ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Thursday, September 03, 2009 7:16 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 175, FSAR Ch 9, Supplement 3
Attachments: RAI 175 Supplement 3 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to RAI No. 175 on February 27, 2009 stating that a complete answer could not be provided for any of the questions. Supplement 1 response to RAI No. 175 was sent on May 22, 2009 to address 9 of the 18 questions. Supplement 2 response to RAI No. 175 was sent on July 31, 2009 to address 7 of the remaining 9 questions.

The attached file, "RAI 175 Supplement 3 Response US EPR DC.pdf" provides technically correct and complete responses to the remaining 2 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 175 Questions 09.02.05-6 and 09.02.05-17.

The following table indicates the respective pages in the response document, "RAI 175 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 175 — 09.02.05-6	2	5
RAI 175 — 09.02.05-17	6	9

This concludes the formal AREVA NP response to RAI 175, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Ronda Pederson
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Licensing Manager, U.S. EPR Design Certification
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From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, July 31, 2009 5:18 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 175, FSAR Ch 9, Supplement 2

Getachew,

AREVA NP Inc. provided responses to RAI No. 175 on February 27, 2009 stating that a complete answer could not be provided for any of the questions. Supplement 1 response to RAI No. 175 was sent on May 22, 2009 to address 9 of the 18 questions.

The attached file, "RAI 175 Supplement 2 Response US EPR DC.pdf" provides technically correct and complete responses to 7 of the remaining 9 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 175 Questions 09.02.05-7, 09.02.05-8, 09.02.05-9, 09.02.05-13, 09.02.05-15, and 09.02.05-20.

The following table indicates the respective pages in the response document, "RAI 175 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 175 — 09.02.05-7	2	4
RAI 175 — 09.02.05-8	5	6
RAI 175 — 09.02.05-9	7	9
RAI 175 — 09.02.05-13	10	10
RAI 175 — 09.02.05-15	11	12
RAI 175 — 09.02.05-18	13	14
RAI 175 — 09.02.05-20	15	16

Since responses to the remaining questions remain in process, a revised schedule is provided in this email. The schedule for technically correct and complete responses to the remaining questions has been changed as provided below:

Question #	Response Date
RAI 175 — 09.02.05-6	September 3, 2009
RAI 175 — 09.02.05-17	September 3, 2009

Sincerely,

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From: WELLS Russell D (AREVA NP INC)
Sent: Friday, May 22, 2009 4:22 PM
To: 'Getachew Tesfaye'
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 175, FSAR Ch 9, Supplement 1

Getachew,

On February 27, 2009, AREVA NP Inc. provided a schedule for the responses to RAI No. 175. The attached file, "RAI 175 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 9 of the 18 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 175 Questions 09.02.05-4, 09.02.05-10, 09.02.05-16, and 09.02.05-19.

The following table indicates the respective pages in the response document, "RAI 175 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 175 — 09.02.05-3	2	2
RAI 175 — 09.02.05-4	3	4
RAI 175 — 09.02.05-5	5	7
RAI 175 — 09.02.05-10	8	8
RAI 175 — 09.02.05-11	9	9
RAI 175 — 09.02.05-12	10	11
RAI 175 — 09.02.05-14	12	12
RAI 175 — 09.02.05-16	13	14
RAI 175 — 09.02.05-19	15	15

The schedule for technically correct and complete responses to the remaining questions has been changed and is provided below:

Question #	Response Date
RAI 175 — 09.02.05-6	July 31, 2009
RAI 175 — 09.02.05-7	July 31, 2009
RAI 175 — 09.02.05-8	July 31, 2009
RAI 175 — 09.02.05-9	July 31, 2009
RAI 175 — 09.02.05-13	July 31, 2009
RAI 175 — 09.02.05-15	July 31, 2009
RAI 175 — 09.02.05-17	July 31, 2009
RAI 175 — 09.02.05-18	July 31, 2009
RAI 175 — 09.02.05-20	July 31, 2009

Sincerely,

(Russ Wells on behalf of)
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From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, February 27, 2009 3:28 PM
To: Getachew Tesfaye
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 175 (1817), FSARCh. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 175 Response US EPR DC" states that complete answers cannot be provided for the eighteen questions at this time.

The following table provides the page in the response document, "RAI 175 Response US EPR DC" containing the response to each question.

Question #	Start Page	End Page
RAI 175 — 09.02.05-3	2	2
RAI 175 — 09.02.05-4	3	3
RAI 175 — 09.02.05-5	4	4
RAI 175 — 09.02.05-6	5	5
RAI 175 — 09.02.05-7	6	6
RAI 175 — 09.02.05-8	7	7
RAI 175 — 09.02.05-9	8	8
RAI 175 — 09.02.05-10	9	9
RAI 175 — 09.02.05-11	10	10
RAI 175 — 09.02.05-12	11	11
RAI 175 — 09.02.05-13	12	12
RAI 175 — 09.02.05-14	13	13
RAI 175 — 09.02.05-15	14	14
RAI 175 — 09.02.05-16	15	15
RAI 175 — 09.02.05-17	16	16
RAI 175 — 09.02.05-18	17	17
RAI 175 — 09.02.05-19	18	18
RAI 175 — 09.02.05-20	19	19

A complete answer is not provided for any of the 18 questions. The schedule for technically correct and complete responses to these questions is provided below.

Question #	Response Date
RAI 175 — 09.02.05-3	May 22, 2009
RAI 175 — 09.02.05-4	May 22, 2009
RAI 175 — 09.02.05-5	May 22, 2009
RAI 175 — 09.02.05-6	May 22, 2009
RAI 175 — 09.02.05-7	May 22, 2009
RAI 175 — 09.02.05-8	May 22, 2009
RAI 175 — 09.02.05-9	May 22, 2009
RAI 175 — 09.02.05-10	May 22, 2009
RAI 175 — 09.02.05-11	May 22, 2009
RAI 175 — 09.02.05-12	May 22, 2009

RAI 175 — 09.02.05-13	May 22, 2009
RAI 175 — 09.02.05-14	May 22, 2009
RAI 175 — 09.02.05-15	May 22, 2009
RAI 175 — 09.02.05-16	May 22, 2009
RAI 175 — 09.02.05-17	May 22, 2009
RAI 175 — 09.02.05-18	May 22, 2009
RAI 175 — 09.02.05-19	May 22, 2009
RAI 175 — 09.02.05-20	May 22, 2009

Sincerely,

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, January 28, 2009 4:12 PM
To: ZZ-DL-A-USEPR-DL
Cc: Larry Wheeler; John Segala; Peter Wilson; Peter Hearn; Joseph Colaccino; Michael Miernicki; Meena Khanna; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 175 (1817), FSARCh. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on January 9, 2009, and discussed with your staff on January 22, 2009. Draft RAI Question 09.02.05-12 was modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

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

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 787

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D310133B81A)

Subject: Response to U.S. EPR Design Certification Application RAI No. 175, FSAR Ch 9, Supplement 3
Sent Date: 9/3/2009 7:15:36 PM
Received Date: 9/3/2009 7:15:54 PM
From: Pederson Ronda M (AREVA NP INC)

Created By: Ronda.Pederson@areva.com

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MESSAGE	9758	9/3/2009 7:15:54 PM
RAI 175 Supplement 3 Response US EPR DC.pdf		184686

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Priority: Standard
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Recipients Received:

Response to

Request for Additional Information No. 175 (1817), Supplement 3

01/28/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.05 - Ultimate Heat Sink
Application Section: 9.2.5

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

Question 09.02.05-6:

Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.5 states that the ultimate heat sink (UHS) is sized to provide adequate cooling capacity to dissipate essential service water system (ESWS) heat loads, however, insufficient information is provided to confirm this capability. Table 9.2.5-2 provides some technical information for the dual cell forced draft ESW cooling towers, but no heat rejection rate is provided that would support confirmation of sufficient cooling capability. Standard Review Plan (SRP) 9.2.5 Section III, paragraph 2.B of "Evaluation Procedures" instructs the reviewer to verify whether "the UHS can dissipate the maximum possible total heat load including that of a loss of coolant accident (LOCA) under the worst combination of adverse environmental conditions." Provide key assumptions and inputs for the design calculations that demonstrate sufficient capability and margin. Additional information that is needed in the FSAR includes (for example):

1. Key assumptions and inputs (including justification) for calculations that demonstrate sufficient heat rejection capability to meet maximum predicted heat loads and define the available margin with limited system temperatures and pressures. These assumptions should include sufficient margin to account for uncertainties in the analysis, anticipated degradation in performance over time, and fluctuations in the frequency of electric current. These calculations should be made available for staff audit
2. Explanation of how the wet bulb correction of 1˚F was determined to be sufficient for potential tower interferences; (FSAR Tier 2 Table 9.2.5-2).
3. Performance curves that show the minimum required tower heat rejection capability verses time (including spent fuel pool cooling) for post LOCA cooldown, and cooldown to cold shutdown conditions following a reactor trip with and without offsite power available.
4. Explanation of the monitoring of UHS heat rejection capability for ensuring adequate performance over time.

Response to Question 09.02.05-6:

1. To support sizing of the UHS, an analysis was performed to provide a set of bounding cooling chain heat rejection requirements. These requirements include an instantaneous heat transfer need by plant mode of operation (Cooling Tower Sizing), and a time dependent heat rejection, which is required for long term decay heat removal (Storage Basin Sizing).

   The conceptual UHS design comprises cooling towers that cool the ESWS fluid and an associated collection basin that provides the net positive suction head (NPSH) to the ESWS pumps and stores water to support long term safety-related core cooling.

   The tower basin contains a minimum 72-hour supply of water for meeting evaporation requirements based on the design basis accident (DBA) heat load. The UHS operates for a nominal 30 days following a LOCA. The required heat removal for plant systems is considered during different plant modes of operation (e.g., DBA, normal plant operation, outage cooldown, and severe accident). The required component cooling water system (CCWS) heat transfer during the limiting plant modes and system alignments is used. The heat rejected from each emergency diesel generator (EDG) to the ESWS is added to the UHS DBA load. During each plant mode of operation, the design ESW temperature requirements vary, commensurate with the safety significance. Refer to Table 9.2.5-6-1 for a summary of ESW design temperatures for various plant modes.

The mechanical systems of the safety-related cooling chain have been sized using the temperatures in Table 9.2.5-6-1, which represent design requirements of the UHS. A plant instrument uncertainty of 2°F is applied. To provide plant operators with sufficient time to align the plant for long term core cooling on the UHS, all core cooling equipment is assumed to be running for 48-hours. The plants non-safety-related loads are considered to be shed from the plant's core cooling systems. Decay heat is a function of not only time, but also reactor power and core burn-up. Fuel at the end of core (EOC) conditions (62GWd/MTU) is limiting for the purpose of this calculation. Required uncertainty in reactor thermal power (RTP) is applied consistent with NRC Branch Technical Position ASB 9-2. To support the operation of the safety-related decay heat removal function, cooling is provided to related equipment. These loads are associated with CCWS trains as follows:

- Trains 1 & 4: Cooling only associated with safety injection system (SIS) users.
- Train 2: Cooling associated SIS users and Common 1 (operational loads, including the spent fuel pool (SFP)).
- Train 3: Cooling associated SIS users and Common 2 (operational loads, not including the SFP).

During a DBA, non-safety-related loads are removed from service by either the EDG load shedding or manual operator action. The thermal increase imparted to the fluid by a pump is due to total friction loss in a closed loop (e.g., such as CCW and ESW) from the power applied to the pump shaft, which is converted to thermal energy by friction loss in the system and the pump efficiency losses, then rejected to the UHS. To support sizing the UHS, a time and train dependent heat rejection rate is compiled by simple summation of the constituents operating during the assumed accident scenario, with changes in the plant operation at 48-hrs after event initiation. The time dependent heat rejection is numerically integrated to provide total heat rejection during the event. Only two trains are credited with decay heat removal and reactor coolant system (RCS) sensible heat transfer. The decay heat is assumed to be removed in conjunction with cooling of a "Common" CCWS header (including the SFP). This confirms that a maximum heat rejection rate is considered. Two cases are presented: A residual heat removal (RHR) cooldown of the RCS after a DBA, with a loss of offsite power (LOOP) event; and the in-containment refueling water storage tank (IRWST) temperature heat-up and resulting low head safety injection (LHSI) heat exchanger (HX) load after a large break LOCA (LBLOCA). The DBA with LOOP event is limiting for small break LOCA (SBLOCA) due to the high heat transfer rate achieved at 356°F with the early RHR connection of two LHSI HX trains in recirculation to the RCS legs.

During an LBLOCA, whereby the steam generators (SG) are immediately decoupled from RCS heat rejection, energy is transferred from the RCS to the containment atmosphere and eventually to the IRWST. The two LHSI HX trains take suction from the IRWST and pump the fluid through the LHSI/CCW heat exchangers and inject it back into the RCS. In this scenario, the heat transfer via the cooling chain will be tempered by the latency of the IRWST fluid as it absorbs the energy of the RCS and containment atmosphere. The limiting case is the highest IRWST temperature which results from an LBLOCA in the hot leg. The integral of the heat rejection rate over time provides the total UHS heat rejection. The results of these analyses are summarized in U.S. EPR FSAR Tier 2, Table 9.2.5-1—Ultimate Heat Sink System Interface.

2. The wet bulb correction of 1°F is an established practice to account for potential interference effects for cooling towers. Basic factors are the total tower size requirements to meet the specified design conditions, orientation, location, wind velocity and direction, and to a small extent, plume buoyancy, which is basically the result of heat load placed on the tower. This approach includes an allowance in the specified design entering air wet bulb temperature of a mechanical draft tower. The UHS cooling tower inlet wet bulb temperature was adjusted based on these factors.

   The interference factor will be deleted from U.S. EPR FSAR Tier 2, Table 9.2.5-2—Ultimate Heat Sink Design Parameters because this factor may not be sufficient for certain site-specific conditions. As part of addressing COL Item 2.0-1 in U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items, each COL applicant will determine the inlet wet bulb temperature correction factor to address site-specific conditions of orientation, location, wind velocity and direction, to account for potential interference and recirculation effects.

   U.S. EPR FSAR Tier 2, Table 2.1-1—U.S. EPR Site Design Envelope, Sheets 4 of 7 and 7 of 7, and U.S. EPR FSAR Tier 2, Section 9.2.5.3.1 will be revised to reflect this information.

3. Final performance curves showing the minimum required tower heat rejection capability versus time (including spent fuel pool cooling) for post LOCA cooldown, and cooldown to cold shutdown conditions following a reactor trip with and without offsite power available will be identified later in the design process, upon receipt of final vendor information.

4. Refer to the Response to RAI 119, Question 09.02.01-10 for a description concerning monitoring the ESWS and UHS.

FSAR Impact:

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

2. U.S. EPR FSAR Tier 2, Section 9.2.5.3.1, Table 9.2.5-2, and Table 2.1-1 will be revised as described in the response and indicated on the enclosed markup.

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

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

Table 9.2.5-6-1—Design ESW Temperature for Different Plant Modes

Plant Mode	ESW Temperature	Notes
DBA	95°F	Condition must be met with a 0% exceedance.
Normal Operation	92°F	Condition must be met with a 1% exceedance.
Spring/Fall Refueling Outage	90°F	Considered to be representative of typical spring/fall outage seasonal ambient capabilities.
Severe Accident	95°F	None.

Question 09.02.05-17:

Standard Review Plan (SRP) 9.2.5 Section III, paragraph 1 requires confirmation of the overall arrangement of the ultimate heat sink (UHS). The staff reviewed the descriptive information, arrangement, design features, environmental qualification, performance requirements, and interface information provided in Tier 1 Final Safety Analysis Report (FSAR) Section 2.7.11 to confirm completeness and consistency with the plant design basis as described in Tier 2 Section 9.2.5. The staff found that the Tier 1 information is incomplete, inconsistent, inaccurate, or that clarification is needed in the FSAR with respect to the following considerations:

a. Although the Introduction Section in Chapter 1 of the Tier 1 FSAR states that the information in the Tier 1 portion of the FSAR is extracted from the detailed information contained in Tier 2, the staff found that much of the information provided in FSAR Tier 1 is not described in Tier 2 FSAR Section 9.2.5 (e.g., equipment locations, valve functional requirements, indication and control information, priority actuation and control system description and functions, automatic actuation and interlock details, valve failure modes, and harsh environment considerations). This Tier 1 information needs to be added to Tier 2.

b. FSAR Tier 1 does not stipulate that the ultimate heat sink (UHS) is accessible for performing periodic inspections as required by General Design Criteria (GDC) 45.

c. FSAR Tier 1 does not stipulate that the UHS design provide for flow testing of makeup water for accident and emergency conditions.

d. FSAR Tier 1 does not stipulate that the essential service water system (ESWS) pumps are protected from debris from the cooling towers.

e. FSAR Tier 1 does not stipulate that the safety related UHS outdoor piping is adequately protected from the elements and postulated hazards.

f. Tier 1, Figure 2.7.11-1, “Essential Service Water System Functional Arrangement,” does not show nominal pipe sizes for the UHS, which are necessary for design certification. This table does not show design information for the UHS fans.

g. Tier 1, Table 2.7.11-2, “Essential Service Water System Equipment I&C and Electrical Design,” does not include information pertaining to the UHS fans and corresponding power supplies.

h. The point of Note 2 for Tier 1, Table 2.7.11-2 is not clear since it does not appear to pertain to anything on the table. However, this appears to be due to an oversight whereby dedicated ESWS components are not listed in the table.

i. The discussion under Item 6 Tier 1 of Table 2.7.11-2 related to environmental qualification is inconsistent with the information provided in Table 2.7.11-2 in that no equipment is listed in the table for harsh environment considerations.

Response to Question 09.02.05-17:

a. For the UHS, Tier 2 information is also located in U.S. EPR FSAR sections other than U.S. EPR FSAR Tier 2, Section 9.2.5. For example:

- Equipment locations and environmental qualification information, including functions, such as reactor trip (RT), engineered safeguards, and post-accident monitoring

(PAM), is provided in U.S. EPR FSAR Tier 2, Table 3.10-1—List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment, and U.S. EPR FSAR Tier 2, Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment.

- Indication and control requirements are addressed in U.S. EPR FSAR Tier 2, Sections 7.3 through 7.6.

- Function of priority and actuator control system modules is described in U.S. EPR FSAR Tier 2, Section 7.3.

b. Information regarding accessibility for Inservice Inspection (ISI) is not required in U.S. EPR FSAR Tier 1 as addressed in SRP 14.3, Appendix C, Fluid Systems Review Checklist:

"(xii) Accessibility for ISI Testing and Inspection. The accessibility does not have to be addressed in Tier 1, but should be addressed in Tier 2. The NRC does not intend to grant reliefs to the ISI requirements after design certification."

The ESWS, of which the UHS is a part, is designed to permit periodic inspection of important components necessary to maintain the integrity and capability of the system (GDC 45). Refer to U.S. EPR FSAR Tier 2, Section 9.2.5.1.

Safety-related portions of the ESWS UHS are designed in accordance with ASME III, Class 3, and safety-related, above-ground portions of the system are designed and installed to permit periodic inspection in accordance with ASME XI. The system is designed so that safety-related valves, other active components, and supports are not buried.

c. The makeup water system is defined as a UHS support system, such as blowdown and chemical treatment. The design of these support systems is treated as conceptual and is not considered part of the U.S. EPR standard design.

The following sections of the U.S. EPR FSAR support these statements:

U.S. EPR FSAR Tier 2, Section 1.8 identifies the site-specific items that must be included by a COL applicant that references the U.S. EPR design certification.

U.S. EPR FSAR Tier 2, Table 1.8-1—Summary of U.S. EPR Plant Interfaces with Remainder of Plant identifies the interfaces between the U.S. EPR standard design and the remainder of the plant. Interface Item No. 9-2 in this table specifies the makeup water, blowdown, and chemical treatment support systems for the UHS.

U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items identifies the COL information items that must be addressed by the COL applicant. Information Item No. 9.2-1 (referenced in U.S. EPR FSAR Tier 2, Section 9.2.5) states the following:

> "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)."

Even though conceptual designs are outside the scope of the U.S. EPR standard design, general conceptual design information is provided in U.S. EPR FSAR Tier 2, Section 1.8.

In the response to RAI 175, Question 09.02.05-20 (Part 3), U.S. EPR FSAR Tier 2, Section 1.8, was revised to include the following information:

> "Site-specific ultimate heat sink (UHS) systems. Conceptual design information for these systems is presented, delineated by double brackets ([[ ]]), in Section 9.2.5."

U.S. EPR FSAR Tier 1, Section 4.0 provides Tier 1 information for the plant interface items. Tier 1 information is not provided for the conceptual design portions that are to be addressed by the COL applicant.

U.S. EPR FSAR Tier 1, Section 4.7 addresses the ESWS and UHS and states the following:

> "Interface requirements for the essential service water system (ESWS) and ultimate heat sink (UHS) are provided in Section 2.7.11 for the emergency makeup water system and Section 4.6 for buried conduit and duct banks, and pipe and pipe ducts."

In the response to RAI 175, Question 09.02.05-20 (Part 3), U.S. EPR FSAR Tier 2, Section 9.2.5 was revised to reflect a new figure showing the conceptual site specific UHS systems, and U.S. EPR FSAR Tier 2, Section 9.2.5.2 was revised to include the following information:

> "The site-specific UHS systems are shown in Figure 9.2.5-2—[[Conceptual Site-Specific UHS Systems]]."

In the response to RAI 175, Question 09.02.05-13, U.S. EPR FSAR Tier 2, Section 9.2.5.6 was revised to clarify inspection and testing requirements of UHS systems by including the following information:

> "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."

The COL applicant is responsible for providing inspections, tests, analyses, and acceptance criteria (ITAAC) associated with the site-specific design. COL Information Item No. 14.3-1 in U.S. EPR FSAR Tier 2, Table 1.8-2 states the following:

> "A COL applicant that references the U.S. EPR design certification will provide ITAAC for emergency planning, physical security, and site-specific portions of the facility that are not included in the Tier 1 ITAAC associated with the certified design (10 CFR 52.80(a))."

Since the design of the site-specific UHS makeup water system is conceptual and not considered part of the U.S. EPR standard design, the U.S. EPR FSAR will not be changed in response to this question.

d. Filters in the ESWS are provided solely for equipment protection and are not credited in safety analyses; therefore, they are not safety significant and do not require U.S. EPR FSAR Tier 1 treatment. For example, filters shall be included if they are required to remove radionuclides as part of the primary safety function of the system (see SRP 14.3 Appendix C, Fluid Systems Review Checklist, Item (4)):

"(4) Filters - Filters that are required for a safety function (such as control room HVAC radiation filtering) should be in the design description. The basic configuration ITAAC should check that the filter exists, but need not test the filter performance."

Refer to the Response to RAI 175, Question 09.02.05-10 on how the ESW pumps are protected from debris from the cooling towers.

e. The UHS does not have any safety-significant outdoor piping within the scope of design certification. Refer to the Response to RAI 119, Question 09.02.01-23.

Safety-related UHS piping located outside of buildings is buried. The design of buried piping is site specific. U.S. EPR FSAR Tier 1, Section 4.6 provides the interface requirements applicable to safety-related buried piping in general, and U.S. EPR FSAR, Tier 1 Section 4.7 refers specifically to the interface requirements for the UHS makeup water system.

f. Refer to the Response to RAI 119, Question 09.02.01-22 (Part 1) for the basis of why U.S. EPR FSAR Tier 1, Figure 2.7.11-1—Essential Service Water System Functional Arrangement does not show nominal pipe sizes for the UHS.

Design information for the UHS fans will be added to U.S. EPR FSAR Tier 1, Table 2.7.11-2—Essential Service Water System Equipment I&C and Electrical Design as part of the response to Part g of this question.

g. U.S. EPR FSAR Tier 1, Table 2.7.11-2—Essential Service Water System Equipment I&C and Electrical Design will be revised to include information pertaining to the ESWS cooling tower fans and corresponding Class 1E power supplies.

h. As part of the Response to RAI 119, Question 09.02.01-1, alternate power supplies for applicable dedicated ESWS components have been added to U.S. EPR FSAR Tier 1, Table 2.7.11-2—Essential Service Water System Equipment I&C and Electrical Design.

i. Refer to the Response to RAI 119, Question 09.02.01-21 (Part 20).

FSAR Impact:

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

U.S. EPR Final Safety Analysis Report Markups

Table 2.1-1—U.S. EPR Site Design Envelope
Sheet 4 of 7

U.S. EPR Site Design Envelope			
Missile Spectra			6 in Schedule 40 pipe, 6.625 in diameter x 15 ft long, area, impact velocity of 135 fps horizontal and
			Automobile, 16.4 ft x 6.6 ft x 4.3 ft, 4000 lb, 4086.7 i velocity of 135 fps horizontal and 90 fps vertical. (A considered at elevations up to 30.0 ft above g
			Solid steel sphere, 1 in diameter, 0.147 lb, 0.79 in^2 velocity of 26 fps horizontal and 17 fps
Temperature (Refer to Section 2.3)			
Air	0% Exceedance Values	Maximum	115°F Dry Bulb / 80°F Wet Bul 81°F Wet Bulb (non-coincident) U
		Minimum	-40°F
	1% Exceedance Values	Maximum	100°F dry bulb/77°F coincide 80°F wet bulb (noncoincident) ~~U~~
		Minimum	-10°F
UHS Meteorological Conditions			
Conditions resulting in Maximum Evaporation and Drift Loss of Water from the UHS (Section 2.3.1)			As presented in Table 2.1-3—Design Evaporation and Drift Loss of Wat
Conditions resulting in Minimum Water Cooling in the UHS (Section 2.3.1)			As presented in Table 2.1-4—Design Water Cooling in the

Table 2.1-1—U.S. EPR Site Design Envelope
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U.S. EPR Site Design Envelope								
Time Period	Vent Stack Base	Releases via Safe-guard Building Canopy #1	Releases via Safe-guard Building Canopy #2	Equip-ment Hatch Releases via Material Lock	Depress-urization Shaft Releases	Main Steam Relief Train Silencer #1	Main Steam Relief Train Silencer #2	S
0–2 hours (s/m³)	4.30E-03	1.67E-02	3.03E-03	1.65E-03	7.52E-03	1.93E-03	2.43E-03	1.
2–8 hours (s/m³)	3.71E-03	1.47E-02	2.68E-03	1.47E-03	6.67E-03	1.66E-03	2.12E-03	1.
8–24 hours (s/m³)	1.46E-03	5.96E-03	1.15E-03	5.74E-04	2.88E-03	6.69E-04	8.28E-04	5.
1–4 days (s/m³)	1.12E-03	4.28E-03	7.59E-04	4.37E-04	1.89E-03	5.02E-04	6.38E-04	4.
4–30 days (s/m³)	1.03E-03	3.89E-03	6.89E-04	4.00E-04	1.71E-03	4.65E-04	5.85E-04	4.

(1) The maximum 48-hour PMWP liquid of 32 inches is based on data obtained from National Oceanic and Atmospheric Adminis logical Report No. 53 "Seasonal Variation of 10-square-mile Probable Maximum Precipitation Estimates, United States East o for the three winter months – December through February. However, the effect of rainfall events on roof loads is negligible, d pets.

(2) COL applicant to determine wet bulb temperature correction factor to account for potential interference and recirculation effec Item 2.0-1 in Table 1.8-2—U.S. EPR Combined License Information Items).

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.

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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 2004 Edition, 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

Table 9.2.5-2—Ultimate Heat Sink Design Parameters

Cooling Tower Cells 31/32/33/34 URB	
Description	**Technical Data**
Cooling Tower Type	Mechanical Induced Draft
Design Water Flow (total both cells)	19,200 gpm
Design Cold (Outlet) Water Temperature	≤95°F (max, DBA)
~~Ambient Wet Bulb/Summer/~~Design Inlet ~~WBT~~Wet Bulb Temperature	81°F (~~includes 1°F correction for interference~~non-coincident, 0% exceedance value)(1)
Maximum Drift Loss (Percent of Water Flow)	< 0.005%
Maximum Evaporation Loss at Design Conditions (total both cells)	571 gpm
Number of Cells	2 Cell/Tower
Basin Water Volume (Min)	~~337,987~~ ≥295,120 ft^3
Basin Water Level (Min)	~~27.2~~23.75 ft

(1) COL applicant to determine wet bulb temperature correction factor to account for potential interference and recirculation effects. (Refer to COL Item 2.0-1 in Table 1.8-2).

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

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	IEEE Class 1E (2)	PACS	MCR/RSS Displays
Tower Isolation Valve Division 4	30PED40AA010	ESW Pump Structure Division 4	Division 4	No	Pos/N/A
Tower Bypass Isolation Valve Division 4	30PED40AA011	ESW Pump Structure Division 4	Division 4	No	Pos/N/A
Makeup Water Isolation Valve Division 4	30PED40AA019	ESW Pump Structure Division 4	Division 4	No	Pos/N/A
Emer. Makeup Water Isolation Valve Division 4	30PED40AA021	ESW Pump Structure Division 4	Division 4	No	Pos/N/A
Dedicated ESW Pump	30PEB80AP001	ESW Pump Structure Division 4	Division 4[N] SBO[A]	No	On-Off/ On-Off
Dedicated Filter Blowdown Isolation Valve	30PEB80AA009	ESW Pump Structure Division 4	Division 4[N] SBO[A]	No	Pos/N/A
Dedicated Blowdown Isolation Valve	30PEB80AA016	ESW Pump Structure Division 4	Division 4	No	Pos/N/A
Dedicated Recirc Isolation Valve	30PEB80AA015	ESW Pump Structure Division 4	Division 4	No	Pos/N/A
Dedicated Emergency Blowdown Isolation Valve	30PEB80AA003	ESW Pump Structure Division 4	Division 4	No	Pos/N/A
Cooling Tower Fan	30PED10AN001	ESW Cooling Tower, Division 1	Division 1	Yes	On-Off/ On-Off

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

~~Equipment~~ Description	~~Equipment~~ Tag Number (1)	~~Equipment~~ Location	IEEE Class 1E (2)	PACS	MCR/RSS Displays
Cooling Tower Fan	30PED10AN002	ESW Cooling Tower, Division 1	Division 1	Yes	On-Off/ On-Off
Cooling Tower Fan	30PED20AN001	ESW Cooling Tower, Division 2	Division 2	Yes	On-Off/ On-Off
Cooling Tower Fan	30PED20AN002	ESW Cooling Tower, Division 2	Division 2	Yes	On-Off/ On-Off
Cooling Tower Fan	30PED30AN001	ESW Cooling Tower, Division 3	Division 3	Yes	On-Off/ On-Off
Cooling Tower Fan	30PED30AN002	ESW Cooling Tower, Division 3	Division 3	Yes	On-Off/ On-Off
Cooling Tower Fan	30PED40AN001	ESW Cooling Tower, Division 4	Division 4	Yes	On-Off/ On-Off
Cooling Tower Fan	30PED40AN002	ESW Cooling Tower, Division 4	Division 4	Yes	On-Off/ On-Off

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 f
feed is implemented.

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