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RS-13-151 10 CFR 50.90

October 4, 2013

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-001

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Response to Request for Additional Information Related to License Amendment Request to Technical Specification 3.7.3, "Ultimate Heat Sink (UHS)"

References:

1) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Request for a License Amendment to LaSalle County Station, Units 1 and 2, Technical Specification 3.7.3, 'Ultimate Heat Sink,'" dated July 12, 2012

2) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Supplemental Information Related to License Amendment Request to LaSalle County Station, Units 1 and 2 Technical Specification 3.7.3, 'Ultimate Heat Sink,'" dated September 17, 2012

3) Letter from P. R. Simpson (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Response to Request for Additional Information Related to License Amendment Request to Technical Specification 3.7.3, 'Ultimate Heat Sink,'" dated January 18, 2013

4) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Additional Information Supporting License Amendment Request to Revise Technical Specification 3.7.3, 'Ultimate Heat Sink,'" dated February 11, 2013

5) Letter from N. J. DiFrancesco (U. S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), "LaSalle County Station, Units 1 and 2 – Request for Additional Information Related to License Amendment Request to Technical Specification 3.7.3 Ultimate Heat Sink (TAC Nos. ME9076 and ME9077)," dated June 27, 2013

In Reference 1, Exelon Generation Company, LLC, (EGC) requested an amendment to the Technical Specifications (TS) of Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station, Units 1 and 2 (LSCS). The license amendment would allow the TS temperature limit of the cooling water supplied to the plant from the Ultimate Heat Sink (UHS) to vary with the

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observed diurnal cycle. EGC supplemented Reference 1 with letters dated September 17, 2012, January 18, 2013, and February 11, 2013 (References 2, 3, and 4).

The U. S. Nuclear Regulatory Commission (NRC) requested additional information to complete its review of the proposed license amendment request in Reference 5. Attachments 1 through 6 provide the requested information.

Attachment 2 provides a revised No Significant Hazards Consideration. This supersedes the No Significant Hazards Consideration previously provided to the NRC in Attachment 1 of Reference 2.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), a copy of this letter and its attachments are being provided to the designated State of Illinois official.

There are no regulatory commitments contained in this submittal. Should you have any questions concerning this letter, please contact Ms. Lisa A. Simpson at (630) 657-2815.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 4th day of October 2013.

Respectfully,

David M. Gullott
Manager – Licensing
Exelon Generation Company, LLC

Attachments:

1) Response to Request for Additional Information
2) Supplemental Information Related to License Amendment Request to Technical Specification 3.7.3, "Ultimate Heat Sink (UHS)"
3) UHS Calculation
4) LaSalle County Station Drawing S-79
5) UHS Heat Load Calculation
6) Study Performed by CPP Wind Engineering and Air Quality Consultants

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, LaSalle County Station
Illinois Emergency Management Agency – Division of Nuclear Safety

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ATTACHMENT 1
Response to Request for Additional Information

By letter to the U. S. Nuclear Regulatory Commission (NRC) dated July 12, 2012, Exelon Generation Company, LLC, (EGC) requested an amendment to the Technical Specifications (TS) of Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station, Units 1 and 2 (LSCS). The license amendment would allow the TS temperature limit of the cooling water supplied to the plant from the Ultimate Heat Sink (UHS) to vary with the observed diurnal cycle. This letter was supplemented by EGC letters dated September 17, 2012, January 18, 2013, and February 11, 2013. In a letter dated June 27, 2013, the NRC requested additional information to complete its review of the proposed license amendment request.

Review of Operator Actions

NRC Question 1:

Background:

In response to NRC RAI Question 12, in EGC letter dated January 18, 2013, the licensee described the required operator actions that support implementation of the proposed LAR. The response stated that LSCS utilizes a predictive lake thermal model during the summer to facilitate station and lake operations during extreme heat conditions. The UHS temperature is the same as the condenser water inlet temperature prior to the assumed event.

Request:

Please clarify how operators will participate in performing the actions, the timing associated with the action, and training that may be involved.

EGC Response to Question 1:

There are no changes to LSCS's existing response to high lake temperatures due to the proposed license amendment. The thermal model used to predict the lake temperature is controlled and operated by the station's Chemistry Department. The thermal response of the 2058-acre LSCS cooling lake is slow, typically taking in excess of one day to increase from 85°F to 95°F, when the Extreme Heat Implementation Plan as described in the response to NRC Question 12 of EGC letter dated January 18, 2013 (Reference 1) is implemented. This timing allows Operations sufficient opportunity to engage site support groups, which includes staffing of the Outage Control Center (OCC) when the lake temperature exceeds 99°F. The OCC staff includes managers from various site work groups with on-call pre-assigned duty teams. The Operating response to high lake temperatures due to the proposed license amendment is not affected. Operator actions and timing are described in the response to NRC Question 12 of Reference 1. As described in NRC Questions 12 and 15 of Reference 1, Operators will utilize the main control room plant process computer to monitor the UHS temperature (cooling water temperature). Proposed TS 3.7.3 Required Action B.1 (i.e., Perform Surveillance Requirement (SR) 3.7.3.1), which verifies cooling water temperature is within TS limits once per hour when the cooling water temperature is greater than or equal to 101°F, is consistent with existing LSCS procedures (i.e., EN-LA-402-0005, "Extreme Heat Implementation Plan – LaSalle," and LOA-CW-101/201, "Unit 1/2 Circulating Water System Abnormal") for monitoring of critical plant parameters during elevated lake temperatures. This monitoring action is estimated to take control room operators less than two minutes to perform once each hour and does not create any undue operator response burden.

As described in the response to NRC Question 13 of Reference 1, linear interpolation will be used to define the TS limit between identified points of the figure. LSCS procedures EN-LA-402-0005 and LOA-CW-101/201 will be revised to include the linear interpolation values at five minute intervals to assist Operations personnel in the performance of TS SR 3.7.3.1. LSCS Operators will be trained on the revised procedures and TS 3.7.3 prior to implementation, specifically the new surveillance action when cooling water temperature is greater than or equal to 101°F and the new acceptance criteria for SR 3.7.3.1 (TS Figure 3.7.3-1).

Therefore, LSCS Operators will participate in the plant response to elevated UHS temperatures as described in the response to NRC Question 12 of Reference 1. There are no changes required as a result of the proposed amendment to any Operator response times including shutting down both units if required. Appropriate Operator training will be given for the revised TS 3.7.3 and corresponding procedure changes prior to implementation of the proposed amendment.

NRC Question 2:

Background:

In response to NRC RAI Question 13, in EGC letter dated January 18, 2013, the licensee described additions to, deletions, or changes to current operator actions required to support this LAR. The licensee responded that operators will be required to compare water inlet temperatures to the technical specification water temperature and that linear interpolation will be used.

Request:

How will the time associated with completing the action affect the operators? Will any other actions be affected by this change?

EGC Response to Question 2:

As discussed in the response to NRC Question 1, it is estimated the time required for Operators to perform proposed Required Action B.1 of SR 3.7.3.1 is less than two minutes every hour. The control room indication for cooling water temperature is readily available from the plant process computer at each of the unit's computer consoles. The operators will read and log the temperatures as described in the response to NRC Question 15 of Reference 1.

No other actions will change as a result of the proposed license amendment. Existing LSCS procedures EN-LA-402-0005 and LOA-CW-101/201 already provide guidance for high cooling lake temperatures including actions to shutdown both units if temperatures cannot be maintained within TS limits.

Review of UHS Transient Analysis

NRC Question 3:

Background:

Appendix L of Attachment 1 to the LSCS LAR provides a description and the basis of the Plant Temperature Rise value of 44.8 °F. Attachment I, Section I6.3, states that Case 3a is the most limiting case considered by the LAKET calculation (as it results in the lowest allowable initial temperature). Table I7.1b, "EPU (4037 MWt) Overall Summary for Maximum Temperature," provides that the initial lake temperature for Case 3a_6am is 102.42 °F. In the "Total Cumulative Summary" section in the output file for this model run (Case3a_6am.out), the Maximum Value of the lake temp at Inlet is stated to be 140 °F.

Issue:

Based on the maximum initial lake temperature of 102.42 °F and the initial plant temperature rise of 44.8 °F, the NRC staff calculates that the maximum lake temperature at the inlet should be approximately 147.22 °F.

Request:

Please explain how the maximum lake temperature at the inlet was determined to be 140 °F.

EGC Response to Question 3:

The LAKET-PC code was developed to limit UHS temperature output files to 140 °F. Therefore, as stated in NRC Question 3 and as shown in Attachment I to Design Analysis L-002457 (Attachment 3 to EGC letter dated September 17, 2012 (Reference 2)), the maximum plant outlet temperature is presented as 140 °F for cases when the temperature is greater. This known program limitation (described in the user manual) is only present in the output files, and it has no impact on the results of the UHS analysis (i.e., no impact on the UHS discharge temperature). The actual values used in the code computations were confirmed to be the maximum lake temperature resulting from the combination of maximum initial lake temperature and plant temperature rise.

Therefore, for the example described in this RAI, the correct maximum lake temperature is 147.22 °F. It was confirmed the actual code computations used this value to determine the corresponding temperature of the fluid entering the plant did not exceed 107 °F. Based on this information, it can be seen that although the LAKET-PC code limits output files to 140 °F, there is no impact on the computations performed by the code.

LAKET-PC output for EPU Case 3a 6AM
The tables provided below show the computer output from the original LAKET-PC run and the LAKET-PC run with the maximum displayed UHS inlet temperature increased to 160 °F. The increased displayed temperature caused two changes in the values shown below. All other values remained the same including "lake temp @ outlet," which is 106.97 °F and is below the limit of 107 °F, with the following two exceptions:

- The "lake temp @ inlet" changed from 140.00 °F to 147.22 °F. As discussed above, since the "lake temp @ outlet" stayed the same, it is shown that the appropriate value is used in temperature calculations.

- The change to the average value of "lake temp @ inlet" (106.64 °F vs. 106.65 °F) is due to the statistical analysis of additional values that are above the original display limit of 140 °F. With the display limit increased, higher values (such as 147.22 °F) are used in the statistical summary. As discussed in Section 6.2.2 of the user manual for LAKET-PC, these values are not used in the calculation routines and are only used in the statistical summary.

Table 1: Original output table (EPU Case 3a 6AM)

TOTAL CUMULATIVE SUMMARY

QUANTITY	MAXIMUM VALUE	(DATE)	MINIMUM VALUE	(DATE)	AVERAGE VALUE
ANEMOMETER HEIGHT (FT)	33.00	(7011900)	33.00	(7011900)	33.00
LAKE ELEVATION (FEET)	689.98	(7011900)	688.01	(7311900)	688.91
TOTAL AREA (ACRE)	81.32	(7011900)	78.15	(7311900)	79.60
TOTAL VOLUME (ACRE-FT)	339.79	(7011900)	182.09	(7311900)	254.00
EFFECTIVE AREA (ACRE)	47.08	(7011900)	45.25	(7311900)	46.09
EFFECTIVE VOL (ACRE-FT)	215.46	(7011900)	115.44	(7311900)	161.04
CIRCULATION TIME (HR)	29.00	(7021900)	1.00	(7011900)	21.80
PRECIPITATION (CFS)	0.00	(7011900)	0.00	(7011900)	0.00
MAKEUP TOTAL (CFS)	0.00	(7011900)	0.00	(7011900)	0.00
SEEPAGE (CFS)	-0.86	(7311900)	-1.54	(7011900)	-1.17
EVAPORATION TOTAL (CFS)	-0.41	(7261900)	-3.39	(7061900)	-1.40
EVAPORATION NATURL (CFS)	0.00	(7261900)	-2.54	(7091900)	-0.80
EVAPORATION FORCED (CFS)	0.00	(7011900)	-1.24	(7021900)	-0.59
BLOWDOWN TOTAL (CFS)	0.00	(7011900)	0.00	(7011900)	0.00
SOLAR GAIN (BTU/HR-FT2)	436.56	(7101900)	101.21	(7201900)	220.17
SURF LOSS (BTU/HR-FT2)	172.22	(7011900)	151.62	(7261900)	159.22
EVAP LOSS (BTU/HR-FT2)	168.97	(7091900)	0.00	(7261900)	53.84
COND LOSS (BTU/HR-FT2)	41.21	(7061900)	0.00	(7261900)	10.20
LAKE TEMP NATURAL (F)	106.97	(7011900)	89.20	(7261900)	95.92
LAKE TEMP @ INLET (F)	140.00	(7011900)	98.26	(7261900)	106.64
LAKE TEMP @ OUTLET (F)	106.97	(7011900)	90.70	(7261900)	97.53
DISSOLVED SOLIDS (PPM)	0.00	(7011900)	0.00	(7011900)	0.00

Table 2: Table with output temperature limit increased

TOTAL CUMULATIVE SUMMARY

QUANTITY	MAXIMUM VALUE (DATE)	MINIMUM VALUE (DATE)	AVERAGE VALUE
ANEMOMETER HEIGHT (FT)	33.00 (7011900)	33.00 (7011900)	33.00
LAKE ELEVATION (FEET)	689.98 (7011900)	688.01 (7311900)	688.91
TOTAL AREA (ACRE)	81.32 (7011900)	78.15 (7311900)	79.60
TOTAL VOLUME (ACRE-FT)	339.79 (7011900)	182.09 (7311300)	254.00
EFFECTIVE AREA (ACRE)	47.08 (7011900)	45.25 (7311900)	46.09
EFFECTIVE VOL (ACRE-FT)	215.46 (7011900)	115.44 (7311900)	161.04
CIRCULATION TIME (HR)	29.00 (7021900)	1.00 (7011900)	21.80
PRECIPITATION (CFS)	0.00 (7011900)	0.00 (7011900)	0.00
MAKEUP TOTAL (CFS)	0.00 (7011900)	0.00 (7011900)	0.00
SEEPAGE (CFS)	-0.86 (7311900)	-1.54 (7011900)	-1.17
EVAPORATION TOTAL (CFS)	-0.41 (7261900)	-3.39 (7061900)	-1.40
EVAPORATION NATURL(CFS)	0.00 (7261900)	-2.54 (7091900)	-0.80
EVAPORATION FORCED(CFS)	0.00 (7011900)	-1.24 (7021900)	-0.59
BLOWDOWN TOTAL (CFS)	0.00 (7011900)	0.00 (7011900)	0.00
SOLAR GAIN (BTU/HR-FT2)	436.56 (7101900)	101.21 (7201900)	220.17
SURF LOSS (BTU/HR-FT2)	172.22 (7011900)	151.62 (7261900)	159.22
EVAP LOSS (BTU/HR-FT2)	168.97 (7091900)	0.00 (7261900)	53.84
COND LOSS (BTU/HR-FT2)	41.21 (7061900)	0.00 (7261900)	10.20
LAKE TEMP NATURAL (F)	106.97 (7011900)	89.20 (7261900)	95.92
LAKE TEMP @ INLET (F)	147.22 (7011900)	98.26 (7261900)	106.65
LAKE TEMP @ OUTLET (F)	106.97 (7011900)	90.70 (7261900)	97.53
DISSOLVED SOLIDS (PPM)	0.00 (7011900)	0.00 (7011900)	0.00

NRC Question 4:

Background:

The licensee has modeled the UHS as:

> "a one-dimensional thermal prediction model for bodies of water. The model assumes that the temperature is constant at any point along the plane perpendicular to the direction of the flow. The one dimensional model assumptions coerce the water body into an idealized rectangular channel. The movement of fluid through the one-dimensional channel is envisioned as a series of individual, distinct fluid segments. Each segment has an individual length and temperature, while the width and depth remain constant for all. The channel thus forms a queue of fluid segments, where additions are made at the inlet, and deletions are made at the outlet. Any segment that enters the channel will cause an equal amount to be expelled at the outlet. The program assumes that all segments are uniform in temperature, and each segment is allowed to react independently with the environment. The horizontal heat conduction for each segment is assumed to be negligible with respect to the heat rejection at the air-water interface and is ignored. Similarly, conductive heat loss at the water channel interface is ignored."

Issue:

Heat loss caused by evaporative cooling (Q_e) is one of the main factors that affect the UHS temperature in the licensee's model. Q_e is a function of the surface temperature of each fluid segment of the model. The licensee has apparently modeled each segment that enters the UHS after a design-basis accident (DBA) to retain the heat energy transferred from the plant into that segment causing that segment to have a high surface temperature and thus a relatively large heat loss to the environment. The plant temperature rise for each segment is listed in Appendix L9.4 of calculation L-002457. The staff believes that the model segments closest to the plant discharge to the UHS, experience much turbulent flow due to the 38,600 GPM (gallons per minute) discharge. The turbulent flow allows segment mixing causing lower surface temperatures of the closest segments and smaller corresponding values of Q_e. This mixing is confirmed by the computational fluid dynamics (CFD) analysis. Thus the models determination of Q_e is not conservative. The NRC staff expects the mixing of the initial fluid segments will allow less diurnal variation in the calculated TS limits than that proposed in the licensee's submittal. Other factors also allow Q_e to not be conservative. With Q_e also being a function of wind speed, the licensee's modeling of wind speed at the UHS surface may not be conservative in that the UHS surface is 10-20 feet below grade in many locations (Reference final safety analysis report Figures 2.5-50, 52, 53, 54, and 59).

These two factors are significant and may cause the model to be less conservative than the licensee contends and thus affect heat transfer from heat exchangers. The residual heat removal (RHR) and diesel generator coolers in particular have small design heat transfer margins of 1 percent and 2 percent respectively, as shown in Attachment 5 of the licensee's submittal. Although the current existing heat transfer margins of these heat exchangers are greater, as stated in Exelon letter dated January 18, 2013, these margins could deteriorate over time and still be within allowable design values. Thus the staff considers that the model used by the licensee does not accurately predict UHS temperatures such that diurnal TS limits can be established.

Request:

Provide a detailed analysis that uses a UHS model that conservatively accounts for fluid segment mixing and corresponding lower water surface temperatures and conservative surface wind speeds. The model and analysis should provide adequate technical justification for the proposed varying maximum diurnal TS limits.

EGC Response to Question 4:

As requested, the UHS analysis provided in Attachment 3 (Attachment O, Section O2.2) accounts for fluid segment mixing and corresponding lower water surface temperatures and conservative surface wind speeds. The results of the analysis show that while mixing does indeed decrease the surface temperature of the segments, the lower starting surface temperature results in a lower ending surface temperature. As described in Question 6e, sensitivity runs were completed to show that mixing up to 20% has an insignificant impact on the peak plant cooling water inlet temperature and that the highest maximum UHS temperature occurs when no mixing zone is considered. Conservative wind speeds have been used as described in Questions 8b and 9b.

NRC Question 5:

Background:

In the LAR submittal dated July 12, 2012, the licensee chose a first critical time period of 1 day to find the worst case weather data for predicting peak UHS temperature after a DBA-LOCA [Loss-of-coolant accident]. Peak UHS temperature occurred on the first day after the design basis event before plant discharge heat entered the UHS supply to the plant. In a letter dated February 11, 2013, the licensee reported sensitivity studies with longer first critical time periods and found that the peak temperature occurred in the second day after a DBA-LOCA. The licensee's existing model used a transit time of 30 hours.

Issue:

As reported in their letter dated February 11, 2013, the licensee performed sensitivity studies with the purpose of validating their selection of weather data for the LAR submittal. In the licensee's response to RAI 3 in letter dated February 11, 2013, the licensee stated that they performed sensitivity analysis using meteorological data from a continuous 774-hour period based on the 774-hour period that created the highest running average UHS temperature. The staff does not agree with that approach in selecting limiting meteorological data because that approach may not find the limiting data for the first critical time period when UHS temperature supply to safety related components is expected to peak. As stated in Regulatory Guide (RG) 1.27, Revision 2, "sufficient conservatism should be provided to ensure that s 30-day cooling supply is available and that design basis temperatures of safety related equipment are not exceeded," and "The meteorological conditions resulting in minimum water cooling should be the worst combination of controlling parameters, including diurnal variations where appropriate, for the critical time periods unique to the specific design of the sink." [underlines added for emphasis]. Selecting meteorological data from a 774-hour period based on the highest running UHS temperature may not include the worst first few days when peak UHS input to the plant is expected at LSCS.

The licensee's response to RAI 5a in the February 11, 2013, letter does not agree with their response to RAI 3 in that they stated that LSCS screened environmental data for 30 hour periods of time creating the highest running average UHS temperature as opposed to a 774 running average approach. The period from June 22, 2009, to June 23, 2009, created the highest UHS temperature when applied to the design-basis event. The licensee further stated that the same screening process was performed for transit times of 33, 36, and 39 hours and that the 774 consecutive hour period starting with the worst 30-hour periods on June 22, 2009, were evaluated. The licensee's method for determining limiting environmental data as stated in their response to RAI 5a is more reasonable than their approach as described in RAI 3 for a UHS with a 30-hour transit time and first critical time period. Limiting environmental data is necessary to determine peak UHS temperature to the plant and ensure that design basis temperatures of safety related equipment are not exceeded.

Request:

Provide UHS modeling and analysis for the proposed new TS limits based on limiting environmental data. The analysis should determine peak UHS temperature to safety related equipment and ensure that design basis temperatures of safety related equipment are not exceeded and ensure a 30-day supply of UHS cooling water.

EGC Response to Question 5:

As requested, the UHS analysis provided in Attachment 3 (Attachment O, Section O2.1) utilizes limiting environmental data and is consistent with RG 1.27, Revision 2. The model in this analysis used weather data corresponding to the transit time, the worst 24 hours, and the worst 30 days. Transit times of 33 hours, 39 hours, 42 hours, and 45 hours were evaluated for various levels of sedimentation. The 33 hour time period corresponds to the transit time with 18 inches of sedimentation. The results of the analysis show that the peak plant cooling water inlet temperature does not exceed 107 °F for all cases. More than 40 maximum temperature cases were evaluated, and the most limiting case was for the 33 hour transit time with 18 inches of sedimentation followed by the subsequent 31 calendar days.

Review of CFD and Entrance Mixing Conclusions

NRC Question 6:

Background:

The LSCS UHS model relies on a CFD model to approximate the mean transit time water across the core standby cooling system (CSCS) pond for use in transient heatup analysis.

Issue:

The LSCS UHS transient heatup analysis assumes a plug model where no segment exchanges energy with the adjacent segment. This model assumption neglects the impact of entrance mixing caused by the LSCS CSCS outfall structure. Entrance mixing may influence peak accident temperature and the associate time of the peak. Inspection of CFD, Figures J-12 and J-13, appear to show that the main CSCS flow mixes with a number of modeling segments over just a few hours. The Appendix J CFD analysis projects that after 20 hours incoming water will already be exiting the UHS. The remaining water will be trapped in recirculation loops, resulting in a mean transit time around 30 hours indicating that there is significant mixing.

Requests:

a. Please discuss the accuracy of the CSCS outfall structure discharge modeling and its effect on mixing in the entrance of the CSCS cooling pond (e.g., nodalization, exit velocities, surface roughness).

b. Please provide, on scale, figures of fluid velocity in the entrance region including both surface and mid-plane elevations.

c. Please estimate the percentage of water returning (of total CSCS flow) in each recirculation loop. Please estimate the mean return period for each recirculation loop.

d. Justify the use of constant density fluid given that thermal stratification may shorten the effective transit time across the UHS. Additionally, how do water temperatures higher than 100°F affect the analysis results (e.g., fluid viscosity)?

e. To credit diurnal effects, please demonstrate that entrance mixing has no effect on the timing and magnitude of peak UHS temperatures.

EGC Response to Question 6a:

The LSCS UHS outfall structure (plant discharge to UHS) is shown in Attachment 4 (Reference 4, LSCS Drawing S-79). The UHS outfall flow path is designed to mitigate entrance turbulence by allowing the return water to flow over a weir with an eight foot wide inclined channel (less than 30°) to the UHS which minimizes inlet mixing at the entrance. The intent of the CFD model was not to investigate local inlet induced turbulence, but to quantify the UHS effectiveness. The CFD analysis included the eight foot wide outfall structure interface to the UHS with the design cooling water flow rate of 86 ft^3/s (38,600 gpm). This feature was modeled in the CFD analysis that determines the effectiveness of the LSCS UHS. Figures of the nodalization of the inlet boundary are provided in Attachment 3 (Attachment J, Appendix J8.6) and are shown below in Figures 1 through 3. The inlet velocity of the water is equal to approximately 3.1 ft/s, which corresponds to 86 ft^3/s and indicates accurate modeling of the inlet water velocity based on the dimensions of the discharge channel and the UHS depth. The surface roughness of the bottom of the UHS (including the silt layer), based on the calculated UHS low water velocities, does not significantly affect the results of the analysis, which are the overall water flow pattern and speed within the UHS.

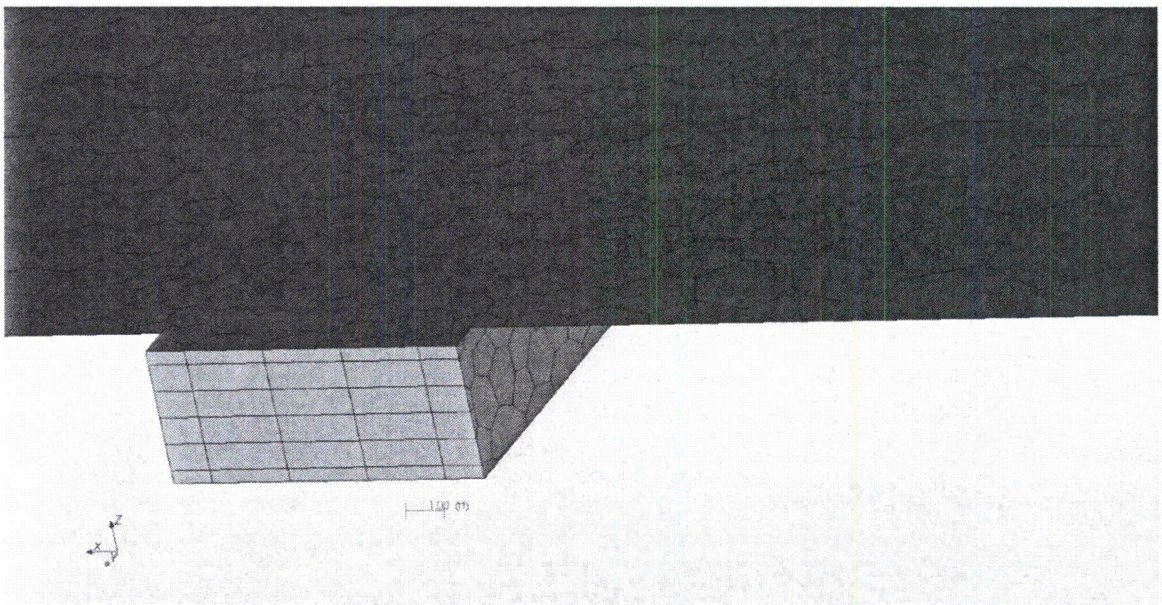

Figure 1: Detail of Mesh at Inlet Boundary (Perspective Side View)

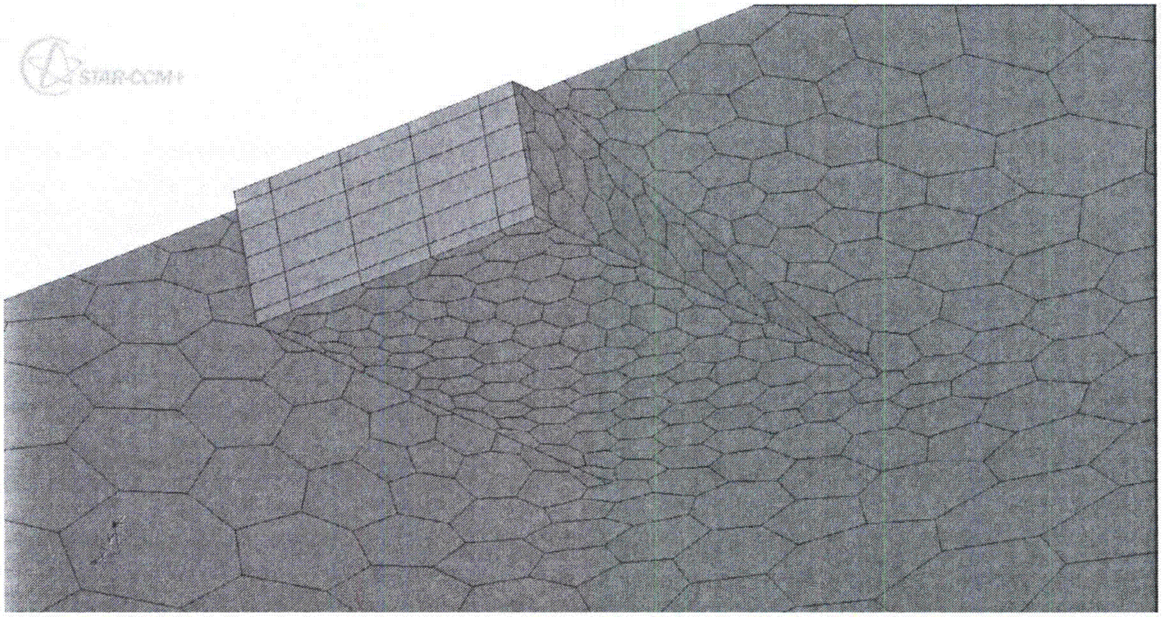

Figure 2: Detail of Mesh at Inlet Boundary (Perspective Bottom View)

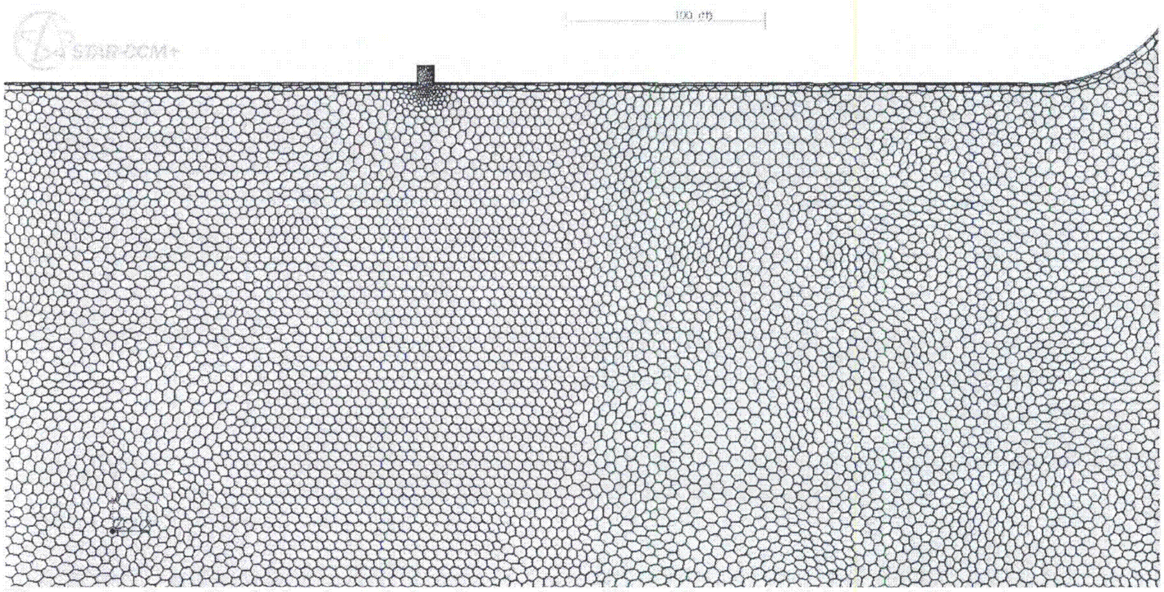

Figure 3: Detail of Mesh at Inlet Boundary (Top View of Mid-Level Plane)

EGC Response to Question 6b:

Requested Figures are provided in Attachment 3 (Attachment J, Appendix J8.6) and are shown in Figures 4 through 9.

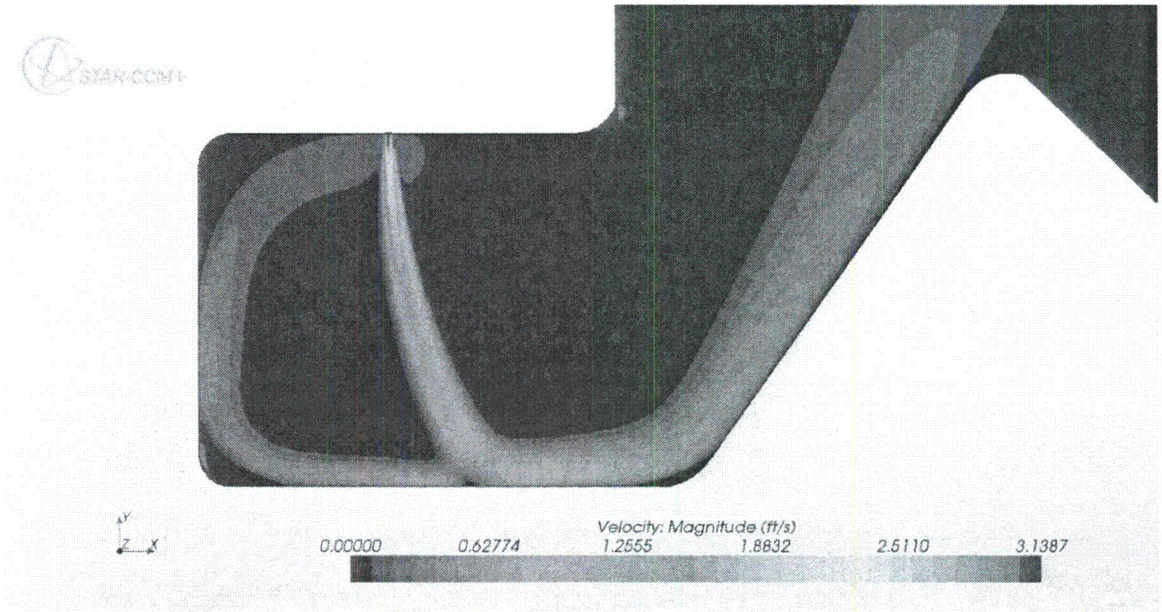

Figure 4: Water Velocity on Free Surface at Inlet Region

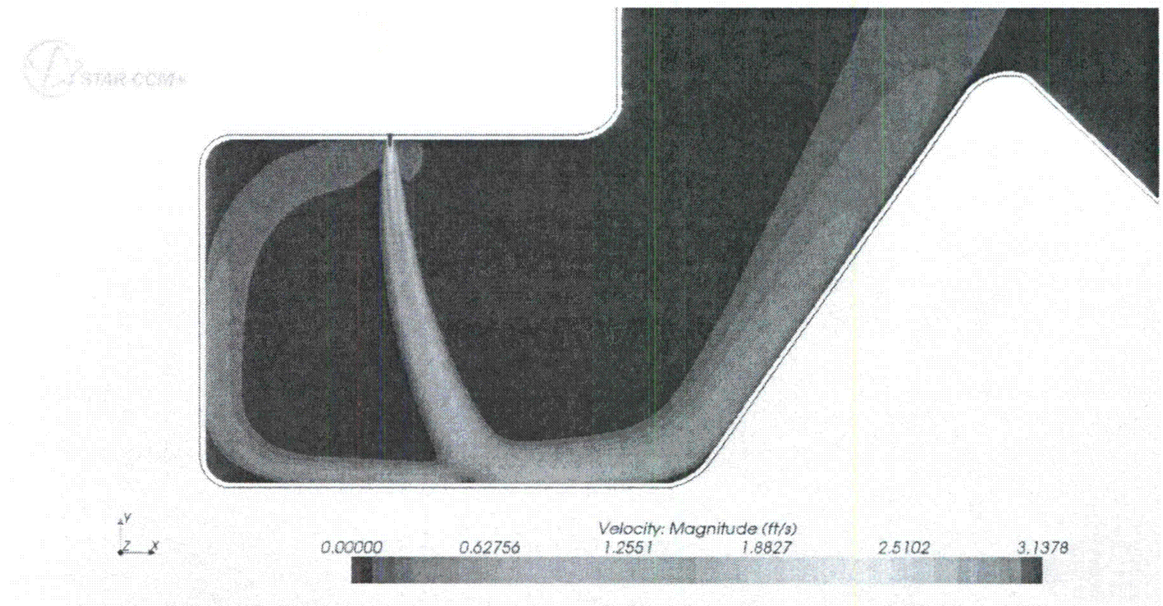

Figure 5: Water Velocity at Mid-Plane of UHS

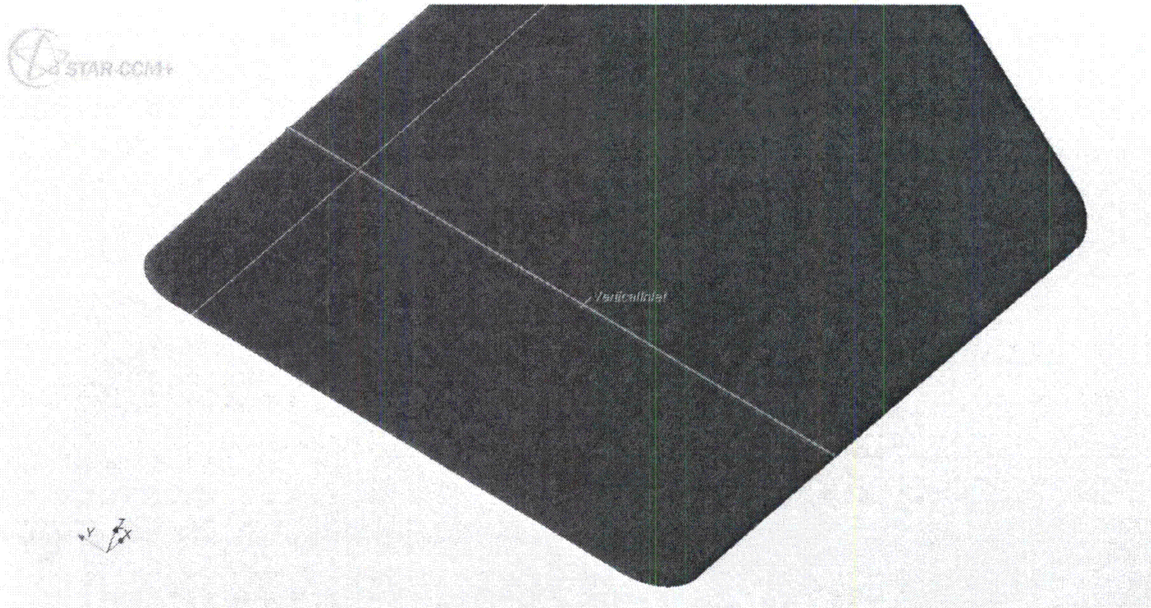

Figure 6: Location of Vertical Cross-Section across Inlet Channel and UHS (Used In Figures Below)

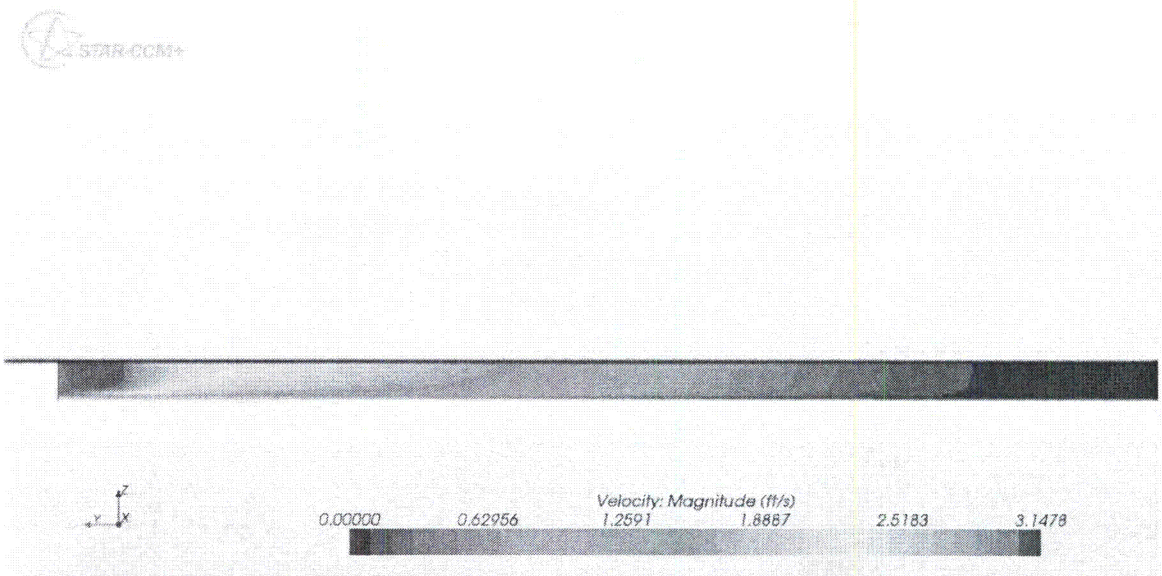

Figure 7: Water Velocity on Vertical Cross Section along Inlet Channel and UHS (See Figure 6). Note: Scale of Y-Axis is 3.5 Times Larger than Scale of X-Axis.

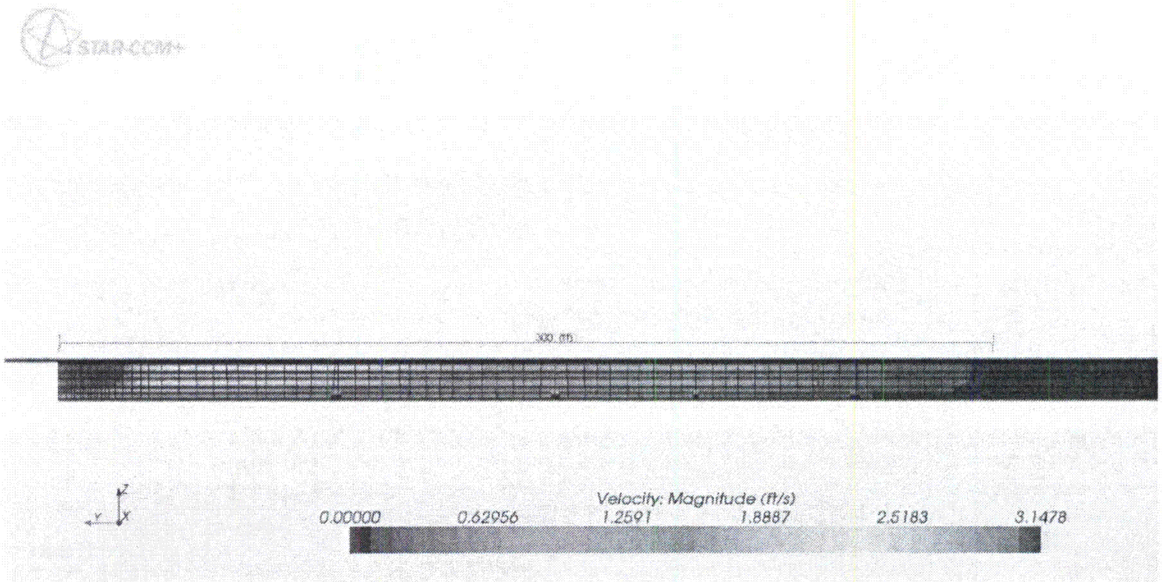

Figure 8: Water Velocity on Vertical Cross Section along Inlet Channel and UHS (See Figure 6) with Details of Mesh.
Note: Scale of Y-Axis is 3.5 Times Larger than Scale of X-Axis.

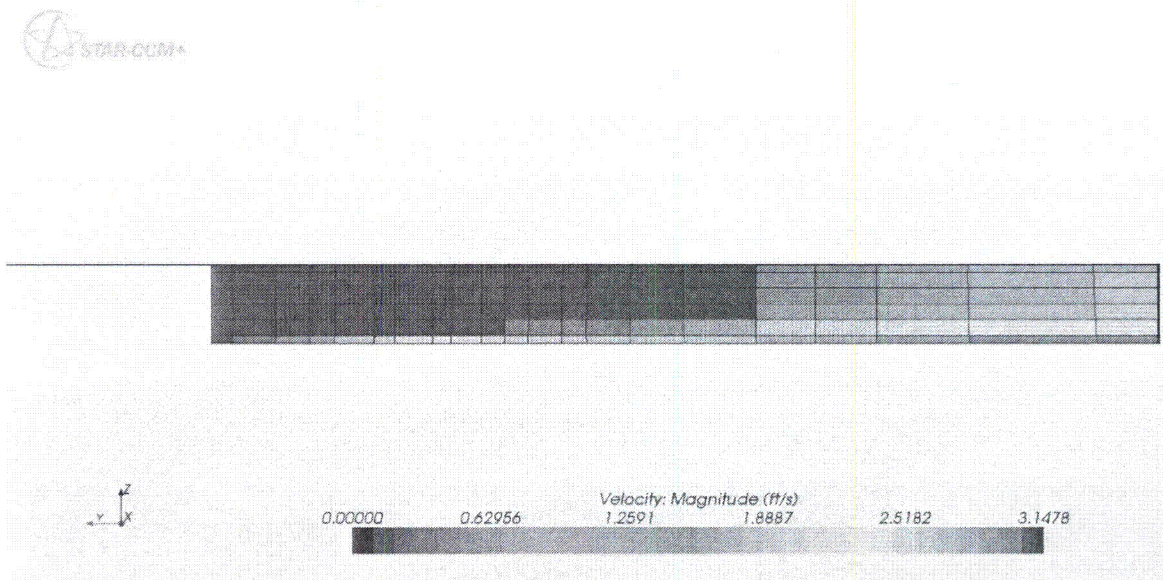

Figure 9: Water Velocity on Vertical Cross Section along Inlet Channel and UHS (See Figure 6) with Details of Mesh (Close-Up View of Inlet)

<u>EGC Response to Question 6c:</u>

Figure 10 shows the two recirculation loops at the entry region. The estimates of the water flow rate returning in each recirculation loop were determined in Attachment 3 (Attachment J, Appendix J8.6) and are as follows:

Mass flow rate in section S1: 184.5 ft^3/s
Mass flow rate in section S2 of Loop A: 52.4 ft^3/s or 61% of plant flow to the UHS
Mass flow rate in section S3 of Loop B: 46.1 ft^3/s or 54% of plant flow to the UHS
Mass flow rate entering the UHS: 86.0 ft^3/s

The mean return period for each recirculation loop is estimated in Attachment 3 (Attachment J, Appendix J8.6) to be:

Mean return period in Loop A: ~1 hour
Mean return period in Loop B: ~14 hours

Based on the above flow rates and return period, the mixing volume is estimated as:

$$(52.4\ ft^3/s \times 1\ hr + 46.1\ ft^3/s \times 14\ hrs) \times 3600\ s/hr \times 1\ ac/\ 43560\ ft^2 = 57.7\ acre\text{-}ft$$

The total UHS volume with 18-in sediment is 340.0 acre-ft. The percentage of mixed volume is approximately:

57.7 acre-ft / 340.0 acre-ft = 0.17 or 17%

Based on a 3.5 ft depth, the mixed surface area is estimated as:

57.7 acre-ft / 3.5 ft = 16.5 acres

The UHS surface area with 18-in sediment is 81.3 acres. The percentage of mixed surface area is approximately:

16.5 acres/ 81.3 acres = 0.20 or 20%

As described in Question 6e, sensitivity runs were completed to show that mixing up to 20% has an insignificant impact on the peak plant cooling water inlet temperature and that the highest maximum UHS temperature occurs when no mixing is considered. Therefore, the use of a non-mixed model is acceptable.

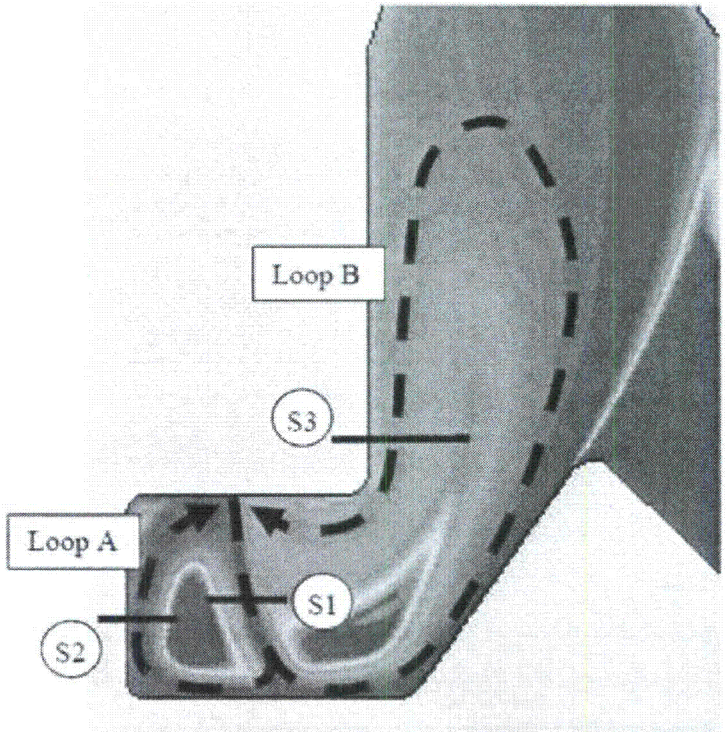

Figure 10: Recirculation Loops at Entry Region (Red Areas Indicate Stagnant Flow Volumes)

EGC Response to Question 6d:

The analysis provided in Attachment 3 (Attachment N, Section N2.0) evaluates the effects of thermal stratification of the UHS. The method consists of assuming the UHS is stratified with the less dense hot water floating on top of the slightly more dense colder water. The method considers the average temperature of discharge and receiving water temperature (°F) and the temperature difference between upper and lower levels (°F). The evaluation determined that the UHS can be regarded as not stratified and a LAKET-PC is acceptable for analyzing the LSCS UHS.

As shown in Attachment 3 (Attachment J, Appendix J8.6), changes in average water temperatures within the range of expected values (~100°F to 120°F) produce small changes in water properties and thus may marginally affect the local water velocity distribution. However, these changes would not cause a significant change in the UHS overall water flow pattern and thus to the size of the recirculation regions. Therefore, the results of the CFD calculation are insignificantly affected by a change in water temperature.

EGC Response to Question 6e:

As requested, the analysis provided in Attachment 3 (Attachment O, Section O2.2) evaluates entrance mixing effects. Sensitivity runs were completed to show that mixing up to 20% has an insignificant impact on the peak plant cooling water inlet temperature and that the highest maximum UHS temperature occurs when no mixing is considered. Increased entrance mixing reduces the transit time which results in a small shift in the timing of the peak temperature. However, mixing has an insignificant impact on the peak plant cooling water inlet temperatures and the highest maximum UHS temperature occurs when no mixing zone is considered. Therefore, the use of a non-mixed model is acceptable.

Review of Accident and Peak Heat Loads

NRC Question 7:

Background:

The UHS should be capable of dissipating to the environment heat generated under plant conditions which result in the maximum heat rejection rate to the UHS as allowed by limiting design parameters and operating procedures in order to perform its safety function as described in RG 1.27.

Issue:

Selecting non-limiting heat rejection rates when determining TS limits, in lieu of the more limiting heat rejection rates allowed by plant design parameters and operating procedures, could result in UHS peak temperature exceeding the design basis temperature of safety-related equipment.

The analysis should include cooling requirements for the nuclear fuel storage in spent pool fuels, as appropriate. The total heat load and rejection rate of heat from spent fuel should be evaluated on the basis of the maximum number of spent fuel elements (i.e., for EPU conditions) that can be stored on-site at any one time with appropriate consideration of plant configuration and allowances for post-shutdown time for all fuel. The Analysis should also consider maximum available heat input to the UHS using all options available in the operating procedures (e.g., using two emergency core cooling system trains for cooling).

Requests:

a. Please provide the heat loads calculations to be relied on for the TS limit safety basis (i.e., by the letter dated July 12, 2012, or February 11, 2013).

b. Please provide heat loads for fully loaded spent fuel pools, and describe any appropriate considerations and allowances for post-shutdown time for all fuel.

c. Please confirm that peak heat rejection rates are consistent with plant shutdown allowable under LSCS's emergency operating procedures and any other operational requirements.

d. Please provide justification that any variation in the timing of peak heat load will not affect the proposed TS curve.

EGC Response to Question 7a:

Attachment D of Attachment 5 contains the heat load calculations to be relied upon for the TS limit safety basis. These heat loads are input to the LSCS UHS analysis (Attachment 3) to determine the peak plant cooling water inlet temperature. The analysis maximizes heat rejection from the plant using all available RHR heat exchangers. The overall heat load is comprised of decay heat from both units, decay heat from the spent fuel pools of both units, sensible heat, and associated safety equipment. Figure 11 below shows the first 500,000 seconds to emphasize peak values (which occur at the beginning of the event) in the plot.

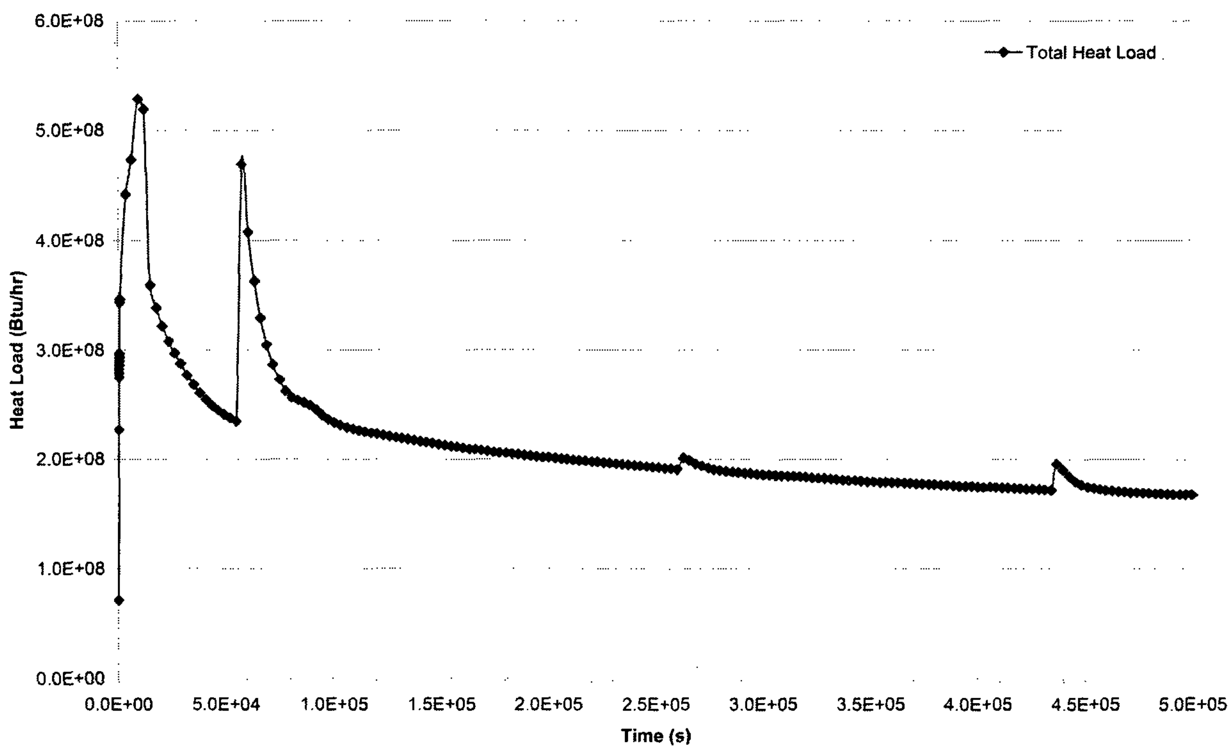

Figure 11: UHS Heat Load

<u>EGC Response to Question 7b:</u>

The heat load rejected to the UHS from the spent fuel pools is determined by utilizing the RHR heat exchanger effectiveness factor (K factor) with Equation 1 below.

$$Q = K * (T_{SFP} - T_{SW}) * 3600 \qquad \text{(Equation 1)}$$

Where:
Q = heat load (Btu/hr)
K = RHR Heat Exchanger K factor (Btu/sec-°F)
T_{SFP} = Spent Fuel Pool Temperature
T_{SW} = Service Water Temperature

For determining the spent fuel pool temperature, a heat load of approximately 18.1 MBtu/hr was input and held constant throughout the duration of the event. This is conservative as this heat load would decay during the 30+ day event. The spent fuel pool temperature response is then determined and the corresponding heat load rejected to the UHS is determined. The calculation of these parameters and the corresponding heat load is provided in Attachment 5.

To determine the heat load of approximately 18.1 MBtu/hr, multiple operating scenarios were evaluated. The critical case considers a unit that completes a refueling outage and is allowed to operate for 100 days (see discussion below) when the UHS event (and LOCA on the other unit) occurs. Once the event occurs, Operators direct that the spent fuel pool cooling assist mode of RHR be aligned. When complete (approximately 16 hours later), heat rejection to the UHS from the spent fuel pools begins. Additional details for the evaluation are discussed below.

For this scenario, it is assumed one unit performs a refueling outage and offloads half of the core (382 fuel bundles) to the spent fuel pool 100 days prior to the event. This bounds typical reloads which have historically been between 280 and 320 fuel bundles. The other unit is assumed to be operated at steady state conditions for an entire 2 year cycle. This is conservative as it would have been operating for about one year based on current outage schedules. Because the two units are identical with respect to core size and decay heat, unit designation does not impact the analysis. The spent fuel pools of the two units are assumed to be completely filled with the maximum number of fuel bundles allowed by LSCS Technical Specifications (Unit 1 = 3,986 fuel bundles; Unit 2 = 4,078 fuel bundles). The maximum combined decay heat for the reactor and spent fuel pool was determined by running multiple scenarios, which considered the recently refueled unit operating for periods of 1 day, 25 days, 100 days, and 1 year. During the operating time, the new fuel in the core gains decay heat, while the recently offloaded fuel in the spent fuel pools loses decay heat. Of the scenarios considered, the time period of 100 days was determined to yield the highest combined heat load for the reactor core and spent fuel pool.

Figure 12 below shows the first 500,000 seconds after initiation of the fuel pool cooling assist mode of RHR to emphasize the peak spent fuel pool heat load value (which occurs at the beginning of the event) in the plot.

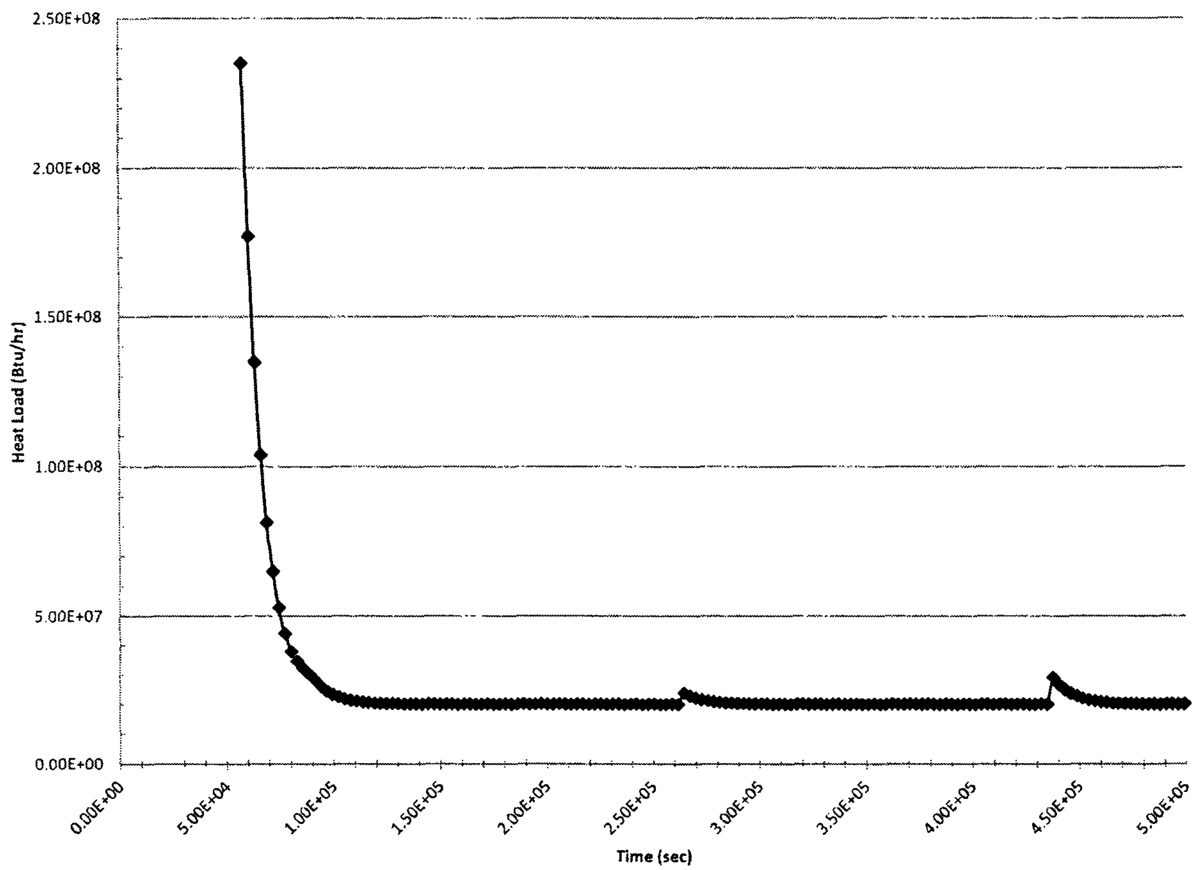

Figure 12: Spent Fuel Pool Heat Load Rejected to UHS

EGC Response to Question 7c:

The peak heat rejection rates are consistent with plant shutdown allowable under LSCS's emergency operating procedures. The heat rejection rates discussed above consider all available trains of RHR (2 trains per unit) rejecting heat to the UHS. The two trains of RHR on the unit that experiences a LOCA reject all decay heat from the unit for the duration of the event. For the non-LOCA unit, one train of RHR is assumed to be placed in suppression pool cooling mode immediately and later transferred to shutdown cooling mode. The heat added to the suppression pool is consistent with a maximum heat rejection rate of 100 °F/hr in accordance with LSCS Technical Specifications. The second train of RHR is being aligned to fuel pool cooling assist mode for the first 16 hours of the event. When alignment is complete, heat rejection to the UHS from the spent fuel pool begins. In addition to the heat loads rejected to the UHS by the RHR heat exchangers, the heat loads associated with plant equipment are also considered as appropriate. These heat loads include ECCS pump room coolers and diesel generator coolers.

EGC Response to Question 7d:

The peak heat load occurs approximately two hours into the event and coincides with a train of RHR on the non-LOCA unit being placed into shutdown cooling mode. Two hours was determined based on the reactor vessel operating normally at approximately 550 °F. At the time of the event, it is assumed that Operators would cooldown at a Technical Specification limit of 100 °F/hr as discussed above. This cooldown rate maximizes suppression pool heatup, which maximizes heat load to be rejected to the UHS for the suppression pool cooling mode of RHR. After two hours, the vessel would approach the interlocks that would allow the shutdown cooling mode of RHR to be aligned and placed into service. Performing a cooldown at a lower rate would reduce the heatup of the suppression pool and allow decay heat to decrease on the non-LOCA unit during that time. Also during this time, the decay heat on the LOCA unit would decrease. Releasing as much plant energy as early as possible in the event is consistent with the station's UHS design basis.

Review of Impact of Site Specific Features on Wind Speed

NRC Question 8:

Background:

The treatment of wind speed is an important consideration for UHS analysis heat transfer. Accurate determination of the air flow 2 meters (approximately 6.6 feet) above the surface of the water in the LCSC UHS is essential to estimate minimum heat transfer from the water to the environment.

In Question 2a of NRC RAI letter dated January 9, 2013 (ADAMS Accession No. ML12320A422), the NRC asked how the LSCS UHS analysis provided in the July 12, 2012, LAR accounts for the difference in heights between the LSCS meteorological measurements made at a height of 752 feet (ft) mean sea level (MSL) and the nominal lake surface level (690 ft MSL) during a UHS heatup event.

Issue:

In Attachment 1 to the Exelon RAI response dated January 18, 2013, the licensee stated that a generic exponent coefficient of 0.3 had been applied and provided a limited basis justifying the use of the generic exponent coefficient.

Since the licensee is attempting to credit diurnal variation of heat transfer, diurnal variations in the exponent coefficient should be assessed to demonstrate that use of the generic exponent coefficient of 0.3 is conservative given that local stability generally varies by time of the day.

Requests:

a. Please calculate and provide a discussion of the average exponent coefficients by hour of the day for the summer months of June, July, and August, from 1995 through 2009.

b. Please justify how the worst 30-hour period is well represented by the generic coefficient and how diurnal variation in the exponent of the power law is addressed.

EGC Response to Question 8a:

The average exponent coefficients were calculated by hour of day for the summer months of June, July, and August from 1995 through 2009 using the on-site meteorological tower wind speed at the measurement heights of 33 ft and 200 ft in the power law equation. The average wind speed exponent is 0.24, being lower during the day for unstable atmospheric conditions and higher at night during stable conditions, is shown in Figure 13.

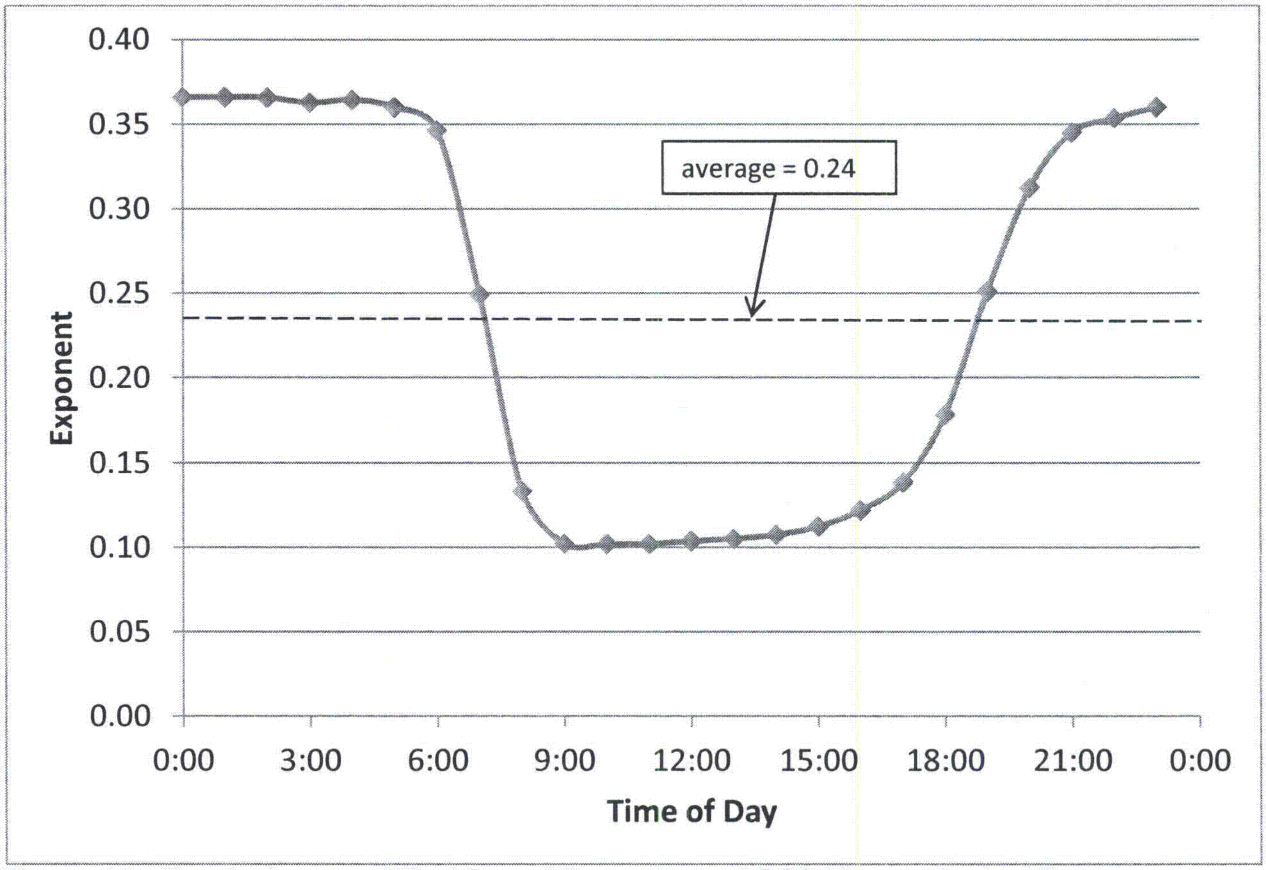

Figure 13: Hourly Average Wind Speed Exponent at LSCS Meteorological Tower

A monthly (30-day) average allows a meaningful quantitative appraisal of meteorological data, where the effects of short-term, local variations have been adequately included without having to deal analytically with such phenomena as thunderstorms (Reference 3).

The monthly average wind speed exponents during the summer months of June, July, and August from 1995 through 2009, as shown in Table 3 below, were all found to be less than 0.3.

Table 3: Monthly Average Wind Speed Exponent

1995	0.257	June
	0.277	July
	0.283	August
1996	0.232	June
	0.261	July
	0.261	August
1997	0.276	June
	0.273	July
	0.275	August
1998	0.272	June
	0.281	July
	0.247	August
1999	0.196	June
	0.224	July
	0.215	August
2000	0.197	June
	0.204	July
	0.252	August
2001	0.207	June
	0.218	July
	0.222	August
2002	0.220	June
	0.229	July
	0.257	August*
2003	0.218	June
	0.226	July
	0.241	August
2004	0.222	June
	0.226	July
	0.233	August
2005	0.229	June
	0.235	July
	0.231	August
2006	0.216	June
	0.252	July
	0.253	August
2007	0.211	June
	0.234	July
	0.260	August

2008	0.245	June
	0.258	July
	0.252	August
2009	0.189	June
	0.219	July
	0.237	August

*Note: Data unavailable for the period 0500 on August 23, 2002, through 1100 on September 4, 2002.

EGC Response to Question 8b:

As described above in Question 8a, the daily average wind speed exponent at the LSCS meteorological tower location is 0.24, being lower during the day for unstable atmospheric conditions and higher at night during stable conditions as a result of the diurnal variation of ground surface temperature at the meteorological tower location. The lower exponents during the day coincide with peak solar energy input to the UHS. Attachment 3 (UHS analysis Attachment O, Section O6.8) documents a sensitivity evaluation where hourly calculated wind speed exponent coefficients of the limiting weather period were input to LAKET-PC. The results of this evaluation found that 0.3 remains bounding with regards to the maximum plant inlet cooling water temperature. Therefore, the use of the generic exponent coefficient of 0.3 is conservative.

NRC Question 9:

Background:

In Question 2b of NRC RAI letter dated January 9, 2013, the NRC asked how the wind gradients were modeled and why they are conservative for LSCS's site characteristics for UHS cooling performance.

In its January 18, 2013, response, the licensee stated:

> "The wind speed extrapolation is a power law equation correcting the wind speed to an elevation of 2 meters above the ground level (the reference wind speed elevation used for wind functions in MIT Report No. 161 (Reference 2)). There are a variety of exponential factors that have been used over the years in the power law equation, which are introduced in Section 2.2.4 of the structural engineering book, "Wind Effects on Structures" (Reference 1). The original LAKET - PC program was developed in 1971 - 1972, and the only reference for the power law exponent cited in the book pre-dating LAKET-PC recommends an exponent of 0.28 for suburban terrain, and 0.16 for open terrain. As the wind measurement height is always expected to be above 2 meters, a higher exponent is more conservative for extrapolating wind speeds to 2 meters since lower wind speeds are conservative for the UHS analysis. The two other (more recent) references for the exponent in "Wind Effects on Structures" (Reference 1) suggest even lower exponents for the suburban terrain. Thus, LAKET-PC uses a conservatively bounding value of 0.3 for the exponent."

Issue:

Use of the exponent coefficient of 0.3 does not appear to directly consider the potential impact of plant structures and topographic modifications specific to LSCS, given that the LSCS UHS is, at least partially, recessed relative to the overall site. For example, using Figures J-3 and J-5 of Attachment J to letter dated September 17, 2012, and Figure 2.5-59 of the LSCS updated final safety analysis report, NRC staff estimates that the narrowest part of the UHS flume is approximately 2200 feet in length, 160 feet in width, and the water surface is about 15 to 25 feet below the side of the flume when the water level is at 690 ft MSL. Thus, the flume and water in the flume are generally recessed below local grade and the overall site winds.

Requests:

a. Please provide a rigorous quantitative assessment of any reduction in air flow in the flume for a range of wind directions.

b. Provide a conservative calculation of the exponent coefficient based on site characteristics for the most adverse wind orientation and/or provide an estimate of the coefficient based upon direct measurement.

c. Please revise the proposed technical specification, if appropriate, to account for this local topographic effect to ensure sufficient safety margin for plant equipment.

EGC Response to Question 9a:

A study of the LSCS UHS was performed by CPP Wind Engineering and Air Quality Consultants and is provided as Attachment 6. The study performed wind tunnel testing on a 1:500 scale model of the LSCS site and UHS water elevation of 690 ft. The study conducted wind measurements at 22.5° increments to determine the limiting wind direction at the station. As shown in Figure 2 of Attachment 6, the flume is modeled on the West Turntable, which includes plant structures and is represented by data collection points 1 through 9. Attachment 6 determined the ratios of the wind speed at the 114 m (375 ft) meteorological tower elevation, which corresponds to 123 m above the UHS surface, to the wind speed at 2m (6.6 ft) over the UHS as a function of wind direction. For neutral conditions (with respect to atmospheric stability over the UHS), the lowest area average wind speed ratio (WSR) of the flume for all wind directions is 0.405 for a wind direction at 0°, which translates to an equivalent exponent, based on the power law equation, of 0.22 ($\log_{2m/123m} 0.405 = 0.22$) and is less than 0.3. The results of Attachment 3 (UHS analysis Attachment O, Section O6.8) using this limiting WSR show that the peak plant cooling water inlet temperature does not exceed 107 °F.

The UHS water surface temperatures during the initial 33 hours of the worst weather period are warmer than the ambient air temperature due to the heat rejected to the UHS. Water vapor is lighter than air thus evaporation increases the buoyancy forces (Reference 5). Therefore, the atmospheric conditions over the heated UHS water surface will be essentially unstable. This would result in higher wind speeds at the water surface as discussed in Attachment 6. These higher wind speeds due to unstable conditions were not considered in the UHS calculations but are noted here as margin of the UHS calculations.

Therefore, even for the limiting direction (winds from the north), reduction in air flow in the intake flume is not limiting to the maximum UHS temperature. Wind speeds from other directions were bounded by this direction.

<u>EGC Response to Question 9b:</u>

The study performed by CPP Wind Engineering (Attachment 6) determined that the exponent coefficient for the LSCS UHS analysis (Attachment O, Section O6.8 of Attachment 3) would be less than the coefficient exponent of 0.3 which was previously considered. This held true for all wind directions. As stated in the response to NRC Question 9a, the limiting direction was winds from the north. For this direction, the average calculated exponent coefficient was 0.22.

<u>EGC Response to Question 9c:</u>

No revision to the proposed TS is warranted to account for this local topographic effect. Adequate margin is provided based on the study performed by CPP Wind Engineering (Attachment 6).

Review of Resolution of Fish Kill Concern on Core Standby Cooling System

<u>NRC Question 10:</u>

<u>Background</u>

By letter dated October 30, 2012, LSCS, Units 1 and 2, NRC Integrated Inspection Report 05000373/2012004; 05000374/2012004 (ADAMS Accession No. ML12305A166), states that:

> "The inspectors identified a finding of very low safety significance and associated NCV of Title 10 of the Code of Federal Regulations (CFR) Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to adequately verify the adequacy of the design of systems needed during a design basis accident. Specifically, the inspectors identified the licensee failed to evaluate the effects of fish mortality resulting from the elevated ultimate heat sink (UHS) temperatures predicted to occur during design basis accidents. The licensee entered the issue into its corrective action program (CAP) and based on engineering judgment, concluded the fish mortality or fish kills would not prevent systems from performing their safety functions during a design basis accident."

<u>Requests</u>:

a. Please discuss the extent of fish mortality resulting from a design basis event and if any controls are in place to monitor and limit fish populations. Describe the fish populations on both sides of the shad net.

b. Please confirm that there are no impacts on the capability of the CSCS structure systems and components to mitigate the effects of fish kill and have the capability to cope with any debris or increased turbidity that may result from materials bypassing/clogging system strainers or may otherwise impact equipment during a design basis event.

EGC Response to Question 10a:

Fish mortality resulting from a design basis event has been evaluated. The evaluation shows that the estimated quantity of perished fish on both sides of the shad net is significant, but is within the capability of the site personnel that are directed to remove the fish. Small quantities of fish may perish within hours of the event, but the larger numbers may start perishing at approximately 48 hours into the event. This period of time is large enough to mobilize personnel to the UHS to remove the perished fish, thereby preventing the perished fish from impacting the UHS and intake. In the evaluation of the fish in the UHS, the fish populations were estimated by using Illinois Department of Natural Resources (IDNR) stocking data over the past several years. Fish size was estimated based on sample data taken at the LSCS Lake fish hatchery. As a result of these evaluations, station procedures have been revised to provide guidance to operators to establish monitoring and mobilize station resources to remove perished fish. Equipment necessary for this activity (boats, nets, lights, fuel, etc.) is permanently staged at the site. Note that the perished fish removal capability for these evaluations is based on performance data from previous fish kill events at the site.

EGC Response to Question 10b:

The cooling water for the CSCS normally passes through bar grates and traveling screens to prevent debris from entering the system. Station procedures direct operators to transition to an alternate suction path that would bypass the traveling screens if cooling water flow is lost. The bypass line that is used is a 54 inch pipe with the top of the pipe located approximately 8 feet below the water surface (lowest expected surface elevation due to evaporative losses). During a design basis event in which fish mortality occurs, perished fish may be distributed throughout the vertical water column. During this time, maintenance personnel can be called upon to remove perished fish such that the supply of water to the CSCS is not lost. Additionally, procedures and alarms are in place to assist operators in monitoring pressure drops across system strainers. Actions are in place to backwash strainers at prescribed pressure drops on these strainers. Large fish kills have previously occurred at LSCS. During these occurrences, maintenance personnel were able to demonstrate their ability to remove perished fish and maintain the supply of cooling water to the plant. Therefore, we conclude that, during a design basis event, the design function of the CSCS is maintained.

References:

1) Letter from P. R. Simpson (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Response to Request for Additional Information Related to License Amendment Request to Technical Specification 3.7.3, 'Ultimate Heat Sink,'" dated January 18, 2013

2) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "Supplemental Information Related to License Amendment Request to LaSalle County Station, Units 1 and 2 Technical Specification 3.7.3, 'Ultimate Heat Sink,'" dated September 17, 2012

3) NUREG-0693, "Analysis of Ultimate Heat Sink Cooling Ponds," Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission, November 1980

4) LaSalle County Station Drawing S-79, "CSCS Pond Water Inlet Chutes Plan & Sections," Revision H (provided as Attachment 4)

5) MIT Report 161, "An Analytical and Experimental Study of Transient Cooling Pond Behavior," Ryan and Harleman, Massachusetts Institute of Technology, Cambridge Massachusetts, 1973

ATTACHMENT 2
Supplemental Information Related to License Amendment Request to Technical Specification 3.7.3, "Ultimate Heat Sink (UHS)"

The following No Significant Hazards Consideration supersedes the No Significant Hazards Consideration previously provided in Attachment 1 of EGC letter to the NRC dated September 17, 2012 (i.e., ADAMS Accession No. ML12269A021).

5.1 No Significant Hazards Consideration

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (EGC) is requesting a change to the Technical Specifications (TS) of Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS), Units 1 and 2.

The Core Standby Cooling System (CSCS) Pond is the Ultimate Heat Sink (UHS) for LSCS, Units 1 and 2. The CSCS pond is excavated and integral with the LSCS Cooling Lake. The volume of the CSCS Pond is sized to permit the safe shutdown and cooldown of both LSCS units for a 30 day period, including a design basis event with no additional makeup water source. The LSCS UHS is analyzed to withstand a failure of the LSCS cooling lake dike coincident with a loss of offsite power and a design basis loss of coolant accident (LOCA) on one unit and a normal shutdown of the other unit. The UHS provides a heat sink for process and operating heat from safety-related components during the UHS design basis event. The Residual Heat Removal Service Water system and Diesel Generator Cooling Water system are the principal systems at LSCS that utilize the UHS to reject heat from safety-related plant loads.

The maximum safety-related cooling water design temperature at LSCS has been evaluated in accordance with 10 CFR 50.59, "Changes, tests and experiments," and found to be acceptable. Currently, Surveillance Requirement (SR) 3.7.3.1 verifies the cooling water temperature supplied to the plant from the CSCS Pond is ≤ 101.25 °F. If the temperature of the cooling water supplied to the plant from the CSCS Pond exceeds 101.25 °F, the UHS must be declared inoperable in accordance with TS 3.7.3. Additionally, TS 3.7.3 Required Action B.1 requires that both units be placed in Mode 3 within 12 hours, and Required Action B.2 requires that both units be placed in Mode 4 within 36 hours, concurrently.

The proposed change modifies the acceptance criterion for verification of cooling water temperature supplied to the plant from the CSCS Pond from a fixed temperature limit to a variable limit based on time-of-day. If the indicated UHS temperature exceeds the time-of-day-based limit, TS 3.7.3 Required Actions would be entered, and both units would be required to be placed in Mode 3 within 12 hours and in Mode 4 within 36 hours.

The proposed change will continue to ensure that the maximum temperature of the safety-related cooling water supplied to the plant during the UHS design basis event remains less than the design limit for LSCS, Units 1 and 2. In addition, there are no adverse influences on risk associated with any other Design Basis Accident (DBA) and; therefore, a Probabilistic Risk Analysis (PRA) assessment is not required for this change.

According to 10 CFR 50.92, "Issuance of amendment," paragraph (c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Involve a significant reduction in a margin of safety.

In support of this determination, an evaluation of each of the three criteria set forth in 10 CFR 50.92 is provided below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed change makes no physical changes to the plant, nor does it alter any of the assumptions or conditions upon which the UHS is designed. These assumptions and conditions as described in the LSCS UFSAR include failure of the cooling lake dike, a loss of offsite power and a DBA LOCA on one unit, and a normal shutdown of the other unit.

   The accidents analyzed in the UFSAR are assumed to be initiated by the failure of plant structures, systems, or components (SSCs). An inoperable UHS is not an initiator of any analyzed events as described in the UFSAR. The impact on the structural integrity of the UHS due to a potential increase water temperature prior to and during the UHS design basis event has been evaluated, and does not increase the probability of the failure of the cooling lake dike. The proposed temperature limit for cooling water supplied to the plant from the CSCS Pond could reduce the commercial capability of the LSCS units; however, it does not result in an increase in the probability of occurrence for any of the events described in the UFSAR.

   The basis provided in Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 2, dated January 1976, was employed for the temperature analysis of the LSCS UHS to implement General Design Criteria 2, "Design bases for protection against natural phenomena," and 44, "Cooling water," of Appendix A to 10 CFR 50. Revision 1 of this Regulatory Guide was employed for the original design and licensing basis of the LSCS UHS, and Revision 2 of this Regulatory Guide was used for the subsequent evaluation, which investigated the potential for changing the average water temperature of the cooling water supplied to the plant from the CSCS Pond from a fixed temperature limit to a limit based on the time of day. The meteorological conditions chosen for the LSCS UHS analysis utilized a critical period consisting of the most severe 33 hour transit time followed by the subsequent 31 calendar days based on historical data. The heat loads selected for the UHS analysis considered failure of the cooling lake dike, a loss of offsite power and a DBA LOCA on one unit, and a normal shutdown of the other unit. The LSCS cooling lake is conservatively assumed to be unavailable at the start of the event. The analysis shows that with an initial UHS temperature less than or equal to the proposed time-of-day-based limit, the required safety-related heat loads can be adequately cooled for 30 days while continuing to ensure safety-related cooling water temperature remains less than the design temperature for LSCS, Units 1 and 2.

Based on the above, it has been demonstrated that the change of the initial temperature limit for cooling water supplied to the plant from the CSCS Pond to less than or equal to a temperature based on the time of day will not impede the ability of the equipment and components cooled by the UHS during a UHS design basis event to perform their safety functions.

There is no impact of this change on LSCS safety analyses including the consequences of all postulated events since all required safety-related equipment continues to perform as designed. The effects of the proposed change on the ability of the UHS to assure that a 30-day supply of water is available considering losses due to evaporation, seepage, and firefighting have been considered. Sufficient inventory remains available to mitigate the design basis event for the LSCS UHS for the required 30-day period.

Therefore, the proposed activity does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The proposed change does not physically alter the operation, testing, or maintenance of any plant SSCs beyond operating with a UHS temperature limit based on the time of day. The proposed change is supported by appropriate design analysis. Moreover, the UHS temperature does not initiate accident precursors. The impact of increased UHS temperature can affect the commercial operation of the plant, but the proposed change would not create any accident not considered in the LSCS UFSAR.

   This proposed change will not alter the manner in which equipment operation is initiated, nor will the functional demands on credited equipment be changed. No alteration in the procedures that ensure the LSCS units remain within analyzed limits is proposed, and no change is being made to procedures relied upon to respond to an off-normal event. As such, no new failure modes are being introduced. The proposed change does not alter assumptions made in the LSCS safety analysis.

   Changing the temperature of cooling water supplied to the plant from the CSCS Pond (i.e., the UHS) as proposed has no impact on plant accident response. The proposed temperature limits do not introduce new failure mechanisms for SSCs. An engineering analysis performed to support the change in temperature of cooling water supplied to the plant from the CSCS Pond provides the basis to conclude that the equipment is adequately designed for operation as proposed.

All systems that are important to safety will continue to be operated and maintained within their design bases, and the proposed change will continue to ensure that all associated systems and components are operated reliably within their design capabilities.

The proposed change will ensure the maximum temperature of the cooling water supplied to the plant during the UHS design basis event remains less than the current safety-related cooling water design temperature for LSCS, Units 1 and 2. Therefore, there is no impact of this change on the LSCS safety analyses including inventory and cooling requirements for safety-related systems using the UHS as their cooling water supply.

All systems will continue to be operated within their design capabilities, no new failure modes are introduced, nor is there any adverse impact on plant equipment; therefore, the proposed change does not result in the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The margin of safety is determined by the design and qualification of the plant equipment, the operation of the plant within analyzed limits, and the point at which protective or mitigative actions are initiated. The proposed change does not impact any of these factors. There are no required design changes or equipment performance parameter changes associated with the proposed change. No protection setpoints are affected as a result of this change. The proposed change in the limit for the temperature of cooling water supplied to the plant from the CSCS Pond will not change the operational characteristics of the design of any equipment or system. All accident analysis assumptions and conditions will continue to be met.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above evaluation, EGC concludes that the proposed change does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), "Issuance of Amendment," and, accordingly, a finding of no significant hazards consideration is justified.