THERMAL MIXING ZONE EVALUATION

2018 WATER QUALITY MONITORING REPORT

Prepared for

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THERMAL MIXING ZONE EVALUATION VIRGIL C. SUMMER NUCLEAR STATION NPDES PERMIT FAIRFIELD COUNTY, SOUTH CAROLINA

ADDENDUM 2:

2013-2018 TEMPERATURE DATA

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ATTACHMENTS

1. INTRODUCTION

South Carolina Electric and Gas Company is making an application to the South Carolina Department of Health and Environmental Control (SCDHEC) for a renewal of its National Pollutant Discharge Elimination System (NPDES) permit for Unit 1 of the Virgil C. Summer Nuclear Station (VCSNS). VCSNS is located in Fairfield County near Jenkinsville, South Carolina.

Previously, Geosyntec Consultants (Geosyntec) and MMI Engineering (MMI), have supported SCE&G in the permit application process by providing modeling studies to determine the size of thermal mixing zones in Monticello Reservoir due to cooling water discharges from VCSNS Unit 1. This was reported in a January 2012 Geosyntec report: *Thermal Mixing Zone Evaluation Virgil C. Summer Nuclear Station NPDES Permit* (2012 Modeling Report).

After SCDHEC's review of this report, additional modeling to determine the thermal plume sizes under the discharge conditions stated on the NPDES permit application and with revised ambient temperatures representing the highest and lowest ambient temperatures recorded over a longer period than used in the earlier modeling work was performed. The results of this additional modeling were presented in a February 2014 addendum to the original report: *Thermal Mixing Zone Evaluation Virgil C. Summer Nuclear Station NPDES Permit Addendum: Additional Modeling Cases for Revised Reservoir Ambient and Discharge Temperatures* (2014 Modeling Addendum).

The current report is a second addendum to the earlier thermal mixing zone reports to provide an update to the ambient and discharge temperatures since last reported.

Due to the fact that there was little difference in the ambient water temperature and no changes to the operating conditions, after discussions with SCDHEC, it was determined that additional thermal modeling was not required. This addendum provides a summary of the updated water temperature data and will be used to support the existing mixing zone as established in previous NPDES permits. This report provides only the updated water temperature data since 2012; the 2012 Modeling Report and 2014 Modeling Addendum should be reviewed to understand the full background to the work and thermal model details. As such, this report should be read in conjunction with the original report and addendum and are provided as attachments to this report.

2. TEMPERATURES

2.1 Reservoir Ambient Temperature

The 2012 Modeling Report used ambient water temperatures in Monticello Reservoir which were based on Discharge Monitoring Report (DMR) temperature data for VCSNS Unit 1 for 2010, the most recent complete year of water temperature monitoring data at the time. These ambient reservoir temperatures were:

- Summer Condition: 86.4°F – this was the highest monthly-averaged water temperature measured at the Unit 1 intakes in 2010.
- Winter Condition: 66.6°F – this was the reservoir temperature when the highest monthly-averaged change in temperature (ΔT) was recorded in 2010 between the reservoir ambient conditions and the Unit 1 cooling water discharge.

In the 2014 Modeling Addendum, SCDHEC questions were addressed by compiling DMR discharge temperature data for VCSNS Unit 1 for a 10-year period from 2003 through 2012. A monthly average intake water temperature of 86.4°F recorded in August 2010, which was used to model summer critical conditions, was the highest monthly average intake water temperature in the 10-year data set.

Based on a review of the longer-term data and SCE&G's proposal to maintain 113°F as a daily maximum discharge temperature limit year-round, the 2014 Modeling Addendum used the highest and lowest ambient water temperatures from the 10-year temperature data set. Specifically, at the request of SCDHEC, the highest possible discharge temperature of 113°F for summer and winter model runs and these ambient reservoir temperatures:

- Summer Condition: 87.9°F – this was the highest daily maximum Unit 1 intake water temperature recorded from 2003 through 2012 (July 2010).
- Winter Condition: 46.4°F – this was a low monthly-averaged Unit 1 intake water temperature recorded from 2003 through 2012 (January 2010).

In this current report addendum, reservoir temperature for the most recent time period of January 2013 through June 2018 were evaluated. The latest data set indicate the highest daily maximum Lake Monticello water temperature was 87.2 °F (occurring in August 2017). For the winter condition, the newer data indicates the minimum monthly average Lake Monticello water temperature is 44.7 °F (occurring in February 2014).

2.2 Nuclear Station Cooling Water Discharge Temperature

In the 2012 Modeling Report, the VCSNS Unit 1 cooling water discharge temperatures were set to 113°F (summer) and 98.7°F (winter). However, at SCDHEC request, the cooling water discharge temperature for the 2014 Modeling Addendum was set to 113°F for both summer and winter conditions to match the NPDES permit application.

2.3 Temperature Analysis

This 2014 Modeling Addendum appropriately considered a worst-case scenario for the summer condition. The newer data (2013-2018) indicate the highest daily maximum Lake Monticello water temperature was 87.2 °F. This is lower than the ambient water temperature used in the existing modeling (87.9 °F). Therefore, the existing modeling already considers the scenario that produces the largest plume with a discharge temperature greater than 90 °F and therefore additional modeling is not needed at this time.

For the winter condition, the newer data indicates the minimum monthly average Lake Monticello water temperature is 44.7 °F (occurring in February 2014). This is slightly colder than the ambient water temperature used in the 2014 Modeling Addendum (46.4 °F). However, this increases the difference between the discharge temperature and ambient water temperature only a small amount—from 66.6°F to 68.3°F (a 2.6% increase). Since the temperature difference is slightly different, it is unlikely that the volume of the plume with $\Delta T > 5$ °F would substantially increase.

Importantly, the 2014 Modeling Addendum demonstrated the worst-case winter condition plume (with an ambient water temperature of 46.4°F) is approximately a factor of 3.2 smaller than the worst-case summer condition plume. While the worst-case winter condition plume would potentially be larger using the newer data, it would still be much smaller than the summer condition plume. Thus, the existing modeling is sufficient to understand the worst-case scenarios for these two conditions.

Repeating thermal modeling with only a minor change in the model input will negligibly affect results and therefore "updated models" are not provided in this addendum, but simply a review of the ambient water temperatures. Furthermore, in-situ data confirms the plume is not present near the intake nor at uplake locations.

A summary of the water temperatures for each time period is shown here:

	Recorded Reservoir Temperature °F		Modeled Discharge Temperature °F	
Period	Summer	Winter	Summer	Winter
2010	86.4	66.6	113.0	98.7
2003-2012	87.9	46.4	113.0	113.0
2013-2018	87.2	44.7	113.0	113.0

3. CONCLUSION

Thermal modeling scenarios from the 2014 Modeling Addendum demonstrated that thermal plumes due to the cooling water discharge remain entirely or predominantly to the east of the island that separates the VCSNS cooling water intake structure and discharge. The thermal plumes do not approach the FPSF intake, the VCSNS Unit 1 cooling water intake structure, or the northern reach of Monticello Reservoir.

The 2013-2018 data did not contain any ambient water temperatures that were warmer than the previous data. Therefore, the recent summertime conditions would not result in a larger-sized plume. February 2014 did have a marginally cooler wintertime reservoir temperature that could have resulted in a slightly larger wintertime plume, however, this plume would still be more than three times smaller than the summer plume. Thus, the existing modeling is adequate to understand the worst-case scenarios for the VCSNS Unit 1 thermal discharge.