## CCNPP3eRAIPEm Resource

**From:** Arora, Surinder
**Sent:** Tuesday, December 14, 2010 2:06 PM
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**Subject:** Draft RAI 279 SBPA 2618
**Attachments:** DRAFT RAI 279 SBPA 2618.doc

Rob,

Attached is DRAFT RAI No. 279 (eRAI No. 2618). You have until December 29, 2010 to review it and decide whether you need a clarification phone call to discuss any questions in the RAI before the final issuance. After the phone call or on December 29, 2010, the RAI will be finalized and sent to you for response. You will then have 30 days to provide a technically complete response or an expected response date for the RAI.

Thanks.

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Request for Additional Information No. 279 (eRAI 2618)
DRAFT
12/14/2010

Calvert Cliffs Unit 3
UniStar
Docket No. 52-016
SRP Section: 09.02.05 - Ultimate Heat Sink
Application Section: 9.2.5

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

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. U.S. Evolutionary Power Reactor (EPR) Final Safety Analysis Report (FSAR) Section 3.5.2, “Structures, Systems, and Components (SSCs) to be Protected from Externally Generated Missiles,” states that the essential service water system (ESWS) building including underground piping cables and instrumentation between the ESWS building and other safety related SSCs are missile protected and meet the recommendations in Regulatory Guide (RG) 1.27, "Ultimate Heat Sink for Nuclear Power Plants." CCNPP Unit 3, FSAR Section 3.5.2 states that there are no departures or supplements. Since the UHS makeup water intake structure is outside the scope of the U.S. EPR design certification and includes safety related components to support the UHS from 72 hours to 30 days post accident the applicant needs to revise the CCNPP FSAR to demonstrate that the structure is missile protected In addition, the applicant needs to revise the CCNPP FSAR to demonstrate that the safety related underground piping system which includes the test bypass, blowdown, alternate blowdown, normal makeup and associated motor operated valves (MOVS) are missile protected.

09.02.05-5

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. CCNPP Unit 3 FSAR Section 9.2.5.5, “Safety Evaluation,” states that the set of traveling screens for the UHS makeup water intake structure meets seismic category II requirements and are large enough to preclude the occurrence of their being blocked to the extent that minimum required flow of water cannot be maintained. Based on the staff’s review of the UHS travelling screen and screen wash design the applicant described in FSAR Section 9.2.5.3, “Component Description,” and Table 3.2-1, “Classification Summary for Site-Specific SSCs,” it was determined that the support systems for the UHS makeup are designed as non-safety related. The staff determined that the non-safety related classification of the travelling screen and screen wash system may be inappropriate since its failure to provide a water flow path to the UHS makeup pumps may effect the ability of the UHS to perform its intended function for up to 30 days. Describe in the FSAR Section 9.2.5.5, related to the natural phenomena events (earthquakes, tornadoes, hurricanes, floods, external missiles and other natural phenomena), the capability of the UHS makeup system to perform its intended safety related function between 72 hours and up to 30 days with the support systems such as screen wash and travelling screens designed as non-safety related.

09.02.05-6

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 in Section 9.2.5.2 of the CCNPP Unit 3 Final Safety Analysis Report (FSAR) does not explain the functioning and maximum allowed combined seat leakage of safety-related boundary isolation valves at the UHS basin and UHS makeup system to ensure UHS integrity and operability during seismic events and other natural phenomena. FSAR Section 9.2.5.5, "Safety Evaluation," does not state that the UHS makeup system meets GDC 2 and is designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles and other natural phenomena. Consequently, additional information needs to be included in Section 9.2.5 of the 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 the periodic testing that will be performed to ensure that the specified limit will not be exceeded,

(c) a description of any other performance assumptions that pertain to the boundary isolation valves or other parts of the system that are necessary to assure the capability of the UHS and UHS makeup system to perform its safety functions during natural phenomena.

09.02.05-7

According to Standard Review Plan (SRP) 9.2.5 the overall arrangement of the ultimate heat sink (UHS) and, in this case, the UHS makeup which is outside the scope of the U.S. EPR design certification needs to comply with GDC 44. The description of the UHS in CCNPP Unit 3 Final Safety Analysis Report (FSAR) Section 9.2.5 and the drawing in FSAR Figure 9.2-3 are incomplete or inaccurate. Revise the FSAR to address the following considerations:

- Pipe sizes are not shown on FSAR Figure 9.2-3, "Normal Makeup, UHS Makeup, Blowdown & Chemical Treatment," 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).
- The system description in FSAR Section 9.2.5 does not provide design details such as system operating temperatures, pressures, and flow rates for all operating modes and alignments.
- FSAR Figure 9.2-3 does not show the location of indications (e.g., local, remote panel, control room, remote shutdown panel), and does not identify the instruments that provide input to a process computer and/or have alarm and automatic actuation functions.
- FSAR Figure 9.2-3 does not identify the normal valve positions, the valves that are locked in position, and the valves that have automatic functions. These design features are not described in FSAR Section 9.2.5.When FSAR Figure 9.2-3 is compared to U.S. EPR FSAR Figure 9.2.5-1, "Ultimate Heat Sink Piping and Instrumentation Diagram," the drawings do not appear to match up with respect to boundaries for the normal makeup and UHS makeup.

· FSAR Figure should be corrected to agree with the U.S. EPR DCD FSAR Figure 9.2.5-1. FSAR Figure 9.2-3 safety related components, for example motor operated valves (MOVs), are not labeled with identification numbers.
· FSAR Figure 9.2-3 shows safety related MOVs that appear to be not located in any safety related buildings and possibly buried. Clarify the exact locations of all safety related components for the UHS.
· FSAR Section 9.2.5 does not specifically describe the material to be used for above ground pipe or buried pipe, other than stating that the material will be compatible with brackish water or chemical associated with the chemicals utilized in the treatment of the system. Note that Part 10, ITAAC Table 2.4.24, “UHS Makeup Water System Inspections, Tests, Analysis and Acceptance Criteria,” states that the materials are either carbon steel with a rubber liner or stainless steel.
· FSAR Figure 9.2-3 does not show the screen wash system or travelling screens.
· FSAR Figure 9.2-3 refers to an alternate blowdown line and the EPR FSAR Figure 9.2.1-1 refers to an emergency blowdown line. Determine if the terminology should be changed to be consistent, or indicate that these are different piping systems.
· FSAR Figure 9.2-3 should label the “UHS makeup” line as essential service water system (ESWS) emergency makeup to be consistent with Section 9.2.5.
· FSAR Figure 9.2-3 is incorrect and does not show the ESWS pumps at the UHS basin. It appears the blowdown piping system is off the UHS basin and not on the ESWS pump discharge; this should be corrected in FSAR Figure 9.2-3.
· FSAR Section 9.2.5 does not provide a discussion on support for severe accident related to ESWS, train four.
· FSAR Figure 9.2-3 does not show strainer MOVs as described in Table 8.1-1 through Table 8.1-4, “Division 1,2,3,4 Emergency Diesel Generator Nominal Loads.”
· FSAR Section 9.2.5 does not specifically describe the ESW basin level controller (automatically or manually) when in normal makeup or safety related UHS makeup. Describe the types of valves which are used for controls (gates, globes, butterfly, etc).
· FSAR Section 9.2.5 does not provide a discussion for the ESW makeup pumps screens which are typically installed on vertical pumps at the suction.
· FSAR Section 9.2.5.1 states that ESWS cooling tower blow-down discharges up 231 lpm (61 gpm) of water from each operating ESWS cooling tower basin to the retention basin to maintain ESWS chemistry. This quantity is based on maintaining ten cycles of concentration in the cooling tower basin, plus evaporative losses during shutdown and cooldown, with ambient conditions at 27° C (81° F) design wet bulb temperature and coincident 46° C (115° F) dry bulb temperature. Provide an explanation and clarify the basis for this statement.
· FSAR Figure 9.2-3 shows a safety related motor operated valve for the sample; however, it is not described in detail if this valve has a logic signal to close on an accident signal.
· FSAR Section 9.2.5 does not provide a discussion for freeze protection, such as heat tracing which has diesel backed power, for the UHS makeup system for up to 30 days post accident.

· FSAR Section 9.2.5 does not provide a discussion for flooding consequences of the non-safety related piping system from the desalinization plant up to the safety related boundary valves or downstream of the safety related blowdown isolation valves.
· FSAR Figure 9.2-3 shows a chemical addition pipe directing flow to the suction of each UHS makeup pump. Describe the installation of this piping system related to seismic supports and effects on the UHS makeup pumps during a seismic event.

09.02.05-8

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." This function must also be met in the event of a loss of off-site power assuming a single failure. The staff noted that assurance of separation between safety and non-safety portions of the system is therefore necessary for compliance with GDC 44. In addition, three U.S. EPR FSAR identified COL items (items 2.3-10, 2.4-9 and 2.4-10) that have not been adequately discussed by the applicant.

a. No discussion of an actual accident isolation signal was located by the staff for the normal blowdown isolation valves as described in CCNPP Unit 3 FSAR Section 9.2.5. In the condition that alternate blowdown is open during normal operation, describe any operator actions or isolation signals to close this open valve to support accident conditions. It is expected that the blowdown valve or alternate blowdown valves on more than one train could be open during normal operation; however, basin makeup can be lost for the first 72 hours of an accident resulting in basin volume loss through the blowdown path on more than one train.

b. No discussion of compliance with RG 1.27 or GDC 44 was located by the staff in FSAR, Section 9.2.5.5, "Safety Evaluation." The applicant needs to provide this statement in the FSAR.

c. U.S. EPR COL item 2.3-10 states that 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. The applicant needs to clarify this statement due to Regulatory Guide 1.27, Rev 2, Jan 1976, Section C3, which states in part the UHS should consist of at least two highly reliable water sources.

d. No discussion was found in the CCNPP Unit 3 FSAR, Section 9.2.5 related to COL Item 2.4-9, which states, "A COL applicant that references the U.S. EPR design certification will provide site-specific information and describe the design basis for cooling water canals and reservoirs used for makeup to the UHS cooling tower basins." The applicant needs to provide this discussion in the FSAR.

e. No discussion was found in the CCNPP Unit 3 FSAR, Section 9.2.5 related to COL Item 2.4-10, which states, "A COL applicant that references the U.S. EPR design certification will provide site-specific information and demonstrate that in the event of upstream diversion or rerouting of the source of cooling water, alternate water supplies will be available to safety-related equipment." The applicant needs to provide this discussion in the FSAR.

09.02.05-9

In order to satisfy the emergency makeup water pumps for the essential service water system (ESWS) flow requirements, the UHS design must assure that the minimum net positive suction head (NPSH) for the UHS makeup water makeup system pumps will be met for all postulated conditions, including consideration of vortex formation. In order to comply with GDC 44, SRP 9.2.5, Section III, paragraph 3.C. states that the maximum design cooling water temperature should not be exceeded under the worst combination of adverse environmental conditions, and basins can supply water for 30 days cooling at the required temperature without makeup unless acceptable makeup capabilities can be demonstrated. The staff found that the NPSH requirement for the emergency makeup water pumps for the ESWS was not specified in FSAR Section 9.2.5 and that FSAR Section 9.2.5 did not describe the assurance that will provide the NPSH requirement for the emergency makeup pumps that is satisfactory (including consideration of vortex formation) or identify the excess margin provided by the design for the most limiting assumptions.

Consequently, provide additional information in FSAR Section 9.2.5 to specify the minimum NPSH requirement for the emergency makeup water pumps for the ESWS and to fully explain how the system design satisfies this minimum NPSH requirement with consideration of the maximum Chesapeake Bay water temperatures when taking vortex formation into consideration. Also, identify how much excess margin is available for the most limiting case. Describe in the FSAR Section 9.2.5 how the UHS makeup water intake structure water level is measured, controlled, and monitored to assure the designed minimum NPSH is maintained. In addition, provide a discussion on the UHS makeup pump head and identify the means that are provided to assure that the pump maximum flow will not exceed pump design limits such as pump run out.

09.02.05-10

The essential service water system (ESWS) and ultimate heat sink (UHS) must be capable of removing heat from structures, systems, and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. The UHS description in FSAR Section 9.2.5 was reviewed to confirm that the applicant has adequately addressed waterhammer considerations. FSAR Section 9.2.5 states that the four trains of emergency makeup water pumps for the ESWS are normally in standby with the UHS makeup pump discharge motor operated valves closed. On a receipt of an accident, the normal ESWS makeup water system isolations motor operated valves (MOVs) that are open will automatically close and the UHS blowdown valves will close. Subsequent action is manually initiated from the main control room or locally which will include initiating the UHS makeup water system to any and/or all ESWS cooling tower basins, as well as controlling blowdown from any and/or all ESWS cooling tower basins.

The UHS description does not adequately consider and address waterhammer vulnerabilities at the point the system is manually started after the system has been in standby for long periods of time. FSAR Section 9.2.5 does not explain the system design features, operating procedures, and periodic surveillance testing that provide adequate assurance that the UHS makeup safety functions will not be compromised by waterhammer events. If system valves are relied upon to prevent excessive back-leakage, fully explain and justify in FSAR Section 9.2.5 the maximum amount of back-leakage that is allowed, and specify the leakage acceptance criteria that will be

established in the in-service testing program for these valves and the basis for this determination.

09.02.05-11

The essential service water system (ESWS) and ultimate heat sink (UHS) must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. The staff reviewed FSAR Section 9.2.5.7, “Instrumentation Applications,” which states that for the UHS makeup water system valve limits switches, pressure, temperature and differential pressures sensors are provided for local and remote displays. The staff’s review of this section concluded that important instruments (system monitoring parameters) for monitoring a safety related system were not specifically stated and some instruments were missing, such as piping system flow instruments, strainer differential pressures, screen wash flow, travelling screen differential pressures, radiation monitors, and intake structure water level. Instrument locations were not shown on Figure 9.2-3 and any automatic closure valves which close on an accident signal or valves that automatically open were not graphically shown with a symbol of the logic signals. The applicant should show these missing instruments on the FSAR drawings related to FSAR Section 9.2.5. In addition, the applicant should determine if this safety related system should be controlled or monitored at the remote shutdown panel.

09.02.05-12

The essential service water system (ESWS) and ultimate heat sink (UHS) must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. In order for the ESWS and the UHS to remove heat from SSCs important to safety, sufficient power must be supplied from the electrical power system and emergency diesel generator (EDG). The staff reviewed FSAR Section 9.2.5, Tables 8.1-1 through Table 8.1-4, “Division 1,2,3,4 Emergency Diesel Generator Nominal Loads,” and determined there was a no specific detail in Section 9.2.5 on the loads for the ESWS and UHS safety related system on the electrical power system and EDG. Provide detailed information in the FSAR, Section 9.2.5, related to safety related power for pumps, motor operated valves, valves, strainers, screen wash pumps, travelling screens, etc., of the UHS makeup water system and blowdown system.

09.02.05-13

The essential service water system (ESWS) and ultimate heat sink (UHS) must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. Generic Letter (GL) 89-13, “Service Water System Problems Affecting Safety-Related Equipment,” was issued to address the observed degradation over time of service water systems. The GL called for implementation of programmatic controls, surveillance, and routine inspection and maintenance to assure that the performance capability and integrity of service water systems are adequately maintained over time. Many of the identified issues for service water, such as flow blockage and biofouling organisms, are related to the UHS makeup water supply to the ESWS basin. FSAR Section 9.2.5 did not specifically address related provisions of GL 89-13 for the CCNPP Unit 3 design. Provide additional information in FSAR Section 9.2.5 to describe the provisions of GL

89-13 that are being implemented, the amount of component degradation allowed, and procedures that will be implemented to identify and correct unacceptable conditions.

09.02.05-14

General Design Criteria (GDC) 45 requires the ultimate heat sink (UHS) and UHS makeup water system 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. CCNPP Unit 3 FSAR Section 9.2.5.6 indicates that periodic inspections will be performed, but does not describe the extent and nature of these inspections and the procedural controls that will be implemented to assure that the UHS is adequately maintained over time. The accessibility and periodic inspection of safety related buried piping and yard MOVs is of particular interest. Provide additional information in FSAR Section 9.2.5 to describe the extent and nature of inspections that will be performed and the procedural controls that will be implemented commensurate with the GDC 45 requirement. Also, confirm in the FSAR that the UHS makeup water system complies with GDC 45.

09.02.05-15

General Design Criteria (GDC) 46 requires cooling water system shall be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and the performance of the active components of the system, and (3) the operability of the system as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation for reactor shutdown and for loss-of-coolant accidents, including operation of applicable portions of the protection system and the transfer between normal and emergency power sources. While the FSAR Section 9.2.5.6 indicates that periodic testing will be performed, the extent and nature of these tests and procedural controls that will be implemented to assure continued UHS makeup water system structural and leak-tight integrity and system operability over time were not described. Provide additional information in FSAR Section 9.2.5 to describe the extent and nature of testing that will be performed and procedural controls that will be implemented commensurate with the GDC 46 requirement. Also, confirm in the FSAR that the UHS makeup water system complies with GDC 46.

09.02.05-16

Means must be provided for monitoring effluent discharge paths and the plant environs for radioactivity that may be released in accordance with GDC 64 requirements. Also, 10 CFR 52.79(a)(45) and 10 CFR 20.1406 require COL applicants to describe how facility design and procedures for operation will minimize contamination of the facility and the environment.
According to Standard Review Plan (SRP) Section 9.2.1, the staff must verify that provisions are provided to detect and control leakage of radioactive contamination into and out of the ESWS, which is part of the UHS and the UHS blowdown. The UHS blowdown is a release point to the environment from the ESWS. The design is considered to be acceptable by the staff if the UHS/ESWS drawings 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 FSAR Section 9.2.5 does 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 this issue.

09.02.05-17

According to Standard Review Plan (SRP) 9.2.5, the overall arrangement of the ultimate heat sink (UHS) needs to comply with GDC 44. The staff reviewed the inspection, tests, analysis, and acceptance criteria (ITAAC) information provided in the CCNPP Unit 3 application, Part 10, Table 2.4-9 and Table 2.4-24, to confirm completeness and consistency with the plant design basis as described in CCNPP Unit 3 FSAR Section 9.2.5. The staff found that the ITAAC information is incomplete, inconsistent, inaccurate, or that clarification is needed with respect to the following considerations:

- Table 2.4-9, item 2 does not specifically state to inspect the buried piping system for the UHS makeup water system for proper pipe sizes.
- Table 2.4-9, item 8 does not specifically state to inspect the buried piping system for the for the rubber liner as stated in Table 2.4-24, item 14, SA-106 grade B with a rubber liner or ASME SB-675 stainless steel. The buried piping coating material was not specified and the specific type of inspection was not identified.
- Table 2.4-24 does not specifically state to inspect ASME pipe supports for the UHS makeup water system.
- Table 2.4-24, item 5 does not specifically state to inspect check valves.
- Table 2.4-24, item 16 states to test the min-flow recirculation valve opens in the event the pump discharge valves fails to open. This design feature is not described in FSAR Section 9.2.5 and the valve is not shown on Figure 9.2-3 as a valve with logic controls or labeled as min-flow recirculation valve.
- Table 2.4-24, item 16 states that the pump discharge valves opens on a pump start. This design feature is not described in FSAR Section 9.2.5 and the valve is not shown on Figure 9.2-3 as a valve with logic controls.
- Table 2.4-24 does not specifically state that all valves that receive a logic signal to close/open are tested.
- Table 2.4-24 does not specifically state that the screen wash system and travelling screens are tested.
- Table 2.4-24 does not specifically state that displays and controls are present in the main control room and remote shutdown panel.