AreváEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Tuesday, October 19, 2010 8:03 AM
To: Tesfaye, Getachew
Cc: Hearn, Peter; KOWALSKI David (AREVA)
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 351 Q.09.02.05-28.pdf; DRAFT FSAR Changes RAI 351 Q.09.02.05-23.pdf; DRAFT FSAR Changes RAI 351 Q.09.02.05-25 (Parts 1-3, 8).pdf; DRAFT FSAR Changes RAI 351 Q.09.02.05-28.pdf; DRAFT FSAR Insert RAI 351 Q.09.02.05-25 (Parts 1-3, 8).pdf; DRAFT RESPONSE + FSAR Changes RAI 351 Q.09.02.05-32 (Orig. 2c).pdf; DRAFT RESPONSE RAI 351 Q.09.02.05-23.pdf; DRAFT RESPONSE RAI 351 Q.09.02.05-25 (Parts 1-3, 8).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 351 questions. These responses will be discussed at today's (10/19/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC.

Attached are the following DRAFT response(s):

- Response to RAI 351 - Question 09.02.05-23. Response.
- Response to RAI 351 - Question 09.02.05-23. FSAR Changes.
- Response to RAI 351 - Question 09.02.05-25 (Parts 1-3, 8). Response.
- Response to RAI 351 - Question 09.02.05-25 (Parts 1-3, 8). (FSAR Changes have not changed from previous DRAFT and are also attached.)
- Response to RAI 351 - Question 09.02.05-28. Response.
- Response to RAI 351 - Question 09.02.05-28. FSAR Changes.
- Response to RAI 351 - Question 09.02.05-32. Response & FSAR Changes.

Note that these DRAFT responses have not been through the final Licensing review/approval process; nor do they reflect technical editing.

Please call me if you have any questions. Thanks.

David J. Kowalski, P.E.
Principal Engineer
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Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Sent Date: 10/19/2010 8:03:05 AM
Received Date: 10/19/2010 8:05:07 AM
From: BRYAN Martin (EXTERNAL AREVA)

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

Recipients:
"Hearn, Peter" <Peter.Hearn@nrc.gov>
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Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

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

Question 09.02.05-28:

Follow-up to RAI 175, Question 9.2.5-11:

General Design Criteria (GDC) 44 requires systems to transfer heat from structures, systems, and components important to safety to a ultimate heat sink under accident conditions. Fermi 2, as part of their design bases, has a nitrogen brake system to prevent overspeed from the design basis tornado. During a design basis tornado, the brake will engage and disengage a number of times. Since two groups of fan are provided for each safety related cooling tower and each cooling tower is divisionally separated, provide justification that a safety related fan braking system is not required for the design basis tornado.

Based on the staff's review of the applicant's response to RAI 9.2.5-11 (ID1817/6806) AREVA #175, Supplement 1, the following were determined as unresolved and needed further clarification/resolution by the applicant.

The applicant's response indicated that the specific method to be used to protect the UHS (i.e., cooling tower fans) from the effects of tornado will be determined in coordination with the cooling tower manufacturer later in the design process. In addition to the impact of tornado on the cooling tower fans, especially differential pressure effects, the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard) needs to be addressed as well. Consequently, this item 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 09.02.05-28:

As indicated on U.S. EPR FSAR Tier 2, Figure 3.8-101, Essential Service Water Building Section A-A and Figure 3.8-102, Essential Service Water Building Section B-B, the UHS cooling tower fans are enclosed within the Essential Service Water Building and protected by a missile shield above the fans. Figure 3.8-102 shows missile protected air intakes that cause the intake air to make multiple turns before entering the fill area of the cooling tower. In case of tornado, these building features and the cooling tower fill and drift eliminators would cause resistance to high air flow that could affect the fans.

ITAAC Item No. 3.X will be added to Tier 1 Section 2.7.11.3 and Table 2.7.11-3 to confirm that the UHS cooling tower fans are protected from the effects of tornado including differential pressure effects, overspeed, and the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard). An analysis will be completed by qualified individuals with the results documented in a report.

U.S. EPR FSAR Tier 2, Section 9.2.5.3.1 will be revised to indicate that the UHS cooling tower fans are designed to withstand the effects of tornado including differential pressure effects, overspeed, and the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard). The method to be used to protect the UHS fans from overspeed due to tornado effects will be a brake system or the resistance of the fan gear reducer.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.7.11 and Tier 2, Section 9.2.5.3.1 will be revised as described in the response and indicated in the attached markup.

Figure 2.7.11-1—Essential Service Water System Functional Arrangement
Sheet 1 of 9

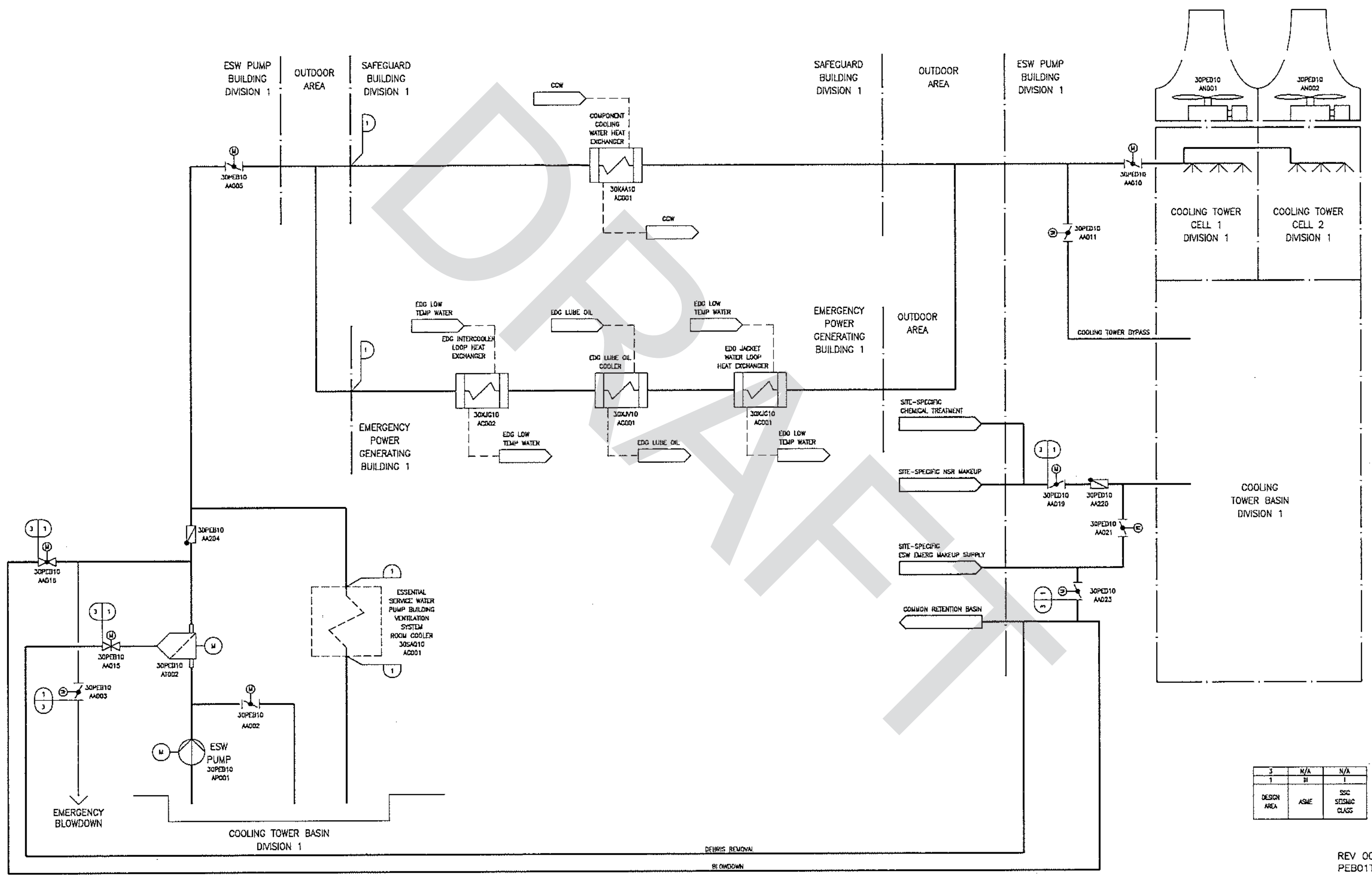


Figure 2.7.11-1—Essential Service Water System Functional Arrangement
Sheet 2 of 9

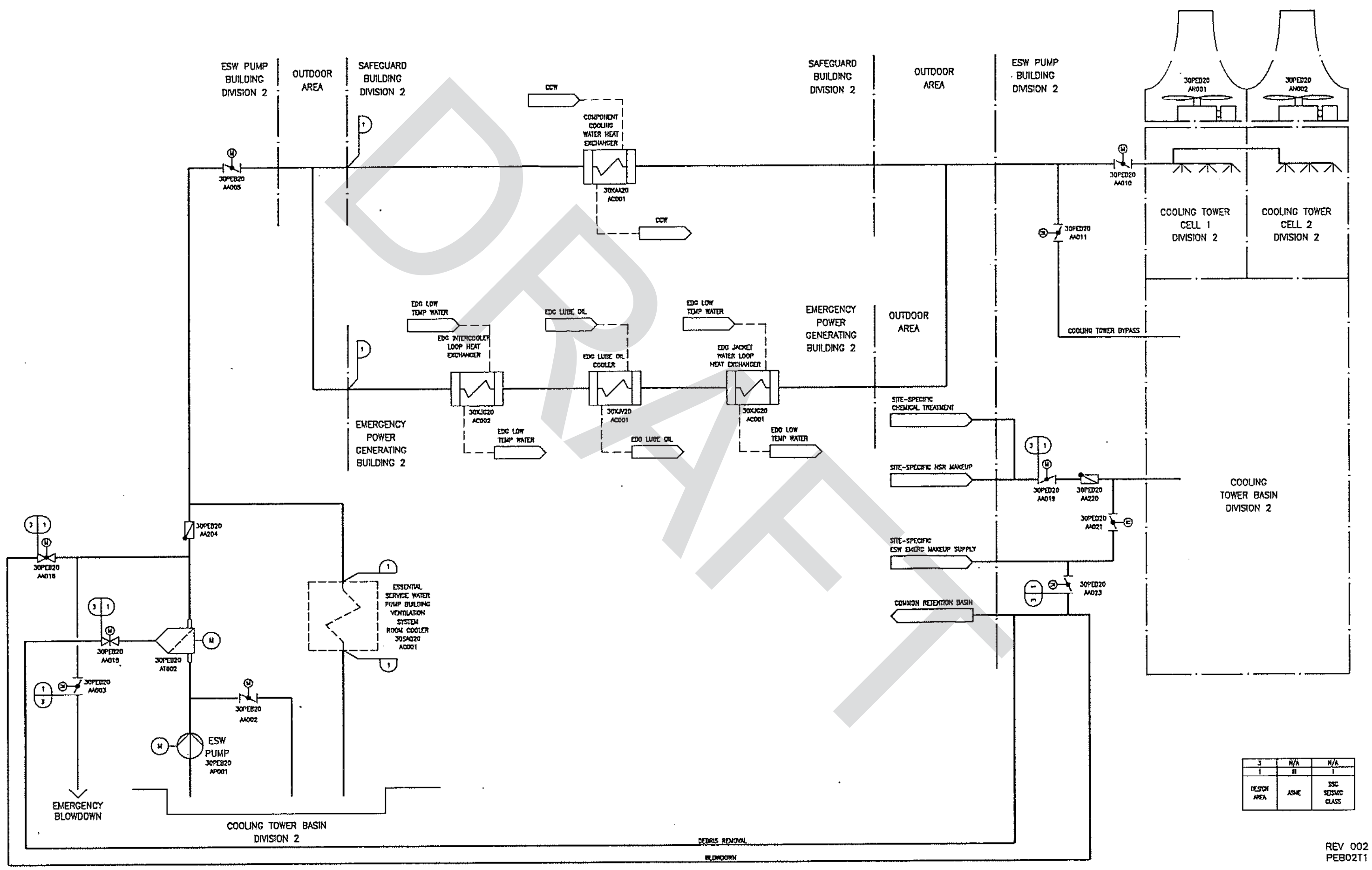
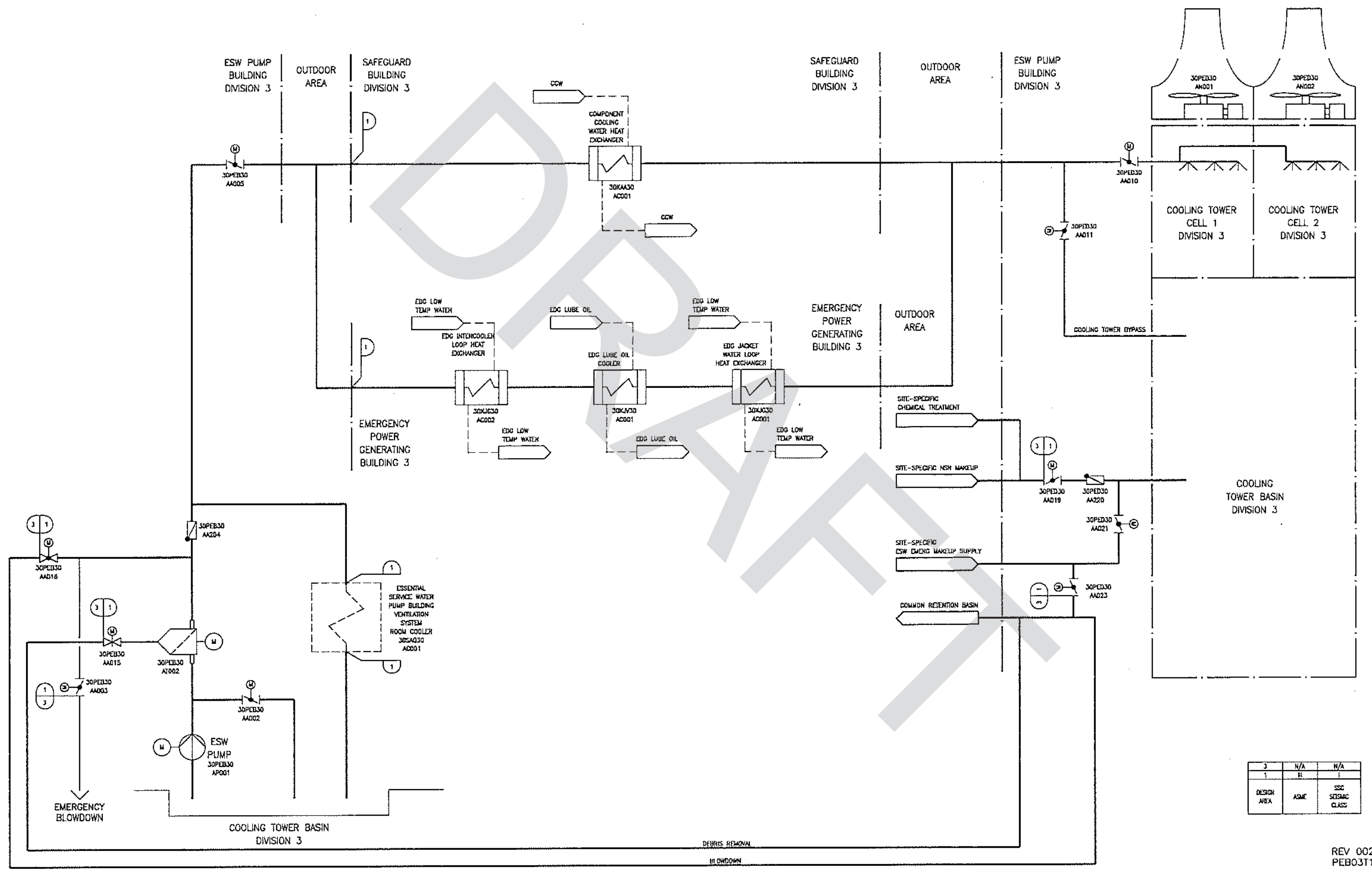


Figure 2.7.11-1—Essential Service Water System Functional Arrangement Sheet 3 of 9



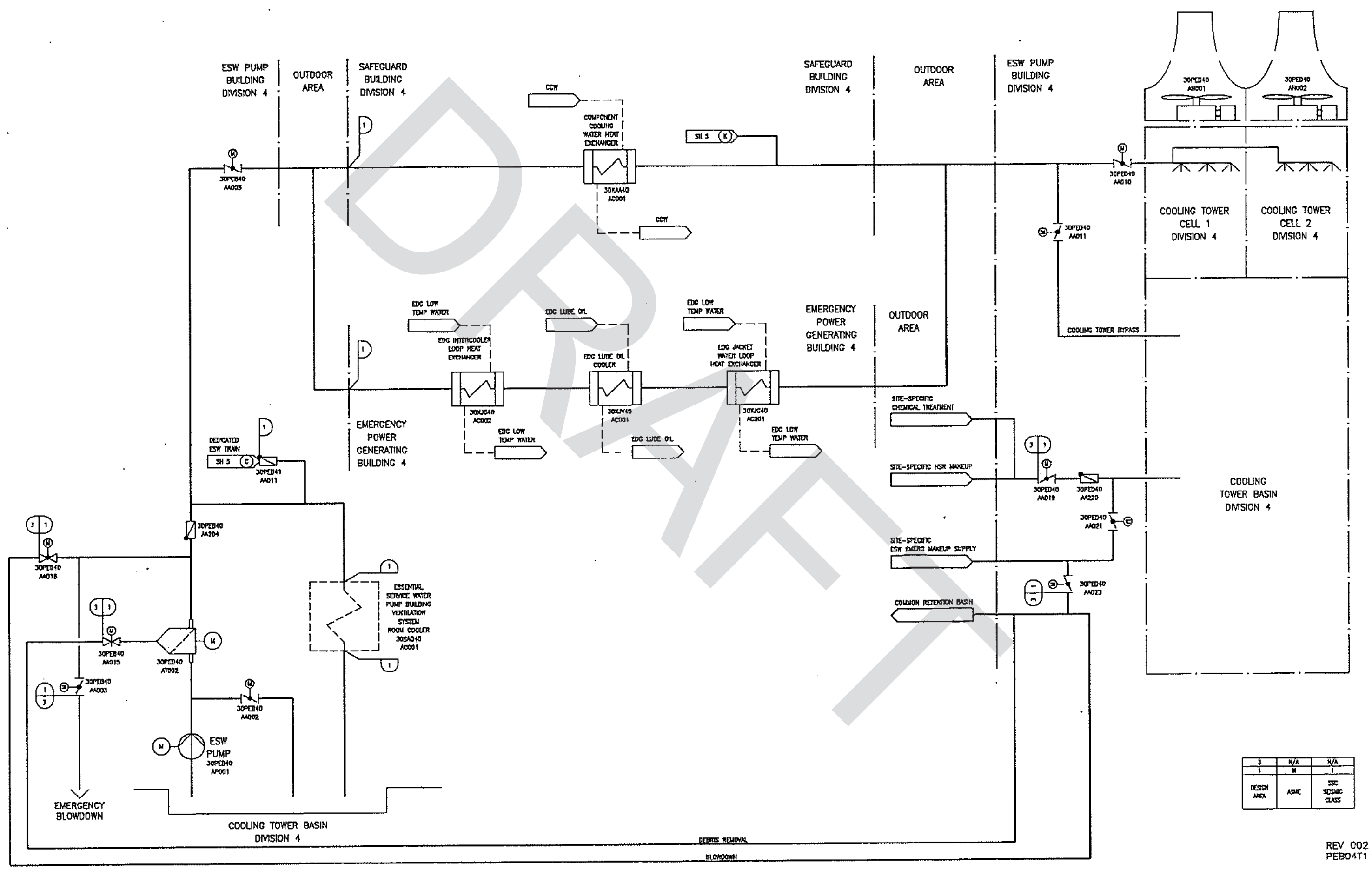


Figure 2.7.11-1—Essential Service Water System Functional Arrangement
Sheet 4 of 9

Figure 2.7.11-1—Essential Service Water System Functional Arrangement
Sheet 6 of 9

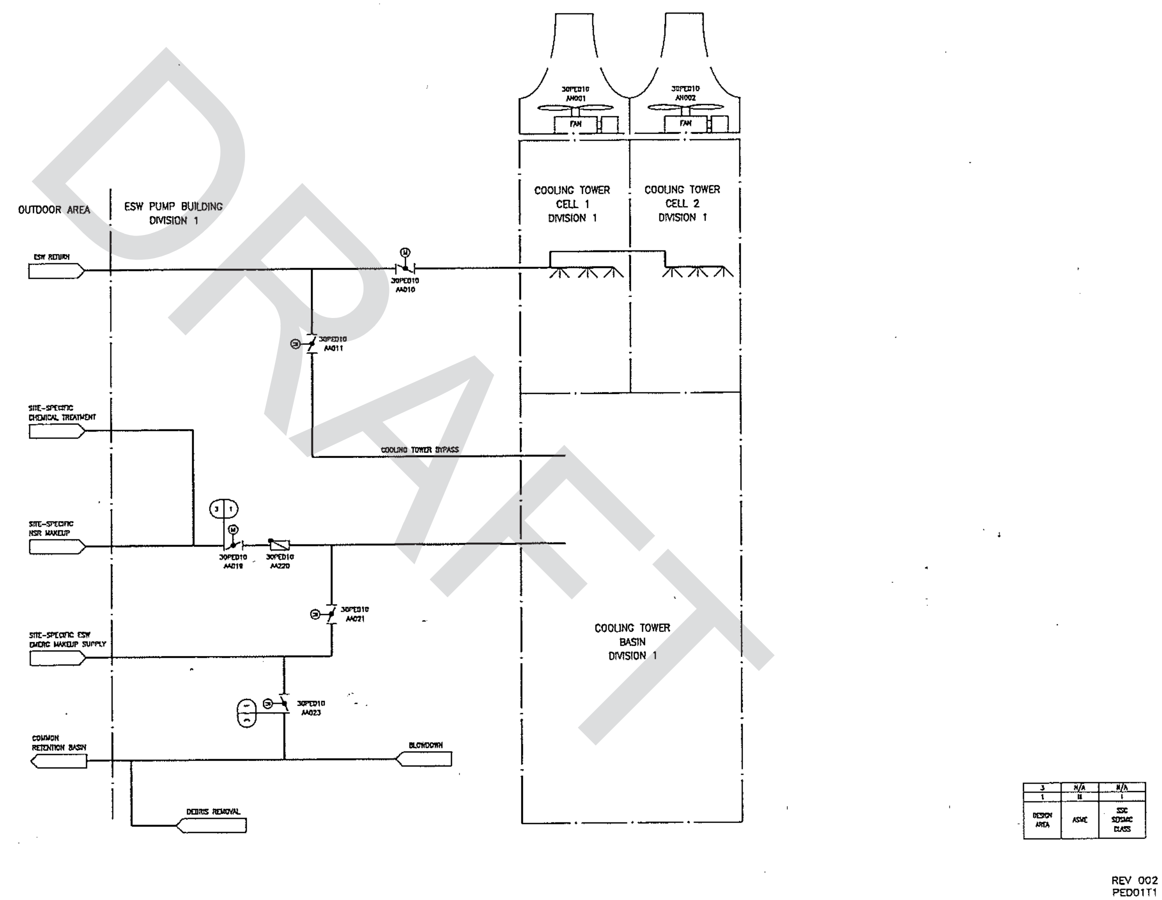


Figure 2.7.11-1—Essential Service Water System Functional Arrangement
Sheet 7 of 9

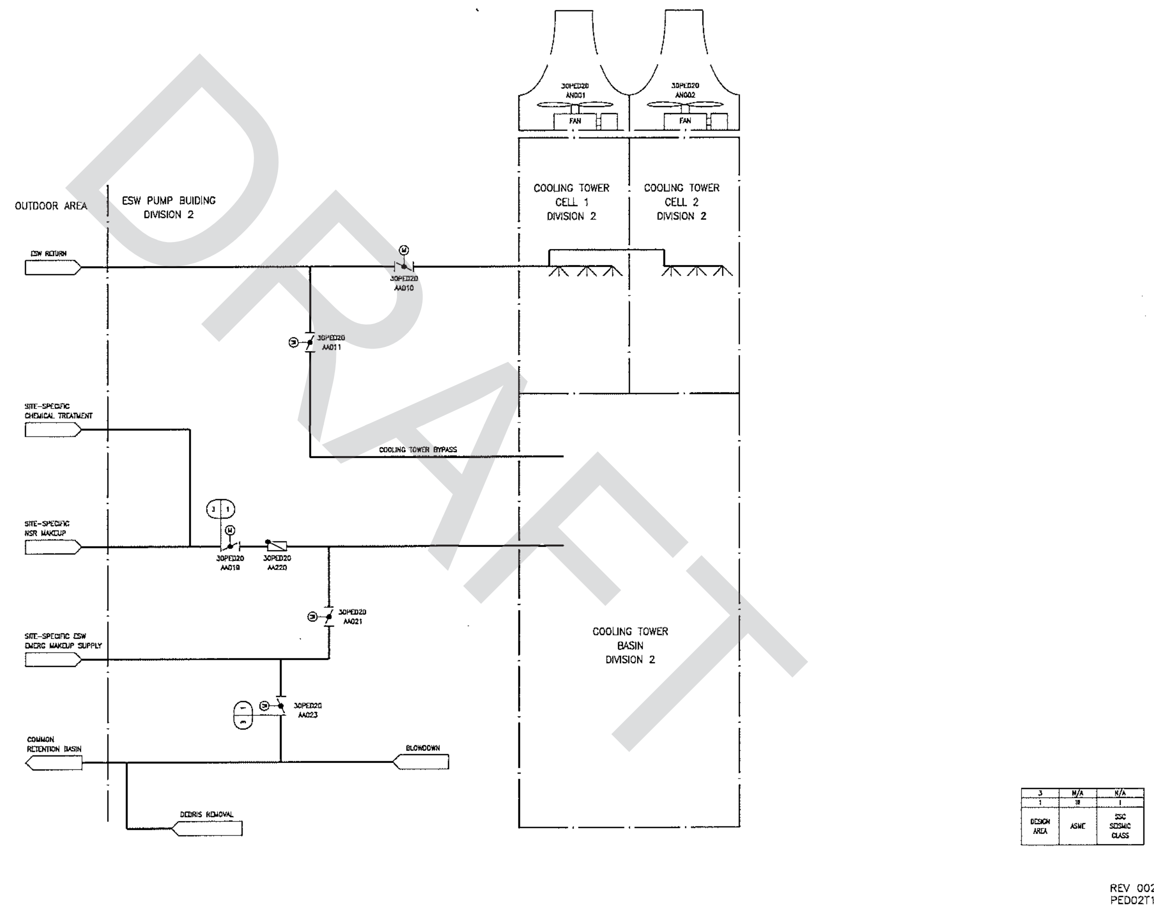


**Figure 2.7.11-1—Essential Service Water System Functional Arrangement
Sheet 8 of 9**

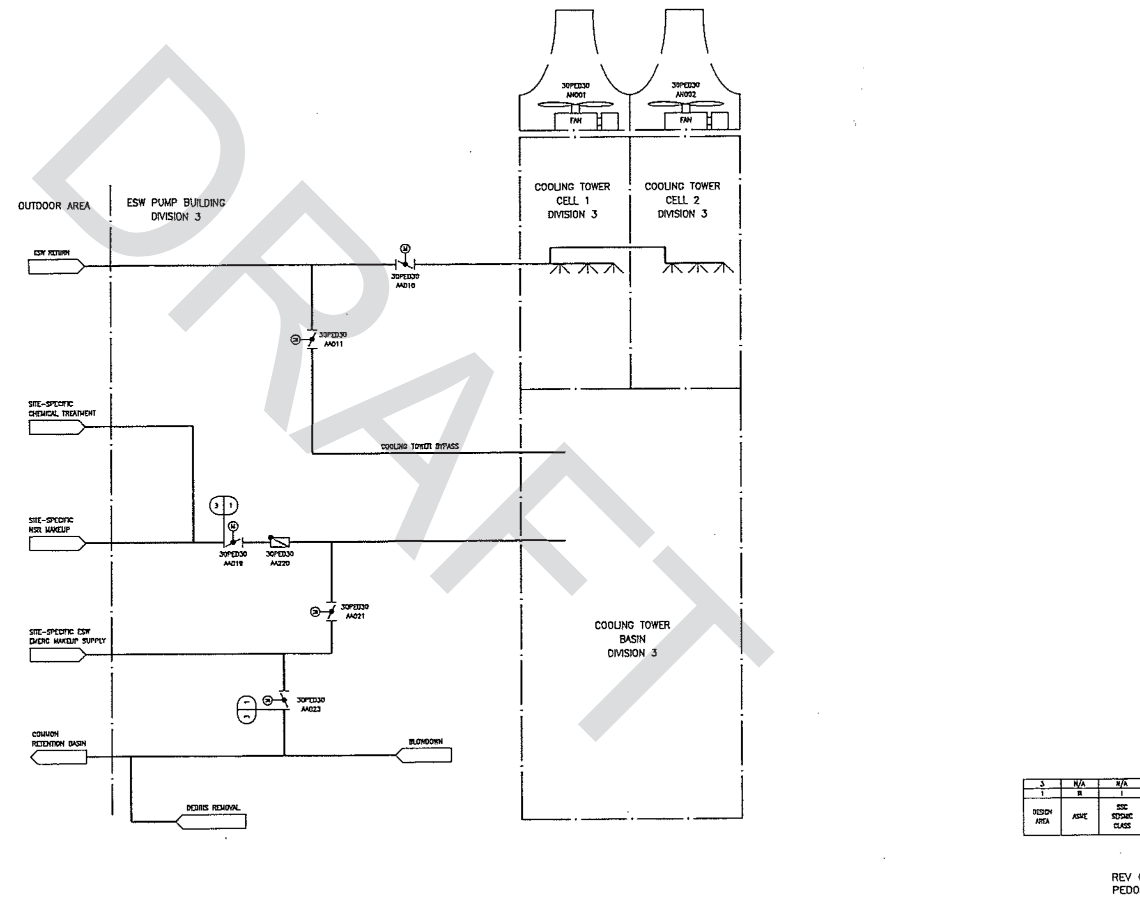
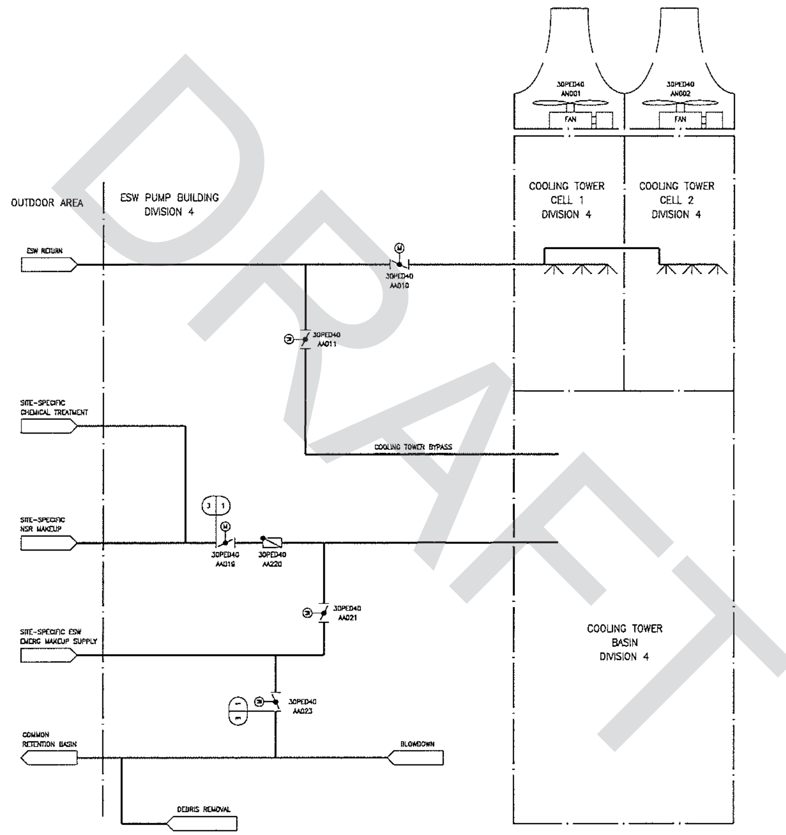


Figure 2.7.11-1—Essential Service Water System Functional Arrangement
Sheet 9 of 9



3	N/A	N/A
1	III	I
DESIGN AREA	ASME	SSC SEISMIC CLASS

Next File

Table 3.9.6-2—Inservice Valve Testing Program Requirements (Sheet 85 of 97)

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
30PED40AA011	Tower Bypass Isolation	BF	MO	3	B	A	C	ET PI	Q 2Y	
30PED40AA019	Makeup Water Isolation	BF	MO	3	B	A	C	ET PI	Q 2Y	
30PED40AA021	Emergency Makeup Water Isolation	BF	MO	3	B	A	O	ET PI	Q 2Y	
30PED40AA220	Makeup Water Check	CK	SA	3	C	A	C	ET	Q	
30PED10AA206	Blowdown Check	CK	SA	3	C	A	C	ET	Q	
30PED20AA206	Blowdown Check	CK	SA	3	C	A	C	ET	Q	
30PED30AA206	Blowdown Check	CK	SA	3	C	A	C	ET	Q	
30PED40AA206	Blowdown Check	CK	SA	3	C	A	C	ET	Q	
30PED10AA023	UHS Makeup Water Test Isolation	BF	MO	3	B	P	C	ET PI	Q 2Y	
30PED20AA023	UHS Makeup Water Test Isolation	BF	MO	3	B	P	C	ET PI	Q 2Y	
30PED30AA023	UHS Makeup Water Test Isolation	BF	MO	3	B	P	C	ET PI	Q 2Y	
30PED40AA023	UHS Makeup Water Test Isolation	BF	MO	3	B	P	C	ET PI	Q 2Y	

Figure 9.2.1-1—Essential Service Water System Piping & Instrumentation Diagram
Sheet 1 of 4

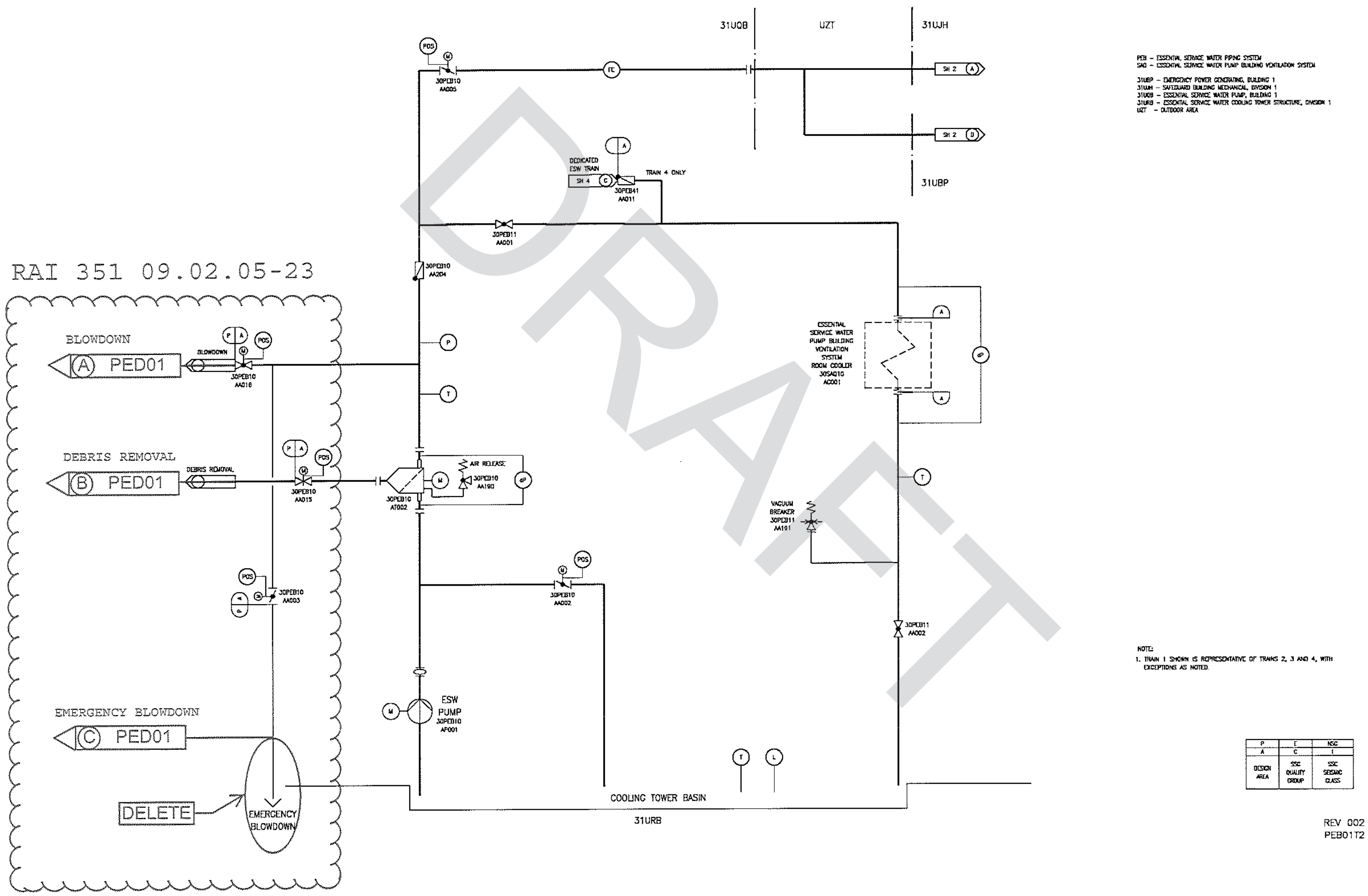
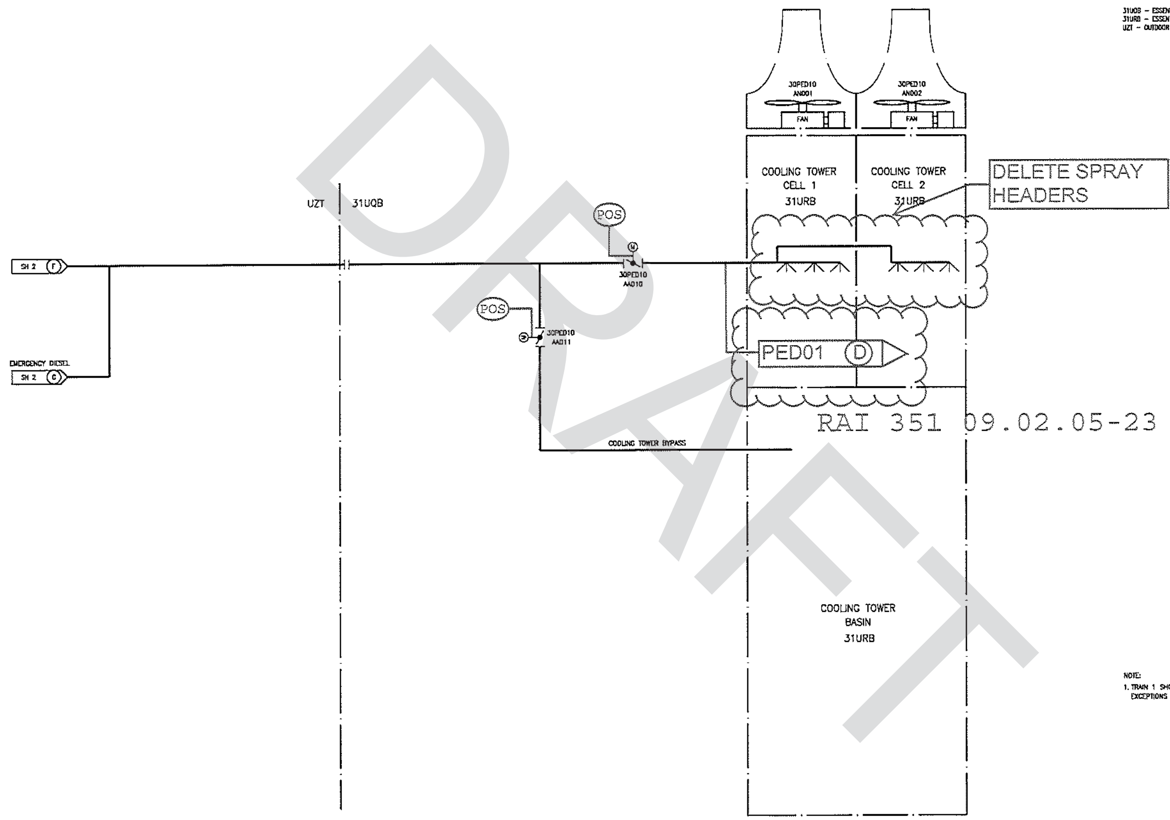


Figure 9.2.1-1—Essential Service Water System Piping & Instrumentation Diagram
Sheet 3 of 4



PEB - ESSENTIAL SERVICE WATER PIPING SYSTEM
PED - ESSENTIAL SERVICE WATER RECIRCULATION COOLING SYSTEM

31UQB - ESSENTIAL SERVICE WATER PUMP BUILDING, DIVISION 1
31URB - ESSENTIAL SERVICE WATER COOLING TOWER STRUCTURE, DIVISION 1
UZT - OUTDOOR AREA

NOTE:
1. TRAIN 1 SHOWN IS REPRESENTATIVE OF TRAINS 2, 3 AND 4, WITH EXCEPTIONS AS NOTED.

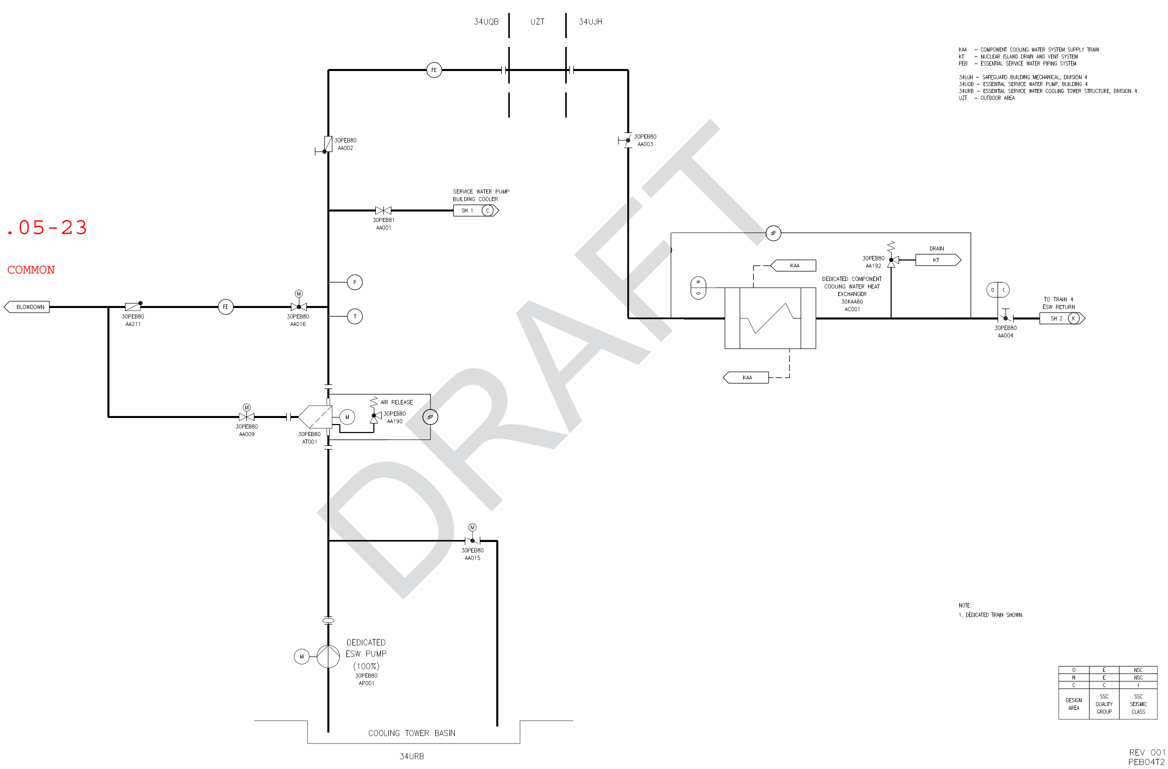
P	E	NSC
O	E	NSC
C	C	I
DESIGN AREA	SSC QUALITY GROUP	SSC SEISMIC CLASS

REV 002
PEB03T2

Figure 9.2.1-1—Essential Service Water System Piping & Instrumentation Diagram
Sheet 4 of 4

RAI 351 09.02.05-23

TO SITE SPECIFIC COMMON
RETENTION BASIN



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9.2.5 Ultimate Heat Sink

The function of the ultimate heat sink (UHS) is to dissipate heat rejected from the essential service water system (ESWS) during normal operations and post accident shutdown conditions. System interface heat loads are listed on Table 9.2.5-1. The UHS for the U.S. EPR is sized to provide adequate cooling capacity as required by RG 1.27.

9.2.5.1 Design Basis

UHS structures, systems and components which provide cooling for safety-related equipment are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, and external missiles without loss of capability to perform their safety-related functions (GDC 2). Structures housing the system as well as the system components are capable of withstanding the effects of earthquakes. The seismic design of this system meets the guidance of RG 1.29 (Position C.1 for the safety-related portion, and Position C.2 for the non-safety-related portion). Refer to Section 3.2 for quality group classifications.

The UHS is designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents. These shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from external events (GDC 4).

The UHS does not share structures, systems or components important to safety with other nuclear power plant units unless it has been shown that such sharing does not significantly impair the ability to perform their safety-related functions; including, the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units (GDC 5).

The UHS functions to provide heat removal from the ESWS during normal operation and accident conditions, and transfers that energy to the environment (GDC 44).

The UHS is designed to permit appropriate periodic inspection of important components necessary to maintain the integrity and capability of the system (GDC 45).

The UHS is designed to permit operational functional testing of safety-related components to ensure system operability (GDC 46).

The UHS operates in conjunction with the ESWS and component cooling water system (CCWS) and other reactor auxiliary components to provide a means to cool the reactor core and reactor coolant system (RCS) to achieve a safe shutdown.

The UHS operates for a nominal 30 days following a loss of coolant accident (LOCA) without requiring any makeup water to the source or demonstrates that replenishment or use of an alternate or additional water supply can be effected to ensure continuous capability of the sink to perform its safety-related functions.

9.2.5.2 System Description

The UHS consists of four separate, redundant, safety-related divisions. Also included is one dedicated non-safety-related division which is located in division 4. Each safety-related UHS division consists of one mechanical draft cooling tower with two fans, piping, valves, controls and instrumentation. System design parameters are listed on Table 9.2.5-2. The system is shown in Figure 9.2.5-1—Ultimate Heat Sink Piping and Instrumentation Diagram.

A COL applicant that references the U.S. EPR design certification will provide site-specific information for the UHS support systems such as makeup water, blowdown and chemical treatment (to control biofouling).

A COL applicant that references the U.S. EPR design certification will provide a description of materials that will be used for the UHS at their site location, including the basis for determining that the materials being used are appropriate for the site location and for the fluid properties that apply.

The UHS contains isolation valves at the cooling towers to isolate the safety related portions of the system from the non-safety-related basin support systems provided by the COL applicant. The site-specific UHS systems are shown in Figure 9.2.5-2—[[Conceptual Site-Specific UHS Systems]].

9.2.5.3 Component Description

9.2.5.3.1 Mechanical Draft Cooling Towers

The cooling towers are rectangular mechanical-induced draft-type towers. Each tower consists of two cells in a back-to-back arrangement. The two cells of the cooling tower in a particular division share a single cooling tower basin and each cell is capable of transferring fifty percent of the design basis heat loads for one division from the ESWS to the environment under worst-case ambient conditions. The division four cooling tower shares use with the dedicated ESW train and can transfer severe accident (SA) heat loads to the environment under worst-case ambient conditions.

The cooling tower fill design and arrangement maximize contact time between water droplets and air inside the tower. The tower fill spacing is chosen to minimize the buildup of biofilm and provide for ease of cleaning, maintenance, and inspection.

UHS cooling tower fill is constructed of ceramic tile, supported on reinforced concrete beams. Spray piping and nozzles are fabricated of corrosion resistant materials (e.g., stainless steel, bronze). UHS cooling tower internals are seismically designed and supported to withstand a safe shutdown earthquake (SSE). Passive failures of the cooling tower spray or fill systems are considered extremely unlikely due to their materials of construction, supporting systems and Seismic Category I design.

To prevent the entrainment of debris from the UHS cooling tower, each cell of the UHS cooling tower includes a debris screen located between the cooling tower internals and the ESW pump.

To account for potential interference effects of the cooling towers, an inlet wet bulb correction factor is used. As part of addressing Item 2.0-1 of Table 1.8-2, the COL applicant that references the U.S. EPR design certification will evaluate their site-specific conditions of orientation (with respect to wind direction), location, wind velocity, and direction to determine a wet bulb correction factor to account for interference effects.

To account for potential recirculation effects of the cooling towers, an inlet wet bulb correction factor is used. As part of addressing Item 2.0-1 of Table 1.8-2, the COL applicant that references the U.S. EPR design certification will evaluate their site-specific location to determine a wet bulb correlation factor to account for recirculation effects.

Each cooling tower basin is sized to provide for a minimum 72-hour supply of cooling water to the associated ESW division under design basis accident (DBA) conditions assuming loss of normal makeup water capability.

9.2.5.3.2 Piping, Valves, and Fittings

System materials are selected that are suitable to the site location, UHS fluid properties and site installation. System materials that come into contact with one another are chosen to minimize galvanic corrosion. All safety-related piping, valves, and fittings are in accordance with ASME Code Section III, Class 3 (Reference 1).

Inservice testing of valves will be performed as described in Section 3.9.6.3. Leakage rates for boundary isolation valves that require testing are based on ASME OM Code, Subsection ISTC (Reference 2).

9.2.5.3.3 Cooling Tower Basin

The 72-hour basin water volume is the minimum water volume that must be present in a basin to accommodate system water inventory losses experienced in the basin due to ultimate heat sink (UHS) tower operation under the worst case environmental conditions, and with the highest essential service water (ESW) heat load for a 72-hour period, without incurring pump damage during operation.

UHS tower blowdown is automatically secured during the initial 72-hour post-accident period through system instrumentation and control design features, so the only significant system water inventory losses are due to evaporation, tower drift, and valve seat leakage and seepage.

Meteorological conditions resulting in the maximum evaporative and drift loss of water for the UHS over a 72-hour period are presented in Table 9.2.5-3—Design Values for Maximum Evaporation and Drift Loss of Water from the UHS.

Meteorological conditions for the U.S. EPR that result in minimum cooling tower cooling that are the worst combination of controlling parameters (wet bulb and dry bulb), including diurnal variations for the first 24 hours of a DBA LOCA, are presented in Table 9.2.5-4 and do not result in a maximum ESWS supply temperature from the UHS basin exceeding 95°F.

9.2.5.4 System Operation

The safety related ESWS pumps cooling water from the cooling tower basin to supply ESWS loads and back to the mechanical draft cooling tower. The four safety-related divisions of the UHS are powered by Class 1E electrical buses and are emergency powered by the emergency diesel generators (EDG).

The non-safety-related dedicated ESWS pumps cooling water from the division four cooling tower basin to the dedicated system heat load and back to the division four mechanical draft cooling tower during SA and beyond DBAs.

The cooling tower fans are driven with multi-speed drives that are capable of fan operation in the reverse direction. Consistent with vendor recommendations, the fan may be operated in the reverse direction for short periods to minimize ice buildup at the air inlets. Cooling tower fans operating in the reverse direction during normal operation are considered operable at the onset of a design basis accident (DBA). Upon receipt of a safety injection (SI) signal, any fans operating in the reverse direction are secured and brought to a complete stop before re-energizing to operate at full speed in the forward direction. Upon receipt of an SI signal, fans in the operating and standby trains are automatically set to full fan speed to dissipate the maximum heat load to the environment. The cooling tower bypass piping provides a means for diverting ESW return flow directly to the tower basin under low load/low ambient temperature conditions to maintain ESW cold water temperature within established limits and to protect against freezing.

at least 72 hours of water inventory for the DBA, in combination with the worst ambient evaporation conditions, the UHS emergency makeup is not required to start until after 72 hours. At that point, the makeup requirements are diminished. The minimum makeup supply rate is based on the maximum evaporation rate over a 72 hour period post-DBA and considers such losses as drift, seepage and valve seat leakage.

COL applicants that reference the U.S. EPR will verify that the makeup water supply is sufficient for the ambient conditions corresponding to their plant location. Refer to Table 1.8-2, Item number 2.3-10.

9.2.5.6 Inspection and Testing Requirements

Prior to initial plant startup, a comprehensive preoperational test is performed to demonstrate the ability of the ESWS and UHS to supply cooling water as designed under normal and emergency conditions. The UHS is tested as described in Chapter 14.2, Test # 49.

The installation and design of the UHS provides accessibility for the performance of periodic inservice inspection and testing. Periodic inspection and testing of safety-related equipment verifies its structural and leaktight 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 and Section 6.6 outline the inservice testing and inspection requirements. Refer to Section 16.0, Surveillance Requirements (SR) 3.7.19 for surveillance requirements that verify continued operability of the UHS.

9.2.5.7 Instrumentation Applications

Instrumentation is provided in order to control, monitor and maintain the safety-related functions of the UHS. Indications of the process variables measured by the instrumentation are provided to the operator in the main control room.

9.2.5.7.1 System Monitoring

- Cooling tower basin water level.
- Cooling tower water temperature.

9.2.5.7.2 System Alarms

- Cooling tower water temperature low.
- Cooling tower basin water level low.
- Cooling tower basin water level high.

RAI 351 Q 09.02.05-23, Markup Inserts

Insert 1 (U.S. EPR FSAR Tier 2, Section 9.2.5)

Essential service water system (ESWS) and dedicated essential service water system components including some UHS valves and some UHS instrumentation are addressed in Section 9.2.1.

Insert 2 (U.S. EPR FSAR Tier 2, Section 9.2.5.2)

Also parts of the blowdown system, emergency blowdown system and dedicated essential service water system are shown in Figure 9.2.1-1.

Insert 3 (U.S. EPR FSAR Tier 2, Section 9.2.5.3.2)

UHS valve functions are addressed in Section 9.2.1.3.5.

Insert 4 (FSAR Tier 2 Section 9.2.5.4)

The nominal HP of each UHS fan is 250 as indicated in Table 8.3-4 Division 1 Emergency Diesel Generator Nominal Loads, Table 8.3-5 Division 2 Emergency Diesel Generator Nominal Loads, Table 8.3-6 Division 3 Emergency Diesel Generator Nominal Loads, and Table 8.3-7 Division 4 Emergency Diesel Generator Nominal Loads. The ESWS flowrate into the UHS cooling tower is indicated in Table 9.2.5-2. The ESWS flowrate out of the UHS cooling tower basin is indicated as the "normal flowrate of each ESW pump" in Table 9.2.1-1.

Insert **5** (FSAR Tier 2 Section 9.2.5.4)

The bypass has the capability of diverting the full flow to the basin by paired operation of the bypass valve and return header valve.

Insert **6** (U.S. EPR FSAR Tier 2, Section 9.2.5.7)

UHS fan status **and controls** including fan speed selection (low speed, high speed, etc.) and forward or reverse direction are provided to the control room operator.

UHS valve positions are addressed in Section 9.2.1.7.
UHS basin level sensors and temperature sensors are shown on Figure 9.2.1-1, Sheet 1.
UHS basin level alarm summary is addressed in Table 9.2.1-3.

Figure 9.2.5-1—Ultimate Heat Sink Piping and Instrumentation Diagram

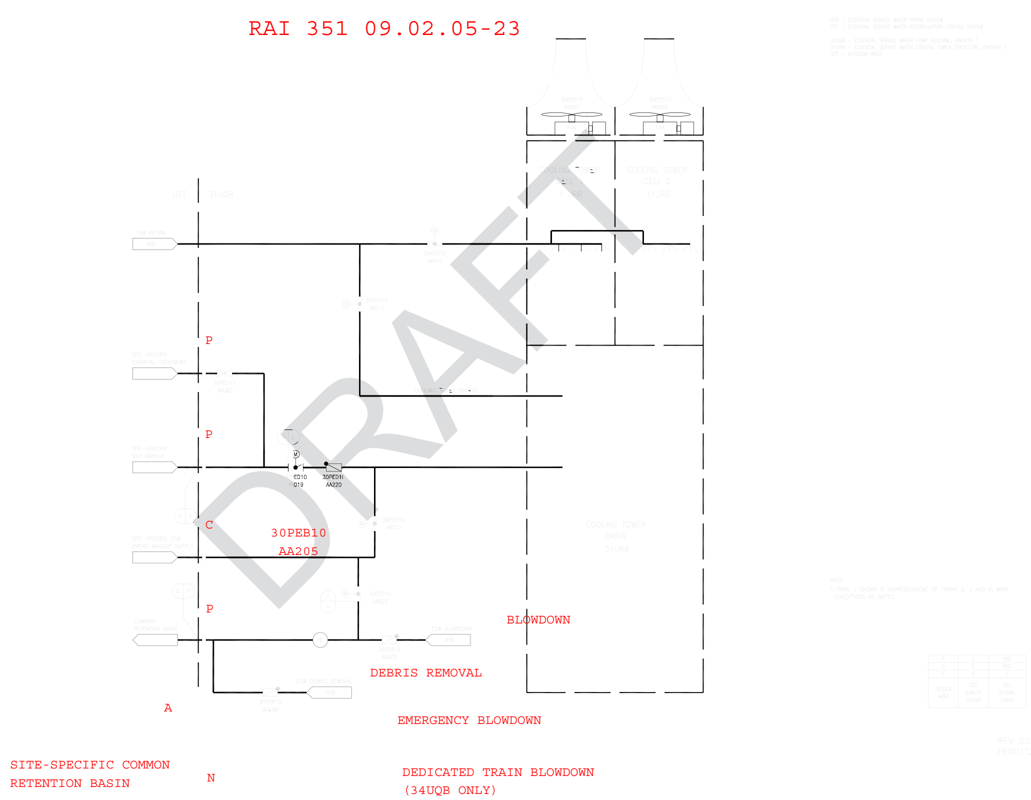
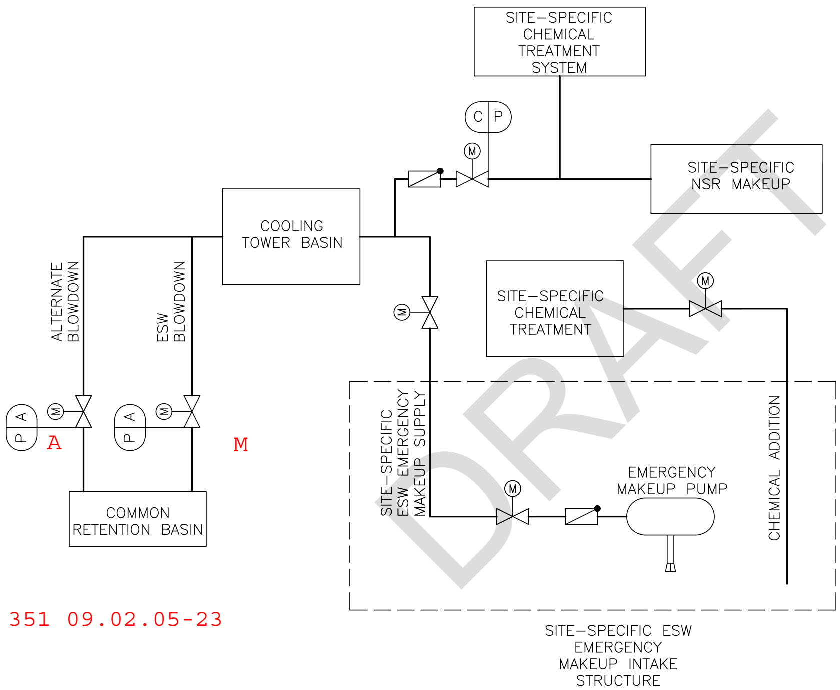


Figure 9.2.5-2—[[Conceptual Site-Specific UHS Systems]]

M
N A M



RAI 351 09.02.05-23

RAI 351 09.02.05-23

NOTE:
CONFIGURATION SHOWN
IS REPRESENTATIVE
FOR TRAINS 1, 2, 3, & 4

P	E	NSC
C	C	I
A	C	I
DESIGN AREA	SSC QUALITY GROUP	SSC SEISMIC CLASS

PED02T2

Next File

Table 3.10-1—List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment Sheet 93 of 195

Name Tag (Equipment Description)	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)
CCW HX Tube Side Thermal Relief Vlv	30PEB40AA192	34UJH05026	M	H	SI	S C/NM	Y (3) Y (5)
CCW HX Inlet Side DP Root Vlv	30PEB40AA306	34UJH10026	M	H	SI	S C/NM	Y (3) Y (5)
CCW HX Outlet Side DP Root Vlv	30PEB40AA307	34UJH10026	M	H	SI	S C/NM	Y (3) Y (5)
ESW Drain Isolation Vlv	30PEB40AA401	34UJH01026	M	H	SI	S C/NM	Y (3) Y (5)
ESW Drain Isolation Vlv	30PEB40AA402	34UJH10026	M	H	SI	S C/NM	Y (3) Y (5)
ESW Drain Isolation Vlv	30PEB40AA403	34UJH05026	M	H	SI	S C/NM	Y (3) Y (5)
ESW Drain Isolation Vlv	30PEB40AA405	34UJH05026	M	H	SI	S C/NM	Y (3) Y (5)
ESW Drain Isolation Vlv	30PEB40AA407	34UJH01026	M	H	SI	S C/NM	Y (3) Y (5)
ESW Drain Isolation Vlv	30PEB40AA408	34UJH01026	M	H	SI	S C/NM	Y (3) Y (5)
CCW HX Tube Side Vent Vlv	30PEB40AA508	34UJH10026	M	H	SI	S C/NM	Y (3) Y (5)
CCW HX Tube Side Vent Vlv	30PEB40AA509	34UJH10026	M	H	SI	S C/NM	Y (3) Y (5)
Orifice Plate	30PEB40BP002	34UJH05026	M	H	SI	S C/NM	Y (3) Y (5)
CCW HX DP Measurement	30PEB40CP004	34UJH05026	M	H	SI	S	Y (5)
CCW HX Outlet Temp Measurement	30PEB40CT002	34UJH05026	M	H	SI	S	Y (5)
SAQ HX DP Measurement	30PEB41CP001	34UQB02001	M	M	SI	S	Y (5)
SAQ HX Outlet Temp Measurement	30PEB41CT001	34UQB02001	M	M	SI	S	Y (5)
CCW HX Outlet Isolation Vlv	30PEB80AA004	34UJH05026	M	H	SI	S C/NM	Y (3) Y (5)
ESW Drain Isolation Vlv	30PEB80AA405	34UJH01026	M	H	SI	S C/NM	Y (3) Y (5)
Safety Chilled Water System (SCWS)							
QKA Cross-Tie Valve, Div 1	30QKA10AA102	31UJK22028	M	M	SI	S C/NM	Y(5)
QKA Cross-Tie Valve, Div 1	30QKA10AA103	31UJK22028	M	M	SI	S C/NM	Y(5)
QK Tank Isol Valve, Div 1	30QKA10AA001	31UJK26029	M	M	SI	S C/NM	Y (5)
QK Pmp #1 Suct Isol Valve, Div 1	30QKA10AA002	31UJK22028	M	M	SI	S C/NM	Y (5)
QK Pmp #1 Disch Check Valve, Div 1	30QKA10AA003	31UJK22028	M	M	SI	S	Y (5)
QK Pmp #1 Disch Isol Valve, Div 1	30QKA10AA004	31UJK22028	M	M	SI	S C/NM	Y (5)
QK Chiller Dnstrm Flow Reg Valve, Div 1	30QKA10AA005	31UJK22028	M	M	SI	S C/NM	Y (5)
QK Chiller Dnstrm Isol Valve, Div 1	30QKA10AA006	31UJK22028	M	M	SI	S C/NM	Y (5)
QKA10AT001 Upstrm Isol Valve, Div 1	30QKA10AA007	31UJK26029	M	M	SI	S C/NM	Y (5)
QKA10AT001 Dnstrm Flow Reg Valve, Div 1	30QKA10AA008	31UJK26029	M	M	SI	S C/NM	Y (5)
QKA10AT001 Dnstrm Isol Valve, Div 1	30QKA10AA009	31UJK26029	M	M	SI	S C/NM	Y (5)
QK QCB Isol Valve, Div 1	30QKA10AA010	31UJK22028	M	M	SI	S C/NM	Y (5)
QK QCB Check Valve, Div 1	30QKA10AA011	31UJK22028	M	M	SI	S	Y (5)
QK Bypass Control Valve-MOV, Div 1	30QKA10AA101	31UJK26029	M	M	ES SI	S C/NM	Y (5)

INSERT

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DRAFT

3.11 Deleted.

3.12 ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 is designed in accordance with ASME Code Section III requirements.

3.13 ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 is installed in accordance with an ASME Code Section III Design Report.

3.14 Pressure boundary welds in ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 are in accordance with ASME Code Section III.

3.15 ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 retains pressure boundary integrity at design pressure.

~~3.16 ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 is installed and inspected in accordance with ASME Code Section III requirements.~~

3.17 Components listed in Table 2.7.11-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.

Insert 1

4.0 I&C Design Features, Displays and Controls

4.1 Displays listed in Table 2.7.11-2— Essential Service Water System Equipment I&C and Electrical Design are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.7.11-2.

4.2 The ESWS equipment controls are provided in the MCR and the RSS as listed in Table 2.7.11-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.7.11-2 responds to the state requested by a test signal.

4.4 If one ESWS pump (30PEB10/20/30/40 AP001) fails during normal operation, a switchover to the other ESWS train is carried out automatically for the entire cooling train and is initiated by the CCWS Switchover sequence.

4.5 A spurious closure of the ESWS pump discharge valve (30PEB10/20/30/40 AA005) results in a switchover to the other ESWS train automatically for the entire cooling train and is initiated by the CCWS Switchover sequence.

4.6 Deleted.

4.7 Deleted.

5.0 Electrical Power Design Features

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.

5.2 Valves listed in Table 2.7.11-2 fail as-is on loss of power.

5.3 Deleted.

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

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.14	Pressure boundary welds in ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 are in accordance with ASME Code Section III.	Inspections of pressure boundary welds verify that welding is performed in accordance with ASME Code Section III requirements.	ASME Code Section III Data Reports exist and conclude that pressure boundary welding for ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 has been performed in accordance with ASME Code Section III.
3.15	ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 retains pressure boundary integrity at design pressure.	Hydrostatic tests will be performed on the as-built system.	For ESWS piping shown as ASME Code Section III on Figure 2.7.11-1, ASME Code Section III Data Reports exist and conclude that hydrostatic test results comply with ASME Code Section III requirements.
3.16	ESWS piping shown as ASME Code Section III on Figure 2.7.11-1 is installed and inspected in accordance with ASME Code Section III requirements.	An inspection of the as-built piping will be performed.	For ESWS piping shown as ASME Code Section III on Figure 2.7.11-1, N–5 Data Reports exist and conclude that installation and inspection are in accordance with ASME Code Section III requirements.
3.17	Components listed in Table 2.7.11-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.	An inspection of ASME Code Data Reports will be performed.	ASME Code Section III N-5 Data Reports exist and conclude that components listed as ASME Code Section III in Table 2.7.11-1 have been installed in accordance with ASME Code Section III requirements.
4.1	Displays exist or can be retrieved in the MCR and the RSS as identified in Table 2.7.11-2.	Tests will be performed for the retrievability of the displays in the MCR or the RSS as listed in Table 2.7.11-2.	a. The displays listed in Table 2.7.11-2 as being retrieved in the MCR can be retrieved in the MCR. b. The displays listed in Table 2.7.11-2 as being retrieved in the RSS can be retrieved in the RSS.

Insert 2

DRAFT

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UHS cooling tower fill is constructed of ceramic tile, supported on reinforced concrete beams. Spray piping and nozzles are fabricated of corrosion resistant materials (e.g., stainless steel, bronze). UHS cooling tower internals are seismically designed and supported to withstand a safe shutdown earthquake (SSE). Passive failures of the cooling tower spray or fill systems are considered extremely unlikely due to their materials of construction, supporting systems and Seismic Category I design.

Insert 3 →

To prevent the entrainment of debris from the UHS cooling tower, each cell of the UHS cooling tower includes a debris screen located between the cooling tower internals and the ESW pump.

To account for potential interference effects of the cooling towers, an inlet wet bulb correction factor is used. As part of addressing Item 2.0-1 of Table 1.8-2, the COL applicant that references the U.S. EPR design certification will evaluate their site-specific conditions of orientation (with respect to wind direction), location, wind velocity, and direction to determine a wet bulb correction factor to account for interference effects.

To account for potential recirculation effects of the cooling towers, an inlet wet bulb correction factor is used. As part of addressing Item 2.0-1 of Table 1.8-2, the COL applicant that references the U.S. EPR design certification will evaluate their site-specific location to determine a wet bulb correlation factor to account for recirculation effects.

Each cooling tower basin is sized to provide for a minimum 72-hour supply of cooling water to the associated ESW division under design basis accident (DBA) conditions assuming loss of normal makeup water capability.

9.2.5.3.2 Piping, Valves, and Fittings

System materials are selected that are suitable to the site location, UHS fluid properties and site installation. System materials that come into contact with one another are chosen to minimize galvanic corrosion. All safety-related piping, valves, and fittings are in accordance with ASME Code Section III, Class 3 (Reference 1).

Inservice testing of valves will be performed as described in Section 3.9.6.3. Leakage rates for boundary isolation valves that require testing are based on ASME OM Code, Subsection ISTC (Reference 2).

9.2.5.3.3 Cooling Tower Basin

The 72-hour basin water volume is the minimum water volume that must be present in a basin to accommodate system water inventory losses experienced in the basin due to ultimate heat sink (UHS) tower operation under the worst case environmental

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RAI 351 Question 09.02.05-28 Inserts

U.S. EPR FSAR Tier 1, Section 2.7.11:

INSERT 1

3.X The UHS fans are **able to** ~~capable of~~ withstand~~ing~~ the effects of tornado including differential pressure effects, overspeed, and the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard).

U.S. EPR FSAR Tier 1, Table 2.7.11-3:

INSERT 2

3.X	The UHS fans are **able to** ~~capable of~~ withstand~~ing~~ the effects of tornado including differential pressure effects, overspeed, and the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard).	a. Analyses will be performed to demonstrate that the UHS fans are **able to**~~capable of~~ withstand~~ing~~ the effects of tornado including differential pressure effects, overspeed, and the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard).	a. A report exists and concludes that the UHS fans are **able to** ~~capable of~~ withstand~~ing~~ the effects of tornado including differential pressure effects, overspeed, and the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard). ~~Methods to be used to protect the UHS fans will be identified and described in the report.~~
		b. Inspections will be performed of the UHS fans and other equipment located within the cooling tower structure to verify that the components are installed as specified on the construction drawings and deviations have been reconciled to the tornado analysis report.	b. Inspection reports exist and conclude that the UHS fans and other equipment located within the cooling tower structure are installed as specified on the construction drawings and deviations have been reconciled to the tornado analysis report.

U.S. EPR FSAR Tier 2, Section 9.2.5.3.1:

INSERT 3

The UHS fans are designed to withstand~~ing~~ the effects of tornado including differential pressure effects, overspeed, and the impact of differential pressure effects on other equipment located within the cooling tower structure (e.g., capability to function, potential to become missile/debris hazard). **The method to be used to protect the UHS fans from overspeed due to tornado effects will be a brake system or the resistance of the fan gear reducer.**

RAI 351, Q 09.02.05-25, Insert _, FSAR Table 3.10-1

UHS Cooling Tower Fan	30PED10AN001	31URB03001	M	M	ES SI	S SI C/NM	Y(5)
UHS Cooling Tower Fan	30PED10AN002	31URB03002	M	M	ES SI	S SI C/NM	Y(5)
UHS Cooling Tower Fan	30PED20AN001	32URB03001	M	M	ES SI	S SI C/NM	Y(5)
UHS Cooling Tower Fan	30PED20AN002	32URB03002	M	M	ES SI	S SI C/NM	Y(5)
UHS Cooling Tower Fan	30PED30AN001	33URB03001	M	M	ES SI	S SI C/NM	Y(5)
UHS Cooling Tower Fan	30PED30AN002	33URB03002	M	M	ES SI	S SI C/NM	Y(5)
UHS Cooling Tower Fan	30PED40AN001	34URB03001	M	M	ES SI	S SI C/NM	Y(5)
UHS Cooling Tower Fan	30PED40AN002	34URB03002	M	M	ES SI	S SI C/NM	Y(5)

Question 09.02.05-32:

Follow-up to RAI 176, Question 14.2.94:

Final Safety Analysis Report (FSAR) Tier 2 Section 14.2.12.5.8 describes initial test for the UHS (Test #049). The NRC staff identified the following issues with test abstract #049:

1. Section 14.2.12.5.8.4.1, "Data Required," includes "UHS makeup, blowdown air flowrates." Blowdown air flowrates are not described in the FSAR. Please clarify what is meant by blowdown air flowrates.
2. The following design features and functions identified in Section 9.2.5 of the EPR FSAR are not included in test abstract #049. Please revise the abstract to include the following tests or justify their exclusion:
    a. Confirmation that "normal and emergency" makeup flowrate meets design flow
    b. Confirmation that chemical injection meets design flow
    c. Confirmation that cooling tower fan performance at various speeds (including the reverse direction for cold weather deicing purposes) is satisfactory
    d. Confirmation that the cooling tower flow bypass functions properly (also for cold weather protection)

Based on the staff's review of the applicant's response to RAI 14.2.94 (ID1833/7333) AREVA #176, the following were determined as unresolved and needed further clarification/resolution by the applicant.

In Item 2.c, the staff requested that the applicant expand FSAR Tier 2 Chapter 14.2, Pre Operational Test 049, Paragraph 3.1, to confirm the capability of the cooling tower fans to operate in all speeds, including the reverse direction. This will demonstrate fan functionality in all operating modes prior to plant operation, and Technical Specification Surveillance 3.7.19.3 will provide continued assurance of fan operability after the initial test program has been completed. In response to this RAI, Paragraph 3.1.2 was added to Test #049 to verify fan operation in reverse, but fan testing to confirm functionality in the forward speeds was not included. The applicant needs to address functionality testing in the forward speeds in Test #049.

Additionally, based upon further review, the staff also determined that confirmation of cooling tower performance during the power ascension test program is necessary. A substantial heat load is needed to adequately confirm that the cooling tower heat removal and water usage rates satisfy design basis considerations. Consequently, UHS cooling tower performance testing should be completed during the power ascension test program. Design-basis conditions should be simulated to the extent possible and the actual cooling tower water usage and heat removal rates should be monitored, extrapolated, and analyzed as necessary to confirm satisfactory performance. This will also serve to establish a benchmark that can be used for periodically assessing performance and determining when actions are needed to address degraded conditions. Therefore, a test procedure needs to be developed and included in FSAR Tier 2, Chapter 14 for testing performance of the UHS cooling towers during the power ascension test program consistent with the guidance provided by Regulatory Guide 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants," Appendix A, Items 1.f and 5.x.

Response to Question 09.02.05-32:

New Item (3)

Tier 2 Section 14.2.12.5.5 will be revised to include performance testing of the UHS during a normal cooldown condition in hot functional testing, as described in Insert 1. The performance test would place one train of RHR into service when the RCS temperature is within the upper RHR operating band. Each train of the cooling chain, including the UHS, would be employed and the thermal-hydraulic performance would be monitored. Cooling chain performance would be determined by extrapolating test data using design data. Conducting the performance test during a cooldown in hot functional testing is recommend because the most significant heat load on the UHS can be provided during this time.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 14.2.12.5.5 will be revised as described in the response and indicated on the enclosed markup.

Insert 1

1.4 To demonstrate the ability of the CCWS in conjunction with the RHR system, ESW system and the UHS to perform a plant cooldown during hot functional testing. Testing will be performed on each safety related cooling chain trains.

Insert 2

2.5 A thermal hydraulic model of the safety related cooling chain (RHR, CCW, ESW, and UHS) is available to analyze data from the cooldown. The data will have to be extrapolated to design conditions in order to determine system performance.

Insert 3

3.37 [Added in response to RAI 406 Question 114]

3.38 [Added in response to RAI 406 Question 114]

3.39 Ensure that all available loads are placed on the safety related cooling chain train that is to be tested.

3.40 Perform a cooldown test of the safety related cooling chain by placing the RHR system into service at the upper limit of operation.

3.41 Perform a cooldown test while operating all four RCPs and minimizing steam generator cooling.

3.42 Ensure UHS make-up water flow and blowdown flows are isolated.

3.43 Collect the following cooldown data:

3.43.2 RHR heat exchanger.

- RHR flow through the heat exchanger.
- CCW flow through the heat exchanger.
- Inlet and outlet RHR temperature.
- Inlet and outlet CCW temperature on the RHR heat exchanger.
- RHR pressure
- CCW pressure

3.43.3 CCW heat exchanger.

- CCW flow through the heat exchanger.
- ESW flow through the heat exchanger.
- Inlet and outlet CCW temperature.
- Inlet and outlet ESW temperature on the CCW heat exchanger.
- CCW pressure
- ESW pressure

3.43.4 Essential service water.

- Essential service water flow to the UHS tower.
- Essential service water flow from the UHS basin.
- Inlet and outlet essential service water temperature at the ultimate heat sink.

3.43.5 Ultimate heat sink.

- Fan power.
- Inlet wet bulb and dry bulb air temperature for the ultimate heat sink.
- Barometric Pressure.

3.44 Determine cooling chain performance by extrapolating available data using design data.Analyze the cooldown data using the thermal-hydraulic model at multiple operating points.

3.45 Perform step 3.39 through 3.44 for each cooling chain train.

Insert 4

4.9 RHR, CCW, ESW, and UHS thermal-hydraulic performance data.

Insert 5

5.1.9 Verify the ability of the CCWS in conjunction with the RHRS, ESWS, and UHS to perform a plant cooldown during hot functional testing.

2.2 Potable and sanitary water systems instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support system required for operation of the potable and sanitary water systems are complete and functional.

2.4 Test instrumentation available and calibrated.

2.5 The potable and sanitary water systems suction supplies are being maintained at the water level (pressure) specified in the design documents.

3.0 TEST METHOD

3.1 Verify potable and sanitary water systems measured pump and system flow meet design specifications.

3.2 Verify that potable and sanitary water systems interlocks and protective features perform as designed.

4.0 DATA REQUIRED

4.1 Pump operating data.

4.2 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The potable and sanitary water systems meet design requirements (refer to Section 9.2.4):

5.1.1 System flow is within design limits.

5.1.2 Supplied water meets design requirements.

14.2.12.5.5 Component Cooling Water System (Test #046)

1.0 OBJECTIVE

1.1 To demonstrate the capability of the CCWS to provide treated cooling water under the following conditions:

1.1.1 Normal unit operation.

1.1.2 During unit cooldown.

1.1.3 During refueling.

1.1.4 During an emergency situation.

1.2 To demonstrate that system response to a simulated ESF actuation signal is as designed.

1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

1.4 To demonstrate the CCWS is adequately designed and constructed to prevent water hammer.

2.0 PREREQUISITES

2.1 Construction activities on the CCWS have been completed.

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

2.3 Test instrumentation is available and calibrated.

2.4 Plant systems required to support testing are functional, or temporary systems are installed and functional.

3.0 TEST METHOD

3.1 Demonstrate that operation of the surge tanks and their controls is within design limits.

3.2 Demonstrate that system and component flow paths, flow rates, and pressure drops including head versus flow verification for the CCW pumps is within design limits.

3.2.1 Verify that pump starts/stops, valve realignments resulting from automatic switchover, RCP thermal barrier transfer, automatic valve closures and pump trips occur without introducingObserve the system during operation for the following water hammer indications:

- Noise.
- Pipe movement.
- Pipe support or restraint damage.
- Leakage.
- Damaged valves or equipment.
- Pressure spikes or waves.

3.3 Perform a pump head versus flow verification for CCW pumps.

3.3.1 $NPSH_a \geq NPSH_R$.

3.3.2 Starting time (motor start time and time to reach rated flow).

3.4 Verify the stroke closure time of the CCWS switchover valves.

3.5 Verify that the start of a CCWS pump generates a starting of the corresponding ESWS train.

3.6 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.7 Observe response of power-operated valves upon loss of motive power (refer to Section 9.2.2 for anticipated response).

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

3.9 Verify pump control from the PICS.

3.10 Demonstrate the ability of the CCWS in conjunction with the RHRS and essential service water system to perform a plant cooldown during HFT.

3.11 Verify that the RCP thermal barriers can be supplied by either the 1.b or 2.b common header. Demonstrate that the supply can be realigned with the RCPs operating during HFT.

3.12 Verify that the fire protection makeup to the CCW surge tank meets design flow rates.

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

3.14 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS common 1.b ~~Emergency~~Automatic Backup Switchover function.

3.14.1 Initiate a failure of CCWS Train 1 by simulating a signal for CCWS Train 1 discharge pressure less than or equal to MIN1. Verify the following actions occur:

- CCWS Train 1 common 1.b supply and return switchover valves close.
- CCWS Train 1 LHSI heat exchanger isolation valve opens.
- CCWS Train 2 common 1.b supply and return switchover valves open.
- CCWS Train 2 pump starts.
- RCP thermal barrier flow returns to normal.

3.14.2 Initiate a failure of CCWS Train 1 by simulating a signal for loss of ESWS Train 1. Verify the following actions occur:

- CCWS Train 1 common 1.b supply and return switchover valves close.
- CCWS Train 1 LHSI heat exchanger isolation valve opens.
- CCWS Train 2 common 1.b supply and return switchover valves open.
- CCWS Train 2 pump starts.
- RCP thermal barrier flow returns to normal.

3.14.3 Initiate a failure of CCWS Train 1 by simulating a signal for main train (flow through CCW pump and heat exchanger, with or without flow through common headers) flow rate less than or equal to MIN1. Verify the following actions occur:

- CCWS Train 1 common 1.b supply and return switchover valves close.
- CCWS Train 1 LHSI heat exchanger isolation valve opens.

- CCWS Train 2 common 1.b supply and return switchover valves open.
- CCWS Train 2 pump starts.
- RCP thermal barrier flow returns to normal.

3.15 Perform step 3.14 for CCWS Trains 2, 3, and 4 to verify appropriate responses.

3.16 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Emergency Temperature Control function by simulating two out of three Train 1 temperature sensors greater than MAX1. Verify the following action occurs:

- CCWS Train 1 heat exchanger bypass valve closes until MAX1 is cleared (or the valve is fully closed).

3.17 Perform step 3.16 for CCWS Trains 2, 3, and 4 to verify appropriate responses.

3.18 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Emergency Leak Detection function.

3.18.1 Simulate a CCWS Train 1 surge tank level signal less than or equal to MIN2 and simulate a flow mismatch between the inlet and outlet of the common 1.b header (~~main common user group~~non-safety related branches). Verify the following actions occur:

- KAB80 AA015/016/019~~CCWS common 1.b non-safety users isolation~~ valves close.
- Normal and Automatic Switchover functions are inhibited~~CCWS common 1.b supply outer RB isolation valve closes~~.

3.18.2 Simulate a CCWS Train 1 surge tank level signal less than or equal to MIN3. Verify the following actions occur:

- CCWS Train 1 common 1.a supply and return switchover valves close.
- CCWS Train 1 common 1.b supply and return switchover valves close.

3.18.3 Simulate a CCWS Train 1 surge tank level signal less than or equal to MIN4. Verify the following actions occur:

- DWDS supply isolation valve closes.
- CCWS common 1.b Automatic~~Emergency~~ Backup Switchover function is enabled.
- CCWS Train 1 pump trips and CCWS Train 2 pump automatically starts~~CCWS Emergency Temperature Control function is enabled~~.

3.19 Perform step 3.18 for CCWS Trains 2, 3, and 4 to verify appropriate responses. For common 2.b testing with Trains 3 and 4 valves KAB50 AA001/004/006 close.

3.20 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Actuation from Safety Injection function by simulating a safety injection signal to CCWS. Verify the following actions occur:

- CCWS Train 1/2/3/4 pumps start automatically (if not previously running).
- CCWS Train 1/2/3/4 LHSI heat exchanger isolation valves KAA12/22/32/42 AA005 open.
- Isolation valves for non-safety-related users outside the Reactor Building (KAB50 AA001/004/006 and KAB80 AA015/016/019) closeCCWS common 2 non-safety users supply isolation valve closes.
- LHSI pump seal cooler isolation valves (KAA22/32 AA013) openCCWS common 2 non-safety users upstream and downstream isolation valves close.
- CCWS common 1.b NAB non-safety users isolation valves close.

3.21 Perform step 3.20 for CCWS Trains 2, 3 and 4 to verify appropriate responses.

3.22 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Operation from Stage 1 Containment Isolation signal and CCWS Operation from Stage 2 Containment Isolation signal functions.

3.22.1 Simulate a containment stage 1 isolation signal to CCWS. Verify the following actions occur:

- CCWS containment isolation valves KAB40 AA001/006/012 closeCCWS common 1 supply outer containment isolation valve closes.
- CCWS common 1 return inner and outer containment isolation valves close.

3.22.2 Simulate a containment stage 2 isolation signal to CCWS. Verify the following actions occur:

- CCWS containment isolation valves KAB60/70 AA013/018/019 closeCCWS common 1 safety users supply outer containment isolation valve closes.
- CCWS common 1 safety users return inner and outer containment isolation valves close.
- CCWS common 2 safety users supply outer containment isolation valve closes.
- CCWS common 2 safety users return inner and outer containment isolation valves close.

3.23 Perform step 3.22 for CCWS Trains 2, 3, and 4 to verify appropriate responses.

3.24 Verify that CCWS Train 1 is supplying the common 1.a header (fuel pool cooling and safety injection loads) and the common 1.b header (main common user group) then perform test of CCWS Response to a LOOP function by simulating a loss of offsite power to CCWS. Verify the following actions occur:

- CCWS common 2 safety users return inner and outer containment isolation valves close.
- CCWS Train 1 starts upon receipt of a Protection System signal.

3.25 Perform step 3.24 for CCWS Trains 2, 3, and 4 to verify appropriate responses.

3.26 Verify that CCWS Train 1 is supplying the common 1.a header (fuel pool cooling and safety injection loads) and the common 1.b header (main common user group) then perform test of CCWS Switchover Valve Interlock function. Verify the following groupings of valves cannot be simultaneously opened to prohibit more than one train from being connected to a common header:

- KAA10 AA033/032 with KAA20 AA033/32.CCWS Train 1 common 1.a switchover valves with Train 2 common 1.a switchover valves
- KAA30 AA033/032 with KAA40 AA033/32.CCWS Train 3 common 2.a switchover valves with Train 4 common 2.a switchover valves
- KAA10 AA006/010 with KAA20 AA006/010.CCWS Train 1 common 1.b switchover valves with Train 2 common 1.b switchover valves
- KAA30 AA006/010 with KAA40 AA006/010.CCWS Train 3 common 2.b switchover valves with Train 4 common 2.b switchover valves

3.27 Verify that CCWS Train 1 or 2 is supplying the common 1.b header (main common user group), then perform test of CCWS RCP Thermal Barrier Containment Isolation Valve Interlock function. Verify the following action occurs:

- KAB30 AA049/051/052 must be closed prior to opening KAB30 AA053/055/056 and vice versaCCWS common Train 1.b and 2.b can not be placed into service at the same time.

3.28 Perform step 3.27 for CCWS Train 3 or 4 supplying common 2.b header to verify appropriate responses.

3.29 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Switchover Valve Leakage or Failure function by simulating CCWS Train 1 surge tank level less than MIN3 and CCWS surge tank 2 level greater than MAX2. Verify the following actions occur:

- CCWS Train 1 common 1.a supply and return switchover valves close.
- CCWS Train 1 common 1.b supply and return switchover valves close.

3.30 Perform step 3.29 for CCWS Train 2 supplying common 2.b header to verify appropriate responses.

3.31 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Surge Tank Makeup function. Verify the following action occurs:

- DWDS supply isolation valve responds to CCWS surge tank level changes.

3.32 Perform step 3.31 for CCWS Trains 2, 3, and 4 to verify appropriate responses.

3.33 Verify that CCWS Train 1 is supplying the common 1.b header (main common user group), then perform test of CCWS Temperature Control function.

3.33.1 Simulate two of three CCWS Train 1 temperature sensors less than MIN1. Verify that the Train 1 heat exchanger bypass valve opens by 10 percent of its 0-100 percent range at 1 minute intervals until 2 of 3 temperature measurements are greater than MIN1, or the valve is fully open.

3.33.2 Simulate two out of three CCWS Train 1 temperature sensors greater than MAX1. Verify that the Train 1 heat exchanger bypass valve closes by 10 percent of its 0-100 percent range at 1 minute intervals until 2 of 3 temperature measurements are less than MAX1, or the valve is fully closed.

3.34 Perform step 3.33 for CCWS Trains 2, 3, and 4 to verify appropriate responses~~Perform Steps 3.14 through 3.24 for CCWS Trains 2, 3, and 4 to verify appropriate responses~~.

3.35 Verify that CCWS common 1.b header is supplying RCP thermal barrier cooling, then perform test of RCP thermal barrier isolation function.

3.35.1 Simulate high flow above threshold value on the return of RCP1 thermal barrier. Verify that RCP1 thermal barrier isolation valves close.

3.35.2 Simulate high pressure above threshold value on the return of RCP1 thermal barrier. Verify that RCP1 thermal barrier isolation valves close.

3.35.3 Perform steps 3.35.1 and 3.35.2 for RCP 2, 3, and 4 thermal barriers.

3.36 Perform step 3.35 for common 2.b header supplying RCP thermal barrier cooling to verify appropriate responses.

4.0 DATA REQUIRED

4.1 Record pump head versus flow and operating data for each pump.

4.2 Flow balancing data including flow to each component and throttle valve positions.

4.3 Setpoints of alarms interlocks and controls.

4.4 Valve performance data, where required.

4.5 Valve position indication.

4.6 Position response of valves to loss of motive power.

4.7 Temperature data during cooldown.

4.8 Response of CCW System to SIAS, CIAS, surge tank level signal, and CCW header differential flow signal.

5.0 ACCEPTANCE CRITERIA

5.1 The CCWS meets design requirements (refer to Section 9.2.2):

5.1.1 Operation of the surge tanks and their controls is within design limits.

5.1.2 System and component flow paths, flow rates, and pressure drops including head versus flow verification for the CCW pumps is within design limits.

5.1.3 Pump head versus flow verification for CCW pumps is within design limits.

5.1.4 Response to safety-related simulated signals meets design requirements.

5.1.5 Non-safety-related headers and RCP headers are isolated on simulated signals.

5.1.6 System valves meet design requirements.

5.1.7 Alarms, interlocks, indicating instruments, and status lights meet design requirements.

5.1.8 Verify pump control from the PICS.

5.1.9 Verify the ability of the CCWS in conjunction with the RHRS and essential service water system (ESWS) to perform a plant cooldown during HFT.

5.1.10 Verify none of the following water hammer indications are present for all operational tests (3.14 through 3.36):

- Noise.
- Pipe movement.
- Pipe support or restraint damage.
- Leakage.
- Damaged valves or equipment.
- Pressure spikes or waves.

Question 09.02.05-23:

Follow-up to RAI 175, Question 9.2.5-05:

Standard Review Plan (SRP) 9.2.5 Section III, paragraph 1 endorses confirmation of the overall arrangement of the ultimate heat sink (UHS). The description and piping and instrumentation diagram (P&IDs) are incomplete or inaccurate and the Final Safety Analysis Report (FSAR) needs to be revised to address the following considerations:

a. Pipe sizes are not shown on the P&ID (Figure 9.2.5-1, “Ultimate Heat Sink Piping and Instrumentation Diagram”), and the system description in Section 9.2.5 does not explain the criteria that were used in establishing the appropriate pipe sizes (such as limiting flow velocities).

b. The system description in Section 9.2.5 does not provide design details such as system operating temperatures, pressures, fan speeds, and flow rates for all operating modes and alignments.

c. Figure 9.2.5-1 does not show the location of indications (e.g., local, remote panel, control room), and identify the instruments that provide input to a process computer and/or have alarm and automatic actuation functions.

d. Figure 9.2.5-1 does not show identify the normal valve positions are, identify the valves that are locked in position, and identify the valves with automatic functions; and these design features are not described in Section 9.2.5.

e. Figure 9.2.5-1 shows the UHS bypass but flow rates are not provided for low load/low ambient temperature conditions to maintain essential service water (ESW) cold water temperature within established limits.

f. The UHS fan alarms are not discussed in the FSAR.

g. Figure 9.2.5-1 does not show the cooling tower basin instruments (level and temperature).

Based on the staff’s review of the applicant's response to RAI 9.2.5-05 (ID1817/6798) AREVA #175, Supplement 1, the following were determined as unresolved and needed further clarification/resolution by the applicant.

The applicant's response for Items (d) and (g) refer to Tier 2 FSAR Section 9.2.1 for information pertaining to certain UHS valves and instruments. The description and piping and instrumentation diagram for the UHS should show those items that are part of the UHS and Tier 2 FSAR Section 9.2.5 should address these items accordingly. Likewise, Tier 2 FSAR Section 9.2.1 should describe and address those items that are designated as part of the essential service water system. Consequently, Tier 2 FSAR Sections 9.2.1 and 9.2.5 and associated figures need to be revised to clearly indicate which items are included within their respective scopes and to describe those items accordingly. The following additional items are also related to this issue:

a. Dedicated and emergency ESWS blowdown are not shown on FSAR Tier 2 Figure 9.2.5-1 as UHS support systems

b. Interface flange connections are not shown on FSAR Tier 2 Figure 9.2.5-1 for the dedicated and emergency ESWS blowdown support system.

c. FSAR Tier 2 Figure 9.2.1-1, Sheet 3, and Figure 9.2.5-1 both show that the chemical treatment system is only connected to the normal makeup system and not to the safety-related emergency makeup system. This appears to be in error and the applicant should correct or explain.

The information provided in response to Items (d) and (e) needs to be reflected in Tier 2 FSAR Sections 9.2.1 and/or 9.2.5 as appropriate.

The responses for Items (a), (b), (c), and (f) indicate that many of the design details will be developed later in the design process. 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 09.02.05-23:

Concerning items d and g, references will be added to U.S. EPR FSAR, Tier 2, Section 9.2.5 to Section 9.2.1 where information on UHS valves and instrumentation is located.

The following U.S. EPR FSAR Tier 2 figures are revised for clarification.

Figure 9.2.1.1, Sheets 1, 3 and 4.

Figure 9.2.5-1

Figure 9.2.5-2

UHS Makeup Water Test Isolation Valves 30PED10/20/30/40AA023 and the associated cross-connect line are removed from U.S. EPR FSAR Tier 1, Figure 2.7.11-1 Sheets 1-4 and Sheets 6-9 and U.S. EPR FSAR Tier 2, Figure 9.2.5-1. Valves 30PED10/20/30/40AA023 are removed from U.S. EPR FSAR Tier 2, Table 3.9-6-2. They are part of the conceptual site-specific UHS support systems as indicated in the attached markup of U.S. EPR FSAR Tier 2, Figure 9.2.5-2. The conceptual function for the valve is each valve is manually opened during surveillance testing of its UHS division.

a. See information above concerning the locations in the FSAR for UHS **valves and instrumentation information and clarification of FSAR figures.** The emergency ESWS blowdown system is shown on U.S. EPR FSAR Tier 2, Figure 9.2.1-1, Sheet 1, Essential Service Water System Piping & Instrumentation Diagram. The dedicated ESWS blowdown system is shown on U.S. EPR FSAR Tier 2, Figure 9.2.1-1, Sheet 4. A conceptual design for the emergency ESWS blowdown system is indicated in the response to RAI 175 Supplement 2, Question 09.02.05-20, Figure 9.2.5-2 [[Conceptual Site-Specific UHS Systems]]. Figure 9.2.5-2 will be revised to show the dedicated blowdown system and the change in classification of emergency ESWS blowdown piping indicated in the response to RAI 351 Question 09.02.05-22.

b. Refer to response to RAI 351, Question 09.02.05-22, markup of U.S. EPR FSAR, Figure 9.2.1-1, Sheet 1 for additional information concerning the emergency ESWS blowdown system. U.S. EPR FSAR Tier 2, Figure 9.2.1-1 Sheet 4 will be revised to show the offpage connection for the ESWS dedicated blowdown system to Tier 2 Figure 9.2.5-1 and the site-specific interface.

c. This is not in error. The chemical treatment system is non-safety site specific system that provides water treatment chemicals to the normal make up water system. The chemical treatment system is not needed during emergency operation. Details related to chemical treatment for the safety-related emergency makeup system are the responsibility of the COL applicant as indicated in Tier 2 Figure 9.2.5-2.

Item a

For criteria for pipe line sizing for UHS refer to response to RAI 351 Question 09.02.05-30 Item (f) (1).

Item b

Refer to the response to RAI 351 Question 09.02.05-31 e and f and the markup of U.S EPR FSAR Tier 1, Table 2.7.11-3 that includes ITAAC 7.7 and 7.8. ITAAC 7.7 and 7.8 will include or envelope the UHS design details such as system operating temperatures, pressures, fan speeds, and flow rates for all operating modes and alignments. The nominal HP of each UHS fan is 250 as indicated in U.S. EPR FSAR Tier 2, Table 8.3-4 Division 1 Emergency Diesel Generator Nominal Loads, Table 8.3-5 Division 2 Emergency Diesel Generator Nominal Loads, Table 8.3-6 Division 3 Emergency Diesel Generator Nominal Loads, and Table 8.3-7 Division 4 Emergency Diesel Generator Nominal Loads. The ESWS flowrate into the UHS cooling tower is indicated in U.S. EPR FSAR Tier 2, Table 9.2.5-2. The ESWS flowrate out of the UHS cooling tower basin is indicated as the “normal flowrate of each ESW pump” in U.S. EPR FSAR Tier 2, Table 9.2.1-1.

Item c

References will be added to U.S. EPR FSAR, Tier 2, Section 9.2.5.7 to Section 9.2.1 where information on UHS instrumentation is located.

Item d

Concerning item d, refer to response to RAI 345, Question 09.02.01-42a, which includes information on UHS valves functions and valve positions.

Item e

Concerning item e, UHS bypass flow rates for low load/low ambient temperature conditions to maintain essential service water (ESW) cold water temperature within established limits, the

U.S. EPR FSAR Tier 2, Section 9.2.5.4 will be revised to indicate that the bypass has the capability of diverting the full flow to the basin as indicated in the response to RAI 175 Supplement 1, Question 09.02.05-5e. Refer to Item d above. The associated valve functions are described in U.S. EPR FSAR Tier 2, Section 9.2.1.3.5.

Item f

U.S EPR FSAR Tier 2, Section 9.2.5.7 will be revised to indicate that UHS fan status and controls including fan speed selection (low speed, high speed, etc.) and forward or reverse direction are provided to the control room operator.

Item g

Refer to above first paragraph in the response.

FSAR Impact:

The following parts of the U.S. EPR FSAR will be revised as described in the response and indicated in the attached markup.

Tier 1, Figure 2.7.11-1, Sheets 1-4 and 6-9.

Tier 2, Table 3.9.6-2

Tier 2, Figure 9.2.1-1, Sheets 1, 3 and 4

Tier 2, Section 9.2.5

Tier 2, Section 9.2.5.2

Tier 2, Section 9.2.5.3.2

Tier 2, Section 9.2.5.4

Tier 2, Section 9.2.5.7

Tier 2, Figure 9.2.5-1

Tier 2, Figure 9.2.5-2

Question 09.02.05-25:

Follow-up to RAI 175, Question 9.2.5-07:

General Design Criteria (GDC) 44 requires that "A system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided." The staff noted the proper understanding of the function and operation of the ESWS ultimate heat sink (UHS) cooling tower fans is necessary for compliance with GDC 44 since these components support the overall system safety functions including accident mitigation. Accordingly the following questions are provided:

Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.5.4 states that the cooling tower fans have multi-speed drives that have the capability of operating in the reverse directions for short periods in cold weather for deicing purposes. The staff identified the following questions relative to these important components:

1. Describe the seismic class and electrical class (1E) of the fans and fan motors in Section 9.2.5.
2. Provide a description in Section 9.2.5 of bounding fan mechanical properties (e.g. capacity, speeds etc).
3. Confirm that the associated ESWS train is considered inoperable when the fans are operated in the reverse direction for deicing purposes. Confirm that reverse direction operation is bounded by Allowable Outage Times in the Technical Specifications (TS).
4. Since the fans receive an automatic signal in response to an accident, confirm that the TS will bound the scenario of an accident occurring during reverse fan operation.
5. Provide in either FSAR Section 9.2.1 or 9.2.5 a description of UHS/ESW cooling tower fan automatic start in response to an accident.
6. Describe the selection meth for the proper fan speed during normal/ accident conditions (automatic process or a manual operator action).
7. Describe the speed at which fans on a standby train will be started in response to an accident signal and provide the normal speed for a fan that was previously in operation.
8. Describe the indications and controls for the fans provided to the operator in the main control room (MCR).
9. With respect to the non safety related (NSR) dedicated train; describe the emergency power source for the division four cooling tower fans (used by the dedicated train) during severe accidents. Similarly, describe the emergency power source for the dedicated train filter and motor operated valves. This should be identified in the FSAR.

Based on the staff's review of the applicant's response to RAI 9.2.5-07 (ID1817/6801) AREVA #175, Supplement 2, the following were determined as unresolved and needed further clarification/resolution by the applicant.

With regard to Items 1 and 3, the information that was provided needs to be reflected in Tiers 1 and 2 of the FSAR as appropriate. The procedures referred to in the response for Item 3 need to be specified in FSAR Tier 2, Chapter 13.

The response for Item 4 indicates that FSAR Tier 2, Section 9.2.5.4, will be revised to indicate that cooling tower fans operating in the reverse direction at the onset of a DBA are secured and brought to a complete stop before reenergizing to operate at full speed in the forward direction. Additional clarification in the FSAR is required to specify that these actions are automatic and do not require operator action. Also, the time it takes for the fans to achieve full speed in the forward direction and the impact of this delay on accident mitigation (either assuming all cooling tower fans are affected or this is not possible) also needs to be described in the FSAR.

The response for Items 2 and 8 indicated that the requested information would not be available until later in the design stage since it is dependent on vendor selection. 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 09.02.05-25:

Item 1

UHS fan classification is covered as follows in the U.S. EPR FSAR;

Tier 1, Table 2.7.11-1 – refer to response to RAI 345 Question 09.02.01-44b

Tier 1, Table 2.7.11-2 – refer to response to RAI 175 S3 Question 09.05.02-17

Tier 2, Table 3.2.2-1

Tier 2, Table 3.11-1

UHS fans will be added to Tier 2, Table 3.10-1 as indicated in attached markup.

Item 2

Refer to the response to RAI 351 Question 09.02.05-31 e and f and the markup of U.S EPR FSAR Tier 1, Table 2.7.11-3 that includes ITAAC 7.7 and 7.8. ITAAC 7.7 and 7.8 will include UHS cooling tower fan data (e.g., capacity, speeds). Refer to the response to RAI 351 Question 09.02.05-23, Item b for the nominal UHS fan power.

Item 3

As indicated in the response to RAI 175 S2 Question 09.02.05-7 and in the response to Item 4 of this RAI question, the associated essential service water system (ESWS) train is considered operable during reverse operation of the fans.

As indicated in the response to RAI 175, Supplement 1, Question 09.02.05-5e, the UHS has the capability of bypassing return water flow to the basin during low ambient temperature conditions to protect against freezing. As indicated in the response to RAI 175, Supplement 2, Question 09.02.05-7, the UHS has multiple fan speed and reverse fan operation capability. Low fan speed operation can be used during low load and/or low ambient temperature conditions. Reverse fan operation can be used to retard ice formation. Operating guidance and procedures to reduce or eliminate ice are within the scope of operating procedures, which is the responsibility of the COL applicant as indicated in U.S. EPR FSAR Tier 2, Section 13.5 and listed in Tier 2 Table 1.8-2, Item No. 13.5-1.

Item 8

Concerning the indications and controls for the cooling tower fans provided to the operator in the MCR, refer to the response to RAI 351 Question 09.02.05-23f.

FSAR Impact:

Item 1

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

Items 2, 3 and 8

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