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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79
10 CFR 2.390

November 5, 2013

UN#13-140

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 398, Ultimate Heat Sink

References:

1) Surinder Arora (NRC) to Paul Infanger (UniStar Nuclear Energy), "CCNPP3 - FINAL RAI 398 BPTS 7198," email dated September 19, 2013

2) UniStar Nuclear Energy Letter UN#13-133, 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 398, Ultimate Heat Sink, dated October 15, 2013

3) UniStar Nuclear Energy Letter UN#13-054, 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 365, Ultimate Heat Sink, dated April 30, 2013

4) UniStar Nuclear Energy Letter UN#13-142, from Paul Infanger to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, Public Version of the Response to RAI 398, Ultimate Heat Sink, dated November 5, 2013

Enclosure 3 to this letter contains Sensitive Unclassified Non-Safeguards Information (SUNSI). Upon separation from the attachment, this letter is decontrolled.

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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 September 19, 2013 (Reference 1). RAI 398 addresses 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 (CCNPP) Unit 3 Combined License Application (COLA), Revision 9.

Reference 2 indicated that a response to RAI 398 would be provided to the NRC by November 5, 2013. Enclosure 1 provides our response to RAI 398, Question 09.02.05-32, and includes revised COLA content. Enclosure 2 provides the COLA impact from the response to RAI 398, Question 09.02.05-32. Enclosure 2 includes a markup to FSAR Section 9.2.5.3.3 on a version of FSAR Section 9.2.5.3.3 which reflects the COLA changes made in the response to RAI 365, Question 09.02.05-30 (Reference 3). A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA. Enclosure 3 provides three figures which support the response to RAI 398, Question 09.02.05-32 (Item #A2). The figures in Enclosure 3 contain Sensitive Unclassified Non-Safeguards Information (SUNSI) that UniStar requests be withheld from the public.

The public version of this RAI 398, Question 09.02.05-32 response, which does not contain SUNSI information, is provided in UniStar letter UN#13-142 (Reference 4).

Enclosure 4 provides a table of changes to the CCNPP Unit 3 COLA associated with the RAI 398, Question 09.02.05-32. As identified in the Enclosure 4 Table of Changes, this response modifies previously submitted RAI responses.

Our response does not include any new regulatory commitments. This letter does not contain any proprietary information. However, as noted previously, it does contain SUNSI information that UniStar requests be withheld from the public in accordance with 10 CFR 2.390(d)(1). An affidavit providing the basis for this request for withholding is provided in Enclosure 5.

If there are any questions regarding this transmittal, please contact me at (410) 369-1987 or Mr. Mark Finley at (410) 369-1907.

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

Executed on November 5, 2013

Paul Infanger

Enclosures:
1) Response to NRC Request for Additional Information RAI 398, Question 09.02.05-32, Ultimate Heat Sink, Calvert Cliffs Nuclear Power Plant, Unit 3

2) Changes to CCNPP Unit 3 COLA Associated with the Response to RAI 398, Question 09.02.05-32, Calvert Cliffs Nuclear Power Plant, Unit 3

3) Three Figures (Proprietary and SUNSI) Utilized in the Response to RAI 398, Question 09.02.05-32 (Item #A2), Calvert Cliffs Nuclear Power Plant, Unit 3

4) Table of Changes to CCNPP Unit 3 COLA Associated with the Response to RAI 398, Question 09.02.05-32, Calvert Cliffs Nuclear Power Plant, Unit 3

5) Affidavit Requesting the Withholding of UN#13-140 Enclosure 3 from Public Disclosure in Accordance with 10 CFR 2.390

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

bcc: Jon Kirkwood, Bell Bend Licensing
William Kline, Regulatory Affairs & Engineering
Robert Randall, Regulatory Affairs & Engineering

Enclosure 1

Response to NRC Request for Additional Information
RAI 398, Question 09.02.05-32, Ultimate Heat Sink,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 398

09.02.05-32

(A) - Follow-up to RAI 365/6582 Question 09.02.05-30

The staff reviewed the applicant's response to Question 09.02.05-30 and has identified additional items that need to be described in the RAI response and/or FSAR.

1. CFD analysis uncertainties are not discussed (e.g., input parameter sensitivities, justification of reported precision of results).
2. Drawings or diagrams of the bounding scenario; distances (horizontal and vertical) between towers and ventilation intakes, and directions (relative to True North and Plant North), are not described.
3. Percentage of time (on an annual basis) that the CCNPP Unit 1 and 2 site was at >22.4 mph for the bounding conditions, whether these wind speed conditions occur during specific times of the year or day, and what wind directions and temperature conditions are associated with these wind speed conditions.
4. Clarify the number of cooling towers in service for the bounding scenarios.
5. The large break LOCA heat load (i.e., the numerical value) was not provided in the response. Specify. Also, explain how this value factors into the CFD analyses determination of cooling tower plume recirculation and interference (if at all) and how it relates to the determination of the cold-water return temperature.

(B) - Follow-up to RAI 331/6221 Question 09.02.05-21

The staff reviewed the applicant's response to Question 09.02.05-21 and has identified additional items that need to be described in the RAI response and FSAR.

1. CFD analysis uncertainties are not discussed (e.g., input parameter sensitivities, justification of reported precision of results).
2. Drawings or diagrams of the bounding scenario; distances (horizontal and vertical) between towers and ventilation intakes, and directions (relative to True North and Plant North), are not described.
3. Clarify the number of cooling towers in service for the bounding scenarios.
4. Other safety-related ventilation systems are not described as having been evaluated for wet bulb effects (i.e., containment building ventilation, annulus building ventilation, and fuel building ventilation).
5. The RAI response discussion related to cooling tower plume and 'cooling tower' or 'cooling towers' is not consistent.
6. "Divisional combination" needs further explanation.
7. FSAR pointers are missing (9.4.1, 9.4.5, 9.4.9, 9.4.11, and 9.5.8).
8. Consider deleting the statement that you confirmed with the EDG vendor in the FSAR.Consider adding statement to FSAR 9.5.8 that UHS cooling tower plume wet bulb interference of 2.2 °F increase above 80 °F wet-bulb was considered in the design of the combustion air for the EDG.
9. Describe why 6 years of onsite measured meteorological data is sufficient. Identify which meteorological conditions (e.g., wind directions, wind speeds and temperatures) were based on 30-years of offsite data or the 6 years of onsite data.

10. The basis for the large break LOCA heat load (194.2 MBTU) was not provided in the response and how it is related to UHS cooling tower plume interactions on safety related HVAC intakes since neutrally buoyant UHS cooling tower discharges were stated to have been assumed.
11. Describe the contribution to cooling tower plume rise due to mechanically-produced momentum from the exhaust fans.
12. Describe the percentage of time (on an annual basis) that the CCNPP Unit 1 and 2 site was at >22.4 mph for the bounding conditions, whether these wind speed conditions occur during specific times of the year or day, and what wind directions and temperature conditions are associated with these wind speed conditions.
13. Describe in the RAI response why is there no 0% exceedance non-coincident wet-bulb temperature specified in COL Table 2.0-1 or DCD Table 2.1-1 when such a site value (i.e., 85.3 °F) appears to have been used in the CFD plume interference analysis.
14. Identify the CCNPP Unit 1 and 2 meteorological tower wind speed and direction measurement height used for the bases for wind speeds and wind directions as input in the CFD.
15. Describe if temperature and moisture measurements from the onsite meteorological tower are used and, if so, at what elevation(s) of the tower were these measurements made.
16. Identify the base (grade) elevation differences between the UHS cooling towers and the onsite meteorological tower.
17. Consider adding a footnote to COL Table 2.0-1 (which points to FSAR Section 9.2.5.3.3) that the cooling tower plume interference was calculated to be an increase of 2.2 °F wet-bulb for various safety-related SSCs.
18. Describe in the RAI response that the cooling tower recirculation effects related to the revised wet bulb effects to the safety-related HVAC intake suction plenum have been evaluated as not being a COL Departure.

Response

(A) - Follow-up to RAI 365/6582 Question 09.02.05-30

1. CFD analysis uncertainties are not discussed (e.g., input parameter sensitivities, justification of reported precision of results).

   The approach to quantifying an upper bound for the cooling tower intake wet-bulb temperature increase was to perform a parametric study of wind speed and wind angle for the highest ambient wet-bulb temperature from a 24-hr period with the least evaporation potential. Thirty year observation data from the Patuxent River Naval Air Station was used to establish the ambient wet-bulb temperature of 85.3 °F that was used in the study, consistent with the Calvert Cliffs Nuclear Power Plant (CCNPP) site-specific values used for minimum cooling in Final Safety Analysis Report (FSAR) Section 9.2.5. Six year observation data from a meteorological monitoring tower at the Calvert Cliffs site was used to establish an upper bound for a realistic wind speed of 10 m/s at 60-m elevation.

   An analysis of the wind speed data, see the response to Item A3 below, shows that winds of 10 m/s and greater at 60-m elevation represent approximately 2.4% of the data on an annual basis, that winds of 10 m/s and greater at 60-m elevation from the south-east (the worst case wind direction for cooling tower ingestion and recirculation) represent approximately 0.03% of the data on an annual basis, and that winds of 10 m/s and greater at 60-m elevation from the east (the worst case wind direction for the main control room intake) represent approximately 0.005% of the data on an annual basis. The median value for wind speed was estimated to be close to 5 m/s at 60-m elevation.

   A parametric computational fluid dynamics (CFD) study of wind angle over a full 360° sweep with a discretization of 22.5° for a zero-buoyancy case at a wind speed of 5 m/s was used to establish the worst case wind conditions for different cooling tower operating scenarios. The zero buoyancy assumption maintains hot plumes at or near source height to interact with intake vents near or lower than source height. The three worst case scenarios were identified to be operating scenario B, wind direction sector 007 (southeasterly flow), operating scenario E, wind direction sector 013 (westerly flow), and operating scenario A, wind direction sector 014 (WNW flow).

   CFD runs for wind speeds of 1 m/s, 2.5 m/s, 5 m/s, and 10 m/s at 60-m elevation for operating scenario B, wind direction sector 007 were used to show that the worst case reingestion/recirculation condition for that scenario within the range of realistic wind speeds for the site (≤ 10 m/s at 60-m elevation) occurs near a wind speed of 10 m/s at 60-m elevation.

   CFD runs for wind speeds of 1 m/s, 2.5 m/s, 5 m/s, and 10 m/s at 60-m elevation for operating scenario E, wind direction sector 013 were used to show that the worst case reingestion/recirculation condition for that scenario within the range of realistic wind speeds for the site (≤ 10 m/s at 60-m elevation) occurs near a wind speed of 5 m/s at 60-m elevation.

   Because the worst case reingestion/recirculation intake wet-bulb temperature increase values for operating scenario A, wind direction sector 014 were significantly less than values for the two leading worst case conditions, no additional CFD runs varying wind speed were made to refine the assessment of the worst case condition.

Fully buoyant runs were conducted for operating scenario B, wind direction sector 007 and operating scenario E, wind direction sector 013 to assess whether the results for the zero buoyancy cases would remain valid under a fully buoyant condition. Wind speeds of 5 m/s and 10 m/s at 60-m elevation were evaluated for operation scenario B, wind direction sector 007. The 10 m/s at 60-m elevation case remained valid. Operating scenarios E and A for wind direction sectors 013 and 014, respectively, were evaluated only at a wind speed of 5 m/s at 60-m elevation. The results confirmed the ordering established by the zero buoyancy cases.

A refinement of the bounding value of the intake wet-bulb temperature increase for operating scenario B, wind direction sector 007 was performed. An additional wind speed of 7.5 m/s at 60-m elevation was added to build confidence that there is no hidden peak in the maximum wet-bulb temperature increase between the 5 m/s at 60-m elevation and the 10 m/s at 60-m elevation wind speed cases, the 10 m/s value set as the upper bound for evaluation based on the wind field statistics established for the site. A finer discretization of wind angle covering wind direction sector 007 in 5° increments was added to yield a better estimate of the peak value. The worst case intake wet bulb temperature increase was assessed to be 2.28 °F occurring at cooling tower URB3. The mesh convergence study at this condition and wind angle quantified the uncertainty of the prediction at URB3 to be approximately 3.5%, yielding an upper estimate for the wet bulb temperature 2.36 °F (2.28 ± 0.08 °F) rounded up to 2.4°F.

This increase in the wet bulb temperature is bounded by the 2.5°F allowance in the increase of the inlet air wet bulb temperature for the ESW cooling towers in U.S. EPR FSAR, Revision 5, Table 9.2.5-2.

2. <u>Drawings or diagrams of the bounding scenario; distances (horizontal and vertical) between towers and ventilation intakes, and directions (relative to True North and Plant North), are not described.</u>

   Two EPR building location reference drawings showing the location of the cooling towers, other plant structures, and associated dimensions are included in Attachment 3. The location (bottom) of the cooling tower intake openings (2 per side) is 14 feet from the grade on two sides of the cooling tower. Attachment 3 also contains a CFD Model Geometric Details figure which provides a useful visual representation. The figures in Enclosure 3 contain Sensitive Unclassified Non-Safeguards Information (SUNSI) that UniStar requests be withheld from the public. These figures are not included in the public version of this letter (UN#13-142[1]).

3. <u>Percentage of time (on an annual basis) that the CCNPP Unit 1 and 2 site was at >22.4 mph for the bounding conditions, whether these wind speed conditions occur during specific times of the year or day, and what wind directions and temperature conditions are associated with these wind speed conditions.</u>

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[1] UniStar Nuclear Energy Letter UN#13-142, from Paul Infanger to Document Control Desk, U.S. NRC, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, Public Version of the Response to RAI 398, Ultimate Heat Sink, dated November 5, 2013

The bounding or worst case conditions referred to in NRC RAI 398 (this response) are wind from the East and South-East (off of Chesapeake Bay), and wind speeds at 10 m/sec (22.4 mph).

It was assumed that these conditions occurred during the summer when air temperature and wet bulb temperature values are highest.

- The percentage of time on an annual basis that wind speeds measured at CCNPP were greater than 22.4 mph (10 m/sec) and wind direction was from the East was approximately 0.005%.
- The percentage of time on an annual basis that wind speeds measured at CCNPP were greater than 22.4 mph (10 m/sec) and wind direction was from the South-East was approximately 0.03%.
- The percentage of time on an annual basis that wind speeds measured at CCNPP were greater than 22.4 mph (10 m/sec) and wind direction was from any sector was approximately 2.4%.
- Wind speed values measured at CCNPP greater than 22.4 mph (10 m/sec) have occurred during every month of the year, at every hour of the day. The summer months have the lowest occurrence rates compared to the rest of the year.
- Wind directions associated with wind speed values greater than 22.4 mph (10 m/sec) measured at CCNPP cover every one of the 16 compass headings (average annual percent frequency: 0.4% N, 0.5% NNE, 0.3% NE, 0.05% ENE, 0.005% E, 0.01% ESE, 0.03% SE, 0.1% SSE, 0.04% S, 0.1% SSW, 0.1% SW, 0.03% WSW, 0.05% W, 0.3% WNW, 0.3% NW, 0.1% NNW).
- Air temperatures associated with wind speed values greater than 22.4 mph (10 m/sec) measured at CCNPP vary from 11.4°F (hour 5 on December 20, 2005) to 84.2°F (hour 14 on May 18, 2000).

The zero percent exceedance temperature values[2] limited to occurrences of wind directions from the east were determined to be 91°F dry bulb temperature with a coincident wet bulb temperature of 75.5°F. The zero percent exceedance temperature values limited to occurrences of wind directions from the south-east were determined to be 98.5°F dry bulb temperature with a coincident wet bulb temperature of 82.5°F. These dry bulb temperature values are less than the zero percent exceedance temperature value using all wind directions presented in CCNPP Unit 3 FSAR Table 2.0-1 of 102°F dry bulb temperature. While the coincident wet bulb temperature value limited to occurrences of wind directions from the south-east of 82.5°F is larger than the design coincident wet bulb temperature value of 80°F, its associated dry bulb temperature value of 98.5°F is lower than the design dry bulb temperature value of 102°F.

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[2] The zero percent exceedance dry bulb temperature value is the highest value than can occur for consecutive hours and can only be exceeded one hour at a time (no consecutive hourly temperature values can exceed it). The zero percent exceedance coincident wet bulb temperature value is the wet bulb temperature value that occurs at the same time as the zero percent exceedance dry bulb temperature value.

While wind speeds greater than 22.4 mph were observed in all months, hours of the day, and directions, these conditions with winds from the East or South-East are rare at CCNPP, and were observed approximately 0.005% and 0.03% of the time, respectively. Therefore as a bounding condition, these wind conditions rarely occur at CCNPP.

4. Clarify the number of cooling towers in service for the bounding scenarios.

In determining the worst effect of the Ultimate Heat Sink (UHS) Cooling Tower plumes on operating UHS Cooling Towers and operating safety-related ventilation systems, the approach taken was to identify the limiting set of conditions related to operation of the UHS Cooling Towers, operation of the safety-related ventilation systems, and wind speed and direction. This approach was necessary in order to limit the scenarios analyzed using CFD to a realistic number.

The limiting set of conditions with respect to operation of the UHS Cooling Towers and the safety-related ventilation systems are interdependent. That is, operating assumptions are made that no off-site power is available, one emergency diesel generator is out of service, and one emergency diesel generator fails to start (single-failure assumption). These limiting assumptions, consistent with the U.S. EPR and Calvert Cliffs Unit 3 licensing basis, result in only two electrical divisions being energized, and, therefore, only two UHS Cooling Towers (with two cells and associated plumes each) operating in each scenario analyzed. These limiting assumptions also result in only two of four Safety Chilled Water System trains operating (to remove MCR ventilation heat, for example), and only two Safeguard Building Ventilation Systems, and associated safety equipment within the buildings, operating.

These operating assumptions are conservative based on engineering judgment. That is, if additional emergency diesel generators and the associated UHS Cooling Towers were available, then the heat of the plant would be dissipated by three (or four) UHS Cooling Towers and not two, reducing the plume temperatures and moisture content significantly. In addition, additional Safety Chilled Water System trains would be operating to remove heat from safety-related ventilation systems, providing additional margin in response to any plume effects.

Given the initial operating assumption of only two electrical power divisions available, all (six) possible combinations of the four electrical power divisions taken two at a time were evaluated using wind from 16 different directions to determine the worst wind direction for each two-tower combination with respect to UHS Cooling Tower and safety-related ventilation impact. This analysis used a simplified portion of the CFD program to model wind flow over the site, in particular the building effects on the wind stream. It used tower fan impulse, but did not include buoyancy. This analysis determined the most limiting two-UHS Cooling Tower operating scenarios and wind direction combinations, which were then analyzed using full CFD (including buoyancy) to quantify the worst effect on UHS Cooling Towers and safety-related ventilation.

This approach yielded the conclusion that, for impact on UHS Cooling Towers (recirculation and interference), the worst case is wind from the South East (130° from true north) at 10 meters/second with the UHS Cooling Towers associated with Divisions 3 and 4 operating. For impact on safety-related ventilation, this approach yielded the conclusion that the worst case is wind from the East (90° from true north) at 10 meters/second with the UHS Cooling Towers associated with Divisions 1 and 2 operating.

5. The large break LOCA heat load (i.e., the numerical value) was not provided in the response. Specify. Also, explain how this value factors into the CFD analyses determination of cooling tower plume recirculation and interference (if at all) and how it relates to the determination of the cold-water return temperature.

   The large break LOCA heat load is 194.2 MBTU/hr which 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.

   The heat load is an input to the tower discharge condition calculation. The bounding heat load used for the ESW return temperature is tied to the peak Design Basis Accident (DBA) heat load. The calculation procedure for the discharge conditions requires specification of the relative humidity at discharge. With the exception of very dry ambient conditions, the cooling tower discharge is nearly saturated for wet cooling towers, and a 100% Relative Humidity is assumed for the low evaporation potential conditions (high ambient far field relative humidity).

(B) - Follow-up to RAI 331/6221 Question 09.02.05-21

1. CFD analysis uncertainties are not discussed (e.g., input parameter sensitivities, justification of reported precision of results).

   The approach to quantify an upper bound for the wet-bulb temperature increase at the main control room heating, ventilation, and air conditioning (HVAC) intakes and the safety-related intakes on the safeguard building was to identify a worst case operating scenario, wind speed, and flow direction.

   To identify the worst case operating scenario, the non-buoyant runs were re-processed to determine which conditions (operating scenario and wind directions for a 5 m/s wind speed at 60-m elevation) transport the cooling tower plume discharge streams to the HVAC intakes.

   Operating scenario A, wind direction sectors 004 and 005 were identified to yield the worst case conditions.

   Fully buoyant runs were performed for these operating scenarios to establish the intake wet-bulb temperature increase value for each.

   CFD runs for a wind speed of 10 m/s at 60-m elevation were added to establish the sensitivity relative to wind speed. The results show that the maximum wet bulb temperature increase at the HVAC intakes and the safety-related intakes on the safeguard building is approximately 2.2 °F.

   CFD runs for the neighboring wind direction sectors 003 and 005 for operating scenario A with 5 m/s wind speed at 60-m elevation were added to confirm that the worst case conditions were correctly identified. A finer grain discretization of wind speed and wind direction was not performed because the available design margin far exceeded the wet-bulb temperature increase.

CFD runs for two other conditions, operating scenarios A and B, wind direction sectors 008 and 014, respectively, were added because the non-buoyant runs indicated that these cases might have potential for cooling tower plume ingestions. The quantified values for wet-bulb temperature increase at the HVAC intakes for these cases remained below the values quantified for operating scenario A, wind direction sectors 004 and 005 discounting these cases as ones of concern.

2. Drawings or diagrams of the bounding scenario; distances (horizontal and vertical) between towers and ventilation intakes, and directions (relative to True North and Plant North), are not described.

   See the response to #A2 above.

3. Clarify the number of cooling towers in service for the bounding scenarios.

   See the response to #A4 above.

4. Other safety-related ventilation systems are not described as having been evaluated for wet bulb effects (i.e., containment building ventilation, annulus building ventilation, and fuel building ventilation).

   Other safety-related ventilation systems such as the Containment Building Ventilation System (CBVS), Annulus Ventilation System (AVS), and Fuel Building Ventilation System (FBVS) have been evaluated for the effects of an increase in wet bulb temperature. All of these systems are supplied air from the Nuclear Auxiliary Building Ventilation System (NABVS). If a condition existed within the NABVS such that the safety related function of the downstream systems could be adversely affected, including excessive moisture or temperature in the air supply, the air supply can be manually isolated for each affected system utilizing the safety related supply dampers. These systems do not require fresh air supply to support a safety related function, and will perform their safety functions as required without air supply from NABVS. Therefore, the CBVS, AVS and FBVS are not affected due to an elevated wet bulb temperature caused by the UHS Cooling Tower plume.

   The above paragraph has been added to FSAR Section 9.2.5.3.3 under the heading, "Other Safety-Related Ventilation Systems."

5. The RAI response discussion related to cooling tower plume and 'cooling tower' or 'cooling towers' is not consistent.

   See the response to #A4 above.

6. "Divisional combination" needs further explanation.

   See the response to #A4 above.

7. FSAR pointers are missing (9.4.1, 9.4.5, 9.4.9, 9.4.11, and 9.5.8).

Pointers have been added from FSAR Sections 9.4.1, 9.4.5, 9.4.9, 9.4.11 and 9.5.8 to FSAR Section 9.2.5 regarding evaluation of UHS Cooling Tower plume effects.

8. Consider deleting the statement that you confirmed with the EDG vendor in the FSAR. Consider adding statement to FSAR 9.5.8 that UHS cooling tower plume wet bulb interference of 2.2 °F increase above 80 °F wet-bulb was considered in the design of the combustion air for the EDG.

   The sentence which read, "This conclusion has been confirmed with the Emergency Diesel Generator vendor." has been deleted from the text in FSAR Section 9.2.5.3.3 under the "Emergency Power Generating Building Ventilation Impact" header. A pointer has been added to FSAR Section 9.5.8 which reads, "The interference effect of the UHS cooling tower plumes on the DG air intake is discussed in section 9.2.5.3.3." A sentence has been added to the text in FSAR Section 9.2.5.3.3 under the "Emergency Power Generating Building Ventilation Impact" header which reads, "The effects of UHS Cooling Tower plumes on combustion air will be addressed in the specification for the design of the emergency diesel generators."

9. Describe why 6 years of onsite measured meteorological data is sufficient. Identify which meteorological conditions (e.g., wind directions, wind speeds and temperatures) were based on 30-years of offsite data or the 6 years of onsite data.

   FSAR Section 2.3.2 states that, "Onsite meteorological data compiled for Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2 were used in this analysis for CCNPP Unit 3." FSAR Section 2.3.2.1.1, "Wind Speed and Direction" indicates that 6 years of onsite meteorological data (2000 to 2005) was taken. Regulatory Guide 1.206 Section C.I.2.3.3, Onsite Meteorological Measurements Program, states that the applicant should provide meteorological data from at least two consecutive annual cycles (and preferably 3 or more entire years), including the most recent 1-year period, at the time of application submittal. Using meteorological data for six years exceeds the minimum required by Regulatory Guide 1.206.

   The Wet Bulb temperature and associated coincident Dry Bulb temperatures used in the analysis of the cooling tower were determined from the 30 year off site data from the Patuxent River Naval Air Station, consistent with the CCNPP site-specific values used for minimum cooling in FSAR Section 9.2.5. The wind direction and speeds were used from the 6 year on site data from CCNPP 1 and 2 Meteorological Tower. These wind speeds were used to place an upper bound on wind speed at 10 m/s at 60-m elevation.

10. The basis for the large break LOCA heat load (194.2 MBTU) was not provided in the response and how it is related to UHS cooling tower plume interactions on safety related HVAC intakes since neutrally buoyant UHS cooling tower discharges were stated to have been assumed.

    The cooling tower discharge is positively buoyant with respect to ambient conditions. A parametric variation of the wind direction for a zero-buoyancy model was used to rapidly isolate worst case wind directions. The zero-buoyancy model was used to ensure that the warm plume would remain near source height to increase the likelihood of recirculation and ingestion for vents below or near the source height. The effect of buoyancy would be to elevate the plume height. Perturbations of the wind speed at the worst case wind directions were used to choose a worst case condition for cooling tower recirculation and ingestion. Perturbations of the wind speed and wind direction about the worst case using a buoyant CFD model were used to confirm that the addition of buoyancy did not change the conclusion.

For the calculation of plume effects on HVAC intakes, drier design basis ambient conditions were used, consistent with design parameters in FSAR Table 2.0-1. These conditions could lead to lower discharge relative humidity, and the use of a discharge humidity of 100% creates discharge temperatures lower than ambient far field temperatures. The specified discharge humidity was lowered until the discharge temperature was at the same level as the ambient temperature. The discharge is buoyant relative to the ambient because of higher water vapor content, although for the given heat load, a higher discharge dry bulb along with a lower relative humidity will lead to even higher buoyancy. The calculation has minimized the buoyancy level for the specified heat rejection but not eliminated the buoyancy.

The use of 100% peak DBA heat load creates a bounding case with regards to wet bulb increases at tower intakes and HVAC intakes. The discharge buoyancy is minimized for given heat load by adjusting the discharge relative humidity. The sensitivity of the results to wind speed and direction further confirms the results as bounding.

11. Describe the contribution to cooling tower plume rise due to mechanically-produced momentum from the exhaust fans.

The CFD model imposes calculated discharge velocity, density, temperature, and water vapor mass fraction at the cooling tower discharge. The cooling tower discharge has a uniform vertical velocity as it leaves the cooling tower confines. The calculation of discharge quantities accounts for fan pressure rise and work done by the fan. Fan scaling laws account for the small changes due to the discharge stream property variation at specified fan operating rpm (a constant speed fan is used).

The discharge behaves like a jet in cross flow before it loses its jet characteristic. The detailed trajectory of the cooling tower discharge is calculated in the CFD simulation.

12. Describe the percentage of time (on an annual basis) that the CCNPP Unit 1 and 2 site was at >22.4 mph for the bounding conditions, whether these wind speed conditions occur during specific times of the year or day, and what wind directions and temperature conditions are associated with these wind speed conditions.

See the response to #A3 above.

13. Describe in the RAI response why is there no 0% exceedance non-coincident wet-bulb temperature specified in COL Table 2.0-1 or DCD Table 2.1-1 when such a site value (i.e., 85.3 °F) appears to have been used in the CFD plume interference analysis.

Design Control Document (DCD) Table 2.1-1 specifies the 0% exceedance maximum dry bulb temperature and coincident wet bulb temperature. For comparison to the DCD, COL Table 2.0-1 also contains the DCD 0% exceedance maximum dry bulb temperature and coincident wet bulb temperature as well as the CCNPP3 site specific values. Note that in

Design Certification (DC) RAI 256, Question 02.03.01-14[3] NRC asked AREVA to "consider deleting" the zero percent exceedance non-coincident wet bulb air temperature as a site parameter in US EPR FSAR Table 2.1-1. As discussed in our previous response to RAI 331, it is extremely 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 by the UHS Cooling Tower plume.

14. <u>Identify the CCNPP Unit 1 and 2 meteorological tower wind speed and direction measurement height used for the bases for wind speeds and wind directions as input in the CFD.</u>

    The meteorological tower velocity data were extracted from 60-m measurements at a near-by (onsite) tower. The measurements from the meteorological tower were used to estimate a worst case observed wind condition for the site. The greatest difference in elevation at grade between the meteorological tower and the cooling towers in the CFD model is estimated to be 40-ft (12.2 m). No attempt was made to adjust the meteorological tower measurements to account for the grade difference because the meteorological tower data were not used directly in the CFD model and because there is no significant terrain at the site, i.e. the boundary layer is assumed to follow the terrain.

15. <u>Describe if temperature and moisture measurements from the onsite meteorological tower are used and, if so, at what elevation(s) of the tower were these measurements made.</u>

    As described in #B9 above, the onsite 60 meter meteorological tower was used for wind speed, but not for temperature and humidity. The temperature and humidity data were obtained from the Patuxent River Naval Station meteorological tower, consistent with the data presented for minimum cooling in FSAR Section 9.2.5.

16. <u>Identify the base (grade) elevation differences between the UHS cooling towers and the onsite meteorological tower.</u>

    The base (grade) elevation differences between the UHS cooling towers and the onsite meteorological tower are estimated to be 40-ft (12.2-m). As described in the response to #B14, it has no impact on the analysis.

17. <u>Consider adding a footnote to COL Table 2.0-1 (which points to FSAR Section 9.2.5.3.3) that the cooling tower plume interference was calculated to be an increase of 2.2 °F wet-bulb for various safety-related SSCs.</u>

    A footnote to FSAR Table 2.0-1 has been added which points to FSAR Section 9.2.5.3.3.

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[3] R. Wells (AREVA) to Tesfaye, Getachew (NRC), "Response to U.S. EPR Design Certification Application RAI No. 256, FSAR Ch 2, Supplement 11," email dated March 3, 2011.

18. Describe in the RAI response that the cooling tower recirculation effects related to the revised wet bulb effects to the safety-related HVAC intake suction plenum have been evaluated as not being a COL Departure.

    From U.S. EPR FSAR, Revision 5, Table 1.8-2, COL Item 9.2-10 states the following:

    "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."

    UniStar has performed the evaluation requested by the above COL item and confirmed that the design air temperature specified in Calvert Cliffs Unit 3 Table 2.0-1 does not need to be changed. As discussed in the response to item B.13 above, it is extremely 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. The design point for the UHS Cooling Towers remains the same in the U.S. EPR and in the Calvert Cliffs Unit 3 COLA. As discussed in Calvert Cliffs Unit 3 FSAR Section 9.2.5, for the transient condition relating to the non-coincident wet bulb temperature of 85°F that would exceed the zero percent exceedance coincident 80°F wet bulb design temperature in Calvert Cliffs Unit 3 Table 2.0-1, the potential increase in wet bulb temperature due to UHS Cooling Tower plume interference is considered a variance that has been analyzed to be acceptable. 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 by the UHS Cooling Tower plume. Therefore, no departure is required.

COLA Impact

Enclosure 2 provides the COLA impact of the response to RAI 398, Question 09.02.05-32.

Enclosure 2

Changes to CCNPP Unit 3 COLA Associated with the Response to RAI 398, Question 09.02.05-32, Calvert Cliffs Nuclear Power Plant, Unit 3

Table 2.0-1— {U.S. EPR Site Design Envelope Comparison}

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	U.S. EPR FSAR Design Parameter Value			CCNPP Unit 3 Site Characteristic Value
Radius of Maximum Rotational Speed	150 ft			150 feet (See Section 2.3.1)
Missile Spectra	6 in Schedule 40 pipe, 6.625 in diameter x 15 ft long, 287 lb, 34.5 in^2 impact area, impact velocity of 135 ft/sec horizontal and 90 ft/sec vertical.			Design values are enveloped (See Section 2.2 and 3.5)
	Automobile, 16.4 ft x 6.6 ft x 4.3 ft, 4000 lb, 4086.7 in^2 impact area, impact velocity of 135 ft/sec horizontal & 90 ft/sec vertical. (Automobile missile is considered at elevations up to 30.0 ft above grade elevation.)			Design values are enveloped (See Section 2.2 and 3.5)
	Solid steel sphere, 1 in diameter, 0.147 lb, 0.79 in^2 impact area, impact velocity of 26 ft/sec horizontal & 17 ft/sec vertical.			Design values are enveloped (See Section 2.2 and 3.5)
		Temperature		
Air	0% Exceedance Values (note j)	Maximum	115°F Dry Bulb / 80°F Wet Bulb mean (coincident)	102°F Dry Bulb /80°F Wet Bulb (coincident) (See Section 9.2.5.3.3) (note a)
		Minimum	-40°F	0°F (See Section 2.3.1)
	1% Exceedance Values (seasonal basis) (note k)	Maximum	100°F Dry Bulb / 77°F Wet Bulb mean (coincident)	93°F dry bulb/ 76.8°F wet bulb (coincident)
			80°F Wet Bulb (non-coincident)	80°F wet bulb (non-coincident)
		Minimum	-10°F	14°F
		Atmospheric Dispersion and Deposition Factors (χ/Q)(D/Q)		
Maximum Annual Average (limiting sector)	≤ 4.973E-6 sec/m^3 (χ/Q) ≤ 5.0E-08 m^{-2}(D/Q)			5.039E-06 sec/m^3 (note c) (See Section 2.3.5)
		Accident		
0-2 hr (EAB)	≤1E-3 sec/m^3			6.914E-04 sec/m^3 (See Section 2.3.4)
0-2 hr (LPZ)	≤1.75E-4 sec/m^3			2.151E-04 sec/m^3 (note d) (See Section 2.3.4)
2-8 hr (LPZ)	≤1.35E-4 sec/m^3			1.176E-04 sec/m^3 (See Section 2.3.4)

Notes:

a. ~~Note not used~~

FSAR Section 9.2.5.3.3 describes that the cooling tower plume interference and recirculation was calculated to be an increase of less than 2.4 °F wet-bulb for the UHS tower and less than approximately 2.2 °F wet-bulb interference increase for the safety related HVAC intakes.

b. The U.S. EPR FSAR equa [illegible] coefficient greater than or equal to 0.5 (see U.S. EPR FSAR Tier 2 Section 2.3.4.2).

c. Value is a departure from a design parameter and is listed in Part 7 of the COL Application. Justification is provided in Section 2.3.5.

d. Value is a departure listed in Part 7 of the COL Application. Justification is provided in Chapter 15.

e. The effect of the extreme liquid winter precipitation event on roof loads is negligible due to the lack of parapets.

f. First value is U.S. EPR Design Parameter/Second value is CCNPP3 Site Specific Characteristic value.

g. The same meteorological data are used to calculate unfiltered χ/Q values. Since the site-specific control room χ/Q values were demonstrated to be bounded by the U.S. EPR χ/Q values, the calculation of the site-specific atmosphere dispersion factors for unfiltered inleakage was not necessary. CCNPP Unit 3 incorporates by reference the doses for the main control room presented in the U.S. EPR FSAR.

h. Since some of these values are less than 1,000 fps, this constitutes a departure from a design parameter and is listed in Part 7 of the COL Application. Justification is provided by the analysis in Section 3.7

i. The atmospheric dispersion parameters for the equipment hatch and depressurization shaft releases are bounded by the parameters for the release via the Safeguards Building canopy.

j. By definition, zero percent exceedence temperature values exclude peaks of temperatures less that two hours in duration. The zero percent exceedence temperature values are based on conservative estimates of 100-year return period values and historic extreme values, whichever is bounding.

k. For maximum values, data from the summer months of June, July, and August are used. For minimum values, data from the winter months of December, January, and February are used.

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

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The ESWS Cooling Tower Blowdown System components downstream of the MOV are non-safety-related. They are made of carbon steel material because the normal blowdown is non-brackish water from the normal ESWS makeup system.

Screen Wash System Components

The screen wash system consists of piping, valves and instruments for each train. The screen wash system components are classified as safety-related, and are designed as Seismic Category I. All of these components are constructed of materials compatible with the brackish UHS makeup water.}

9.2.5.3.3 Cooling Tower Basin

The U.S. EPR FSAR includes the following COL Items in Section 9.2.5.3.3:

> A COL applicant that references the U.S. EPR design certification will confirm by analysis of the highest average site-specific wet bulb and dry bulb temperatures over a 72-hour period from a 30-year hourly regional climatological data set that the site-specific evaporative and drift losses for the UHS are bounded by the values presented in Table 9.2.5-3.
>
> A COL applicant that references the U.S. EPR design certification will confirm that the maximum UHS cold-water return temperature of 95°F is met by an analysis that confirms that the worst combination of site-specific wet bulb and dry bulb temperatures over a 24-hour period, from a 30-year hourly regional climatological data set is bounded by the values presented in Table 9.2.5-4.
>
> A COL applicant that references the U.S. EPR design certification will confirm that the site-specific UHS makeup capacity is 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 COL Items are addressed as follows:

{Conditions for Maximum Evaporation in the Ultimate Heat Sink

In accordance with Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," (NRC, 1976), the meteorological conditions resulting in maximum evaporation and drift loss should be the worst 30-day average combination of controlling parameters (wet bulb and dry bulb temperatures). The design of the UHS, as stated in U.S. EPR FSAR Section 9.2.5.3.3, is based on meteorological conditions that exist for 72 hours, and is consistent with the sizing of the UHS cooling tower basin. For CCNPP Unit 3, the worst meteorological conditions resulting in maximum evaporation and drift loss of water for the UHS over a 72 hour period are shown in the table below. The U.S. EPR and CCNPP Unit 3 use the same 72-hour period of temperature data to determine maximum evaporation of water from the UHS. Therefore, the worst CCNPP Unit 3 meteorological conditions resulting in maximum evaporation and drift loss of water for the UHS over a 72 hour period are bounded by U.S. EPR FSAR Table 9.2.5-3.

A software routine used in the Ultimate Heat Sink analysis calculation evaluated 30 years of meteorological data (PAXNAS) for Patuxent River Naval Air Station (11 miles from CCNPP Unit 3) and determined the worst 72 hour period from the perspective of maximum evaporation (highest evaporation potential, based on the combined effect of the dry bulb temperature and

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its coincident wet bulb temperature). These ambient temperature conditions are imposed on the cooling tower model for the first 72 hours of the design basis accident (DBA).

The table below provides a comparison of the Table 9.2.5-3 values in the U.S. EPR FSAR and the CCNPP site-specific values used for maximum evaporation from the UHS.

	US EPR FSAR Table 9.2.5-3		**Calvert Cliffs Site-Specific Value**	
Time (hr)	**Wet Bulb Temp (°F)**	**Dry Bulb Temp (°F)**	**Wet Bulb Temp (°F)**	**Dry Bulb Temp (°F)**
1	69.87	84	69.87	84
2	68.69	82	68.69	82
3	66.82	78	66.82	78
4	67.02	77	67.02	77
5	69.04	78	69.04	78
6	68.48	78	68.48	78
7	68.14	77	68.14	77
8	67.10	74	67.10	74
9	67.10	74	67.10	74
10	67.80	76	67.80	76
11	67.23	76	67.23	76
12	69.79	82	69.79	82
13	70.98	84	70.98	84
14	72.71	86	72.71	86
15	74.15	89	74.15	89
16	74.71	93	74.71	93
17	74.98	94	74.98	94
18	75.82	93	75.82	93
19	74.98	98	74.98	98
20	74.20	97	74.20	97
21	74.19	97	74.19	97
22	74.16	95	74.16	95
23	74.15	93	74.15	93
24	72.22	90	72.22	90
25	70.49	86	70.49	86
26	71.03	86	71.03	86
27	71.03	86	71.03	86
28	71.03	86	71.03	86
29	71.03	86	71.03	86
30	70.02	81	70.02	81
31	68.24	79	68.24	79
32	68.25	79	68.25	79
33	68.13	77	68.13	77
34	68.13	77	68.13	77
35	69.70	80	69.70	80
36	71.79	83	71.79	83
37	72.98	85	72.98	85
38	75.02	88	75.02	88
39	76.71	92	76.71	92
40	77.49	95	77.49	95
41	78.24	98	78.24	98
42	78.72	100	78.72	100

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	US EPR FSAR Table 9.2.5-3		Calvert Cliffs Site-Specific Value	
Time (hr)	Wet Bulb Temp (°F)	Dry Bulb Temp (°F)	Wet Bulb Temp (°F)	Dry Bulb Temp (°F)
43	78.48	99	78.48	99
44	77.91	99	77.91	99
45	77.91	99	77.91	99
46	77.10	98	77.10	98
47	76.85	97	76.85	97
48	75.24	93	75.24	93
49	74.14	91	74.14	91
50	72.99	87	72.99	87
51	70.96	84	70.96	84
52	69.33	84	69.33	84
53	68.90	81	68.90	81
54	69.46	81	69.46	81
55	69.13	80	69.13	80
56	69.69	80	69.69	80
57	67.70	79	67.70	79
58	67.70	79	67.70	79
59	68.58	80	68.58	80
60	71.53	84	71.53	84
61	72.40	85	72.40	85
62	73	87	73	87
63	73.29	88	73.29	88
64	73.58	89	73.58	89
65	73.58	89	73.58	89
66	73.33	92	73.33	92
67	73.08	93	73.08	93
68	73.36	94	73.36	94
69	74.42	94	74.42	94
70	74.14	93	74.14	93
71	74.68	93	74.68	93
72	73.28	88	73.28	88

Makeup Capacity

The Ultimate Heat Sink analysis calculation uses 3-day meteorological data that maximizes inventory loss.

Review of the Ultimate Heat Sink sizing criteria calculation indicates the DBA heat load decreases, with no anticipated increases, during the period t=72 hours through t=720 hours. As heat load decreases, the cooling tower range decreases. Lower cooling tower range values yield lower evaporation rates for a given ambient wet bulb temperature. The 72nd hour of the DBA scenario represents the peak anticipated evaporation loss during the last 27 days of the DBA. The worst CCNPP Unit 3 meteorological conditions that result in the maximum evaporation loss of water from the UHS Cooling Tower over a 72 hour period is bounded by the value presented in the U.S. EPR FSAR Table 9.2.5-3.

Drift loss is a fixed percentage of the cooling water flowrate and is provided by the cooling tower vendor based on the drift eliminator configuration used. The drift loss value is independent of ambient environmental conditions. Seepage loss is an estimated value that is assumed to remain constant throughout the 30-day DBA scenario. Valve seat leakage is

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assumed to remain constant, based on a calculated value considering the number of closed boundary valves and valve sizes used in the system. Blowdown is secured during the DBA.

Makeup flow to the UHS towers under DBA conditions is the sum of the evaporation loss, valve seat leakage loss, drift loss, and seepage loss. The UHS makeup water system consists of four independent safety-related trains which provide makeup water from the Chesapeake Bay to the ESW System to meet the maximum evaporative and drift, seepage, and valve seat leakage water losses for the period from 72 hours post-accident up to 30 days post-accident. The CCNPP Unit 3 UHS Cooling Tower maximum drift loss (percent of water flow) for a single cooling tower will not exceed 0.005% as described in U.S. EPR FSAR Table 9.2.5-2. However, to be conservative, 0.01% of cooling water flow has been considered as the design drift loss. This maximum drift loss is bound by the value presented in the U.S. EPR FSAR Table 9.2.5-3. The makeup flow to the cooling tower, when based on the inventory loss at the end of the initial 72-hour period, is sufficient to replenish losses through the end of the 30-day DBA scenario. The CCNPP Unit 3 UHS Makeup Water System provides ≥ 300 gpm of makeup water to the UHS Cooling Tower basin starting 72 hours post DBA. The CCNPP Unit 3 UHS Makeup Water pumps are sized to provide a maximum of approximately 750 gpm to the UHS Cooling Tower basin. This flow is sufficient to provide the minimum required flow even when the intermittent traveling screen wash and the intermittent strainer wash systems are operating. Therefore, even during the screen wash process, makeup water provided post DBA is adequate to maintain the water level in the basin above the required minimum water level for the ESW pump Net Positive Suction Head (NPSH) and Vortex Suppression, considering the maximum evaporation and drift loss after 72 hours and up to 30 days post DBA. U.S. EPR FSAR Table 9.2.5-2, Ultimate Heat Sink Design Parameters, states the required cooling tower emergency makeup flow, post DBA (72 hours through 30 days) as ≥ 300 gpm. The U.S. EPR design 72 hour meteorological conditions resulting in maximum evaporation and drift from the UHS Cooling Tower, as depicted in U.S. EPR FSAR Table 9.2.5-3, are identical to the CCNPP Unit 3 values for the 72 hour meteorological conditions, resulting in maximum evaporation and drift loss, as shown in the comparison table in COLA FSAR Subsection 9.2.5.3.3. Therefore, the CCNPP Unit 3 UHS Makeup Water capacity is bounded by U.S. EPR Makeup Water capacity, to meet the maximum evaporation and drift loss starting 72 hours post DBA through the remainder of the 30 day period.

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.

Design Inlet Wet Bulb Temperature

The U.S. EPR FSAR also states that the design of the UHS is based on a consideration of air temperature parameters listed in U.S. EPR FSAR Table 2.1-1 and U.S. EPR FSAR Table 9.2.5-2. Site-specific values for these parameters were determined using 30 years (1978-2007) of meteorological data from Patuxent River Naval Air Station (NAS), Maryland, a nearby representative site (NCDC, 2008). The 0% exceedance maximum dry bulb and coincident wet bulb temperature values are 102°F (39°C) and 80°F (27°C), respectively. The definition of the maximum/minimum zero percent exceedance temperature values is the highest/lowest value that can occur for two or more consecutive hours and can only be exceeded one hour at a time (i.e., no consecutive hourly temperature values can exceed it. The hourly data set for the Patuxent River Naval Air Station (NAS) (1978-2007) did not include wet-bulb temperature values. As a result, wet bulb temperature values were determined using the provided ambient temperature, dew point temperature, and atmospheric pressure hourly values and an

Worst case assumptions were made regarding availability of electrical power that resulted in only two UHS cooling towers operating (each with two operating cells and associated discharge plumes) for the analysis.

algorithm from the National Weather Service. Observations that had valid values for ambient temperature, dew-point temperature, and atmospheric pressure were used in the analysis. The design values listed in U.S. EPR FSAR Table 2.1-1 bound the calculated values for CCNPP Unit 3 listed above. This comparison is shown in Table 2.0-1.

discharge plumes

The temperature data provided in U.S. EPR FSAR Tables 9.2.5-3 and 9.2.5-4 envelops the temperature data for the Calvert Cliffs Site.

A computational fluid dynamics (CFD) analysis of the CCNPP Unit 3 UHS Cooling Towers was completed to determine the increase in ambient wet bulb temperature of cooling tower intake air for cooling towers due to recirculation and interference effects. The CFD analysis considered both cells of two adjacent UHS Cooling Towers, or one each from either side of the power block, operating at a maximum wet bulb temperature (85.3 °F) ~~and heat duty based on the Large Break LOCA Design Basis Accident, which results in the worst case UHS Cooling Tower heat load.~~

From the neutrally buoyant runs the 135° direction from true north in the clockwise direction was the worst case for UHS tower interference and recirculation.

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 is considered from six years of measurements of wind speed at directions from the 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~~ to determine the worst case wind directions. The recirculation effect is determined by using an iterative approach, where the discharge condition calculations are updated using intermediate CFD results at the UHS Cooling Tower air intakes, which iterate until convergence of the discharge parameters is achieved. The worst case condition of wind direction and UHS Cooling Tower operations was evaluated at various wind speeds to determine what conditions produced the highest ingestion of UHS Cooling Tower discharge. It was concluded that for low wind speeds (below 2.5 m/s [5.6 mph]), the cooling tower discharge rose high vertically, and the recirculation and interference 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 UHS Cooling Tower intake wet bulb temperature.

Sensitivity runs were made at wind speeds of 1 m/s, 2.5 m/s, 5 m/s, and 10 m/s at 60 meters. 10 m/s was determined to be an upper bound through review of meteorological data.

CFD analyses were performed on the worst cases determined from the neutrally buoyant studies, as described above, incorporating buoyancy and iteratively updated the UHS Cooling Tower discharge and intake analyses. These CFD analyses result in a dry bulb temperature and water vapor mass fraction at the cooling tower intake that are converted into an increase in wet bulb temperature at the UHS cooling tower over the ambient value. This increase of wet bulb temperature over the ambient value is the UHS Cooling Tower intake wet bulb correction for interference and recirculation.

This value was calculated to be 2.4° F (2.28 ± 0.08 °F).

Sensitivity runs were made at 5 degree plus and minus wind direction increments from the 135° direction. The worst case was determined to be wind from the South East (130° from true north in the clockwise direction) at 10 meters/second with the UHS Cooling Towers associated with Divisions 3 and 4 operating.

The site-specific wet and dry bulb temperatures were determined using the guidance of Regulatory Guide 1.27 (NRC, 1976) and 30 years of climatology data (1976-2006) from Patuxent River Naval Air Station, just south of the site. The data analysis yielded a maximum calculated wet bulb temperature, when applying a 0% exceedance criterion, of 85° F (29° C) with a coincident dry bulb temperature of 99° F (37° C). This temperature is in excess of the U.S. EPR FSAR Table 9.2.5-2 site design parameter for the 0% exceedance non-coincident wet bulb temperature. This variance is acceptable because the cooling tower performance at its design point is analyzed for the worst case, time-dependent meteorological conditions, and the similarly time-dependent DBA heat rejection curve. The time-dependent meteorological conditions, noted below, were modified for UHS Cooling Tower recirculation and interference, which included the sum of the highest recorded wet bulb temperature of 85.3 °F (29.6 °C) and the ~~site-specific wet bulb correction factor of 2.2 °F (1.2 °C)~~. This analysis confirms that the UHS

EPR wet bulb temperature correction factor for interference and recirculation of 2.5°F (1.4°C).

cold-water return temperature does not exceed 95 °F. The 0% exceedance criterion means that the wet bulb temperature does not exceed the 0% exceedance value for more than two consecutive data occurrences, and the Patuxent River data was recorded hourly.

The Essential Service Water System (ESWS) cooling towers are designed in accordance with Regulatory Guide 1.27 guidance. The tower design is based on a wet bulb temperature of 81° F (27° C) at a specific heat load yielding a specific outlet water temperature. A 1° F increase was added for conservatism. The tower design satisfies the supply water temperature requirement under limiting conditions as described below.

The wet bulb temperature is the controlling factor for establishing the tower basin water temperature because of the more limited ability of the ambient air to absorb heat energy in moving through the tower. Refer to U.S. EPR FSAR Table 9.2.5 -4 for the worst case 24 hour meteorological period for ESWS cooling which envelopes the site-specific highest wet bulb temperature of 85° F. Alternatively, the higher difference between wet and coincident dry bulb temperatures indicates lower humidity and resultant higher evaporation rate, thus making this the controlling factor for determining both makeup water demand and required tower basin water volume. Refer to U.S. EPR FSAR Table 9.2.5-3 for the worst case 72 hour meteorological period for ESWS evaporation and refer to U.S. EPR FSAR Table 9.2.5-2 for the minimum basin water volume at the start of the DBA. In applying these factors to CCNPP Unit 3, the resulting maximum ESWS tower basin water temperature is less than the 95° F (35° C) worst-case design basis for the ESWS and the Component Cooling Water System (CCWS) heat exchangers. Based on the analysis of the Ultimate Heat Sink (UHS) System with the worst combination of site-specific wet bulb temperature and dry bulb temperature over a 24 hours period from a 30 year hourly Regional meteorological dataset, it has been determined that the maximum ESWS supply temperature is less than 95° F (35° C) and the maximum evaporative loss from a UHS cooling tower during the post-72 hour Design Basis Accident condition is 249 gpm (943 lpm), and the minimum UHS cooling tower basin water volume to be present in the basin at the start of Design Basis Accident (DBA) is 319,970 ft^3 .

Minimum Cooling

The meteorological conditions resulting in minimum cooling due to evaporation of water are presented in the table below.

The site wet bulb temperature was calculated using site dry bulb temperature, dew point temperature, and station atmospheric pressure. The evaporation potential was determined as the difference between the moisture content of saturated air at the dry bulb temperature minus the actual moisture content of the air. The computer program used a rolling average to establish the 72-hour period of dry-bulb and wet bulb temperatures, and the evaporation potential. Any missing hourly data was filled in using the last temperature reading (e.g., if the temperature data was missing at 1200h, the data at 1100h is used). The computer program skipped any non-hourly data (e.g., data at 1430 hours), and the maximum number of missing hours allowed in any 72-hour running average was four. The rolling average data set was not used if the maximum number of missing hours over the 72-hour period exceeded four.

A software routine used in the Ultimate Heat Sink analysis calculation evaluated 30 years of meteorological data (PAXNAS) for Patuxent River Naval Air Station (11 miles from CCNPP Unit 3) and determined the worst 24 hour period from the perspective of minimum cooling. To maximize the basin cooling water temperature, the 24 hour metrological dataset has been shifted so that the peak ambient wet bulb temperatures coincide with the peak cooling tower

This page for reference only.

heat loads. These ambient temperature conditions are imposed on the cooling tower model with the highest average wet bulb temperature coincident with the peak cooling tower heat load for the first 24 hours of the DBA. The shifting of the site-specific peak ambient wet bulb temperature value constitutes a departure from U.S. EPR FSAR Tier 2 Table 9.2.5-4, and is discussed in COLA Part 7.

The table below provides a comparison of the Table 9.2.5-4 values in the U.S. EPR FSAR and the CCNPP site-specific values used for minimum cooling from the UHS.

	US EPR FSAR Table 9.2.5-4		**Calvert Cliffs Site-Specific Value**	
Time (hr)	**Wet Bulb Temp (°F)**	**Dry Bulb Temp (°F)**	**Wet Bulb Temp (°F)**	**Dry Bulb Temp (°F)**
1	75.8	82	82.0	93.0
2	76.1	83	84.6	99.0
3	76.1	83	85.3	99.0
4	77.3	85	85.3	99.0
5	79.7	89	84.2	100.0
6	80.8	91	84.2	100.0
7	82	93	84.6	99.0
8	84.6	99	83.9	99.0
9	85.3	99	83.9	99.0
10	85.3	99	82.6	96.0
11	84.2	100	82.6	93.0
12	84.2	100	82.1	91.0
13	84.6	99	82.1	91.0
14	83.9	99	81.9	90.0
15	83.9	99	80.7	88.0
16	82.6	96	80.7	88.0
17	82.6	93	79.5	86.0
18	82.1	91	79.5	86.0
19	82.1	91	75.8	82.0
20	81.9	90	76.1	83.0
21	80.7	88	76.1	83.0
22	80.7	88	77.3	85.0
23	79.5	86	79.7	89.0
24	79.5	86	80.8	91.0

A marine weather dataset from the International Comprehensive Ocean Atmosphere Data Set (ICOADS) maintained by the National Center for Atmospheric Research (NCAR) Computational & Information Systems Laboratory (CISL) for the period 1940 through 2005 was reviewed for a region extending from 33° latitude to 41° latitude and from 277° longitude to 288° longitude to determine the historical maximum sea surface temperature experienced in the region nearest the plant (NCAR, 2006). This area encompasses a rectangle of approximately 480 miles by 600 miles, centered on the CCNPP Unit 3 site. This review indicates a maximum surface temperature of the water in Chesapeake Bay of 93° F which is less than the maximum allowable ESW inlet temperature of 95° F as described in U.S. EPR FSAR Section 9.2.1. Therefore, UHS makeup water flow to the cooling tower will not increase the cooling tower basin water temperature beyond 95° F, and therefore, will not adversely impact ESW system safety function.

Each cooling tower basin has an ESW basin external access pipe provided to allow water to be drawn from the basin, as described in Section 9.2.1. 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.

Ventilation

UHS 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

5. Containment Building Ventilation, Annulus Ventilation, and Fuel 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

computational fluid dynamic (CFD)

plumes

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 ~~LBDCR CC3-13-0111 page 9 of 12~~ basis accident (Large Break LOCA) during

Worst case assumptions were made regarding availability of electrical power that resulted in only two UHS cooling towers operating (each with two operating cells and associated discharge plumes) for the analysis.

Sensitivity runs were made at wind speeds of 5 m/s, and 10 m/s at 60 meters.

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.

The worst case was determined to be wind from the East (90° from true north) at 10 meters/second with the UHS Cooling Towers associated with Divisions 1 and 2 operating.

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:

A review of the 0% exceedance dry bulb and coincident wet bulb temperature values was performed using the same 30-year data set used to determine the site-specific values of 102°F and 80°F. Using only hourly records when the winds were from the east direction sector, the review determined that the 0% exceedance dry bulb temperature value would be 91°F, or 11°F lower than the site value of 102°F, and that the 0% exceedance coincident wet bulb temperature value would be 75.5°F, or 4.5°F lower than the site value of 80°F.

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.

(approximately 2.2°F)

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 Building 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.

(approximately 2.2°F)

Emergency Power Generating Building Ventilation Impact

Each emergency diesel division has its own building. Each of the four buildings has one safetyrelated 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.~~

The effects of UHS Cooling Tower plumes on combustion air will be addressed in the specification for the design of the emergency diesel generators.

Diesel Hall and M

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 nonsafety-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 nonsafety-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.~~}~~

Other Safety-Related Ventilation Systems

Other safety-related ventilation systems such as the Containment Building Ventilation System (CBVS), Annulus Ventilation System (AVS), and Fuel Building Ventilation System (FBVS) have been evaluated for the effects of an increase in wet bulb temperature. All of these systems are supplied air from the Nuclear Auxiliary Building Ventilation System (NABVS). If a condition existed within the NABVS such that the safety related function of the downstream systems could be adversely affected, including excessive moisture or temperature in the air supply, the air supply can be manually isolated for each affected system utilizing the safety related supply dampers. These systems do not require fresh air supply to support a safety related function, and will perform their safety functions as required without air supply from NABVS. Therefore, the CBVS, AVS and FBVS are not affected due to an elevated wet bulb temperature caused by the UHS Cooling Tower plume.

Conclusion

The safety-related ventilation systems are not adversely affected by UHS cooling tower interference. These systems have either been analyzed using CFD, or determined not to be affected by moisture, or can be isolated. Further, for those safety-related HVAC systems that continue to draw outside fresh air, the percentage of drawn in fresh air is small in relation to recirculation air flow rate for these systems. It is also extremely unlikely that worst case wind and UHS cooling tower plume conditions would occur simultaneously with design ambient conditions for the systems, and 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.}

9.2.5.3.4 Coarse and Fine Screens

No departures or supplements.

9.2.5.4 System Operation

9.2.5.4.1 Normal Operating Conditions

{During plant normal operation, the UHS makeup Keep-Fill line and Post-DBA UHS Makeup Keep-Fill line manual isolation valves are open. During DBA, these valves will remain open to allow makeup water flow path to the UHS Makeup Water System. During abnormal operation condition, operator action is manually initiated from the main control room or locally, based on operators' judgment resulting from prevailing conditions and indications. This includes initiating the safety-related UHS Makeup Water System to any and/or all ESWS cooling tower basins, as well as blowdown from any and/or all ESWS cooling tower basins.}

9.2.5.5 Safety Evaluation

{This section of the U.S. EPR FSAR is incorporated by reference with the following supplemental information.

Section 9.2.5.5 of the U.S. EPR FSAR discusses the need to verify that the makeup water supply is sufficient for the site-specific ambient conditions. Per the U.S. EPR FSAR, this is addressed as a part of COL Item 2.0-1. CCNPP Unit 3 utilizes Table 2.0-1 in order to respond to COL Item 2.0-1. Table 2.0-1 refers to FSAR Section 9.2.1 with respect to the acceptability of site-specific temperature characteristics for the U.S. EPR FSAR, UHS Design.

Normal ESWS makeup is a non-safety-related function, and thus requires no safety evaluation with respect to design basis events. Similarly, both cooling tower blowdown and chemical treatment are non-safety-related functions and require no safety evaluation. However, the

9.4 AIR CONDITIONING, HEATING, COOLING AND VENTILATION SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

9.4.1 Main Control Room Air Conditioning System

No departures or supplements.

The interference effects of the UHS cooling tower plumes on the MCR ventilation intake is discussed in section 9.2.5.3.3.

9.4.2 Fuel Building Ventilation System

No departures or supplements.

9.4.3 Nuclear Auxiliary Building Ventilation System

No departures or supplements.

9.4.4 Turbine Island Ventilation System

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

The U.S. EPR FSAR includes the following COL Items in Section 9.4.4:

> A COL applicant that references the U.S. EPR design certification will provide site-specific design information for the turbine building design information for the turbine building ventilation system (TBVS).
>
> A COL applicant that references the U.S. EPR design certification will provide site-specific design information for the switchgear building ventilation system, turbine island (SWBVS).

The COL Items are addressed as follows:

The Turbine Island Ventilation System is comprised of the TBVS and the SWBVS. The site-specific design information for the TBVS and SWBVS are provided in Sections 9.4.4.1 through 9.4.4.6. The information provided applies to both the TBVS and SWBVS, unless otherwise stated.

9.4.4.1 Design Basis

TheTurbine Building (TB) and Switchgear Building (SWGB) do not contain safety-related equipment. Therefore, the TBVS and SWBVS do not serve any safety-related functions, have no safety design basis, and are not required to operate during or following a design basis accident. As such, single failure, environmental qualification and redundancy are not applicable to the TBVS and SWBVS.

Turbine Building Ventilation System

The TBVS operates during startup, shutdown, and normal plant operations to maintain acceptable air temperatures in the Turbine Building for equipment operation and for personnel working in the building. The system is not relied upon during Station Blackout and Abnormal (e.g. Loss of Off-Site Power) operation.

The TBVS is sized to provide the heating, ventilation, and cooling requirements during startup, shutdown, and normal plant operations. The system is designed to maintain a positive pressure to mitigate intrusion of dust and dirt into the Turbine Building.

9.4.4.5 Instrumentation Requirements

Indication of the operational status of the equipment, position of remotely operated dampers, instrument indications and alarms are provided in the Main Control Room (MCR). TB Fans, motor-operated dampers, and electric unit heaters are manual and auto-operable from the MCR. The SWBVS is controlled by the Process Automation System (PAS). Local instruments are provided to measure differential pressure across filters, flow, temperature, and pressure. The fire detection and sensors information will be delivered to the fire detection systems.

9.4.4.6 References

ANSI, 1985. Air Moving and Conditioning Association (ANSI/AMCA) 300, Reverberant Room Method of Testing Fans for Rating Purpose, American National Standards Institute, 1985.

ANSI, 1987. Air Moving and Conditioning Association (ANSI/AMCA) 211, Certified Ratings Program-Air Performance, American National Standards Institute, 1987.

ANSI, 1999. Air Moving and Conditioning Association (ANSI/AMCA) 210, Laboratory Methods of Testing Fans of Aerodynamics Performance Rating, American National Standards Institute, 1999.

ANSI/ASHRAE, 1999. Standard 52.2, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size, American National Standards Institute, 1999.

ASME, 2003. ASME AG-1-2003, Code of Nuclear Air and Gas Treatment, American Society of Mechanical Engineers, 2003.

UL, 2006. Underwriters Laboratories' Standard UL 555, Standard for Safety Fire Dampers, 2006.

9.4.5 Safeguard Building Controlled-Area Ventilation System

No departures or supplements.

The interference effects of the UHS cooling tower plumes on the Safeguard Building ventilation intake is discussed in section 9.2.5.3.3.

9.4.6 Electrical Division of Safeguard Building Ventilation System (SBVSE)

No departures or supplements.

9.4.7 Containment Building Ventilation System

No departures or supplements.

9.4.8 Radioactive Waste Building Ventilation System

No departures or supplements.

9.4.9 Emergency Power Generating Building Ventilation System

No departures or supplements.

The interference effects of the UHS cooling tower plumes on the EPG ventilation intake is discussed in section 9.2.5.3.3.

9.4.10 Station Blackout Room Ventilation System

No departures or supplements.

9.4.11 Essential Service Water Pump Building Ventilation System

No departures or supplements.

The interference effects of the UHS cooling tower plumes on the ESW ventilation intake is discussed in section 9.2.5.3.3.

9.5.4.2 System Description

No departures or supplements.

9.5.4.3 System Operation

No departures or supplements.

9.5.4.4 Safety Evaluation

The U.S. EPR includes the following COL item in Section 9.5.4.4:

> A COL applicant that references the U.S. EPR design certification will describe the site-specific sources of acceptable fuel oil available for refilling the EDG fuel oil storage tanks within seven days, including the means of transporting and refilling the fuel storage tanks, following a design basis event to enable each diesel generator system to supply uninterrupted emergency power.

This COL item is addressed as follows:

> {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC have multiple sources of fuel oil that may be brought in by truck, barge, or air. Relationships or points of contact with the entities which are the sources of the fuel oil and the means for its transportation are well established. Multiple sources and means of transportation allow for the flexibility necessary in order to best respond to an event, and provides assurance of the ability to deliver fuel oil to the site.}

9.5.4.5 Inspection and Testing Requirements

No departures or supplements.

9.5.4.6 Instrumentation Requirements

No departures or supplements.

9.5.4.7 References

No departures or supplements.

9.5.5 Diesel Generator Cooling Water System

No departures or supplements.

9.5.6 Diesel Generator Starting Air System

No departures or supplements.

9.5.7 Diesel Generator Lubricating System

No departures or supplements.

9.5.8 Diesel Generator Air Intake and Exhaust System

No departures or supplements.

The interference effect of the UHS cooling tower plumes on the DG air intake is discussed in section 9.2.5.3.3.

Enclosure 4

Table of Changes to CCNPP Unit 3 COLA Associated with the Response to RAI 398, Question 09.02.05-32, Calvert Cliffs Nuclear Power Plant, Unit 3

Table of Changes to CCNPP Unit 3 COLA

Associated with the Response to RAI No. 398

Change ID #	Subsection	Type of Change	Description of Change
Part 2 – FSAR			
CC3-13-0135	Table 2.0-1	Incorporate COLA markups associated with the response to RAI 398 (this response).	Added a note (Note a) to the air temperature row item (on page 4 of 6 of the table) which provides the reference to FSAR Section 9.2.5.3.3. This change was required as part of the response to RAI 398 (this response).
CC3-13-0079	9.2.5.3.3	Incorporate COLA markups associated with the response to RAI 365[4].	The response to RAI 365 Question 09.02.05-30 revised the text to state results of the analysis performed to verify the UHS cold water return does not exceed 95 °F, even though the site-specific wet bulb correction factor does exceed the value in U.S. EPR FSAR Table 9.2.5-2.
CC3-13-0135	9.2.5.3.3	Incorporate COLA markups associated with the response to RAI 398 (this response).	Incorporated COLA markups under the "Design Inlet Wet Bulb Temperature," "Calculation of Wet Bulb Temperature Increase at MCR and Safeguard Building Ventilation Air Intakes," and "Emergency Power Generating Building Ventilation Impact" headings of FSAR Section 9.2.5.3.3. Also added text under the headings of, "Other Safety-Related Ventilation Systems" and "Conclusion" as part of the response to RAI 398 (this response).
CC3-13-0135	9.4.1, 9.4.5, 9.4.9, 9.4.11, 9.5.8	Incorporate COLA markups associated with the response to RAI 398 (this response).	Provided pointers to in FSAR Sections 9.4.1, 9.4.5, 9.4.9, 9.4.11, 9.5.8 which refer to discussion provided in FSAR Section 9.2.5.3.3 as part of the response to RAI 398 (this response).

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[4] UniStar Nuclear Energy Letter UN#13-054, 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 365, Ultimate Heat Sink, dated April 30, 2013

Enclosure 5

Affidavit Requesting the Withholding of UN#13-140 Enclosure 3 from Public Disclosure in Accordance with 10 CFR 2.390

Affidavit of Paul Infanger

(Page 1 of 2)

Paul Infanger, being duly sworn, hereby deposes and states as follows:

1. My name is Paul Infanger. I am the Manager, Regulatory Affairs and Engineering, for UniStar Nuclear Energy, LLC (UniStar).

2. I have been authorized by UniStar to execute this affidavit in support of UniStar's request to withhold proprietary information identified in UniStar's letter to the NRC UN#13-140, "UniStar Nuclear Energy, NRC Docket No. 52-016, Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 398, Ultimate Heat Sink," hereafter referred to as the Commercial Information in accordance with 10 CFR 2.390(d), from public disclosure in accordance with the Nuclear Regulatory Commission (NRC) regulations appearing at 10 CFR 2.390(d)(1).

3. Commercial Information is being submitted as confidential information as part of Enclosure 3 to UniStar letter UN#13-140 from Paul Infanger to the NRC Document Control Desk.

4. The Commercial Information includes information related to physical protection of the proposed U.S. EPR nuclear power plant at the Calvert Cliffs Nuclear Power Plant, Unit 3 Site (i.e., CCNPP Unit 3). In accordance with RIS-2005-26, "CONTROL OF SENSITIVE UNCLASSIFIED NONSAFEGUARDS INFORMATION RELATED TO NUCLEAR POWER REACTORS," this information can be withheld from public disclosure as proprietary information:

5. The Commercial Information was prepared with the explicit understanding that the information itself would be treated as confidential, and is of a type customarily withheld from disclosure by UniStar. The information should therefore be withheld from public disclosure. Indeed, UniStar has refrained from publicly disclosing this information. To the best of my knowledge and belief, the Commercial Information has not otherwise been knowingly made available in any public source.

6. Information related to physical protection by its nature is treated as confidential. The specific physical protection details in the Commercial Information have not been publicly released for the reasons set forth above. Accordingly, withholding the Commercial Information from disclosure will not adversely affect the public.

Affidavit of Paul Infanger

(Page 2 of 2)

7. Enclosure 3 of letter UN#13-140 contains Sensitive Unclassified Non-Safeguards Information (SUNSI). Upon separation from Enclosure 3, this letter is decontrolled.

Further Affiant sayeth not.

Paul Infanger
Manager, Regulatory Affairs &
Engineering
UniStar Nuclear Energy, LLC

Subscribed and sworn to before me,
Notary Public, this 5th day of November 2013: Juanita D Clinton

My Commission expires: 6-1-2014

JUANITA D. CLINTON
Notary Public-Maryland
Baltimore County
My Commission Expires
June 01, 2014