ArevaEPRDCPEm Resource

From:	WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
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
Attachments:	RAI 175 Supplement 1 Response US EPR DC.pdf

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)
Ronda Pederson
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Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
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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
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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 524

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From: WELLS Russell D (AREVA NP INC)

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MESSAGE	5746	5/22/2009 4:22:30 PM
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Response to

Request for Additional Information No. 175 (1817), Supplement 1, Revision 0

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 09.02.05-3:

Based on a review of the information provided in Tier 2 of the Final Safety Analysis Report (FSAR), Section 9.2.5, "Ultimate Heat Sink," the staff found that the description of the ultimate heat sink (UHS) does not adequately explain the designs satisfaction of the design bases considerations, identify the limiting assumptions that apply, provide the excess margin available, include and address relevant operating experience insights and so forth. Consequently, Tier 1 and Tier 2 of the Final Safety Analysis Report (FSAR) needs to be revised to include information that is sufficient to demonstrate that the UHS is capable of performing its design-bases functions, that applicable design considerations are satisfied by the proposed design, and that reasonable assurance exists that the availability and design-bases capability of the UHS will be maintained over the life of the plant. Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," provides guidance on the specific information that should be included in the application for evaluation by the staff.

Response to Question 09.02.05-3:

See the Responses to RAI 175, Questions 09.02.05-4 through 09.02.05-20. Where necessary, the U.S. EPR FSAR as it relates to the ultimate heat sink (UHS) in Tier 1, Section 2.7.11 and Tier 2, Section 9.2.5 will be revised as indicated in the individual responses to RAI 175 Questions 09.02.05-4 through 09.02.05-20.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.7.11 and Tier 2, Section 9.2.5 will be revised as described in the responses to Questions 09.02.05-4 through 09.02.05-20 and indicated on the enclosed markups.

Question 09.02.05-4:

The ultimate heat sink (UHS) must be able to withstand natural phenomena without the loss of function in accordance with General Design Criteria (GDC) 2 requirements. The system description does not explain the functioning and maximum allowed combined seat leakage of safety-related boundary isolation valves at the UHS basin to ensure UHS integrity and operability during seismic events and other natural phenomena. Consequently, additional information needs to be included in Tier 2 Section 9.2.5 of the Final Safety Analysis Report (FSAR) to fully describe: (a) the assurance of the UHS integrity and operability by the safety-related boundary isolation valves so that common-cause simultaneous failure of all non-safety-related UHS piping will not compromise the UHS safety functions during seismic events, (b) the maximum allowed combined seat leakage for the safety-related UHS boundary isolation valves and periodic testing that will be performed to ensure that the specified limit will not be exceeded, and (c) a description of any other performance assumptions that pertain to the boundary isolation valves or other parts of the system including blowdown that are necessary to assure the capability of the UHS to perform its safety functions during natural phenomena. In addition, under FSAR, Section 9.2.5.5, “Safety Evaluation,” it states that “The UHS pump buildings and cooling towers are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles and other natural phenomena.” However, there is no mention of the piping system being designed to meeting these conditions.

Response to Question 09.02.05-4:

a. Non-safety-related ultimate heat sink (UHS) piping, components, and associated pipe supports located near or forming an extension of safety-related system piping and components are classified and designed as Seismic Category II or Non-Seismic depending on pipe routing. As a minimum, the non-safety-related system piping is seismically analyzed up to the boundary anchor. A Seismic Category II classification means that loss of physical integrity of non-safety-related structures, systems and components (SSC) as a result of natural phenomena will not result in an adverse interaction with a safety-related SSC that potentially compromises the capability of the safety-related SSC to perform its safety function. The safety-related UHS boundary isolation valves are classified and designed as Seismic Category I.

   Non-Seismic lines and associated equipment are routed, to the extent possible, outside of safety-related structures and areas to avoid potentially adverse interactions. In the event that this routing is not possible and Non-Seismic lines must be routed in safety-related areas, the Non-Seismic items are evaluated for seismic interactions (refer to U.S. EPR FSAR Tier 2, Section 3.7.3.8).

b. The UHS tower basin volume is calculated considering the loss of inventory through valve seat leakage for 72 hours. The valves considered are those whose leakage will cause a loss of inventory in the UHS tower basin. After 72 hours and up to 30 days, the UHS emergency makeup system will provide sufficient water to the cooling tower basin including compensation for the valve leakage inventory loss. The following methodology is used to determine the valve seat leakage.

   ASME OM Code, subparagraph ISTC-3630 (e) states that leakage rate measurements shall be compared with the permissible leakage rates specified by the owner for a specific valve or valve combination. If leakage rates are not specified by the owner, the following rates shall be permissible:

(1) For water, 0.5D gal/min (12.4d ml/s) or 5 gal/min (315 ml/s), whichever is less, at function pressure differential.

where,

D = nominal valve size, inches

d = nominal valve size, centimeters.

Inservice testing shall be performed as described in U.S. EPR FSAR Tier 2, Section 3.9.6.3, such that the specified limit will not be exceeded.

U.S. EPR FSAR Tier 2, Section 9.2.5.3.2 will be revised to include the following information:

"Inservice testing of valves shall 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."

c. The UHS performs its safety function under design basis accident (DBA) conditions. As stated in U.S. EPR FSAR Tier 2, Section 9.2.5.1, the UHS SSC are designed to withstand the effects of natural phenomena. The above ground piping and components are protected by the structures.

U.S. EPR FSAR Tier 2, Section 9.2.5.5 will be revised to include the following information:

"The above ground piping and components are protected by the structures."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.2.5.3.2 and Section 9.2.5.5 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.05-5:

Standard Review Plan (SRP) 9.2.5 Section III, paragraph 1 specifies confirmation of the overall arrangement of the ultimate heat sink (UHS). Revise the description and piping and instrumentation diagram (P&IDs) and the Final Safety Analysis Report (FSAR) 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 where indications are displayed (e.g., local, remote panel, control room), and what instruments provide input to a process computer and/or have alarm and automatic actuation functions.

d. Figure 9.2.5-1 does not show what the normal valve positions are, what valves are locked in position, and what valves have 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).

Response to Question 09.02.05-5:

a. Specific ultimate heat sink (UHS) line sizing details will be identified later in the design process. Pipe sizing is based on maintaining fluid velocities within 4 to 10 feet per second. Pipe sizes will be determined to optimize fluid velocities during all operating scenarios.

   The following factors are affected by velocity and will be considered:

   - Allowable line pressure drop.
   - Piping layout and configuration.
   - Economic evaluation that considers piping material costs and pumping energy costs.
   - Quality of fluid handled.
   - System operation (e.g., continuous, intermittent).

- Effects of flashing, noise, vibration, water hammer, and erosion with high velocities at continuous service.

b. System operating temperatures, pressures, and flow rates for all modes and alignments that are not already provided in U.S. EPR FSAR Tier 2, Section 9.2.5 will be identified later in the design process. Specific fan data, including fan speed, depends upon selection of a particular fan from a vendor.

c. Locations where indications are displayed (e.g., local, remote panel, control room), and what instruments provide input to a process computer and/or have alarm and automatic actuation functions will be developed later in the design process.

d. Refer to the Response to RAI 119 Supplement 1 Question 09.02.01-4 (Part d) for a description of the operation and function of the following UHS valves:

- 30PED10/20/30/40 AA010, ESWS return header isolation valve.
- 30PED10/20/30/40 AA011, ESWS cooling tower bypass isolation valve.
- 30PED10/20/30/40 AA019, ESWS normal makeup water isolation valve.
- 30PED10/20/30/40 AA021, ESWS emergency makeup water isolation valve.

The description of 30PED10/20/30/40 AA021 given in the Response to RAI 119 Supplement 1 Question 09.02.01-4 (Part d) is supplemented with the following information:

> "The ESWS emergency makeup water isolation valve, 30PED10/20/30/40 AA021, is closed during normal operation. Upon receipt of a safety injection signal (SIS), concurrent with the cooling tower basin water level below the established limits, valve 30PED10/20/30/40 AA021 is opened. This establishes a makeup function to the cooling tower basin, post design basis accident (DBA)."

e. To maintain ESW cold water temperature within established limits during low load/low ambient temperature conditions, the UHS cooling tower bypass will have the capability to divert the full system flow directly to the basin. This will preclude overcooling the ESW and protect against freezing within the cooling tower. Paired operation of the bypass and return header operation valves are automatic and will maintain the cold water temperature in an acceptable range by diverting the full flow to either the basin or cooling tower. Hence, the bypass line is sized to 30 inches, which is identical to the ESW main line to the UHS cooling tower cells.

f. Specific information about the UHS fan alarms, including instrumentation and controls, will be identified later in the design process, subsequent to development of final cooling tower information, such as number of alarms, alarm setpoints and basin temperatures.

g. U.S. EPR FSAR Tier 2, Figure 9.2.1-1—Essential Service Water System Piping & Instrumentation Diagram, Sheet 1 of 4, shows level and temperature instruments for the cooling tower basin. U.S. EPR FSAR Tier 2, Sections 9.2.5.7.1 and 9.2.5.7.2 provide a description of system monitoring and alarms, respectively. U.S. EPR FSAR Tier 2, Table 9.2.1-3—Alarm Summary provides a list of the alarms.

FSAR Impact:

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

Question 09.02.05-10:

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 protection of the essential service water system (ESWS) pump suction supports compliance with GDC 44 since these components are essential for the overall system function.

Describe in the FSAR the protection of the ESWS pump suction from potential debris intrusion (e.g. tower fill degradation, etc.). The staff noted that some plants have found this type of protection to be necessary (e.g. screens) due to damage to the fill from failed cooling tower spay nozzles. Also provide in the FSAR a description of the cooling tower spray and fill design arrangements related to failure modes.

Response to Question 09.02.05-10:

To prevent the entrainment of debris from the ultimate heat sink (UHS) cooling tower, each cell of the UHS cooling tower includes a debris screen located between the cooling tower internals and the essential service water (ESW) pump.

Each of the four UHS cooling tower structures is an independent, safety-related, Seismic Category I, reinforced concrete structure. The structures are designed for external hazards, including rain, snow, flooding, wind loads, tornado loads, missile impact loads, safe shutdown earthquake (SSE) loads and site proximity hazards. The structures enclose safety-related, Seismic Category I piping, components and equipment; including the UHS cooling tower fans, fan motors and drives, spray headers and supports, spray nozzles, fill, drift eliminators and related supporting structures.

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 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. The ESW pumps are protected from failures of passive components of the UHS cooling towers (e.g., spray nozzles, tower fill) by screens located in the pump suction flow path, between the cooling tower internals and the ESW pump.

The four division design of the UHS provides complete redundancy; therefore, a single failure does not compromise the UHS system safety-related functions. Each division of UHS is independent of any other division and does not share components with other divisions or with other nuclear power plant units. The design of the UHS cooling towers as related to the single failure criterion is addressed in U.S. EPR FSAR Tier 2, Section 9.2.5.5.

U.S. EPR FSAR Tier 2, Section 9.2.5.3.1 will be revised to include the preceding information concerning the design of the UHS system.

FSAR Impact:

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

Question 09.02.05-11:

General Design Criteria (GDC) 44 requires systems to transfer heat from structures, systems, and components important to safety to an 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, justify that a safety related fan braking system is not needed for the design basis tornado.

Response to Question 09.02.05-11:

U.S. EPR FSAR Tier 2, Section 3.3 provides tornado design parameters applicable to the U.S. EPR standard plant design and consistent with the guidance given in RG 1.76. The ultimate heat sink (UHS) cooling towers will be specified and designed to withstand exposure to these types of design conditions. The specific method to be employed to protect the UHS cooling towers so that they remain available to perform their safety-related function will be determined in coordination with the cooling tower manufacturer later in the design process.

FSAR Impact:

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

Question 09.02.05-12:

General Design Criteria (GDC) 45 requires the ultimate heat sink (UHS) to be designed so that periodic inspections of piping and components can be performed to assure that the integrity and capability of the system will be maintained over time. The staff finds the design to be acceptable if the Final Safety Analysis Report (FSAR) describes inspection program requirements that will be implemented and are considered to be adequate for this purpose. While Tier 2 FSAR Section 9.2.5.6 indicates that periodic inspections will be performed, the extent and nature of these inspections and procedural controls that will be implemented to assure that the UHS is adequately maintained over time were not described. Furthermore, the accessibility and periodic inspection safety related buried piping and the cooling tower spray header system and tower fill is of particular interest. Consequently, additional information needs to be provided in the FSAR to describe the extent and nature of inspections that will be performed and procedural controls that will be implemented commensurate with this requirement.

Response to Question 09.02.05-12:

Safety-related piping, valves, and fittings in the ultimate heat sink (UHS) system and basin support systems are designed in accordance with ASME III, Class 3 (Refer to U.S. EPR FSAR Tier 2, Section 9.2.5.3.2). The inservice inspection (ISI) and preservice inspection (PSI) programs for ASME III, Class 3 components are described in U.S. EPR FSAR Tier 2, Section 6.6. The ISI and PSI programs are identified in U.S. EPR FSAR Tier 2, Section 13.4 as operational programs.

The design of buried pipe is site specific (Refer to U.S. EPR FSAR Tier 2, Section 3.8.4.4.5). Welds, or portions thereof, that are inaccessible due to being buried underground are exempt from the visual examination requirements of ASME XI, IWD-2500, in accordance with IWD-1220(e).

The cooling tower spray header and tower fill systems will be designed to facilitate appropriate periodic inspections in accordance with the recommendations of the cooling tower manufacturer.

U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items, Item No. 13.4-1, states:

> “A COL applicant that references the U.S. EPR design certification will provide site-specific information for operational programs and schedule for implementation.”

U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items, Item No. 13.5-1, states:

> “A COL applicant that references the U.S. EPR design certification will provide site-specific information for administrative, operating, emergency, maintenance and other operating procedures.”

The extent and nature of periodic inspections of piping and components that will be performed, and the procedural controls that will be implemented to assure that the UHS is adequately maintained over time will be developed later in the design process.

FSAR Impact:

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

Question 09.02.05-14:

Means must be provided for monitoring effluent discharge paths and the plant environs for radioactivity that may be released in accordance with General Design Criteria (GDC) 64 requirements. Also, 10 CFR 52.79(a)(45) and 10 CFR 20.1406 require combined operating license (COL) applicants to describe how facility design and procedures for operation will minimize contamination of the facility and the environment. The staff's review criteria (standard review plan (SRP) Section 9.2.1, Paragraph III.3.D) specify that provisions should be provided to detect and control leakage of radioactive contamination into and out of the essential service water system (ESWS) which is part of the ultimate heat sink (UHS). The design is considered to be acceptable by the staff if the UHS/essential service water system (ESWS) piping and instrumentation diagram (P&IDs) show that radiation monitors at components that are susceptible to leakage, and if the components that are susceptible to leakage can be isolated. However, the staff noted that Tier 2 Final Safety Analysis Report (FSAR) Section 9.2.5 and the UHS/ESWS P&ID do not include radiation monitors in the system design and the NRC regulations in this regard have not been addressed. Therefore, additional information needs to be included in Tier 2 FSAR Section 9.2.5 to address the NRC requirements referred to above.

Response to Question 09.02.05-14:

Refer to the Response to RAI 119, Supplement 1, Question 09.02.01-14, which provides information relevant to the inclusion of radiation monitors in the design of the essential service water system (ESWS), and consequently, the ultimate heat sink (UHS).

FSAR Impact:

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

Question 09.02.05-16:

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 in GDC 44 that adequate emergency makeup is also necessary.

Final Safety Analysis Report (FSAR) Tier 2, Table 9.2.5-2 identifies a maximum essential service water system (ESWS) cooling tower evaporation rate of 2.16 m^3/min (571 gpm). However, Technical Specification Surveillance (TS) 3.7.8.7 requires periodic confirmation that safety-related ESW basin makeup is greater than or equal to 1.14 m^3/min (300 gpm). Regulatory Position C.1 of Regulatory Guide (RG) 1.27 states that, "A cooling supply of less than 30 days may be acceptable if it can be demonstrated that replenishment or use of an alternative water supply can be effected to assure the continued ability of the sink to perform its safety functions…"

a. Explain the basis in FSAR 9.2.5 for why the basin makeup to be less than the maximum evaporation rate.

b. Describe in the FSAR Section 9.2.5 the basis for the Technical Specification minimum 1.14 m^3/min (300 gpm).

Response to Question 09.02.05-16:

a. The rate of evaporation loss given in U.S. EPR FSAR Tier 2, Table 9.2.5-2—Ultimate Heat Sink Design Parameters, is the maximum evaporation loss from both cooling tower cells at peak heat load and design ambient conditions at 5 hours into a design basis accident (DBA). The heat load after 72 hours post-DBA is lower than the peak heat load due to a reduction in decay heat from the reactor. Consequently, the makeup flow rate after 72 hours is lower than the peak condition. Since the ultimate heat sink (UHS) basin contains 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 significantly diminished.

   U.S. EPR FSAR Tier 2, Section 9.2.5.5 and Table 9.2.5-2—Ultimate Heat Sink Design Parameters, will be revised to reflect the preceding information.

b. The basis for the essential service water (ESW) basin makeup Technical Specification minimum of 1.14 m^3/min (300 gpm) is a requirement based on temperature data given in Table 2.1-3—Design Values for Maximum Evaporation and Drift Loss of Water from the UHS. Applying this data over a 72 hour period post-DBA to calculate the evaporation losses, drift losses and evaluating other losses such as valve seat leakage and seepage losses, for the associated cooling tower, a minimum of 1.14 m^3/min (300 gpm) is required after the 72^{nd} hour post-DBA.

   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. U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items, Item No. 2.3-10 states:

   > "A COL applicant that references the U.S. EPR design certification will describe the means for providing UHS makeup sufficient to meet the maximum evaporative and

drift water loss after 72 hours through the remainder of the 30 day period consistent with RG 1.27."

U.S. EPR FSAR Tier 2, Section 9.2.5.5 will be revised to reflect the preceding information.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.2.5.5 and Table 9.2.5-2 will be revised as described in the response and indicated on the enclosed markup.

Question 09.02.05-19:

Standard Review Plan (SRP) 9.2.5 Section III, paragraph 1 specifies confirmation of the overall arrangement of the ultimate heat sink (UHS). The staff noted that Tier 1 Final Safety Analysis Report (FSAR) Section 4.7, “Buried Piping and Pipe Ducts for Service Water,” states that interface requirements for buried ESWS pipe and ducts are provided in Tier 1 FSAR Section 2.7.11. However, the interface information that is referred to is not provided in Section 2.7.11. Also, the interface information is not listed in Tier 2 FSAR Table 1.8-1, “Summary of U.S. EPR Plant Interfaces with Remainder of Plant,” and there is no discussion of the interface requirements for buried safety related ultimate heat sink UHS pipe and ducts in Tier 2 Section 9.2.5. Therefore, additional information is needed in the FSAR to provide the missing interface requirements for buried UHS and essential service water system (ESWS) pipe and ducts.

Response to Question 09.02.05-19:

As defined in SRP 14.3, Appendix C, Fluid Systems Review Checklist, the ultimate heat sink (UHS) does not contain any safety-significant outdoor piping within the scope of design certification. The UHS piping and ducts carry the same piping designation as the essential service water system (ESWS). Refer to the Response to RAI 119 Supplement 2, Question 09.02.01-23.

The title of U.S. EPR FSAR Tier 1, Section 4.7 will be changed to read:

> “Essential Service Water System and Ultimate Heat Sink”

U.S. EPR FSAR Tier 1, Section 4.7 will be revised to read:

> “Interface requirements for the essential service water system and ultimate heat sink 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.”

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 4.7 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

4.7 Essential Service Water System and Ultimate Heat Sink

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.

09.02.05-19

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).

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.

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.

09.02.05-10

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). Pass ive 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.

09.02.05-10

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.

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).

09.02.05-4

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).

9.2.5.4 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. 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.

9.2.5.5 Safety Evaluation

09.02.05-4

The UHS pump buildings and cooling towers are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles and other natural phenomena. Section 3.3, Section 3.4, Section 3.5, Section 3.7 and Section 3.8 provide the basis for the adequacy of the structural design of these structures. The aboveground piping and components are protected by the structures.

The UHS is designed to remain functional after a safe shutdown earthquake (SSE). Section 3.7 and Section 3.9 provide the design loading conditions that are considered. Section 3.5, Section 3.6 and Section 9.5.1 provide the hazards analyses to verify that a safe shutdown, as outlined in Section 7.4, can be achieved and maintained.

The four division design of the UHS provides complete redundancy; therefore a single failure will not compromise the UHS system safety-related functions. Each division of UHS is independent of any other division and does not share components with other divisions or with other nuclear power plant units.

Considering preventative maintenance and a single failure, two UHS divisions may be lost, but the ability to achieve the safe shutdown state under DBA conditions can be reached by the remaining two UHS divisions. In case of LOOP the four UHS cooling towers have power supplied by their respective division EDGs. Isolation valves can isolate non-safety-related portions of the system if necessary without compromising the safety-related function of the system.

The cooling towers must operate for a nominal 30 days following a LOCA without requiring any makeup water to the source or it must be demonstrated that replenishment or use of an alternate or additional water supply can provide continuous capability of the heat sink to perform its safety-related functions. The tower basin contains a minimum 72-hour supply of water. After the initial 72 hours, the site specific makeup water system will provide sufficient flow rates of makeup water to compensate for system volume losses for the remaining 27 days.

09.02.05-16

The heat load after 72 hours post-DBA is lower than the peak heat load due to a reduction in the decay heat from the reactor. Consequently, the makeup flow rate required after 72 hours is lower than the peak condition. Since the UHS basin contains 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.

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

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.

9.2.5.8 References

09.02.05-4

1. ASME Boiler and Pressure Vessel Code, Section III: "Rules for Construction of Nuclear Facility Components," Class 3 Components, The American Society of Mechanical Engineers, 2004.
2. ASME Code OM-2004, "Operation and Maintenance of Nuclear Power Plants," Subsection ISTC, The American Society of Mechanical Engineers, 2004.

09.02.05-16

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	81°F (includes 1°F correction for interference)
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

Next File