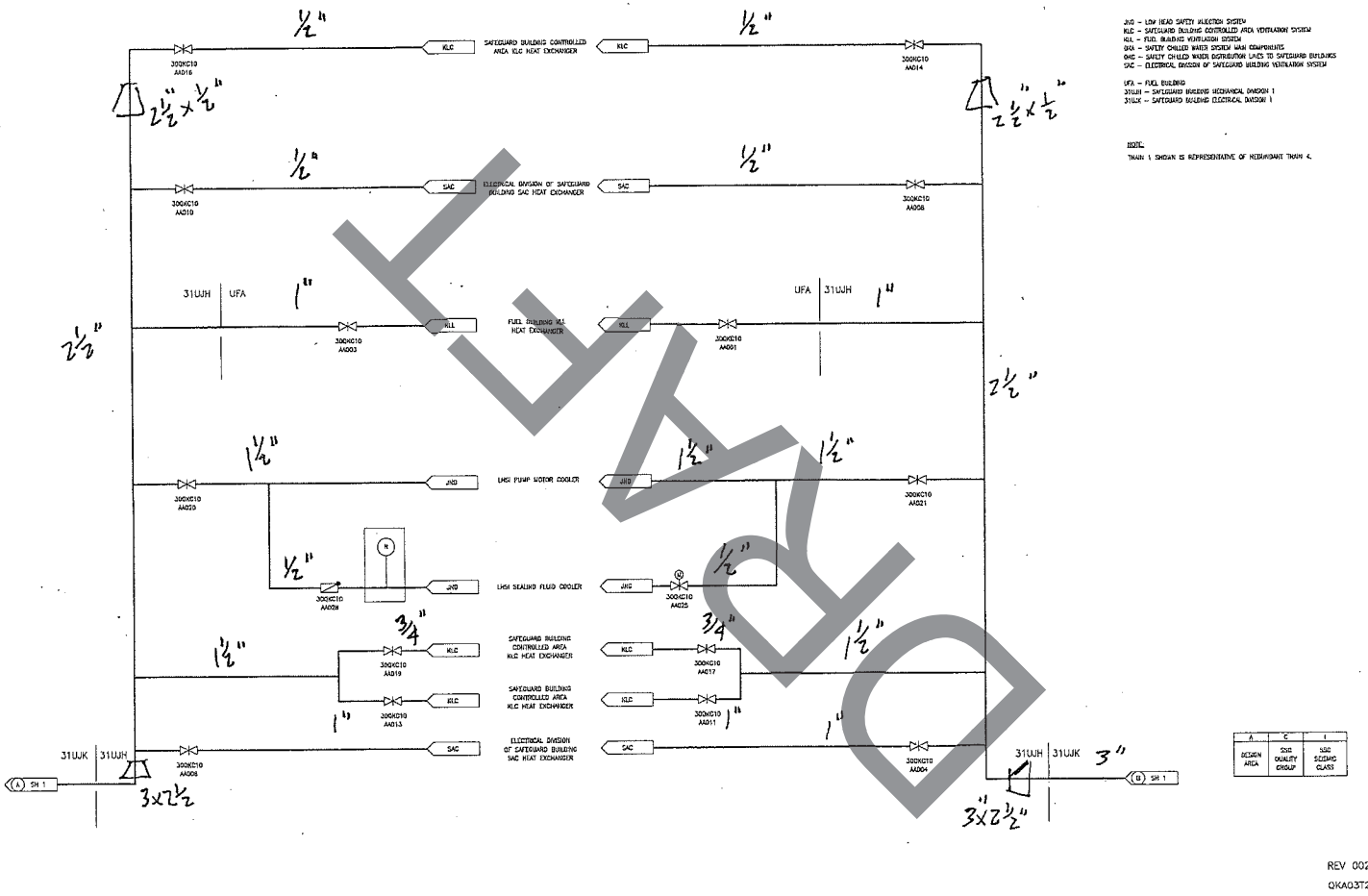
A	C	I
DESIGN AREA	SSC QUALITY GROUP	SSC SEISMIC CLASS

REV 002
QKA04T2

DRAFT

Next File

Figure 9.2.8-1—Safety Chilled Water System Diagram
Sheet 3 of 4



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Question 09.02.01-34:

Follow-up to RAI 119 Question 9.2.1-08

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. In order to satisfy system flow requirements, the ESWS design must assure that the minimum net positive suction head (NPSH) for the ESWS pumps will be met for all postulated conditions, including consideration of vortex formation. The staff found that the NPSH requirement for the ESWS pumps was not specified and Tier 2 FSAR Section 9.2.1 did not describe how the ESWS design will assure that the NPSH requirement for the ESWS pumps is satisfied (including consideration of vortex formation) and how much excess margin is provided by the ESWS design for the most limiting assumptions. Consequently, the applicant needs to provide additional information in Tier 2 FSAR Section 9.2.1 to specify the minimum NPSH requirement for the ESWS pumps and fully explain how the minimum NPSH requirement by the system design when taking vortex formation into consideration is satisfied. In addition, excess margin available for the most limiting case should be provided. Sufficient information is needed to enable the staff to independently confirm that the design is adequate in this regard, including limiting assumptions that were used along with supporting justification.

Based on the staff's review of response RAI 119 Question 9.2.1-08 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's found several points in the response and proposed FSAR markup that require further explanation, clarification or additional information. These points are provided below and require resolution to support completion of the staff's evaluation of this subject.

a. The minimum worst case cooling tower basin water level after 72 hours of post accident operation (reference Tier 2, FSAR Section 9.2.5.3.1, "Mechanical Draft Cooling Towers,") needs to be identified in order to address the actual margin between NPSH available and NPSH required. This approach will provide a more meaningful assessment of NPSH margin.

b. The response indicates that the basin water level necessary for vortex suppression was found to be more limiting than that required to satisfy NPSH but does not specifically state what levels were determined.

c. Related to the item above, the applicant needs to state the basis for the "height for minimum pump submergence" of 3.0 m (119 inches) (identified in Figure 09.02.01-17-1). This height is inconsistent with the height of 2.4 m (95 inches) identified in the FSAR markup. Clarify the discrepancy.

d. With regard to the markup of U.S FSAR Tier 2 Table 9.2.1-1, the description for the new line item states "Required Minimum Water Level in the Basin" does not agree with the corresponding "Technical Data," which indicates that 2.4 m (95 inches) is from the suction inlet. This comment also applies to the corresponding addition to U.S.EPR FSAR Table 9.2.1-2 for the dedicated ESW pump. In order to completely define basin water level, the distance between the pump suction inlet and the bottom of the basin needs to be clearly identified.

DRAFT

e. Identify the assumptions used for calculating available NPSH (e.g. atmospheric pressure, centerline elevation of inlet to the first stage impeller etc). Sufficient information along with the supporting justification is needed to enable the staff to confirm the results in accordance with SRP 9.2.1.

Response to Question 09.02.01-34:

Part (a)

Refer to Response to RAI Question 09.02.01-41(b) for cooling tower basin water level after 72 hours of post accident operation and related information to be added to the FSAR.

Part (b)

Refer to Response to RAI Question 09.02.01-41(b) for cooling tower basin water level necessary for vortex suppression and NPSH and related information to be added to the FSAR.

Part (c)

The "height for minimum pump submergence" of 3.0 m (119 inches) is dimensioned from the bottom of the basin. The "height for minimum pump submergence" of 2.4 m (95 inches) is dimensioned from the 119 inches level to the pump suction inlet. Refer to Response to RAI Question 09.02.01-41(d) for the cooling tower basin water level for minimum pump submergence.

Part (d)

The distance between the pump suction inlet and the bottom of the basin is 24".

Part (e)

With regard to the assumptions used for calculating available NPSH, the system fluid is water at 95°F. The absolute vapor pressure of the water is 1.89 ft. The atmospheric pressure is assumed at sea level but will vary based on location and altitude. The centerline elevation of inlet to the first stage impeller is 95 inches (7.92') below the minimum pump submergence level. The total suction head considers the minimum height for pump submergence plus the minimum 72 hours water losses volume of 12.5'.

From the response to RAI 119, Question 9.2.1-9, the pump design sizing assumes maximum reduction in available NPSH of 6 ft, so margin between design NPSH reduction and actual NPSH reduction is available. The addition of water treatment chemicals to the ESW system increases the water vapor pressure, resulting in available NPSH reduction of as much as 6 ft, according to ANSI/HI 9.6.1-1998 Section 9.6.1.5.4 part c. The actual range of increase in water vapor pressure would depend on actual water chemistry.

FSAR Impact:

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

DRAFT

Question 09.02.01-41:

Follow-up to RAI 119, Question 9.2.1-17

With respect to Surveillance Requirement (SR) 3.7.8.1, Tier 2 FSAR Figure 3.8-101 shows that the normal cooling tower basin water level is at 3.05 meters (10 feet) above grade elevation. SR 3.7.8.1 requires that the water level in the ESWS basin be maintained greater than or equal to 8.29 meters (27.2 feet) above the bottom of the basin. However, Figure 3.8-101 shows the bottom of the basin to be -4.88 meters (-16 feet) below grade. Therefore, Figure 3.8-101 shows that the normal basin water level is at 3.05+4.88=7.93 meters (16+10= 26 feet) above the bottom of the basin, which conflicts with the SR value of 8.29 meters (27.2 feet). The applicant needs to provide additional information in the FSAR to correct this apparent inconsistency.

Based on the staff's review of response to RAI 119, Question 9.2.1-17 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 reviewed the RAI response and determined that additional information is required related to basin water level as noted below.

a. Provide an explanation of the basis and technical justification for the changes which amount to about a 13 percent reduction in minimum stored water volume. At a minimum, the explanation should justify the acceptability of reduced margins for: (1) cooling tower basin minimum water level that remains after 72 hours of post accident operation and the minimum level required for pump operability, and (2) the cooling tower basin maximum temperature after 72 hours when compared to the maximum basin water temperature of 35°C (95°F) based on an assumed pre-event temperature at the maximum permitted by TS 3.7.19 of 32.2°C (90°F).

b. Provide an explanation or clarification of the basin water level at which the ESWS pumps will still be able to perform their intended safety related function since it appears based on Figure 09.02.01-17-1 that at elevation 6.92' (minimum 72 hours water losses volume), the ESWS pumps remain operable at this level. Add to the table NPSH and vortex water level elevation from RAI 9.2.1-08.

c. Provide an explanation or clarification of the basin water level control system during torrential rains and hurricanes since blowdown piping is considered non-safety.

d. The applicant should consider providing Figure 09-02-01-17-1 as a DCD figure since this is an important part of the licensing basis of the ESW pumps defining margins related to NPSH and vortexing, alarms, operating bands, related to the UHS basin.

Response to Question 09.02.01-41:

Part (b)

After 72 hours post accident, the basin water level will be no lower than elevation -5.58' with 6" margin to the minimum pump submergence elevation -6.08'. The ESWS pumps will be able to perform their intended safety related function and remain operable at this elevation. Additionally, a 10" basin level margin is provided above the minimum 72 hour water losses volume at elevation 6.92'.

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The available NPSH is calculated to be approximately 32.4 feet at the minimum water level condition in the cooling tower basin assuming atmospheric pressure at sea level. The minimum water level and height for minimum pump submergence from the bottom of the basin is 119" (elevation -6.08'). This height is 95" above the pump suction inlet. An additional six inches of water height is considered above the water level for vortex suppression and instrument uncertainty but is not credited in the calculation of available NPSH. NPSH values will vary slightly with atmospheric pressure at altitude depending on location.

Table 9.2.1-1 will be revised to show:

Required Minimum Water Level in the Basin for NPSH and vortex suppression	95" inches (above suction inlet)

Correspondingly, Table 9.2.1-2 will be revised to show:

Required Minimum Water Level in the Basin for NPSH and vortex suppression	46" inches (above suction inlet)

Part (c)

Refer to RAI 345, Question 9.2.5-22 for an explanation of basin water level control system during torrential rains and hurricanes.

Part (d)

The figure provided in Response to RAI 119, Question 09.02.01-17 (Figure 09.02.01-17-1) will be provided in the U.S EPR FSAR as Tier 2, Figure 9.2.5-3. In order to completely define basin water level, the distance between the pump suction inlet and the bottom of the basin (24") will also be clearly identified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Tables 9.2.1-1 and 9.21-2 will be revised as described in the response and indicated on the enclosed markup.

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

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Table 9.2.1-1—Essential Service Water Design Parameters

Essential Service Water Pump 30PEB10/20/30/40 AP001	
Description	Technical Data
Number	4
Type	Wet Pit Vertical Turbine
Normal Flow Rate	19,340 gpm
Required Pump Head at Normal Flow Rate	185 ft/H_2O
Required Minimum Water Level in the Basin	95 inches (from suction inlet)

INSERT A — RAI 345 09.02.0-41(b) — INSERT B

Table 9.2.1-2—Dedicated Essential Service Water Design Parameters

Dedicated Essential Service Water Pump 30PEB80 AP001	
Description	Technical Data
Number	1
Type	Wet Pit Vertical Turbine
Normal Flow Rate	2737 gpm
Required Pump Head at Normal Flow Rate	150 ft/H_2O
Required Minimum Water Level in the Basin	46 inches (from suction inlet)

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Next File

INSERT for RAI 345, Question 09.02.01-41

INSERT A

Required Minimum Water Level in the Basin for NPSH and vortex suppression	95" inches (above suction inlet)

INSERT B

Required Minimum Water Level in the Basin for NPSH and vortex suppression	46" inches (above suction inlet)

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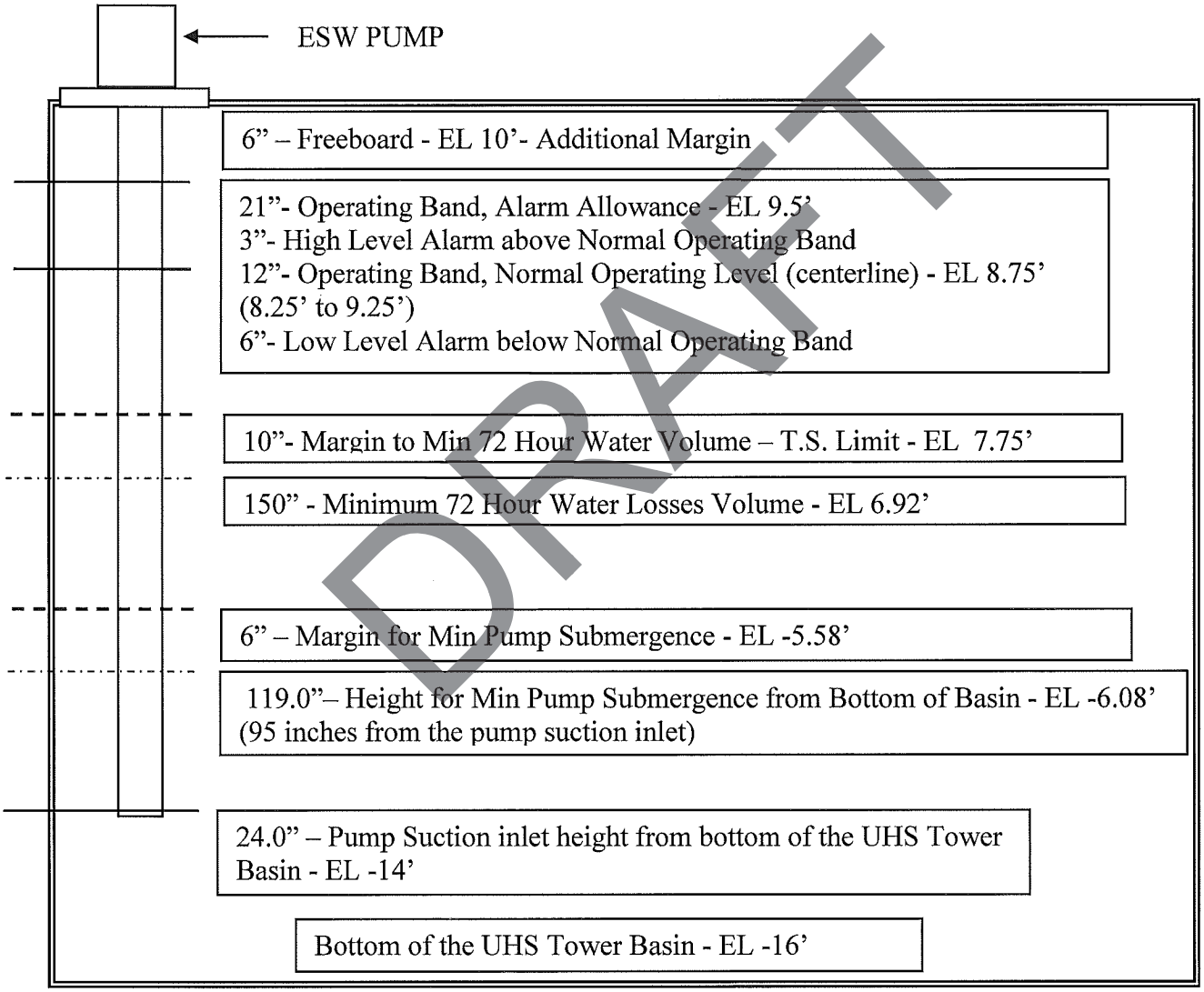
INSERT For RAI Question 09.02.01-41

INSERT New Figure

Figure 9.2.5-3 Cross Section of UHS Tower Basin Schematic



Note: Figure Not to Scale

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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.

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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 be revised to "Essential Service Water System and Ultimate Heat Sink".

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, Tables 2.7.11-3 does not require revision.

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 and Ultimate Heat Sink

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	Yes	Run	I
Cooling Tower Fan	30PED10AN002	ESW Cooling Tower Division 1	Yes	Run	I
Cooling Tower Fan	30PED20AN001	ESW Cooling Tower Division 2	Yes	Run	I
Cooling Tower Fan	30PED20AN002	ESW Cooling Tower Division 2	Yes	Run	I
Cooling Tower Fan	30PED30AN001	ESW Cooling Tower Division 3	Yes	Run	I
Cooling Tower Fan	30PED30AN002	ESW Cooling Tower Division 3	Yes	Run	I
Cooling Tower Fan	30PED40AN001	ESW Cooling Tower Division 4	Yes	Run	I
Cooling Tower Fan	30PED40AN002	ESW Cooling Tower Division 4	Yes	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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