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UniStar
NUCLEAR ENERGY

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June 30, 2011

UN#11-197

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the
Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI 279, Ultimate Heat Sink

Reference:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI 279 SBPA 2618" email dated January 21, 2011

2) UniStar Nuclear Energy Letter UN#11-173, from Greg Gibson to Document Control Desk, U.S. NRC, Submittal of Response to RAI No. 279, Ultimate Heat Sink, dated June 3, 2011

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated January 21, 2011 (Reference 1). RAI 279 addresses the Ultimate Heat Sink, as discussed in Section 9.2.5 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant, Unit 3 Combined License Application (COLA), Revision 7.

Reference 2 provided a response date of June 30, 2011, for Questions 09.02.05-4, 09.02.05-6, 09.02.05-7, 09.02.05-9, 09.02.05-10, 09.02.05-11, 09.02.05-12, 09.02.05-13, 09.02.05-15, 09.02.05-16, and 09.02.05-17.

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The Enclosure provides our response to RAI No. 279 Questions 09.02.05-6, 09.02.05-10, 09.02.05-13, and 09.02.05-15, and includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA.

UniStar Nuclear Energy requires additional time to finalize the responses to the remaining RAI 279 questions. Responses to Questions 09.02.05-4, 09.02.05-7, 09.02.05-11, 09.02.05-16, and 09.02.05-17 will be provided to the NRC by July 29, 2011. The responses to Questions 09.02.05-9 and 09.02.05-12 will be provided to the NRC by September 30, 2011.

There are no regulatory commitments identified in this letter. This letter does not contain any proprietary or sensitive information.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Wayne A. Massie at (410) 470-5503.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 30, 2011

Greg Gibson

Enclosure: Response to NRC Request for Additional Information RAI No. 279, Questions 09.02.05-6, 09.02.05-10, 09.02.05-13, and 09.02.05-15, Ultimate Heat Sink, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application
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Enclosure
Response to NRC Request for Additional Information RAI No. 279,
Questions 09.02.05-6, 09.02.05-10, 09.02.05-13, and 09.02.05-15,
Ultimate Heat Sink,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 279

NRC Question 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.

Response

<u>Response to NRC Question 09.02.05-6 Item (a)</u>:

As part of the response to RAI 279 Question 09.02.05-07, COLA FSAR Figure 9.2-3 will be updated to show the Nonsafety-related/Safety-related interfaces for each train of the UHS Makeup Water System. The Nonsafety-related/Safety-related interfaces for the UHS Makeup Water System are depicted below.

1. RWSS interface at the ESW normal makeup
2. Interface at the Test Bypass isolation valve
3. Interface at the Screen wash system isolation valve
4. Interface at the sample valve

The NRC RAI 286, Question 09.02.05-18 response[1] addresses the common cause simultaneous failure of nonsafety-related RWSS piping that interfaces with the UHS.

Simultaneous failure of non-safety interfaces will not hinder any safety-related SSCs and will not affect the UHS Makeup System function to deliver the required UHS makeup water inventory. The piping and components are designed to the following criteria:

[1] UniStar Nuclear Energy Letter UN#11-122, from Greg Gibson to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 286, Ultimate Heat Sink, dated April 6, 2011

Nonsafety-related 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 nonsafety-related system piping is seismically analyzed up to the boundary anchor. A Seismic Category II classification ensures that loss of physical integrity of nonsafety-related SSCs as a result of natural phenomena will not result in an adverse interaction with a safety-related SSC that will potentially compromise the capability of the safety-related SSC to perform its safety function.

Response to NRC Question 09.02.05-6 Item (b):

Normally, the UHS Makeup Water System is in a state of dry layup and the boundary isolation valves are not relied upon to prevent any system drain.

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 specific valve or valve combination. If leakage rates are not specified by the Owner, the following rates shall be permissible:

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

Where,

D or d = nominal valve size in inches or centimeters"

The design of the UHS Makeup Water System pump capacity will consider the expected valve seat leakage for the boundary isolation valves. Since the UHS Makeup pump capacity has significant margin, boundary valve leakage rates are inconsequential.

Response to NRC Question 09.02.05-6 Item (c):

The UHS Makeup Water System is designed to perform its safety function under Design Basis Accident (DBA) conditions. The UHS Makeup Water System components are designed to withstand the effect of natural phenomena. The above ground piping and components are protected by Seismic Category I structures. The buried piping and components are protected against natural phenomena, by providing adequate depth of soil cover to ensure the integrity to perform the intended safety function.

The UHS Makeup Water System pumps are designed with sufficient excess capacity to account for expected leakages across the boundary isolation valves. No other performance assumption is considered for the UHS Makeup Water System integrity and operability during a natural event.

COLA Impact

FSAR Subsection 9.2.5.3.2 under the subtitle "UHS Makeup Water System Isolation Valves" will be supplemented to add the following:

9.2.5.3.2 Piping, Valves, and Fittings

...

UHS Makeup Water System Isolation Valves

...

Leakage rates for boundary isolation valves are based on ASME OM Code 2004 Edition, Subsection ISTC. The design of the UHS Makeup Water System pump capacity considers the expected valve seat leakage for the boundary isolation valves. Since UHS Makeup pump capacity has significant margin, boundary valve leakage rates are inconsequential.

COLA FSAR Subsection 9.2.5.5 will be supplemented to add a bullet as below:

9.2.5.5 Safety Evaluation

...

- Meets the requirements of GDC 2.

RAI No. 279

NRC Question 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 water hammer 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 water hammer 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 water hammer 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.

Response

The UHS makeup system piping is normally in a state of dry layup. The UHS makeup system is not used during normal operations, and is designed to provide a backup source of makeup water to the UHS cooling towers 72 hours post accident when the normal source of makeup water is unavailable. In the event that makeup to the UHS cooling towers from the UHS makeup system is required, operator action will start the desired UHS makeup pumps to prime the respective system trains as per the plant emergency operating procedures. Prior to the start of the pumps, operators ensure that there is adequate water level in the pump bay, and traveling screens are not blocked to supply necessary water flow. To mitigate the effect of water hammer during startup, the emergency service water isolation valve is closed and the UHS makeup water system pumps are started manually against closed motor operated discharge isolation valves. The discharge isolation valves will be opened and controlled to slowly fill the piping system with Chesapeake Bay water. The recirculation valves are also opened to ensure that minimum flow required for the pumps is achieved. Once the system is full, the pump discharge isolation valves and emergency service water isolation valves are fully opened and the recirculation valves are closed, to provide flow to the UHS cooling tower basin. Adequate vents will be provided to release air at appropriate high points to expel entrapped air to ensure complete system fill. Once the UHS Makeup pumps are started manually, remaining operations are accomplished automatically.

The UHS Makeup Water system incorporates design provisions that minimize the effect of hydraulic transients upon the functional capability and the integrity of the system components. These design features include slow-stroke motor-operated valves, air release valves, check valves to fill and keep the system full, valve control and interlock features that ensure correct valve line up prior to pump start, and discharge isolation valves that open and close with pump start and stop signals. The evaluation of system design pressure considers the pump shutoff head and other system transients.

The dry layup of the system is preferable over the wet layup to prevent bio-fouling. To keep the UHS makeup piping in dry layup, drains are provided at low points and pipe is sloped to prevent water ponding inside the pipe after any system fill and subsequent draining.

The valve testing frequency and leakage criteria are specified in CCNPP Unit 3 COLA FSAR Table 3.9-2. Since the system is normally in dry layup and the system valves are not relied upon to prevent excessive back-leakage, the valve leakage criteria specified in ASME OM code is adequate and no additional criteria is specified.

As part of the US EPR FSAR response to RAI 345, Question 09.02.01-42 (b), the testing requirements were added to specifically address the water hammer events for the normal and the emergency makeup system.

COLA Impact

COLA FSAR Subsection 9.2.5.5 will be revised to add the following description:

9.2.5.5 Safety Evaluation

...

The UHS makeup system piping is normally in a state of dry layup. The UHS makeup system is not used during normal operations, and is designed to provide a backup source of makeup water to the UHS cooling towers 72 hours post accident when the normal source of makeup water is unavailable. In the event that makeup to the UHS cooling towers from the UHS makeup system is required, operator action will start the desired UHS makeup pumps to prime the respective system trains as per the plant emergency operating procedures. Prior to the start of the pumps, operators ensure that there is adequate water level in the pump bay, and traveling screens are not blocked to supply necessary water flow. To mitigate the effect of water hammer during startup, the emergency service water isolation valve is closed and the UHS makeup water system pumps are started manually against closed motor operated discharge isolation valves. The discharge isolation valves will be opened and controlled to slowly fill the piping system with Chesapeake Bay water. The recirculation valves are also opened to ensure that minimum flow required for the pumps is achieved. Once the system is full, the pump discharge isolation valves and emergency service water isolation valves are fully opened and the recirculation valves are closed, to provide flow to the UHS cooling tower basin. Adequate vents will be provided to release air at appropriate high points to expel entrapped air to ensure complete system fill. Once the UHS Makeup pumps are started manually, remaining operations are accomplished automatically.

The dry layup of the system is preferable over the wet layup to prevent bio-fouling. The UHS makeup system will incorporate design provisions that minimize the effect of hydraulic transients upon the functional capability and the integrity of the system components. These design features include slow-stroke motor-operated valves, air release valves to fill and keep the system full, valve control and interlock features that ensure correct valve line up prior to pump start, and discharge isolation valves that open and close with pump start and stop signals. To keep the UHS makeup piping in dry layup, drains will be provided at low points and pipe will be sloped to prevent water ponding inside the pipe after any system fill and subsequent draining.

RAI No. 279

NRC Question 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.

Response

Pursuant to the recommendations included in Generic Letter 89-13, the design of safety-related portions of the UHS makeup system considers the potential for capability and performance degradation and subsequent system failure due to silting, erosion, corrosion, protective coating failure, and the presence of organisms that subject the system to microbiological influenced corrosion as well as macro fouling.

In order to identify and reduce the incidence of flow blockage problems from biofouling near the intake structure and traveling screens, the UHS Makeup intake pipes, traveling screens and pump forebay will be inspected once per refueling cycle to ensure that there is no biological growth, sedimentation and corrosion. Inspection will be performed by either scuba divers or by dewatering the intake structure or by other comparable methods, and fouling accumulations will be removed.

UHS Makeup Water System supplies makeup water to the UHS starting 72 hours post accident only. Silting, erosion, corrosion and biological fouling are a concern for normally operating wet systems. These are of minimal concern for the UHS Makeup Water System, which is normally in a dry layup condition. Water for periodic testing is chemically treated to mitigate biofouling and the system is completely drained after each periodic testing. As specified in the response to RAI 279, Question 09.02.05-14[2], periodic pressure testing of the system is performed to verify and ensure the system integrity is maintained. Selection of pipe material and components for the UHS makeup water system will ensure that corrosive effects of brackish water are considered.

Routine inspection and maintenance activities as established by the plant procedures identify any degradation and correct performance gaps due to corrosion, erosion, protective coating failure, silting and biofouling. Response to NRC RAI 279, Question 09.02.05-15 (this enclosure) defines the routine inspection and inspection frequency for the UHS Makeup Water System.

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[2] UniStar Nuclear Energy Letter UN#11-173, from Greg Gibson to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 279, Ultimate Heat Sink, dated June 3, 2011

Generic Letter 89-13 requirements for heat exchangers are not applicable to the UHS Makeup Water System since this system has no heat exchangers.

COLA Impact

COLA FSAR Subsection 9.2.5.6 will be supplemented as described below:

9.2.5.6 Inspection and Testing Requirements

...

Pursuant to the recommendations included in Generic Letter 89-13, the design of safety-related portions of the UHS makeup system considers the potential for capability and performance degradation and subsequent system failure due to silting, erosion, corrosion, protective coating failure, and the presence of organisms that subject the system to microbiological influenced corrosion as well as macro fouling.

In order to identify and reduce the incidence of flow blockage problems from biofouling near the intake structure and traveling screens, the UHS Makeup intake pipes, traveling screens and pump forebay will be inspected once per refueling cycle to ensure that there is no biological growth, sedimentation and corrosion. Inspection will be performed by either scuba divers or by dewatering the intake structure or by other comparable methods, and fouling accumulations will be removed.

UHS Makeup Water System supplies makeup water to the UHS starting 72 hours post accident only. Silting, erosion, corrosion and biological fouling are a concern for normally operating wet systems. These are of minimal concern for the UHS Makeup Water System, which is normally in a dry layup condition. Water for periodic testing is chemically treated to mitigate biofouling and the system is completely drained after each periodic testing.

Routine inspection and maintenance activities as established by the plant procedures identify any degradation and correct performance gaps due to corrosion, erosion, protective coating failure, silting and biofouling.

RAI No. 279

NRC Question 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.

Response

The UHS Makeup Water system is a safety-related ASME Code Class 3 system, which is subject to inservice inspection and inservice testing in accordance with ASME Section XI and ASME OM Code, respectively. Components of the UHS Makeup Water System, subject to inservice inspection and inservice testing, as well as the corresponding inservice testing program requirements, are described in CCNPP Unit 3 COLA FSAR Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints," FSAR Table 3.9-1, "Site-Specific Inservice Pump Testing Program Requirements" and FSAR Table 3.9-2, "Site- Specific Inservice Valve Testing Program Requirements." Inservice testing program implementation requirements are discussed in CCNPP Unit 3 COLA FSAR Table 13.4-1, "Operational Programs Required by NRC Regulations and Program Implementation." In addition, U.S. EPR FSAR Tier 2 Chapter 16, Generic Technical Specification, Surveillance Requirement (SR) 3.7.19.5 requires verification of the UHS Makeup Water System ability to supply makeup water to each UHS cooling tower basin at greater than or equal to 300 gpm every 24 months. Additionally, SR 3.7.19.6 requires verification every 24 months of each UHS Makeup Water System automatic valve in the flow path, to actuate to the correct position on an actuation signal.

CCNPP Unit 3 COLA FSAR Subsection 9.2.5.6, "Inspection and Testing Requirements", will be revised to clarify appropriate periodic pressure and testing requirements. CCNPP Unit 3 COLA FSAR Subsection 9.2.5.1 will be revised to state that the UHS makeup water system complies with GDC 46.

COLA Impact

COLA FSAR Subsection 9.2.5.1 will be supplemented as described below:

9.2.5.1 Design Basis

...

The UHS Makeup Water System is designed to permit operational functional testing of safety-related components to ensure operability and performance of the system to comply with 10 CFR 50 Appendix A, General Design Criterion 46.

COLA FSAR Subsection 9.2.5.6 will be revised as described below:

9.2.5.6 Inspection and Testing Requirements

...

Installation of individual components and overall system construction are inspected to verify the as-built condition is in accordance with approved drawings. ~~Performance testing upon completion of construction verifies the system's ability to perform it design safety function.~~ A preoperational test is performed, as described in Section 14.2.14, to verify the ability of the UHS Makeup Water System to perform its safety function.

Inservice testing of the UHS Makeup Water System including valves, pumps and components, is performed as identified in FSAR Section 3.9.6, in accordance with the requirements of the ASME OM Code. The installation and design of the UHS Makeup Water System provides accessibility for the performance of periodic inservice testing. Periodic testing of safety-related equipment verifies its structural and leak-tight integrity, availability, and ability to fulfill its safety function. Inservice inspection and testing are in accordance with ASME Section XI and ASME OM Code requirements. Refer to U.S. EPR FSAR Tier 2 Chapter 16, Generic Technical Specification Surveillance Requirements (SR) 3.7.19.5 and SR 3.7.19.6 for surveillance requirements that verify continued operability of the UHS Makeup Water System.