ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Tuesday, July 27, 2010 8:41 AM
To: Tesfaye, Getachew
Cc: Hearn, Peter; ROMINE Judy (AREVA); RYAN Tom (AREVA); KOWALSKI David (AREVA); COLEMAN Sue (AREVA); PATTON Jeff (AREVA); RANSOM James (AREVA); GARDNER George Darrell (AREVA)
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; RESPONSE RAI 417 Q.09.02.02-121-draft.pdf; RESPONSE RAI 406 Q.09.02.02-110-draft.pdf

Importance: High

Getachew,

Additional draft responses to discuss today if the staff is able to support.

Thanks,

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From: KOWALSKI David J (AREVA NP INC)
Sent: Tuesday, July 27, 2010 6:49 AM
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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 406 and 417 questions. If the NRC reviewers have enough time to review these responses, they can be discussed at today's (7/27/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC, or can be scheduled for a future telecon. Both responses have been revised to reflect NRC review comments received by AREVA on 7/26/10.

Attached are the following DRAFT responses:

- Response to RAI 406 - Question 09.02.02-110.
- Response to RAI 417 - Question 09.02.02-121.

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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RESPONSE RAI 406 Q.09.02.02-110-draft.pdf	800997	

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Request for Additional Information No. 417(4741), Revision 0

6/8/2010

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: 9.2.2

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

09.02.02-121

Follow-up to RAI 334, Question 9.2.2-76 and RAI 174, Question 9.2.2-31:

Part (i)2 and Part i(3)- In Parts (i)2 and (i)3 of follow-up RAI 9.2.2-76 the staff asked the applicant to resolve discrepancies with the alternate power source for ESWS and CCWS Dedicated Train Components identified in U.S. EPR FSAR Tier 1 Tables 2.7.1-2 (CCWS) and 2.7.11-2 (ESWS). In Part (i)2 the staff noted that the FSAR markup provided by the applicant in the response to RAI 174, Supplement 3 of Table 2.7.1-2 identified normal power for the Dedicated Train was provided by Class 1E Division 4 with alternate power from Division 3 for some components but not for others. In Part (i)3 the staff asked the applicant to resolve differences in the power source identified in dedicated train components between CCWS Tier 1 Table 2.7.1-2 (markup for RAI 174, Supplement 3) and ESWS Tier 1 Table 2.7.11-2 (From FSAR Rev. 1). For some Dedicated Train components ESWS Table 2.7.11-2 identified Division 4 normal power with alternate power from the SBO EDG while the markup of CCWS Table 2.7.1-2 identified alternate power from division 3.

The response provided by the applicant in RAI 334, Supplement 1 included markups of Tier 1 Tables 2.7.1-2 and Table 2.7.11-2 as well as Tier 2 Sections 9.2.1 (ESWS) and 9.2.2 (CCWS). The staff's review of the applicant's response and markup of Tier 1 Tables 3.7.1-2 and 2.7.11-2 found them acceptable since only normal power was identified from Class 1E Division 4 and the conflicting alternate power sources were deleted. However, the staff review of the markups provided for FSAR Tier 2 Sections 9.2.1 and 9.2.2 noted a difference in the description of the power source for the Dedicated ESWS Train when compared to the markup for CCWS. The staff believes the FSAR description for the power source for the Dedicated ESWS and CCWS trains should be consistent. Accordingly, the applicant is requested to revise the markup provided for FSAR Tier 2, Section 9.2.1 and 9.2.2 to provide consistency. The subject descriptions from the markup are provided below followed by a list of items that require clarification.

From the markup of ESWS Tier 2 Section 9.2.1, Page 9.2-3

> The dedicated ESWS pump is powered by Class 1E electrical buses and is capable of being supplied by an EDG or a station blackout diesel generators (SBODG).

From the markup of CCWS Tier 2 Section 9.2.2, Page 9.2-20

The dedicated CCWS train … is normally fed from offsite power and is capable of being supplied by the onsite electrical power supplies that are backed by an EDG or SBO diesel generator.

The applicant should provide clarifications as shown below:

1. The FSAR description should state that the identified power sources are applicable to the entire dedicated train (pump, valves, components etc.) not just the pump as stated in the ESWS markup.

2. The FSAR description should be corrected since Tier 1 Table 2.7.1-2 and Table 2.7.11-2 which identified normal power for the dedicated train is from Class 1E Division 4, conflicts with the CCWS markup of Section 9.2.2 states that the normal source is off-site power.

3. The FSAR description should state the dedicated trains are also capable of being powered by the Division 4 EDG or the SBO DG.

Part (i)5- In Part (i)5 the applicant was asked to describe the basis for CCWS equipment that is provided with alternate power supplies in Tier 2, Section 9.2.2 In RAI 334 Supplement 1 the applicant responded by including new Table 9.2.2-4 "Power Supplies for CCWS Valves" in the markup of U.S. EPR FSAR Tier 2 Section 9.2.2 which is consistent with Tier 1. The Table identifies CCWS motor operated valves that are provided with normal and alternate Class 1E power supplies. The staff noted that Tier 2 Section 8.3.1.1.1, "Emergency Power Supply System," describes the alternate feed alignments which addressed the basis for alternate power in the EPR design for added power flexibility. However, the staff noted that the markup of Tier 1 Table 2.7.1-2 should identify a Class 1E power source for hydraulic fluid pumps that are associated with each hydraulic valve and associated pilot valves. This information should be added to the FSAR.

Part (m)- In Part (m) the staff requested that the applicant define the ESWS/CCWS design heat load in Tier 1 and cited examples of comparable FSAR Tier 1 Sections where this information was provided. In RAI 334 Supplement 1 the applicant responded by referring to the response to RAI 9.2.2-77 for revised CCWS ITAAC. However, the staff's review of the response to RAI 9.2.2-77 found no information was provided in regard to the addition of ITAAC for ESWS/ CCWS Hx heat load. The applicant should provide this information in Tier 1.

Response to Question 09.02.02-121:

Part (i)2 and (i)3:

1. A review of the CCWS and ESWS confirmed the identified power sources are applicable to the entire dedicated train for each system. U.S. EPR FSAR Section 9.2.1 will be revised to include this information.
2. A review of the CCWS and ESWS confirmed normal power for the dedicated train of each system is from Class 1E Division 4. U.S. EPR FSAR Section 9.2.2 will be revised to include this information.
3. Refer to the Response to 1 and 2 above for the Tier 2 Sections 9.2.1 and 9.2.2 addition of the description related to alternate power from an EDG or SBODG. Refer to the Response to RAI 345 Question 9.2.1-26 for the addition of this information in Tier 1 Section 2.7.11. U.S. EPR FSAR Tier 1 Table 2.7.1-3 will be revised to include this information.

Part (i)5:

A review of the CCWS confirmed the Class 1E power source for hydraulic fluid pumps that are associated with each hydraulic valve. U.S. EPR FSAR Tier 1, Table 2.7.1-2 will be revised to add hydraulic fluid pumps to the current discussion related to pilot valves for the hydraulically operated valves.

Part (m):

A review of the CCWS confirmed the DBA heat load for the CCWS heat exchanger of 291.8E+06 BTU/hr. Refer to the Response to RAI 406 Question 9.2.2-110 for details related to the CCWS heat exchanger design data. U.S. EPR FSAR Tier 1 Table 2.7.1-3 will be revised to include this information.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.7.1 and Tier 2 Sections 9.2.1 and 9.2.2 will be revised as described in the response and indicated on the enclosed markup.

ESWS are powered by Class 1E electrical buses and are emergency powered by the EDGs.

The non-safety-related dedicated division contains a dedicated ESWS pump, debris filter, piping, valves, controls, and instrumentation. The non-safety related ESWS pumps cooling water from the division four UHS cooling tower basin to the dedicated CCWS HX and back to the division four UHS cooling tower during severe accidents (SA). The dedicated ESWS pump is powered by Class 1E electrical buses and is capable of being supplied ~~emergency powered~~ by an EDG or a ~~the~~ station blackout diesel generators (SBODG).

Refer to Section 12.3.6.5.7 for essential service water system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.2.1.3 Component Description

9.2.1.3.1 Safety-Related Essential Service Water Pumps

Each of the four safety-related cooling divisions contains one 100 percent capacity pump. During normal operating conditions, two of the four divisions are operating. The required flow rate of each ESWS pump is defined by the heat to be removed from the system loads. Design parameters are listed in Table 9.2.1-1. The pumps are designed to fulfill the corresponding minimal required design mass flow rate under the following conditions:

- Minimal water level without cavitation.
- Head losses in the cooling water inlet piping according to full power plant operation.
- Fluctuations in the supplied electrical frequency.
- Increased pipe roughness due to aging and fouling.
- Fouled debris filters.
- Maximum pressure drop through the system HXs.
- Minimum water level in cooling tower basin considers minimum submergence requirements to prevent vortex effects, and net positive suction head to prevent cavitation of the ESWS pump.

Determination of the discharge head of the pumps is based on the dynamic pressure losses, the minimum/maximum water levels of the water source, and the head losses of the mechanical equipment of the associated ESWS at full load operation.

which performs a containment isolation function is classified Seismic Category I. This equipment is located in buildings designed to Seismic Category I requirements.

~~CCWS equipment that does not serve safety-related functions but is routed proximate to other safety-related structures, systems and components (SSC) is classified Seismic Category II to prevent loss of function of safety-related SSC.~~

CCWS users, which are not classified Seismic Category I, can be isolated by Seismic Category I fast-acting isolation valves in case of external hazards.

The Seismic Category I fast-acting isolation valves for non-safety-related CCWS users are hydraulically operated and designed to close in less than 10 seconds. The CCWS common header switchover valves are also fast-acting hydraulically operated valves with a closure time of less than 10 seconds. These switchover valves can be used to isolate the common headers to conserve the system capacity to cool the safety-related SIS users directly associated with the CCWS train.

The four separate, independently powered safety cooling trains of the CCWS, combined with high standards for system design, installation and maintenance, provides assurance that the system will fulfill its safety-related function under the most demanding postulated conditions in spite of its most limiting credible single failure.

During severe accidents, containment heat is removed by the dedicated cooling chain, consisting of the SAHRS, dedicated CCWS, and dedicated ESWS. This dedicated CCWS train is normally in standby operation and is manually started if needed. In case of loss of the dedicated CCWS or ESWS division, the SAHRS cooling chain is lost. This condition is outside the DBA. The dedicated CCWS train supports beyond design basis accident mitigation and is normally fed from offsite power and is capable of being supplied by the onsite electrical power supplies that are backed by an EDG or SBO diesel generator.

Each physically separated CCWS safety-related train includes:

- A main system pump fitted with a recirculation line and pump motor cooling line.
- An HX, cooled by ESWS, with a parallel flow bypass line with control valve to maintain CCW minimum temperature during cold weather and low-load operation.
- A concrete, steel lined surge tank connected to the pump suction line with sufficient capacity to compensate for CCWS normal leaks or component draining.
- A sampling line with continuous radiation monitor.
- A chemical additive supply line.

Table 2.7.1-2—Component Cooling Water System Equipment I&C and Electrical Design (7 Sheets)

Description	Tag Number (1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Common Header 1b Safety Related Loads CVCS HP Cooler 1 Downstream Control Valve	KAB60AA116	Reactor Building	NA	N/A	Yes	Pos	Open-Close
Common Header 2b Safety Related Loads CVCS HP Cooler 2 Downstream Control Valve	KAB70AA116	Reactor Building	NA	N/A	Yes	Pos	Open-Close
Dedicated CCWS Surge Tank Isolation Valve	KAA80AA020	Safeguards Building 4	4	N/A	Yes	Pos	Open-Close
Dedicated CCWS Surge Tank Nitrogen Supply Valve	KAA80AA021	Safeguards Building 4	4	N/A	Yes	Pos	Open-Close
Dedicated CCWS Demin Water Makeup Water Supply Valve	KAA80AA202	Safeguards Building 4	4	N/A	Yes	Pos	Open-Close
Dedicated CCWS Pump	KAA80AP001	Safeguards Building 4	4	N/A	Yes	On-Off / NA	Start-Stop / NA
Dedicated CCWS Demin Water Makeup Pump	KAA80AP201	Safeguards Building 4	4	N/A	Yes	On-Off / NA	Start-Stop / NA

To provide reliability of the switchover function, an uninterruptible power supply (UPS) is provided to the hydraulic actuation pilot valves. A failure of the electrical distribution system does not inhibit the transfer of the common header to the non-faulted train.

The non-safety load isolation valves are also fast-acting, hydraulically-operated valves. Each hydraulically-operated valve has multiple solenoid-operated pilot valves. Each pilot valve is powered from a different Class 1E uninterruptible power supply division to provide redundancy.~~The difference between the isolation and switchover valves is in the actuation of the pilot valves. The pilot valves for the non-safety load isolation valves are de-energized to open and bleed off the hydraulic fluid pressure.~~

LHSI Heat Exchanger Isolation Valves

These valves are motor-operated valves. The valves are normally closed to prevent dilution of the LHSI fluid and may be opened when necessary to provide an adequate flow path to support long term pump operation. The valves automatically open when the train associated LHSI system is placed into service.

LHSI Pump Seal Fluid Cooler Isolation Valves

These valves are motor-operated valves. The valves are normally closed to prevent dilution of the LHSI fluid and automatically open when the train associated LHSI system is placed into service.

Containment Isolation Valves

The CCWS containment isolation valves are motor-operated valves. The normally open valves provide the means for containment isolation to maintain the integrity of the containment penetrations and thus prevent the release of potentially radioactive material during a design based accident. The containment isolation valves for non-safety-related loads are automatically closed by containment isolation actuation signals. The containment isolation valves for the RCP thermal barrier coolers are not provided with a containment isolation signal but may be remote manually closed from the control room if required.

9.2.2.3 System Operation

9.2.2.3.1 Normal System Operation

The safety-related CCWS is a four train concept which allows sharing of operational and safety users during normal operation and to separate them in case of design and beyond design based accidents. Each physically separated train consists of a main pump, motor cooler, an HX, surge tank, sample piping with permanently installed radiation monitor, a chemical addition tank and pairs of common header isolation valves. Each train also supplies cooling to the associated MHSI pump motor cooler and

Table 2.7.1-2—Component Cooling Water System Equipment I&C and Electrical Design (7 Sheets)

Description	Tag Number (1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Safety Chilled Water Chiller CCWS Flow Control Valve	KAA22AA101	Safeguards Building 2	2^N 1^A	N/A	Yes	NA / NA	NA / NA
Safety Chilled Water Chiller CCWS Flow Control Valve	KAA32AA101	Safeguards Building 3	3^N 4^A	N/A	Yes	NA / NA	NA / NA

1) Equipment tag numbers are provided for information only and are not part of the certified design.

2) ^{N} denotes the division the component is normally powered from; ^{A} denotes the division the component is powered from when alternate feed is implemented.

3) Each hydraulically operated valve has multiple solenoid-operated pilot valves. Each pilot valve is powered from a different Class 1E uninterruptible power supply division to provide redundancy.

Table 2.7.1-3—Component Cooling Water System ITAAC (7 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		b. Components listed as harsh environment in Table 2.7.1-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.~~b. For equipment listed for harsh environment in Table 2.7.1-2, an inspection will be performed of the as-installed Class 1E equipment and the associated wiring, cables and terminations.~~	b. Inspection reports exists and conclude that the components listed in Table 2.7.1-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.~~b. Inspection concludes the as-installed Class 1E equipment and associated wiring, cables, and terminations as listed in Table 2.7.1-2 for harsh environment conform to the design.~~
7.1	The CCWS heat exchanger as listed in Table 2.7.1-1 has the capacity to transfer the design heat load to the ESWS system.	Tests and analyses will be performed to demonstrate the capability of the CCWS heat exchanger as listed in Table 2.7.1-1 to transfer the heat load to the ESWS.	~~A report exists and concludes that the ESWS has the capacity to remove the design heat load via the heat exchanger listed in Table 2.7.1-1.~~The CCW heat exchanger satisfies the required heat transfer of an equivalent combined product of the heat exchanger area of 39963 ft^2 and the overall heat transfer coefficient of 360 $BTU/hr*ft^2*°F$.
7.2	The pumps listed in Table 2.7.1-1 have sufficient NPSHA.	Testing and analyses will be performed to verify NPSHA for pumps listed in Table 2.7.1-1.	~~A report exists and concludes that t~~The pumps listed in Table 2.7.1-1 have NPSHA that is greater than net positive suction head required (NPSHR) at system run-out flow with consideration for minimum allowable surge tank water level (as corrected to account for actual temperature and atmospheric conditions).

Response to

Request for Additional Information No. 406(4683, 4664, 4707), Revision 0

6/16/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
SRP Section: 09.04.01 - Control Room Area Ventilation System
SRP Section: 09.05.01 - Fire Protection Program

Application Section: FSAR Chapter 9

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)
QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Balance of Plant Branch 1 (SBPA)

Question 09.02.02-110:

Follow-up to RAI 334, Question 9.2.2-62 and RAI 174, Question 9.2.2-13

In RAI 9.2.2-62 the applicant was requested to determine CCWS minimum heat transfer and flow requirements for the various plant operating modes and accident conditions. The applicant previously stated this information would not be available until later in the design process. In response to RAI 9.2.2-62 the applicant provided a FSAR markup that included FSAR Tier 2 Table 9.2.2-2, "CCWS User Requirements," with heat load and flow information. The staff's review of this information identified the follow-up questions discussed below:

a. The applicant should provide a summary table in the FSAR to identify the total system flow and heat load requirements for normal and accident conditions as well as an assessment in the RAI response of margin by comparison with the design heat transfer and flow capacities for the CCWS heat exchanger and CCWS pump, respectively.

b. Explain the basis for the CCW LHSI heat exchanger DBA heat load (241 MBTU/Hr) in the markup of Table 9.2.2-2 and explain its difference from the DBA heat load identified elsewhere in the FSAR. For example both Tables 9.2.2-1 and 9.2.5-1 identify a DBA heat load of 291.3 MBTU/Hr. This should be explained in the FSAR.

c. Table 9.2.2-2 states that RCP motor air and bearing oil coolers isolate on a Stage 1 Containment isolation signal. However, FSAR Tier 2 Section 9.2.2 indicates that these loads isolate at Stage 2. This table should also state that the CVCS HP coolers isolate at Stage 2. These discrepancies should be corrected in the FSAR.

d. Describe in the RAI response the differences between the CCW Fuel Pool Cooling heat load for normal refueling (47.8 MBTU/Hr) which is significantly greater than the heat load for a full core offload (33.78 MBTU/Hr), see Table 9.2.2-2. The applicant should consider an explanatory note to the FSAR table for clarification of these heat loads.

e. The dedicated heat exchanger capacity is missing from FSAR Tier 2 Table 9.2.2-1. This information should be added to the FSAR.

f. For Table 9.2.2-2, sheet 1 identifies LHSI Hx heat load and flow values for the two cooldown conditions below. Explain in the RAI response the difference for the CCW heat load and flow being significantly less when the CCW train is connected to both the SIS users and the common header and when compared to only being connected to the SIS users (difference of 116 E6 BTU/hr). The applicant should consider adding an explanatory note to the FSAR Table.

Condition	Heat Load (MBTU/Hr)	Flow (10^6 Lb/Hr)
Normal Cooldown when CCW train is only connected to SIS users	152.8	2.984
Normal Cooldown when CCW train is also connected to the common header	36.54	2.1906

Response to Question 09.02.02-110:

a. A review of the CCWS confirmed the system heat load and user flow requirements for normal and accident conditions. The following table summarizes the heat load and flow requirements used for determining the heat exchanger design case. Note that the CCWS user flow listed in this table is the total flow that exits the CCWS heat exchanger and is distributed to the users. This is not the total pump discharge flow.

Due to variations in heat load, required flow and "U" for each CCWS operational alignment, the combined "UA" value is used to determine the design case for each CCWS heat exchanger. The design parameters for these operational cases will be provided to the heat exchanger vendor. The vendor will factor these system parameters into the design of the heat exchanger with the design constraint that the heat exchanger must meet the highest required combined "UA" of all cases. The vendor will determine the best combination of "U" and "A" to meet these requirements. By meeting this requirement for the highest required combined "UA", the heat exchanger design will have margin for all other operational alignments. The DBA cases assume an ESW inlet temperature of 95°F with a CCWS outlet temperature of 110°F. The value of 110°F is used to account for instrument uncertainty in the maximum allowed CCWS outlet temperature of 113°F. The RCS cooldown cases assume an ESW inlet temperature of 90°F with a CCWS outlet temperature of 99.2°F. The RCS heatup cases assume an ESW inlet temperature of 92°F with a CCWS outlet temperature of 99.2°F. The value of 99.2°F is used to account for instrument uncertainty in the maximum allowed CCWS outlet temperature of 100.4°F for normal operations cases. No correction factor is assumed in the LMTD calculations.

CCWS Operational Alignment	Reqd Heat Transfer (10^6 BTU/hr)	CCWS User Flow (10^6 lbm/hr)	ESWS Flow (10^6 lbm/hr)	LMTD (°F)	UA (10^6 BTU/hr-°F)
RCS Cooldown; CCWS Train Not Connected to a Common Header	153.1	3.061	7.54	20.60	7.43
RCS Cooldown; CCWS Train 1 or 2 Connected to Common 1 Plus Train Specific SIS Users	118.4	7.071	7.54	9.71	12.19
RCS Cooldown; CCWS Train 3 or 4 Connected to Common 2 Plus Train Specific SIS Users	124.9	7.055	7.54	9.76	12.79
RCS Heatup; CCWS Train 1 or 2 Connected to Common 1	106.8	5.624	7.54	9.41	11.35
RCS Heatup; CCWS Train 3 or 4 Connected to Common 2	123.4	5.802	7.54	9.44	13.07
DBA - CCWS Train 1 or 2 aligned to Common 1 Header	291.8	4.299	7.54	27.01	10.80
DBA - CCWS Train 3 or 4 aligned to Common 2 Header	291.4	4.278	7.54	27.12	10.74

The highest required combined "UA" of 13.07E+06 BTU/hr-°F results from RCS Heatup; CCWS Train 3 or 4 Connected to Common 2. This case yields the highest required combined "UA" due to low temperature deltas in the system during this operational alignment. The LMTD for this case is calculated with an ESWS inlet temperature of 92°F and a CCWS outlet temperature of 100.4°F for normal operations. An example area calculation for this case assuming a U of 360 BTU/hr*ft^2*°F yields a required area of 36,311 ft^2. Considering a 10% margin for tube plugging, the heat exchanger design area for this example case becomes 39,942 ft^2. The design of the CCWS heat exchanger will contain an additional 10% margin for the DBA case above the 10% added for tube plugging.

Calculation of UA values fro different modes of heat exchanger operation provides a reasonable initial basis for comparison prior to selection of a final heat exchanger design. However, the physical parameter of heat transfer area required for each case would provide a much more accurate basis for comparison. The required area cannot be reliably determined without detailed heat exchanger design information necessary to support calculation of the overall heat transfer coefficient (U), which will vary for each case. Operating modes for the CCWS with the highest UA value also have significantly higher CCW flow rates. Higher flow rates will increase U and actually require lower heat transfer area thus changing design margin comparisons based solely on UA values. Since this information will not be known until final procurement, the DBA case will require a minimum additional margin of 10 percent above the specified 10 percent tube plugging allowance. This will provide assurance that adequate safety margin in provided for the DBA case irrespective of the final CCWS heat exchanger design.

A review of the CCWS confirmed the highest required pump discharge flow results from any of the trains connected to either of the common headers during normal operation. This normal operation alignment has all CCWS users connected simultaneously (including SIS users). The following table summarizes the pump discharge flow requirements used for determining the pump design flow rate. Note that the CCWS pump discharge flow listed in this table is the total flow through the pump. This flow includes flow through the 4 inch surge tank recirculation line that does not go through the CCWS heat exchanger. In addition to the recirculation flow, the normal operations flow requirement for the CVCS HP coolers is greater than the CVCS HP cooler required flow in the cooldown alignment. These factors result in a higher required total pump discharge flow as compared to the user required CCWS flow through the heat exchanger for heatup and cooldown cases.

The expected CCWS pump suction temperatures for the various operational alignments are enveloped by a temperature of 190°F. The 190°F temperature is conservatively based on CCWS heat exchanger DBA inlet temperature (181°F) plus margin. Using water at 190°F this converts to a required flow of 15570 gpm. Applying the pump margin of 15.33% from the Response to RAI 334, Question 9.2.2-63 to the highest required pump discharge flow of 15570 gpm results in a design pump flow of 17957 gpm.

CCWS Operational Alignment	CCWS Pump Discharge Flow (10^6 lbm/hr)	CCWS Pump Discharge Flow (gpm)
Normal Operation; CCWS Train 1 or 2 Connected to Common 1 Plus Train Specific SIS Users	7.359	15203
Normal Operation; CCWS Train 3 or 4 Connected to Common 2 Plus Train Specific SIS Users	7.537	15570
DBA - CCWS Train 1 or 2 aligned to Common 1 Header	4.407	9104
DBA - CCWS Train 3 or 4 aligned to Common 2 Header	4.386	9061

A pump design flow rate of 17957 gpm provides margin for operational alignments where the total user required flow is less than 15570 gpm. The following table summarizes the margin in the CCWS pump flow for normal operations and DBA cases.

CCWS Operational Alignment	CCWS Pump Discharge Flow (gpm)	Pump Design Flow (gpm)	Margin in Pump Flow (%)
Normal Operation; CCWS Train 1 or 2 Connected to Common 1 Plus Train Specific SIS Users	15203	15957	18
Normal Operation; CCWS Train 3 or 4 Connected to Common 2 Plus Train Specific SIS Users	15570		15
DBA - CCWS Train 1 or 2 aligned to Common 1 Header	9104		97
DBA - CCWS Train 3 or 4 aligned to Common 2 Header	9061		98

The surge tank recirculation line flow has no effect on the heat transfer margins of the CCWS heat exchangers. The surge tank recirculation flow is included in the pump flow design case. The surge tank recirculation flow does not go through the CCWS heat exchanger to be distributed to CCWS users, therefore that flow is not used in the heat exchanger design case and margin calculations. For the heat exchanger design case and margin calculations, only the CCWS user flows are considered.

U.S. EPR FSAR, Tier 2, Tables 9.2.2-1 and 9.2.2-2 will be revised to update the CCWS flow requirements. Tier 2 Tables 9.2.2-6 and 9.2.2-7 will be added to summarize CCWS heat load and flow requirements for various operational alignments. U.S. EPR FSAR Tier 2, Section 9.2.2 will be revised to include the heat transfer and pump discharge flow margins for the DBA case.

b. A review of the CCWS confirmed the CCWS LHSI heat exchanger DBA heat load of 241 MBTU/hr. The LHSI heat exchanger DBA heat load of 241 MBTU/hr is the decay heat removed by the LHSI system to the CCWS heat exchanger. The MHSI and LHSI pump heat loads are specifically listed as individual values in FSAR Table

9.2.2-2. U.S EPR FSAR Tier 2, Table 9.2.2-1 and 9.2.5-1 will be revised to update the CCWS DBA heat load that is applied to the Ultimate Heat Sink.

A review of the CCWS design confirmed the CCWS heat exchanger DBA heat load on the Ultimate Heat Sink (UHS) of 291.8 MBTU/hr. This heat load is equal to the LHSI heat exchanger DBA heat load of 241 MBTU/hr from Table 9.2.2-2 plus the additional loads from the CCWS common header users aligned during a DBA. The value of 291.8 MBTU/hr in Tables 9.2.2-1 and 9.2.5-1 is the total DBA heat load that the CCWS is required to reject to the UHS. The design of the UHS is required to account for this CCWS heat load plus any additional DBA heat loads that directly impact the UHS. Refer to U.S. EPR FSAR Section 9.2.5 for a discussion on the UHS design. The following table summarizes the CCWS user loads for the DBA condition (the limiting DBA case results from Train 1 or 2 aligned to Common 1).

			Reqd HT	
Designation of equipment		**# of comp/train**	**per comp**	**per train**
Name	**KKS**		**10^6 BTU/hr**	**10^6 BTU/hr**
CCWS pump MAC	KAA10/20 AC002	1	0.0955	0.0955
LHSI hx	JNG10/20 AC001	1	241.0	241.0
LHSI pump MAC	JNG10/20 AP001	1	0.1262	0.1262
LHSI seal fluid cooler	JNG10/20 AP001	1	0.0341	0.0341
MHSI pump MAC	JND10/20 AP001	1	0.0239	0.0239
Charging pump motor air cooler	KBA31 AP001	1	0.1706	0.1706
Charging pump oil cooler	KBA31 AP001	1	0.1706	0.1706
Charging pump seal water cooler	KBA31 AP001	1	0.1706	0.1706
CVCS HP cooler	KBA11 AC001	1	6.9	6.9
RCP lower bearing oil cooler	JEB10/20 AC001	2	0.0819	0.1638
RCP motor air cooler	JEB10/20 AC002/003	4	1.075	4.3
RCP thermal barrier	N/A	4	0.3915	1.566
RCP upper bearing oil cooler	JEB10/20 AC004	2	1.305	2.61
Nuke Sample Coolers	KUA20/30 AC001	2	0.3958	0.7916
QKA Chiller	QKA20 AC001	1	4.123	4.123
SFP heat exchanger	FAK20 AC001	1	29.00	29.00
SG Sample Coolers	QUC11/12 AC001	2	0.2593	0.5186
		Sum		**291.8**

U.S EPR FSAR Tier 2, Table 9.2.5-1 will be revised to update the CCWS heat exchanger DBA heat load.

c. Refer to the Response to part (a) of RAI 406, Question 9.2.2-110 for the update of U.S. EPR FSAR Table 9.2.2-2.

d. Refer to the Response to part (a) of RAI 406, Question 9.2.2-110 for the update of U.S. EPR FSAR Table 9.2.2-2.

e. A review of the CCWS confirmed the Dedicated CCWS Heat Exchanger capacity of 51.2 MBTU/hr. The value of 50.5 MBTU/hr listed in 9.2.2-2 is only the SAHRS heat exchanger heat load on the Dedicated CCWS train. The Dedicated CCWS heat exchanger design parameter of 51.2 MBTU/hr includes the additional SAHRS pump cooler loads that are directly cooled by the Dedicated CCWS.

f. Refer to the Response to part (a) of RAI 406, Question 9.2.2-110 for the update of U.S. EPR FSAR Table 9.2.2-2.

FSAR Impact:

U.S. EPR FSAR, Tier 2 Table 9.2.2-1, 9.2.2-2 and 9.2.5-1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR, Tier 2 Section 9.2.2.2.1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR, Tier 2 Tables 9.2.2-6 and 9.2.2-7 will be added as described in the response and indicated on the enclosed markup.

The CCWS is a four train system configured to allow sharing of operational and safety-related users among the trains during normal operation, while always maintaining train separation with rapid isolation capability of the non-safety-related users in the event of an accident. The trains form pairs; trains 1 and 2 form one pair, and trains 3 and 4 the other pair. During normal operation, one or both trains in each associated pair can be in operation to cool the two common sets of users. Depending on the system user requirements, heat loads, and flow rates, and depending on the existing plant operating condition, the CCWS may have two, three, or all four trains in operation. System design parameters and flow requirements are listed in Table 9.2.2-1—CCWS Design Parameters and Table 9.2.2-2—CCWS User ~~Flow~~ Requirements.

Trains may be added or dropped as necessary to maintain the CCWS HX outlet temperature above the minimum required and below the maximum allowed and maintain the individual CCWS pump steady-state operating flow between the minimum required and the maximum allowed values. Idle CCWS trains are available and isolated from the common headers to provide safety injection system (SIS) availability if necessary. Maintenance on a CCWS train during power operation is possible.

During normal operation and design basis events, the CCWS provides the cooling function for the safety injection system/residual heat removal system (SIS/RHRS) and the safety chilled water system (SCWS) of divisions 2 and 3. The CCWS also transfers decay heat from the fuel pool cooling system (FPCS) whenever fuel is stored in the spent fuel pool. The CCWS additionally cools the thermal barriers of the RCP seals during all plant operating modes when the RCPs are running. Upon receipt of a containment isolation signal, the CCWS responds to protect the integrity of the containment pressure boundary.

~~To meet single-failure criteria for the RCP thermal barrier cooling function, the load is required to be cooled by a common header which is capable of being connected to two operable CCW trains. A single failure of a train initiates an automatic system response to transfer the common header to the remaining train.~~

The CCWS flow rate is automatically controlled for those users which have been determined to have a limited operating temperature range for support of stable operation, while less temperature-sensitive users remain at a fixed flow resistance during all operating conditions. These fixed flow rates are adjusted once during plant commissioning with the system in its most demanding flow configuration (system flow balancing), and is reaffirmed regularly throughout the plant life by periodic surveillance, to make sure there is adequate required user flow for all operating conditions. It is not expected that the CCWS flow balance will require adjustment after the initial flow balance has been established.

FSAR Section 9.2.2.2.1 Insert for RAI 406; 9.2.2-110

During normal operation the temperature at the outlet of the CCWS heat exchanger must be greater than 59°F and lower than 100.4°F. During a DBA, the CCWS heat exchanger outlet temperature must be lower than 113°F.

The expected CCWS pump suction temperatures for the various operational alignments are enveloped by a temperature of 190°F. The 190°F temperature is conservatively based on CCWS heat exchanger DBA inlet temperature (181°F) plus margin.

Pump head design margin: $\sqrt{(10\%)^2 + (2\%)^2 + (3.31\%)^2} + 5\% = 15.72\%$

Pump flow design margin: $\sqrt{(10\%)^2 + (2\%)^2 + (1.67\%)^2} + 5\% = 15.33\%$

The CCWS pumps are part of the safety-related cooling trains.

The four pumps are centrifugal type. The pump motor is cooled by an air-water cooler supplied by CCWS itself. The pump and motor are horizontally mounted on a common base plate. The pump and motor bearings are oil lubricated and are air cooled.

Motor heaters are provided on the motors and are energized when the pump is not in operation to prevent the formation of condensation.

During normal operating conditions, two of the four pumps are operating.

Dedicated CCWS Pump

The dedicated CCWS pump is non-safety-related and is in standby during normal plant operation.

The pump is centrifugal type. The pump motor is cooled by an air-water cooler supplied by the CCWS itself. The pump and motor are horizontally mounted on a common base plate. The pump and motor bearings are oil lubricated and are air cooled.

A motor heater is provided on the motor and is energized when the pump is not in operation to prevent the formation of condensation.

Dedicated CCWS Makeup Pump

The water supply pump is a positive displacement piston type to increase the head of the demineralized water distribution system (DWDS) supply to adjust the level of the pressurized surge tanks. To prevent flow pulses and to limit system vibration a pulsation damper is installed just downstream of the piston pump.

CCWS Heat Exchangers

The CCWS HXs are horizontal tube and shell type HXs. The CCW is circulated on the shell side and the ESWS supplies cooling water on the tube side.

Dedicated CCWS Heat Exchanger

The dedicated CCWS HX is a horizontal tube and shell type HX. CCWS circulates on the shell side and the ESWS supplies cooling water on the tube side.

Table 9.2.2-1—CCWS Design Parameters

Description	Technical Data
Component Cooling Water Pump (KAA10/20/30/40 AP001	
Number	4
Type	Centrifugal Pump
Flow rate max.	17,768 gpm
Pump head min (at max flow rate)	199.7 ft
Dedicated Component Cooling Water Pump (KAA80 AP001)	
Number	1
Type	Centrifugal Pump
Flow Rate	2678 gpm
Pump Head	180 ft
Component Cooling Water Surge Tank KAA10/20/30/40 BB001)	
Number	4
Volume	950 ft^3
Dedicated Component Cooling Water Surge Tank (KAA80 BB001)	
Number	1
Volume	75 ft^3
Component Cooling Water HX (KAA10/20/30/40 AC001)	
Number	4
Heat Load (DBA)	291.3×10^6 Btu/hr

Table 9.2.2-2—CCWS User Requirements
Sheet 1 of 4

Component	KKS	Heat Load (10^6 BTU/hr)	Required Flow (10^6 lb/hr)	Comments
Fuel Pool Cooling System				
Fuel Pool Cooling Heat Exchanger	30FAK10/20 AC001	29	0.8818	Normal Operations
		47.8	2.645	Normal Refueling
		33.78	2.645	Refueling (full off-load)
Reactor Coolant System				
RCP Lower Bearing Oil Cooler	JEB10/20/30/40 AC001	0.0819	0.0088	Cooling Isolated with Containment Isolation (CI) Stage 1 Signal
RCP Motor Air Cooler	JEB10/20/30/40 AC002/003	1.075	0.0529	
RCP Upper Bearing Oil Cooler	JEB10/20/30/40 AC004	1.305	0.1323	
RCP Thermal Barrier	N/A	0.3915	0.0198	Not Isolated with CI-1 or CI-2
Safety Injection and Residual Heat Removal System				
MHSI Pump Motor Cooler	JND10/20/30/40 AP001	0.239	0.0265	
LHSI Heat Exchanger	JNG10/20/30/40 AC001	152.8	2.984	Normal cooldown when CCW train is only connected to the train SIS users
		36.54	2.1906	Normal cooldown when CCW train is also connected to the CCW common header
		241	2.1906	DBA
LHSI Pump Motor Cooler	JNG20/30 AP001	0.1262	0.0141	
LHSI Sealing Fluid Cooler	JNG20/30 AP001	0.0341	0.0062	Flow isolated when LHSI pump is out of service for dilution prevention
Severe Accident Heat Removal System				
SAHRS Heat Exchanger	JMQ40 AC001	47.77	1.106	Cooled by dedicated CCWS
SAHRS Pump Seal Watercooler	JMQ40 AC003	0.0593	0.0053	Cooled by dedicated CCWS

Table 9.2.2-2—CCWS User Requirements
Sheet 2 of 4

Component	KKS	Heat Load (10^6 BTU/hr)	Required Flow (10^6 lb/hr)	Comments
SAHRS Pump Motor Cooler	JMQ40 AC002	0.089	0.0079	Cooled by dedicated CCWS
SAHRS Pump Bearing Cooler	JMQ40 AC004	0.0223	0.002	Cooled by Dedicated CCWS
Volume Control System				
CVCS HP Cooler	KBA11/12 AC001	30.71	0.873	Plant Heatup
		14.3	0.2968	Normal Load
		6.9	0.1228	Plant Cooldown
Charging Pump Motor Cooler	KBA31/32 AP001	0.1706	0.0198	
Charging Pump Oil Cooler	KBA31/32 AP001	0.1706	0.0025	
Charging Pump Seal Water Cooler	KBA31/32 AP001	0.1706	0.0033	
Coolant Treatment System				
After Cooler	KBF25 AC001	0.6824	0.0381	Cooling Isolated with Safety Injection (SI) Signal
Condensate Cooler	KBF20 AC006	0.9315	0.0262	
Condenser	KBF20 AC003	0.6824	0.019	
Gas Cooler	KBF20 AC004	0.0358	0.002	
Gas Cooler	KBF40 AC004	0.0481	0.0027	
Reflux Cooler	KBF40 AC003	0.9622	0.0262	
Seal Water Cooler	KBF35 AC001	0.1297	0.0071	
Coolant Degasification System				
CDS Condenser	KBG10 AC002	8.131	0.4524	Cooling Isolated with SI Signal
CDS Gas Cooler	KBG10 AC003	0.6244	0.0349	
Containment Ventilation System				
Containment HVAC Cooler 1/2/3/4	KLA61/63 AC001/003	1.365	0.1437	Cooling Isolated with CI Stage 1 Signal
Solid Waste System				
Condenser	KPC30/40/50 AC001	0.0341	0.0024	Cooling Isolated with SI Signal
Vacuum Unit	KPC60 AC001	0.0239	0.0048	

Table 9.2.2-2—CCWS User Requirements
Sheet 3 of 4

Component	KKS	Heat Load (10^6 BTU/hr)	Required Flow (10^6 lb/hr)	Comments
Liquid Waste Processing System				
Distillate Cooler	KPF11 AC004	0.3583	0.0167	Cooling Isolated with SI Signal
Gas Cooler	KPF11 AC003	1.365	0.0397	
Injection Water Cooler	KPF11 AC006	0.0409	0.0024	
Seal Water Cooler	KPF11 AC007	0.1297	0.0071	
Nuclear Island Drain and Vent System				
Reactor Coolant Drain Cooler	KTA10 AC001	1.996	0.1124	Cooling Isolated with CI Stage 1 Signal
Nuclear Sampling System				
Nuclear Sampling (RCS/HL3)	KUA10 AC001	0.3958	0.0147	
Nuclear Sampling (RCS/HL3)	KUA20 AC001	0.3958	0.0147	
Nuclear Sampling (RCS/PZR)	KUA30 AC001	0.3958	0.0147	
Steam Generator Blowdown System				
SGBS Second Stage Cooler	LCQ51 AC003/004	10.03	0.1932	Cooling Isolated with SI Signal; Heat Exchangers are in series and the heat transfer listed is the combined load.
Safety Chilled Water System				
Safety Chiller	QKA20/30 AC002	4.123	0.373	
Operational Chilled Water System				
OCWS (QNA)	QNA21/22/23/24 AC002	11.84	0.986	Cooling Isolated with SI Signal
OCWS (QNB)	QNB62/63 AC002	1.269	0.119	
Sampling System for Condensate Systems				
SG Secondary Sampling (SG1)	QUC11 AC001	0.2593	0.0097	
SG Secondary Sampling (SG2)	QUC12 AC002	0.2593	0.0097	
SG Secondary Sampling (SG3)	QUC13 AC003	0.2593	0.0097	

Table 9.2.2-2—CCWS User Requirements
Sheet 4 of 4

Component	KKS	Heat Load (10^6 BTU/hr)	Required Flow (10^6 lb/hr)	Comments
SG Secondary Sampling (SG4)	QUC14 AC004	0.2593	0.0097	
~~FPCS Heat Exchanger~~			~~30FAK10/20 AC001~~	~~0.8818~~
~~RCP Thermal Barrier~~			~~N/A~~	~~0.0198~~
~~LHSI Heat Exchanger~~			~~30JNG10/20/30/40 AC001~~	~~2.1906~~
~~SCWS Chiller~~			~~30QKA20/30 AC002~~	~~0.3730~~

Table 9.2.2-2 - CCWS User Requirements Summary

Component	KKS	Heat Load (10^6 BTU/hr)	Required Flow (10^6 lbm/hr)	Comments
CCWS Main Trains 1 and 4				
CCWS Pump Motor Cooler	KAA10/40 AC002	0.0955	0.0302	
LHSI Heat Exchanger	JNG10/40 AC001	152.8	2.984	Normal Cooldown when CCW train is only connected to the train SIS users (1)
		36.54	2.1906	Normal Cooldown when CCW train is also connected to the CCW common header (1)
		241	2.1906	DBA
MHSI Pump Motor Cooler	JND10/40 AP001	0.0239	0.0265	
CCWS Main Trains 2 and 3				
CCWS Pump Motor Cooler	KAA20/30 AC002	0.0955	0.0302	
LHSI Heat Exchanger	JNG20/30 AC001	152.8	2.984	Normal Cooldown when CCW train is only connected to the train SIS users (1)
		36.54	2.1906	Normal Cooldown when CCW train is also connected to the CCW common header (1)
		241	2.1906	DBA
MHSI Pump Motor Cooler	JND20/30 AP001	0.0239	0.0265	
LHSI Pump Motor Cooler	JNG20/30 AP001	0.1262	0.0141	
LHSI Sealing Fluid Cooler	JNG20/30 AP001	0.0341	0.0062	Flow isolated when LHSI pump is out of service for dilution prevention
Common Header 1				
Fuel Pool Cooling Hx	FAK10 AC001	29	0.8818	Normal Operations
		67.62	2.645	Refueling
Safety Chiller	QKA20 AC002	4.123	0.373	
RCP Thermal Barrier	N/A	1.566	0.0792	Thermal Barriers 1-4 can be cooled by
Additional Operational Users	QNA, QNB, JEB, KBA, KLA, KTA, QUC, KUA	69.86	4.11	
Common Header 2				
Fuel Pool Cooling Hx	FAK20 AC001	29	0.8818	Normal Operations
		47.8	2.645	Refueling
Safety Chiller	QKA30 AC002	4.123	0.373	
RCP Thermal Barrier	N/A	1.566	0.0792	Thermal Barriers 1-4 can be cooled by
Additional Operational Users	QNA, QNB, JEB, KBA, QUC, KUA, LCQ, KBF, KBG, KPC, KPF	86.29	4.29	
Dedicated CCWS Train				
Severe Accident Heat Removal System Heat Exchanger	JMQ40 AC001/004	50.5	1.104	

Notes:

1. A CCWS train aligned only to the train SIS users has a higher heat removal capacity than a CCWS train that is also aligned to the Common header plus the CCWS train SIS users. Flow that would normally go to the common header is used for additional heat removal capacity from the SIS users.

RAI 406, Q 9.2.2-110 FSAR Insert 'B'

Table 9.2.2-6 - CCWS Heat Load Summary

CCWS Operational Alignment	Heat Load (10^6 BTU/hr)
RCS Heat-up CCWS Train 1or 2 Connected to Common 1	106.8
RCS Heat-up CCWS Train 3 or 4 Connected to Common 2	123.4 (1)
RCS Cooldown CCWS Train 1 or 2 Connected to Common 1 Plus Train Specific SIS Users	118.4
RCS Cooldown CCWS Train 3 or 4 Connected to Common 2 Plus Train Specific SIS Users	124.9
RCS Cooldown CCWS Trains Not Connected to a Common Header	153.1
DBA - CCWS Train 1 or 2 aligned to Common 1 Header	291.8
DBA - CCWS Train 3 or 4 aligned to Common 2 Header	291.4

Notes:

1. Current analysis assuming a representative constant heat transfer coefficient indicates that 123.4 MBTU/hr combined with CCWS and ESWS flow rates will require the greatest heat transfer area for the CCWS heat exchanger. For final procurement a 10% margin for tube plugging will be required. The DBA case will require a minimum additional margin of 10% above the specified 10% tube plugging allowance.

RAI 406, Q 9.2.2-110 FSAR Insert 'C'

Table 9.2.2-7 - CCWS Pump Flow Summary

CCWS Operational Alignment	CCWS Pump Discharge Flow (10^6 lbm/hr) (1)	CCWS Pump Discharge Flow (gpm) (1)
Normal Operation; CCWS Train 1 or 2 Connected to Common 1 Plus Train Specific SIS Users	7.359	15203
Normal Operation; CCWS Train 3 or 4 Connected to Common 2 Plus Train Specific SIS Users	7.537	15570
DBA - CCWS Train 1 or 2 aligned to Common 1 Header	4.407	9104
DBA - CCWS Train 3 or 4 aligned to Common 2 Header	4.386	9061

Notes:

1. The total required pump flow in each alignment includes recirculation flow to each CCWS surge tank. The margins discussed in Section 9.2.2 are applied to the highest calculated required flow. Applying the margin to the largest calculated total flow requirement envelopes the required flow for all CCWS pumps in any operating mode.

Table 9.2.5-1—Ultimate Heat Sink System Interface

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