Mark T. Finley
Senior Vice President, Regulatory Affairs & Engineering

750 East Pratt Street, Suite 1600
Baltimore, Maryland 21202

UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

July 2, 2013

UN#13-093

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

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Revised Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 331, Ultimate Heat Sink

References:
1) Surinder Arora (NRC) to Paul Infanger (UniStar Nuclear Energy), "FINAL RAI 331 SBPA 6221" email dated January 20, 2012

2) UniStar Nuclear Energy Letter UN#13-074, from Mark T. Finley to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 331, Ultimate Heat Sink, dated May 30, 2013

3) UniStar Nuclear Energy Letter UN#13-085, from Mark T. Finley to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 331, Ultimate Heat Sink, dated June 28, 2013

The purpose of this letter is to provide a revised response to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy (UNE), dated January 20, 2012 (Reference 1). This RAI addresses Ultimate Heat Sink, as discussed in Section 09.02.05 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 9.

Reference 2 indicated that a response to RAI 331, Question 09.02.05-21 would be provided to the NRC by June 28, 2013. Reference 3 provided the response to RAI 331, Question 09.02.05-21 on June 28, 2013. However, Reference 3 contained a typographical error which appeared in the response and in the COLA Impact section of the response. The words "Main Control Room"

D096
NRO

were changed to read, "Safeguard Buildings" under the "For the Safeguard Buildings HVAC systems" heading of the response and COLA text. Enclosure 1 provides our revised response to RAI No. 331, Question 09.02.05-21, 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. This letter supersedes the RAI No. 331, Question 09.02.05-21 response transmitted on June 28, 2013 (Reference 3) in its entirety.

Enclosure 2 provides a table of changes to the CCNPP Unit 3 COLA associated with the revised RAI 331 response.

Our response does not include any new regulatory commitments. This letter, and its enclosures, does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 369-1907 or Mr. Wayne A. Massie at (410) 369-1910.

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

Executed on July 2, 2013

Mark T. Finley

Enclosures: 1) Revised Response to NRC Request for Additional Information RAI No. 331, Question 09.02.05-21, Ultimate Heat Sink, Calvert Cliffs Nuclear Power Plant, Unit 3

2) Table of Changes to CCNPP Unit 3 COLA Associated with the Revised Response to RAI No. 331, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
John Fringer, NRC Environmental Project Manager, U.S. EPR COL Application
Amy Snyder, NRC Project Manager, U.S. EPR DC Application, (w/o enclosure)
Patricia Holahan, Acting Deputy Regional Administrator, NRC Region II, (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2,
David Lew, Deputy Regional Administrator, NRC Region I (w/o enclosure)

Enclosure 1

Revised Response to NRC Request for Additional Information RAI No. 331, Question 09.02.05-21, Ultimate Heat Sink, Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 331

Question 09.02.05-21

The following EPR COL Information Item needs to be addressed by the COL applicant in Section 9.2.5. Presently, CCNPP Unit 3 FSAR does not address this item since this new COL information item was added under the US EPR DCD, Revision 3.

Table 1.8-2, U.S. EPR Combined License Information Items, COL 9.2-10.

A COL applicant that references the U.S. EPR design certification will perform an evaluation of the interference effects of the UHS cooling tower on nearby safety-related air intakes. This evaluation will confirm that potential UHS cooling tower interference effects on the safety related air intakes does not result in air intake inlet conditions that exceed the U.S. EPR Site Design parameters for Air Temperature as specified in Table 2.1-1. This COL information item should be addressed under Section 9.2.5.3.1 of the CCNPP Unit 3 FSAR.

Response

A computational fluid dynamic (CFD) analysis of the Calvert Cliffs Nuclear Power Project (CCNPP) Unit 3 Ultimate Heat Sink (UHS) Cooling Towers and surrounding structures was completed to determine the increase in ambient wet bulb temperature of intake air for the main control room (MCR) and Safeguard Building Division 1 & 2 Ventilation systems. The increase in wet bulb temperature was calculated to be approximately 2.2°F.

The effect of an increase in wet bulb temperature of 2.5°F was evaluated relative to the 0% exceedance site conditions (102°F dry bulb and 80°F wet bulbs temperatures) in CCNPP Unit 3 COLA Table 2.0-1. The conclusion of the evaluation is that the functions performed by safety-related ventilation systems are not adversely affected.

COL Item 9.2-10 is addressed in Final Safety Analysis Report (FSAR) Sections 9.2.5.3.1 and 9.2.5.3.3.

UniStar Nuclear Energy (UNE) additionally has performed an evaluation of the interference effects of the UHS cooling tower plumes on nearby safety-related air intakes. The evaluation concluded that there is no effect due to insensitivity to higher wet bulb temperatures and design features that isolate the fresh air intake of the system, and that there is sufficient margin in the system to accommodate the minor effects of a small wet bulb temperature increase. The conclusion of the evaluation is that the functions performed by safety-related ventilation systems are not adversely affected.

The following safety-related air intakes have been evaluated for potential adverse effects from the UHS cooling tower plumes:

1. Main Control Room (MCR) Air Conditioning System
2. Safeguards Building Ventilation, including Controlled-Area and Electrical Division
3. Emergency Power Generating Building Ventilation, including Diesel Hall, Electric Room, Main Tank Room and Combustion Air
4. Essential Service Water Pump Building Ventilation

Given the significant distance from the UHS Cooling Towers to the UHS Makeup Water Intake Structure (MWIS) – approximately 2000 feet, and the lower elevation of the UHS MWIS – ventilation intake for MWIS lower by approximately 130 feet from the UHS Cooling Tower plume discharge point, any effect on the UHS Makeup Water Intake Structure Ventilation system will be negligible.

Main Control Room Air Conditioning and Safeguard Building Ventilation

These safety-related systems draw outside fresh air and their HVAC systems are affected by the moisture content of the drawn in fresh air. The percentage of drawn in fresh air is small in relation to recirculation air flow rate for both systems. It is also unlikely that worst case wind and UHS cooling tower plume conditions would occur simultaneously with design ambient conditions for the systems. Additionally, the duration of such worst case conditions would be short (on the order of a few hours) during which time any effect on the thermal inertia of the systems would be negligible. For these reasons, the current design ambient conditions for these systems at the Calvert Cliffs Unit 3 site, as shown in COLA FSAR Table 2.0-1, are not adversely affected. Nevertheless, a quantitative evaluation of the interference effect of the UHS cooling tower plume on the operation of these safety-related air intake systems was performed.

Calculation of Wet Bulb Temperature Increase at MCR and Safeguard Building Ventilation Air Intakes

A CFD analysis of the CCNPP Unit 3 UHS Cooling Towers and surrounding structures was performed to determine the increase in ambient wet bulb temperature of intake air for MCR and Safeguard Building Division 1 & 2 ventilation systems. The CFD analysis considered both cells of two adjacent UHS Cooling Towers operating at the design ambient conditions for the HVAC systems (102°F dry bulb and 80°F wet bulb). The UHS Cooling Tower heat load considered for the analysis (194.2 MBtu/hr) is an approximate one-hour average of the heat load from a design basis accident (Large Break LOCA) during its peak input to the UHS Cooling Tower. This is the worst case UHS Cooling Tower heat load. Meteorological data with regard to wind speeds were considered from six years of measurements of wind speed, at directions from a meteorological tower at CCNPP Unit 1 & 2.

Isothermal CFD simulations were run for 16 individual and equally spaced wind directions (each at 22.5 degrees apart), using no heat load (neutrally buoyant) discharge from the UHS Cooling Tower discharge. The dry bulb and wet bulb temperatures for MCR and Safeguard Building Division 1 & 2 HVAC air intake are based on the worst case conditions of wind direction and cooling tower operations, as determined by analysis. This worst case condition of wind direction and UHS Cooling Tower operations was then evaluated at various wind speeds to determine what conditions produced the greatest wet bulb temperature increase at the MCR HVAC air intakes. It was concluded that for low wind speeds (below 2.5 m/s [5.6 mph]) the cooling tower discharge plume rose high vertically, therefore recirculation and interference effects are negligible. Wind speeds between the range of 5.0 m/s (11.2 mph) and 10 m/s (22.4 mph) at various wind directions yielded results with the highest associated increase in safety-related HVAC ventilation intake wet bulb temperature. Based on wind data, wind speeds considered in the analysis wind speeds considered in the analysis were limited to 10 m/s (22.4 mph).

The UHS Cooling Tower discharge conditions were determined using an iterative approach, where the discharge condition calculations were updated using intermediate CFD results for humidity and dry bulb temperature at the UHS Cooling Tower air intakes. Recirculation and interference cause these parameters to differ from ambient field values.

CFD analyses were then performed on these worst case conditions of wind speed, wind direction, and operating scenario determined from the neutrally buoyant studies, as described above, incorporating buoyancy and iteratively updating the UHS Cooling Tower discharge and its effect on the MCR HVAC intake conditions. These CFD analyses result in a dry bulb temperature and water vapor mass fraction at the MCR ventilation intake that are converted into an increase in wet bulb temperature over the ambient value. A CFD analysis was performed for the Safeguard Building Division 1 & 2 HVAC intakes considering the worst case conditions determined from the analysis of the UHS Cooling Tower effect on the MCR HVAC intakes.

Considering the worst case wind direction, wind speed, and divisional combination, the results of the CFD analysis showed a negligible dry bulb temperature increase and a small (approximately 2.2°F) wet bulb temperature increase above ambient temperatures at the most affected safety-related MCR and Safeguard Building HVAC intake.

The CFD analysis determined the worst case wind direction (due East), wind speed (10 m/s), and divisional equipment combinations (UHS Cooling Tower Divisions 1 and 2), which resulted in the negligible dry bulb temperature increase and a small (approximately 2.2°F) wet bulb temperature increase at the most affected MCR or Safeguard Building Ventilation intake.

Main Control Room and Safeguard Building Ventilation Impact

A small wet bulb temperature increase, due to UHS Cooling Tower plume interference, for the safety-related HVAC fresh air intake systems has no adverse impact on system performance due to the following factors:

1. For the Main Control Room HVAC system:

   There is 13°F margin between 0% exceedance dry bulb temperature for the CCNPP Unit 3 site (102°F) and the 0% exceedance dry bulb temperature used in the design of the system (115°F). This results in a smaller heat transfer rate from the outside to the Main Control Room to be removed by the ventilation system. This margin more than offsets the small increase in latent heat resulting from the worst case increase in wet bulb temperature (2.2°F) caused by the UHS Cooling Tower plume.

2. For the Safeguard Buildings HVAC systems:

   There is 13°F margin between 0% exceedance dry bulb temperature for the CCNPP Unit 3 site (102°F) and the 0% exceedance dry bulb temperature used in the design of the system (115°F). This results in a smaller heat transfer rate from the outside to the Safeguard Buildings to be removed by the ventilation system. This margin, combined with the margin in the Safety Chilled Water system cooling capacity, more than offsets the increase in latent heat resulting from the worst case small increase in wet bulb temperature (2.2°F) caused by the UHS Cooling Tower plume.

Emergency Power Generating Building Ventilation Impact

Each emergency diesel division has its own building. Each of the four buildings has one safety-related air intake, which supplies fresh air for diesel combustion as well as building ventilation.

Diesel Combustion Air

Any fresh air wet bulb temperature increase has no effect on the Emergency Diesel Generator combustion air intake, since diesel combustion is not adversely affected by wet bulb temperature. This conclusion has been confirmed with the Emergency Diesel Generator vendor.

Diesel Hall and Main Tank Room

For the Diesel Hall and Main Tank rooms, any fresh air wet bulb temperature increase has no effect, since this is a once through ventilation system with no cooling coil to be impacted by an additional latent heat load from the cooling tower. Once through cooling systems are affected by increases in dry bulb temperature, but not wet bulb temperature increases. Therefore the maximum design temperature for the components of the Diesel Hall and Main Tank rooms is not challenged.

Electrical Room

Any fresh air wet bulb temperature increase has no effect on the components in the Emergency Power Generating Building electrical room. The safety-related isolation damper at the air intake to the non safety-related cooling system will close when the outside air exceeds 100°F. The safety-related cooling system operates in recirculation mode, cooling the electrical components in the Emergency Power Generating Building electrical room with divisional cooling coils supplied by the Essential Service Water System.

Essential Service Water Pump Building (ESWB) Ventilation Impact

Any fresh air wet bulb temperature increase has no effect on the components in the four ESWB. The safety-related isolation damper at the air intake to the non safety-related cooling system will close when the outside air exceeds 100°F. The safety-related cooling system operates in recirculation mode with no drawn in fresh air.

COLA Impact

CCNPP Unit 3 COLA Part 2, FSAR, Section 9.2.5.3.3, has been updated as follows:

9.2.5.3.3 Cooling Tower Basin

...

Minimum Cooling

...

Figure 9.2-3 provides the interface between the ESW and the UHS makeup water system. U.S. EPR FSAR Section 9.2 provides a detailed discussion of the ESW system, including a simplified flow arrangement for the ESW system.

UHS Cooling Tower Interference on Safety-Related Intakes

~~(TBD) - Cooling tower interference on safety-related intakes.~~An evaluation has been performed of the interference effects of the UHS cooling tower plumes on nearby safety-related air intakes. The evaluation concluded that there is no effect due to insensitivity to higher wet bulb temperatures and design features that isolate the fresh air intake of the system, and that there is sufficient margin in the system to accommodate the minor effects of a small wet bulb temperature increase. The conclusion of the evaluation is that the functions performed by safety-related ventilation systems are not adversely affected.

The following safety-related air intakes have been evaluated for potential adverse effects from the UHS cooling tower plumes:

1. Main Control Room (MCR) Air Conditioning System
2. Safeguards Building Ventilation, including Controlled-Area and Electrical Division
3. Emergency Power Generating Building Ventilation, including Diesel Hall, Electric Room, Main Tank Room and Combustion Air
4. Essential Service Water Pump Building Ventilation

Given the significant distance from the UHS Cooling Towers to the UHS Makeup Water Intake Structure (MWIS) – approximately 2000 feet, and the lower elevation of the UHS MWIS – ventilation intake for MWIS lower by approximately 130 feet from the UHS Cooling Tower plume discharge point, any effect on the UHS Makeup Water Intake Structure Ventilation system will be negligible.

Main Control Room Air Conditioning and Safeguard Building Ventilation

These safety-related systems draw outside fresh air and their HVAC systems are affected by the moisture content of the drawn in fresh air. The percentage of drawn in fresh air is small in relation to recirculation air flow rate for both systems. It is also unlikely that worst case wind and UHS cooling tower plume conditions would occur simultaneously with design ambient conditions for the systems. Additionally, the duration of such worst case conditions would be short (on the order of a few hours) during which time any effect on the thermal inertia of the systems would be negligible. For these reasons, the current design ambient conditions for these systems at the Calvert Cliffs Unit 3 site, as shown in COLA FSAR Table 2.0-1, are not adversely affected. Nevertheless, a quantitative evaluation of the interference effect of the UHS cooling tower plume on the operation of these safety-related air intake systems was performed.

Calculation of Wet Bulb Temperature Increase at MCR and Safeguard Building Ventilation Air Intakes

A CFD analysis of the CCNPP Unit 3 UHS Cooling Towers and surrounding structures was performed to determine the increase in ambient wet bulb temperature of intake air for MCR and Safeguard Building Division 1 & 2 ventilation systems. The CFD analysis considered both cells of two adjacent UHS Cooling Towers operating at the design ambient conditions for the HVAC systems (102°F dry bulb and 80°F wet bulb). The UHS Cooling Tower heat load considered for the analysis (194.2 MBtu/hr) is an approximate one-hour average of the heat load from a design basis accident (Large Break LOCA) during its peak input to the UHS Cooling Tower. This is the worst case UHS Cooling Tower heat load. Meteorological data with regard to wind speeds were considered from six years of measurements of wind speed, at directions from a meteorological tower at CCNPP Unit 1 & 2.

Isothermal CFD simulations were run for 16 individual and equally spaced wind directions (each at 22.5 degrees apart), using no heat load (neutrally buoyant) discharge from the UHS Cooling Tower discharge. The dry bulb and wet bulb temperatures for MCR and Safeguard Building Division 1 & 2 HVAC air intake are based on the worst case conditions of wind direction and cooling tower operations, as determined by analysis. This worst case condition of wind direction and UHS Cooling Tower operations was then evaluated at various wind speeds to determine what conditions produced the greatest wet bulb temperature increase at the MCR HVAC air intakes. It was concluded that for low wind speeds (below 2.5 m/s [5.6 mph]) the cooling tower discharge plume rose high vertically, therefore recirculation and interference effects are negligible. Wind speeds between the range of 5.0 m/s (11.2 mph) and 10 m/s (22.4 mph) at various wind directions yielded results with the highest associated increase in safety-related HVAC ventilation intake wet bulb temperature. Based on wind data, wind speeds considered in the analysis wind speeds considered in the analysis were limited to 10 m/s (22.4 mph).

The UHS Cooling Tower discharge conditions were determined using an iterative approach, where the discharge condition calculations were updated using intermediate CFD results for humidity and dry bulb temperature at the UHS Cooling Tower air intakes. Recirculation and interference cause these parameters to differ from ambient field values.

CFD analyses were then performed on these worst case conditions of wind speed, wind direction, and operating scenario determined from the neutrally buoyant studies, as described above, incorporating buoyancy and iteratively updating the UHS Cooling Tower discharge and its effect on the MCR HVAC intake conditions. These CFD analyses result in a dry bulb temperature and water vapor mass fraction at the MCR ventilation intake that are converted into an increase in wet bulb temperature over the ambient value. A CFD analysis was performed for the Safeguard Building Division 1 & 2 HVAC intakes considering the worst case conditions determined from the analysis of the UHS Cooling Tower effect on the MCR HVAC intakes.

Considering the worst case wind direction, wind speed, and divisional combination, the results of the CFD analysis showed a negligible dry bulb temperature increase and a small (approximately 2.2°F) wet bulb temperature increase above ambient temperatures at the most affected safety-related MCR and Safeguard Building HVAC intake.

The CFD analysis determined the worst case wind direction (due East), wind speed (10 m/s), and divisional equipment combinations (UHS Cooling Tower Divisions 1 and 2), which resulted in the negligible dry bulb temperature increase and a small (approximately 2.2°F) wet bulb temperature increase at the most affected MCR or Safeguard Building Ventilation intake.

Main Control Room and Safeguard Building Ventilation Impact

A small wet bulb temperature increase, due to UHS Cooling Tower plume interference, for the safety-related HVAC fresh air intake systems has no adverse impact on system performance due to the following factors:

1. For the Main Control Room HVAC system:

   There is 13°F margin between 0% exceedance dry bulb temperature for the CCNPP Unit 3 site (102°F) and the 0% exceedance dry bulb temperature used in the design of the system (115°F). This results in a smaller heat transfer rate from the outside to the Main Control Room to be removed by the ventilation system. This margin more than offsets the small increase in latent heat resulting from the worst case increase in wet bulb temperature (2.2°F) caused by the UHS Cooling Tower plume.

2. For the Safeguard Buildings HVAC systems:

   There is 13°F margin between 0% exceedance dry bulb temperature for the CCNPP Unit 3 site (102°F) and the 0% exceedance dry bulb temperature used in the design of the system (115°F). This results in a smaller heat transfer rate from the outside to the Safeguard Buildings to be removed by the ventilation system. This margin, combined with the margin in the Safety Chilled Water system cooling capacity, more than offsets the increase in latent heat resulting from the worst case small increase in wet bulb temperature (2.2°F) caused by the UHS Cooling Tower plume.

Emergency Power Generating Building Ventilation Impact

Each emergency diesel division has its own building. Each of the four buildings has one safety-related air intake, which supplies fresh air for diesel combustion as well as building ventilation.

Diesel Combustion Air

Any fresh air wet bulb temperature increase has no effect on the Emergency Diesel Generator combustion air intake, since diesel combustion is not adversely affected by wet bulb temperature. This conclusion has been confirmed with the Emergency Diesel Generator vendor.

Diesel Hall and Main Tank Room

For the Diesel Hall and Main Tank rooms, any fresh air wet bulb temperature increase has no effect, since this is a once through ventilation system with no cooling coil to be impacted by an additional latent heat load from the cooling tower. Once through cooling systems are affected by increases in dry bulb temperature, but not wet bulb temperature increases. Therefore the maximum design temperature for the components of the Diesel Hall and Main Tank rooms is not challenged.

Electrical Room

Any fresh air wet bulb temperature increase has no effect on the components in the Emergency Power Generating Building electrical room. The safety-related isolation damper at the air intake to the non safety-related cooling system will close when the outside air exceeds 100°F. The safety-related cooling system operates in recirculation mode, cooling the electrical components in the Emergency Power Generating Building electrical room with divisional cooling coils supplied by the Essential Service Water System.

Essential Service Water Pump Building (ESWB) Ventilation Impact

Any fresh air wet bulb temperature increase has no effect on the components in the four ESWB. The safety-related isolation damper at the air intake to the non safety-related cooling system will close when the outside air exceeds 100°F. The safety-related cooling system operates in recirculation mode with no drawn in fresh air.}

Enclosure 2

Table of Changes to CCNPP Unit 3 COLA Associated with the Revised Response to RAI No. 331, Calvert Cliffs Nuclear Power Plant, Unit 3

Table of Changes to CCNPP Unit 3 COLA Associated with the Revised Response to RAI No. 331

Change ID #	Subsection	Type of Change	Description of Change
Part 2 – FSAR			
CC3-11-0180	9.2.5.3.3	Design Control Document (DCD) Revision 3 change reflected in COLA Revision 8[1].	The text in FSAR Section 9.2.5.3.3 which read, "(TBD) - Cooling tower interference on safety-related intakes.}" was added as part of the DCD Revision 3 review which was reflected in COLA Revision 8.
CC3-13-0107	9.2.5.3.3	Incorporate COLA markups associated with the response to RAI 331, Question 09.02.05-21[2].	Text addressing UHS Cooling Tower Interference on Safety-Related Intakes has been added to FSAR Section 9.2.5.3.3 as part of the response to RAI 331, Question 09.02.05-21[2].
CC3-13-0111	9.2.5.3.3	Incorporate COLA markups associated with the revised response to RAI 331, Question 09.02.05-21 (this response).	Text addressing UHS Cooling Tower Interference on Safety-Related Intakes has been added to FSAR Section 9.2.5.3.3 as part of the revised response to RAI 331, Question 09.02.05-21 (this response).

[1] UniStar Nuclear Energy Letter UN#12-026, from Mark T. Finley to Document Control Desk, U.S. NRC, Submittal of Revision 8 to the Combined License Application for the Calvert Cliffs Nuclear Power Plant, Unit 3, and Application for Withholding of Documents, dated March 27, 2012

[2] UniStar Nuclear Energy Letter UN#13-085, from Mark T. Finley to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 331, Ultimate Heat Sink, dated June 28, 2013