PSD Air Permit Application to Increase Operating Hours at the Rockingham County Combustion Turbine Facility

March 2019

Prepared for:

Rockingham County Combustion Turbine Facility
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1.0 INTRODUCTION

Duke Energy Carolinas, LLC operates the 825 MW Rockingham County Combustion Turbine Facility located in Reidsville, NC. The Rockingham County facility's operations are categorized under North American Industrial Classification System (NAICS) code 221112 for Electric Power Generation, fossil fuel and Standard Industrial Classification (SIC) code 4911 for Electric Services.

In the next several years, there will be a substantial influx of power from solar photovoltaic installations coming to the Duke Energy electric grids. Grid operating flexibility will be needed in order to accommodate this intermittent generation source. The current air quality permit for the Rockingham County Combustion Turbine Facility includes 5 simple cycle combustion turbines (CT-1 through CT-5). The 5 turbines are subject to PSD and BACT limits for NO_x, SO_2, CO, VOC, PM/PM_{10}, and H_2SO_4. The permit contains annual emission limits based on a maximum of 3,000 hours of operation. Duke Energy is submitting this permit application to allow the units to operate more frequently for voltage support (up to 6,500 hours per year on natural gas). Duke Energy is applying to the North Carolina Division of Air Quality (NC DAQ) for a Prevention of Significant Deterioration (PSD) permit and a revision to the Title V operating permit.

1.1 Technical Conclusions

The following is a summary of the technical and regulatory conclusions in this permit application:

- In accordance with NC DAQ regulations governing the prevention of significant deterioration (PSD) of air quality and other applicable state and federal regulations, major new source review (NSR) is required for this project for NO_x, CO, CO_2e, VOC, and PM/PM_{10}/$PM_{2.5}$. The estimated increase in emission rates of all other regulated pollutants associated with the project will be less than their respective PSD significant emission rates. Appendix B contains project emissions calculations.
- A Best Available Control Technology (BACT) analysis was conducted for NO_x CO, CO_2e, VOC, and PM/PM_{10}/$PM_{2.5}$ emissions from the turbines (CT-1 through CT-5). Section 5 contains details of the BACT analysis.
- The ambient air quality analysis demonstrates that the project will not result in an exceedance of applicable National Ambient Air Quality Standards (NAAQS) in Class I and Class II areas.
- The additional impact analysis demonstrates that the project will not result in adverse impacts on soil, vegetation, and visibility in Class I and Class II areas and that there are no anticipated indirect impacts from general commercial, residential, industrial, and other growth associated with this project.
- A facility-wide air toxics analysis is included in this application.

1.2 Permit Request

The Rockingham County Combustion Turbine Facility currently operates under Title V Air Quality Permit (AQP) No. 08731T15, issued on March 18, 2016 by the North Carolina Division of Air Quality (NCDAQ) and expiring on October 31, 2020. Duke Energy understands that the proposed modification will be permitted as a one-step major modification because we are proposing a change that contravenes a condition in the permit.

The following information is included in this application in order for NC DAQ to complete the permit review:

1. Completed permit application forms for the proposed project (Appendix A);
2. Emissions calculations (Appendix B);
3. NC Air Toxics Analysis (Appendix D);
4. Modeling evaluation and results (Appendix E); and
5. An application fee of $15,119.

1.3 Contact Information

If there are any questions or comments regarding this application, please contact Ms. Erin Wallace of Duke Energy at 919-546-5797 or Ms. Amy Marshall of AECOM at 919-461-1251.

1.4 Report Organization

The remainder of this application report is divided into the following sections:

Section 2.0:	Facility Information and Proposed Project
Section 3.0:	Summary of Project Emissions
Section 4.0:	Regulatory Analysis
Section 5.0:	BACT Analysis
Section 6.0:	Ambient Air Quality and Additional Impacts Analysis

The Table of Contents contains a detailed listing of tables, figures, and appendices.

2.0 FACILITY INFORMATION AND PROJECT DESCRIPTION

2.1 Site Location

The Rockingham County Combustion Turbine Facility is located in Reidsville, North Carolina. The approximate Universal Transverse Mercator (UTM) coordinates of the plant are Zone 17, 605.0 km East and 4,021.3 km North, at an elevation of approximately 800 feet above mean sea level. Figure 2-1 displays the plant site location and property boundary. The Reidsville area is located in the upper piedmont region of North Carolina, approximately 25 miles north of Greensboro. The terrain surrounding the site can be described as gently rolling.

The Class I areas within 200 kilometers of the Rockingham County Generating Station are the Linville Gorge Wilderness Area and the James River Face Wilderness Area (VA). These Class I areas are located approximately 190 kilometers and 140 kilometers from the site, respectively.

2.1.1 Attainment Status of Area

The current Section 107 attainment status designations for areas within the state of North Carolina are summarized in 40 CFR 81.344. Rockingham County is classified as "better than national standards" for total suspended particulates (TSP, also referred to as Particulate Matter, PM), the annual nitrogen dioxide (NO_2) standard, and for the 1971 sulfur dioxide (SO_2) NAAQS. Rockingham County is designated as "unclassifiable/attainment" for carbon monoxide (CO), particulate matter less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$), lead, 1-hour SO_2, 1-hour NO_2, and ozone. Therefore, the Rockingham County Combustion Turbine Facility is not located in an area currently designated as "nonattainment" for any pollutant regulated under the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) is the applicable regulatory program for major new source review.

2.2 Facility Description

The Rockingham County Combustion Turbine facility is comprised of five (5) Siemens Westinghouse W501F simple cycle combustion turbines (CT-1 through CT-5) that are capable of combusting either natural gas or No. 2 fuel oil and are equipped with dry low NO_x (DLN) combustors and water injection. Each unit is rated at 1,875 MMBtu per hour (MMBtu/hr) when firing natural gas or 1,839 MMBtu/hr when combusting No. 2 fuel oil. These heat input rates are equivalent to approximately 180 MW of gross electrical output. The site also includes other ancillary sources (i.e., emergency generators and storage tanks) to support the operation of the combustion turbines. The combustion turbines historically have functioned as "peaking" capacity to meet the electric system demands during periods of high customer use and are critical to meeting demand during cold weather. The combustion turbines are each currently permitted to operate up to 3,000 hours per year, with no more than 1,000 hours per year while firing No. 2 fuel oil.

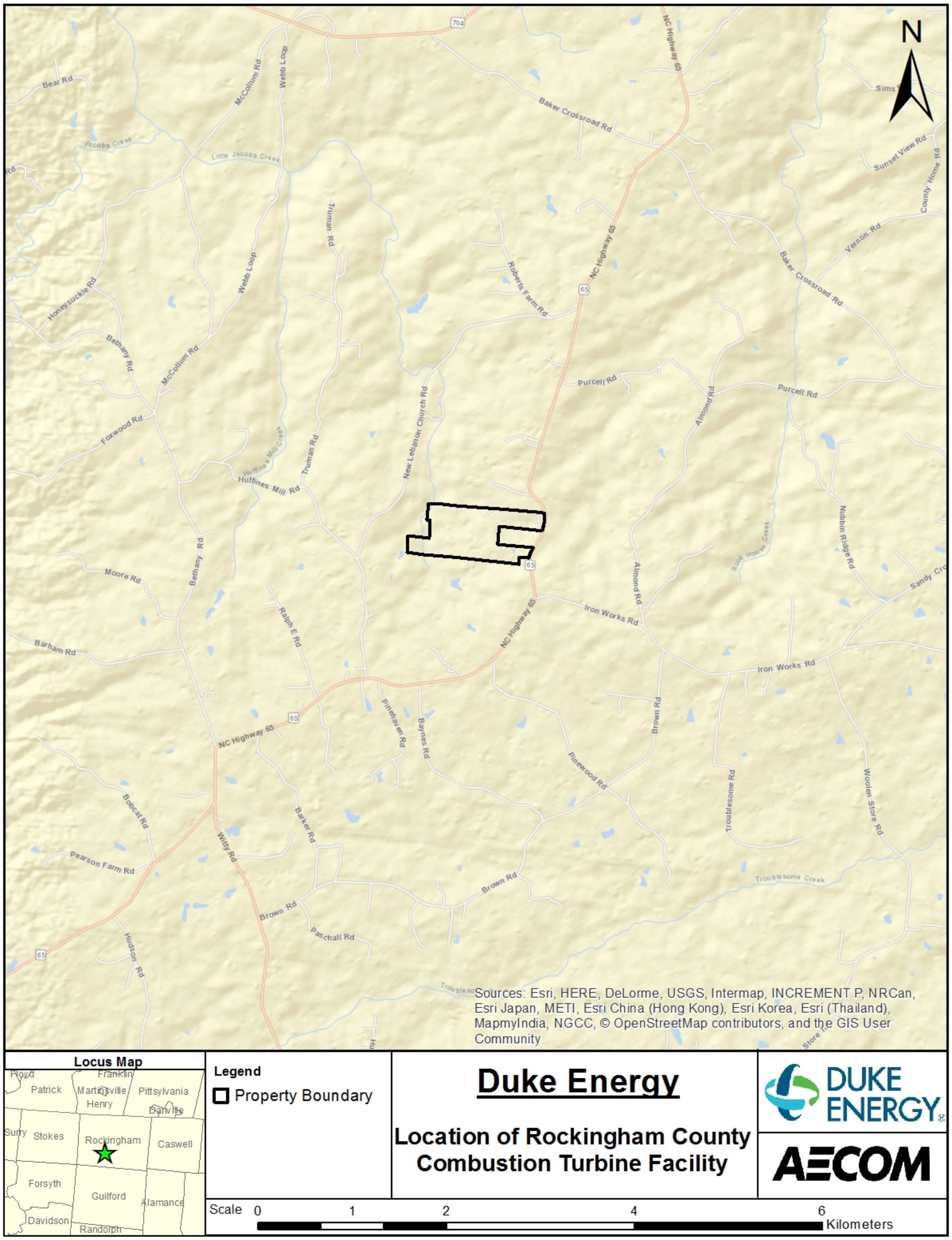


Figure 2-1. Location of Rockingham County Combustion Turbine Facility

2.3 Proposed Project

North Carolina is a national leader in solar energy, an intermittent and variable resource that introduces added uncertainty and variability to grid operation. While solar energy is an important renewable resource for North Carolina, the large amount of solar that is currently and forecast to come online has increased the need for operational flexibility of Duke Energy's natural gas fleet. These flexibility needs were not anticipated at the time air permits were issued. As a result, air permit modifications are necessary to maintain system reliability under new operating conditions associated with high levels of variable solar energy. While renewable generation is positive for system-level GHG emissions, solar capacity is operationally undependable with significant day-ahead and intra-day energy production variability, volatility, and intermittency. This volatility requires an increasingly steep morning ramp-down and increasingly steep afternoon ramp-up. In addition to the load-following service, system operators must also keep contingency generation assets online and in reserve to respond to forced outages and local area protection, address load demand changes, and now to manage unpredictable solar variability. Combustion turbines, such as the units at Rockingham, are uniquely positioned to meet system demands as more solar is implemented. They are able to come online quickly and can adjust load (i.e., ramp rates) much quicker than other generation sources.

Sections below provide an overview of solar development and integration in North Carolina and describe the need for increased operational flexibility of Duke Energy's natural gas combined cycle units and combustion turbines to accommodate the continued growth of solar energy.

2.3.1 Solar Energy in North Carolina

North Carolina is a national leader in solar energy, with 4,491 MW of solar capacity as of Q2 2018 – more installed solar capacity than any other state except California.[1] North Carolina's solar energy resource will continue to expand rapidly to 6,800 MW in the Duke Energy Progress and Duke Energy Carolinas service territories through 2025, in accordance with the House Bill 589, the 2017 Competitive Energy Solutions Act (Figures 2-2 and 2-3).

[1] Solar Energy Industry Association, "Top 10 Solar States," (accessed October 26, 2018 with data through Q2 2018), https://www.seia.org/research-resources/top-10-solar-states-0

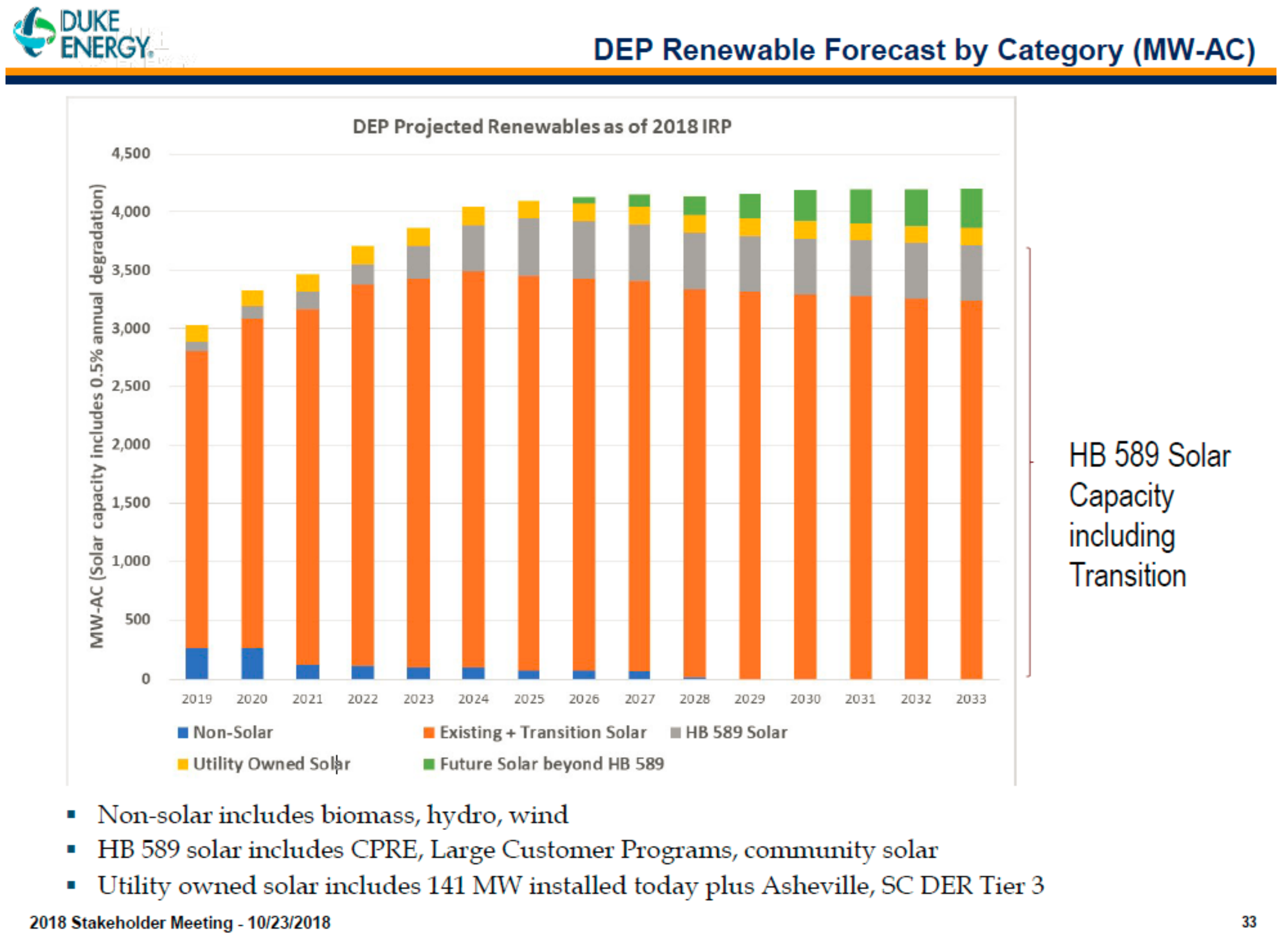


Figure 2-2. Duke Energy Progress Renewable Energy Forecast (2018 Integrated Resource Plan)

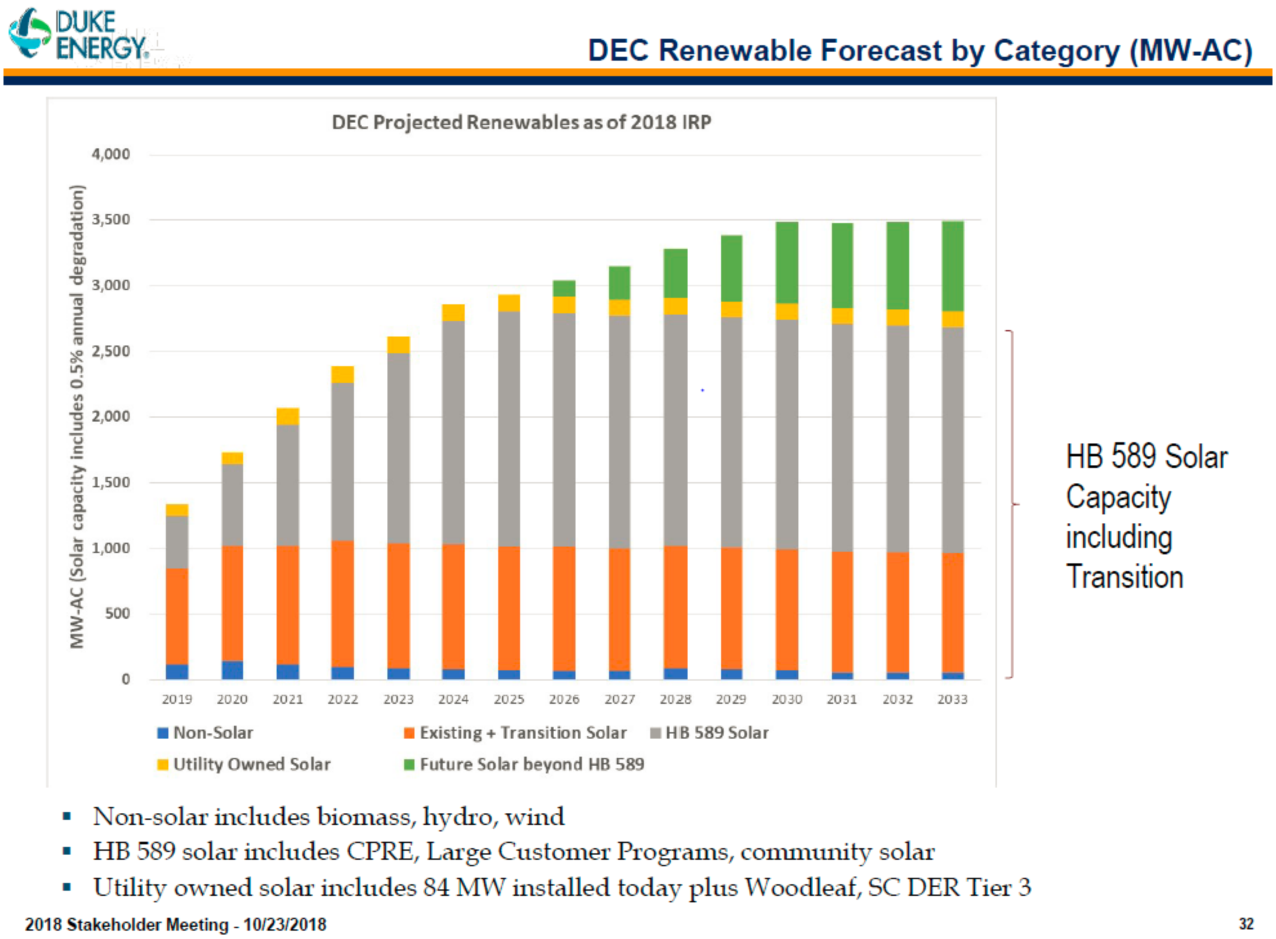


Figure 2-3. Duke Carolinas Renewable Energy Forecast (2018 Integrated Resource Plan)

State policy has been a primary driver of solar energy development in North Carolina, including the Renewable Energy and Energy Efficiency Portfolio Standard (Senate Bill 3) and state implementation of the federal Public Utilities Regulatory Policy Act (PURPA) of 1978.[2] PURPA requires utilities to purchase energy from renewable and cogeneration facilities – called "qualifying facilities" – owned by third parties at the utility's avoided cost of generation. The North Carolina Utilities Commission (NCUC) establishes avoided cost rates and standard offer contract terms in accordance with PURPA. Today, approximately 60% of all PURPA-qualifying facilities in the country are in North Carolina. Most of these qualifying facilities are solar energy facilities located in the eastern part of the state; in 2017, 74% of North Carolina's solar capacity was in the Duke Energy Progress (DEP) service territory. The rapid growth of utility-scale solar in DEP has outpaced upgrades and investments in grid infrastructure, at times resulting in power quality challenges for large, precision manufacturers.

In 2017, North Carolina enacted House Bill 589, also known as the Competitive Energy Solutions Act, which amended North Carolina's implementation of PURPA and established a competitive procurement

[2] North Carolina Energy Policy Council, 2018 Biennial Report, https://files.nc.gov/ncdeq/Energy%20Mineral%20and%20Land%20Resources/Energy/Energy%20Policy%20Council/2018%20EPC%20Biennial%20Report%20-%20FINAL.pdf

of renewable energy process (CPRE) which could guarantee that the North Carolina remains at the forefront of renewable energy development while ensuring just and reasonable prices for utility customers. The CPRE requires utilities with more than 150,000 customers to issue a request for proposals (RFP) – overseen by an independent administrator – over a 45-month term for a total procurement of 2,660 MW.[3] The CPRE process also provided the utilities with some discretion to ensure that optimal locations are selected to site facilities, which will also enhance reliability by enabling Duke Energy to locate more solar in the western part of the state (DEC service territory).

2.3.2 Operational Characteristics of Solar Energy and Flexibility Requirements

Solar energy is an important renewable energy resource in North Carolina. However, as an intermittent and variable energy resource, as the amount of solar energy increases, additional operational flexibility is required to maintain grid reliability. In particular, solar energy drives the need for added flexibility in three primary ways: First, solar energy reduces net minimum load and increases ramp rates. Second, solar energy increases uncertainty on both day-to-day and minute-to-minute timescales. Finally, solar energy requires voltage support.

2.3.2.1 Minimum Load and Ramp Rates

Solar energy operates when the sun is shining. Production increases rapidly as the sun rises and decreases rapidly as the sun sets. This production pattern leads to "net load" (electricity demand net of solar energy output) that is characterized by a steep decrease in the morning as solar energy comes online and a steep increase in the evening as the sun sets . Net load is lowest In the middle of the day, when solar energy is most abundant (Figure 2-4).

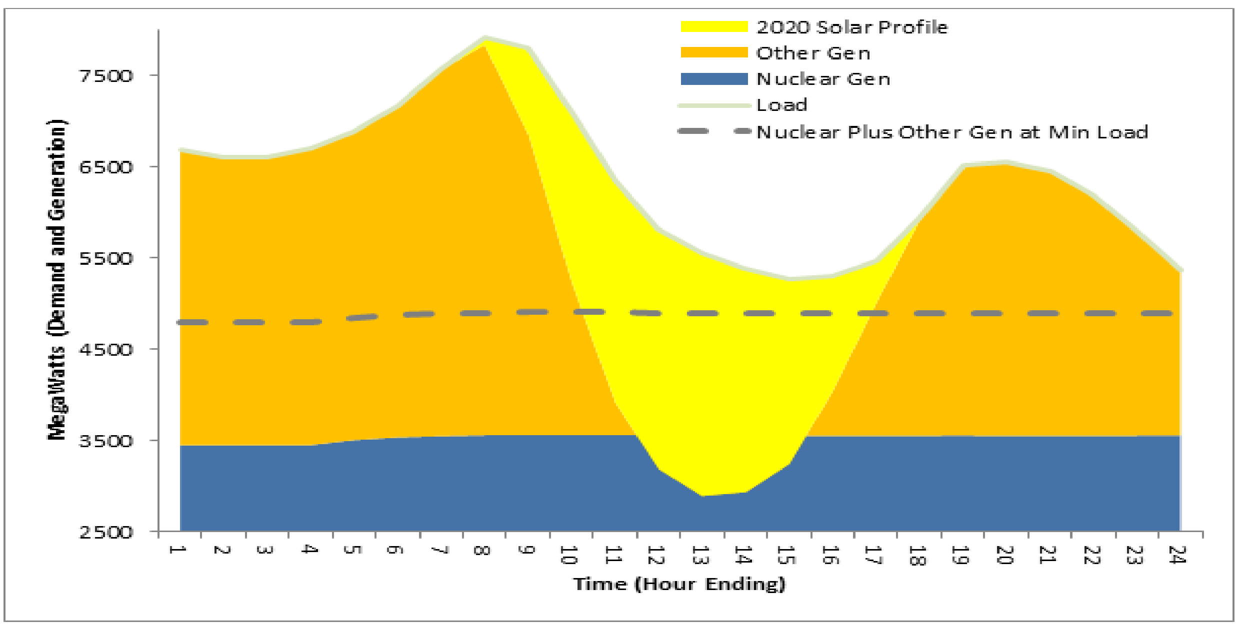


Figure 2-4. Solar Impact on Minimum Load: Duke Energy Progress Operating System

[3] The procurement amount will be adjusted up or down by any amount in which the public utility's renewable energy procurement outside of the CPRE and large customer renewable energy procurement program is more or less than 3500 MW.

Challenges associated with decreased minimum load and increased ramp rates are exacerbated when solar energy and consumer demand for electricity experience non-coincident peaks, such as on a sunny winter day (Figure 2-5). In this example, solar energy production is highest in the middle of the afternoon, when the sun is shining. However, electricity demand is highest in the early morning and evening hours when the sun intensity is less and residents are at home and using electricity for heating, hot water, cooking and other activities. During these times, when solar generation is most abundant and least needed, low minimum load can make it challenging to maintain base load generation needed to meet the system peaks.

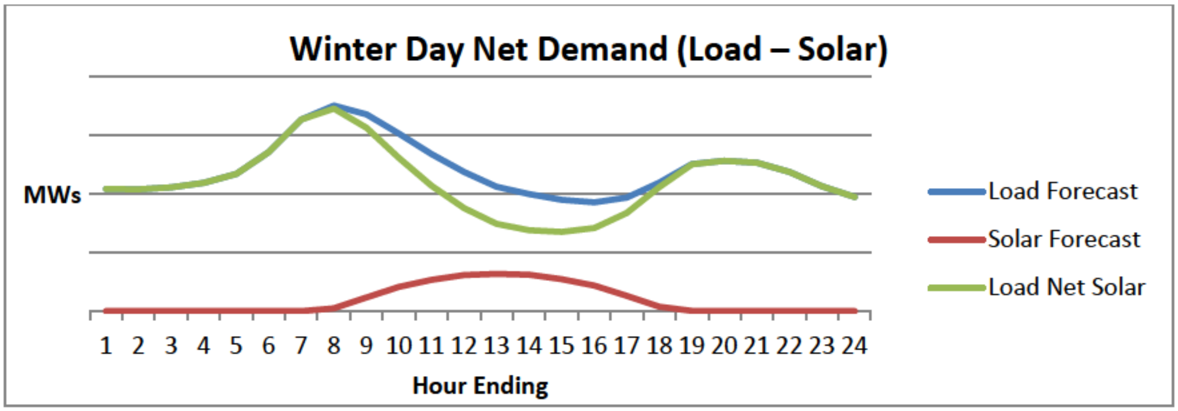
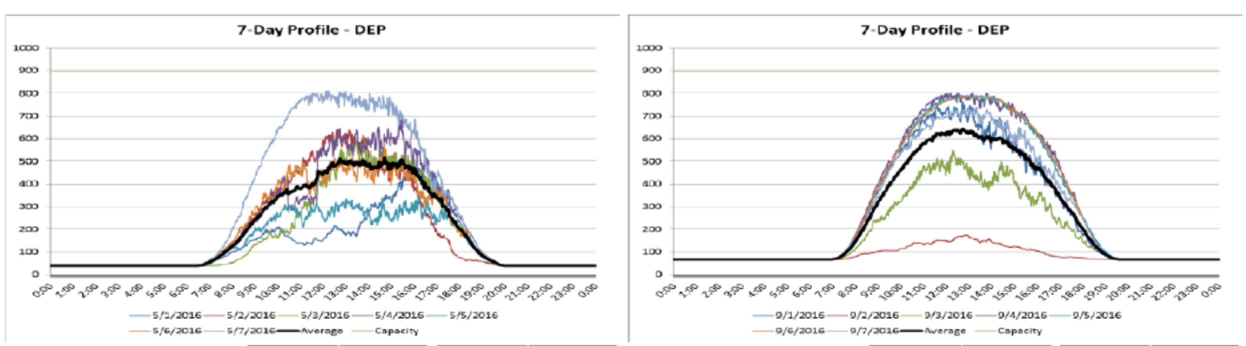


Figure 2-5. Winter Day Net Demand Illustrative Example

2.3.2.2 Solar Energy Increases Uncertainty from Day-to-Day and Minute-to-Minute

Solar energy output varies from day-to-day – increasing forecast error – and from minute-to-minute based on cloud cover, snow cover and other factors (Figure 2-6). With the current amount of installed solar in Duke Energy's North Carolina service territories, solar forecast error already exceeds load forecast error in some hours. The intra-hour variability of solar generation also increases the difficulty in complying with NERC reliability standards, with generation swings as high as 20% in a 10-minute time period.



Spring

1-Min Volatility		10-Min Volatility	
Max	31.3	Max	59.9
Min	-22.0	Min	-42.5
Mean	0.1	Mean	1.7
StdDev	5.5	StdDev	17.5

Summer

1-Min Volatility		10-Min Volatility	
Max	9.4	Max	36.8
Min	-12.9	Min	-36.1
Mean	0.1	Mean	1.3
StdDev	3.6	StdDev	19.1

Figure 2-6. Day-to-Day and Minute-to-Minute Variation in Solar Output

2.3.3 Increasing Regulating Reserves (Operating Range) to Integrate Solar

Regulating reserves refers to the cumulative ability of connected generators to increase or decrease production to match demand and is often expressed as a directional, time-bound value. For example, 250 MW Up /30 minutes, means that collectively, for the connected generators in the control area, output may be increased by 250 MW in a 30-minute time span. The same group of generators may have more or less capability to move in the down direction over the same period. Many variables come into play in calculating regulating reserves. One of the most important variables, however, is ramp rate. Ramp rate describes a single generating unit's capability to increase or decrease generation over a period of time and is typically expressed in MW / minute.

Failure to match generation to demand leads to frequency deviations in the interconnection, which, if severe enough, can cause customer load interruption or generators to trip offline through automated, protective action. To ensure reliability of the bulk power system, the North American Electric Reliability Corporation (NERC) has established operational requirements that must be adhered to by all utilities, such as NERC BAL standards.

As solar capacity increases on the bulk electric system, so does the importance of regulating reserves. A substantial amount of regulating reserves is required (in the down direction) to accommodate the rapid increase of solar output as the sun begins to rise in the morning. Likewise, regulating reserves in the up direction are required to replace the loss of solar generation as the sun begins to set in the evening. Throughout any given day, regulating reserves are required in both directions to cover the change in solar output that comes from cloud cover, rain, or anything else that impacts the sun's intensity. For example, an overcast sky can reduce a solar facility's production to as low as 15-30 percent of its rated capacity. This variability in solar output, whether predictable or not, requires an increase in regulating reserves to maintain an acceptable match between demand and generation within the operating area. Failure to maintain adequate regulating reserves would result in excessive inadvertent interchange with neighboring control areas and could also potentially threaten the integrity of the bulk electric system.

Gas-fired generating units have a relatively high ramp rate when compared to most other generating technologies. Gas-fired units are also typically cheaper to operate from a fuel cost standpoint. These two factors position gas-fired units to provide much of the needed regulating reserves to accommodate for the increase in solar penetration in North Carolina.

In addition to the proposed change at the Rockingham facility, Duke Energy is proposing changes at HF Lee to allow three of the simple cycle combustion turbines to operate up to 8,760 hours per year on natural gas. For the combined cycle units at the Richmond County Facility and Buck Facility, turndown capabilities will be expanded to allow the units to operate at a lower threshold and not have to cycle the equipment on and off multiple times each day.

Currently, the station air permits limit the combined cycle units from turning down below 60% of total capacity. Given the increase in solar that Duke Energy is currently purchasing and the forecasted continue growth of solar in North Carolina, flexibility to turn those units down to 10% of total capacity is needed to delay the need to shut-down and start-up the combined cycle unit. Avoiding shut-down and start-up will result in fewer air emissions overall, due to the increased emission rates during startup and shutdown events (Table 2-1). Additionally, avoiding shut-down and start-up will result in less wear and tear to equipment and lower maintenance costs for electricity consumers.

Table 2-1. Comparison of Emissions for Startup/Shutdown and Turndown Scenarios

		Current							Proposed			
Facility	Unit Type	Event	Date	Time	Duration of Event (mins)	Unit No.	Total NOx Emissions from Event (lbs)	Equivalent Hourly Rate for Event (lb/hr)	Unit No.	Proposed Emission Rate at Low Load (lb/hr)	Duration of Turndown per Day (hrs)	Emissions from Turndown Event (lb/event)
Richmond County	GE	Controlled Shutdown	3/16/2018-3/17/2018	21:16-3:05	350	7	710.44	121.79	7	25.63	8	205.04
						8	769.02	131.83				
		Warm Start-up	5/17/2018	2:23-4:36	133	7	221.4	99.90	8		8	205.04
				2:45-4:36	112	8	173.6	93.02				
		Total Emissions for Each Type of Event			--	--	1,874.55	--	--	--	--	410.08
	Siemens	Controlled Shutdown	3/28/2018-3/29/2018	21:09-1:16	248	9	517.13	125.11	9	25.59	8	204.72
				21:10-1:16	247	10	529.33	128.58				
		Warm Start-up	5/22/2017	9:37-13:19	223	9	373.84	100.59	10		8	204.72
				10:26-13:19	173	10	289.97	100.57				
		Total Emissions for Each Type of Event			--	--	1,710.27	--	--	--	--	409.44

2.3.4 Evaluation of Alternative Sources of Flexibility

Duke Energy evaluated several alternatives to address the minimum load and ramp rates associated with solar integration. These options include the sale of excess energy, curtailing coal plants, curtailing nuclear plants, curtailing solar, energy storage and demand side management. While several of these options – including the sale of excess energy, curtailing soar, energy storage, and demand side management – can contribute to grid flexibility and aid in solar integration, none of these alternatives can substitute for near-term need for increased natural gas operational flexibility.

Sale of Excess Energy: The sale of excess energy can aid in solar integration. However, this alternative is limited by market factors. To sell excess energy to neighboring utilities or into the PJM market, Duke Energy must be able to generate the energy at a cost that is lower than the market price, neighboring utilities must have a need for the energy and sufficient transmission capacity must be available.

At present, because the majority of North Carolina's solar capacity (approximately 74% as of 2017) is in the DEP service territory in the eastern part of the state, the joint dispatch agreement enables DEP to sell excess solar generation to DEC.[4] However, recent regulatory changes have further limited the available transmission capacity to transfer excess solar from DEP to DEC.

Curtailing Coal Plants: Curtailing coal plants intra-day is not possible due to the time required for start-up. If a coal unit is taken offline during a period of high solar output, that unit would be unable to start-up and produce energy to meet demand as solar energy output declines in the evening.

[4] North Carolina Energy Policy Council, 2018 Biennial Report, https://files.nc.gov/ncdeq/Energy%20Mineral%20and%20Land%20Resources/Energy/Energy%20Policy%20Council/2018%20EPC%20Biennial%20Report%20-%20FINAL.pdf

Curtailing Nuclear: Similar to coal, curtailing nuclear plants intra-day is not possible. Nuclear energy generation is not a resource that can respond rapidly; production is increased and decreased in a controlled manner to ensure safe operations. Additionally, curtailing nuclear would trade off one clean energy source for another, reducing or eliminating the emissions benefits of solar energy.

Curtailing Solar: Duke Energy's authority to curtail solar is limited and varies according to solar facility ownership and contract terms:

- *Utility-Owned Solar:* Utility-owned solar is controlled by Duke Energy and can be curtailed as necessary to balance the electric system. However, utility-owned solar currently represents a small fraction of total solar energy in North Carolina and cannot exceed 30 percent of solar installed under the 2017 Competitive Energy Solutions Act.
- *PURPA Solar:* Most of North Carolina's existing solar facilities are PURPA qualifying facilities. For these facilities, Duke Energy's curtailment authority extends only to system emergencies, including an imminent violation of NERC BAL standards.[5]
- *CPRE Solar:* CPRE projects will comprise a significant amount of solar installed in the early 2020s. For these facilities, Duke Energy will have the ability to curtail up to 5% of the facilities annual energy production for facilities located in the DEC service territory and up to 10% of annual energy production for facilities located in the DEP service territory.

While solar curtailment, including curtailment of PURPA solar during a system emergency, provides limited flexibility, the fact that solar will be unavailable every night must be assessed for maintaining system reliability.

Energy Storage: As described in the DEP and DEC 2018 Integrated Resource Plans (IRPs), Duke Energy is actively assessing the integration of battery storage technology into its portfolio of assets.[6] The 2018 IRPs include plans to deploy about 300 MW of battery storage in North Carolina over the next 15 years in addition to the approximately 15 MW deployed today.

Battery storage costs are expected to continue to decline, which may make storage a viable option for grid support services, including frequency regulation and solar smoothing during periods with high incidences of intermittency. Battery storage may also provide additional benefits to the generation, transmission and distribution systems, resulting in stacked benefits. These opportunities are being addressed through the Integrated System Operations Planning (ISOP) enhancements to the IRP process.[7]

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[5] NCUC Docket No E-100, Sub 148

[6] Duke Energy Progress 2018 North Carolina Integrated Resource Plan, https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=25fb3634-54b6-464b-9704-b6fe99cda1a8; Duke Energy Carolinas 2018 North Carolina Integrated Resource Plan, https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=aa9862b5-5e31-4b3f-bb26-c8a12c85c658

[7] ISOP envisions the creation of a broader process by which all energy resources are evaluated fully and fairly valued on functional capability irrespective of the resource location on the grid. As of the 2019 Integrated Resource Plan filings, ISOP has completed evaluations of the current planning practices and has identified future enhancements to be addressed in a systematic, disciplined manner to realize this future vision. These future

The deployment of utility scale battery storage over the next decade will provide valuable real-world experience for optimizing and assessing the benefits of battery storage. These deployments will allow for a more complete evaluation of potential benefits to the distribution, transmission and generation system while also providing actual operations and maintenance cost impacts of batteries deployed at a significant scale. This will allow the Company to explore the nature of new offerings desired by customers and fill knowledge gaps such as how the Company can best integrate battery storage into its daily operations. However, at present energy storage is not a viable alternative to fulfill the near-term need for operational flexibility to support the continued growth of solar energy in North Carolina. For example, increasing the operational flexibility of the Richmond County combined cycle facility to operate at a minimum load of 10% provides 1200MW of additional flexibility as compared to 15 MW of energy storage available today.

enhancements in planning are expected to be addressed over the next several years, as soon as the modeling tools, processes and data development will allow.

3.0 PROJECT EMISSIONS

To determine the appropriate permitting path for the project, it was necessary to calculate the emission increases expected to occur as a direct result of the project. An overview of the emissions estimation methods used and the emissions calculations is presented in the remainder of this section of the permit application. Detailed emissions calculations are presented in Appendix B.

3.1 Overview of Emission Estimation Methods

To develop estimated emission rates from the project, Duke Energy and AECOM utilized generally-accepted methodologies along with project-specific fuel consumption rates, equipment operating configurations, and other data. Emission factors and data from a variety of references were used to estimate emission rates, including:

- Site specific CEMS or test data;
- United States Environmental Protection Agency (US EPA) publications, such as AP-42, *Compilation of Air Emission Factors* (5^{th} Edition, Revised);
- Regulatory and permit limits; and
- U.S. EPA's Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98).

The sources of information for emission factor determination and calculation methodologies are discussed in greater detail in the following sections.

3.1.1 Site Specific Data

CEMS data were used for baseline actual emissions of NOx and SO_2. The EPRI calculation methodology in conjunction with CEMS data for SO2 were utilized to calculate baseline actual emissions of H_2SO_4 for both natural gas and fuel oil and to estimate projected actual emissions of H_2SO_4 from fuel oil. Site specific data were also used to calculate baseline actual emissions of $PM_{2.5}$ from gas firing.

3.1.2 US EPA AP-42 Emission Factors

Emission factors from US EPA's AP-42 document (5th edition unless otherwise noted) were relied upon to calculate emission rates for the combustion turbines at the station where site specific data were not available or representative (filterable PM and lead from natural gas firing; baseline actual emissions of CO and VOC from natural gas firing; baseline actual emissions of PM, CO, VOC, and lead from fuel oil firing; and projected actual emissions of filterable PM, SO_2, and lead from fuel oil firing). The following AP-42 sections were utilized to obtain emission factor data for the combustion of fuel oil and natural gas at the facility:

- Section 3.1, Stationary Gas Turbines; and
- Section 1.4, Natural Gas Combustion.

3.1.3 Regulatory Limits

BACT limits were used to calculate baseline actual emissions of PM and PM_{10} from gas firing and to calculate projected actual emissions of PM, PM_{10}, $PM_{2.5}$, NOx, CO, SO_2, VOC, and H_2SO_4 from gas firing. BACT limits were used to calculate projected actual emissions of PM, PM_{10}, $PM_{2.5}$, NOx, CO, and VOC from oil firing.

3.1.4 Greenhouse Gas Emission Factors

The US EPA Mandatory Greenhouse Gas (GHG) reporting rule emission factors and global warming potentials from 40 CFR 98, Subparts A and C were used to calculate emissions from carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Tables C-1 and C-2 to Subpart C list default CO_2, CH_4, and N_2O emission factors and high heat values for various fuel types.

3.2 PSD Applicability Test Methodology

Duke Energy has assessed the applicability of PSD to this project by performing a comparison of "baseline actual emissions" to "projected actual emissions" for existing units as prescribed under U.S. EPA's PSD rules (as adopted by North Carolina) at 40 CFR 51.166(a)(7)(iv)(c). The PSD applicability analysis has been completed for the applicable federally-regulated PSD-regulated air pollutants, including PM (filterable), PM_{10}, $PM_{2.5}$, H_2SO_4, CO, CO_2e, Pb, NO_x, SO_2, and VOC.

3.3 Baseline Actual Emissions (BAE)

North Carolina has incorporated the federal PSD rules by reference with specified changes in the North Carolina Air Pollution Control Rule 15A NCAC 2D .0530. Changes made by North Carolina to the federal PSD rules include the definition of baseline actual emissions. Per 15A NCAC 2D .0530(b)(1)(A), baseline actual emissions are "the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period … within the 5-year period immediately preceding the date that a complete permit application is received by the Division…" However, "the Director shall allow a different time period, not to exceed 10 years immediately preceding the date on which a complete permit application is received by the Division, if the owner or operator demonstrates that it is more representative of normal source operation."

For this project, 5 years of monthly data was reviewed to select the appropriate baseline period for each pollutant. Baseline actual emissions represent the highest historical 24-month average annual emissions in tons per year for each pollutant.

3.4 Projected Actual Emissions (PAE)

Projected actual emissions are defined by 51.166(b)(40)(i) as "the maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the 5 years (12-month period) following the date the unit resumes regular operation after the project, or in any one of the 10 years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that regulated NSR pollutant, and full utilization of the unit would result in a significant emissions increase, or a significant net emissions increase at the major stationary source." To determine the maximum annual rate, a source must consider all relevant information, including historical operational data, the company's expected business activity, and the company's highest projections of business activity for the five year period after implementation of the project.

Projected actual emissions for CT-1 through CT-5 are based on operation at 6,500 hours per year. The amount of fuel oil fired was not increased from the baseline, so the projected actual emissions represent an increase in emissions from combustion of additional natural gas in the turbines.

3.5 Summary of Project Related Emissions Increases

The project emissions increases are the difference between the projected actual emissions and the baseline actual emissions, as presented in Table 3-1. The following compounds have emissions increases that are above the PSD significant emission rate: PM (filterable), PM_{10}, $PM_{2.5}$, NO_x, CO, VOC, and CO_2e. Appendix B contains the detailed emissions calculations.

Table 3-1. PSD Applicability Summary

	Emissions, tpy									
	PM filterable	PM_{10} (Total)	$PM_{2.5}$ (Total)	NO_x	CO	SO_2	VOC	Lead	H_2SO_4	CO_2e
Baseline Actual Emissions	11.10	19.35	10.50	264.16	168.52	4.30	11.80	0.0045	0.0002	670,097
Projected Actual Emissions	58.52	99.46	99.46	1,776.80	1,769.97	30.69	98.18	0.017	2.438	3,591,565
Project Emissions Increase	47.42	80.12	88.97	1,512.64	1,601.45	26.38	86.38	0.012	2.438	2,921,468
PSD Significant Emission Rate	25	15	10	40	100	40	40	0.6	7	75,000
PSD Review Required	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	No	No	**Yes**

4.0 REGULATORY APPLICABILITY

This section summarizes federally- and state-enforceable air regulations that are potentially applicable to the project. Both applicable and important non-applicable regulations are addressed. Supporting information for the proposed project is provided in the application forms contained in Appendix A. Information contained on the application forms is provided for determining regulatory applicability and demonstrating compliance with applicable requirements, and should not be considered proposed permit terms, limits, or conditions. Discussions pertaining to applicable regulatory requirements are separated into two categories: 1) federal air quality regulations and 2) North Carolina air quality regulations.

4.1 Federal Air Quality Regulations

Federal regulations potentially applicable to the proposed project are Prevention of Significant Deterioration (PSD) regulations in 40 CFR 51.166; New Source Performance Standards (NSPS) in 40 CFR 60; National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR 63; Compliance Assurance Monitoring (CAM) in 40 CFR 64; and Title V Operating Permit regulations in 40 CFR 70. A discussion of these regulations is provided in the following subsections.

4.1.1 40 CFR 51 - New Source Review (NSR)/Prevention of Significant Deterioration (PSD)

Implementation of the PSD regulations has been delegated in full to NC DAQ. These air quality regulations are contained in 15A NCAC 2D .0530. The PSD regulations apply to major modifications at major stationary sources, which are considered those sources belonging to any one of the 28 source categories listed in the regulations that has the potential to emit more than 100 tons per year of any PSD-regulated compound, or any other source which has the potential to emit more than 250 tons per year of any PSD compound. A major modification is defined as "any change to a major stationary source that would result in a significant emissions increase of any pollutant subject to regulation under the Act." Major modifications must meet certain pre-construction review and permitting requirements.

The facility is not in one of the 28 PSD source categories (simple-cycle turbines are not included in the definition of fossil fuel-fired steam electric plants) but it is a major stationary source for the purposes of PSD applicability because the potential emissions rate of at least one PSD-regulated pollutant exceeds 250 tpy. As such, the proposed project's emissions increases were evaluated to determine whether PSD permitting is required. The emissions calculation methodology used to determine PSD applicability was described in Section 3. The emission factors and throughputs used to estimate emissions are presented in Appendix B.

This project proposes to allow operation of CT-1 through CT-5 up to 6,500 hours per year when firing natural gas. The annual emissions limits currently in the permit are based on 3,000 hours per year of operation. Table 3-1 shows that project emission increases are above the PSD significant emission rates for PM, PM_{10}, $PM_{2.5}$, NO_x, VOC, CO, and CO_{2e}; therefore, PSD permitting is required for these compounds. Section 5 of this document consists of the BACT analysis for these compounds; Section 6 contains the ambient air quality analyses and the additional impacts analysis.

4.1.2 40 CFR 60 - New Source Performance Standards (NSPS)

NSPS apply to any stationary source for which the standards are promulgated, and which is constructed, reconstructed, or modified after the effective date of the applicable standard. NSPS requirements are promulgated under 40 CFR 60 pursuant to Section 111 of the Clean Air Act. An existing facility can become subject to the NSPS requirements upon reconstruction or modification. A modification under NSPS is defined as any physical or operational change that results in an increase in the hourly emission rate of any pollutant to which a standard applies. According to 60.14(e)(3), an increase in hours of operation is not considered a modification.

NSPS Subparts GG and KKKK - Standards of Performance for Stationary Combustion Turbines

NSPS Subpart GG, Standards of Performance for Stationary Gas Turbines, regulates stationary gas turbines with a heat input at peak load equal to or greater than 10 MMBtu/hr for which construction, modification, or reconstruction was commenced after October 3, 1977. The stationary gas turbines at the Duke Energy Rockingham County facility have a capacity of 1,875 MMBtu/hr and were constructed between 1999 and 2000. In late 2001, the stationary turbines were retrofitted with water injection to the pilot flame, and have not been modified or reconstructed since this modification. CT-1 through CT-5 are currently subject to NSPS Subpart GG.

NSPS Subpart KKKK, Standards of Performance for Stationary Combustion Turbines, regulates stationary combustion turbines with a heat input at peak load equal to or greater than 10 MMBtu/hour that commenced construction, modification or reconstruction after February 18, 2005. Because CT-1 through CT-5 have not been modified or reconstructed since February 18, 2005, these combustion turbines are not subject to NSPS Subpart KKKK.

The purpose of this project is to remove the annual operational restrictions for CT-1 through CT-5. There are no physical modifications being made to the turbines and the project does not increase the hourly emission rate of any of the turbines. Therefore, the project is neither a modification nor a reconstruction and does not change NSPS applicability.

NSPS Subpart TTTT - Standards of Performance for Greenhouse Gas Emissions from Electric Generating Units

EPA promulgated standards of performance for greenhouse gas (GHG) emissions from new, modified, and reconstructed electric utility generating units on October 23, 2015. GHG standards included in this subpart apply to any steam generating unit, IGCC, or stationary combustion turbine that commenced construction after January 8, 2014 or commenced reconstruction after June 18, 2014; has a base load rating greater than 260 GJ/h (250 MMBtu/h) of fossil fuel (either alone or in combination with any other fuel); and serves a generator or generators capable of selling greater than 25 MW of electricity to a utility power distribution system. The turbines were constructed prior to January 8, 2014 and are not being modified or reconstructed, so applicability of this standard is not triggered.

4.1.3 40 CFR 63 - National Emission Standards for Hazardous Air Pollutants (NESHAP)

Subpart YYYY - National Emission Standards for Hazardous Air Pollutants: Stationary Combustion Turbines

40 CFR 63, Subpart YYYY, regulates any existing, new, or reconstructed stationary combustion turbine located at a major source of HAP emissions. Pursuant to 63.6090(a)(4), existing stationary combustion turbines do not have to meet the requirements of this subpart and of subpart A of Part 63. Under Subpart YYYY, an existing stationary combustion turbine is defined as a stationary combustion turbine that commenced construction or reconstruction on or before January 14, 2003. Because the combustion turbines at the Duke Energy Rockingham County facility were constructed prior to January 14, 2003, there are no applicable requirements under this subpart.

4.1.4 40 CFR 64 - The Compliance Assurance Monitoring (CAM) Rule

The CAM Rule (40 CFR 64) applies to a pollutant-specific emission unit (PSEU) that is a pre-control major source and uses a control device to comply with an emission limit. For the CAM Rule to apply to a specific emission unit/pollutant, the following four criteria must be met:

1. The emission unit must be located at a major source for which a Part 70 or Part 71 permit is required.
2. The emission unit must be subject to an emission limitation or standard.
3. The emission unit must use a control device to achieve compliance with the emission limitation or standard.
4. The emission unit must have potential, pre-controlled emissions of the pollutant of at least 100 percent of the major source threshold.

Part 64 does not apply to emission limitations or standards proposed after November 15, 1990 pursuant to Section 111 or 112 of the Clean Air Act (e.g., post-1990 NSPS or NESHAP) or where a continuous compliance determination method (e.g., CEMS) is used. The Duke Energy Rockingham County Facility does not use any add-on emissions control devices to comply with the NO_x emission limits, as the current emissions control technology is inherent to the process (dry low NO_x burners with water injection). This project does not trigger CAM applicability for any of the emissions sources at the facility.

4.1.5 40 CFR 70 - Title V Operating Permits

The facility currently operates under Title V Air Quality Permit (AQP) No. 0873T15 issued on March 18, 2016 by NC DAQ and expiring on October 31, 2020. Duke Energy understands that the project must be permitted as a one-step major modification because we are requesting to remove the current annual operational restrictions for CT-1 through CT-5 (i.e., the proposed project contravenes an existing permit condition). Permit application forms are included in Appendix A.

4.1.6 Acid Rain Program Requirements

CT-1 through CT-5 are subject to Acid Rain Program requirements as outlined in the facility's acid rain permit application. The facility will continue to comply with applicable requirements.

4.1.7 Clean Air Interstate Rule (CAIR) and Cross State Air Pollution Rule (CSAPR)

On July 6, 2011, US EPA finalized CSAPR. CSAPR requires a total of 28 states, including North Carolina, to reduce annual SO_2 emissions, annual NO_X emissions and/or ozone season NO_X emissions to assist in attaining the ozone and fine particle NAAQS. CSAPR was finalized to address flaws with EPA's 2005 CAIR, and was to ultimately replace CAIR. However, several court actions affected the timing of CSAPR's implementation, and CAIR remained in place until an October 2014 court decision granted CSAPR Phase 1 implementation beginning January 1, 2015 (marking the end of CAIR), with CSAPR Phase 2 beginning in 2017. Permit condition 2.4 requires compliance with 40 CFR 97, Subparts AAAAA, BBBBB, and CCCCC and condition 2.5 states that CAIR requirements are no longer applicable. The facility will continue to comply with CSAPR requirements post project.

4.2 North Carolina Air Quality Regulations

NC DAQ air quality regulations for stationary sources are codified in 15A NCAC, Subchapter 2D (Air Pollution Control Requirements) and Subchapter 2Q (Air Quality Permit Procedures).

4.2.1 15A NCAC 2D .0516 - Sulfur Emissions from Combustion Sources

This regulation limits sulfur dioxide (SO_2) emissions from combustion sources to 2.3 pounds of sulfur dioxide per million BTU heat input, but does not apply because SO_2 emissions from the combustion turbines (ES-CT-1 through ES-CT-5) are limited by NSPS Subpart GG.

4.2.2 15A NCAC 2D .0521 - Control of Visible Emissions

This regulation limits visible emissions to 20% opacity, except that six-minute averaging periods may exceed 20 percent opacity not more than once in any hour and not more than four times in any 24-hour period. In no event shall the six-minute average exceed 87 percent opacity. A Method 9 observation is performed on each turbine after each 1,100 hours of fuel oil combustion. This project does not increase combustion of fuel oil and does not affect compliance with this rule.

4.2.3 15A NCAC 2D .0524 - New Source Performance Standards

NSPS applicability was addressed in Section 4.1.2 above.

4.2.4 15A NCAC 2D .0530 - Prevention of Significant Deterioration

PSD applicability was addressed in Section 4.1.1 above.

4.2.5 15A NCAC 2D .0544 – Prevention of Significant Deterioration Requirements for Greenhouse Gases

Under this rule, a major stationary source or major modification is not required to obtain a PSD permit solely due to GHG emissions. Duke Energy has incorporated greenhouse gas (GHG) emissions into the PSD applicability calculations; PSD review for the project is triggered for GHG and other regulated pollutants. PSD applicability calculations are presented in Appendix B. A BACT analysis that includes GHG emissions is presented in Section 5.

4.2.6 15A NCAC 2D .0614 – Compliance Assurance Monitoring

CAM applicability was addressed in Section 4.1.4 above.

4.2.7 15A NCAC 2D .1100 and 2Q .0700 - Control of Toxic Air Pollutants

15A NCAC 2Q .0700 requires facilities that emit toxic air pollutants (TAPs) for which they are required to have a permit under 15A NCAC 2D.1100 to demonstrate compliance with Acceptable Ambient Levels (AALs). On June 21, 2012, the North Carolina General Assembly passed air toxics reform legislation (HB 952). Under this bill, any source covered under a MACT or Generally Achievable Control Technology (GACT) standard or covered under a 112(j) permit is exempt from regulation under the state air toxics rule, except in those circumstances when the NC DAQ Director makes a written finding that emissions from such a source presents an unacceptable risk to public health (e.g., a Director's call). The legislation requires that, upon receipt of any permit application that would result in an increase in TAP emissions, DAQ must review the application to determine if the TAP emissions from the facility present an unacceptable risk to human health. MACT affected sources were incorporated into the listed exemptions at 15A NCAC 2Q .0702(a)(27) and 2Q .0702(c) states "the addition or modification of an activity identified in Paragraph (a) of this Rule shall not cause the source or facility to be evaluated for emissions of toxic air pollutants."

A facility-wide TAP analysis was performed for this project because there are emissions increases of NC TAPs from the proposed removal of the 3,000-hour operational restrictions for CT-1 through CT-5. Please refer to Section 7 for a detailed TAP analysis.

4.2.8 15A NCAC 2D .1111 - Maximum Achievable Control Technology

Applicability of MACT standards was discussed in Section 4.1.3.

4.2.9 15A NCAC 2Q .0500 – Title V Procedures

The facility currently operates under Title V Air Quality Permit (AQP) No. 0873T15 issued on March 18, 2016 by NC DAQ and expiring on October 31, 2020. Duke Energy understands that this project will be permitted using the one-step process for significant modifications that would contravene with a permit term or condition per 2Q .0501(c)(1). Permit application forms are included in Appendix A.

4.2.10 Zoning Consistency Determination

Because this request does not constitute a new facility or facility expansion and does not involve any physical modifications or changes to the facility's footprint, a zoning consistency determination is not required.

5.0 BACT ANALYSIS

The PSD regulations (40 CFR 51.166) and North Carolina air regulations (15A NCAC 02D.0530) require a Best Available Control Technology (BACT) analysis for each new or modified affected emission units at an existing major source for which a significant net emissions increase of a PSD-regulated pollutant will occur. Duke Energy is proposing to increase the annual hours of operation for the 5 simple-cycle turbines at the Rockingham County facility (Units CT-1, CT-2, CT-3, CT-4, and CT-5), and the emissions increases associated with this project are sufficient to trigger PSD review for PM, PM_{10}, $PM_{2.5}$, NO_x, VOC, CO, and greenhouse gases (CO_2e).

5.1 BACT Approach

The NCDEQ regulations (15A NCAC 02D.0530) incorporate the federal PSD regulatory requirement to conduct a BACT analysis, which is set forth as follows in the PSD regulations [40 CFR 51.166 (j)(2)]:

> *(j) Control Technology Review.*
>
> *(3) A major modification shall apply best available control technology for each a regulated NSR pollutant for which it would be a significant net emissions increase at the source. This requirement applies to each proposed emissions unit at which a net emissions increase in the pollutant would occur as a result of a physical change or change in the method of operation in the unit.*

BACT is defined in the PSD regulations [40 CFR 51.166(b)(12)] as:

> *... an emissions limitation (including a visible emissions standard) based on the maximum degree of reduction for each a regulated NSR pollutant which would be emitted from any proposed major stationary source or major modification which the reviewing authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61.*
>
> *If the reviewing authority determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.*

Guidelines for the evaluation of BACT can be found in EPA's Guidance for Determining Best Available Control Technology (BACT)[8] and in the PSD Workshop Manual[9]. These guidelines were drafted by the EPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. Unlike many of the Clean Air Act programs, the PSD program's BACT evaluation is determined on a case-by-case basis. To assist applicants and regulators with the case-by-case process, in 1987 U.S. EPA issued a memorandum that implemented certain program initiatives to improve the effectiveness of the PSD program within the confines of existing regulations and state implementation plans.[10] Among the initiatives was a "top-down" approach for determining BACT. In brief, the top-down process suggests that all available control technologies be ranked in descending order of control effectiveness. The most stringent or "top" control option is the default BACT emission limit unless the applicant demonstrates, and the permitting authority in its informed opinion agrees, that energy, environmental, and/or economic impacts justify the conclusion that the most stringent control option is not achievable in that case. Upon elimination of the most stringent control option based upon energy, environmental, and/or economic considerations, the next most stringent alternative is evaluated in the same manner. This process continues until BACT is selected.

BACT is to be set at the lowest value that is achievable. However, there is an important distinction between emission rates achieved at a specific time on a specific unit, and an emission limitation that a unit must be able to meet continuously over its operating life. As discussed by the DC Circuit Court of Appeals

> In National Lime Ass'n v. EPA, 627 F.2d 416, 431 n.46 (D.C. Cir. 1980), we said that where a statute requires that a standard be "achievable," it must be achievable "under most adverse circumstances which can reasonably be expected to recur."[11]

U.S EPA has reached similar conclusions in prior determinations for PSD permits.

> "Agency guidance and our prior decisions recognize a distinction between, on the one hand, measured 'emissions rates,' which are necessarily data obtained from a particular facility at a specific time, and on the other hand, the 'emissions limitation' determined to be BACT and set forth in the permit, which the facility is required to continuously meet throughout the facility's life. Stated simply, if there is uncontrollable fluctuation or variability in the measured emission rate, then the lowest measured emission rate will necessarily be more stringent than the "emissions limitation" that is "achievable" for that pollution control method over the life of the facility. Accordingly, because the "emissions limitation" is applicable for the facility's life, it is wholly appropriate for the permit issuer to consider, as part of the BACT analysis, the extent to which the available

[8] Memo dated January 4, 1979 from David G. Hawkins (EPA Headquarters) to EPA Regional Administrators, titled "Guidance for Determining BACT Under PSD."

[9] Draft New Source Review Workshop Manual, US EPA New Source Review Section, October 1990.

[10] Memo dated December 1, 1987, from J. Craig Potter (EPA Headquarters) to EPA Regional Administrators, titled "Improving New Source Review Implementation."

[11] As quoted in Sierra Club v. EPA (97-1686).

> data demonstrate whether the emissions rate at issue has been achieved by other facilities over a long term."[12]

Thus, BACT must be set at the lowest feasible emission rate recognizing that the facility must be in compliance with that limit for the lifetime of the facility on a continuous basis. Thus, while viewing individual unit performance can be instructive in evaluating what BACT might be, any actual performance data must be viewed carefully, as rarely will the data be adequate to truly assess the performance that a unit will achieve during its entire operating life. While statistical variability of actual performance can be used to infer what is "achievable," such testing requires a detailed test plan akin to what teams in U.S. EPA use to develop MACT standards over a several year period, and is far beyond what is reasonable to expect of an individual source. In contrast to limited snapshots of actual performance data, emission limits from similar sources can reasonably be used to infer what is "achievable."[13]

A control technology must be "available" to be considered in a BACT determination. This means that the technology has progressed beyond the conceptual stage and pilot testing phase and must have been demonstrated successfully on full-scale operations for a sufficient period. Theoretical, experimental, or developing technologies are not "available" under BACT. A control technology is neither demonstrated nor available if government subsidies are required to fund evaluations of the technology. In many cases, a technology is not "available" for all sizes of a unit. A control technology must also be "commercially available." This means that the technology must be offered for sale through commercial channels with commercial terms.

The source must consider production processes or available methods, systems or techniques, as long as those considerations do not redefine the source. EPA does not consider the BACT requirement as a means to redefine the basic design of the source or change the fundamental scope of the project when considering available control alternatives.

5.1.1 BACT Assessment Methodology

The following sections provide detail on the BACT assessment methodology utilized in preparing the BACT analysis for the proposed removal of the annual operational restrictions for CT-1 through CT-5.

Step 1

The first step is to define the spectrum of process and/or add-on control alternatives potentially applicable to the subject emissions unit. The following categories of technologies are addressed in identifying candidate control alternatives:

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12 EPA Environmental Appeals Board decision, *In re: Newmont Nevada Energy Investment L.L.C.* PSD Appeal No. 05-04, decided December 21, 2005. Environmental Administrative Decisions, Volume 12, Page 442.

13 Emission limits must be used with care in assessing what is "achievable." Limits established for facilities that were never built must be viewed with care, as they have never been demonstrated and that company never assumed a significant liability in having to meet that limit. Likewise, permitted units that have not yet commenced construction must also be viewed with special care for similar reasons.

- Demonstrated add-on control technologies applied to the same emissions unit at other similar source types;
- Add-on controls not demonstrated for the source category in question but transferred from other source categories with similar emission stream characteristics;
- Combustion controls;
- Add-on control devices serving multiple emission units in parallel; and
- Equipment or work practices, especially for fugitive or area emission sources where add-on controls are not feasible.

There is no specific methodology that is required to be used to identify all available emission control technologies and levels for a given source or pollutant. The most comprehensive source of this information, however, is EPA's RACT/BACT/LAER Clearinghouse (RBLC). This searchable database of emission control technology determinations is maintained by EPA, and as such is generally the starting point for developing the required ranking of emission control technologies and levels.

Step 2

The second step is to evaluate the technical feasibility of the alternatives identified in the first step and to reject those that can be demonstrated as technically infeasible based on an engineering evaluation or on chemical or physical principles. The following criteria were considered in determining technical feasibility: previous commercial-scale demonstrations, precedents based on issued PSD permits, state requirements for similar sources, technology transfer, and engineering evaluations for the control devices considered.

Step 3

The third step involves ranking each technically feasible alternative in decreasing order of overall emissions control effectiveness considering the specific operating constraints of the emission unit in question. After determining what control efficiency is achievable with each technically feasible control alternative, the alternatives are ranked into a control hierarchy from most to least stringent. Typically the Step 3 ranking presents an array of control technology alternatives that includes the following types of information:

- Control efficiencies (% pollutant removed or controlled),
- Expected emission rate (ton/yr, pounds/hr)
- Expected emission reduction (tons/yr)
- Economic impacts (cost effectiveness), and
- Adverse environmental and energy impacts.

However, an applicant proposing the top level of control as BACT need not provide cost and other detailed information in regard to other control options.

Step 4

The fourth step consists of an objective evaluation of the energy, environmental, and economic impacts to arrive at a control technology or level of control that is representative of BACT. The economic evaluation is carried out using procedures recommended by the EPA's Office of Air Quality Planning and Standards (OAQPS) Air Pollution Control Cost Manual (latest edition). The economic evaluation looks at the annualized control cost (in dollars per ton of emissions removed) for a particular control technology or level on the source under consideration in comparison to commonly accepted values for cost effective emission controls established by the state regulatory agency. As noted above, this is a site-specific evaluation and the fact that a particular technology or level of emissions control has been concluded to be representative of BACT at another facility does not mean that the same technology or level constitutes BACT for the new Lincoln Station combustion turbine.

If the top level of control is determined to be economically infeasible based on high cost effectiveness, or to cause adverse energy or environmental impacts, the control technology is rejected as BACT and the impact analysis is performed on the next most stringent control alternative until the technology or emissions level under consideration cannot be eliminated by any source-specific adverse environmental, energy, or economic impacts.

Step 5

The final step is to summarize the selection of BACT and propose the associated emission limits or work practices to be incorporated into the permit plus any recommended recordkeeping and monitoring conditions that should be incorporated into the final permit.

5.2 BACT Analysis for CO Emissions

CO emissions are generated during combustion turbine operation as a result of incomplete conversion of carbon-containing compounds to CO_2 and water during fuel combustion. CO emissions are principally related to turbine operating conditions, such as lower than optimal combustion temperature, insufficient combustor residence time, and turbine operating load.

The following sections present the BACT assessment for CO emissions.

5.2.1 Step 1 – Identification of CO Control Technologies

A search of EPA's RBLC was performed that included recent CO BACT determinations (2008 or later) for large simple-cycle combustion turbines (i.e., those with an electrical output greater than 25 MW) firing natural gas. The RBLC search found a total of 64 simple-cycle natural gas-fired turbine listings meeting these criteria with emission limitations for CO. The RBLC search results are summarized in Appendix C, BACT Table 1.

Oxidation Catalyst

An oxidation catalyst is a post-combustion technology that removes CO from the exhaust gas stream after it is formed in the combustion turbine. In the presence of a catalyst, CO will react with oxygen present in the turbine exhaust, converting it to carbon dioxide. No supplementary reactant is used in conjunction with an oxidation catalyst.

Oxidation catalyst systems seek to remove pollutants from the turbine exhaust gas rather than limiting pollutant formation at the source. Oxidation of CO to CO_2 utilizes the excess oxygen present in the turbine exhaust; the activation energy required for the oxidation reaction to proceed is lowered in the presence of the catalyst. Technical factors relating to this technology include the catalyst reactor design, optimum operating temperature, back pressure loss to the system, catalyst life, and potential collateral increases in emissions of PM_{10} and sulfuric acid mist emissions.

CO catalytic oxidation reactors operate in a relatively narrow temperature range. At lower temperatures, CO conversion efficiency falls off rapidly. At higher temperatures, catalyst sintering may occur, thus causing permanent damage to the catalyst. For this reason, the CO catalyst is strategically placed within the proper turbine exhaust point and proper operating temperature considering the temperature variations that are expected to occur across the unit's operating load range. Operation at part load or during start-up/shutdown will result in less than optimum temperatures and reduced control efficiency.

Catalyst systems are subject to loss of activity over time. Since the catalyst itself is the most costly part of the installation, the cost of catalyst replacement should be considered on an annualized basis. Catalyst life may vary from the manufacturer's typical 3-year guarantee to a 5- to 6-year predicted life. Periodic testing of catalyst material is necessary to predict annual catalyst life for a given installation.

Combustion Control/Good Combustion Practices

As previously discussed, CO is formed during the combustion process as a result of incomplete combustion of the carbon present in the fuel. The formation of CO is limited by designing and operating the combustion system to maximize oxidation of the fuel carbon to CO_2. Proper combustor design and optimization of the combustion air feed systems to achieve good combustion efficiency will minimize the generation of CO emissions from combustion turbines.

5.2.2 Step 2 – Technical Feasibility Analysis – CO Control Alternatives

Oxidation Catalyst

Among the natural gas-fired simple-cycle turbine listings in the RBLC with outputs greater than 25 MW that were permitted since 2008, fifteen listings describe the use of an oxidation catalyst system as BACT. Accordingly, an oxidation catalyst is considered to be technically feasible for application to this project.

Combustion Controls/Good Combustion Practices

The RBLC search conducted for this project found that combustion controls alone (including combustor design or good combustion practices) were concluded to be representative of BACT for a total of 35 of the 64 natural gas-fired RBLC entries identified. Duke Energy utilizes proper design and good combustion practices for CO control on all of its simple-cycle turbines. Thus combustion controls are considered to be a technically feasible alternative for control of CO emissions from natural gas-fired simple-cycle combustion turbines.

5.2.3 Step 3 – Ranking of CO Control Technologies

Based on the RBLC search conducted, the use of an oxidation catalyst system is considered the most stringent CO emissions control alternative for natural gas-fired simple-cycle combustion turbines. The two listings in the RBLC with the lowest emission limits (the two turbines at the Cove Point LNG terminal with emission limits of 1.5 ppmvd @ 15% O_2, equivalent to 0.0034 lb/MMBtu and CPV St. Charles at 2 ppmvd @ 15% O_2, equivalent to 0.0045 lb/MMBtu) are described as employing oxidation catalyst systems.

Combustion controls are considered to be the next-most stringent emission control alternative below the use of an oxidation catalyst system. Emission limits for turbines listed as employing combustion controls are less stringent, ranging from 0.0090 lb/MMBtu (4 ppm) to 0.91 lb/MMBtu (250 ppm) with a majority of the listings (20 of 35) having a limit of 9 ppm (0.02 lb/MMBtu).

In Duke Energy’s experience, low CO levels can be achieved using good combustion practices, without the installation of an oxidation catalyst system.

5.2.4 Step 4 – CO Control Effectiveness Evaluation

Energy and Economic Impacts

An oxidation catalyst system does provide a negative impact on combustion turbine performance related to the backpressure the system imposes on the turbine. An output energy penalty of approximately 0.1% of the turbine design output is typical (equivalent to 165 kw or 0.56 MMBtu/hr per turbine). For all five units combined, the energy penalty associated with the use of oxidation catalyst systems is equivalent to 23.2 MMBtu/ton CO controlled compared to the use of combustion controls.

Table 5-1 provides estimated capital and operating costs associated with the use of oxidation catalyst systems on each turbine unit. The estimated total capital cost is $18.2 million per turbine. Table 5-2 provides the estimated cost effectiveness of this alternative, which is approximately $16,300 per ton CO controlled for each of the five turbine units.

There are no adverse economic or energy impacts associated with the use of combustion controls.

Table 5-1. Oxidation Catalyst System Capital and Operating Cost Estimates

		CT-1	CT-2	CT-3	CT-4	CT-5
CAPITAL COST ESTIMATE						
Direct Capital Costs						
Equipment Items						
Oxidation Catalyst System	Duke Energy estimate	$9,171,300	$9,171,300	$9,171,300	$9,171,300	$9,171,300
Instrumentation and Controls	10% of equipment cost (EPA CCM Chapter 2)	$917,100	$917,100	$917,100	$917,100	$917,100
Freight	5% of equipment cost (EPA CCM Chapter 2)	$458,600	$458,600	$458,600	$458,600	$458,600
Total Equipment Cost (TEC)		**$10,547,000**	**$10,547,000**	**$10,547,000**	**$10,547,000**	**$10,547,000**
Direct Installation Cost						
Design, Installation, Framing and Materials by vendor	Duke Energy estimate	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Foundations Structural Support	Included	$0	$0	$0	$0	$0
Handling and Erection	Included	$0	$0	$0	$0	$0
Electrical	Included	$0	$0	$0	$0	$0
Piping and Wiring	Included	$0	$0	$0	$0	$0
Insulation	Included	$0	$0	$0	$0	$0
Painting	Included	$0	$0	$0	$0	$0
Sample Ports	Included	$0	$0	$0	$0	$0
Subtotal, Direct Capital Cost (DCC)		**$12,547,000**	**$12,547,000**	**$12,547,000**	**$12,547,000**	**$12,547,000**
Indirect Capital Costs						
Indirect Installation Costs						
General Facilities	5% of TEC (EPA CCM Section 4, Table 2.5)	$527,000	$527,000	$527,000	$527,000	$527,000
Engineering	10% of TEC (EPA CCM Section 4, Table 2.5)	$1,055,000	$1,055,000	$1,055,000	$1,055,000	$1,055,000
Process Contingency	5% of TEC (EPA CCM Section 4, Table 2.5)	$527,000	$527,000	$527,000	$527,000	$527,000
Other Indirect Costs						
Emissions Monitoring	Engineering Estimate	$10,000	$10,000	$10,000	$10,000	$10,000
Performance Testing	1% of TEC (EPA CCM Section 3, Table 2.8)	$105,000	$105,000	$105,000	$105,000	$105,000
Contractor Fees	10% of TEC (EPA CCM Section 3, Table 2.8)	$1,055,000	$1,055,000	$1,055,000	$1,055,000	$1,055,000
Subtotal, Indirect Capital Costs (ICC)		**$3,279,000**	**$3,279,000**	**$3,279,000**	**$3,279,000**	**$3,279,000**
Project Contingency	15% of (DCC + ICC)	$2,374,000	$2,374,000	$2,374,000	$2,374,000	$2,374,000
TOTAL CAPITAL INVESTMENT (TCI)	DCC + ICC + Project Contingency	**$18,200,000**	**$18,200,000**	**$18,200,000**	**$18,200,000**	**$18,200,000**
OPERATING COST ESTIMATE						
Capital Recovery Costs (CRC)	15 year equipment life, 7% interest	**$1,994,700**	**$1,994,700**	**$1,994,700**	**$1,994,700**	**$1,994,700**
Direct Operating Costs						
Operating Labor	1/2 hr/shift, 6500 hrs/yr operation, $30/hr	$12,200	$12,200	$12,200	$12,200	$12,200
Supervisory Labor	15% of operating labor	$1,830	$1,830	$1,830	$1,830	$1,830
Maintenance Labor & Materials	1.5% of TCI (EPA CCM Section 4, Equation 2.46)	$182,000	$182,000	$182,000	$182,000	$182,000
Power Loss Penalty	Estimated at 0.1% of power output, $0.08/kwhr	$85,800	$85,800	$85,800	$85,800	$85,800
Catalyst Replacement Cost	6 years catalyst life, 50% catalyst replaced	$878,900	$878,900	$878,900	$878,900	$878,900
Subtotal, Direct Operating Costs (DOC)		**$1,160,730**	**$1,160,730**	**$1,160,730**	**$1,160,730**	**$1,160,730**
Indirect Operating Costs						
Overhead	60% of O&M (EPA CCM Chapter 2)	$117,600	$117,600	$117,600	$117,600	$117,600
Property Taxes	Assumed none	$0	$0	$0	$0	$0
Insurance	1% of TCI (EPA CCM Chapter 2)	$182,000	$182,000	$182,000	$182,000	$182,000
Administration	Assumed none	$0	$0	$0	$0	$0
Subtotal, Indirect Operating Costs (IOC)		**$299,600**	**$299,600**	**$299,600**	**$299,600**	**$299,600**
TOTAL ANNUALIZED OPERATING COST	CRC + DOC + IOC	**$3,455,030**	**$3,455,030**	**$3,455,030**	**$3,455,030**	**$3,455,030**

Table 5-2. Cost Effectiveness Estimate – Oxidation Catalyst Systems for CO Control

	CT-1	CT-2	CT-3	CT-4	CT-5
Total Annualized Oxidation System Costs	$3,455,030	$3,455,030	$3,455,030	$3,455,030	$3,455,030
Uncontrolled CO emissions (ton/yr)	353.2	353.9	354.6	355.1	353.1
Control Efficiency (%)	60%	60%	60%	60%	60%
Controlled CO emissions (ton/yr)	141.3	141.6	141.8	142.0	141.3
Reduction in CO emissions (ton/yr)	211.9	212.4	212.8	213.0	211.9
CO Cost Effectiveness ($/ton reduced)	**$16,302**	**$16,270**	**$16,239**	**$16,218**	**$16,307**

Environmental Impacts

The use of an oxidation catalyst system on simple-cycle turbines has been shown to increase sulfuric acid emissions as a result of oxidation of a portion of the unit's SO_2 emissions to SO_3 and the subsequent reaction of SO_3 with water vapor to form sulfuric acid. The catalyst must also be regenerated periodically and must be disposed of or recycled at the end of its useful life. There are no adverse environmental impacts associated with the use of combustion controls.

Achievable Emissions Levels

With the use of combustion controls, these turbines can achieve a CO emission level when firing natural gas of 0.0575 lb/MMBtu. The use of an oxidation catalyst system is projected to provide a CO control efficiency of 60%, which would correspond to an emission level of 0.0230 lb/MMBtu.

5.2.5 Step 5 – Proposed BACT for CO Emissions

The use of oxidation catalyst systems is expensive to retrofit on these combustion turbine units and the resulting cost effectiveness of this alternative (at $18.2 million in capital and $16,300 per ton of CO controlled, per turbine) is considered to be unrepresentative of BACT for CO. Therefore, the current BACT emission limits when firing natural gas (0.0575 lb/MMBtu, achieved using combustion controls) are considered to be representative of BACT for CO emissions from each of these units.

Each combustion turbine is equipped with continuous emissions monitors for CO emissions.

As provided by Condition 2.1.A.3.a.i(A) of the current permit, CO emissions may be higher than this level during startup and shutdown when operating below 70% load, or during periods of malfunction of these units. During startup, shutdown, or malfunction events Duke Energy will adhere to optimum turbine operational practices and will minimize the duration of periods of excess emissions resulting from such events.

5.3 BACT Analysis for VOC Emissions

VOC emissions from combustion turbines are attributable to the same factors as described for CO emissions in Section 5.2 above. VOC emissions result from incomplete combustion of carbon compounds in the fuel, which is influenced primarily by the temperature and residence time within the combustion zone.

The following subsections present the BACT analysis for VOC emissions.

5.3.1 Step 1 – Identification of VOC Control Technologies

A search of EPA's RBLC was performed to identify large natural gas-fired simple-cycle turbines permitted since 2008 with BACT determinations for VOC. This search identified a total of 33 listings of natural gas-fired turbines in this category with emission limitations for VOC. The results of this RBLC search are summarized in Appendix C, BACT Table 2.

Oxidation Catalyst

As described above in Section 5.2.1, an oxidation catalyst is a post-combustion technology that oxidizes products of incomplete combustion in the turbine exhaust. As with CO, VOC compounds will react with residual oxygen in the presence of a catalyst, producing carbon dioxide and water vapor. The performance of an oxidation catalyst system is dependent on the specific VOC constituents present in the turbine exhaust.

Combustion Controls/Good Combustion Practices

As previously discussed, VOCs are formed during the combustion process as a result of incomplete combustion of the carbon present in the fuel. The formation of VOC is limited by designing and operating the combustion system to maximize oxidation of the fuel carbon to CO_2. Good combustion practices consisting primarily of controlled fuel/air mixing and adequate temperature and gas residence time within the turbine combustor will minimize the formation of VOCs.

5.3.2 Step 2 – Analysis of Technical Feasibility – VOC Control

Oxidation Catalyst

There are fourteen large natural gas-fired simple-cycle turbine listings in the RBLC permitted since 2008 that are described as using an oxidation catalyst system to control VOC emissions. Thus, oxidation catalyst systems are considered to be technically feasible for application to the simple-cycle turbines at the Rockingham County facility. However, Duke Energy does not typically employ oxidation catalyst systems for VOC control on its simple-cycle turbines.

Good Combustion Practices

The RBLC search conducted for this project found that combustor design or good combustion practices were concluded to be representative of BACT for a total of fifteen of the 33 natural gas-fired RBLC entries with VOC BACT limits identified. Duke Energy utilizes proper design and good combustion practices for VOC control on all of its simple-cycle turbines. Thus, combustor design or good combustion practices is considered to be a technically feasible alternative for control of this pollutant from simple-cycle turbines.

5.3.3 Step 3 – Ranking of VOC Control Technologies

The use of an oxidation catalyst system is considered the most stringent VOC emissions control alternative for natural gas-fired simple-cycle combustion turbines based on the RBLC search conducted. The RBLC listings with the lowest emission limit (the two turbines at the Cove Point LNG terminal at three turbines at the Cricket Valley Energy Center with an emission limit of 0.7 ppmvd @ 15% O_2 or 0.00090 lb/MMBtu as methane) are described as employing oxidation catalyst systems.

Combustion controls are considered to be the next level of emission control below the use of an oxidation catalyst system. Emission limits for natural gas-fired simple-cycle turbines listed in the RBLC as employing combustion controls range from 1.4 ppm (0.0018 lb/MMBtu) to 0.024 lb/MMBtu as methane. It is Duke Energy's experience that low VOC emission levels can be obtained without the use of an oxidation catalyst system.

5.3.4 Step 4 – VOC Control Effectiveness Evaluation

Energy and Economic Impacts

As described in Section 5.2.4, an oxidation catalyst system does provide a negative impact on combustion turbine performance related to the backpressure the system imposes on the turbine. With respect to control of VOC, the output energy penalty of approximately 0.1% of the turbine design output is equivalent to 375 MMBtu/ton VOC controlled. In addition, the catalyst material itself has a functional lifetime and must be periodically regenerated or replaced.

As for economic impacts, Table 5-1 in Section 5.2.4 provides estimated capital and operating costs associated with the use of oxidation catalyst systems on each turbine unit. Table 5-3 provides the estimated cost effectiveness of this alternative for VOC control, which is over $350,000 per ton controlled for each turbine unit.

There are no adverse economic or energy impacts associated with the use of combustion controls.

Table 5-3. Cost Effectiveness Estimate – Oxidation Catalyst Systems for VOC Control

	CT-1	*CT-2*	*CT-3*	*CT-4*	*CT-5*
Total Annualized Oxidation System Costs	**$3,455,030**	**$3,455,030**	**$3,455,030**	**$3,455,030**	**$3,455,030**
Uncontrolled VOC emissions (ton/yr)	19.6	19.6	19.7	19.7	19.6
Control Efficiency (%)	50%	50%	50%	50%	50%
Controlled VOC emissions (ton/yr)	9.8	9.8	9.8	9.8	9.8
Reduction in VOC emissions (ton/yr)	9.8	9.8	9.8	9.8	9.8
VOC Cost Effectiveness ($/ton reduced)	**$352,409**	**$351,944**	**$351,480**	**$351,171**	**$352,487**

Environmental Impacts

As described in Section 5.2, a slight increase in sulfuric acid emissions can be expected to occur in conjunction with the use of an oxidation catalyst system. The catalyst must also be regenerated periodically and must be disposed of or recycled at the end of its useful life, which has some, but minimal, environmental impact. As noted above, there are no adverse environmental impacts associated with the use of combustion controls.

Achievable Emission Levels

With the use of combustion controls, these turbines can achieve a VOC emission level when firing natural gas of 0.0032 lb/MMBtu. The use of an oxidation catalyst system is projected to provide a VOC control efficiency of 50%, or which would correspond to an emission level of 0.0016 lb/MMBtu.

5.3.5 Step 5 – Proposed BACT for VOC Emissions

As described above, oxidation catalyst systems are considered to be technically feasible on these combustion turbines, but expensive to retrofit onto the existing units. The estimated cost effectiveness of this alternative is over $350,000 per ton of VOC controlled is not representative of BACT for these units. Therefore, the current BACT emission limits for these units, 0.0032 lb/MMBtu achieved using combustion controls, are representative of BACT for VOC emissions.

Similar to the description provided above in Section 5.2.5, VOC emissions during startup, shutdown, or malfunction of these units may be higher than this level, however Duke Energy Carolinas will adhere to optimum turbine operational practices during startup, shutdown, and malfunction events and will minimize the duration of periods of excess emissions resulting from such events as required by the current permit Condition 2.1.A.3.a.i(A).

5.4 BACT Analysis for NO_X Emissions

NO_x emissions result from combustion turbine operation in two ways: 1) the combination of elemental nitrogen and oxygen in the combustion air within the high temperature environment of the combustor (thermal NO_x); and 2) the oxidation of nitrogen contained in the fuel (fuel NO_x). Although natural gas contains free nitrogen, it does not contain fuel bound nitrogen; therefore, NO_x emissions from natural gas fired combustion turbine generators originate as thermal NO_x only. The rate of formation of thermal NO_x is a function of residence time and free oxygen concentration, and increases exponentially with increasing peak flame temperature.

"Front end" NO_x control techniques are aimed at controlling thermal NO_x and/or fuel NO_x. The primary front-end combustion controls for combustion turbine systems include water or steam injection into the combustor, and specific combustor design features. The addition of an inert diluent such as water or steam into the high temperature region of the combustor decreases NO_X formation by quenching peak flame temperature. Dry low-NO_x combustors limit peak flame temperature and excess oxygen with lean, pre-mix flames that decrease NO_x formation to levels that are equal or better than achieved via water or steam injection when burning natural gas.

Catalytic combustion is an emerging front-end technology which uses an oxidation catalyst within the combustor to produce a lower temperature flame and hence, low thermal NO_x formation. Other control methods, known as "back-end" controls, remove NO_x from the exhaust gas stream once NO_x has been formed.

The following subsections present the BACT assessment for NO_x emissions.

5.4.1 Step 1 – Identification of NO_x Control Alternatives

Selective Catalytic Reduction (SCR)

SCR is a process which involves post combustion removal of NO_x from the flue gas with a catalytic reactor. In the SCR process, ammonia injected into the combustion turbine exhaust gas reacts with nitrogen oxides and oxygen to form nitrogen and water. The SCR process converts nitrogen oxides to nitrogen and water by the following chemical reactions:

$$4\ NO + 4\ NH_3 + O_2 \rightarrow 4\ N_2 + 6\ H_2O \qquad (1)$$

$$6\ NO + 4\ NH_3 \rightarrow 5\ N_2 + 6\ H_2O \qquad (2)$$

$$2\ NO_2 + 4\ NH_3 + O_2 \rightarrow 3\ N_2 + 6\ H_2O \qquad (3)$$

$$6\ NO_2 + 8\ NH_3 \rightarrow 7\ N_2 + 12\ H_2O \qquad (4)$$

$$NO + NO_2 + 2\ NH_3 \rightarrow 2\ N_2 + 3\ H_2O \qquad (5)$$

The reactions take place on the surface of a catalyst. The function of the catalyst is to lower the activation energy of the NO_x decomposition reactions. Technical factors related to this technology include increased turbine backpressure, exhaust temperature materials limitations, thermal shock/stress during rapid starts, catalyst masking/blinding, reported catalyst failure due to "crumbling," design of the NH_3 injection system, and high NH_3 slip.

The NO_x reduction reactions take place within the temperature range of 650 to 850°F. The exhaust temperature of simple-cycle turbines is typically higher than this range, so either the use of a catalyst specifically formulated to operate at high temperatures or some means to reduce the temperature of the turbine exhaust must be utilized in order for SCR to be technically feasible on this source type. Nonetheless, SCR is a technically feasible option for NO_x control for simple-cycle combustion turbines.

Dry Low- NO_x Combustors

Combustion control techniques that utilize design and/or operational features of the turbine's combustors which reduce NO_X emissions without injecting an inert diluent (water or steam) are generically referred to as "dry" Low NO_x (DLN) measures. The particular features of a DLN combustor design is vendor-specific, but generally DLN combustors seek to reduce thermal NO_x formation by controlling peak combustion temperature, combustion zone residence time, and combustion zone free oxygen. Alternatives include combustion distribution over several burner stages and pre-mixing air and fuel prior to injection into the combustion zone. These measures produce a lean, pre-mixed flame that burns at a lower flame temperature and excess oxygen levels than conventional combustors. DLN combustors have been employed successfully on natural gas-fired combustion turbines for more than fifteen years.

Water or Steam Injection

Water and steam injection involves the injection of water or steam into the high temperature region of the combustor flame. These alternatives also seek to control peak combustion temperature, combustion zone residence time, and combustion zone free oxygen, thereby minimizing thermal NO_x formation. Although water and steam injection have been employed successfully for nearly thirty years on combustion turbines, this alternative greatly reduces the turbine's efficiency.

5.4.2 Steps 2 and 3 – Technical Feasibility Analysis and Ranking of NO_x Control Alternatives

A search of EPA's RBLC was carried out to identify NO_x BACT determinations for large natural gas-fired simple-cycle turbines permitted since 2008. The results of this RBLC search are summarized in Appendix C, BACT Table 3.

Among the simple-cycle turbine listings in the RBLC that met these criteria, 21 of the 75 natural gas-fired listings describe the use of SCR either alone or in conjunction with DLN combustors or water injection as BACT. Thus the use of SCR, either alone or in conjunction with DLN combustors and/or water injection is considered to be a technically feasible alternative for control of NO_x emissions from simple-cycle turbines.

DLN combustors are also technically feasible for control of NO_x emissions from this source category. The RBLC search found that 44 of the 75 natural gas-fired turbine listings concluded that DLN combustors alone were representative of BACT. Moreover, Units CT-1, CT-2, CT-3, CT-4, and CT-5 are each equipped with DLN combustors. Water injection is also considered to be technically feasible, but is typically employed more frequently during periods of distillate oil firing. Water injection is used to control NOx emissions from the Rockingham County simple cycle turbine units during periods of fuel oil firing.

The top level of NO_x control for natural gas-fired simple-cycle combustion turbines is the use of DLN combustors to minimize NO_x formation in conjunction with the use of SCR. The RBLC search found two listings (CPV St. Charles and Cricket Valley Energy Center) where an emission level of 2 ppmvd @ 15% O_2 using SCR in combination with DLN combustors was concluded to represent BACT; one other listing concluded that an emission level of 2.5 ppmvd @ 15% O_2 using SCR in combination with DLN combustors was concluded to be BACT.

The use of DLN combustors alone is the next-most stringent level of NO_x control for this source type. Thirty-one of the 44 listings where DLN combustors were concluded to represent BACT list an emission level of 9 ppmvd @ 15% O_2. The current permit limit for the Rockingham simple-cycle combustion turbines when firing natural gas is 15 ppmvd @ 15% O_2 using DLN combustors.

Water injection alone is the third-most stringent level of NO_x control; the RBLC contains four listings where water injection alone is described as BACT. The lowest emission level among these listings appears to be 25 ppm. Water injection alone was not considered further because DLN combustors achieve lower emissions levels and are already in use on each of these units.

5.4.3 Step 4 – NO_x Control Effectiveness Evaluation

Energy and Economic Impacts

SCR systems provide a negative impact on combustion turbine performance in two ways: pressure drop associated with the catalyst reactor and ductwork (estimated by EPA at 0.4 inches of water column in total, per the Control Cost Manual Section 4 Chapter 2) and the power requirements associated with vaporizing the reducing agent (typically aqueous ammonia solution). This negative energy impact is estimated at approximately 700 kW for each of the Rockingham simple-cycle units, which is equivalent to a total energy impact associated with SCR of 52 MMBtu/ton NO_x controlled for each unit.

Retrofitting SCR systems on these existing simple-cycle combustion turbine units would have significant capital and annual operating cost impacts. Table 5-4 provides estimates of these capital and operating costs associated with the use of SCR systems on each turbine unit. The Total Capital Investment required for each unit is $25 million, and total annualized costs would be in excess of $4.7 million per unit. Table 5-5 provides the estimated cost effectiveness of this alternative, which is over $15,800 per ton NO_x controlled for each unit. This level is not considered cost effective for NO_x BACT.

Table 5-4. SCR System Capital and Operating Cost Estimates

CAPITAL COST ESTIMATE						
Direct Capital Cost (DCC)	Duke Energy estimate	**$18,099,200**	**$18,099,200**	**$18,099,200**	**$18,099,200**	**$18,099,200**
Indirect Capital Costs						
Indirect Installation Costs						
General Facilities	5% of DCC	$905,000	$905,000	$905,000	$905,000	$905,000
Engineering & Fees	10% of DCC	$1,809,900	$1,809,900	$1,809,900	$1,809,900	$1,809,900
Process Contingency	5% of DCC	$905,000	$905,000	$905,000	$905,000	$905,000
Other Indirect Costs						
Performance Testing	Estimate	$20,000	$20,000	$20,000	$20,000	$20,000
Subtotal, Indirect Capital Costs (ICC)		**$3,639,900**	**$3,639,900**	**$3,639,900**	**$3,639,900**	**$3,639,900**
Project Contingency	15% of (DCC + ICC)	$3,260,900	$3,260,900	$3,260,900	$3,260,900	$3,260,900
TOTAL CAPITAL INVESTMENT (TCI)	DCC + ICC + Project Contingency	**$25,000,000**	**$25,000,000**	**$25,000,000**	**$25,000,000**	**$25,000,000**
OPERATING COST ESTIMATE						
		CT-1	***CT-2***	***CT-3***	***CT-4***	***CT-5***
Capital Recovery Costs (CRC)	15 year equipment life, 7% interest	**$2,740,000**	**$2,740,000**	**$2,740,000**	**$2,740,000**	**$2,740,000**
Direct Operating Costs						
Reduction Reagent Cost	Calculated from NOx reduction rate	$79,000	$79,000	$79,000	$79,000	$79,000
Operating and Supervisory Labor	None	$0	$0	$0	$0	$0
Maintenance Labor & Materials	1.5% of TCI (EPA CCM Section 4, Equation 2.46)	$250,000	$250,000	$250,000	$250,000	$250,000
Utility Cost	Pressure drop, reagent vaporization	$317,800	$317,800	$317,800	$317,800	$317,800
Catalyst Replacement Cost	6 years catalyst life, 50% catalyst replaced	$926,100	$926,000	$925,900	$925,900	$926,200
Subtotal, Direct Operating Costs (DOC)		**$1,572,900**	**$1,572,800**	**$1,572,700**	**$1,572,700**	**$1,573,000**
Indirect Operating Costs						
Overhead	60% of O&M (EPA CCM Chapter 2)	$150,000	$150,000	$150,000	$150,000	$150,000
Property Taxes	Assumed none	$0	$0	$0	$0	$0
Insurance	1% of TCI (EPA CCM Chapter 2)	$250,000	$250,000	$250,000	$250,000	$250,000
Administration	Assumed none	$0	$0	$0	$0	$0
Subtotal, Indirect Operating Costs (IOC)		**$400,000**	**$400,000**	**$400,000**	**$400,000**	**$400,000**
TOTAL ANNUALIZED OPERATING COST	CRC + DOC + IOC	**$4,712,900**	**$4,712,800**	**$4,712,700**	**$4,712,700**	**$4,713,000**

Table 5-5. Cost Effectiveness Estimate - SCR Systems

	CT-1	CT-2	CT-3	CT-4	CT-5
Total Annualized Costs	$4,712,900	$4,712,800	$4,712,700	$4,712,700	$4,713,000
Uncontrolled NOx emissions (ton/yr)	354.3	355.3	356.2	356.8	354.2
Controlled NOx emissions (ton/yr)	59.2	59.4	59.6	59.8	59.2
Reduction in NOx emissions (ton/yr)	295.1	295.8	296.6	297.1	295.0
NOx Cost Effectiveness ($/ton reduced)	**$15,972**	**$15,931**	**$15,891**	**$15,865**	**$15,979**

There are no adverse energy or economic impacts associated with the use of the DLN combustors that are currently installed on each unit.

Environmental Impacts

SCR applications require that an excess of ammonia be injected into the turbine exhaust in order to achieve low NO_x emission rates. This creates two forms of adverse environmental impacts. Ammonia that is not consumed in the SCR reactor is discharged to the atmosphere as ammonia slip, and excess ammonia can react with SO_2 and SO_3 in the turbine exhaust to form ammonium salt compounds (ammonium sulfate and ammonium bisulfate) which are discharged as particulate matter.

In addition, the use of SCR can be expected to increase the formation of sulfuric acid emissions by the oxidation of a portion of the turbine's SO_2 emissions to SO_3 and the subsequent reaction of SO_3 with water vapor to form sulfuric acid.

There are no adverse environmental impacts associated with the DLN combustors.

Achievable Emission Levels

The combustion turbines at this facility, which began commercial operations in 2000, were designed to meet a NO_x limit of 15 ppmvd @ 15% O_2 while firing natural gas. However, the combustion turbines have difficulty meeting the 15 ppmvd NO_x emission limit during cold weather conditions ($\leq$ 32^o F) due to low frequency dynamics (LFD), which affect the safe operation of the combustion turbines at these low temperatures. At typical ambient temperatures (greater than 32° F), the facility can meet the current NO_x BACT emission limitation for gas firing of 15 ppmvd corrected to 15% oxygen. However, as the ambient air temperature drops, the density of the air increases, which results in more air mass (and subsequently fuel mass) moving through the units. Because the burners are a lean pre-mix design, ensuring that proper ratios of air and fuel are achieved is integral to proper combustion. If the mixture is too lean then the flame extinguishes and rich mixtures cause flash back towards the pilot flame. The air is compressed to a 19:1 compression ratio, which further narrows the available window for ensuring proper combustion.

Each time this flame extinguishes or flashes back, the combustion "plane" becomes unstable and pressure pulses throughout the combustion section of the unit. These pulses are also known as "frequency dynamics" within the unit. As the dynamics increase, the stresses on the equipment increase exponentially and ultimately result in physical damage. In order to prevent damage to the combustion turbines from these dynamics issues, the units must be tuned, which leads to increases in NO_x emissions during cold weather conditions.

As the mass of air and water is increased through the unit, the amount of water required to be injected with the pilot flame also increases. The water serves to cool the combustion temperature, thereby lowering the amount of thermal NO_x generated. However, when water injection rates are greater than 7 gallons per minute (gpm) there are diminishing returns on the amount of NO_x that is controlled. The additional water also increases the potential for “lean” combustion conditions, which can ultimately create additional combustion dynamics issues.

To ensure that the equipment is in top working order, the facility replaced combustion related parts and worked with three companies to optimize tuning of the units (Siemens, PSM, and Mitsubishi), yet the equipment is not capable of achieving 15 ppm NO_x for natural gas firing during cold weather conditions. The permit includes an allowance for operating at 25 ppmvd NOx at 15% O_2 on a 1-hour average basis for up to 500 full load equivalent hours when firing gas when ambient temperatures are 32° F or lower.

Lower emissions levels than these are not technically feasible using DLN combustors alone; achieving a lower NO_x emissions level on these units would require the installation of SCR, which would be operated in conjunction with the existing DLN combustors. Based on information presented in the RBLC, the use of SCR in conjunction with DLN combustors would likely be capable of reducing the NO_x emission level on each turbine when firing natural gas to 2.5 ppmvd at 15% O_2.

5.4.4 Step 5 – Proposed BACT for NO_x Emissions

Although it is technically feasible to retrofit SCR systems on the existing simple cycle combustion turbine units, this alternative would be prohibitively expensive and at over $15,800/ton removed is not representative of BACT for NO_x emissions for these units. Accordingly, the next-most stringent alternative (the use of DLN combustors at the currently achievable hourly BACT limits) is concluded to be representative of BACT for control of NO_x emissions for these units. We propose to retain the current short term BACT limits included in permit condition 2.1.A.3.a.i.

As with the description provided above in Section 5.2.5, NO_x emissions during startup, shutdown, or malfunction of these units may be higher, however Duke Energy Carolinas will adhere to optimum turbine operational practices during startup, shutdown, and malfunction events and will minimize the duration of periods of excess emissions resulting from such events as required by the current permit condition 2.1.A.3.a.i(A). We also propose to retain the current BACT conditions for tuning and cold weather contained in permit conditions 2.1.A.3.a.i(B) and (C).

5.5 BACT Analysis for Particulate Matter

Particulate matter emissions from combustion turbine generators are a combination of filterable (front-half) and condensable (back-half) particles. Filterable particulate matter is formed from impurities contained in the fuels and from incomplete combustion. Condensable particulate emissions, which are to be aggregated with filterable particulate matter when quantifying PM_{10} and $PM_{2.5}$ emission rates, are attributable primarily to the formation of sulfates and possibly organic compounds. Only the filterable fraction of particulate matter is used to quantify PM emission rates.

The following subsections present the BACT assessment for particulate matter emissions.

5.5.1 Step 1 – Identification of PM Control Alternatives

When the original NSPS for Stationary Gas Turbines (40 CFR 60, Subpart GG) was promulgated in 1979, EPA recognized that "particulate emissions from stationary gas turbines are minimal." The Agency noted that particulate matter control devices are not typically installed on gas turbine generators and that the cost of installing a particulate control device is prohibitive.[14] Performance standards for control of particulate matter emissions from stationary gas turbine generators were, therefore, not proposed or promulgated as part of Subpart GG.

Similarly, when updated NSPS for stationary combustion turbines (40 CFR 60, Subpart KKKK) were proposed in 2005, EPA declined to establish emission limits on particulate matter because "…particulate matter emissions are negligible with natural gas firing due to the low sulfur content of natural gas. Emissions of PM are only marginally significant with distillate oil firing because of the lower ash content…"[15] Additionally, EPA found that no combustion turbines permitted since 2003 utilized add-on controls.

The most stringent particulate control method demonstrated for natural gas- fired combustion turbines is the use of low-ash and low-sulfur fuel. Proper combustion control and the firing of fuels with negligible or zero ash content and low sulfur content is the only particulate matter control method listed in any of the natural gas-fired simple-cycle combustion turbine listings in the RBLC (see Appendix C, BACT Table 4).

5.5.2 Step 2 – Technical Feasibility Analysis – PM Control Alternatives

Add-on controls, such as electrostatic precipitators (ESPs) or baghouses, have never been applied to commercial natural gas-fired combustion turbines. The use of ESPs and baghouses are considered technically infeasible, and do not represent an available control technology. Moreover, the estimated combustion turbine exhaust particulate matter concentration for the existing turbine units, including condensable particulate matter, is approximately 0.001 gr/dscf. This is an order of magnitude lower than the outlet performance specification (0.01 gr/dscf) of a typical baghouse or ESP.

Proper combustion and the firing of clean fuels (i.e., those with negligible or zero ash content and low sulfur content) is considered to be technically feasible for application to the Rockingham County units.

[14] USEPA, 44 FR 52798, September 1979
[15] USEPA, 70 FR 8314, February 2005

5.5.3 Step 3 – Ranking of PM Control Alternatives

The use of good combustion practices and the use of clean fuels is the top level of PM, PM_{10}, and $PM_{2.5}$ control for simple-cycle combustion turbines. Per the data presented in EPA's RBLC, the typical emission rates determined to represent BACT for PM, PM_{10}, and $PM_{2.5}$ are in the range of 0.0003 to 0.04 lb/MMBtu for natural gas firing (see Appendix C, BACT Table 4). The current permit limit for PM for these units when firing natural gas (0.0032 lb/MMBtu) is within this range. However, it must be noted that a large degree of uncertainty exists with regard to the range of limits in the RBLC listings because particulate matter emissions vary with turbine make, model and heat input rate and the emission limits reported to the RBLC are not all in consistent units. Additionally, for many of the RBLC listings, the reported species (PM, PM_{10}, or $PM_{2.5}$), test method, and whether the emission rate has been achieved in practice are not described.

5.5.4 Steps 4 and 5 – PM Control Effectiveness Evaluation and Proposed BACT

The use of good combustion practices and clean fuels is concluded to be representative of BACT for PM, PM_{10}, and $PM_{2.5}$ emissions from simple-cycle combustion turbines. PM emission rates from these types of units vary depending upon the experience of the manufacturer, the size of combustion turbine, and the resulting available vendor performance guarantees. Currently, using good combustion practices and clean fuels, the Rockingham County units are meeting an emission level of 0.0032 lb/MMBtu. Accordingly, the current short term BACT limits in permit condition 2.1.A.3.a.i are concluded to be representative of BACT for PM, PM_{10}, and $PM_{2.5}$ control for these units.

As described above in Section 5.2.5, PM emissions during startup, shutdown, or malfunction of these units may be higher than this level, however Duke Energy will adhere to optimum turbine operational practices during startup, shutdown, and malfunction events and will minimize the duration of periods of excess emissions resulting from such events as required by the current permit condition 2.1.A.3.a.i(A).

5.6 BACT Analysis for GHG Emissions

Emissions of greenhouse gases (GHG) from combustion turbine generators are approximately 99.9% CO_2, which result from oxidation of carbon in the fuel. Small quantities of methane and nitrous oxide account for the balance of the GHG emissions. The following subsections present the BACT assessment for GHG emissions for units CT-1 through CT-5.

5.6.1 Step 1 – Identification of GHG Control Alternatives

Carbon Capture and Sequestration (CCS)

CCS requires capture of CO_2 from the flue gas, drying and compression, transport, and long term storage or conversion of CO_2. Research, Development, and Demonstration (RD&D) programs are being conducted by the U.S. Department of Energy (DOE) to reduce project uncertainty and improve technology cost and performance. The focus of CCS RD&D is twofold: 1) to demonstrate the operation of current CCS technologies integrated at an appropriate scale to prove safe and reliable capture and storage; and 2) to develop improved CO_2 capture component technologies and advanced power generation technologies to significantly reduce the cost of CCS, in order to facilitate widespread cost-effective deployment of this technology in the future.

Existing federal programs are being used to deploy at least five to ten large-scale integrated CCS projects. These projects are intended to demonstrate a range of current generation CCS technologies applied to coal-fired power plants and industrial facilities.[16] To date, none of these projects have encompassed natural gas- or distillate oil-fired combustion turbines. Although currently-available technologies could be used to capture CO_2 from new and existing fossil energy power plants, they are not ready for widespread implementation primarily because they have not been demonstrated at the scale necessary to establish confidence for power plant application.

The U.S Department of Energy's National Energy Technology Laboratory (DOE-NETL) summarizes the process steps required for CCS as follows:

> ". . . Separating CO_2 from flue gas streams is challenging for several reasons:
>
> - CO_2 is present at dilute concentrations (13-15 volume percent in coal-fired systems and 3-4 volume percent in gas-fired turbines) and at low pressure (15-25 pounds per square inch absolute (psia)), which dictates that a high volume of gas must be treated;
> - Trace impurities (particulate matter, sulfur dioxide, nitrogen oxides) in the flue gas can degrade sorbents and reduce the effectiveness of certain CO_2 capture processes;
> - Compressing captured or separated CO_2 from atmospheric pressure to pipeline pressure (about 2,000 psia) represents a large auxiliary power load on the overall power plant system."[17]

If CO_2 capture can be achieved at a power plant, the collected volume would need to be routed to a geologic formation capable of long-term storage. Due to the volume of CO_2 generated by the proposed project, the captured gas would need to be transported to a potential storage site via a pipeline. The DOE-NETL describes the geologic formations that could potentially serve as CO_2 storage sites as follows:

> " . . . The majority of geologic formations considered for CO_2 storage, deep saline or depleted oil and gas reservoirs, are layers of porous rock underground that are "capped" by a layer or multiple layers of non-porous rock above them. Sequestration practitioners drill a well down into the porous rock and inject pressurized CO_2. Under high pressure, CO_2 turns to liquid and can move through a formation as a fluid. Once injected, the liquid CO_2 tends to be buoyant and will flow upward until it encounters a barrier of non-porous rock, which can trap the CO_2 and prevent further upward migration. Coal seams are another formation considered a viable option for geologic storage, and their storage process is a slightly different. When CO_2 is injected into the formation, it is adsorbed onto the coal surfaces, and methane gas is released and produced

[16] Report of the Interagency Task Force on Carbon Capture and Storage at Page 123 (Aug. 2010).
[17] NETL: Carbon Sequestration - Core R&D http://www.netl.doe.gov/technologies/carbon_seq/corerd/corerd.html

in adjacent wells. There are other mechanisms for CO_2 trapping as well: CO_2 molecules can dissolve in brine and react with minerals to form solid carbonates; or adsorb in the pores of the porous rock. The degree to which a specific underground formation is amenable to CO_2 storage can be difficult to discern . . ."[18]

The technical feasibility of the three steps needed to implement CCS is discussed below:

Capture and Compression - Although amine absorption technology has been applied for CO_2 capture in the petroleum refining and natural gas processing industries, it is not yet commercially available for power plant gas turbine exhausts, which have much larger flow volumes and low CO_2 concentrations. The Obama Administration's Interagency Task Force on Carbon Capture and Storage confirmed this conclusion in its recently completed report on the current status of development of CCS systems:

> "Current technologies could be used to capture CO_2 from new and existing fossil energy power plants; however, they are not ready for widespread implementation primarily because they have not been demonstrated at the scale necessary to establish confidence for power plant application. Because the CO_2 capture capacities used in current industrial processes are much smaller than the capacity required for the purposes of GHG emissions mitigation at a typical power plant, there is considerable uncertainty associated with capacities at volumes necessary for commercial deployment."

CO_2 Transport - Even if it is assumed that CO_2 capture and compression could feasibly be achieved for the proposed project, the large quantity of material generated would need to be transported to a facility capable of storing it. Geological formations suitable for long term storage must provide a depth below the ground surface that is sufficient to provide the temperatures and pressures needed to maintain CO_2 in a supercritical state. Other factors such as a low permeability cap rocks and host rocks that can provide for the formation of stable minerals or the presence of deep saline formations are also required. The USGS is conducting studies to identify suitable geologic formations in the Eastern United States, but has not completed the work. The most promising formations appear to be in Southwest Virginia[19], far from the Rockingham Station. A pipeline suitable for transporting CO_2 from the Rockingham County facility is not currently available, thereby making CCS infeasible for this project.

CO_2 Storage - Even if it is assumed that CO_2 capture and compression could feasibly be achieved in this instance, and that the CO_2 could be transported economically, the feasibility of CCS would still depend on the availability of a sequestration site. Further research is needed to determine whether or not deep saline formations suitable for storage exist in reasonable proximity to the Rockingham County facility. Additionally, even if it is assumed that CO_2 could be transported economically to a sequestration site, there are potential environmental impacts that would still require assessment before CCS technology can be considered feasible. These include:

[18] NETL: Carbon Sequestration - Core R&D http://www.netl.doe.gov/technologies/carbon_seq/corerd/corerd.html
[19] Virginia Department of Mines, Minerals and Energy - Division of Geology and Mineral Resources

- Uncertainty concerning the significance of dissolution of CO_2 into brine;
- Risks of brine displacement resulting from large-scale CO_2 injection, including a pressure leakage risk for brine into underground drinking water sources and/or surface water; and
- Risks to fresh water as a result of leakage of CO_2, including the possibility for damage to the biosphere, underground drinking water sources, and/or surface water.

In December 2018, EPA proposed to amend 40 CFR 60 Subpart TTTT, the federal Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units (EGUs). In the Federal Register notice proposing these amendments, EPA concluded "…that CCS is not adequately demonstrated in certain key respects…" including availability of geologic sequestration sites, the scarcity of water needed for CCS in certain areas of the country, and ongoing issues with successful demonstration of carbon capture technologies. Accordingly, the Agency revised its previous conclusion that partial CCS represented the best system of emission reduction (BSER) for control of GHG emissions from newly constructed EGUs. [20]

CCS is not technically feasible for the Rockingham County facility based on the factors noted above and because this technology has not been demonstrated in practice for a combustion turbine-based power plant. Even if CCS was technically feasible, this technology could not be considered representative of BACT due to unacceptable cost and energy impacts. The US DOE has estimated that CCS applied to a combustion turbine-based power plant would more than double the total plant cost and increase the levelized cost of electricity by 45%.[21] The net result would be a cost effectiveness in excess of $100/ton of CO_2 controlled.[22] In addition, CCS would consume 20% of the power plant energy output. The energy requirement of CCS is unacceptable and would result in increased emissions of NO_x and other pollutants.

Low Carbon Fuels

GHG emissions from fuel combustion depend on the carbon content of the fuel. GHG emissions from firing natural gas and distillate oil are among the lowest contributors on a heat input basis.

A search of the RBLC was conducted to identify recently-permitted large natural gas- or distillate oil-fired simple-cycle combustion turbines with BACT determinations for GHGs. The results of this search are provided in Appendix C, BACT Table 5. A total of 31 natural gas-fired units that meet these criteria were identified. The measures concluded to be representative of BACT are identified in 19 of these listings; seven of these listings describe BACT as being the use of low carbon or low-emitting fuels.

Energy Efficiency/Good Combustion Practices

Turbine design, energy efficiency, or good combustion practices are listed as being representative of BACT in twelve of the 31 large simple-cycle combustion turbine listings in the RBLC with limits on GHGs.

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[20] USEPA, 83 FR 65441, December 20, 2018

[21] http://www.netl.doe.gov/energy-analyses/pubs/BitBase_FinRep_Rev2.pdf at Page 5

[22] Report of the Interagency Task Force on Carbon Capture and Storage at Page 123 (Aug. 2010). http://www.epa.gov/climatechange/downloads/CCS-Task-Force-Report-2010.pdf.

5.6.2 Steps 2 and 3 – Technical Feasibility Analysis and Ranking of GHG Control Alternatives

The use of low carbon fuels and good combustion practices are the only technically feasible GHG emissions controls for existing simple-cycle combustion turbines. Accordingly, these measures are considered the most stringent available alternatives.

5.6.3 Steps 4 and 5 – GHG Control Effectiveness Evaluation and Proposed BACT

CCS is not technically feasible for the simple cycle combustion turbines at the Rockingham County facility. The proposed BACT for GHGs is the use of low carbon fuels and proper operation of the turbines (good combustion practices) and an emission rate of 117 lb CO_2/MMBtu when firing natural gas. The proposed GHG BACT for this project is consistent with recent BACT determinations that are summarized in Appendix C, BACT Table 5.

6.0 AIR QUALITY MODELING ANALYSIS

The dispersion modeling analyses conducted for the project adheres to the United States Environmental Protection Agency (US EPA) "Guideline on Air Quality Models" (GAQM, which is contained in 40 CFR 51, Appendix W) (EPA 2017), *North Carolina PSD Modeling Guidance* (NC DAQ 2012), direction received from the NCDEQ Division of Air Quality (DAQ), and with the air dispersion modeling protocol submitted to DAQ on November 26, 2018. The following sections present the source data modeled, the procedures used for assessing ambient air impacts from the project's emissions, the standards to which the predicted impacts were compared, and the results of the analyses.

The location of the facility is provided in Figures 6-1 and 6-2. Figures 6-1 and 6-2 show the local land use and topography around the Station. The land use is generally very rural with agriculture and forested areas. The topography is generally rolling hills with terrain below stack top with the exception of some taller hills approximately 2 kilometers to the southwest.

6.1 Introduction

The proposed project triggers PSD review for NO_2, CO, VOC, PM, PM_{10}, and $PM_{2.5}$; therefore, a dispersion modeling analysis is required for these pollutants. Modeling analyses were performed to evaluate compliance with applicable PSD increments for these pollutants and compliance with the NAAQS. Although potential PM, CO_2e, and VOC emissions trigger PSD review, there are no NAAQS or PSD increments for these regulated pollutants, so modeling was not performed for them. The project's impact on VOC, however, was addressed with the ozone impact analysis as described in Sections 6.7 and 6.10. The modeling also addresses impacts associated with secondary $PM_{2.5}$ as appropriate (See Section 6.7 and 6.10).

North Carolina still has a state ambient air quality standard (SAAQS) for total suspended particulate (TSP). The *North Carolina PSD Modeling Guidance* states that, "NC requires that TSP (i.e., < 100 micron size particles) be modeled as a part of the state SAAQS demonstration. The SAAQS demonstration is not necessary if all particulate emissions fall into the more conservative PM_{10} size category." Total PM, PM_{10}, and $PM_{2.5}$ emission factors used in the PSD applicability calculations are all equal to each other. Therefore, the TSP and PM_{10} emissions are equal and the SAAQS demonstration for TSP is not required.

Maximum modeled concentrations due to the difference between projected actual emissions and baseline emissions for Units 1, 2, 3, 4, and 5 were compared to the Significant Impact Levels (SILs), which are shown in Table 6-1. For those pollutants with modeled concentrations below the applicable SIL, no additional analyses were necessary since, by definition, the pollutant could not cause or contribute to a NAAQS violation or an exceedance of a PSD increment. For this analysis, as will be shown in Section 6.8, all modeled concentrations are less than their respective SILs.

Table 6-1. Criteria Pollutant Class II Significant Impact Levels

Pollutant	Averaging Period	SIL (µg/m3) [1]
CO	1-hour	2,000
	8-hour	500
NO_2	1-hour	10
	Annual	1
PM_{10}	24-hour	5
	Annual	1
$PM_{2.5}$ [2]	24-hour	1.2
	Annual	0.2

1. *North Carolina PSD Modeling Guidance, January 6, 2012, Table 4-1.*
2. *Guidance on Significant Impact Levels for Ozone and Fine Particulates in The Prevention of Significant Deterioration Permitting Program, USEPA, April 17, 2018, Table 1.*

6.2 Source Data

The air dispersion modeling analysis was conducted with flue gas exhaust characteristics (flow rate and temperature), corresponding to the worst-case stack parameters for natural gas combustion, over varying loads (Peak, Base, 75%, and 70%), for the combustion turbines associated with this project (Table 6-2). No changes will be made to existing stack parameters for this project.

Table 6-2. PSD Dispersion Modeling Stack Parameters

Source ID	Source Description	Base Elevation (m)	Stack Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
NGCT1	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbine (ES-CT-1)	247.8	18.3	866.72	30.163	7.0
NGCT2	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbine (ES-CT-2)	247.8	18.3	866.72	30.163	7.0
NGCT3	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbine (ES-CT-3)	247.8	18.3	866.72	30.163	7.0
NGCT4	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbine (ES-CT-4)	247.8	18.3	866.72	30.163	7.0
NGCT5	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbine (ES-CT-5)	247.8	18.3	866.72	30.163	7.0

6.3 Air Dispersion Model Selection

The suitability of an air quality dispersion model for a particular application is dependent upon several factors.

The following selection criteria were evaluated:

- stack height relative to nearby structures;
- dispersion environment;
- local terrain; and
- representative meteorological data.

The US EPA GAQM (2017) prescribes a set of approved models for regulatory applications for a wide range of source types and dispersion environments. Based on a review of the above factors as discussed below, the latest version of AERMOD (18081) was used to assess air quality impacts for the project.

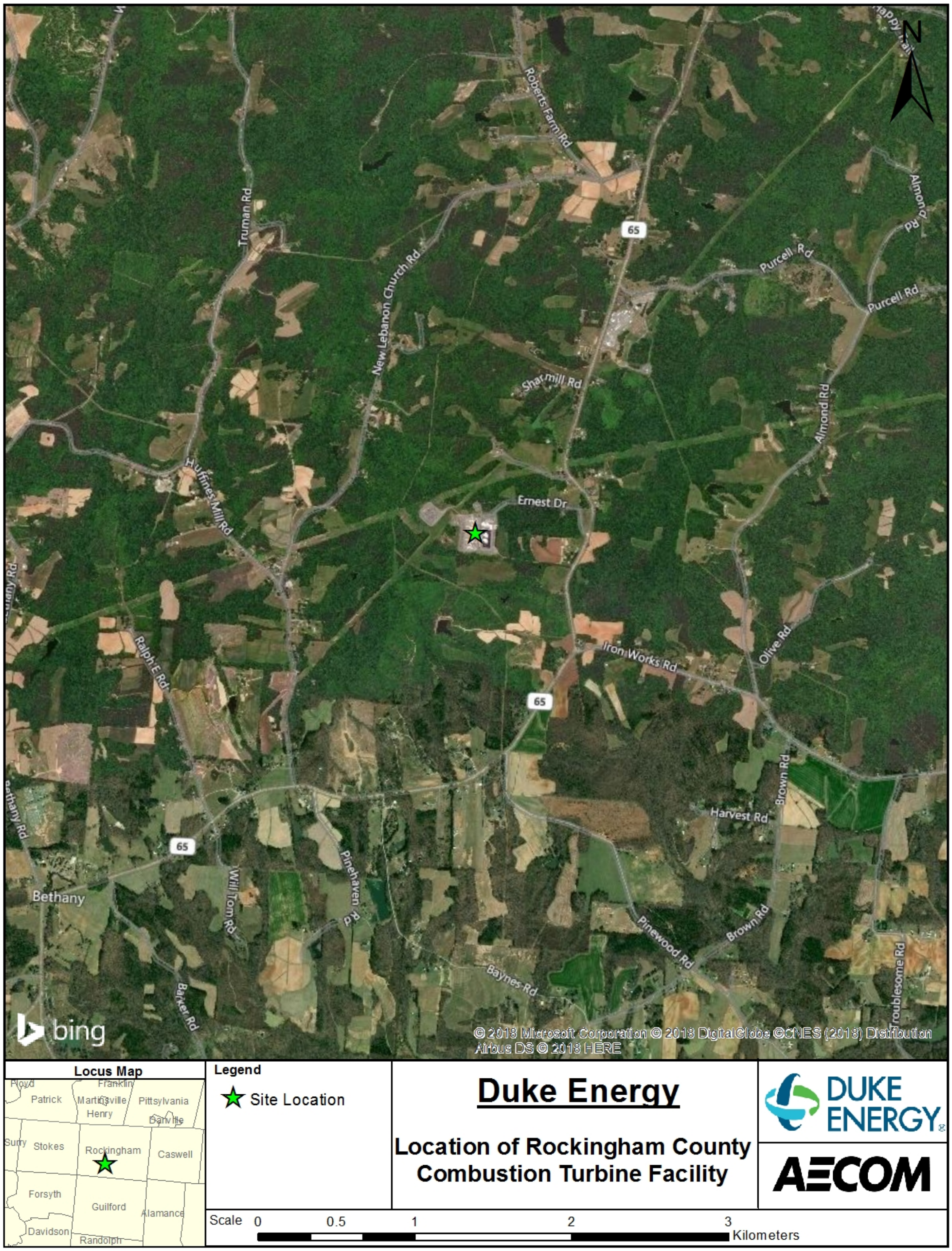

Figure 6-1. Location of Rockingham County Combustion Turbine Facility (Aerial)

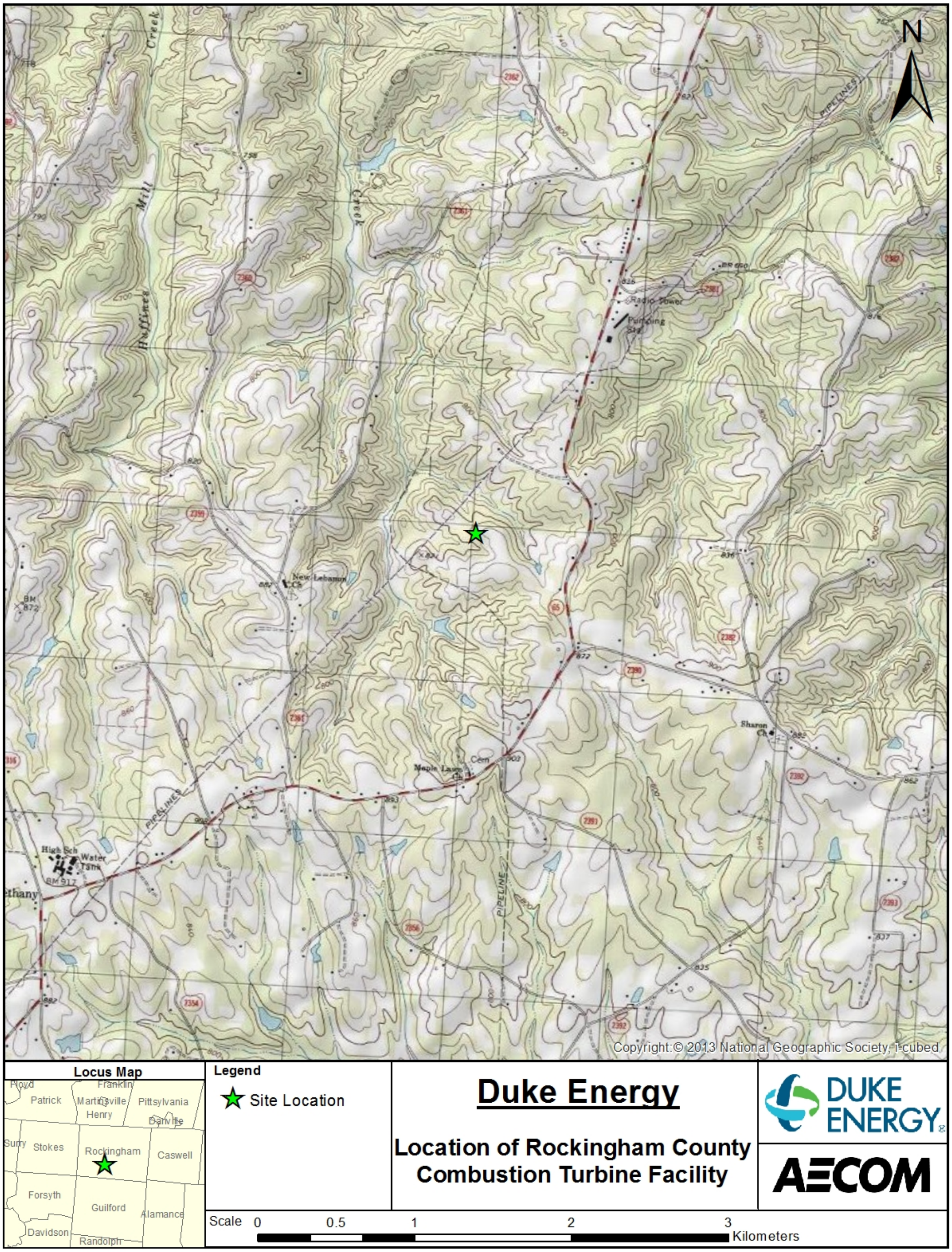

Figure 6-2. Location of Rockingham County Combustion Turbine Facility (Topography)

6.4 Meteorological Data

DAQ guidance suggests that for projects in southern Rockingham County, data from the Piedmont-Triad International Airport should be considered representative. Therefore, a five-year meteorological data set (2013-2017) of surface and upper-air sounding meteorological data from the Piedmont-Triad International Airport, Greensboro NC (Station No. 13723) was used in the modeling analysis.

The meteorological data files were prepared by DAQ using AERMET (Version 18081) and were obtained from DAQ's website[23]. A five-year wind rose is provided as Figure 6-3.

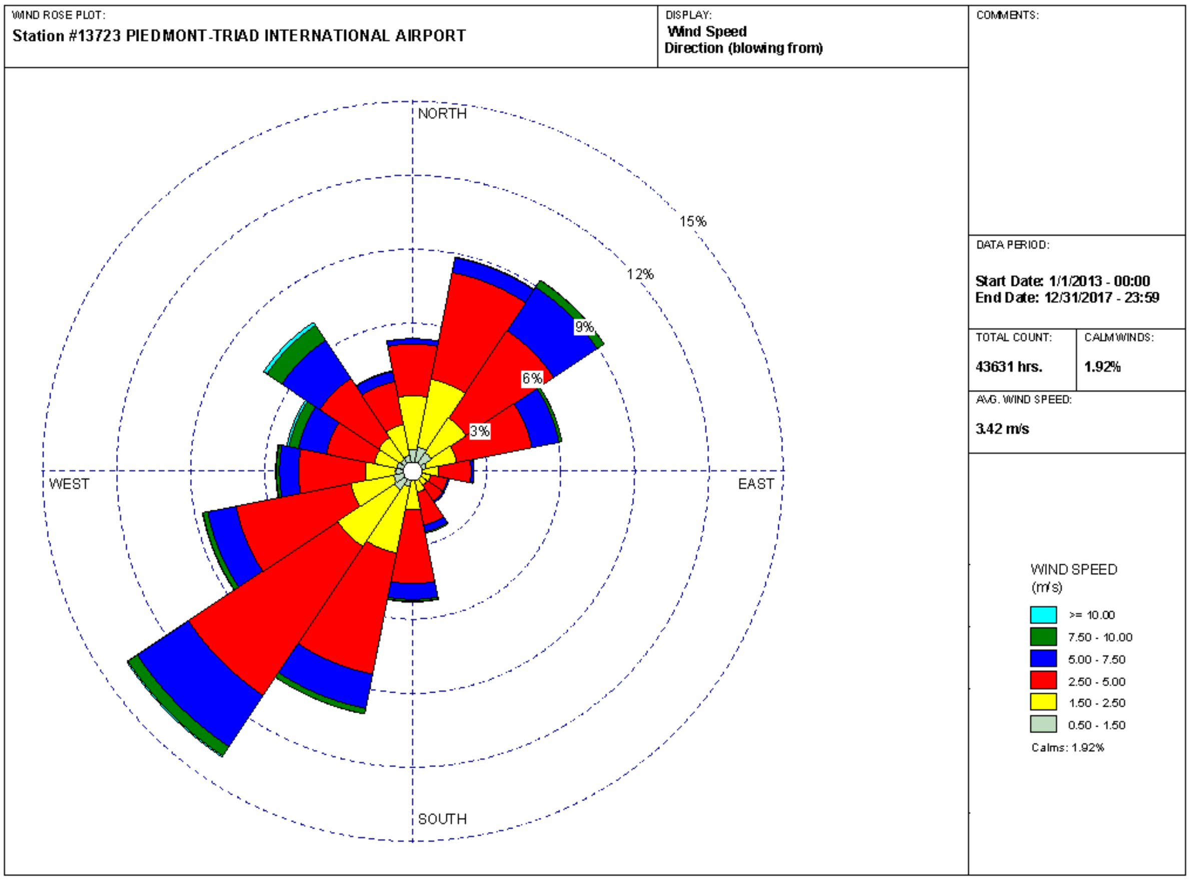

Figure 6-3. Wind Rose for Piedmont-Triad International Airport (2013-2017)

6.5 Good Engineering Practice (GEP) Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis was performed based on the facility building/stack configuration to determine the potential for building-induced aerodynamic downwash for all modeled stacks. The analysis procedures described in US EPA's *Guidelines for Determination of Good Engineering Practice Stack Height* (EPA 1985), Stack Height Regulations (40 CRF 51), and current Model Clearinghouse guidance was used.

[23] https://deq.nc.gov/about/divisions/air-quality/air-quality-permits/modeling-meteorology/meteorological-data

The GEP formula height is based on the observed phenomena of disturbed atmospheric flow in the immediate vicinity of a structure resulting in higher ground level concentrations at a closer proximity to the building than would otherwise occur. It identifies the minimum stack height at which significant aerodynamic downwash is avoided. The GEP formula stack height, as defined in the 1985 final regulations, is calculated from:

$$H_{GEP} = H_{BLDG} + 1.5L$$

Where:

- H_{GEP} is the maximum GEP stack height
- H_{BLDG} is the height of the nearby structure, and
- L is the lesser dimension (height or projected width) of the nearby structure

For a squat structure, i.e., height less than projected width, the formula reduces to:

$$H_{GEP} = 2.5H_{BLDG}$$

Both the height and width of the structure are determined from the frontal area of the structure projected onto a plane perpendicular to the direction of the wind. In all instances, the GEP stack height is based on the plane projections of any nearby building which result in the greatest justifiable height. For purposes of the GEP analysis, nearby refers to the "sphere of influence", defined as five times the height or width of the building, whichever is less, downwind from the trailing edge of the structure. In the case where a stack is not influenced by nearby structures, the maximum GEP stack height is defined as 65 meters.

All stacks at the Facility are less than 65 meters. As such, they were modeled with their actual stack heights.

In addition, the US EPA's Building Profile Input Program (BPIP-Version 04274) version that is appropriate for use with PRIME algorithms in AERMOD was used to incorporate downwash effects in the model for all modeled stacks. The stack locations and building dimensions of each structure were input in BPIPPRM program to determine direction specific building data. PRIME addresses the entire structure of the wake, from the cavity immediately downwind of the building, to the far wake.

Figure 6-4 presents the Rockingham County facility layout of buildings and sources included in the BPIP analysis. BPIP input and output files are provided in the modeling archive as part of Appendix E.

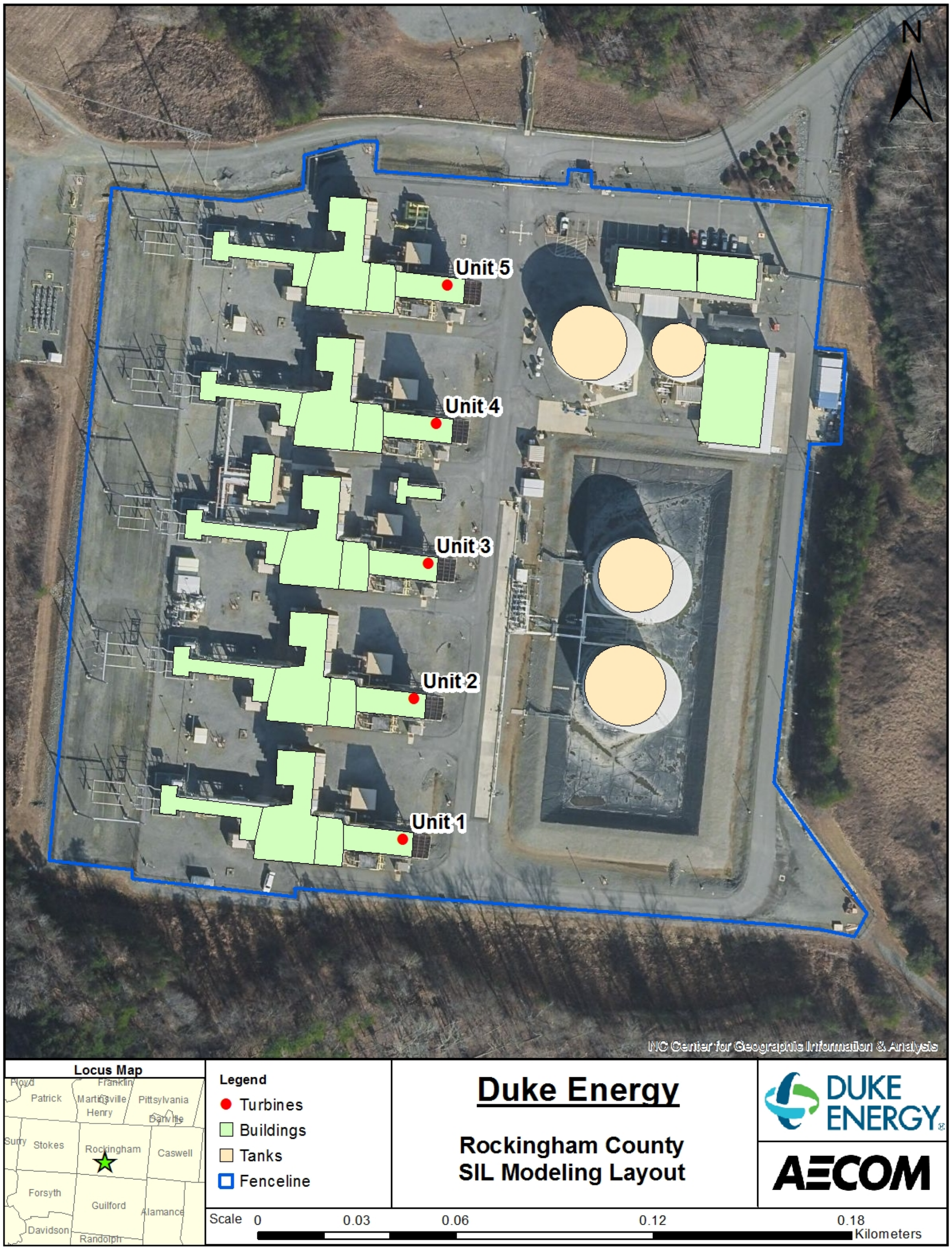

Figure 6-4. Stacks and Buildings Used for the BPIP Analysis

6.6 Receptors

The Class II area receptor grid consists of receptors spaced 25 meters (m) apart along the fence line which delineates ambient air from non-ambient air. A spacing of 50 m was used for the receptors beyond the fence line and extending out to 1 km from the fence line. Beyond 1 km from the fence line, a spacing of 100 m was used up to 3 km from the Station. Between 3 and 5 km, a spacing of 250 m was used. Between 5 and 10 km, a spacing of 500 m was used. Between 10 and 20 km, a spacing of 1000 m was used. The receptor grid used in the modeling analysis was based on NAD 83 datum and in zone 17. Figures 6-5 and 6-6 illustrate the near and far-field receptor grids used for modeling the project.

The extent of this grid was sufficient to capture maximum modeled concentrations in the Class II areas. All maximum modeled concentrations were also located in areas of 100 m receptor spacing.

AERMAP (version 18081), the AERMOD terrain preprocessor program, was used to calculate terrain elevations and critical hill heights for the modeled receptors (NAD83 datum and zone 17) using National Elevation Data (NED). The dataset that was downloaded from the Multi-Resolution Land Characteristics Consortium (MRLC)[24] consisted of 1 arc second (~30 m resolution) NED.

[24] https://www.mrlc.gov/viewerjs/

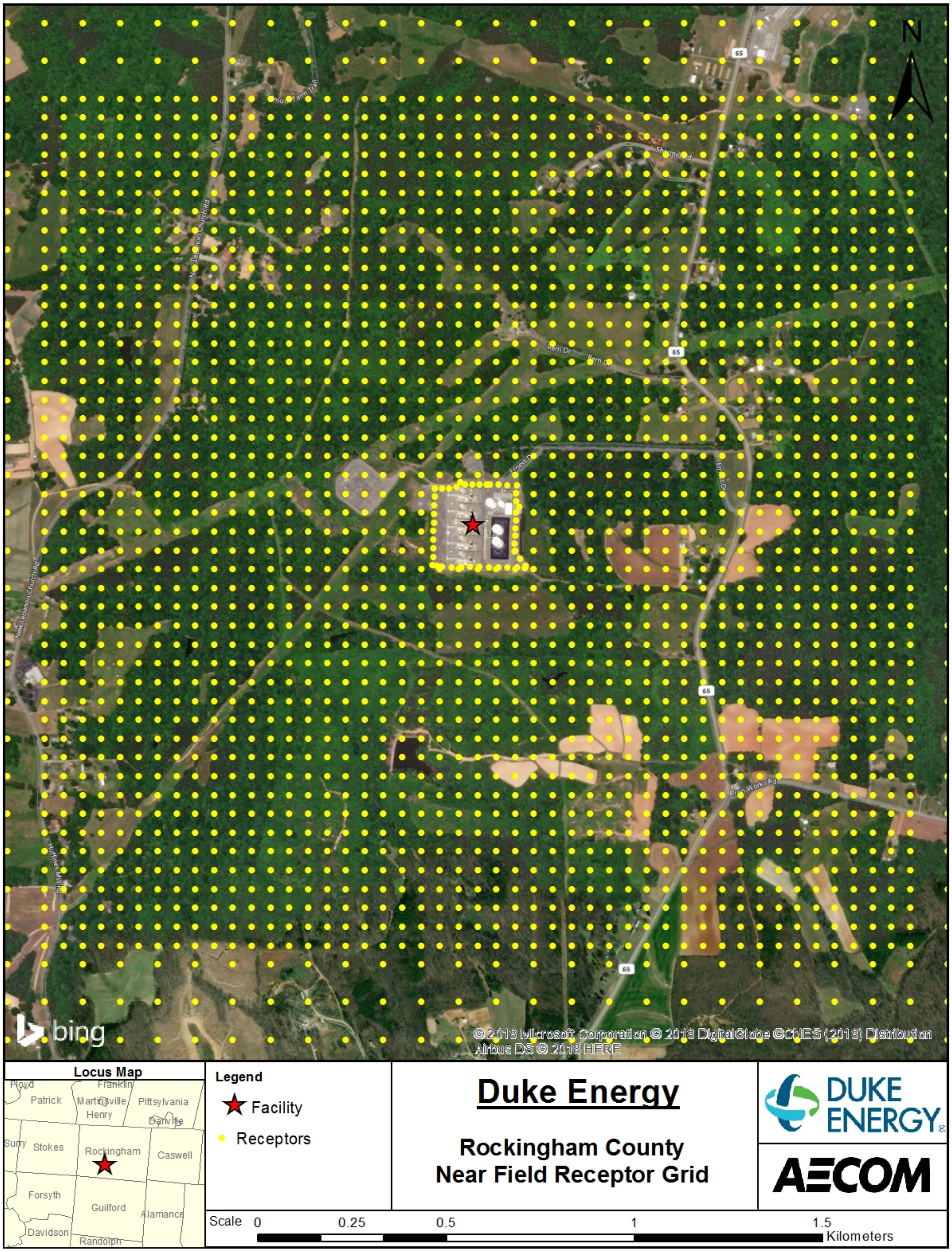

Figure 6-5. Near-field Receptors Used in the Modeling Analysis

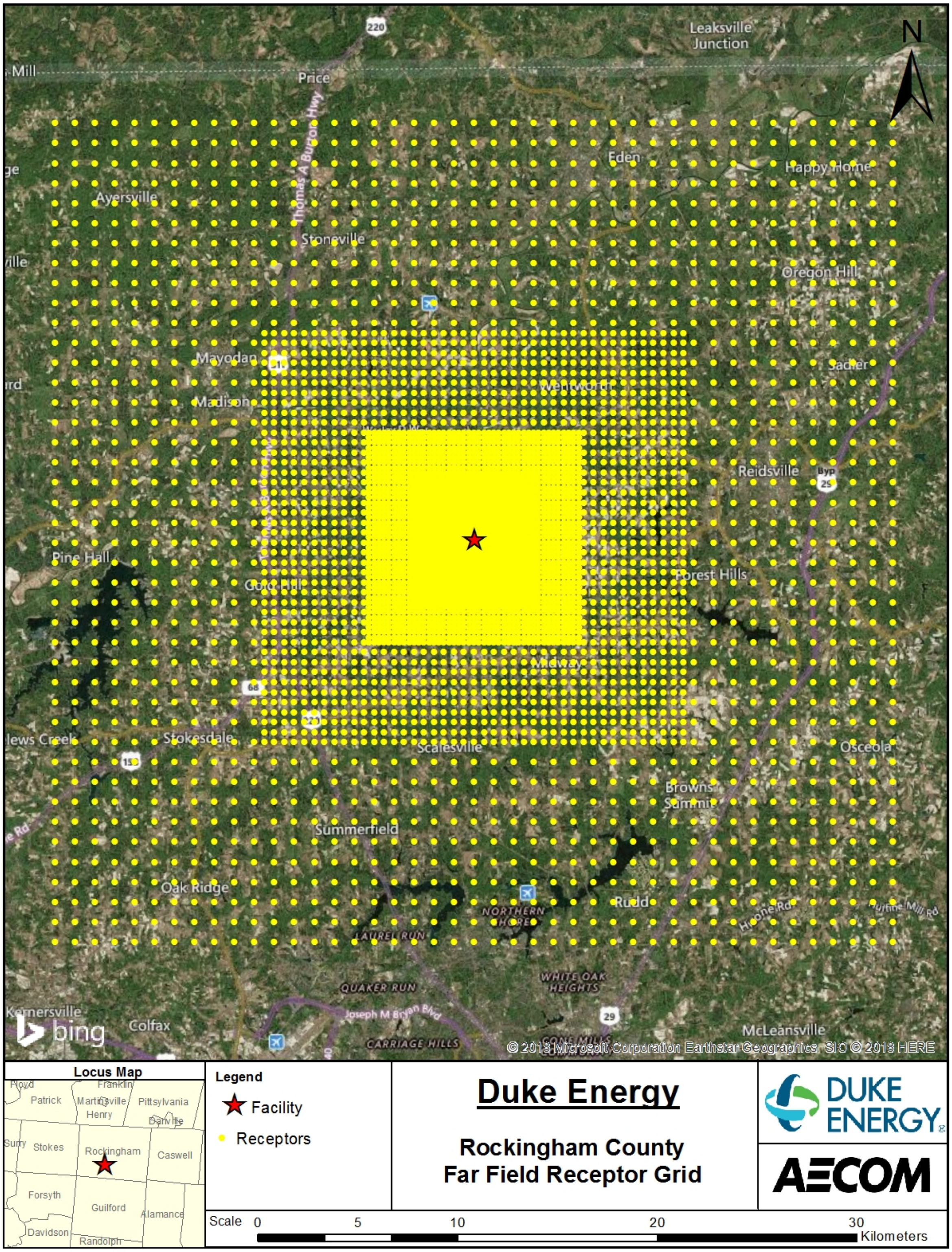

Figure 6-6. Far-field Receptors Used in the Modeling Analysis

6.7 Class II Area Modeling Analyses

A refined modeling analysis was conducted using AERMOD (version 18081). The analysis was conducted to demonstrate compliance with state and federal applicable ambient air quality standards.

6.7.1 Class II Area Preliminary Impact Air Quality Analysis

The Preliminary Impact Air Quality Analysis consisted of a Class II area SIL analysis conducted using five years of airport meteorological data as described in Section 6.4, and emissions consisting of the difference between the projected actual emissions and baseline emissions for CT1 through CT5 (Table6-3). This modeling analysis was used to make a determination of significance for CO, NO_2, PM_{10}, and $PM_{2.5}$. For the 1-hour NO_2 standard, the determination of significance was made using the highest maximum daily 1-hour modeled concentration averaged over the five years of meteorological data modeled. For CO, significance was determined based on the highest 1-hour and 8-hour modeled concentrations over the five years modeled. For annual NO_2 and PM_{10}, the determination of significance was made using the highest annual modeled concentration over the five years of meteorological data modeled. For 24-hour PM_{10}, as well as, annual and 24-hour $PM_{2.5}$, significance was determined based on the highest 5-year average concentrations.

Table 6-3. SIL Analysis Modeled Emission Rates

Source ID	CO (g/s)	NO_2 (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)
NGCT1	9.25	8.82	0.47	0.52
NGCT2	9.22	8.75	0.46	0.51
NGCT3	9.30	8.90	0.47	0.52
NGCT4	9.11	8.32	0.45	0.51
NGCT5	9.19	8.72	0.46	0.51

A comparison of the overall maximum modeled concentrations with the SILs is presented in Table 6-4. As is depicted in Table 6-4 all modeled concentrations are below their respective SILs. As such, no further analyses were required. The NO_2 modeling for this analysis was performed using a Tier 3 method and is explained in the following section.

Table 6-4. Summary of Maximum AERMOD Concentrations to Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration μg/m³)	SIL	Significant? (Yes or No)
CO	1-hour	9.3	2,000	N
	8-hour	4.9	500	N
NO_2	1-hour	9.7	10	N
	Annual	0.2	1	N
PM_{10}	24-hour	0.3	5	N
	Annual	0.02	1	N
$PM_{2.5}$	24-hour	0.2	1.2	N
	Annual	0.02	0.2	N

6.7.1.1 Conversion of NO to NO_2

Based on current guidance, NO_2 impacts can be determined by using a 3-tiered NO_x to NO_2 conversion rate system, where:

- Tier 1 assumes 100 percent NO to NO_2 conversion;
- Tier 2 utilizes the Ambient Ratio Method 2 (ARM2);
- Tier 3 allows the use of refined techniques such as the Ozone Limiting Method (OLM) or the Plume Volume Molar Ratio Method (PVMRM).

For this project, 1-hour NO_2 modeled concentrations were assessed using the EPA default Tier 3 PVMRM methodology for estimating NO_2 concentrations from total NO_x emissions. The PVMRM method was chosen for its suitability for this project. According to GAQM (4.2.3.4.e), “PVMRM works best for relatively isolated and elevated point source modeling.” Modeling for this project, includes just the five elevated and highly buoyant turbine stacks. These stacks are located close to each other and no other sources were included in the SIL modeling. This Tier 3 method is now a part of the EPA’s preferred modeling approach for NO_2[25].

One important input required for PVMRM, is the NO_2/NO_x in-stack ratio. Duke Energy obtained NO_2/NO_x in-stack ratio data from a test performed on similar Siemens turbines at another facility in 2004. The tested turbines were of the same frame and used the same combustors as the Duke Rockingham turbines. The data in Table 6-5 below shows in-stack ratios from 10-12%. Based on this data, a more representative in-stack ratio of 15%, and the default equilibrium ratio of 0.9 was selected for this application.

[25] http://www.cleanairinfo.com/regionalstatelocalmodelingworkshop/archive/2017/Presentations/1-7_2017_RSL-NO2_Implementation.pdf

Table 6-5. NO_2/NO_x In-Stack Ratios for a Similar Turbine

Turbine	Load	Test Date	NO_2/NO_x
Unit 1	Base	Feb. 15, 2004	11%
	90%	Feb. 15, 2004	11%
	80%	Feb. 15, 2004	11%
	70%	Feb. 15, 2004	12%
Unit 2	Base	Feb. 11, 2004	10%
	90%	Feb. 12, 2004	11%
	80%	Feb. 12, 2004	10%
	70%	Feb. 12, 2004	11%

In addition, the application of PVMRM to estimate NO_2 concentrations requires the input of ozone data that is representative of the modeling domain. The AERMOD model uses either a single representative background ozone value for all hours of simulation or varying hourly background ozone data as collected from representative ozone monitors.

Hourly background ozone data was obtained from the Bethany School ozone monitor (37-157-0099), located 3.5 kilometers to the southwest, for the years 2013-2017. This monitor operated during the ozone season (April-October) during this period; therefore, a suitable year-round monitor was needed to augment the data for the non-ozone season. The Rockwell monitor (37-159-0021) data was used for the non-ozone season as it is the closest year-round ozone monitor to the facility.

Written guidance titled *Filling Missing Ozone Data for OLM and PVMRM Applications,*[26] developed by the Minnesota Pollution Control Agency (MPCA), was used for filling in missing hours of ozone data. For single missing hours, simple interpolation in the form of an average of the preceding and following hours was employed to fill in the data. For multiple consecutive hours of missing data, the missing hours were filled with maximum monthly/hourly values to capture both seasonal and diurnal ozone variability. This was accomplished by determining the maximum concentration for each hour for each month; the missing data was then filled with these values based on the month and hour of the missing data.

6.8 Preconstruction Ambient Monitoring Data

The PSD regulations require that a PSD permit application contain an analysis of existing air quality for all regulated pollutants that the source has the potential to emit in significant amounts. The definition of existing air quality can be satisfied by air measurements from either a state-operated or private network, or by a pre-construction monitoring program that is specifically designed to collect data in the vicinity of the proposed source. To fulfill the pre-construction monitoring requirement for PSD without conducting on-site monitoring a source may either:

[26] https://www.pca.state.mn.us/sites/default/files/aq2-69.pdf

1. Justify that data collected from existing monitoring sites are conservatively representative of the air quality in the vicinity of the proposed project site;

2. Demonstrate through modeling the ambient impacts from the proposed project are less than the de minimis levels established by the EPA (see Table 6-6).

For this project, modeled concentrations were compared to the de minimis monitoring concentrations. Table 6-6 shows the modeled concentrations along with the de minimis monitoring concentrations for each pollutant and annual averaging period. The results in Table 6-6 show that all the project modeled concentrations (see Table 6-4) are below the de minimis monitoring concentrations. Therefore, preconstruction monitoring is not required for this project.

Table 6-6. De Minimis Monitoring Concentrations

Pollutant	Averaging Period	Modeled Concentration(1) ($\mu g/m^3$)	De Minimis Monitoring Concentration ($\mu g/m^3$)
CO	8-hour	4.9	575
NO_2	Annual	0.2	14
PM_{10}	24-hour	0.3	10
$PM_{2.5}$	24-hour	0.2	4

(1) Modeled concentration taken from Table 6-4.

6.9 Secondary $PM_{2.5}$ and Ozone

In December 2016, EPA released the draft Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program (EPA-454/R-16-006) [27] (EPA MERP Guidance). Section 7 of the draft EPA MERP Guidance provides several examples of MERP Tier 1 demonstrations for sources subject to PSD review. The examples focus on both secondary $PM_{2.5}$ and ozone precursor emissions and at what emission levels those precursors would result in a potential project insignificant impact, which would eliminate the need for project-specific modeling.

In January 2017 EPA released the draft Guidance on the Use of Models for Assessing the Impacts of Emissions from Single Sources on the Secondarily Formed Pollutants: Ozone and $PM_{2.5}$. This document, along with the December 2016 guidance, was utilized to develop the approaches used to assess the extent of analysis required for secondary $PM_{2.5}$ and ozone for this project as described below.

Secondary $PM_{2.5}$ - Approach

[27] https://www3.epa.gov/ttn/scram/guidance/guide/EPA454_R_16_006.pdf

For secondary $PM_{2.5}$, since the project has direct $PM_{2.5}$ emissions along with emissions increases of NO_X and SO_2 (secondary $PM_{2.5}$ precursors), EPA's example under Scenario D of the EPA MERP Guidance was utilized to demonstrate that secondary $PM_{2.5}$ due to project precursor emissions is relatively small and when combined with the direct $PM_{2.5}$, the total impact is still less than the 24-hour and annual $PM_{2.5}$ SIL. This demonstration was made by determining the percent of the critical air quality value (CAQV; e.g., the SIL) that is consumed by the direct modeled concentration plus the estimated secondary $PM_{2.5}$ concentration. The CAQVs utilized for this exercise was the EPA-recommended SILs for $PM_{2.5}$ of 0.2 $\mu g/m^3$ and 1.2 $\mu g/m^3$ for the annual and daily averaging periods, respectively. The percent of the CAQV for the direct and secondary $PM_{2.5}$ was then summed to show the total is less than 100 percent of the CAQV.

Secondary $PM_{2.5}$ - Results

The percentage of the CAQV for the direct $PM_{2.5}$ was estimated by dividing the AERMOD-modeled concentration by the $PM_{2.5}$ SIL. For this project the direct $PM_{2.5}$ concentration estimated using AERMOD was 0.02 $\mu g/m^3$ for the annual averaging period and 0.2 $\mu g/m^3$ for the daily averaging period (see Section 6.7). Given this direct modeled concentration, the percent CAQV for the direct modeled would be calculated using the following formulae:

0.02 $\mu g/m^3$ $PM_{2.5}$ annual from AERMOD / 0.2 $\mu g/m^3$ $PM_{2.5}$ annual SIL = .10 *100 (or 10%)

0.2 $\mu g/m^3$ $PM_{2.5}$ daily from AERMOD / 1.2 $\mu g/m^3$ $PM_{2.5}$ daily SIL = .17 *100 (or 17%).

The secondary contribution was calculated using the project precursor emissions of NO_x and SO_2 of 1,512.64 and 26.38 TPY respectively. Using the data for the Eastern US in Table 7.1 of EPA's MERP Guidance (Errata –released in February 2017), the lowest, most conservative illustrative MERP in the Eastern US that showed a modeled concentration below the annual $PM_{2.5}$ SIL was 10,144 TPY and 4,013 TPY, respectively for NO_x and SO_2. The most conservative illustrative MERP in the Eastern US for daily $PM_{2.5}$ was 2,295 TPY and 628 TPY, respectively for NO_x and SO_2. Using these values, along with the project's emissions and EPA's MERP Guidance in Scenario D, the percent of the CAQV would be determined using the following formulae:

(1,512.64 TPY NO_X from source/10,144 TPY NO_X annual $PM_{2.5}$ MERP) +
(26.38 TPY SO_2 from source/4,013 TPY SO_2 annual $PM_{2.5}$ MERP) = .15 + .007 = .16 * 100 = 16%

(1,512.64 TPY NO_X from source/2,295 TPY NO_X daily $PM_{2.5}$ MERP) +
(26.38 TPY SO_2 from source/628 TPY SO_2 daily $PM_{2.5}$ MERP) = .66 + .04 = .70 * 100 = 70%.

For annual $PM_{2.5}$, combining the 10% of the CAQV from the direct modeled concentration and the 16% from the secondary estimated concentration shows that the combined $PM_{2.5}$ impact for the annual averaging period is less than 100%. For daily $PM_{2.5}$, combining the 17% of the CAQV from the direct modeled concentration and the 70% from the secondary estimated concentration shows that the combined $PM_{2.5}$ impact for the daily averaging period is less than 100%. As such, for this project, the secondary $PM_{2.5}$ will not create any issues with NAAQS compliance.

Ozone - Approach

For ozone, the project emission increases of NO_X exceed the lowest MERP of 170 TPY developed by EPA in their December 2016 MERP Guidance (Table 7-1) for sources located in the Eastern US. Project emission increases of VOC are below the most stringent EPA MERP of 948 TPY for sources located in the Eastern US, however the combined impact of NO_X and VOC was evaluated.

As EPA has noted in its MERP Guidance, the Tier 1 approach for estimating ozone concentrations from new proposed sources could utilize estimates based upon existing modeling information. The MERPs are one form of the Tier 1 approach for which estimated concentrations below the SILs for various source types and emission strengths throughout the country are sufficient grounds to exempt the source from modeling. However, if the project emissions are above the MERPs, then the Tier 1 information should be considered a relevant and conservative indicator of the source's impact for the PSD assessment without the need for new modeling if the result is acceptable.

In the January 2017 Guidance on the Use of Models for Assessing the Impacts of Emissions from Single Sources on the Secondarily Formed Pollutants: Ozone and $PM_{2.5}$, EPA suggests that a Tier I type of demonstration could be developed for a project using the following: (1) existing modeling data, (2) the relationship of the modeled precursor emissions and resultant ozone concentrations of that model, and (3) the project precursor emissions. In this case, the project could extrapolate their ozone concentration based on the modeled ozone concentration and a ratio of the project emissions over the modeled emissions. This would provide a very conservative estimate of the project-specific modeled ozone concentration. This project-specific ozone concentration would then be added to a representative monitor design value to estimate the total ozone concentration post-construction of the project to show an impact less than 70 ppb (the 8-hour Ozone NAAQS).

For this application, the modeling results found in Appendix A of EPA's MERP Guidance that provides estimated ozone concentrations for hypothetical sources was used as a Tier 1 approach to estimate the project's ozone concentration, as described above.

In order to determine the project's ozone concentration, two hypothetical sites modeled by EPA with resultant maximum modeled ozone concentrations found in Appendix A of EPA's MERP Guidance were considered. The resultant EPA-modeled ozone concentrations for these two sites along with their modeled precursor emission levels are provided in Table 6-7. The two sites selected are located in Dinwiddie County, Virginia and Ashe County, North Carolina. These two sites were selected because they are located approximately the same distance in opposite directions from the facility in areas with similar land use (mainly agricultural). The terrain in Ashe County more closely resembles that in the area surrounding the facility. In addition, they show similar resulting ozone concentrations given identical modeled emissions levels. Since this is an elevated source, the EPA results for the "H" source were utilized.

Table 6-7 shows the combined project ozone concentration for each site by scaling the EPA modeled ozone concentration by a ratio of NO_X and VOC project emissions over the EPA-modeled emissions, respectively. Table 6-7 shows the project ozone concentrations estimated from each site. The highest value of 3.3 ppb was chosen for the analysis.

The project maximum modeled concentration would then be added to the design concentration from a representative monitor. There is one ozone monitor 3.5 km southwest of the project location. This data is summarized in Table 6-8.

Table 6-7. Project Estimated Ozone Concentrations

Hypothetical Source	NO_X				VOC				Project Ozone Modeled Concentration (ppb)
	EPA Precursor Emissions (TPY)	EPA Modeled Concentration (ppb)	Project Precursor Emissions (TPY)	Project Modeled Concentration (ppb)	EPA Precursor Emissions (TPY)	EPA Modeled Concentration (ppb)	Project Precursor Emissions (TPY)	Project Modeled Concentration (ppb)	
Dinwiddie, VA	3,000	6.59	1,512.64	3.3	500	0.07	86.38	0.01	3.3
Ashe, NC	3,000	6.34	1,512.64	3.2	500	0.03	86.38	0.01	3.2

Table 6-8. 8-Hour Ozone Design Values for 2015

Monitor	Distance from Facility (km)	Year	High 4th High Concentration (ppb)	Design Concentration (3-year average) (ppb)
Bethany School 37-157-0099 Rockingham County, NC	3.5	2015	66	65
		2016	67	
		2017	64	

Ozone concentration data taken from the EPA Air Trends website (https://www.epa.gov/air-trends/air-quality-design-values)

Ozone - Results

Table 6-7 shows the estimated ozone concentration due to the project based on the data provided by EPA in Appendix A of their December 2016 MERP Guidance document and project-specific precursor emission rates of 1,512.64 TPY of NOx and 86.38 TPY of VOC. The highest concentration from among the two sites was chosen as the project-specific ozone concentration (3.3 ppb).

The closest, most representative background ozone monitor is the Bethany School Monitor (AQS Site ID: 37-157-0099) located in Rockingham County, approximately 3.5 kilometers southwest of the project. The three year (2015-2017) 8-hour Ozone NAAQS design value for this site is 65 ppb based on design value summaries from EPA[28]. Adding the project ozone concentration of 3.3 ppb to the 65 ppb results in a total concentration of 68.3 ppb, which is below the NAAQS of 70 ppb.

[28] https://www.epa.gov/sites/production/files/2018-07/ozone_designvalues_20152017_final_07_24_18.xlsx

This approach is conservative for the following reasons:

- The project-modeled value being derived from the MERP data is a highest modeled concentration, not a high 4th high consistent with the standard.
- The approach would assume that the highest project-modeled concentration derived using the MERP data occurs on the same days in which the highest monitor's design concentration occurred, which is a conservative paired-in time assumption.
- The Tier 1 approach also assumes that the location of the peak concentration prediction also coincides with the peak background ozone concentration

6.10 Additional Impacts Analysis

Pursuant to the federal PSD regulations, additional impact analyses must be addressed for projects subject to PSD review. The various components of the additional impact analyses are discussed below.

6.10.1 Class I Area Modeling Analysis

DAQ sent information on the project emission increases and the distances to Class I areas to the Federal Land Managers at the National Park Service (NPS), United States Forest Service (USFS), and United States Fish and Wildlife Service (FWS) to determine if they would require an AQRV analysis. We do not anticipate that a Class I AQRV analysis would be required for this project based on historical responses to similar projects. Therefore, the Class I area analysis addresses only PSD increment consumption at the following nearby Class I areas within 300 km of the project:

1. James River Face Wilderness Area at 142 km;
2. Linville Gorge Wilderness Area at 190 km;
3. Shenandoah National Park at 212 km; and
4. Shining Rock Wilderness Area at 288 km.

6.10.1.1 Class I PSD Increment Analysis

In accordance with Appendix W (Section 4.2.c.i), because AERMOD (Version 18081) was used for the project's nearfield assessment, it can be utilized as a screening-level analysis to estimate the project's potential for a significant modeled impact at the PSD Class I areas listed above. As such, AERMOD was used as a screening analysis with the meteorological data described in Section 6.4 and with a radial arc of receptors located 50 km from the proposed project. Receptors along the 50-km arc were placed every 1 degree and covered 360 degrees surrounding the facility.

The results of the PSD increment modeling are presented in Table 6-9. As shown in Table 6-9 all modeled concentrations are below their respective SILs. As such, no additional modeling is required.

Table 6-9. Class I Area — PSD Increment Modeling Results

Pollutant	Averaging Period	Maximum Modeled Concentration (µg/m³)	Class I SILs (µg/m³)	% of SILs
NO_2	Annual	0.065	0.1	65%
PM_{10}	24-hour	0.09	0.32	28%
	Annual	0.003	0.2	2%
$PM_{2.5}$	24-hour	0.06	0.27	22%
	Annual	0.003	0.05	6%

6.10.2 Growth

A growth analysis examines the potential emissions from secondary sources associated with the proposed project. While these activities are not directly involved in project operation, the emissions involve those that can reasonably be expected to occur; for instance, industrial, commercial, and residential growth that will occur in the project area due to the project itself. Secondary emissions do not include any emissions which come directly from a mobile source, such as emissions from the tailpipe of any on-road motor vehicle or the propulsion of a train (EPA 1990). They also do not include sources that do not impact the same general area as the source under review.

The proposed project is not expected to employ additional employees at this time. Therefore, secondary growth is not expected, and thus an analysis of such growth was not performed.

6.10.3 Soils and Vegetation

An analysis of the project's potential impact on soils and vegetation in the vicinity of the facility was performed in accordance with the procedures recommended in EPA's *A Screening Procedure for Impacts of Air Pollution Sources on Plants, Soils and Animals* (EPA-450/2-81-078) (EPA 1980).

The highest modeled concentrations of CO and NO_2 from this project were compared to the screening concentrations as shown in Table 6-10. As shown, the modeled concentrations are all well below their screening thresholds, therefore, no significant impacts on local vegetation is expected as a result of the project.

Table 6-10. Injury Threshold for Vegetation

Pollutant	Screening Averaging Period	EPA's 1980 Screening Concentration (µg/m³)(1)	Modeled Averaging Period	Maximum Modeled Concentration (µg/m³)	Over Screening Concentration? (Yes or No)
CO	1-week	1,800,000	1-hour	9.3	No
			8-hour	4.9	No
NO_2	4-hour	3760	1-hour	9.7	No
	Annual	94	Annual	0.2	No

(1) Source: "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals". EPA 450/2-81-078, December 1980.

6.10.4 Visibility Impairment

The PSD regulations require an evaluation of the impact of the project emissions on visibility. The primary pollutants responsible for visibility impairment are particulates and NO_x. A visibility analysis was conducted with US EPA's VISCREEN model for Haw River State Park in North Carolina. Haw River State Park is approximately 10 km south-southeast of the facility.

The analysis was conducted in accordance with US EPA's Workbook for Plume Visual Impacts Screening and Analysis (Revised) ("Workbook"; US EPA, 1992). The VISCREEN model was applied to estimate two visual impact parameters, plume perceptibility (ΔE) and plume contrast (C_p). Screening-level guidance indicates that values above 2.0 for ΔE and +/- 0.05 for C_p are considered perceptible.

The VISCREEN model Workbook offers two levels of analysis. Level 1 screening analysis is the most simplified and conservative approach employing worst-case default meteorological data. Level 2 analysis allows refinement of meteorological conditions and site-specific conditions such as complex terrain. Initially, the Level 1 analysis was conducted and indicated ΔE and C_p values were above the screening thresholds. Therefore, a Level 2 analysis was performed.

The Level 2 analysis was conducted with five years of surface observations and stability classes from the Piedmont-Triad International Airport in Greensboro, North Carolina. Terrain elevation differences between the stack top (266.09 m) and Haw River State Park maximum elevation within the sector (approximately 257 m) is less than 500 meters.

The source data required by VISCREEN are total NO_x emissions (1,512.64 tons/yr) and particulate emissions (88.97 tons/yr) for the project.

The 22.5 degree (°) wind direction sector that would transport emissions from the facility toward Haw River State Park chosen for the analysis, along with the closest distance from the park to the project site, are shown in Table 6-11. The location of Haw River State Park relative to the facility is shown in Figure 6-7.

Table 6-11. VISCREEN Level 2 Input Data

22.5° Wind Sector	Closest Distance to the Source (km)	Furthest Distance from the Source (km)	Level 2 Worst Case Stability Class	Level 2 Worst Case Wind Speed (m/s)
319.5 – 342.0	10.2	11.6	D	3

Based on this information, and the five years of meteorological data, a table of joint frequency of occurrence of wind speed, wind direction, and stability class was developed as outlined in the Workbook. The dispersion conditions, defined by wind speed and stability class, were ranked by evaluating the product of σ_y, σ_z, and u, where σ_y and σ_z are the Pasquill-Gifford horizontal and vertical diffusion coefficients for the given stability class and downwind distance and u is the wind speed. The dispersion conditions were then ranked in ascending order according to the value of $\sigma_y\sigma_z u$ as shown in Table 6-12.

According to the Workbook, VISCREEN is to be applied with the worst-case meteorological conditions that have a $\sigma_y\sigma_z u$ product with a cumulative probability of one percent. That is, the dispersion condition is selected such that the sum of all frequencies of occurrence of conditions worse than this condition totals one percent. Note that as recommended by the Workbook, dispersion conditions that result in greater than 12 hours of plume transport time are discounted from the analysis, since it is unlikely that steady-state plume conditions would persist for more than 12 hours.

According to Table 6-12, the worst-case daylight (6 am – 6 pm) dispersion conditions with cumulative frequency of 1 percent are D stability, 3 m/sec. Therefore, VISCREEN was applied with D stability, and a wind speed of 3 m/sec. As recommended by the Workbook, a visual range of 25 kilometers was used (see Figure 9 of the Workbook).

The VISCREEN results are summarized in Table 6-13 using project emissions. VISCREEN provides results of ΔE and C_p for both sky and terrain backgrounds. The results are below the significance criteria. Therefore, the plume is expected to be imperceptible against background sky and terrain

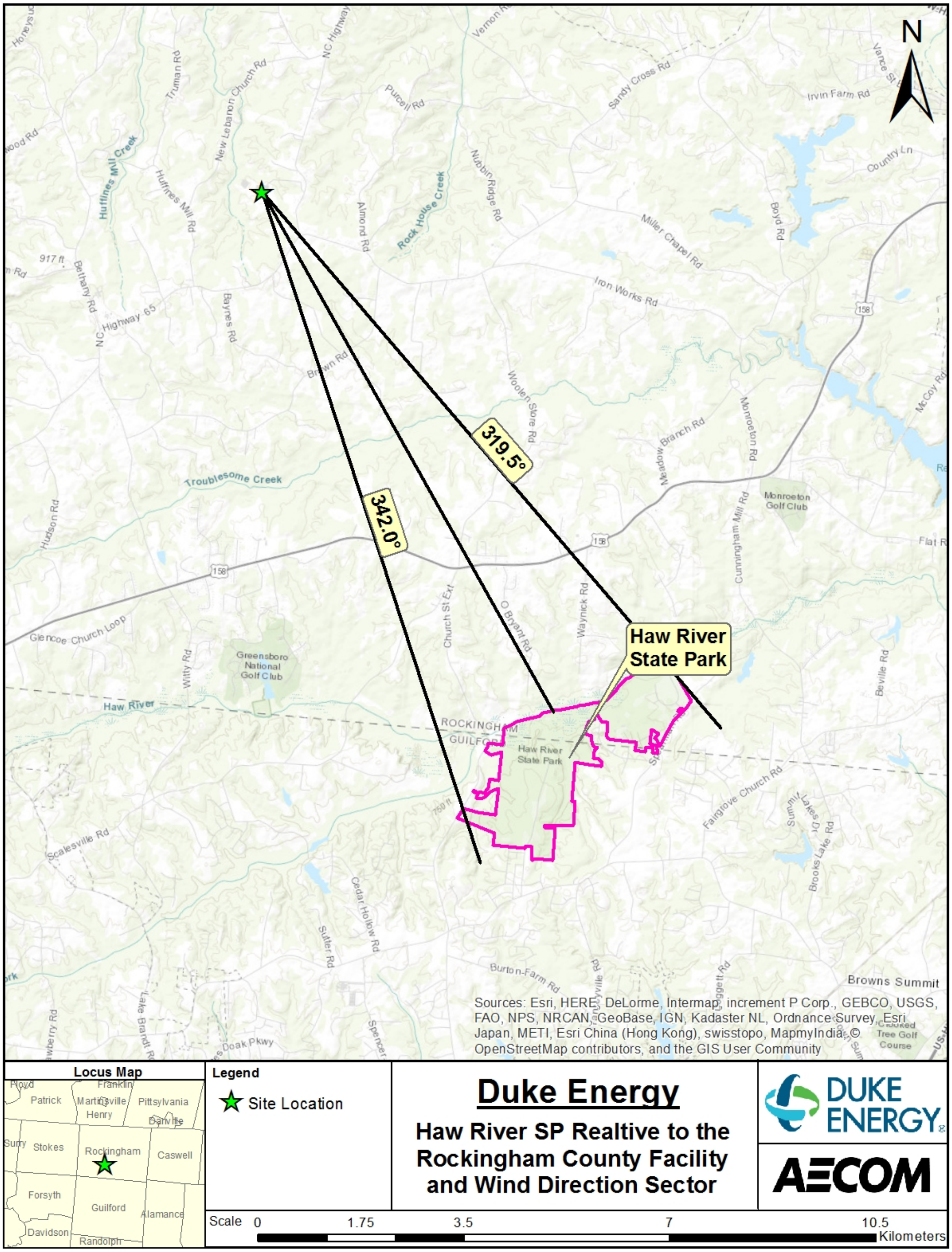

Figure 6-7. VISCREEN Level II Analysis Wind Sector

Table 6-12. Dispersion Condition Frequency Analysis

Dispersion Condition		$\sigma_y\sigma_z u$	Transport Time	Frequency By Time of Day (%)				Cumulative Frequency By Time of Day (%)			
Stability Class	Wind Speed (m/s)	(m^3/s)	(hours)	0-6	6-12	12-18	18-24	0-6	6-12	12-18	18-24
F	1	12895	6	0.338	0.027	0.000	0.246	0.338	0.027	0.000	0.246
F	2	25790	2	1.597	0.265	0.091	1.187	1.935	0.292	0.091	1.433
E	1	33052	6	0.000	0.000	0.000	0.000	1.935	0.292	0.091	1.433
F	3	38684	1	0.630	0.091	0.037	0.539	2.565	0.383	0.128	1.972
E	2	66105	2	0.055	0.055	0.018	0.009	2.620	0.438	0.146	1.981
D	1	75474	6	0.000	0.000	0.000	0.000	2.620	0.438	0.146	1.981
E	3	99157	1	0.465	0.119	0.046	0.557	3.085	0.557	0.192	2.537
E	4	132209	1	0.685	0.183	0.110	1.059	3.770	0.739	0.301	3.596
D	2	150949	2	0.000	0.183	0.037	0.046	3.770	0.922	0.338	3.642
E	5	165261	1	0.319	0.064	0.073	0.575	4.089	0.986	0.411	4.217
D	**3**	226423	1	0.000	0.612	0.575	0.046	4.089	**1.597**	0.986	4.263
D	4	301898	1	0.000	0.922	0.885	0.027	4.089	2.519	1.871	4.290
D	5	377372	1	0.000	0.739	0.694	0.018	4.089	3.258	2.565	4.308
D	6	452846	1	0.000	0.438	0.465	0.009	4.089	3.697	3.030	4.317
D	7	528321	0	0.000	0.274	0.402	0.009	4.089	3.970	3.432	4.326
D	8	603795	0	0.000	0.110	0.183	0.000	4.089	4.080	3.614	4.326

Notes: m/s = meters/second m^3/s = cubic meters/second

Table 6-13. VISCREEN Model Results

Background	Distance (km)	Plume Perceptibility (ΔE)			Plume Contrast (C_p)		
		VISCREEN[1]		Criteria	VISCREEN[1]		Criteria
		Theta 10	Theta 140		Theta 10	Theta 140	
Sky	11.6	1.507	0.503	2.0	-0.003	-0.005	0.05
Terrain	10.2	0.481	0.147	2.0	0.003	0.002	0.05

1. VISCREEN results are provided for the two VISCREEN default worst-case theta angles. The two theta angles represent the sun being in front of the observer (theta = 10 degrees) or behind the observer (theta = 140 degrees).
2. A negative C_p means the plume has a darker contrast than the background sky.

7.0 AIR TOXICS ANALYSIS

Per 15A NCAC 2Q .0700, toxic air pollutant (TAP) compliance demonstrations are required for new or modified sources to ensure TAPs from the facility will not cause any acceptable ambient level (AAL) listed in 15A NCAC 02D .1104 to be exceeded beyond the property line. TAP emissions from not only the project, but also from unmodified operations of the facility are required to demonstrate compliance with the AALs.

A facility-wide air toxics analysis was performed for compounds emitted from burning natural gas with emission rates that exceed the North Carolina Toxic Pollutant Emission Rates (TPER). As shown in Appendix D (Table D-9), a TPER analysis indicates the following compounds require a modeling demonstration:

- Acrolein;
- Arsenic;
- Benzene;
- Beryllium;
- Butadiene, 1,3-;
- Cadmium;
- Formaldehyde;
- Manganese;
- Mercury;
- Nickel; and
- Sulfuric acid.

Facility-wide modeling was conducted for the compounds listed above and the resulting modeled concentrations were compared to the applicable AALs.

7.1 Air Toxics Analysis Approach

The analysis was based on requirements and recommendations contained in the NCDAQ's *Guidelines for Evaluating the Air Quality Impacts of Toxic Pollutants in North Carolina* (May 2018). The modeling system and meteorological data used were the same as that used for the air quality modeling analysis described in Section 6. The GEP analysis was similar to that described in Section 6 but included all point sources at the facility. Figure 7-1 shows the toxics modeling setup.

7.2 Sources and Emissions

The highest potential to emit emission rates were modeled for all facility sources that emit any of the pollutants that exceed the TPERs. Stack parameters and potential emission rates for all sources modeled are listed in Table D-10.

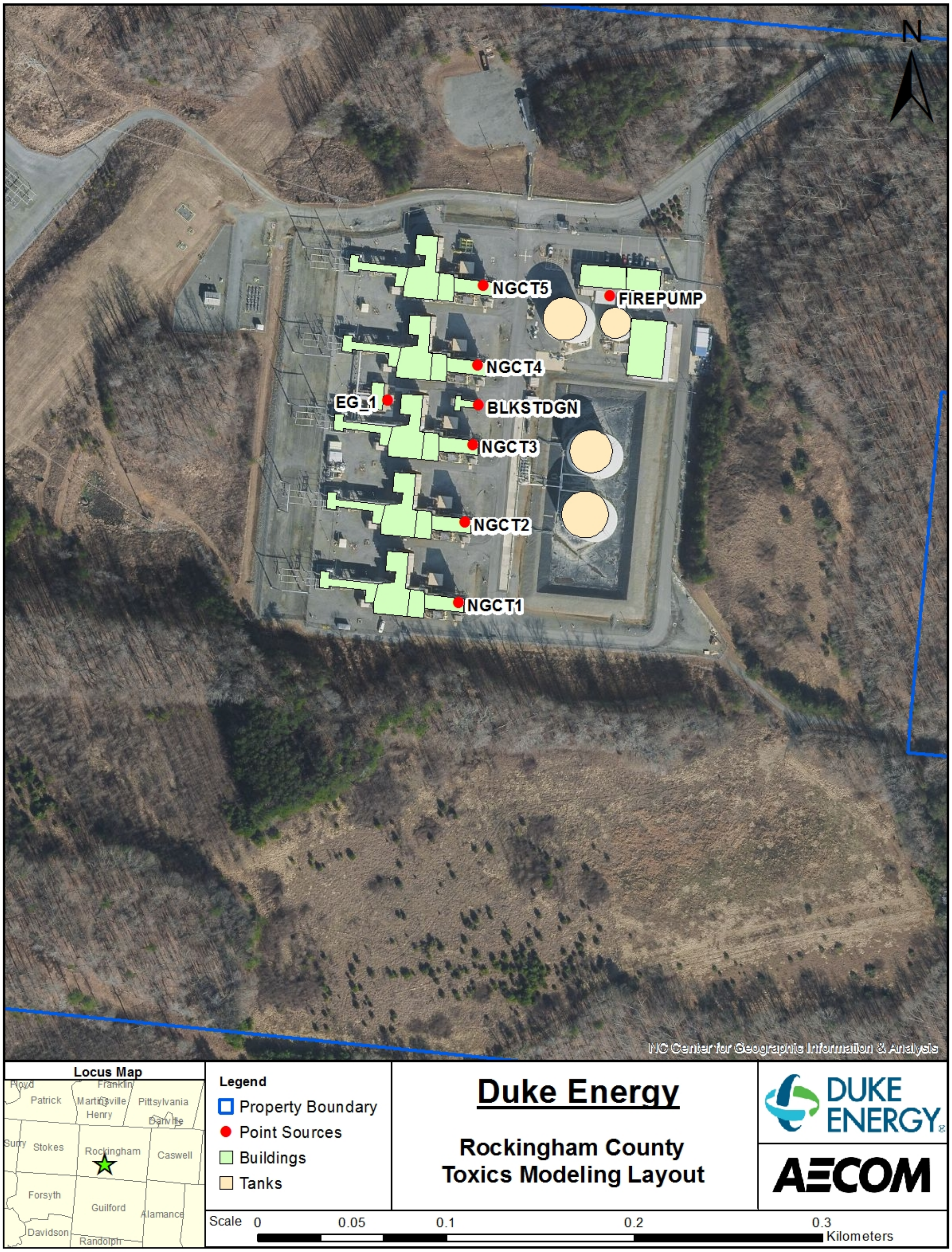

Figure 7-1. Toxics Modeling Layout

7.3 Receptors

The toxics receptor grid consists of receptors spaced 25 meters (m) apart along the property boundary, shown in Figure 2-1. A spacing of 100 m was used for the receptors beyond the property boundary and extending out to 1 km from the property boundary. Beyond 1 km from the property boundary, a spacing of 250 m was used up to 2.5 km from the facility. Between 2.5 and 5 km, a spacing of 500 m was used. Between 5 and 10 km, a spacing of 1,000 m was used. The receptor grid used in the toxics modeling analysis was based on NAD 83 datum and in zone 17. Figure 7-2 illustrates the receptor grid used for the toxics analysis.

Receptors on public rights-of-way, such as Ernest Drive, were included in the short-term modeling but excluded from the long-term modeling per DAQ Toxics Modeling Guidance. Figure 7-3 shows the near-field receptor grid, along with the short-term receptors.

All maximum concentrations were located in areas with 100 m or less receptor spacing.

7.4 Modeling Results

Potential emission rates for all modeled pollutants were multiplied by 1,000,000 to ensure a non-zero modeling concentration was obtained. The resulting concentration was then divided by 1,000,000 before being compared to the AAL. Based on the resulting concentrations from the potential model run, the emission rates were then increased to an optimized rate such that modeled allowable emission rates result in ambient concentrations that are 98 percent of the AAL. Optimizing the emission rates provides the facility with additional operational flexibility and should reduce the need for future TAP modeling analyses for these sources at the facility. Appendix D presents a summary of the maximum modeling results.

The TAP modeling analysis demonstrates that the maximum optimized TAP emissions from the facility do not result in predicted ambient concentrations that exceed the respective AALs.

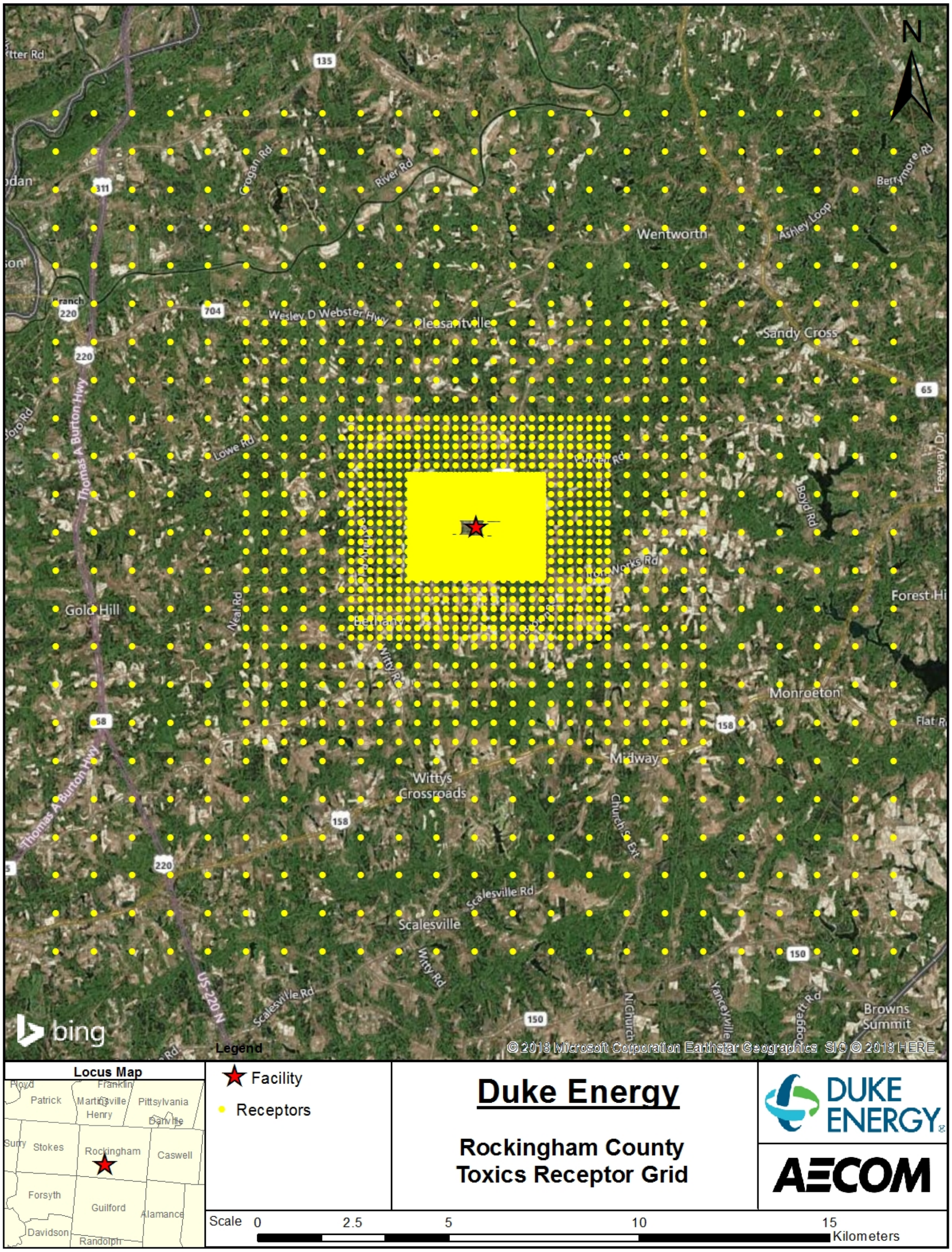

Figure 7-2. Toxics Receptor Grid

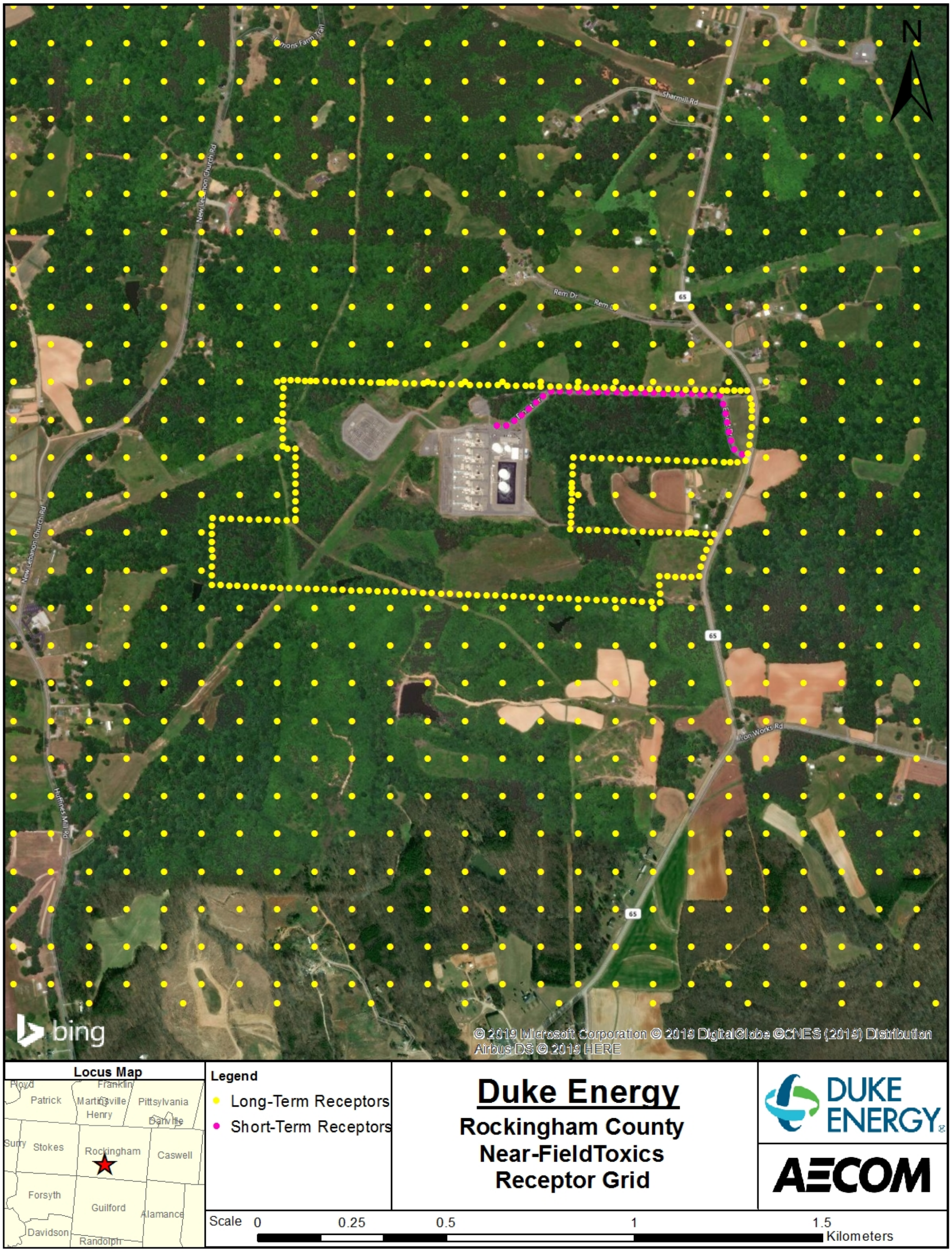

Figure 7-3. Near-Field Toxics Receptor Grid

Appendix A

Permit Application Forms

FORM A

GENERAL FACILITY INFORMATION

REVISED 09/22/16 — NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate — **A**

NOTE- APPLICATION WILL NOT BE PROCESSED WITHOUT THE FOLLOWING:

- ☐ Local Zoning Consistency Determination (new or modification only)
- ☑ Appropriate Number of Copies of Application
- ☑ Application Fee (if required)
- ☑ Responsible Official/Authorized Contact Signature
- ☐ P.E. Seal (if required)

GENERAL INFORMATION

Legal Corporate/Owner Name: Duke Energy Carolinas, LLC	
Site Name: Rockingham County Combustion Turbine Facility	
Site Address (911 Address) Line 1: 240 Ernest Drive	
Site Address Line 2:	
City: Reidsville	State: NC
Zip Code: 27230	County: Rockingham

CONTACT INFORMATION

Responsible Official/Authorized Contact:		***Invoice Contact:***	
Name/Title: Michael Lanning		Name/Title: Cynthia Winston	
Mailing Address Line 1: 240 Ernest Drive		Mailing Address Line 1: 410 S. Wilmington St.	
Mailing Address Line 2:		Mailing Address Line 2:	
City: Reidsville State: NC Zip Code: 27230		City: Raleigh State: NC Zip Code: 27601	
Primary Phone No.: (336) 635-3080	Fax No.:	Primary Phone No.: (919) 546-5538	Fax No.:
Secondary Phone No.:		Secondary Phone No.:	
Email Address: Michael.Lanning@duke-energy.com		Email Address: Cynthia.Winston@duke-energy.com	
Facility/Inspection Contact:		***Permit/Technical Contact:***	
Name/Title: Dana Newcomb		Name/Title: Erin Wallace	
Mailing Address Line 1: 240 Ernest Drive		Mailing Address Line 1: 410 S. Wilmington St.	
Mailing Address Line 2:		Mailing Address Line 2:	
City: Reidsville State: NC Zip Code: 27230		City: Raleigh State: NC Zip Code: 27601	
Primary Phone No.: (336) 635-3186	Fax No.:	Primary Phone No.: (919) 546-5797	Fax No.:
Secondary Phone No.:		Secondary Phone No.:	
Email Address: Dana.Newcomb@duke-energy.com		Email Address: Erin.Wallace@duke-energy.com	

APPLICATION IS BEING MADE FOR

- ☐ New Non-permitted Facility/Greenfield
- ☑ Modification of Facility (permitted)
- ☐ Renewal Title V
- ☐ Renewal Non-Title V
- ☐ Name Change
- ☐ Ownership Change
- ☐ Administrative Amendment
- ☐ Renewal with Modification

FACILITY CLASSIFICATION AFTER APPLICATION (Check Only One)

- ☐ General
- ☐ Small
- ☐ Prohibitory Small
- ☐ Synthetic Minor
- ☑ Title V

FACILITY (Plant Site) INFORMATION

Describe nature of (plant site) operation(s): Combustion Turbine peaking station with five (5) simple cycle combustion turbines, black start generator, emergency generator, fire water pump, and fuel storage tanks.

	Facility ID No. 7900156
Primary SIC/NAICS Code: 4911 / 221112	Current/Previous Air Permit No. 08731T15 Expiration Date: 10/31/2020
Facility Coordinates: Latitude: 36°19' 51.6828" N	Longitude: 79° 49' 48.3636" W
Does this application contain confidential data? ☐ YES ☑ NO	***If yes, please contact the DAQ Regional Office prior to submitting this application.*** (See Instructions)

PERSON OR FIRM THAT PREPARED APPLICATION

Person Name: Amy Marshall, P.E.		Firm Name: AECOM	
Mailing Address Line 1: 1600 Perimeter Park Drive, Suite 400		Mailing Address Line 2:	
City: Morrisville	State: NC	Zip Code: 27560	County: Wake
Phone No.: (919) 461-1251	Fax No.: (919) 461-141	Email Address: amy.marshall@aecom.com	

SIGNATURE OF RESPONSIBLE OFFICIAL/AUTHORIZED CONTACT

Name (typed): Michael Lanning	Title: General Manager II, Rockingham CT
X Signature(Blue Ink): Michael Lanning	Date: 1/14/19

Attach Additional Sheets As Necessary

FORM A (continued, page 2 of 2)

GENERAL FACILITY INFORMATION

REVISED 09/22/16 — **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** — **A**

SECTION AA1 - APPLICATION FOR NON-TITLE V PERMIT RENEWAL

______________________ (Company Name) hereby formally requests renewal of Air Perm ______________

There have been no modifications to the originally permitted facility or the operations therein that would require an air permit since the last permit was issued.

Is your facility subject to 40 CFR Part 68 "Prevnetion of Accidental Releases" - Section 112(r) of the Clean Air Act? ☐ YES ☐ NO

If yes, have you already submitted a Risk Manage Plan (RMP) to EPA? ☐ YES ☐ NO Date Submitted: ______________

Did you attach a current emissions inventory? ☐ YES ☐ NO

If no, did you submit the inventory via AERO or by mail? ☐ Via AERO ☐ Mailed Date Mailed: ______________

SECTION AA2- APPLICATION FOR TITLE V PERMIT RENEWAL

In accordance with the provisions of Title 15A 2Q 0513, the responsible official of ______________________ (Company Name) hereby formally requests renewal of Air Permit No. ______________ (Air Permit No.) and further certifies that:

(1) The current air quality permit identifies and describes all emissions units at the above subject facility, except where such units are exempted under he North Carolina Title V regula ions at 15A NCAC 2Q .0500;

(2) The current air quality permit cits all applicable requirements and provides the method or methods for determing compliance with the applicable requirements;

(3) The facility is currently in compliance, and shall con inue to comply, with all applicable requiremetns. (Note: As provided under 15A NCAC 2Q .0512 compliance with the conditions of the permit shall be deemed compliance with the applicable requirements specifically identified in the permit);

(4) For applicable requirements that become effective during the term of the renewed permit that the facility shall comply on a timely basis;

(5) The facility shall fulfill applicable enhanced monitoring requirements and submit a compliance certification as required by 40 CFR Part 64.

The responsible official (signature on page 1) certifies under the penalty of law that all information and statements provided above, based on information and belief formed after reasonable inquiry, are true, accurate, and complete.

SECTION AA3- APPLICATION FOR NAME CHANGE

New Facility Name: ______________________

Former Facility Name: ______________________

An official facility name change is requested as described above for the air permit mentioned on page 1 of this form. Complete the other sections if here have been modifications to the originally premitted facility that would requie an air quality permit since the last permit was issued and if ther has been an ownership change associated with this name change.

SECTION AA4- APPLICATION FOR AN OWNERSHIP CHANGE

By his application we hereby request transfer of Air Quality Permit No. ______________ from the former owner to the new owner as described below. The transfer of permit responsibility, coverage and liability shall be effective ______________ (immediately or insert date.) The legal ownership of the facility described on page 1 of this form has been or will be transferred on ______________ (date). There have been no modifications to the originally permitted facility that would require an air quality permit since the last permit was issued.

<u>Signature of New (Buyer) Responsible Official/Authorized Contact (as typed on page 1):</u>

X Signature (Blue Ink): ______________________

Date:

New Facility Name:

Former Facility Name:

<u>Signature of Former (Seller) Responsible Official/Authorized Contact:</u>

Name (typed or print):

Title:

X Signature (Blue Ink): ______________________

Date:

Former Legal Corporate/Owner Name:

In lieu of the seller's signature on this form, a letter may be submitted with the seller's signature indicating the ownership change

SECTION AA5- APPLICATION FOR ADMINISTRATIVE AMENDMENT

Describe the requested administrative amendment here (attach additional documents as necessary):

Attach Additional Sheets As Necessary

FORMs A2, A3

EMISSION SOURCE LISTING FOR THIS APPLICATION - A2

112r APPLICABILITY INFORMATION - A3

REVISED 09/22/16 **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** **A2**

EMISSION SOURCE LISTING: New, Modified, Previously Unpermitted, Replaced, Deleted			
EMISSION SOURCE ID NO.	EMISSION SOURCE DESCRIPTION	CONTROL DEVICE ID NO.	CONTROL DEVICE DESCRIPTION
Equipment To Be ADDED By This Application (New, Previously Unpermitted, or Replacement)			
Existing Permitted Equipment To Be MODIFIED By This Application			
ES-CT-1	Natural Gas/No. 2 Fuel Oil fired SCCT	N/A	N/A
ES-CT-2	Natural Gas/No. 2 Fuel Oil fired SCCT	N/A	N/A
ES-CT-3	Natural Gas/No. 2 Fuel Oil fired SCCT	N/A	N/A
ES-CT-4	Natural Gas/No. 2 Fuel Oil fired SCCT	N/A	N/A
ES-CT-5	Natural Gas/No. 2 Fuel Oil fired SCCT	N/A	N/A
Equipment To Be DELETED By This Application			

112(r) APPLICABILITY INFORMATION **A 3**

Is your facility subject to 40 CFR Part 68 "Prevention of Accidental Releases" - Section 112(r) of the Federal Clean Air Act? ☐ Yes ☑ No

If No, please specify in detail how your facility avoided applicability:

No chemicals stored above threshold amounts.

If your facility is Subject to 112(r), please complete the following:

A. Have you already submitted a Risk Management Plan (RMP) to EPA Pursuant to 40 CFR Part 68.10 or Part 68.150?

☐ Yes ☐ No Specify required RMP submittal date: __________ If submitted, RMP submittal date: _____________

B. Are you using administrative controls to subject your facility to a lesser 112(r) program standard?

☐ Yes ☐ No If yes, please specify ______________________________

C. List the processes subject to 112(r) at your facility:

PROCESS DESCRIPTION	PROCESS LEVEL (1, 2, or 3)	HAZARDOUS CHEMICAL	MAXIMUM INTENDED INVENTORY (LBS)

Attach Additional Sheets As Necessary

FORM B

SPECIFIC EMISSION SOURCE INFORMATION (REQUIRED FOR ALL SOURCES)

REVISED 09/22/16 — **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** — **B**

EMISSION SOURCE DESCR PTION: Five (5) Natural Gas/No. 2 Fuel Oil Fired Simple Cycle Combustion Turbines	EMISSION SOURCE ID NO: ES-CT-1 through ES-CT-5
	CONTROL DEVICE D NO(S): N/A
OPERATING SCENARIO 1 OF 1	EMISSION PO NT (STACK) D NO(S):

DESCRIBE IN DETAILTHE EMISSION SOURCE PROCESS (ATTACH FLOW DIAGRAM)

Five (5) Natural Gas/No. 2 Fuel Oil Fired Simple Cycle Combustion Turbines (1,875 million Btu per hour maximum heat input rate while firing natural gas and 1,839 million Btu per hour maximum heat input rate while firing No. 2 fuel oil) equipped with dual-fuel dry low-NOx combustors and water injection for NOx control.

TYPE OF EMISSION SOURCE (CHECK AND COMPLETE APPROPRIATE FORM B1-B9 ON THE FOLLOWING PAGES)

- ☑ Coal,wood,oil, gas, other burner (Form B1)
- ☐ Woodworking (Form B4)
- ☐ Manuf. of chemicals/coatings/inks (Form B7)
- ☐ Int.combustion engine/generator (Form B2)
- ☐ Coating/finishing/printing (Form B5)
- ☐ Incineration (Form B8)
- ☐ Liquid storage tanks (Form B3)
- ☐ Storage silos/bins (Form B6)
- ☐ Other (Form B9)

START CONSTRUCTION DATE: 1999 — DATE MANUFACTURED: 1999

MANUFACTURER / MODEL NO.: W501F — EXPECTED OP. SCHEDULE: _____ HR/DAY _____ DAY/WK _____ WK/YR

IS THIS SOURCE SUBJECT TO? ☑ NSPS (SUBPARTS?): GG ☑ NESHAP (SUBPARTS?): YYYY

PERCENTAGE ANNUAL THROUGHPUT (%): DEC-FEB 25 MAR-MAY 25 JUN-AUG 25 SEP-NOV 25

CRITERIA AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

	SOURCE OF	EXPECTED ACTUAL*		POTENTIAL EMISSIONS			
	EMISSION	(AFTER CONTROLS / LIMITS)		(BEFORE CONTROLS / LIMITS)		(AFTER CONTROLS / LIMITS)	
AIR POLLUTANT EMITTED	FACTOR	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
PARTICULATE MATTER (PM)	BACT Limit	28 05	11.87	124.13	159.57	124.13	159.57
PARTICULATE MATTER<10 MICRONS (PM_{10})	BACT Limit	28.05	11.87	124.13	159.57	124.13	159.57
PARTICULATE MATTER<2.5 MICRONS ($PM_{2.5}$)	BACT Limit	14.27	6.04	124.13	159.57	124.13	159.57
SULFUR DIOX DE (SO2)	BACT Limit	5.44	2.30	435.84	248.39	435.84	248.39
NITROGEN OX DES (NOx)	BACT Limit	392.39	166.00	1572 35	2538.13	1572.35	2538.13
CARBON MONOX DE (CO)	BACT Limit	258.44	109.40	1140.18	2322.04	1140.18	2322 04
VOLATILE ORGANIC COMPOUNDS (VOC)	BACT Limit	18.10	7 66	43.22	119.11	43 22	119.11
LEAD	AP-42	4 80E-03	2.03E-03	0.13	0.08	0.13	0 08
OTHER							

HAZARDOUS AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

		SOURCE OF	EXPECTED ACTUAL*		POTENTIAL EMISSIONS			
		EMISSION	(AFTER CONTROLS / LIMITS)		(BEFORE CONTROLS / LIMITS)		(AFTER CONTROLS / LIMITS)	
HAZARDOUS AIR POLLUTANT	**CAS NO.**	FACTOR	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Antimony	SBC	EPRI	3.10E-06	1.31E-06	6.90E-04	3.45E-04	6.90E-04	3.45E-04
Arsenic	7778394	AP-42	2.14E-03	9.06E-04	1.01E-01	5 65E-02	1.01E-01	5.65E-02
Beryllium	BEC	AP-42	1.14E-04	4.83E-05	2.85E-03	1.78E-03	2.85E-03	1.78E-03
Cadmium	CDC	AP-42	9.48E-03	4.01E-03	4.41E-02	5.49E-02	4.41E-02	5.49E-02
Chromium (Total)	CRC	AP-42	1 23E-02	5.19E-03	1.01E-01	9 24E-02	1.01E-01	9.24E-02
Cobalt	COC	EPRI	7 88E-04	3.33E-04	1.75E-02	1.12E-02	1.75E-02	1.12E-02
Lead	PBC	AP-42	4 80E-03	2.03E-03	1.29E-01	7 93E-02	1.29E-01	7.93E-02
Manganese	MNC	AP-42	3 59E-02	1.51E-02	7.26E+00	3 64E+00	7.26	3 64
Mercury	HGC	AP-42	2 24E-03	9.50E-04	1.10E-02	1 33E-02	1.10E-02	1.33E-02
Nickel	NIC	AP-42	1.79E-02	7.58E-03	4.23E-02	8 39E-02	4.23E-02	8.39E-02
Selenium	SEC	AP-42	1 24E-03	5.22E-04	2.30E-01	1.16E-01	2.30E-01	0.12
Acetaldehyde	75070	AP-42	3.44E-01	1.46E-01	3.75E-01	1 22E+00	3.75E-01	1 22
Acrolein	107028	AP-42	5 51E-02	2.33E-02	6.00E-02	1 95E-01	6.00E-02	1.95E-01
Benzene	71432	AP-42	1 06E-01	4.47E-02	5.06E-01	6.18E-01	5.06E-01	6.18E-01
Butadiene, 1,3-	106990	AP-42	4 36E-03	1.85E-03	1.47E-01	8 67E-02	1.47E-01	8.67E-02
Ethylbenzene	100414	AP-42	2.76E-01	1.17E-01	3.00E-01	9.75E-01	3.00E-01	0 98
Formaldehyde	50000	AP-42	6.12E+00	2.59E+00	6.66E+00	2 29E+01	6.66	22.92
Naphthalene	91203	AP-42	1 26E-02	5.35E-03	3.22E-01	2 01E-01	3.22E-01	0 20
Propylene Oxide	75569	AP-42	2 50E-01	1.06E-01	2.72E-01	8 84E-01	2.72E-01	0 88
Toluene	108883	AP-42	1.12E+00	4.74E-01	1.22E+00	3 96E+00	1.22	3 96
Xylenes	1330207	AP-42	5 51E-01	2.33E-01	6.00E-01	1 95E+00	6.00E-01	1 95
Total POM	POM	AP-42	2 06E-02	8.72E-03	3.68E-01	2 51E-01	3.68E-01	0 25

TOXIC AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

		SOURCE OF EMISSION	EXPECTED ACTUAL EMISSIONS AFTER CONTROLS / L MITATIONS*		
TOXIC AIR POLLUTANT	**CAS NO.**	FACTOR	lb/hr	lb/day	lb/yr
Arsenic	7778394	AP-42	2.14E-03	5.14E-02	1 81
Beryllium	BEC	AP-42	1.14E-04	2.74E-03	0.10
Cadmium	CDC	AP-42	9.48E-03	0.23	8 03
Manganese	MNC	AP-42	3 59E-02	0.86	30.26
Mercury	HGC	AP-42	2 24E-03	0.05	1 90
Acetaldehyde	75070	AP-42	3.44E-01	8.27	291.59
Acrolein	107028	AP-42	5 51E-02	1.32	46.65
Benzene	71432	AP-42	1 06E-01	2.53	89.39
Butadiene, 1,3-	106990	AP-42	4 36E-03	1.05E-01	3 69
Formaldehyde	50000	AP-42	6.12E+00	146 99	5,185.45
Toluene	108883	AP-42	1.12E+00	26.86	947.66
Xylenes	1330207	AP-42	5 51E-01	13.23	466.54

* Expected Actual Emissions are totals from the 2017 Air Emissions Inventory.

Attachments: (1) emissions calculations and supporting documentation; (2) indicate all requested state and federal enforceable permit limits (e.g. hours of operation, emission rates) and describe how these are monitored and with what frequency; and (3) describe any monitoring devices, gauges, or test ports for this source.

COMPLETE THIS FORM AND COMPLETE AND ATTACH APPROPRIATE B1 THROUGH B9 FORM FOR EACH SOURCE

Attach Additional Sheets As Necessary

FORM B1

EMISSION SOURCE (WOOD, COAL, OIL, GAS, OTHER FUEL-FIRED BURNER)

REVISED 09/22/16 **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** **B1**

EMISSION SOURCE DESCRIPTION: Five (5) Natural Gas/No. 2 Fuel Oil Fired Simple Cycle Combustion Turbines

EMISSION SOURCE ID NO: ES-CT-1 through ES-CT-5

CONTROL DEVICE ID NO(S): N/A

OPERATING SCENARIO: 1 OF 1

EMISSION POINT (STACK) ID NO(S):

DESCRIBE USE: ☐ PROCESS HEAT ☐ PACE HEAT ☑ ELECTRICAL GENERATION ☐ CONTINUOUS USE ☐ STAND BY/EMERGENCY ☐ OTHER (DESCRIBE): ____

HEATING MECHANISM: ☐ INDIRECT ☐ DIRECT

MAX. FIRING RATE (MMBTU/HOUR): 1,875 MMBtu/hr Natural Gas | 1,839 MMBtu/hr No. 2 Fuel Oil

WOOD-FIRED BURNER

WOOD TYPE: ☐ BARK ☐ WOOD/BARK ☐ WET WOOD ☐ DRY WOOD ☐ OTHER (DESCRIBE): ____

PERCENT MOISTURE OF FUEL: ____

☐ UNCONTROLLED ☐ CONTROLLED WITH FLYASH REINJECTION ☐ CONTROLLED W/O REINJECTION

FUEL FEED METHOD: | HEAT TRANSFER MEDIA: ☐ STEAM ☐ AIR ☐ OTHER (DESCRIBE) ____

COAL-FIRED BURNER

TYPE OF BOILER | IF OTHER DESCRIBE:

PULVERIZED	OVERFEED STOKER	UNDERFEED STOKER	SPREADER STOKER	FLUIDIZED BED
☐ WET BED	☐ UNCONTROLLED	☐ UNCONTROLLED	☐ UNCONTROLLED	☐ CIRCULATING
☐ DRY BED	☐ CONTROLLED	☐ CONTROLLED	☐ FLYASH REINJECTION	☐ RECIRCULATING
			☐ NO FLYASH REINJECTION	

OIL/GAS-FIRED BURNER

TYPE OF BOILER: ☑ UTILITY ☐ INDUSTRIAL ☐ COMMERCIAL ☐ INSTITUTIONAL

TYPE OF FIRING: ☐ NORMAL ☐ TANGENTIAL ☑ LOW NOX BURNERS ☐ NO LOW NOX BURNER

OTHER FUEL-FIRED BURNER

TYPE(S) OF FUEL: ____ PERCENT MOISTURE: ____

TYPE OF BOILER: ☐ UTILITY ☐ INDUSTRIAL ☐ COMMERCIAL ☐ INSTITUTIONAL

TYPE OF FIRING: ____ TYPE(S) OF CONTROL(S) (IF ANY): ____

FUEL USAGE (INCLUDE STARTUP/BACKUP FUELS)

FUEL TYPE	UNITS	MAXIMUM DESIGN CAPACITY (UNIT/HR)	REQUESTED CAPACITY LIMITATION (UNIT/HR)
Natural Gas	MMBtu/hr	1,875	1,875
No. 2 Fuel Oil	MMBtu/hr	1,839	1,839

FUEL CHARACTERISTICS (COMPLETE ALL THAT ARE APPLICABLE)

FUEL TYPE	SPECIFIC BTU CONTENT	SULFUR CONTENT (% BY WEIGHT)	ASH CONTENT (% BY WEIGHT)
Natural Gas	1,020	2.0 gr/ 100scf	neglig ble
No. 2 Fuel Oil	137,000	0.025	neglig ble

COMMENTS:

Attach Additional Sheets As Necessary

FORM D1

FACILITY-WIDE EMISSIONS SUMMARY

REVISED 09/22/16 **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** **D1**

CRITERIA AIR POLLUTANT EMISSIONS INFORMATION - FACILITY-WIDE

	EMISSIONS* (AFTER CONTROLS / L MITATIONS)	POTENTIAL EMISSIONS (BEFORE CONTROLS / L MITATIONS)	POTENTIAL EMISSIONS (AFTER CONTROLS / L MITATIONS)
AIR POLLUTANT EMITTED	tons/yr	tons/yr	tons/yr
PARTICULATE MATTER (PM)	11.90	160.04	160.04
PARTICULATE MATTER < 10 MICRONS (PM_{10})	11.90	160.04	160.04
PARTICULATE MATTER < 2 5 MICRONS ($PM_{2.5}$)	6.07	160.04	160.04
SULFUR DIOX DE (SO_2)	2.32	248.44	248.44
NITROGEN OX DES (NOx)	166.66	2,544.97	2,544.97
CARBON MONOXIDE (CO)	109.56	2,326.91	2,326.91
VOLAT LE ORGANIC COMPOUNDS (VOC)	7 69	120.52	120.52
LEAD	2.03E-03	7.93E-02	7.93E-02
GREENHOUSE GASES (GHG) (SHORT TONS)		4.32E+06	4.32E+06
OTHER			

HAZARDOUS AIR POLLUTANT EMISSIONS INFORMATION - FACILITY-WIDE

		EMISSIONS* (AFTER CONTROLS / L MITATIONS)	POTENTIAL EMISSIONS (BEFORE CONTROLS / L MITATIONS)	POTENTIAL EMISSIONS (AFTER CONTROLS / L MITATIONS)
HAZARDOUS AIR POLLUTANT EMITTI	CAS NO.	tons/yr	tons/yr	tons/yr
Antimony	SBC	1.31E-06	3.45E-04	3.45E-04
Arsenic	7778394	9.07E-04	5.66E-02	5.66E-02
Beryllium	BEC	4.88E-05	1.79E-03	1.79E-03
Cadmium	CDC	4.01E-03	5.49E-02	5.49E-02
Chromium (Total)	CRC	5.20E-03	9.24E-02	9.24E-02
Cobalt	COC	3.33E-04	1.12E-02	1.12E-02
Lead	PBC	2.03E-03	7.93E-02	7.93E-02
Manganese	MNC	1.51E-02	3.64E+00	3.64E+00
Mercury	HGC	9.51E-04	1.33E-02	1.33E-02
Nickel	NIC	7.58E-03	8.39E-02	8.39E-02
Selenium	SEC	5.24E-04	1.16E-01	1.16E-01
Acetaldehyde	75070	1.46E-01	1.22E+00	1.22E+00
Acrolein	107028	2.33E-02	1.95E-01	1.95E-01
Benzene	71432	4.48E-02	6.21E-01	6.21E-01
Butadiene, 1,3-	106990	1.85E-03	8.67E-02	8.67E-02
Ethylbenzene	100414	1.17E-01	9.76E-01	9.76E-01
Formaldehyde	50000	2.59E+00	2.29E+01	2.29E+01
Naphthalene	91203	5.37E-03	2.02E-01	2.02E-01
Propylene Oxide	75569	1.06E-01	8.84E-01	8.84E-01
Toluene	108883	4.74E-01	3.97E+00	3.97E+00
Xylenes	1330207	2.33E-01	1.95E+00	1.95E+00
Total POM	POM	8.75E-03	2.51E-01	2.51E-01

TOXIC AIR POLLUTANT EMISSIONS INFORMATION - FACILITY-WIDE**

NDICATE REQUESTED ACTUAL EMISSIONS AFTER CONTROLS / LIMITATIONS. EMISSIONS ABOVE THE TOXIC PERMIT EMISSION RATE (TPER) IN 15A NCAC 2Q .0711 MAY REQUIRE A R DISPERSION MODEL NG. USE NETT NG FORM D2 IF NECESSARY.

					Modeling Required ?	
TOXIC AIR POLLUTANT EMITTED	CAS NO.	lb/hr	lb/day	lb/year	Yes	No
Arsenic	7778394	1.29E-02	0.31	113.11	X	
Beryllium	BEC	4.09E-04	0.01	3.58	X	
Cadmium	CDC	1.25E-02	0.30	109.87	X	
Chromium VI	NSCR6	0.00E+00	0.00	0.00		X
Manganese	MNC	8.32E-01	19.96	7,286.78		X
Mercury	HGC	3.03E-03	0.07	26 58		X
Acetaldehyde	75070	2.78E-01	6.68	2,439 01		X
Acrolein	107028	4.45E-02	1.07	390.20		X
Benzene	71432	1.42E-01	3.40	1,242.40	X	
Butadiene, 1,3-	106990	1.98E-02	0.48	173.40	X	
Formaldehyde	50000	5.23E+00	125 60	45,842.68		X
Sulfuric Acid	7664939	5.66E-01	13.59	4,961.77		X
Toluene	108883	9.06E-01	21.73	7,932 60		X
Xylenes	1330207	4.46E-01	10.71	3,907 63		X
Benzo(a)Pyrene	50328	1.30E-07	3.12E-06	1.14E-03		X

COMMENTS:

*Expected Actual Emissions are totals from the 2017 AEI

**Facility-wide Toxic Air Pollutant emissions are conservatively based upon the maximum input by source to give the highest amount of emissions for each pollutant.

Attach Additional Sheets As Necessary

FORM E1

TITLE V GENERAL INFORMATION

IF YOUR FACILITY IS CLASSIFIED AS "MAJOR" FOR TITLE V YOU MUST COMPLETE THIS FORM AND ALL OTHER REQUIRED "E" FORMS (E2 THROUGH E5 AS APPLICABLE)

Indicate here if your facility is subject to Title V by: ☑ EMISSIONS ☐ OTHER

If subject to Title V by "OTHER", specify why: ☐ NSPS ☐ NESHAP (MACT) ☐ TITLE IV ☐ OTHER (specify) ____________

If you are or will be subject to any maximum achievable control technology standards (MACT) issued pursuant to section 112(d) of the Clean Air Act, specify below:

EMISSION SOURCE ID	*EMISSION SOURCE DESCRIPTION*	*MACT*
See permit and Section 4		

List any additional regulation which are requested to be included in the shield and provide a detailed explanation as to why the shield should be granted:

REGULATION	*EMISSION SOURCE (Include ID)*	*EXPLANATION*
See Permit and Section 4		

Comments:

Attach Additional Sheets As Necessary

FORM E2

EMISSION SOURCE APPLICABLE REGULATION LISTING

REVISED 09/22 NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate **E2**

EMISSION SOURCE ID NO.	EMISSION SOURCE DESCRIPTION	OPERATING SCENARIO INDICATE PRIMARY (P) OR ALTERNATIVE (A)	POLLUTANT	APPLICABLE REGULATION
ES 1	*Coal/Wood Boiler*	*P - Coal*	*PM*	*NCAC 2D .0503*
		A - Wood	*PM*	*NCAC 2D .0504*
ES-CT-1 through ES-CT-5	Five (5) Natural Gas/No. 2 Fuel Oil Fired Simple Cycle Combustion Turbines	P - Natural Gas & A - Fuel Oil	Opacity	15A NCAC 02D .0521
			NOx & SO2	15A NCAC 02D .0524/40 CFR 60 Subpart GG
			Opacity, NOx, SO2, CO, VOC, PM/PM10, and H2SO4	15A NCAC 02D .0530
			NOx & SO2	Acid Rain Rules and CSAPR
*The above applicable requirements are per Air Quality Permit No. 08731T15.				

Attach Additional Sheets As Necessary

FORM E3

EMISSION SOURCE COMPLIANCE METHOD

REVISED 09/22/16 **NCDEQ/Division Of Air Quality - Application for Air Permit to Construct/Operate** **E3**

	Regulated Pollutant	Opacity
Emission Source ID NO. ES-CT-1 through ES-CT-5	Applicable Regulation	15A NCAC 2D .0521
Alternative Operating Scenario (AOS) NO: Fuel Oil		

ATTACH A SEPARATE PAGE TO EXPAND ON ANY OF THE BELOW COMMENTS

MONITORING REQUIREMENTS

Is Compliance Assurance Monitoring (CAM) 40 CFR Part 64 Applicable? ☐ YES ☑ NO

If yes, is CAM Plan Attached (if applicable, CAM plan must be attached)? ☐ YES ☐ NO

Descr be Monitoring Device Type: See AQ Permit No. 08759T15, Section 2.1.A.1

Descr be Monitoring Location: See AQ Permit No. 08759T15, Section 2.1.A.1

Other Monitoring Methods (Describe In Detail): See AQ Permit No. 08759T15, Section 2.1.A.1

Descr be the frequency and duration of monitoring and how the data will be recorded (i.e., every 15 minutes, 1 minute instantaneous readings taken to produce an hourly average):

See AQ Permit No. 08759T15, Section 2.1.A.1

RECORDKEEPING REQUIREMENTS

Data (Parameter) being recording: See AQ Permit No. 08759T15, Section 2.1.A.1

Frequency of recordkeeping (How often is data recorded?): See AQ Permit No. 08759T15, Section 2.1.A.1

REPORTING REQUIREMENTS

Generally describe what is being reported: See AQ Permit No. 08759T15, Section 2.1.A.1

Frequency: ☐ MONTHLY ☐ QUARTERLY ☐ EVERY 6 MONTHS

☐ OTHER (DESCRIBE):

TESTING

Specify proposed reference test method: See AQ Permit No. 08759T15, Section 2.1.A.1

Specify reference test method rule and citation: See AQ Permit No. 08759T15, Section 2.1.A.1

Specify testing frequency: See AQ Permit No. 08759T15, Section 2.1.A.1

NOTE - Proposed test method subject to approval and possible change during the test protocol process

Attach Additional Sheets As Necessary

FORM E3

EMISSION SOURCE COMPLIANCE METHOD

REVISED 09/22/16 | NCDEQ/Division Of Air Quality - Application for Air Permit to Construct/Operate | **E3**

	Regulated Pollutant	NOx and SO_2
Emission Source ID NO. ES-CT-1 through ES-CT-5	Applicable Regulation	15A NCAC 2D .0524/40 CFR 60, Subpart GG
Alternative Operating Scenario (AOS) NO: All		

ATTACH A SEPARATE PAGE TO EXPAND ON ANY OF THE BELOW COMMENTS

MONITORING REQUIREMENTS

Is Compliance Assurance Monitoring (CAM) 40 CFR Part 64 Applicable? ☐ YES ☑ NO

If yes, is CAM Plan Attached (if applicable, CAM plan must be attached)? ☐ YES ☐ NO

Describe Monitoring Device Type: See AQ Permit No. 08759T15, Section 2.1.A.2

Describe Monitoring Location: See AQ Permit No. 08759T15, Section 2.1.A.2

Other Monitoring Methods (Describe In Detail): See AQ Permit No. 08759T15, Section 2.1.A.2

Describe the frequency and duration of monitoring and how the data will be recorded (i.e., every 15 minutes, 1 minute instantaneous readings taken to produce an hourly average):

See AQ Permit No. 08759T15, Section 2.1.A.2

RECORDKEEPING REQUIREMENTS

Data (Parameter) being recording: See AQ Permit No. 08759T15, Section 2.1.A.2

Frequency of recordkeeping (How often is data recorded?): See AQ Permit No. 08759T15, Section 2.1.A.2

REPORTING REQUIREMENTS

Generally describe what is being reported: See AQ Permit No. 08759T15, Section 2.1.A.2

Frequency: ☐ MONTHLY ☐ QUARTERLY ☐ EVERY 6 MONTHS

☐ OTHER (DESCRIBE):

TESTING

Specify proposed reference test method: See AQ Permit No. 08759T15, Section 2.1.A.2

Specify reference test method rule and citation: See AQ Permit No. 08759T15, Section 2.1.A.2

Specify testing frequency: See AQ Permit No. 08759T15, Section 2.1.A.2

NOTE - Proposed test method subject to approval and possible change during the test protocol process

Attach Additional Sheets As Necessary

FORM E3

EMISSION SOURCE COMPLIANCE METHOD

REVISED 09/22/16 **NCDEQ/Division Of Air Quality - Application for Air Permit to Construct/Operate** **E3**

Emission Source ID NO. ES-CT-1 through ES-CT-5	Regulated Pollutant	PSD pollutants
	Applicable Regulation	15A NCAC 2D .0530
Alternative Operating Scenario (AOS) NO: All		

ATTACH A SEPARATE PAGE TO EXPAND ON ANY OF THE BELOW COMMENTS

MONITORING REQUIREMENTS

Is Compliance Assurance Monitoring (CAM) 40 CFR Part 64 Applicable? ☐ YES ☑ NO

If yes, is CAM Plan Attached (if applicable, CAM plan must be attached)? ☐ YES ☐ NO

Descr be Monitoring Device Type: See AQ Permit No. 08759T15, Section 2.1.A.3

Descr be Monitoring Location: See AQ Permit No. 08759T15, Section 2.1.A.3

Other Monitoring Methods (Descr be In Detail): See AQ Permit No. 08759T15, Section 2.1.A.3

Describe the frequency and duration of monitoring and how the data will be recorded (i.e., every 15 minutes, 1 minute instantaneous readings taken to produce an hourly average):

See AQ Permit No. 08759T15, Section 2.1.A.3

RECORDKEEPING REQUIREMENTS

Data (Parameter) being recording: See AQ Permit No. 08759T15, Section 2.1.A.3

Frequency of recordkeeping (How often is data recorded?): See AQ Permit No. 08759T15, Section 2.1.A.3

REPORTING REQUIREMENTS

Generally descr be what is being reported: See AQ Permit No. 08759T15, Section 2.1.A.3

Frequency: ☐ MONTHLY ☐ QUARTERLY ☐ EVERY 6 MONTHS

☐ OTHER (DESCRIBE):

TESTING

Specify proposed reference test method: See AQ Permit No. 08759T15, Section 2.1.A.3

Specify reference test method rule and citation: See AQ Permit No. 08759T15, Section 2.1.A.3

Specify testing frequency: See AQ Permit No. 08759T15, Section 2.1.A.3

NOTE - Proposed test method subject to approval and possible change during the test protocol process

Attach Additional Sheets As Necessary

FORM E4

EMISSION SOURCE COMPLIANCE SCHEDULE

COMPLIANCE STATUS WITH RESPECT TO ALL APPLICABLE REQUIREMENTS

Will each emission source at your facility be in compliance with all applicable requirements at the time of permit issuance and continue to comply with these requirements?

☑ YES ☐ NO **If NO**, complete **A** through **F** below for each requirement for which compliance is not achieved.

Will your facility be in compliance with all applicable requirements taking effect during the term of the permit and meet such requirements on a timely basis?

☑ YES ☐ NO **If NO**, complete **A** through **F** below for each requirement for which compliance is not achieved.

If this application is for a modification of existing emissions source(s), is each emission source currently in compliance with all applicable requirements?

☑ YES ☐ NO **If NO**, complete **A** through **F** below for each requirement for which compliance is not achieved.

A. Emission Source Description (Include ID NO.) ______

B. Identify applicable requirement for which compliance is not achieved:

______

C. Narrative description of how compliance will be achieved with this applicable requirements:

______

D. Detailed Schedule of Compliance:

Step(s)	Date Expected

E. Frequency for submittal of progress reports (6 month minimum):

______

F. Starting date of submittal of progress reports: ______

Attach Additional Sheets As Necessary

FORM E5

TITLE V COMPLIANCE CERTIFICATION (Required)

REVISED 09/22/ **E5**

In accordance with the provisions of Title 15A NCAC 2Q .0520 and .0515(b)(4) the responsible company official of:

SITE NAME: Duke Energy Carolinas, LLC - Rockingham County Combustion Turbine Facility

SITE ADDRESS: 240 Ernest Drive

CITY, NC : Reidsville, NC

COUNTY: Rockingham

PERMIT NUMBER : 08731T15

CERTIFIES THAT (Check the appropriate statement(s):

- [x] The facility is in compliance with all applicable requirements
- [ ] In accordance with the provisions of Title 15A NCAC 2Q .0515(b)(4) the responsible company official certifies that the proposed minor modification meets the criteria for using the procedures set out in 2Q .0515 and requests that these procedures be used to process the permit application.
- [ ] The facility is not currently in compliance with all applicable requirements
  If this box is checked, you must also complete Form E4 "Emission Source Compliance Schedule"

The undersigned certifies under the penalty of law, that all information and statements provided in the application, based on information and belief formed after reasonable inquiry, are true, accurate, and complete.

Michael Lanning

Signature of responsible company official (REQUIRED, USE BLUE INK)

Date: 1/14/19

Michael Lanning, General Manager II

Name, Title of responsible company official (Type or print)

Attach Additional Sheets As Necessary

Appendix B

Project Emissions Calculations

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B.1: PSD Applicability Calculations

PSD Applicability Analysis:

	Emission Rates (tons/yr)									
	PM filterable	PM_{10} (Total)	$PM_{2.5}$ (Total)	NOx	CO	SO_2	VOC	Lead	H_2SO_4	CO_2e
Total Baseline Actual Emissions	**11.10**	**19.35**	**10.50**	**264.16**	**168.52**	**4.30**	**11.80**	**0.0045**	**0.0002**	**670,097**
Projected Actual Emissions										
Unit RK1	11.68	19.81	19.81	354.32	353.24	6.13	19.61	0.0033	0.4875	717,320
Unit RK2	11.70	19.88	19.88	355.26	353.93	6.14	19.63	0.0034	0.4875	718,223
Unit RK3	11.72	19.96	19.96	356.21	354.61	6.15	19.66	0.0034	0.4875	719,125
Unit RK4	11.74	20.01	20.01	356.84	355.07	6.15	19.68	0.0035	0.4876	719,727
Unit RK5	11.67	19.80	19.80	354.16	353.13	6.13	19.60	0.0033	0.4875	717,170
Total Projected Actual Emissions	**58.52**	**99.46**	**99.46**	**1,776.80**	**1,769.97**	**30.69**	**98.18**	**0.017**	**2.438**	**3,591,565**
Emissions Increase	**47.42**	**80.12**	**88.97**	**1,512.64**	**1,601.45**	**26.38**	**86.38**	**0.012**	**2.438**	**2,921,468**
Significant Emission Rate	25	15	10	40	100	40	40	0.6	7	75,000
PSD Review?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**	**Yes**

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment

Table B-2: Unit RK1 Baseline Actual Emissions

The Table below presents baseline actual emissions for Unit RK1. Emission factors and references are located in the RK1 Emission Factor Table.

	Baseline Data						Unit RK1 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
January-13	1,017.0	28,243.1	-	-	28,243.1	-	0.03	0.05	0.02	0.63	0.42	-	0.03	6.92E-06	0.00E+00	1,651.9	0.031	0.003	1,653.6
February-13	1,017.0	28,308.2	-	-	28,308.2	-	0.03	0.05	0.02	0.64	0.42	-	0.03	6.94E-06	0.00E+00	1,655.7	0.031	0.003	1,657.4
March-13	1,018.0	17,292.8	-	-	17,292.8	-	0.02	0.03	0.01	0.39	0.26	-	0.02	4.24E-06	0.00E+00	1,011.4	0.019	0.002	1,012.5
April-13	1,017.0	48,834.3	-	-	48,834.3	-	0.05	0.08	0.04	1.10	0.73	-	0.05	1.20E-05	0.00E+00	2,856.2	0.054	0.005	2,859.2
May-13	1,016.0	33,088.1	-	-	33,088.1	-	0.03	0.05	0.03	0.74	0.50	-	0.03	8.11E-06	0.00E+00	1,935.3	0.036	0.004	1,937.3
June-13	1,014.0	58,459.1	-	-	58,459.1	-	0.06	0.09	0.05	1.31	0.88	-	0.06	1.43E-05	0.00E+00	3,419.2	0.064	0.006	3,422.7
July-13	1,014.0	146,273.6	-	-	146,273.6	-	0.14	0.23	0.12	3.29	2.19	-	0.15	3.59E-05	0.00E+00	8,555.3	0.161	0.016	8,564.1
August-13	1,018.0	94,853.2	-	-	94,853.2	-	0.09	0.15	0.08	2.13	1.42	-	0.10	2.32E-05	0.00E+00	5,547.8	0.105	0.010	5,553.5
September-13	1,016.0	90,447.4	-	-	90,447.4	-	0.09	0.14	0.07	2.03	1.36	-	0.09	2.22E-05	0.00E+00	5,290.1	0.100	0.010	5,295.6
October-13	1,016.0	34,158.9	-	-	34,158.9	-	0.03	0.05	0.03	0.77	0.51	-	0.04	8.37E-06	0.00E+00	1,997.9	0.038	0.004	2,000.0
November-13	1,019.0	93,240.5	-	-	93,240.5	-	0.09	0.15	0.07	2.09	1.40	-	0.10	2.29E-05	0.00E+00	5,453.5	0.103	0.010	5,459.1
December-13	1,020.0	43,690.7	-	-	43,690.7	-	0.04	0.07	0.03	0.98	0.66	-	0.05	1.07E-05	0.00E+00	2,555.4	0.048	0.005	2,558.0
January-14	1,020.0	62,332.2	138,303.0	14,435.8	76,768.0	-	0.09	0.19	0.14	1.85	0.96	0.04	0.07	1.16E-04	5.88E-07	4,822.6	0.116	0.016	4,830.4
February-14	1,021.0	4,221.8	137,000.0	-	4,221.8	-	0.00	0.01	0.00	0.10	0.06	0.00	0.00	1.03E-06	0.00E+00	246.9	0.005	0.000	247.2
March-14	1,022.0	73,278.4	137,692.0	8,441.8	81,720.2	-	0.09	0.17	0.11	1.97	1.11	0.05	0.08	7.71E-05	3.44E-07	4,974.1	0.109	0.014	4,980.9
April-14	1,022.0	-	137,000.0	-	-	-	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
May-14	1,023.0	80,660.5	137,000.0	-	80,660.5	-	0.08	0.13	0.06	1.95	1.21	0.05	0.08	1.98E-05	0.00E+00	4,717.7	0.089	0.009	4,722.5
June-14	1,025.0	87,090.2	137,000.0	-	87,090.2	-	0.08	0.14	0.07	2.10	1.31	0.05	0.09	2.13E-05	0.00E+00	5,093.7	0.096	0.010	5,099.0
July-14	1,025.0	68,144.1	137,000.0	-	68,144.1	-	0.06	0.11	0.05	1.64	1.02	0.04	0.07	1.67E-05	0.00E+00	3,985.6	0.075	0.008	3,989.7
August-14	1,025.0	7,031.5	137,000.0	-	7,031.5	-	0.01	0.01	0.01	0.17	0.11	0.00	0.01	1.72E-06	0.00E+00	411.3	0.008	0.001	411.7
September-14	1,025.0	35,651.6	137,000.0	-	35,651.6	-	0.03	0.06	0.03	0.86	0.53	0.02	0.04	8.74E-06	0.00E+00	2,085.2	0.039	0.004	2,087.3
October-14	1,021.0	23,636.2	137,000.0	-	23,636.2	-	0.02	0.04	0.02	0.57	0.35	0.01	0.02	5.79E-06	0.00E+00	1,382.4	0.026	0.003	1,383.9
November-14	1,028.0	7,265.9	138,640.0	2,483.7	9,749.6	-	0.01	0.03	0.02	0.24	0.11	0.01	0.01	1.92E-05	1.01E-07	627.5	0.016	0.002	628.6
December-14	1,030.0	57,118.7	138,640.0	2,975.1	60,093.7	625,828.5	0.06	0.11	0.06	1.45	0.86	0.03	0.06	3.48E-05	1.21E-07	3,583.3	0.073	0.008	3,587.6
January-15	1,029.0	6,706.0	138,640.0	45,636.4	52,342.4	637,878.2	0.10	0.28	0.28	1.77	0.18	0.23	0.02	3.21E-04	4.58E-05	4,112.8	0.158	0.031	4,126.0
February-15	1,028.0	19,637.9	138,068.0	29,407.8	49,045.7	648,246.9	0.08	0.21	0.19	1.49	0.34	0.15	0.03	2.11E-04	2.95E-05	3,546.1	0.119	0.022	3,555.5
March-15	1,028.0	-	137,000.0	-	-	639,600.5	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
April-15	1,038.0	144,843.6	137,000.0	-	144,843.6	687,605.2	0.14	0.23	0.12	3.33	2.17	0.04	0.15	3.55E-05	0.00E+00	8,471.6	0.160	0.016	8,480.4
May-15	1,036.0	140,933.3	137,000.0	-	140,933.3	741,527.8	0.13	0.23	0.11	3.24	2.11	0.04	0.15	3.45E-05	0.00E+00	8,242.9	0.155	0.016	8,251.4
June-15	1,031.0	283,852.8	137,000.0	-	283,852.8	854,224.6	0.27	0.45	0.23	6.52	4.26	0.08	0.30	6.96E-05	0.00E+00	16,602.0	0.313	0.031	16,619.1

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-2: Unit RK1 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK1. Emission factors and references are located in the RK1 Emission Factor Table.

	Baseline Data						Unit RK1 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
July-15	1,037.0	205,618.4	137,000.0	-	205,618.4	883,897.1	0.20	0.33	0.16	4.72	3.08	0.06	0.22	5.04E-05	0.00E+00	12,026.2	0.227	0.023	12,038.6
August-15	1,039.0	116,041.8	137,000.0	-	116,041.8	894,491.4	0.11	0.19	0.09	2.67	1.74	0.03	0.12	2.84E-05	0.00E+00	6,787.1	0.128	0.013	6,794.1
September-15	1,041.0	186,617.0	137,000.0	-	186,617.0	942,576.2	0.18	0.30	0.15	4.29	2.80	0.05	0.20	4.57E-05	0.00E+00	10,914.9	0.206	0.021	10,926.1
October-15	1,043.0	201.3	137,000.0	-	201.3	925,597.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.93E-08	0.00E+00	11.8	0.000	0.000	11.8
November-15	1,036.0	246,140.1	138,054.0	4,239.2	250,379.3	1,004,166.8	0.24	0.42	0.22	5.80	3.70	0.09	0.26	9.00E-05	4.26E-06	14,741.9	0.285	0.030	14,757.9
December-15	1,040.0	116,480.0	137,000.0	-	116,480.0	1,040,561.4	0.11	0.19	0.09	2.68	1.75	0.03	0.12	2.85E-05	0.00E+00	6,812.7	0.128	0.013	6,819.7
January-16	1,034.0	14,062.4	139,834.0	2,361.7	16,424.1	1,010,389.4	0.02	0.04	0.03	0.41	0.21	0.00	0.02	2.00E-05	1.28E-07	1,015.0	0.023	0.003	1,016.5
February-16	1,036.0	85,865.8	139,834.0	2,564.3	88,430.0	1,052,493.5	0.09	0.15	0.08	2.03	1.29	0.02	0.09	3.90E-05	1.39E-07	5,231.2	0.103	0.011	5,237.1
March-16	1,043.0	311,593.1	137,000.0	0.0	311,593.1	1,167,430.0	0.30	0.50	0.25	7.00	4.67	0.08	0.33	7.64E-05	7.44E-15	18,224.5	0.343	0.034	18,243.3
April-16	1,048.0	456,959.4	137,000.0	0.0	456,959.4	1,395,909.7	0.43	0.73	0.37	10.27	6.85	0.12	0.48	1.12E-04	7.44E-15	26,726.7	0.504	0.050	26,754.3
May-16	1,045.0	102,055.7	137,000.0	0.0	102,055.7	1,406,607.4	0.10	0.16	0.08	2.29	1.53	0.03	0.11	2.50E-05	7.44E-15	5,969.0	0.112	0.011	5,975.2
June-16	1,039.0	129,226.7	137,000.0	0.0	129,226.7	1,427,675.6	0.12	0.21	0.10	2.90	1.94	0.04	0.14	3.17E-05	7.44E-15	7,558.2	0.142	0.014	7,566.0
July-16	1,041.0	391,336.9	137,000.0	0.0	391,336.9	1,589,272.0	0.37	0.63	0.31	8.80	5.87	0.11	0.41	9.59E-05	7.44E-15	22,888.5	0.431	0.043	22,912.2
August-16	1,041.0	383,865.6	137,000.0	0.0	383,865.6	1,777,689.1	0.36	0.61	0.31	8.63	5.76	0.10	0.40	9.41E-05	7.44E-15	22,451.5	0.423	0.042	22,474.7
September-16	1,042.0	279,860.4	137,000.0	0.0	279,860.4	1,899,793.5	0.27	0.45	0.22	6.29	4.20	0.08	0.29	6.86E-05	7.44E-15	16,368.5	0.308	0.031	16,385.4
October-16	1,044.0	97,984.6	137,000.0	0.0	97,984.6	1,936,967.7	0.09	0.16	0.08	2.20	1.47	0.03	0.10	2.40E-05	7.44E-15	5,730.9	0.108	0.011	5,736.8
November-16	1,043.0	291,138.8	137,000.0	0.0	291,138.8	2,077,662.3	0.28	0.47	0.23	6.54	4.37	0.08	0.31	7.14E-05	7.44E-15	17,028.1	0.321	0.032	17,045.7
December-16	1,035.0	18,653.8	137,000.0	0.0	18,653.8	2,056,942.4	0.02	0.03	0.01	0.42	0.28	0.01	0.02	4.57E-06	7.44E-15	1,091.0	0.021	0.002	1,092.2
January-17	1,039.0	18,872.4	139,834.0	1,877.6	20,749.9	2,041,146.2	0.02	0.04	0.03	0.55	0.29	0.01	0.02	1.78E-05	1.08E-07	1,256.9	0.027	0.003	1,258.5
February-17	1,039.0	86,951.8	139,834.0	1,828.3	88,780.2	2,061,013.4	0.09	0.15	0.08	2.10	1.31	0.03	0.09	3.41E-05	1.05E-07	5,234.7	0.102	0.011	5,240.5
March-17	1,037.0	96,404.7	137,000.0	-	96,404.7	2,109,215.8	0.09	0.15	0.08	2.20	1.45	0.03	0.10	2.36E-05	0.00E+00	5,638.5	0.106	0.011	5,644.3
April-17	1,038.0	104,773.6	137,000.0	-	104,773.6	2,089,180.8	0.10	0.17	0.08	2.39	1.57	0.03	0.11	2.57E-05	0.00E+00	6,128.0	0.115	0.012	6,134.3
May-17	1,032.0	106,586.0	137,000.0	-	106,586.0	2,072,007.1	0.10	0.17	0.09	2.43	1.60	0.03	0.11	2.61E-05	0.00E+00	6,234.0	0.117	0.012	6,240.4
June-17	1,032.0	71,306.0	137,000.0	-	71,306.0	1,965,733.7	0.07	0.11	0.06	1.63	1.07	0.02	0.07	1.75E-05	0.00E+00	4,170.6	0.079	0.008	4,174.9
July-17	1,038.0	250,674.9	137,000.0	-	250,674.9	1,988,262.0	0.24	0.40	0.20	5.72	3.76	0.07	0.26	6.14E-05	0.00E+00	14,661.5	0.276	0.028	14,676.6
August-17	1,043.0	125,058.8	137,000.0	-	125,058.8	1,992,770.5	0.12	0.20	0.10	2.86	1.88	0.04	0.13	3.07E-05	0.00E+00	7,314.4	0.138	0.014	7,322.0
September-17	1,041.0	64,553.4	137,000.0	-	64,553.4	1,931,738.8	0.06	0.10	0.05	1.47	0.97	0.02	0.07	1.58E-05	0.00E+00	3,775.6	0.071	0.007	3,779.5
October-17	1,040.0	185,941.6	137,000.0	-	185,941.6	2,024,608.9	0.18	0.30	0.15	4.25	2.79	0.05	0.20	4.56E-05	0.00E+00	10,875.4	0.205	0.020	10,886.6
November-17	1,047.0	272,936.2	139,834.0	2,858.3	275,794.5	2,037,316.5	0.27	0.45	0.24	6.41	4.10	0.08	0.29	8.69E-05	1.64E-07	16,196.5	0.310	0.032	16,213.8
December-17	1,031.0	0.001	137,000.0	-	0.001	1,979,076.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.53E-13	0.00E+00	0.0	0.000	0.000	0.0

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-3: Unit RK2 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK2. Emission factors and references are located in the RK2 Emission Factor Table.

	Baseline Data						Unit RK2 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
January-13	1,017.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
February-13	1,017.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
March-13	1,018.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
April-13	1,017.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
May-13	1,016.0	30,704.5	-	-	30,704.5	-	0.029	0.049	0.025	0.668	0.461	-	0.032	7.53E-06	0.00E+00	1,795.848	0.034	0.003	1,797.7
June-13	1,014.0	44,478.1	-	-	44,478.1	-	0.042	0.071	0.036	0.967	0.667	-	0.047	1.09E-05	0.00E+00	2,601.437	0.049	0.005	2,604.1
July-13	1,014.0	131,721.6	-	-	131,721.6	-	0.125	0.211	0.105	2.864	1.976	-	0.138	3.23E-05	0.00E+00	7,704.140	0.145	0.015	7,712.1
August-13	1,018.0	73,733.7	-	-	73,733.7	-	0.070	0.118	0.059	1.603	1.106	-	0.077	1.81E-05	0.00E+00	4,312.542	0.081	0.008	4,317.0
September-13	1,016.0	63,935.9	-	-	63,935.9	-	0.061	0.102	0.051	1.390	0.959	-	0.067	1.57E-05	0.00E+00	3,739.483	0.070	0.007	3,743.3
October-13	1,016.0	-	-	-	-	-	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
November-13	1,019.0	148,130.0	-	-	148,130.0	-	0.141	0.237	0.119	3.221	2.222	-	0.156	3.63E-05	0.00E+00	8,663.832	0.163	0.016	8,672.8
December-13	1,020.0	54,595.5	-	-	54,595.5	-	0.052	0.087	0.044	1.187	0.819	-	0.057	1.34E-05	0.00E+00	3,193.184	0.060	0.006	3,196.5
January-14	1,020.0	71,288.8	138,303.0	21,384.8	92,673.6	-	0.114	0.242	0.185	2.190	1.105	0.07065	0.079	1.67E-04	5.37E-07	5,912.965	0.149	0.022	5,923.3
February-14	1,021.0	9,493.3	137,000.0	-	9,493.3	-	0.009	0.015	0.008	0.224	0.142	0.00724	0.010	2.33E-06	0.00E+00	555.242	0.010	0.001	555.8
March-14	1,022.0	85,882.7	137,692.0	19,371.9	105,254.6	-	0.123	0.254	0.185	2.487	1.320	0.08024	0.094	1.57E-04	4.87E-07	6,602.428	0.159	0.022	6,613.0
April-14	1,022.0	-	137,000.0	-	-	-	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
May-14	1,023.0	98,179.4	137,000.0	-	98,179.4	-	0.093	0.157	0.079	2.320	1.473	0.07484	0.103	2.41E-05	0.00E+00	5,742.318	0.108	0.011	5,748.2
June-14	1,025.0	111,461.6	137,000.0	-	111,461.6	-	0.106	0.178	0.089	2.634	1.672	0.08497	0.117	2.73E-05	0.00E+00	6,519.169	0.123	0.012	6,525.9
July-14	1,025.0	67,951.4	137,000.0	-	67,951.4	-	0.065	0.109	0.054	1.606	1.019	0.05180	0.071	1.67E-05	0.00E+00	3,974.341	0.075	0.007	3,978.4
August-14	1,025.0	30,126.8	137,000.0	-	30,126.8	-	0.029	0.048	0.024	0.712	0.452	0.02297	0.032	7.38E-06	0.00E+00	1,762.057	0.033	0.003	1,763.9
September-14	1,025.0	33,646.7	137,000.0	-	33,646.7	-	0.032	0.054	0.027	0.795	0.505	0.02565	0.035	8.25E-06	0.00E+00	1,967.927	0.037	0.004	1,970.0
October-14	1,021.0	28,485.9	137,000.0	-	28,485.9	-	0.027	0.046	0.023	0.673	0.427	0.02172	0.030	6.98E-06	0.00E+00	1,666.084	0.031	0.003	1,667.8
November-14	1,028.0	7,572.2	138,640.0	2,375.7	9,948.0	-	0.012	0.026	0.020	0.235	0.118	0.00758	0.008	1.85E-05	5.97E-08	636.570	0.016	0.002	637.7
December-14	1,030.0	65,862.3	138,640.0	2,802.9	68,665.2	601,592.9	0.069	0.122	0.070	1.623	0.993	0.05235	0.070	3.58E-05	7.04E-08	4,080.666	0.082	0.009	4,085.4
January-15	1,029.0	47,979.2	138,640.0	24,208.2	72,187.4	637,686.6	0.098	0.222	0.184	2.053	0.760	0.10967	0.055	1.81E-04	1.91E-05	4,779.809	0.133	0.021	4,789.5
February-15	1,028.0	25,888.1	138,068.0	70,656.4	96,544.6	685,958.8	0.177	0.465	0.445	3.500	0.505	0.28704	0.042	5.01E-04	5.57E-05	7,274.490	0.262	0.050	7,295.8
March-15	1,028.0	-	137,000.0	-	-	685,958.8	-	-	-	-	-	-	-	0.00E+00	0.00E+00	-	-	-	-
April-15	1,038.0	186,990.5	137,000.0	-	186,990.5	779,454.1	0.178	0.299	0.150	4.082	2.805	0.05413	0.196	4.58E-05	0.00E+00	10,936.708	0.206	0.021	10,948.0
May-15	1,036.0	140,970.6	137,000.0	-	140,970.6	834,587.1	0.134	0.226	0.113	3.077	2.115	0.04081	0.148	3.46E-05	0.00E+00	8,245.093	0.155	0.016	8,253.6
June-15	1,031.0	367,411.3	137,000.0	-	367,411.3	996,053.7	0.349	0.588	0.294	8.020	5.511	0.10637	0.386	9.01E-05	0.00E+00	21,489.165	0.405	0.040	21,511.4

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-3: Unit RK2 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK2. Emission factors and references are located in the RK2 Emission Factor Table.

	Baseline Data						Unit RK2 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
July-15	1,037.0	224,932.6	137,000.0	-	224,932.6	1,042,659.2	0.214	0.360	0.180	4.910	3.374	0.06512	0.236	5.51E-05	0.00E+00	13,155.864	0.248	0.025	13,169.5
August-15	1,039.0	138,589.1	137,000.0	-	138,589.1	1,075,086.9	0.132	0.222	0.111	3.025	2.079	0.04012	0.146	3.40E-05	0.00E+00	8,105.804	0.153	0.015	8,114.2
September-15	1,041.0	230,319.2	137,000.0	-	230,319.2	1,158,278.5	0.219	0.369	0.184	5.028	3.455	0.06668	0.242	5.65E-05	0.00E+00	13,470.916	0.254	0.025	13,484.8
October-15	1,043.0	82,845.5	137,000.0	-	82,845.5	1,199,701.3	0.079	0.133	0.066	1.808	1.243	0.02398	0.087	2.03E-05	0.00E+00	4,845.470	0.091	0.009	4,850.5
November-15	1,036.0	158,476.9	138,054.0	1,671.1	160,148.1	1,205,710.3	0.154	0.264	0.137	3.529	2.380	0.05249	0.167	5.05E-05	1.32E-06	9,405.246	0.180	0.019	9,415.3
December-15	1,040.0	122,686.7	139,834.0	4,565.6	127,252.3	1,242,038.7	0.126	0.224	0.126	2.868	1.848	0.05358	0.130	6.20E-05	3.60E-06	7,547.919	0.150	0.017	7,556.6
January-16	1,034.0	27,774.3	139,834.0	4,178.7	31,952.9	1,211,678.3	0.035	0.070	0.047	0.801	0.424	0.00963	0.030	3.61E-05	2.51E-07	1,965.133	0.044	0.006	1,968.0
February-16	1,036.0	87,265.4	139,834.0	2,476.6	89,742.0	1,251,802.7	0.088	0.154	0.085	2.036	1.313	0.02704	0.092	3.87E-05	1.49E-07	5,305.889	0.104	0.011	5,311.9
March-16	1,043.0	441,772.0	137,000.0	-	441,772.0	1,420,061.4	0.420	0.707	0.353	9.742	6.627	0.13311	0.464	1.08E-04	0.00E+00	25,838.379	0.487	0.049	25,865.1
April-16	1,048.0	469,438.0	137,000.0	-	469,438.0	1,654,780.4	0.446	0.751	0.376	10.352	7.042	0.14145	0.493	1.15E-04	0.00E+00	27,456.506	0.517	0.052	27,484.9
May-16	1,045.0	62,055.2	137,000.0	-	62,055.2	1,636,718.3	0.059	0.099	0.050	1.368	0.931	0.01870	0.065	1.52E-05	0.00E+00	3,629.489	0.068	0.007	3,633.2
June-16	1,039.0	62,822.1	137,000.0	-	62,822.1	1,612,398.6	0.060	0.101	0.050	1.385	0.942	0.01893	0.066	1.54E-05	0.00E+00	3,674.341	0.069	0.007	3,678.1
July-16	1,041.0	323,390.8	137,000.0	-	323,390.8	1,740,118.3	0.307	0.517	0.259	7.131	4.851	0.09744	0.340	7.93E-05	0.00E+00	18,914.494	0.356	0.036	18,934.0
August-16	1,041.0	403,457.3	137,000.0	-	403,457.3	1,926,783.5	0.383	0.646	0.323	8.897	6.052	0.12157	0.424	9.89E-05	0.00E+00	23,597.423	0.445	0.044	23,621.8
September-16	1,042.0	341,856.2	137,000.0	-	341,856.2	2,080,888.3	0.325	0.547	0.273	7.538	5.128	0.10301	0.359	8.38E-05	0.00E+00	19,994.500	0.377	0.038	20,015.1
October-16	1,044.0	172,111.8	137,000.0	-	172,111.8	2,152,701.3	0.164	0.275	0.138	3.795	2.582	0.05186	0.181	4.22E-05	0.00E+00	10,066.479	0.190	0.019	10,076.9
November-16	1,043.0	239,069.2	137,000.0	-	239,069.2	2,267,261.8	0.227	0.383	0.191	5.272	3.586	0.07204	0.251	5.86E-05	0.00E+00	13,982.686	0.264	0.026	13,997.1
December-16	1,035.0	17,333.1	137,000.0	-	17,333.1	2,241,595.8	0.016	0.028	0.014	0.382	0.260	0.00522	0.018	4.25E-06	0.00E+00	1,013.782	0.019	0.002	1,014.8
January-17	1,039.0	18,931.6	139,834.0	2,712.1	21,643.7	2,216,324.0	0.024	0.047	0.031	0.588	0.288	0.00548	0.020	2.36E-05	1.37E-07	1,328.379	0.030	0.004	1,330.3
February-17	1,039.0	61,301.0	139,834.0	1,980.9	63,281.9	2,199,692.6	0.062	0.110	0.061	1.481	0.923	0.01603	0.065	2.89E-05	9.99E-08	3,746.869	0.074	0.008	3,751.1
March-17	1,037.0	65,874.4	137,000.0	0.0	65,874.4	2,232,629.8	0.063	0.105	0.053	1.459	0.988	0.01668	0.069	1.61E-05	6.91E-15	3,852.864	0.073	0.007	3,856.8
April-17	1,038.0	117,063.6	137,000.0	0.0	117,063.6	2,197,666.3	0.111	0.187	0.094	2.592	1.756	0.02965	0.123	2.87E-05	6.91E-15	6,846.818	0.129	0.013	6,853.9
May-17	1,032.0	133,981.5	137,000.0	0.0	133,981.5	2,194,171.8	0.127	0.214	0.107	2.967	2.010	0.03393	0.141	3.28E-05	6.91E-15	7,836.313	0.148	0.015	7,844.4
June-17	1,032.0	77,389.7	137,000.0	0.0	77,389.7	2,049,161.0	0.074	0.124	0.062	1.714	1.161	0.01960	0.081	1.90E-05	6.91E-15	4,526.371	0.085	0.009	4,531.0
July-17	1,038.0	278,966.7	137,000.0	0.0	278,966.7	2,076,178.0	0.265	0.446	0.223	6.178	4.184	0.07065	0.293	6.84E-05	6.91E-15	16,316.212	0.308	0.031	16,333.1
August-17	1,043.0	150,385.0	137,000.0	0.0	150,385.0	2,082,076.0	0.143	0.241	0.120	3.330	2.256	0.03808	0.158	3.69E-05	6.91E-15	8,795.721	0.166	0.017	8,804.8
September-17	1,041.0	72,049.7	137,000.0	0.0	72,049.7	2,002,941.2	0.068	0.115	0.058	1.596	1.081	0.01825	0.076	1.77E-05	6.91E-15	4,214.045	0.079	0.008	4,218.4
October-17	1,040.0	250,942.6	137,000.0	0.0	250,942.6	2,086,989.8	0.238	0.402	0.201	5.557	3.764	0.06355	0.263	6.15E-05	6.91E-15	14,677.143	0.277	0.028	14,692.3
November-17	1,047.0	330,165.2	139,834.0	1,917.8	332,083.0	2,172,957.3	0.318	0.540	0.276	7.431	4.956	0.08410	0.347	9.43E-05	9.67E-08	19,467.065	0.370	0.038	19,487.5
December-17	1,031.0	14,364.9	139,834.0	1,443.9	15,808.8	2,117,235.5	0.017	0.032	0.020	0.408	0.218	0.00400	0.015	1.36E-05	7.28E-08	957.894	0.021	0.003	959.2

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-4: Unit RK3 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK3. Emission factors and references are located in the RK3 Emission Factor Table.

	Baseline Data						Unit RK3 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
January-13	1,017.00	15,197.0	-	-	15,197.0	-	0.01	0.02	0.01	0.34	0.23	0.00	0.02	3.72E-06	0.00E+00	888.8	0.02	0.002	889.76
February-13	1,017.00	44,681.9	-	-	44,681.9	-	0.04	0.07	0.04	1.00	0.67	0.00	0.05	1.10E-05	0.00E+00	2613.4	0.05	0.005	2616.06
March-13	1,018.00	12,534.6	-	-	12,534.6	-	0.01	0.02	0.01	0.28	0.19	0.00	0.01	3.07E-06	0.00E+00	733.1	0.01	0.001	733.88
April-13	1,017.00	32,401.6	-	-	32,401.6	-	0.03	0.05	0.03	0.73	0.49	0.00	0.03	7.94E-06	0.00E+00	1895.1	0.04	0.004	1897.06
May-13	1,016.00	35,121.1	-	-	35,121.1	-	0.03	0.06	0.03	0.79	0.53	0.00	0.04	8.61E-06	0.00E+00	2054.2	0.04	0.004	2056.29
June-13	1,014.00	57,230.2	-	-	57,230.2	-	0.05	0.09	0.05	1.28	0.86	0.00	0.06	1.40E-05	0.00E+00	3347.3	0.06	0.006	3350.74
July-13	1,014.00	141,937.7	-	-	141,937.7	-	0.13	0.23	0.11	3.18	2.13	0.00	0.15	3.48E-05	0.00E+00	8301.7	0.16	0.016	8310.23
August-13	1,018.00	109,157.1	-	-	109,157.1	-	0.10	0.17	0.09	2.45	1.64	0.00	0.11	2.68E-05	0.00E+00	6384.4	0.12	0.012	6390.98
September-13	1,016.00	96,535.2	-	-	96,535.2	-	0.09	0.15	0.08	2.17	1.45	0.00	0.10	2.37E-05	0.00E+00	5646.2	0.11	0.011	5651.99
October-13	1,016.00	55,177.9	-	-	55,177.9	-	0.05	0.09	0.04	1.24	0.83	0.00	0.06	1.35E-05	0.00E+00	3227.2	0.06	0.006	3230.58
November-13	1,019.00	82,405.5	-	-	82,405.5	-	0.08	0.13	0.07	1.85	1.24	0.00	0.09	2.02E-05	0.00E+00	4819.7	0.09	0.009	4824.71
December-13	1,020.00	31,025.3	-	-	31,025.3	-	0.03	0.05	0.02	0.70	0.47	0.00	0.03	7.60E-06	0.00E+00	1814.6	0.03	0.003	1816.49
January-14	1,020.00	54,393.5	138,303.0	9,347.3	63,740.9	-	0.07	0.14	0.10	1.52	0.83	0.03	0.06	1.14E-04	3.83E-07	3943.4	0.09	0.012	3949.32
February-14	1,021.00	3,251.9	137,000.0	-	3,251.9	-	0.00	0.01	0.00	0.08	0.05	0.00	0.00	7.97E-07	0.00E+00	190.2	0.00	0.000	190.39
March-14	1,022.00	52,382.6	137,692.0	13,456.5	65,839.1	-	0.08	0.16	0.12	1.57	0.81	0.03	0.06	7.19E-05	5.52E-07	4160.8	0.10	0.015	4167.74
April-14	1,022.00	2,345.5	137,000.0	-	2,345.5	-	0.00	0.00	0.00	0.06	0.04	0.00	0.00	5.75E-07	0.00E+00	137.2	0.00	0.000	137.32
May-14	1,023.00	62,290.5	137,000.0	-	62,290.5	-	0.06	0.10	0.05	1.49	0.93	0.03	0.07	1.53E-05	0.00E+00	3643.2	0.07	0.007	3647.01
June-14	1,025.00	81,666.9	137,000.0	-	81,666.9	-	0.08	0.13	0.07	1.95	1.23	0.03	0.09	2.00E-05	0.00E+00	4776.5	0.09	0.009	4781.47
July-14	1,025.00	59,386.5	137,000.0	-	59,386.5	-	0.06	0.10	0.05	1.42	0.89	0.03	0.06	1.46E-05	0.00E+00	3473.4	0.07	0.007	3476.98
August-14	1,025.00	14,971.2	137,000.0	-	14,971.2	-	0.01	0.02	0.01	0.36	0.22	0.01	0.02	3.67E-06	0.00E+00	875.6	0.02	0.002	876.54
September-14	1,025.00	37,118.3	137,000.0	-	37,118.3	-	0.04	0.06	0.03	0.89	0.56	0.02	0.04	9.10E-06	0.00E+00	2171.0	0.04	0.004	2173.22
October-14	1,021.00	31,790.9	137,000.0	-	31,790.9	-	0.03	0.05	0.03	0.76	0.48	0.01	0.03	7.79E-06	0.00E+00	1859.4	0.04	0.004	1861.31
November-14	1,028.00	6,823.9	138,640.0	2,536.3	9,360.1	-	0.01	0.03	0.02	0.22	0.11	0.00	0.01	1.91E-05	1.04E-07	605.9	0.02	0.002	607.01
December-14	1,030.00	34,026.1	138,640.0	2,786.7	36,812.7	590,989.8	0.04	0.07	0.04	0.88	0.51	0.02	0.04	2.92E-05	1.14E-07	2217.3	0.05	0.006	2220.14
January-15	1,029.00	6,648.4	138,640.0	44,026.2	50,674.6	608,728.6	0.10	0.27	0.27	1.54	0.17	0.15	0.02	3.21E-04	2.94E-05	3978.1	0.15	0.030	3990.86
February-15	1,028.00	15,520.7	138,068.0	71,181.4	86,702.1	629,738.7	0.17	0.45	0.44	2.59	0.35	0.24	0.03	2.10E-04	4.76E-05	6710.9	0.25	0.049	6731.77
March-15	1,028.00	21,940.6	137,000.0	-	21,940.6	634,441.7	0.02	0.04	0.02	0.44	0.33	0.01	0.02	5.38E-06	0.00E+00	1283.3	0.02	0.002	1284.59
April-15	1,038.00	112,537.9	137,000.0	-	112,537.9	674,509.8	0.11	0.18	0.09	2.28	1.69	0.04	0.12	2.76E-05	0.00E+00	6582.1	0.12	0.012	6588.92
May-15	1,036.00	170,082.2	137,000.0	-	170,082.2	741,990.4	0.16	0.27	0.14	3.44	2.55	0.05	0.18	4.17E-05	0.00E+00	9947.8	0.19	0.019	9958.05
June-15	1,031.00	371,441.5	137,000.0	-	371,441.5	899,096.0	0.35	0.59	0.30	7.52	5.57	0.12	0.39	9.10E-05	0.00E+00	21724.9	0.41	0.041	21747.32

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-4: Unit RK3 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK3. Emission factors and references are located in the RK3 Emission Factor Table.

	Baseline Data						Unit RK3 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
July-15	1,037.00	241,638.6	137,000.0	-	241,638.6	948,946.5	0.23	0.39	0.19	4.89	3.62	0.08	0.25	5.92E-05	0.00E+00	14133.0	0.27	0.027	14147.57
August-15	1,039.00	141,068.1	137,000.0	-	141,068.1	964,902.0	0.13	0.23	0.11	2.86	2.12	0.05	0.15	3.46E-05	0.00E+00	8250.8	0.16	0.016	8259.32
September-15	1,041.00	167,669.7	137,000.0	-	167,669.7	1,000,469.3	0.16	0.27	0.13	3.39	2.52	0.05	0.18	4.11E-05	0.00E+00	9806.7	0.18	0.018	9816.80
October-15	1,043.00	26,625.7	137,000.0	-	26,625.7	986,193.1	0.03	0.04	0.02	0.54	0.40	0.01	0.03	6.53E-06	0.00E+00	1557.3	0.03	0.003	1558.89
November-15	1,036.00	178,928.6	138,054.0	3,906.0	182,834.6	1,036,407.7	0.18	0.31	0.17	3.75	2.69	0.07	0.19	7.35E-05	2.61E-06	10783.6	0.21	0.022	10795.52
December-15	1,040.00	106,904.7	137,000.0	-	106,904.7	1,074,347.3	0.10	0.17	0.09	2.16	1.60	0.03	0.11	2.62E-05	0.00E+00	6252.6	0.12	0.012	6259.10
January-16	1,034.00	9,378.4	139,834.0	3,674.6	13,052.9	1,049,003.4	0.02	0.04	0.03	0.39	0.15	0.00	0.01	1.88E-05	2.24E-07	848.1	0.02	0.003	849.69
February-16	1,036.00	50,026.4	139,834.0	2,486.4	52,512.8	1,073,633.8	0.05	0.09	0.05	1.23	0.75	0.02	0.05	3.02E-05	1.52E-07	3128.6	0.06	0.007	3132.37
March-16	1,043.00	478,171.7	137,000.0	-	478,171.7	1,279,800.1	0.45	0.77	0.38	10.62	7.17	0.15	0.50	1.17E-04	0.00E+00	27967.3	0.53	0.053	27996.21
April-16	1,048.00	490,810.9	137,000.0	-	490,810.9	1,524,032.8	0.47	0.79	0.39	10.91	7.36	0.15	0.52	1.20E-04	0.00E+00	28706.6	0.54	0.054	28736.21
May-16	1,045.00	59,609.9	137,000.0	-	59,609.9	1,522,692.5	0.06	0.10	0.05	1.32	0.89	0.02	0.06	1.46E-05	0.00E+00	3486.5	0.07	0.007	3490.07
June-16	1,039.00	93,342.7	137,000.0	-	93,342.7	1,528,530.4	0.09	0.15	0.07	2.07	1.40	0.03	0.10	2.29E-05	0.00E+00	5459.4	0.10	0.010	5465.07
July-16	1,041.00	357,216.0	137,000.0	-	357,216.0	1,677,445.2	0.34	0.57	0.29	7.94	5.36	0.11	0.38	8.76E-05	0.00E+00	20892.9	0.39	0.039	20914.44
August-16	1,041.00	398,928.9	137,000.0	-	398,928.9	1,869,424.1	0.38	0.64	0.32	8.86	5.98	0.12	0.42	9.78E-05	0.00E+00	23332.6	0.44	0.044	23356.67
September-16	1,042.00	344,679.0	137,000.0	-	344,679.0	2,023,204.4	0.33	0.55	0.28	7.66	5.17	0.11	0.36	8.45E-05	0.00E+00	20159.6	0.38	0.038	20180.42
October-16	1,044.00	71,577.7	137,000.0	-	71,577.7	2,043,097.9	0.07	0.11	0.06	1.59	1.07	0.02	0.08	1.75E-05	0.00E+00	4186.4	0.08	0.008	4190.76
November-16	1,043.00	227,723.4	137,000.0	-	227,723.4	2,152,279.5	0.22	0.36	0.18	5.06	3.42	0.07	0.24	5.58E-05	0.00E+00	13319.1	0.25	0.025	13332.85
December-16	1,035.00	19,954.8	137,000.0	-	19,954.8	2,143,850.5	0.02	0.03	0.02	0.44	0.30	0.01	0.02	4.89E-06	0.00E+00	1167.1	0.02	0.002	1168.32
January-17	1,039.00	15,083.2	139,834.0	1,766.0	16,849.1	2,126,937.8	0.02	0.03	0.02	0.42	0.23	0.01	0.02	1.68E-05	1.10E-07	1026.2	0.02	0.003	1027.56
February-17	1,039.00	18,621.0	139,834.0	1,958.5	20,579.5	2,093,876.5	0.02	0.04	0.03	0.51	0.28	0.01	0.02	1.74E-05	1.22E-07	1248.8	0.03	0.003	1250.45
March-17	1,037.00	41,748.6	137,000.0	-	41,748.6	2,103,780.5	0.04	0.07	0.03	0.95	0.63	0.01	0.04	1.02E-05	0.00E+00	2441.8	0.05	0.005	2444.31
April-17	1,038.00	80,969.2	137,000.0	-	80,969.2	2,087,996.1	0.08	0.13	0.06	1.84	1.21	0.03	0.09	1.98E-05	0.00E+00	4735.7	0.09	0.009	4740.62
May-17	1,032.00	98,528.1	137,000.0	-	98,528.1	2,052,219.1	0.09	0.16	0.08	2.24	1.48	0.03	0.10	2.41E-05	0.00E+00	5762.7	0.11	0.011	5768.67
June-17	1,032.00	39,768.1	137,000.0	-	39,768.1	1,886,382.4	0.04	0.06	0.03	0.90	0.60	0.01	0.04	9.75E-06	0.00E+00	2326.0	0.04	0.004	2328.36
July-17	1,038.00	232,037.6	137,000.0	-	232,037.6	1,881,581.9	0.22	0.37	0.19	5.28	3.48	0.07	0.24	5.69E-05	0.00E+00	13571.4	0.26	0.026	13585.44
August-17	1,043.00	141,390.1	137,000.0	-	141,390.1	1,881,742.9	0.13	0.23	0.11	3.21	2.12	0.04	0.15	3.47E-05	0.00E+00	8269.6	0.16	0.016	8278.17
September-17	1,041.00	74,411.7	137,000.0	-	74,411.7	1,835,113.9	0.07	0.12	0.06	1.69	1.12	0.02	0.08	1.82E-05	0.00E+00	4352.2	0.08	0.008	4356.69
October-17	1,040.00	213,530.7	137,000.0	-	213,530.7	1,928,566.4	0.20	0.34	0.17	4.85	3.20	0.07	0.22	5.23E-05	0.00E+00	12489.0	0.24	0.024	12501.89
November-17	1,047.00	300,806.3	139,834.0	2,792.2	303,598.5	1,988,948.4	0.29	0.50	0.26	6.97	4.52	0.10	0.32	9.37E-05	1.75E-07	17821.2	0.34	0.035	17840.16
December-17	1,031.00	9,932.7	139,834.0	0.0	9,932.7	1,940,462.3	0.01	0.02	0.01	0.23	0.15	0.00	0.01	2.43E-06	8.74E-15	580.9	0.01	0.001	581.54

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-5: Unit RK4 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK4. Emission factors and references are located in the RK4 Emission Factor Table.

	Baseline Data						Unit RK4 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
January-13	1,017.00	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00000	0.000	0.00
February-13	1,017.00	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00000	0.000	0.00
March-13	1,018.00	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00000	0.000	0.00
April-13	1,017.00	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00000	0.000	0.00
May-13	1,016.00	48,462.2	-	-	48,462.2	-	0.05	0.08	0.04	1.04	0.73	0.00	0.05	1.19E-05	0.00E+00	2834.5	0.05342	0.005	2837.39
June-13	1,014.00	77,622.7	-	-	77,622.7	-	0.07	0.12	0.06	1.66	1.16	0.00	0.08	1.90E-05	0.00E+00	4540.0	0.08556	0.009	4544.69
July-13	1,014.00	175,043.8	-	-	175,043.8	-	0.17	0.28	0.14	3.75	2.63	0.00	0.18	4.29E-05	0.00E+00	10238.0	0.19295	0.019	10248.54
August-13	1,018.00	124,355.8	-	-	124,355.8	-	0.12	0.20	0.10	2.66	1.87	0.00	0.13	3.05E-05	0.00E+00	7273.3	0.13708	0.014	7280.84
September-13	1,016.00	100,751.6	-	-	100,751.6	-	0.10	0.16	0.08	2.16	1.51	0.00	0.11	2.47E-05	0.00E+00	5892.8	0.11106	0.011	5898.85
October-13	1,016.00	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00000	0.000	0.00
November-13	1,019.00	113,524.8	-	-	113,524.8	-	0.11	0.18	0.09	2.43	1.70	0.00	0.12	2.78E-05	0.00E+00	6639.8	0.12514	0.013	6646.70
December-13	1,020.00	46,431.4	-	-	46,431.4	-	0.04	0.07	0.04	0.99	0.70	0.00	0.05	1.14E-05	0.00E+00	2715.7	0.05118	0.005	2718.49
January-14	1,020.00	74,450.8	138,303.0	39,913.7	114,364.5	-	0.16	0.36	0.30	2.86	1.18	0.08	0.09	2.98E-04	7.47E-07	7608.5	0.21406	0.035	7624.15
February-14	1,021.00	16,267.6	137,000.0	-	16,267.6	-	0.02	0.03	0.01	0.41	0.24	0.01	0.02	3.99E-06	0.00E+00	951.5	0.01793	0.002	952.44
March-14	1,022.00	96,371.5	137,692.0	16,480.5	112,852.0	-	0.13	0.25	0.18	2.82	1.47	0.07	0.10	1.39E-04	3.09E-07	6980.2	0.16073	0.022	6990.60
April-14	1,022.00	-	137,000.0	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00000	0.000	0.00
May-14	1,023.00	97,410.1	137,000.0	-	97,410.1	-	0.09	0.16	0.08	2.44	1.46	0.06	0.10	2.39E-05	0.00E+00	5697.3	0.10738	0.011	5703.21
June-14	1,025.00	134,758.8	137,000.0	-	134,758.8	-	0.13	0.22	0.11	3.37	2.02	0.09	0.14	3.30E-05	0.00E+00	7881.8	0.14854	0.015	7889.92
July-14	1,025.00	81,907.8	137,000.0	-	81,907.8	-	0.08	0.13	0.07	2.05	1.23	0.05	0.09	2.01E-05	0.00E+00	4790.6	0.09029	0.009	4795.57
August-14	1,025.00	41,002.1	137,000.0	-	41,002.1	-	0.04	0.07	0.03	1.03	0.62	0.03	0.04	1.00E-05	0.00E+00	2398.1	0.04520	0.005	2400.61
September-14	1,025.00	48,116.6	137,000.0	-	48,116.6	-	0.05	0.08	0.04	1.20	0.72	0.03	0.05	1.18E-05	0.00E+00	2814.2	0.05304	0.005	2817.15
October-14	1,021.00	40,993.2	137,000.0	-	40,993.2	-	0.04	0.07	0.03	1.03	0.61	0.03	0.04	1.00E-05	0.00E+00	2397.6	0.04519	0.005	2400.09
November-14	1,028.00	13,673.4	138,640.0	2,311.8	15,985.3	-	0.02	0.04	0.02	0.40	0.21	0.01	0.01	1.95E-05	4.33E-08	988.2	0.02272	0.003	989.68
December-14	1,030.00	48,544.9	138,640.0	2,898.4	51,443.3	720,646.7	0.05	0.10	0.06	1.29	0.73	0.03	0.05	3.22E-05	5.43E-08	3075.6	0.06310	0.007	3079.34
January-15	1,029.00	8,288.6	138,640.0	41,373.2	49,661.8	745,477.6	0.10	0.26	0.25	2.30	0.19	0.16	0.02	2.92E-04	3.10E-05	3857.8	0.14595	0.028	3869.86
February-15	1,028.00	3,578.5	138,068.0	82,876.4	86,454.9	788,705.1	0.18	0.50	0.50	4.32	0.19	0.31	0.02	5.81E-04	6.21E-05	6965.9	0.27801	0.055	6989.29
March-15	1,028.00	51,440.1	137,000.0	-	51,440.1	814,425.1	0.05	0.08	0.04	1.14	0.77	0.01	0.05	1.26E-05	0.00E+00	3008.6	0.05670	0.006	3011.74
April-15	1,038.00	215,676.7	137,000.0	-	215,676.7	922,263.4	0.20	0.35	0.17	4.77	3.24	0.06	0.23	5.29E-05	0.00E+00	12614.5	0.23774	0.024	12627.53
May-15	1,036.00	153,843.9	137,000.0	-	153,843.9	974,954.3	0.15	0.25	0.12	3.40	2.31	0.04	0.16	3.77E-05	0.00E+00	8998.0	0.16958	0.017	9007.32
June-15	1,031.00	388,580.8	137,000.0	-	388,580.8	1,130,433.4	0.37	0.62	0.31	8.60	5.83	0.11	0.41	9.52E-05	0.00E+00	22727.3	0.42833	0.043	22750.80

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-5: Unit RK4 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK4. Emission factors and references are located in the RK4 Emission Factor Table.

	Baseline Data						Unit RK4 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
July-15	1,037.00	222,232.2	137,000.0	-	222,232.2	1,154,027.6	0.21	0.36	0.18	4.92	3.33	0.06	0.23	5.45E-05	0.00E+00	12997.9	0.24497	0.024	13011.35
August-15	1,039.00	148,943.8	137,000.0	-	148,943.8	1,166,321.6	0.14	0.24	0.12	3.30	2.23	0.04	0.16	3.65E-05	0.00E+00	8711.4	0.16418	0.016	8720.43
September-15	1,041.00	276,288.7	137,000.0	-	276,288.7	1,254,090.1	0.26	0.44	0.22	6.11	4.14	0.07	0.29	6.77E-05	0.00E+00	16159.6	0.30455	0.030	16176.27
October-15	1,043.00	96,645.4	137,000.0	-	96,645.4	1,302,412.8	0.09	0.15	0.08	2.14	1.45	0.03	0.10	2.37E-05	0.00E+00	5652.6	0.10653	0.011	5658.44
November-15	1,036.00	233,228.5	138,054.0	8,490.6	241,719.1	1,366,509.9	0.24	0.42	0.24	5.60	3.51	0.10	0.25	1.17E-04	6.37E-06	14333.3	0.28517	0.031	14349.74
December-15	1,040.00	49,231.5	137,000.0	-	49,231.5	1,367,910.0	0.05	0.08	0.04	1.09	0.74	0.01	0.05	1.21E-05	0.00E+00	2879.5	0.05427	0.005	2882.43
January-16	1,034.00	29,044.0	139,834.0	2,689.6	31,733.6	1,326,594.5	0.03	0.06	0.04	1.31	0.44	0.01	0.03	2.59E-05	1.28E-07	1918.0	0.04091	0.005	1920.50
February-16	1,036.00	87,588.6	139,834.0	2,482.5	90,071.1	1,363,496.3	0.09	0.16	0.08	2.84	1.32	0.03	0.09	3.88E-05	1.18E-07	5325.3	0.10476	0.011	5331.26
March-16	1,043.00	682,797.9	137,000.0	-	682,797.9	1,648,469.2	0.65	1.09	0.55	18.40	10.24	0.24	0.72	1.67E-04	0.00E+00	39935.5	0.75265	0.075	39976.75
April-16	1,048.00	419,531.2	137,000.0	-	419,531.2	1,858,234.8	0.40	0.67	0.34	11.31	6.29	0.14	0.44	1.03E-04	0.00E+00	24537.6	0.46245	0.046	24562.90
May-16	1,045.00	80,515.2	137,000.0	-	80,515.2	1,849,787.3	0.08	0.13	0.06	2.17	1.21	0.03	0.08	1.97E-05	0.00E+00	4709.2	0.08875	0.009	4714.04
June-16	1,039.00	43,617.2	137,000.0	-	43,617.2	1,804,216.5	0.04	0.07	0.03	1.18	0.65	0.02	0.05	1.07E-05	0.00E+00	2551.1	0.04808	0.005	2553.72
July-16	1,041.00	282,915.7	137,000.0	-	282,915.7	1,904,720.5	0.27	0.45	0.23	7.62	4.24	0.10	0.30	6.93E-05	0.00E+00	16547.2	0.31186	0.031	16564.27
August-16	1,041.00	417,469.1	137,000.0	-	417,469.1	2,092,954.0	0.40	0.67	0.33	11.25	6.26	0.14	0.44	1.02E-04	0.00E+00	24416.9	0.46018	0.046	24442.17
September-16	1,042.00	378,604.4	137,000.0	-	378,604.4	2,258,198.0	0.36	0.61	0.30	10.20	5.68	0.13	0.40	9.28E-05	0.00E+00	22143.8	0.41734	0.042	22166.70
October-16	1,044.00	231,275.2	137,000.0	-	231,275.2	2,353,339.0	0.22	0.37	0.19	6.23	3.47	0.08	0.24	5.67E-05	0.00E+00	13526.8	0.25493	0.025	13540.81
November-16	1,043.00	496,930.1	137,000.0	-	496,930.1	2,593,811.4	0.47	0.80	0.40	13.39	7.45	0.17	0.52	1.22E-04	0.00E+00	29064.5	0.54777	0.055	29094.48
December-16	1,035.00	16,861.2	137,000.0	-	16,861.2	2,576,520.3	0.02	0.03	0.01	0.45	0.25	0.01	0.02	4.13E-06	0.00E+00	986.2	0.01859	0.002	987.20
January-17	1,039.00	19,373.2	139,834.0	1,827.2	21,200.4	2,562,289.6	0.02	0.04	0.03	0.65	0.29	0.01	0.02	1.75E-05	2.11E-07	1282.1	0.02740	0.003	1283.75
February-17	1,039.00	78,937.0	139,834.0	1,835.9	80,772.9	2,559,448.6	0.08	0.14	0.07	2.23	1.19	0.04	0.08	3.22E-05	2.12E-07	4766.5	0.09308	0.010	4771.82
March-17	1,037.00	80,241.0	137,000.0	0.0	80,241.0	2,573,849.1	0.08	0.13	0.06	2.13	1.20	0.04	0.08	1.97E-05	1.58E-14	4693.1	0.08845	0.009	4697.98
April-17	1,038.00	99,890.9	137,000.0	0.0	99,890.9	2,515,956.2	0.09	0.16	0.08	2.65	1.50	0.05	0.10	2.45E-05	1.58E-14	5842.4	0.11011	0.011	5848.46
May-17	1,032.00	94,801.6	137,000.0	0.0	94,801.6	2,486,435.0	0.09	0.15	0.08	2.51	1.42	0.04	0.10	2.32E-05	1.58E-14	5544.8	0.10450	0.010	5550.49
June-17	1,032.00	50,145.9	137,000.0	0.0	50,145.9	2,317,217.6	0.05	0.08	0.04	1.33	0.75	0.02	0.05	1.23E-05	1.58E-14	2932.9	0.05528	0.006	2935.97
July-17	1,038.00	261,729.6	137,000.0	0.0	261,729.6	2,336,966.3	0.25	0.42	0.21	6.94	3.93	0.12	0.27	6.41E-05	1.58E-14	15308.1	0.28850	0.029	15323.86
August-17	1,043.00	142,620.9	137,000.0	0.0	142,620.9	2,333,804.8	0.14	0.23	0.11	3.78	2.14	0.07	0.15	3.50E-05	1.58E-14	8341.6	0.15721	0.016	8350.23
September-17	1,041.00	131,929.0	137,000.0	0.0	131,929.0	2,261,625.0	0.13	0.21	0.11	3.50	1.98	0.06	0.14	3.23E-05	1.58E-14	7716.3	0.14543	0.015	7724.24
October-17	1,040.00	261,174.2	137,000.0	0.0	261,174.2	2,343,889.4	0.25	0.42	0.21	6.93	3.92	0.12	0.27	6.40E-05	1.58E-14	15275.6	0.28789	0.029	15291.34
November-17	1,047.00	277,241.4	139,834.0	2,178.2	279,419.6	2,362,739.6	0.27	0.46	0.23	7.52	4.16	0.13	0.29	8.32E-05	2.52E-07	16392.9	0.31281	0.032	16410.24
December-17	1,031.00	10,670.8	139,834.0	3,727.0	14,397.8	2,345,322.8	0.02	0.04	0.03	0.57	0.17	0.01	0.01	2.87E-05	4.31E-07	928.0	0.02409	0.004	929.65

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-6: Unit RK5 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK5. Emission factors and references are located in the RK5 Emission Factor Table.

	Baseline Data						Unit RK5 Actual Emissions												
	Natural Gas	Natural Gas	#2 Fuel Oil	#2 Fuel Oil	Total	24-month	PM (filterable)	PM_{10}	$PM_{2.5}$	NOx	CO	SO_2	VOC	Lead	H_2SO_4	CO_2	CH_4	N_2O	CO_2e
Month	Btu/cf	MMBtu	Btu/gal	MMBtu	MMBtu	average	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month	tons/month
January-13	1,017.00	8,552.0	-	-	8,552.0	-	0.01	0.01	0.01	0.19	0.13	0.00	0.01	2.10E-06	0.00E+00	500.2	0.01	0.00	500.70
February-13	1,017.00	46,141.3	-	-	46,141.3	-	0.04	0.07	0.04	1.01	0.69	0.00	0.05	1.13E-05	0.00E+00	2698.7	0.05	0.01	2701.50
March-13	1,018.00	12,790.2	-	-	12,790.2	-	0.01	0.02	0.01	0.28	0.19	0.00	0.01	3.13E-06	0.00E+00	748.1	0.01	0.00	748.84
April-13	1,017.00	11,237.8	-	-	11,237.8	-	0.01	0.02	0.01	0.25	0.17	0.00	0.01	2.75E-06	0.00E+00	657.3	0.01	0.00	657.96
May-13	1,016.00	20,118.8	-	-	20,118.8	-	0.02	0.03	0.02	0.44	0.30	0.00	0.02	4.93E-06	0.00E+00	1176.7	0.02	0.00	1177.93
June-13	1,014.00	63,101.2	-	-	63,101.2	-	0.06	0.10	0.05	1.38	0.95	0.00	0.07	1.55E-05	0.00E+00	3690.7	0.07	0.01	3694.48
July-13	1,014.00	123,607.6	-	-	123,607.6	-	0.12	0.20	0.10	2.70	1.85	0.00	0.13	3.03E-05	0.00E+00	7229.6	0.14	0.01	7237.03
August-13	1,018.00	127,556.4	-	-	127,556.4	-	0.12	0.20	0.10	2.78	1.91	0.00	0.13	3.13E-05	0.00E+00	7460.5	0.14	0.01	7468.23
September-13	1,016.00	72,591.2	-	-	72,591.2	-	0.07	0.12	0.06	1.58	1.09	0.00	0.08	1.78E-05	0.00E+00	4245.7	0.08	0.01	4250.10
October-13	1,016.00	47,156.6	-	-	47,156.6	-	0.04	0.08	0.04	1.03	0.71	0.00	0.05	1.16E-05	0.00E+00	2758.1	0.05	0.01	2760.95
November-13	1,019.00	83,969.7	-	-	83,969.7	-	0.08	0.13	0.07	1.83	1.26	0.00	0.09	2.06E-05	0.00E+00	4911.2	0.09	0.01	4916.29
December-13	1,020.00	34,414.8	-	-	34,414.8	-	0.03	0.06	0.03	0.75	0.52	0.00	0.04	8.44E-06	0.00E+00	2012.9	0.04	0.00	2014.93
January-14	1,020.00	-	138,303.0	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00	0.00	0.00
February-14	1,021.00	-	137,000.0	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00	0.00	0.00
March-14	1,022.00	62,784.5	137,692.0	5,885.9	68,670.4	-	0.07	0.14	0.09	1.58	0.95	0.02	0.07	5.66E-05	6.33E-07	4152.0	0.09	0.01	4157.44
April-14	1,022.00	-	137,000.0	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.0	0.00	0.00	0.00
May-14	1,023.00	55,579.6	137,000.0	-	55,579.6	-	0.05	0.09	0.04	1.28	0.83	0.02	0.06	1.36E-05	0.00E+00	3250.7	0.06	0.01	3254.10
June-14	1,025.00	73,114.3	137,000.0	-	73,114.3	-	0.07	0.12	0.06	1.69	1.10	0.02	0.08	1.79E-05	0.00E+00	4276.3	0.08	0.01	4280.73
July-14	1,025.00	53,839.2	137,000.0	-	53,839.2	-	0.05	0.09	0.04	1.24	0.81	0.02	0.06	1.32E-05	0.00E+00	3148.9	0.06	0.01	3152.20
August-14	1,025.00	6,917.7	137,000.0	-	6,917.7	-	0.01	0.01	0.01	0.16	0.10	0.00	0.01	1.70E-06	0.00E+00	404.6	0.01	0.00	405.02
September-14	1,025.00	31,770.9	137,000.0	-	31,770.9	-	0.03	0.05	0.03	0.73	0.48	0.01	0.03	7.79E-06	0.00E+00	1858.2	0.04	0.00	1860.14
October-14	1,021.00	28,516.5	137,000.0	-	28,516.5	-	0.03	0.05	0.02	0.66	0.43	0.01	0.03	6.99E-06	0.00E+00	1667.9	0.03	0.00	1669.60
November-14	1,028.00	7,284.4	138,640.0	2,329.6	9,614.0	-	0.01	0.03	0.02	0.22	0.11	0.00	0.01	1.81E-05	2.51E-07	616.0	0.02	0.00	617.06
December-14	1,030.00	20,800.9	138,640.0	2,505.5	23,306.4	501,283.3	0.03	0.05	0.03	0.54	0.32	0.01	0.02	2.26E-05	2.70E-07	1420.9	0.03	0.00	1422.82
January-15	1,029.00	52,277.3	138,640.0	-	52,277.3	523,146.0	0.05	0.08	0.04	1.16	0.78	0.02	0.05	1.28E-05	0.00E+00	3057.6	0.06	0.01	3060.76
February-15	1,028.00	30,129.7	138,068.0	68,967.2	99,096.8	549,623.7	0.18	0.46	0.44	4.32	0.57	0.19	0.05	4.90E-04	3.55E-05	7384.8	0.26	0.05	7405.96
March-15	1,028.00	25,893.3	137,000.0	-	25,893.3	556,175.3	0.02	0.04	0.02	0.58	0.39	0.01	0.03	6.35E-06	0.00E+00	1514.4	0.03	0.00	1516.01
April-15	1,038.00	115,220.1	137,000.0	-	115,220.1	608,166.4	0.11	0.18	0.09	2.56	1.73	0.03	0.12	2.82E-05	0.00E+00	6739.0	0.13	0.01	6745.96
May-15	1,036.00	157,895.7	137,000.0	-	157,895.7	677,054.8	0.15	0.25	0.13	3.51	2.37	0.05	0.17	3.87E-05	0.00E+00	9235.0	0.17	0.02	9244.55
June-15	1,031.00	343,662.2	137,000.0	-	343,662.2	817,335.3	0.33	0.55	0.27	7.64	5.15	0.10	0.36	8.42E-05	0.00E+00	20100.1	0.38	0.04	20120.89

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-6: Unit RK5 Baseline Actual Emissions
The Table below presents baseline actual emissions for Unit RK5. Emission factors and references are located in the RK5 Emission Factor Table.

	Baseline Data						Unit RK5 Actual Emissions												
Month	Natural Gas Btu/cf	Natural Gas MMBtu	#2 Fuel Oil Btu/gal	#2 Fuel Oil MMBtu	Total MMBtu	24-month average	PM (filterable) tons/month	PM_{10} tons/month	$PM_{2.5}$ tons/month	NOx tons/month	CO tons/month	SO_2 tons/month	VOC tons/month	Lead tons/month	H_2SO_4 tons/month	CO_2 tons/month	CH_4 tons/month	N_2O tons/month	CO_2e tons/month
July-15	1,037.00	237,811.1	137,000.0	-	237,811.1	874,437.0	0.23	0.38	0.19	5.29	3.57	0.07	0.25	5.83E-05	0.00E+00	13909.1	0.26	0.03	13923.47
August-15	1,039.00	148,219.6	137,000.0	-	148,219.6	884,768.6	0.14	0.24	0.12	3.30	2.22	0.04	0.16	3.63E-05	0.00E+00	8669.1	0.16	0.02	8678.03
September-15	1,041.00	226,596.5	137,000.0	-	226,596.5	961,771.3	0.22	0.36	0.18	5.04	3.40	0.07	0.24	5.55E-05	0.00E+00	13253.2	0.25	0.02	13266.88
October-15	1,043.00	42,959.1	137,000.0	-	42,959.1	959,672.5	0.04	0.07	0.03	0.96	0.64	0.01	0.05	1.05E-05	0.00E+00	2512.6	0.05	0.00	2515.19
November-15	1,036.00	162,405.4	138,054.0	8,491.4	170,896.9	1,003,136.1	0.17	0.31	0.18	4.06	2.45	0.07	0.17	9.92E-05	4.36E-06	10191.0	0.21	0.02	10203.23
December-15	1,040.00	148,200.0	137,000.0	-	148,200.0	1,060,028.7	0.14	0.24	0.12	3.29	2.22	0.04	0.16	3.63E-05	0.00E+00	8667.9	0.16	0.02	8676.88
January-16	1,034.00	15,057.1	139,834.0	629.4	15,686.5	1,067,872.0	0.02	0.03	0.02	0.36	0.23	0.00	0.02	8.10E-06	3.69E-08	932.0	0.02	0.00	933.06
February-16	1,036.00	70,868.6	139,834.0	1,708.6	72,577.2	1,104,160.6	0.07	0.12	0.07	1.65	1.07	0.02	0.07	2.93E-05	1.00E-07	4284.3	0.08	0.01	4289.02
March-16	1,043.00	594,260.8	137,000.0	-	594,260.8	1,366,955.8	0.56	0.95	0.48	13.22	8.91	0.18	0.62	1.46E-04	0.00E+00	34757.1	0.66	0.07	34793.04
April-16	1,048.00	164,430.2	137,000.0	-	164,430.2	1,449,170.8	0.16	0.26	0.13	3.66	2.47	0.05	0.17	4.03E-05	0.00E+00	9617.2	0.18	0.02	9627.13
May-16	1,045.00	110,359.3	137,000.0	-	110,359.3	1,476,560.7	0.10	0.18	0.09	2.46	1.66	0.03	0.12	2.70E-05	0.00E+00	6454.7	0.12	0.01	6461.37
June-16	1,039.00	133,173.8	137,000.0	-	133,173.8	1,506,590.5	0.13	0.21	0.11	2.96	2.00	0.04	0.14	3.26E-05	0.00E+00	7789.1	0.15	0.01	7797.12
July-16	1,041.00	301,857.7	137,000.0	-	301,857.7	1,630,599.8	0.29	0.48	0.24	6.72	4.53	0.09	0.32	7.40E-05	0.00E+00	17655.1	0.33	0.03	17673.30
August-16	1,041.00	385,249.1	137,000.0	-	385,249.1	1,819,765.5	0.37	0.62	0.31	8.57	5.78	0.11	0.40	9.44E-05	0.00E+00	22532.5	0.42	0.04	22555.74
September-16	1,042.00	319,020.8	137,000.0	-	319,020.8	1,963,390.4	0.30	0.51	0.26	7.10	4.79	0.09	0.33	7.82E-05	0.00E+00	18658.9	0.35	0.04	18678.17
October-16	1,044.00	106,614.3	137,000.0	-	106,614.3	2,002,439.3	0.10	0.17	0.09	2.37	1.60	0.03	0.11	2.61E-05	0.00E+00	6235.7	0.12	0.01	6242.10
November-16	1,043.00	495,000.5	137,000.0	-	495,000.5	2,245,132.6	0.47	0.79	0.40	11.02	7.43	0.15	0.52	1.21E-04	0.00E+00	28951.6	0.55	0.05	28981.51
December-16	1,035.00	18,325.7	137,000.0	-	18,325.7	2,242,642.3	0.02	0.03	0.01	0.41	0.27	0.01	0.02	4.49E-06	0.00E+00	1071.8	0.02	0.00	1072.94
January-17	1,039.00	17,168.4	139,834.0	964.6	18,133.0	2,225,570.1	0.02	0.03	0.02	0.52	0.26	0.01	0.02	1.10E-05	3.92E-08	1082.8	0.02	0.00	1084.09
February-17	1,039.00	76,339.5	139,834.0	1,595.5	77,935.0	2,214,989.2	0.08	0.13	0.07	2.19	1.15	0.03	0.08	2.99E-05	6.49E-08	4595.0	0.09	0.01	4600.08
March-17	1,037.00	93,389.1	137,000.0	-	93,389.1	2,248,737.1	0.09	0.15	0.07	2.59	1.40	0.04	0.10	2.29E-05	0.00E+00	5462.1	0.10	0.01	5467.79
April-17	1,038.00	129,577.7	137,000.0	-	129,577.7	2,255,915.9	0.12	0.21	0.10	3.60	1.94	0.05	0.14	3.18E-05	0.00E+00	7578.7	0.14	0.01	7586.57
May-17	1,032.00	141,174.5	137,000.0	-	141,174.5	2,247,555.3	0.13	0.23	0.11	3.92	2.12	0.06	0.15	3.46E-05	0.00E+00	8257.0	0.16	0.02	8265.55
June-17	1,032.00	12,884.5	137,000.0	-	12,884.5	2,082,166.5	0.01	0.02	0.01	0.36	0.19	0.01	0.01	3.16E-06	0.00E+00	753.6	0.01	0.00	754.37
July-17	1,038.00	187,221.0	137,000.0	-	187,221.0	2,056,871.4	0.18	0.30	0.15	5.20	2.81	0.07	0.20	4.59E-05	0.00E+00	10950.2	0.21	0.02	10961.50
August-17	1,043.00	140,850.9	137,000.0	-	140,850.9	2,053,187.1	0.13	0.23	0.11	3.91	2.11	0.06	0.15	3.45E-05	0.00E+00	8238.1	0.16	0.02	8246.60
September-17	1,041.00	146,203.3	137,000.0	-	146,203.3	2,012,990.4	0.14	0.23	0.12	4.06	2.19	0.06	0.15	3.58E-05	0.00E+00	8551.1	0.16	0.02	8559.97
October-17	1,040.00	293,225.9	137,000.0	-	293,225.9	2,138,123.8	0.28	0.47	0.23	8.15	4.40	0.12	0.31	7.19E-05	0.00E+00	17150.2	0.32	0.03	17167.92
November-17	1,047.00	312,592.3	139,834.0	303.6	312,895.9	2,209,123.4	0.30	0.50	0.25	8.70	4.69	0.12	0.33	7.87E-05	1.23E-08	18307.7	0.35	0.03	18326.63
December-17	1,031.00	8,018.1	139,834.0	1,298.4	9,316.4	2,139,681.6	0.01	0.02	0.01	0.28	0.12	0.00	0.01	1.11E-05	5.28E-08	574.8	0.01	0.00	575.66

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment

Table B-7: Total Baseline Actual Emissions and Selection of Project Baseline

Month	PM (filterable) tons/month	24-month average annual	PM_{10} (Total) tons/month	24-month average annual	$PM_{2.5}$ (total) tons/month	24-month average annual	SO_2 tons/month	24-month average annual	CO tons/month	24-month average annual
January-13	0.05	-	0.08	-	0.04	-	-	-	0.78	-
February-13	0.11	-	0.19	-	0.10	-	-	-	1.79	-
March-13	0.04	-	0.07	-	0.03	-	-	-	0.64	-
April-13	0.09	-	0.15	-	0.07	-	-	-	1.39	-
May-13	0.16	-	0.27	-	0.13	-	-	-	2.51	-
June-13	0.29	-	0.48	-	0.24	-	-	-	4.51	-
July-13	0.68	-	1.15	-	0.57	-	-	-	10.78	-
August-13	0.50	-	0.85	-	0.42	-	-	-	7.94	-
September-13	0.40	-	0.68	-	0.34	-	-	-	6.36	-
October-13	0.13	-	0.22	-	0.11	-	-	-	2.05	-
November-13	0.50	-	0.83	-	0.42	-	-	-	7.82	-
December-13	0.20	-	0.34	-	0.17	-	-	-	3.15	-
January-14	0.43	-	0.93	-	0.72	-	0.22	-	4.08	-
February-14	0.03	-	0.05	-	0.03	-	0.02	-	0.50	-
March-14	0.49	-	0.97	-	0.68	-	0.25	-	5.67	-
April-14	0.00	-	0.00	-	0.00	-	0.00	-	0.04	-
May-14	0.37	-	0.63	-	0.32	-	0.23	-	5.91	-
June-14	0.46	-	0.78	-	0.39	-	0.28	-	7.32	-
July-14	0.31	-	0.53	-	0.26	-	0.18	-	4.97	-
August-14	0.10	-	0.16	-	0.08	-	0.06	-	1.50	-
September-14	0.18	-	0.30	-	0.15	-	0.10	-	2.79	-
October-14	0.15	-	0.25	-	0.12	-	0.08	-	2.30	-
November-14	0.07	-	0.14	-	0.11	-	0.03	-	0.66	-
December-14	0.25	2.99	0.45	5.25	0.26	2.89	0.14	0.80	3.42	44.44
January-15	0.45	3.19	1.13	5.77	1.03	3.38	0.67	1.13	2.08	45.09
February-15	0.78	3.53	2.09	6.72	2.01	4.34	1.18	1.73	1.95	45.17
March-15	0.09	3.56	0.16	6.77	0.08	4.36	0.03	1.74	1.49	45.60
April-15	0.74	3.88	1.24	7.31	0.62	4.64	0.22	1.85	11.63	50.72
May-15	0.73	4.16	1.22	7.79	0.61	4.87	0.22	1.96	11.46	55.19
June-15	1.67	4.85	2.81	8.95	1.40	5.46	0.51	2.22	26.32	66.10
July-15	1.08	5.05	1.81	9.28	0.91	5.62	0.33	2.38	16.98	69.20
August-15	0.66	5.13	1.11	9.41	0.55	5.69	0.20	2.48	10.39	70.42
September-15	1.03	5.44	1.74	9.94	0.87	5.95	0.31	2.64	16.31	75.40
October-15	0.24	5.50	0.40	10.03	0.20	6.00	0.07	2.67	3.74	76.24
November-15	0.99	5.74	1.73	10.48	0.94	6.26	0.38	2.86	14.73	79.70
December-15	0.53	5.91	0.90	10.76	0.46	6.41	0.18	2.95	8.16	82.20
January-16	0.12	5.75	0.23	10.41	0.16	6.13	0.03	2.86	1.45	80.89
February-16	0.39	5.93	0.68	10.73	0.38	6.30	0.12	2.91	5.74	83.51
March-16	2.38	6.88	4.01	12.25	2.01	6.96	0.78	3.17	37.63	99.50
April-16	1.90	7.82	3.20	13.85	1.60	7.76	0.61	3.48	30.02	114.49
May-16	0.39	7.83	0.66	13.86	0.33	7.77	0.13	3.42	6.22	114.64
June-16	0.44	7.82	0.74	13.84	0.37	7.76	0.14	3.35	6.93	114.45
July-16	1.57	8.45	2.65	14.90	1.33	8.29	0.50	3.51	24.85	124.39
August-16	1.89	9.35	3.18	16.41	1.59	9.05	0.61	3.78	29.83	138.55
September-16	1.58	10.05	2.66	17.59	1.33	9.64	0.51	3.99	24.96	149.64
October-16	0.65	10.30	1.09	18.02	0.54	9.85	0.21	4.05	10.19	153.58
November-16	1.66	11.10	2.80	19.35	1.40	10.50	0.54	4.30	26.25	166.38
December-16	0.09	11.02	0.15	19.20	0.07	10.40	0.03	4.25	1.37	165.35
January-17	0.10	10.85	0.20	18.73	0.13	9.95	0.03	3.93	1.36	164.99
February-17	0.33	10.62	0.57	17.97	0.31	9.10	0.12	3.40	4.85	166.43
March-17	0.36	10.75	0.60	18.19	0.30	9.21	0.13	3.45	5.66	168.52
April-17	0.51	10.63	0.85	18.00	0.43	9.11	0.18	3.43	7.98	166.70
May-17	0.55	10.54	0.92	17.85	0.46	9.04	0.20	3.42	8.63	165.29
June-17	0.24	9.83	0.40	16.65	0.20	8.44	0.08	3.20	3.77	154.01
July-17	1.15	9.87	1.94	16.71	0.97	8.47	0.41	3.24	18.16	154.60
August-17	0.67	9.87	1.12	16.71	0.56	8.47	0.24	3.26	10.50	154.65
September-17	0.46	9.59	0.78	16.24	0.39	8.23	0.18	3.20	7.34	150.17
October-17	1.14	10.04	1.93	17.00	0.96	8.61	0.42	3.37	18.07	157.33
November-17	1.44	10.27	2.45	17.36	1.26	8.77	0.51	3.44	22.42	161.18
December-17	0.05	10.03	0.11	16.97	0.07	8.57	0.02	3.36	0.66	157.43

	PM	PM_{10}	$PM_{2.5}$	SO_2	CO
Baseline Emissions:	11.10	19.35	10.50	4.30	168.52
Baseline Period:	12/14 - 11/16	12/14 - 11/16	12/14 - 11/16	12/14 - 11/16	04/15 - 03/17

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment

Table B-7: Total Baseline Actual Emissions and Selection of Project Baseline

Month	NOx tons/ month	24-month average annual	H_2SO_4 tons/month	24-month average annual	VOC tons/month	24-month average annual	Lead tons/month	24-month average annual
January-13	1.16	-	0.00E+00	-	0.05	-	1.27E-05	-
February-13	2.64	-	0.00E+00	-	0.13	-	2.92E-05	-
March-13	0.95	-	0.00E+00	-	0.04	-	1.04E-05	-
April-13	2.07	-	0.00E+00	-	0.10	-	2.27E-05	-
May-13	3.68	-	0.00E+00	-	0.18	-	4.11E-05	-
June-13	6.60	-	0.00E+00	-	0.32	-	7.37E-05	-
July-13	15.78	-	0.00E+00	-	0.75	-	1.76E-04	-
August-13	11.63	-	0.00E+00	-	0.56	-	1.30E-04	-
September-13	9.33	-	0.00E+00	-	0.45	-	1.04E-04	-
October-13	3.03	-	0.00E+00	-	0.14	-	3.35E-05	-
November-13	11.43	-	0.00E+00	-	0.55	-	1.28E-04	-
December-13	4.61	-	0.00E+00	-	0.22	-	5.15E-05	-
January-14	8.43	-	2.26E-06	-	0.29	-	6.96E-04	-
February-14	0.81	-	0.00E+00	-	0.03	-	8.15E-06	-
March-14	10.44	-	2.32E-06	-	0.40	-	5.01E-04	-
April-14	0.06	-	0.00E+00	-	0.00	-	5.75E-07	-
May-14	9.47	-	0.00E+00	-	0.41	-	9.66E-05	-
June-14	11.75	-	0.00E+00	-	0.51	-	1.20E-04	-
July-14	7.96	-	0.00E+00	-	0.35	-	8.12E-05	-
August-14	2.43	-	0.00E+00	-	0.11	-	2.45E-05	-
September-14	4.48	-	0.00E+00	-	0.20	-	4.57E-05	-
October-14	3.69	-	0.00E+00	-	0.16	-	3.76E-05	-
November-14	1.32	-	5.59E-07	-	0.05	-	9.43E-05	-
December-14	5.78	69.75	6.30E-07	2.88E-06	0.24	3.12	1.55E-04	1.34E-03
January-15	8.82	73.58	1.25E-04	6.56E-05	0.16	3.17	1.13E-03	1.89E-03
February-15	16.22	80.37	2.30E-04	1.81E-04	0.17	3.19	1.99E-03	2.88E-03
March-15	2.16	80.97	0.00E+00	1.81E-04	0.10	3.22	2.43E-05	2.88E-03
April-15	17.02	88.45	0.00E+00	1.81E-04	0.81	3.58	1.90E-04	2.97E-03
May-15	16.67	94.95	0.00E+00	1.81E-04	0.80	3.89	1.87E-04	3.04E-03
June-15	38.30	110.80	0.00E+00	1.81E-04	1.84	4.66	4.30E-04	3.22E-03
July-15	24.73	115.27	0.00E+00	1.81E-04	1.19	4.87	2.78E-04	3.27E-03
August-15	15.14	117.03	0.00E+00	1.81E-04	0.73	4.96	1.70E-04	3.29E-03
September-15	23.86	124.30	0.00E+00	1.81E-04	1.14	5.31	2.67E-04	3.37E-03
October-15	5.45	125.50	0.00E+00	1.81E-04	0.26	5.37	6.11E-05	3.38E-03
November-15	22.74	131.16	1.89E-05	1.90E-04	1.03	5.61	4.30E-04	3.53E-03
December-15	12.09	134.90	3.60E-06	1.920E-04	0.57	5.78	1.65E-04	3.59E-03
January-16	3.27	132.32	7.68E-07	1.91E-04	0.10	5.69	1.09E-04	3.30E-03
February-16	9.80	136.81	6.57E-07	1.916E-04	0.40	5.87	1.76E-04	3.38E-03
March-16	58.99	161.09	7.44E-15	1.90E-04	2.63	6.99	6.15E-04	3.44E-03
April-16	46.49	184.31	7.44E-15	1.90E-04	2.10	8.04	4.90E-04	3.68E-03
May-16	9.61	184.38	7.44E-15	1.90E-04	0.44	8.05	1.02E-04	3.69E-03
June-16	10.50	183.76	7.44E-15	1.90E-04	0.49	8.04	1.13E-04	3.68E-03
July-16	38.21	198.88	7.44E-15	1.90E-04	1.74	8.73	4.06E-04	3.85E-03
August-16	46.21	220.77	7.44E-15	1.90E-04	2.09	9.72	4.87E-04	4.08E-03
September-16	38.79	237.93	7.44E-15	1.90E-04	1.75	10.50	4.08E-04	4.26E-03
October-16	16.19	244.18	7.44E-15	1.90E-04	0.71	10.78	1.67E-04	4.32E-03
November-16	41.28	264.16	7.44E-15	1.90E-04	1.84	11.67	4.29E-04	4.489E-03
December-16	2.11	262.33	7.44E-15	1.90E-04	0.10	11.60	2.23E-05	4.42E-03
January-17	2.73	259.28	6.05E-07	1.27E-04	0.10	11.57	8.67E-05	3.90E-03
February-17	8.52	255.43	6.04E-07	1.26E-05	0.34	11.65	1.42E-04	2.98E-03
March-17	9.33	259.02	2.27E-14	1.26E-05	0.40	11.80	9.26E-05	3.01E-03
April-17	13.08	257.04	2.27E-14	1.26E-05	0.56	11.67	1.30E-04	2.98E-03
May-17	14.08	255.75	2.27E-14	1.26E-05	0.60	11.57	1.41E-04	2.96E-03
June-17	5.93	239.56	2.27E-14	1.26E-05	0.26	10.78	6.16E-05	2.77E-03
July-17	29.32	241.86	2.27E-14	1.26E-05	1.27	10.83	2.97E-04	2.78E-03
August-17	17.10	242.84	2.27E-14	1.26E-05	0.74	10.83	1.72E-04	2.79E-03
September-17	12.32	237.07	2.27E-14	1.26E-05	0.51	10.51	1.20E-04	2.71E-03
October-17	29.73	249.21	2.27E-14	1.26E-05	1.27	11.02	2.95E-04	2.83E-03
November-17	37.02	256.35	6.99E-07	3.46E-06	1.57	11.29	4.37E-04	2.83E-03
December-17	1.49	251.05	5.56E-07	1.94E-06	0.05	11.02	5.58E-05	2.78E-03

	264.16	1.920E-04	11.80	4.489E-03
	12/14 - 11/16	01/14 - 12/15	04/15 - 03/17	12/14 - 11/16

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment

Table B-7: Total Baseline Actual Emissions and Selection of Project Baseline

Month	CO_2 tons/month	24-month average annual	CH_4 tons/month	24-month average annual	N_2O tons/month	24-month average annual	CO_2e tons/month	24-month average annual
January-13	3,040.92	-	0.06	-	0.006	-	3044.1	-
February-13	6,967.76	-	0.13	-	0.013	-	6975.0	-
March-13	2,492.62	-	0.05	-	0.005	-	2495.2	-
April-13	5,408.61	-	0.10	-	0.010	-	5414.2	-
May-13	9,796.44	-	0.18	-	0.018	-	9806.6	-
June-13	17,598.54	-	0.33	-	0.033	-	17616.7	-
July-13	42,028.59	-	0.79	-	0.079	-	42072.0	-
August-13	30,978.55	-	0.58	-	0.058	-	31010.5	-
September-13	24,814.21	-	0.47	-	0.047	-	24839.8	-
October-13	7,983.24	-	0.15	-	0.015	-	7991.5	-
November-13	30,488.09	-	0.57	-	0.057	-	30519.6	-
December-13	12,291.71	-	0.23	-	0.023	-	12304.4	-
January-14	22,287.46	-	0.57	-	0.085	-	22327.1	-
February-14	1,943.82	-	0.04	-	0.004	-	1945.8	-
March-14	26,869.55	-	0.62	-	0.083	-	26909.7	-
April-14	137.18	-	0.00	-	0.000	-	137.3	-
May-14	23,051.30	-	0.43	-	0.043	-	23075.1	-
June-14	28,547.52	-	0.54	-	0.054	-	28577.0	-
July-14	19,372.92	-	0.37	-	0.037	-	19392.9	-
August-14	5,851.68	-	0.11	-	0.011	-	5857.7	-
September-14	10,896.56	-	0.21	-	0.021	-	10907.8	-
October-14	8,973.39	-	0.17	-	0.017	-	8982.7	-
November-14	3,474.09	-	0.09	-	0.013	-	3480.0	-
December-14	14,377.73	179,836	0.30	3.544	0.034	0.383	14395.3	180,039
January-15	19,786.11	188,209	0.65	3.839	0.116	0.438	19836.9	188,435
February-15	31,882.23	200,666	1.17	4.360	0.224	0.544	31978.3	200,937
March-15	5,806.34	202,323	0.11	4.391	0.011	0.547	5812.3	202,596
April-15	45,343.95	222,291	0.85	4.768	0.085	0.585	45390.8	222,584
May-15	44,668.82	239,727	0.84	5.096	0.084	0.618	44715.0	240,038
June-15	102,643.50	282,249	1.93	5.898	0.193	0.698	102749.5	282,605
July-15	66,222.08	294,346	1.25	6.126	0.125	0.721	66290.5	294,714
August-15	40,524.16	299,119	0.76	6.215	0.076	0.730	40566.0	299,492
September-15	63,605.22	318,514	1.20	6.581	0.120	0.766	63670.9	318,907
October-15	14,579.72	321,813	0.27	6.643	0.027	0.772	14594.8	322,209
November-15	59,455.06	336,296	1.17	6.940	0.126	0.806	59521.7	336,710
December-15	32,160.64	346,231	0.61	7.131	0.063	0.826	32194.7	346,655
January-16	6,678.22	338,426	0.15	6.921	0.019	0.793	6687.8	338,835
February-16	23,275.25	349,092	0.46	7.132	0.050	0.816	23301.6	349,513
March-16	146,722.83	409,018	2.77	8.205	0.277	0.913	146874.4	409,496
April-16	117,044.48	467,472	2.21	9.307	0.221	1.023	117165.4	468,010
May-16	24,248.87	468,071	0.46	9.318	0.046	1.025	24273.9	468,609
June-16	27,032.15	467,313	0.51	9.304	0.051	1.023	27060.1	467,850
July-16	96,898.13	506,076	1.83	10.034	0.183	1.096	96998.2	506,653
August-16	116,330.95	561,315	2.19	11.075	0.219	1.200	116451.1	561,950
September-16	97,325.31	604,530	1.83	11.890	0.183	1.282	97425.8	605,209
October-16	39,746.34	619,916	0.75	12.180	0.075	1.311	39787.4	620,611
November-16	102,345.99	669,352	1.93	13.101	0.193	1.401	102451.7	670,097
December-16	5,329.94	664,828	0.10	13.003	0.010	1.389	5335.4	665,567
January-17	5,976.27	657,923	0.13	12.744	0.016	1.339	5984.2	658,641
February-17	19,591.90	651,778	0.39	12.350	0.042	1.247	19613.9	652,459
March-17	22,088.46	659,919	0.42	12.504	0.042	1.263	22111.3	660,608
April-17	31,131.72	652,813	0.59	12.370	0.059	1.249	31163.9	653,495
May-17	33,634.81	647,296	0.63	12.266	0.063	1.239	33669.6	647,972
June-17	14,709.41	603,329	0.28	11.437	0.028	1.156	14724.6	603,959
July-17	70,807.36	605,622	1.33	11.480	0.133	1.160	70880.5	606,254
August-17	40,959.50	605,839	0.77	11.484	0.077	1.161	41001.8	606,472
September-17	28,609.26	588,341	0.54	11.155	0.054	1.128	28638.8	588,956
October-17	70,467.27	616,285	1.33	11.681	0.133	1.181	70540.0	616,929
November-17	88,185.35	630,650	1.68	11.937	0.171	1.203	88278.4	631,307
December-17	3,041.61	616,091	0.07	11.664	0.009	1.176	3046.0	616,733

24-month CO_2	24-month CH_4	24-month N_2O	24-month CO_2e
669,352	13.101	1.401	670,097
12/14 - 11/16	12/14 - 11/16	12/14 - 11/16	12/14 - 11/16

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-8: Unit RK1 Projected Actual Emissions

Unit RK1

Heat Input Capacity, Natural Gas	1,875	MMBtu/hr
Heat Input Capacity, No. 2 Fuel Oil	1,839	MMBtu/hr
Projected Operation on Natural Gas	**6,500**	hours/year
Representative of Baseline on No. 2 Fuel Oil	25	hours/year

	Projected Actual Emissions (tpy)												
	PM (filterable)	PM10	PM2.5	NOx	CO	SO_2	VOC	Lead	H_2SO_4	CO_2	CH_4	N_2O	CO_{2e}
Natural Gas	11.58	19.50	19.50	350.39	350.39	6.09	19.50	0.0030	0.4875	712,823	13.43	1.34	713,559
No. 2 Fuel Oil	0.10	0.31	0.31	3.93	2.85	0.03	0.11	0.0003	4.62E-05	3,748	0.15	0.03	3,761
Total	11.68	19.81	19.81	354.32	353.24	6.13	19.61	0.0033	0.4875	716,571	13.59	1.37	717,320

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-9: Unit RK2 Projected Actual Emissions

Unit RK2

Heat Input Capacity, Natural Gas	1,875	MMBtu/hr
Heat Input Capacity, No. 2 Fuel Oil	1,839	MMBtu/hr
Projected Operation on Natural Gas	**6,500**	hours/year
Representative of Baseline on No. 2 Fuel Oil	31	hours/year

	Projected Actual Emissions (tpy)												
	PM (filterable)	PM10	PM2.5	NOx	CO	SO_2	VOC	Lead	H_2SO_4	CO_2	CH_4	N_2O	CO_{2e}
Natural Gas	11.58	19.50	19.50	350.39	350.39	6.09	19.50	0.0030	0.4875	712,823	13.43	1.34	713,559
No. 2 Fuel Oil	0.12	0.38	0.38	4.87	3.53	0.04	0.13	0.0004	0.0000	4,648	0.19	0.04	4,664
Total	11.70	19.88	19.88	355.26	353.93	6.14	19.63	0.0034	0.4875	717,471	13.62	1.38	718,223

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-10: Unit RK3 Projected Actual Emissions

Unit RK3

Heat Input Capacity, Natural Gas	1,875	MMBtu/hr
Heat Input Capacity, No. 2 Fuel Oil	1,839	MMBtu/hr
Projected Operation on Natural Gas	**6,500**	hours/year
Representative of Baseline on No. 2 Fuel Oil	37	hours/year

	Projected Actual Emissions (tpy)												
	PM (filterable)	PM10	PM2.5	NOx	CO	SO_2	VOC	Lead	H_2SO_4	CO_2	CH_4	N_2O	CO_{2e}
Natural Gas	11.58	19.50	19.50	350.39	350.39	6.09	19.50	0.0030	0.4875	712,823	13.43	1.34	713,559
No. 2 Fuel Oil	0.15	0.46	0.46	5.82	4.22	0.05	0.16	0.0005	4.55E-05	5,547	0.23	0.05	5,566
Total	11.72	19.96	19.96	356.21	354.61	6.15	19.66	0.0035	0.4875	718,370	13.66	1.39	719,125

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-11: Unit RK4 Projected Actual Emissions

Unit RK4

Heat Input Capacity, Natural Gas	1,875	MMBtu/hr
Heat Input Capacity, No. 2 Fuel Oil	1,839	MMBtu/hr
Projected Operation on Natural Gas	**6,500**	hours/year
Representative of Baseline on No. 2 Fuel Oil	41	hours/year

	Projected Actual Emissions (tpy)												
	PM (filterable)	PM10	PM2.5	NOx	CO	SO_2	VOC	Lead	H_2SO_4	CO_2	CH_4	N_2O	CO_{2e}
Natural Gas	11.58	19.50	19.50	350.39	350.39	6.09	19.50	0.0030	0.4875	712,823	13.43	1.34	713,559
No. 2 Fuel Oil	0.16	0.51	0.51	6.45	4.67	0.06	0.18	0.0005	0.0001	6,147	0.25	0.05	6,168
Total	11.74	20.01	20.01	356.84	355.07	6.15	19.68	0.0035	0.4876	718,970	13.68	1.39	719,727

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-12: Unit RK5 Projected Actual Emissions

Unit RK5

Heat Input Capacity, Natural Gas	1,875	MMBtu/hr
Heat Input Capacity, No. 2 Fuel Oil	1,839	MMBtu/hr
Projected Operation on Natural Gas	**6,500**	hours/year
Representative of Baseline on No. 2 Fuel Oil	24	hours/year

	Projected Actual Emissions (tpy)												
	PM (filterable)	PM10	PM2.5	NOx	CO	SO_2	VOC	Lead	H_2SO_4	CO_2	CH_4	N_2O	CO_{2e}
Natural Gas	11.58	19.50	19.50	350.39	350.39	6.09	19.50	0.0030	0.4875	712,823	13.43	1.34	713,559
No. 2 Fuel Oil	0.09	0.30	0.30	3.77	2.74	0.03	0.10	0.0003	0.0000	3,598	0.15	0.03	3,611
Total	11.67	19.80	19.80	354.16	353.13	6.13	19.60	0.0033	0.4875	716,421	13.58	1.37	717,170

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-13: Unit RK1 Emission Factors

	Fuel	Pollutant	Emission Factor (lb/MMBtu)	Reference
Baseline	Natural Gas	PM (filterable)	0 0019	AP-42 Table 3.1-2a
		PM (total)	0 0032	BACT limit
		PM10	0 0032	BACT limit
		PM2.5	0 0016	Rockingham Natural Gas Combustion Site-Specific EF
		NOx	--	CEMS
		CO	0.030	AP-42 Table 3.1-1 (Water Inj.)
		SO_2	--	CEMS
		VOC	0 0021	AP-42 Table 3.1-2a
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0 0019	AP-42 Table 3.1-2a
		PM (total)	0 0032	BACT limit
		PM10	0 0032	BACT limit
		PM2.5	0 0032	BACT limit
		NOx	0 0575	BACT limit
		CO	0 0575	BACT limit
		SO_2	0.001	BACT limit
		VOC	0 0032	BACT limit
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	0.00008	BACT limit
Baseline	No. 2 Fuel Oil	PM (filterable)	0 0043	AP-42 Table 3.1-2a
		PM (total)	0.012	AP-42 Table 3.1-2a
		PM10	0.012	AP-42 Table 3.1-2a
		PM2.5	0.012	AP-42 Table 3.1-2a
		NOx	--	CEMS
		CO	0 0033	AP-42 Section 3.1 (Uncontrolled)
		SO_2	--	CEMS
		VOC	4.1E-04	AP-42 Table 3.1-2a
		Lead	1.4E-05	AP-42 Table 3.1-2a
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0 0043	AP-42 Table 3.1-2a
		PM (total)	0 0135	BACT limit
		PM10	0 0135	BACT limit
		PM2.5	0 0135	BACT limit
		NOx	0.171	BACT limit
		CO	0.124	BACT limit
		SO_2	0 0015	AP-42 Table 3.1-2a, sulfur content of 0.0015%
		VOC	0 0047	BACT limit
		Lead	1.4E-05	AP-42 Section 3.1 (Uncontrolled)
		H_2SO_4	2.01E-06	Stack data, max annual average of past five years

GHG Emission Factors[1]				
		Natural Gas (lb/MMBtu)	No. 2 Oil (lb/MMBtu)	GWP
Baseline	CO_2	1.17E+02	1.6E+02	1
	CH_4	2 20E-03	6.6E-03	25
	N_2O	2 20E-04	1.3E-03	298

1 kg = 2.2046 lb

1. 40 CFR 98 Subpart C - Table C-1 and Table C-2; CO2e=CO2+CH4 x 25+ N2O x 298; same factors for both baseline and projected emissions

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-14: Unit RK2 Emission Factors

	Fuel	Pollutant	Emission Factor (lb/MMBtu)	Reference
Baseline	Natural Gas	PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0016	Rockingham Natural Gas Combustion Site-Specific EF
		NOx	--	CEMS
		CO	0.030	AP-42 Table 3.1-1 (Water Inj.)
		SO_2	--	CEMS
		VOC	0.0021	AP-42 Table 3.1-2a
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0032	BACT limit
		NOx	0.0575	BACT limit
		CO	0.0575	BACT limit
		SO_2	0.001	BACT limit
		VOC	0.0032	BACT limit
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	0.00008	BACT Limit
Baseline	No. 2 Fuel Oil	PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.012	AP-42 Table 3.1-2a
		PM10	0.012	AP-42 Table 3.1-2a
		PM2.5	0.012	AP-42 Table 3.1-2a
		NOx	--	CEMS
		CO	0.0033	AP-42 Section 3.1 (Uncontrolled)
		SO_2	--	CEMS
		VOC	4.1E-04	AP-42 Table 3.1-2a
		Lead	1.4E-05	AP-42 Table 3.1-2a
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.0135	BACT limit
		PM10	0.0135	BACT limit
		PM2.5	0.0135	BACT limit
		NOx	0.171	BACT limit
		CO	0.124	BACT limit
		SO_2	0.0015	AP-42 Table 3.1-2a, sulfur content of 0.0015%
		VOC	0.0047	BACT limit
		Lead	1.4E-05	AP-42 Section 3.1 (Uncontrolled)
		H_2SO_4	1.58E-06	Stack data, max annual average of past five years

GHG Emission Factors[1]				
		Natural Gas (lb/MMBtu)	No. 2 Oil (lb/MMBtu)	GWP
Baseline	CO_2	1.17E+02	1.6E+02	1
	CH_4	2.20E-03	6.6E-03	25
	N_2O	2.20E-04	1.3E-03	298

1 kg = 2 2046 lb

1. 40 CFR 98 Subpart C - Table C-1 and Table C-2; CO2e=CO2+CH4 x 25+ N2O x 298; same factors for both baseline and projected emissions

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-15: Unit RK3 Emission Factors

	Fuel	Pollutant	Emission Factor (lb/MMBtu)	Reference
Baseline	Natural Gas	PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0016	Rockingham Natural Gas Combustion Site-Specific EF
		NOx	--	CEMS
		CO	0.030	AP-42 Table 3.1-1 (Water Inj.)
		SO_2	--	CEMS
		VOC	0.0021	AP-42 Table 3.1-2a
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0032	BACT limit
		NOx	0.0575	BACT limit
		CO	0.0575	BACT limit
		SO_2	0.001	BACT limit
		VOC	0.0032	BACT limit
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	0.00008	BACT Limit
Baseline	No. 2 Fuel Oil	PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.012	AP-42 Table 3.1-2a
		PM10	0.012	AP-42 Table 3.1-2a
		PM2.5	0.012	AP-42 Table 3.1-2a
		NOx	--	CEMS
		CO	0.0033	AP-42 Section 3.1 (Uncontrolled)
		SO_2	--	CEMS
		VOC	4.1E-04	AP-42 Table 3.1-2a
		Lead	1.4E-05	AP-42 Table 3.1-2a
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.0135	BACT limit
		PM10	0.0135	BACT limit
		PM2.5	0.0135	BACT limit
		NOx	0.171	BACT limit
		CO	0.124	BACT limit
		SO_2	0.0015	AP-42 Table 3.1-2a, sulfur content of 0.0015%
		VOC	0.0047	BACT limit
		Lead	1.4E-05	AP-42 Section 3.1 (Uncontrolled)
		H_2SO_4	1.34E-06	Stack data, max annual average of past five years

GHG Emission Factors[1]

		Natural Gas (lb/MMBtu)	No. 2 Oil (lb/MMBtu)	GWP
Baseline	CO_2	1.17E+02	1.6E+02	1
	CH_4	2.20E-03	6.6E-03	25
	N_2O	2.20E-04	1.3E-03	298

1 kg = 2 2046 lb

1. 40 CFR 98 Subpart C - Table C-1 and Table C-2; CO2e=CO2+CH4 x 25+ N2O x 298; same factors for both baseline and projected emissions

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-16: Unit RK4 Emission Factors

	Fuel	Pollutant	Emission Factor (lb/MMBtu)	Reference
Baseline	Natural Gas	PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0016	Rockingham Natural Gas Combustion Site-Specific EF
		NOx	--	CEMS
		CO	0.030	AP-42 Table 3.1-1 (Water Inj.)
		SO_2	--	CEMS
		VOC	0.0021	AP-42 Table 3.1-2a
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0032	BACT limit
		NOx	0.0575	BACT limit
		CO	0.0575	BACT limit
		SO_2	0.001	BACT limit
		VOC	0.0032	BACT limit
		Lead	4.90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	0.00008	BACT limit
Baseline	No. 2 Fuel Oil	PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.012	AP-42 Table 3.1-2a
		PM10	0.012	AP-42 Table 3.1-2a
		PM2.5	0.012	AP-42 Table 3.1-2a
		NOx	--	CEMS
		CO	0.0033	AP-42 Section 3.1 (Uncontrolled)
		SO_2	--	CEMS
		VOC	4.1E-04	AP-42 Table 3.1-2a
		Lead	1.4E-05	AP-42 Table 3.1-2a
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.0135	BACT limit
		PM10	0.0135	BACT limit
		PM2.5	0.0135	BACT limit
		NOx	0.171	BACT limit
		CO	0.124	BACT limit
		SO_2	0.0015	AP-42 Table 3.1-2a, sulfur content of 0.0015%
		VOC	0.0047	BACT limit
		Lead	1.4E-05	AP-42 Section 3.1 (Uncontrolled)
		H_2SO_4	1 50E-06	Stack data, max annual average of past five years

GHG Emission Factors[1]				
		Natural Gas (lb/MMBtu)	**No. 2 Oil (lb/MMBtu)**	**GWP**
Baseline	CO_2	1.17E+02	1.6E+02	1
	CH_4	2.20E-03	6.6E-03	25
	N_2O	2.20E-04	1.3E-03	298

1 kg = 2.2046 lb

1. 40 CFR 98 Subpart C - Table C-1 and Table C-2; CO2e=CO2+CH4 x 25+ N2O x 298; same factors for both baseline and projected emissions

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-17: Unit RK5 Emission Factors

	Fuel	Pollutant	Emission Factor (lb/MMBtu)	Reference
Baseline	Natural Gas	PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0016	Rockingham Natural Gas Combustion Site-Specific EF
		NOx	--	CEMS
		CO	0.030	AP-42 Table 3.1-1 (Water Inj.)
		SO_2	--	CEMS
		VOC	0.0021	AP-42 Table 3.1-2a
		Lead	4 90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0019	AP-42 Table 3.1-2a
		PM (total)	0.0032	BACT limit
		PM10	0.0032	BACT limit
		PM2.5	0.0032	BACT limit
		NOx	0.0575	BACT Limit
		CO	0.0575	BACT limit
		SO_2	0.001	BACT Limit
		VOC	0.0032	BACT limit
		Lead	4 90E-07	AP-42 Section 1.4. Assumed EF of 0.0005 lb/10^6 cf and annual average HHV of 1020 Btu/scf for conservatism.
		H_2SO_4	0.00008	BACT Limit
Baseline	No. 2 Fuel Oil	PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.012	AP-42 Table 3.1-2a
		PM10	0.012	AP-42 Table 3.1-2a
		PM2.5	0.012	AP-42 Table 3.1-2a
		NOx	--	CEMS
		CO	0.0033	AP-42 Section 3.1 (Uncontrolled)
		SO_2	--	CEMS
		VOC	4.1E-04	AP-42 Table 3.1-2a
		Lead	1.4E-05	AP-42 Table 3.1-2a
		H_2SO_4	--	Stack data
Projected		PM (filterable)	0.0043	AP-42 Table 3.1-2a
		PM (total)	0.0135	BACT limit
		PM10	0.0135	BACT limit
		PM2.5	0.0135	BACT limit
		NOx	0.171	BACT limit
		CO	0.124	BACT limit
		SO_2	0.0015	AP-42 Table 3.1-2a, sulfur content of 0.0015%
		VOC	0.0047	BACT limit
		Lead	1.4E-05	AP-42 Section 3.1 (Uncontrolled)
		H_2SO_4	1 03E-06	Stack data, max annual average of past five years

GHG Emission Factors[1]				
		Natural Gas (lb/MMBtu)	No. 2 Oil (lb/MMBtu)	GWP
Baseline	CO_2	1.17E+02	1.6E+02	1
	CH_4	2.20E-03	6.6E-03	25
	N_2O	2.20E-04	1.3E-03	298

1 kg = 2.2046 lb

1. 40 CFR 98 Subpart C - Table C-1 and Table C-2; CO2e=CO2+CH4 x 25+ N2O x 298; same factors for both baseline and projected emissions

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-18: Summary of SO_2, NO_x, and H_2SO_4 Emission Factors

Used NOx, SO2, and H2SO4 (NG) BACT permit limits for Projected Actual calcs, rather than the info here.

		Unit RK1[1]						
		SO_2	NO_x	H_2SO_4[2]	Total heat input	SO_2	NO_x	H_2SO_4
		tons/year	tons/year	tons/year	MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu
2017	**Total**	**0.40**	**32.00**	**3.76E-07**	**1,390,624**			
	NG	0.40	31.6	0.00E+00	**1,384,059.550**	5.75E-04	4.57E-02	0.00E+00
	Oil	1.89E-03	0.40	3.76E-07	**6,564.227**	5.75E-04	1.22E-01	1.15E-07
2016	**Total**	**0.70**	**57.80**	**2.67E-07**	**2,567,529**			
	NG	0.70	57.6	0.00E+00	**2,562,603**	5.45E-04	4.50E-02	0.00E+00
	Oil	1.34E-03	0.20	2.67E-07	**4,925.9**	5.45E-04	8.12E-02	1.09E-07
2015	**Total**	**0.80**	**36.50**	**7.96E-05**	**1,546,356**			
	NG	0.40	33.7	0.00E+00	**1,467,072.15**	5.45E-04	4.59E-02	0.00E+00
	Oil	0.40	2.80	7.96E-05	**79,283.42**	1.01E-02	7.06E-02	2.01E-06
2014	**Total**	**0.30**	**12.90**	**1.15E-06**	**534,767**			
	NG	2.84E-01	1.22E+01	0.00E+00	**506,430.89**	1.12E-03	4.82E-02	0.00E+00
	Oil	0.02	0.68	1.15E-06	**28,336.36**	1.12E-03	4.82E-02	8.14E-08
2013	**Total**	**0.00**	**16.10**	**0.00E+00**	**716,890**			
	NG	0.00	16.10	0.00E+00	**716,889.83**	0 00E+00	4.49E-02	0.00E+00
	Oil	0.00	0.00	0.00E+00	0	--	--	--
					Average NG	**5.37E-04**	**4.56E-02**	**0.00E+00**
					Average Oil	**7.04E-03**	**6.86E-02**	**1.37E-06**
					Max NG	**1.12E-03**	**4.82E-02**	**0.00E+00**
					Max Oil	**1.01E-02**	**1.22E-01**	**2.01E-06**

		Unit RK2[1]						
		SO_2	NO_x	H_2SO_4[2]	Total heat input	SO_2	NO_x	H_2SO_4
		tons/year	tons/year	tons/year	MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu
2017	**Total**	**0.40**	**35.30**	**4.06E-07**	**1,579,470**			
	NG	0.40	34.8	0.00E+00	**1,571,415.745**	5.06E-04	4.43E-02	0.00E+00
	Oil	2.04E-03	0.50	4.06E-07	**8,054.719**	5.06E-04	1.24E-01	1.01E-07
2016	**Total**	**0.80**	**58.70**	**3.99E-07**	**2,655,001**			
	NG	0.80	58.4	0.00E+00	**2,648,345**	6.03E-04	4.41E-02	0.00E+00
	Oil	2.01E-03	0.30	3.99E-07	**6,655.3**	6.03E-04	9.02E-02	1.20E-07
2015	**Total**	**0.90**	**41.90**	**7.96E-05**	**1,828,191**			
	NG	0.50	37.7	0.00E+00	**1,727,089.66**	5.79E-04	4.37E-02	0.00E+00
	Oil	0.4	4.20	7.96E-05	**101,101.37**	7.91E-03	8.31E-02	1.58E-06
2014	**Total**	**0.50**	**15.50**	**1.15E-06**	**655,886**			
	NG	4.65E-01	1.44E+01	0.00E+00	**609,951.03**	1.52E-03	4.73E-02	0.00E+00
	Oil	0.04	1.09	1.15E-06	**45,935.33**	1.52E-03	4.73E-02	5.02E-08
2013	**Total**	**0.00**	**11.90**	**0.00E+00**	**547,299**			
	NG	0.00	11 90	0.00E+00	**547,299.36**	0 00E+00	4.35E-02	0.00E+00
	Oil	0.00	0.00	0.00E+00	0	--	--	--
					Average NG	**6.08E-04**	**4.43E-02**	**0.00E+00**
					Average Oil	**5.43E-03**	**7.52E-02**	**1.01E-06**
					Max NG	**1.52E-03**	**4.73E-02**	**0.00E+00**
					Max Oil	**7.91E-03**	**1.24E-01**	**1.58E-06**

1) Emissions except H_2SO_4 based on annual CEMS Data obtained from AEI's

2) H_2SO_4 emissions based on annual stack test data obtained from AEI's

Duke Rockingham County Turbines RK1, RK2, RK3, RK4, RK5 - Permitting Assessment
Table B-18: Summary of SO_2, NO_x, and H_2SO_4 Emission Factors

		Unit RK3[1]						
		SO_2	NO_x	H_2SO_4[2]	Total heat input	SO_2	NO_x	H_2SO_4
		tons/year	tons/year	tons/year	MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu
2017	**Total**	**0.40**	**29.10**	**4.08E-07**	**1,273,344**			
	NG	0.40	28.8	0.00E+00	**1,266,827.251**	6.28E-04	4 55E-02	0.00E+00
	Oil	2.05E-03	0.30	4.08E-07	**6,516.684**	6.28E-04	9 21E-02	1.25E-07
2016	**Total**	**0.80**	**58.10**	**3.76E-07**	**2,607,581**			
	NG	0.80	57.8	0.00E+00	**2,601,420**	6.14E-04	4.44E-02	0.00E+00
	Oil	1.89E-03	3.00E-01	3.76E-07	**6,160.9**	6.14E-04	9.74E-02	1.22E-07
2015	**Total**	**0.90**	**35.40**	**7.96E-05**	**1,680,120**			
	NG	0.50	31.6	0.00E+00	**1,561,006.74**	6.41E-04	4 05E-02	0.00E+00
	Oil	0.40	3.8	7.96E-05	**119,113.57**	6.72E-03	6 38E-02	1.34E-06
2014	**Total**	**0.20**	**11.20**	**1.15E-06**	**468,574**			
	NG	1.88E-01	1.05E+01	0.00E+00	**440,447.59**	8.54E-04	4.78E-02	0.00E+00
	Oil	0.01	0.67	1.15E-06	**28,126.79**	8.54E-04	4.78E-02	8.20E-08
2013	**Total**	**0.00**	**16.00**	**0.00E+00**	**713,405**			
	NG	0.00	16.00	0.00E+00	**713,405.24**	0.00E+00	4.49E-02	0.00E+00
	Oil	0.00	0.00	0.00E+00	0	--	--	--
					Average NG	**5.68E-04**	**4.36E-02**	**0.00E+00**
					Average Oil	**6.98E-03**	**8.52E-02**	**1.37E-06**
					Max NG	**8.54E-04**	**4.78E-02**	**0.00E+00**
					Max Oil	**6.72E-03**	**9.74E-02**	**1.34E-06**

		Unit RK4[1]						
		SO_2	NO_x	H_2SO_4[2]	Total heat input	SO_2	NO_x	H_2SO_4
		tons/year	tons/year	tons/year	MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu
2017	**Total**	**0.60**	**34.10**	**7.53E-07**	**1,518,324**			
	NG	0.60	33.6	0.00E+00	**1,508,755.492**	9.41E-04	5 30E-02	0.00E+00
	Oil	3.78E-03	0.50	7.53E-07	**9,568.283**	1.16E-03	1 53E-01	2.31E-07
2016	**Total**	**0.90**	**71.30**	**2.92E-07**	**3,172,322**			
	NG	0.90	70.1	0.00E+00	**3,167,150**	6.91E-04	5 39E-02	0.00E+00
	Oil	1.47E-03	1.20E+00	2.92E-07	**5,172**	4.76E-04	3 90E-01	9.48E-08
2015	**Total**	**1.00**	**47.70**	**9.95E-05**	**1,980,719**			
	NG	0.50	40.9	0.00E+00	**1,847,978.64**	5.41E-04	4.43E-02	0.00E+00
	Oil	0.5	6.80	9.95E-05	**132,740.24**	7.53E-03	1 02E-01	1.50E-06
2014	**Total**	**0.50**	**18.90**	**1.15E-06**	**755,101**			
	NG	4.59E-01	1.74E+01	0.00E+00	**693,496.69**	1.32E-03	5 01E-02	0.00E+00
	Oil	0.04	1.54	1.15E-06	**61,604.42**	1.32E-03	5 01E-02	3.75E-08
2013	**Total**	**0.00**	**14.70**	**0.00E+00**	**686,192**			
	NG	0.00	14.70	0.00E+00	**686,192.32**	0.00E+00	4 28E-02	0.00E+00
	Oil	0.00	0.00	0.00E+00	0	--	--	--
					Average NG	**3.03E-02**	**2.18E+00**	**0.00E+00**
					Average Oil	**1.92E-04**	**3.53E-03**	**3.58E-08**
					Max NG	**1.32E-03**	**5.39E-02**	**0.00E+00**
					Max Oil	**7.53E-03**	**3.90E-01**	**1.50E-06**

Appendix C

RACT/BACT/LAER Clearinghouse Search Results

BACT Table 1
Summary of RBLC Determinations
Simple-Cycle Combustion Turbines > 25 MW Output – CO Emissions

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
NATURAL GAS FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle turbine	171	MW	Premixing of fuel and air enhances combustion efficiency and minimizes emissions.	9	PPMVD @ 15% O_2
TX-0788	NECHES STATION	TX	Large Combustion Turbines > 25 MW	232	MW	good combustion practices	9	PPM
TX-0777	UNION VALLEY ENERGY CENTER	TX	Simple-cycle Turbine	183	MW	dry low NO_X burners and good combustion practices	9	PPMVD @ 15% O_2
TX-0769	VAN ALSTYNE ENERGY CENTER	TX	Simple-cycle Turbine	183	MW	DLN burners and good combustion practices	9	PPMVD @ 15% O_2
TX-0764	NACOGDOCHES POWER ELECTRIC GENERATING PLANT	TX	Natural Gas Simple-cycle Turbine (>25 MW)	232	MW	dry low NO_X burners, good combustion practices, limited operation	9	PPMVD @ 15% O_2
TX-0768	SHAWNEE ENERGY CENTER	TX	Simple-cycle turbines greater than 25 MW	230	MW	dry low NO_X burners and limited operation, clean fuel	9	PPMVD @ 15% O_2
FL-0354	LAUDERDALE PLANT	FL	Five 200-MW combustion turbines	2100	MMBtu/hr	Good combustion minimizes CO formation	4	PPMVD @ 15% O_2
TX-0733	ANTELOPE ELK ENERGY CENTER	TX	Simple-cycle Turbine & Generator	202	MW	Good combustion practices; limited operating hours	9	PPMVD @ 15% O_2
*TX-0734	CLEAR SPRINGS ENERGY CENTER (CSEC)	TX	Simple-cycle Turbine	183	MW	DLN burners and good combustion practices	9	PPMVD @ 15% O_2
TX-0694	INDECK WHARTON ENERGY CENTER	TX	(3) combustion turbines	220	MW	DLN combustors	4	PPMVD @ 15% O_2
TX-0688	SR BERTRON ELECTRIC GENERATION STATION	TX	Simple-cycle natural gas turbines	225	MW	Good Combustion Practices	9	PPM
CO-0076	PUEBLO AIRPORT GENERATING STATION	CO	Turbines - two simple-cycle gas	799.7	MMBtu/hr each	Catalytic Oxidation	55	LB/HR
TX-0696	ROANS PRAIRIE GENERATING STATION	TX	(2) simple-cycle turbines	600	MW	DLN combustors	9	PPMVD @ 15% O_2
TX-0672	CORPUS CHRISTI LIQUEFACTION PLANT	TX	Refrigeration compressor turbines	40,000	HP	dry low emission combustors	29	PPMVD @ 15% O_2
TX-0695	ECTOR COUNTY ENERGY CENTER	TX	(2) combustion turbines	180	MW	DLN combustors	9	PPMVD @ 15% O_2

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
MD-0044	COVE POINT LNG TERMINAL	MD	2 COMBUSTION TURBINES	130	MW	EXCLUSIVE USE OF FACILITY PROCESS FUEL GAS OR PIPELINE QUALITY NATURAL GAS, USE OF AN OXIDATION CATALYST AND EFFICIENT COMBUSTION	1.5	PPMVD @ 15% O_2
TX-0691	PH ROBINSON ELECTRIC GENERATING STATION	TX	(6) simple-cycle turbines	65	MW	DLN combustors	25	PPMVD @ 15% O_2
FL-0346	LAUDERDALE PLANT	FL	Five 200-MW combustion turbines	2000	MMBtu/hr	Good combustion practices	4	PPMVD @ 15% O_2
TX-0686	ANTELOPE ELK ENERGY CENTER	TX	Combustion Turbine-Generator(CTG)	202	MW	Good combustion practices; limited hours	9	PPMVD
TX-0693	ANTELOPE ELK ENERGY CENTER	TX	combustion turbine	202	MW	DLN combustors, good combustion practices	9	PPMVD
OR-0050	TROUTDALE ENERGY CENTER, LLC	OR	GE LMS-100 combustion turbines, simple-cycle with water injection	1690	MMBtu/hr	Oxidation catalyst; Limit the time in startup or shutdown.	6	PPMVD @ 15% O_2
*ND-0030	LONESOME CREEK GENERATING STATION	ND	Natural Gas Fired Simple-cycle Turbines	412	MMBtu/hr	Oxidation Catalyst	6	PPMVD
*ND-0029	PIONEER GENERATING STATION	ND	Natural gas-fired turbines	451	MMBtu/hr	Catalytic oxidation system	6	PPMVD
TX-0701	ECTOR COUNTY ENERGY CENTER	TX	Simple-cycle Combustion Turbines	180	MW	Good combustion practices	9	PPMVD
*ND-0028	R.M. HESKETT STATION	ND	Combustion Turbine	986	MMBtu/hr	Good Combustion	25	PPMVD @ 15% O_2
TX-0690	CEDAR BAYOU ELECTRIC GERNERATION STATION	TX	Simple-cycle Combustion Turbines	225	MW	Good Combustion Practices	9	PPM
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP03)	40	MW	Oxidation Catalyst	6	PPMVD @ 15% O_2
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP04)	40	MW	Oxidation Catalyst	6	PPMVD @ 15% O_2
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP05)	40	MW	Oxidation Catalyst	6	PPMVD @ 15% O_2
LA-0258	CALCASIEU PLANT	LA	TURBINE EXHAUST STACK NO. 1 & NO. 2	1900	MMBtu/hr	DRY LOW NO_X COMBUSTORS	781	LB/H
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Generation Turbines (2)	286	MMBtu/hr	Good combustion practices and fueled by natural gas	17.46	LB/H

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Refrigeration Compressor Turbines (16)	286	MMBtu/hr	Good combustion practices and fueled by natural gas	43.6	LB/H
NM-0051	CUNNINGHAM POWER PLANT	NM	Normal Mode (without Power Augmentation)			Good Combustion Practices as defined in the permit	77.2	LB/H
NM-0051	CUNNINGHAM POWER PLANT	NM	Power Augmentation			Good Combustion Practices as defined in the permit	138.9	LB/H
NJ-0076	PSEG FOSSIL LLC KEARNY GENERATING STATION	NJ	SIMPLE-CYCLE TURBINE	8940000	MMBtu/year (HHV)	Oxidation Catalyst, Good combustion practices	5	PPMVD @ 15% O_2
NJ-0077	HOWARD DOWN STATION	NJ	SIMPLE-CYCLE (NO WASTE HEAT RECOVERY)(>25 MW)	5000	MMft3/hr	THE TURBINE WILL UTILIZE A CATALYTIC OXIDIZER TO CONTROL CO EMISSION, IN ADDITION TO USING CLEAN BURNING FUELS, NATURAL GAS AND ULTRA LOW SULFUR DISTILLATE OIL WITH 15 PPM SULFUR BY WEIGHT	5	PPMVD @ 15% O_2
*CO-0073	PUEBLO AIRPORT GENERATING STATION	CO	Three simple-cycle combustion turbines	799.7	MMBtu/hr	Good Combustion Control and Catalytic Oxidation (CatOx)	10	PPMVD @ 15% O_2
GA-0139	DAHLBERG COMBUSDTION TURBINE ELECTRIC GENERATING FACILITY	GA	SIMPLE-CYCLE COMBUSTION TURBINE - ELECTRIC GENERATING PLANT	1530	MW	GOOD COMBUSTION PRACTICES	9	PPMVD @ 15% O_2
OH-0333	DAYTON POWER & LIGHT ENERGY LLC	OH	Turbines (4), simple-cycle, natural gas	15020	H/YR	efficient combustion technology	301	LB/HR
NJ-0075	BAYONNE ENERGY CENTER	NJ	COMBUSTION TURBINES, SIMPLE-CYCLE , ROLLS ROYCE, 8	603	MMBtu/hr	CO OXIDATION CATALYST AND CLEAN BURNING FUELS	5	PPMVD @ 15% O_2
TX-0540	BOSQUE COUNTY POWER PLANT	TX	ELECTRICAL GENERATION	170	MW	BACT IS THE USE OF GOOD COMBUSTION PRACTICES TO MINIMIZE THE PRODUCTS OF INCOMPLETE COMBUSTION AND ACHIEVE 9 PPMVD AT 15% O2 IN THE TURBINE EXHAUST OVER A ROLLING 3-HOUR PERIOD.	9	PPMVD @ 15% O_2
FL-0310	SHADY HILLS GENERATING STATION	FL	TWO SIMPLE-CYCLE COMBUSTION TURBINE - MODEL 7FA	170	MW		6.5	PPMVD @ 15% O_2
MD-0040	CPV ST CHARLES	MD	COMBUSTION TURBINES (2)			OXIDATION CATALYST	2	PPMVD @ 15% O_2
MN-0075	GREAT RIVER ENERGY - ELK RIVER STATION	MN	COMBUSTION TURBINE GENERATOR	2189	MMBtu/hr	GOOD COMBUSTION PRACTICES	4	PPM >70% LOAD

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
MN-0075	GREAT RIVER ENERGY - ELK RIVER STATION	MN	COMBUSTION TURBINE GENERATOR	2189	MMBtu/hr	GOOD COMBUSTION PRACTICES	150	PPM <60% LOAD
MN-0075	GREAT RIVER ENERGY - ELK RIVER STATION	MN	COMBUSTION TURBINE GENERATOR	2189	MMBtu/hr	GOOD COMBUSTION PRACTICES	250	PPM 60-70% LOAD
OK-0127	WESTERN FARMERS ELECTRIC ANADARKO	OK	COMBUSTION TURBINE PEAKING UNIT(S)	462.7	MMBtu/hr	NO CONTROLS FEASIBLE.	63	PPM
LA-0224	ARSENAL HILL POWER PLANT	LA	SCN-5 SHUTDOWN CTG-1 / SCN-9 SHUTDOWN CTG-2	2110	MMBtu/hr	COMPLETE EVENTS AS QUICKLY AS POSSIBLE ACCORDING TO MANUFACTURER'S RECOMMENDED PROCEDURES.	964.57	LB/HR
LA-0224	ARSENAL HILL POWER PLANT	LA	SCN-3 COLD STARTUP CTG-1 SCN-7 COLD STARTUP CTG-2	2110	MMBtu/hr	COMPLETE EVENTS AS QUICKLY AS POSSIBLE ACCORDING TO MANUFACTURER'S RECOMMENDED PROCEDURES.	1508.2	LB/HR
LA-0219	CREOLE TRAIL LNG IMPORT TERMINAL	LA	GAS TURBINE GENERATOR NOS. 1-4	30	MW ea	DRY LOW EMISSIONS (DLE) COMBUSTION TECHNOLOGY WITH LEAN PREMIX OF AIR AND FUEL	17.8	LB/HR
OK-0120	PSO RIVERSIDE JENKS POWER STA	OK	COMBUSTION TURBINES			GOOD COMBUSTION PRACTICES & DESIGN	59	LB/HR
FL-0285	PROGRESS BARTOW POWER PLANT	FL	SIMPLE-CYCLE COMBUSTION TURBINE (ONE UNIT)	1972	MMBtu/hr	GOOD COMBUSTION	8	PPMVD @ 15% O_2
NV-0046	GOODSPRINGS COMPRESSOR STATION	NV	LARGE COMBUSTION TURBINE - SIMPLE-CYCLE	97.81	MMBtu/hr	GOOD COMBUSTION PRACTICE	16	PPMVD @ 15% O_2
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	TURBINES WITHOUT 165 MMBTU/HR DUCT BURNERS	75	MW	none listed	55.4	LB/HR
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	TURBINES WITHOUT 165 MMBTU/HR DUCT BURNERS	75	MW	none listed	68.6	LB/HR
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	STARTUP, SHUTDOWN, MAINTENANCE	75	MW	none listed	1000	LB/HR
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING NATURAL GAS W/O BURNERS	80	MW	none listed	296	LB/HR
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING NATURAL GAS W/ BURNERS	80	MW	none listed	496	LB/HR
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINE (1), SIMPLE-CYCLE	1115	MMBtu/hr	none listed	301	LB/HR

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINES (2), SIMPLE-CYCLE	1115	MMBtu/hr	none listed	1700	LB/HR
WI-0240	WE ENERGIES CONCORD	WI	COMBUSTION TURBINE, 100 MW, NATURAL GAS	100	MW	none listed	20	LB/HR
OH-0304	ROLLING HILLS GENERATING PLANT	OH	NATURAL GAS FIRED TURBINES (5)	209	MW	GOOD ENGINEERING PRACTICES	119	LB/HR
DISTILLATE OIL FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle Turbine	171	MW	combustor designed for complete combustion and therefore minimizes emissions	20	PPMVD @ 15% O_2
OH-0353	G.E. AIRCRAFT ENGINES PEEBLES FACILITY	OH	Jet Engine Test Stand			none listed	504.1	LB/HR
MI-0400	WOLVERINE POWER	MI	Turbine generator	540	MMBTU/HR	none listed	0.045	LB/MMBTU
OH-0333	DAYTON POWER & LIGHT ENERGY LLC	OH	Turbines (4), simple-cycle, fuel oil #2	4216	HR/YR	efficient combustion technology	800	LB/HR
MN-0075	GREAT RIVER ENERGY - ELK RIVER STATION	MN	COMBUSTION TURBINE GENERATOR	2169	MMBTU/HR	GOOD COMBUSTION CONTROL	250	PPM
NV-0047	NELLIS AIR FORCE BASE	NV	AIRCRAFT ENGINE TESTING	11490	LB/HR	GOOD MANAGEMENT PRACTICE	0.66	LB/1000 LB FUEL
OH-0311	G.E. AIRCRAFT ENGINES PEEBLES TEST FACILITY	OH	Jet Engine Test Stand 3A			BACT IS BASED ON DESIGN EMISSION LEVELS AND HAS BEEN DETERMINED TO BE NO CONTROL.	480	LB/HR
OH-0306	G.E. AIRCRAFT ENGINES PEEBLES TEST FACILITY	OH	Jet Engine Test Stand			none listed	480	LB/HR
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING FUEL OIL W/O BURNERS	80	MW	none listed	401	LB/HR
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINES (2), SIMPLE-CYCLE	1115	MMBTU/HR	none listed	350	LB/HR
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINE (1), SIMPLE-CYCLE	80	MW	none listed	800	LB/HR

BACT Table 2
Summary of RBLC Determinations
Simple-Cycle Combustion Turbines > 25 MW Output – VOC Emissions

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
NATURAL GAS FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle turbine	171	MW	Premixing of fuel and air enhances combustion efficiency and minimizes emissions.	5.4	LB/H
TX-0788	NECHES STATION	TX	Large Combustion Turbines > 25 MW	232	MW	good combustion practices	2	PPM
TX-0764	NACOGDOCHES POWER ELECTRIC GENERATING PLANT	TX	Natural Gas Simple-cycle Turbine (>25 MW)	232	MW	Pipeline quality natural gas; limited hours; good combustion practices.	2	PPMVD @ 15% O_2
TX-0768	SHAWNEE ENERGY CENTER	TX	Simple-cycle turbines greater than 25 megawatts (MW)	230	MW	Pipeline quality natural gas; limited hours; good combustion practices.	1.4	PPMV
TX-0733	ANTELOPE ELK ENERGY CENTER	TX	Simple-cycle Turbine & Generator	202	MW	Good combustion practices	2	PPMVD @ 15% O_2
TX-0696	ROANS PRAIRIE GENERATING STATION	TX	(2) simple-cycle turbines	600	MW	good combustion	1.4	PPMVD
TX-0672	CORPUS CHRISTI LIQUEFACTION PLANT	TX	Refrigeration compressor turbines	40000	hp	good combustion practices	0.6	LB/H
MD-0044	COVE POINT LNG TERMINAL	MD	2 COMBUSTION TURBINES	130	MW	THE USE OF PROCESS FUEL GAS AND PIPELINE NATURAL GAS, GOOD COMBUSTION PRACTICES, AND USE OF AN OXIDATION CATALYST	0.7	PPMVD @ 15% O_2
FL-0346	LAUDERDALE PLANT	FL	Five 200-MW combustion turbines	2000	MMBtu/hr (approx)	Good combustion practice	3.77	LB/H
OR-0050	TROUTDALE ENERGY CENTER, LLC	OR	GE LMS-100 combustion turbines, simple-cycle with water injection	1690	MMBTU/H	Oxidation catalyst; Limit the time in startup or shutdown.		
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP03)	40	MW	Oxidation Catalyst	3	PPMV AT 15% O_2
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP04)	40	MW	Oxidation Catalyst	3	PPMV AT 15% O_2
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP05)	40	MW	Oxidation Catalyst	3	PPMV AT 15% O_2

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
LA-0258	CALCASIEU PLANT	LA	TURBINE EXHAUST STACK NO. 1 & NO. 2	1900	MM BTU/H EACH	DRY LOW NO_X COMBUSTORS	7	LB/H
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Refrigeration Compressor Turbines (16)	286	MMBTU/H	Good combustion practices and fueled by natural gas	0.66	LB/H
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Generation Turbines (2)	286	MMBTU/H	Good combustion practices and fueled by natural gas	0.66	LB/H
NJ-0076	PSEG FOSSIL LLC KEARNY GENERATING STATION	NJ	SIMPLE-CYCLE TURBINE	8940000	MMBtu/year (HHV)	Oxidation Catalyst and good combustion practices, use of natural gas.	4	PPMVD@15% O_2
*CO-0073	PUEBLO AIRPORT GENERATING STATION	CO	Three simple-cycle combustion turbines	799.7	MMBTU/H	Good Combustion Control and Catalytic Oxidation (CatOx)	2.5	PPMVD AT 15% O_2
GA-0139	DAHLBERG COMBUSDTION TURBINE ELECTRIC GENERATING FACILITY (P	GA	SIMPLE-CYCLE COMBUSTION TURBINE - ELECTRIC GENERATING PLANT	1530	MW	GOOD COMBUSTION PRACTICES	5	PPM@15%0_2
CA-1174	EL CAJON ENERGY LLC	CA	Gas turbine simple-cycle	49.95	MW	Oxidation catalyst	2	PPMV
OH-0333	DAYTON POWER & LIGHT ENERGY LLC	OH	Turbines (4), simple-cycle, natural gas	15020	H/YR	none listed	4	LB/H
NJ-0075	BAYONNE ENERGY CENTER	NJ	COMBUSTION TURBINES, SIMPLE-CYCLE , ROLLS ROYCE, 8	603	MMBTU/H	CO OXIDATION CATALYST AND POLLUTION PREVENTION, BURNING CLEAN FUELS, NATURAL GAS AND ULTRA LOW SULFUR DISTILLATE OIL WITH SULFUR CONTENT OF 15 PPM Subject to LAER	1.93	LB/H
TX-0540	BOSQUE COUNTY POWER PLANT	TX	ELECTRICAL GENERATION	170	MW	BACT IS THE USE OF GOOD COMBUSTION PRACTICES TO MINIMIZE THE PRODUCTS OF INCOMPLETE COMBUSTION OF THE NATURAL GAS TO ACHIEVE LESS THAN 4 PPMV OVER A ROLLING 3-HOUR PERIOD.	4	PPMVD
CA-1176	ORANGE GROVE PROJECT	CA	Gas turbine simple-cycle	49.8	MW	Oxidation catalyst	2	PPM
MD-0040	CPV ST CHARLES	MD	COMBUSTION TURBINES (2)			OXIDATION CATALYST	1	PPMVD @ 15% O_2
CA-1175	ESCONDIDO ENERGY CENTER LLC	CA	Gas turbine simple-cycle	46.5	MW	oxidation catalyst	2	PPMV@15% O_2

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
LA-0224	ARSENAL HILL POWER PLANT	LA	SCN-3 COLD STARTUP CTG-1 SCN-7 COLD STARTUP CTG-2	2110	MMBTU/H	COMPLETE EVENTS AS QUICKLY AS POSSIBLE ACCORDING TO MANUFACTUREÂ¿S RECOMMENDED PROCEDURES	214.07	LB/H
LA-0219	CREOLE TRAIL LNG IMPORT TERMINAL	LA	GAS TURBINE GENERATOR NOS. 1-4	30	MW EA.	GOOD COMBUSTION PRACTICES	1.21	LB/H
FL-0285	PROGRESS BARTOW POWER PLANT	FL	SIMPLE-CYCLE COMBUSTION TURBINE (ONE UNIT)	1972	MMBTU/H	GOOD COMBUSTION	1.2	PPMVD
NV-0046	GOODSPRINGS COMPRESSOR STATION	NV	LARGE COMBUSTION TURBINE - SIMPLE-CYCLE	97.81	MMBTU/H	GOOD COMBUSTION PRACTICE	0.0069	LB/MMBTU
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	TURBINES WITHOUT 165 MMBTU/HR DUCT BURNERS	75	MW	none listed	1.9	LB/H
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	TURBINES WITH 165 MMBTU/HR DUCT BURNERS	75	MW	USE OF NATURAL GAS	3.5	LB/H
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	STARTUP, SHUTDOWN, MAINTENANCE	75	MW	none listed	60	LB/H
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING NATURAL GAS W/O BURNERS	80	MW	none listed	2.2	LB/H
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING NATURAL GAS W/ BURNERS	80	MW	none listed	9.2	LB/H
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINE (1), SIMPLE-CYCLE	1115	MMBTU/H	none listed	10	LB/H
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINES (2), SIMPLE-CYCLE	1115	MMBTU/H	none listed	10	LB/H
WI-0240	WE ENERGIES CONCORD	WI	COMBUSTION TURBINE, 100 MW, NATURAL GAS	100	mw	none listed	5	LB/H
OH-0304	ROLLING HILLS GENERATING PLANT	OH	NATURAL GAS FIRED TURBINES (5)	209	MW	none listed	3.2	LB/H
DISTILLATE OIL FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle Turbine	171	MW	combustor designed for complete combustion and therefore minimizes emissions	3.3	LB/H
OH-0353	G.E. AIRCRAFT ENGINES PEEBLES FACILITY	OH	Jet Engine Test Stand			none listed	135.6	LB/H

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
OH-0333	DAYTON POWER & LIGHT ENERGY LLC	OH	Turbines (4), simple-cycle, fuel oil #2	4216	H/YR	none listed	5.5	LB/H
NV-0047	NELLIS AIR FORCE BASE	NV	AIRCRAFT ENGINE TESTING	11490	LB/H	GOOD MANAGEMENT PRACTICE	0.54	LB/1000 LB FUEL
OH-0311	G.E. AIRCRAFT ENGINES PEEBLES TEST FACILITY	OH	JET ENGINE TEST STAND 3A			none listed	31.2	LB/H
OH-0306	G.E. AIRCRAFT ENGINES-PEEBLES TEST	OH	JET ENGINE TEST STAND			none listed	31.2	LB/H
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING FUEL OIL W/O BURNERS	80	MW	none listed	5.5	LB/H
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINES (2), SIMPLE-CYCLE	1115	MMBTU/H	none listed	10	LB/H
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINE (1), SIMPLE-CYCLE	1115	MMBTU/H	none listed	10	LB/H

BACT Table 3
Summary of RBLC Determinations
Simple-cycle Combustion Turbines > 25 MW Output – NO_X Emissions

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
NATURAL GAS FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle turbine	171	MW	Emission controls consist of dry low-NO_X combustors (DLN).	9	PPMVD @ 15% O_2
TX-0788	NECHES STATION	TX	Large Combustion Turbines > 25 MW	232	MW	Dry low-NO_X burners (DLN), good combustion practices	9	PPM
TX-0777	UNION VALLEY ENERGY CENTER	TX	Simple-cycle Turbine	183	MW	dry low NO_X burners	9	PPMVD @ 15% O_2
TX-0769	VAN ALSTYNE ENERGY CENTER (VAEC)	TX	Simple-cycle Turbine	183	MW	DLN burners	9	PPMVD @ 15% O_2
TX-0764	NACOGDOCHES POWER ELECTRIC GENERATING PLANT	TX	Natural Gas Simple-cycle Turbine (>25 MW)	232	MW	Dry Low NO_X burners, good combustion practices, limited operations	9	PPMVD @ 15% O_2
TX-0768	SHAWNEE ENERGY CENTER	TX	Simple-cycle turbines greater than 25 megawatts (MW)	230	MW	Dry Low NO_X burners	9	PPMVD @ 15% O_2
FL-0355	FORT MYERS PLANT	FL	Combustion Turbines	2262.4	MMBtu/hr gas	DLN and wet injection (for ULSD operation)	9	PPMVD@15% O_2
FL-0354	LAUDERDALE PLANT	FL	Five 200-MW combustion turbines	2100	MMBtu/hr (approx)	Dry-low-NO_X combustion system. Wet injection when firing ULSD.	9	PPMVD@15%O_2
TX-0733	ANTELOPE ELK ENERGY CENTER	TX	Simple-cycle Turbine & Generator	202	MW	Dry Low NO_X burners	9	PPMVD AT 15% O_2
*TX-0734	CLEAR SPRINGS ENERGY CENTER (CSEC)	TX	Simple-cycle Turbine	183	MW	dry low-NO_X (DLN) burners	9	PPMVD @ 15% O_2
TX-0694	INDECK WHARTON ENERGY CENTER	TX	(3) combustion turbines	220	MW	DLN combustors	9	PPMVD
TX-0688	SR BERTRON ELECTRIC GENERATION STATION	TX	Simple-cycle natural gas turbines	225	MW	DLN	9	PPM
CO-0076	PUEBLO AIRPORT GENERATING STATION	CO	Turbines - two simple-cycle gas	799.7	MMBTU/H each	SCR and dry low NO_X burners	23	LB/H
TX-0696	ROANS PRAIRIE GENERATING STATION	TX	(2) simple-cycle turbines	600	MW	DLN combustors	9	PPMVD
TX-0672	CORPUS CHRISTI LIQUEFACTION PLANT	TX	Refrigeration compressor turbines	40000	hp	Dry low emission combustors	25	PPMVD

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
TX-0695	ECTOR COUNTY ENERGY CENTER	TX	(2) combustion turbines	180	MW	DLN combustors	9	PPMVD
MD-0043	PERRYMAN GENERATING STATION	MD	(2) 60-MW SIMPLE-CYCLE COMBUSTION TURBINES, FIRING NATURAL GAS	120	MW	NATURAL GAS, WATER/STEAM INJECTION, AND A SELECTIVE CATAYTIC REDUCTION (SCR) SYSTEM	2.5	PPMVD @ 15% O_2
MD-0044	COVE POINT LNG TERMINAL	MD	2 COMBUSTION TURBINES	130	MW	DRY LOW-NO_X COMBUSTOR TURBINE DESIGN (DLN1), USE OF FACILITY PROCESS FUEL GAS AND PIPELINE NATURAL GAS DURING NORMAL OPERATION AND SCR SYSTEM	2.5	PPMVD @ 15% O_2
TX-0691	PH ROBINSON ELECTRIC GENERATING STATION	TX	(6) simple-cycle turbines	65	MW	DLN combustors	15	PPMVD
FL-0346	LAUDERDALE PLANT	FL	Five 200-MW combustion turbines	2000	MMBtu/hr (approx)	Required to employ dry low-NO_X technology and wet injection. Water injection must be used when firing ULSD.	9	PPMVD @ 15% O_2
TX-0686	ANTELOPE ELK ENERGY CENTER	TX	Combustion Turbine-Generator(CTG)	202	MW	DLN	9	PPM
TX-0693	ANTELOPE ELK ENERGY CENTER	TX	combustion turbine	202	MW	DLN combustors	9	PPMVD
OR-0050	TROUTDALE ENERGY CENTER, LLC	OR	GE LMS-100 combustion turbines, simple-cycle with water injection	1690	MMBTU/H	Utilize water injection when combusting natural gas or ULSD; Utilize selective catalytic reduction (SCR) with aqueous ammonia injection at all times except during startup and shutdown; Limit the time in startup or shutdown.	2.5	PPMDV AT 15% O_2
*ND-0030	LONESOME CREEK GENERATING STATION	ND	Natural Gas Fired Simple-cycle Turbines	412	MMBTU/H	SCR	5	PPMVD
*ND-0029	PIONEER GENERATING STATION	ND	Natural gas-fired turbines	451	MMBTU/H	Water injection plus SCR	5	PPPMVD
TX-0701	ECTOR COUNTY ENERGY CENTER	TX	Simple-cycle Combustion Turbines	180	MW	Dry low NO_X combustor	9	PPMVD
*ND-0028	R.M. HESKETT STATION	ND	Combustion Turbine	986	MMBTU/H	Dry low-NO_X combustion (DLN)	9	PPMVD @15% O_2

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
CA-1223	PIO PICO ENERGY CENTER	CA	COMBUSTION TURBINES (NORMAL OPERATION)	300	MW	WATER INJECTION, SCR	2.5	PPMVD
CA-1223	PIO PICO ENERGY CENTER	CA	COMBUSTION TURBINES (STARTUP & SHUTDOWN PERIODS)	300	MW	water injection and SCR system	22.5	LB/H
TX-0690	CEDAR BAYOU ELECTRIC GERNERATION STATION	TX	Simple-cycle Combustion Turbines	225	MW	DLN	9	PPM
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP03)	40	MW	SCR	5	PPMV AT 15% O_2
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP04)	40	MW	SCR	5	PPMV AT 15% O_2
*WY-0070	CHEYENNE PRAIRIE GENERATING STATION	WY	Simple-cycle Turbine (EP05)	40	MW	SCR	5	PPMV AT 15% O_2
LA-0258	CALCASIEU PLANT	LA	TURBINE EXHAUST STACK NO. 1 & NO. 2	1900	MM BTU/H EACH	DRY LOW NO_x COMBUSTORS	240	LB/H
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Refrigeration Compressor Turbines (16)	286	MMBTU/H	water injection	22.94	LB/H
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Generation Turbines (2)	286	MMBTU/H	water injection	28.68	LB/H
NJ-0076	PSEG FOSSIL LLC KEARNY GENERATING STATION	NJ	SIMPLE-CYCLE TURBINE	8940000	MMBtu/year (HHV)	SCR and Use of Clean Burning Fuel: Natural gas	2.5	PPMVD@15%O_2
NJ-0077	HOWARD DOWN STATION	NJ	SIMPLE-CYCLE (NO WASTE HEAT RECOVERY)(>25 MW)	5000	MMFT3/YR	THE TURBINE WILL UTILIZE WATER INJECTION AND SELECTIVE CATALYTIC REDUCTION (SCR) TO CONTROL NO_x EMISSION AND USE CLEAN FUELS NATURAL GAS AND ULTRA LOW SULFUR DISTILLATE OIL TO MINIMIZE NO_x EMISSIONS	2.5	PPMVD@15%O_2
*CO-0073	PUEBLO AIRPORT GENERATING STATION	CO	Three simple-cycle combustion turbines	799.7	MMBTU/H	Good combustor design, Water Injection and Selective Catalytic Reduction (SCR)	5	PPMVD AT 15% O_2
GA-0139	DAHLBERG COMBUSDTION TURBINE ELECTRIC GENERATING FACILITY (P	GA	SIMPLE-CYCLE COMBUSTION TURBINE - ELECTRIC GENERATING PLANT	1530	MW	DRY LOW NO_x BURNERS (FIRING NATURAL GAS). WATER INJECTION (FIRING FUEL OIL).	9	PPM@15%0_2

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
GA-0139	DAHLBERG COMBUSDTION TURBINE ELECTRIC GENERATING FACILITY (P	GA	SIMPLE-CYCLE COMBUSTION TURBINE - ELECTRIC GENERATING PLANT	1530	MW	DRY LOW NO_X BURNERS (FIRING NATURAL GAS), WATER INJECTION (FIRING FUEL OIL).	297	T/YR
CA-1174	EL CAJON ENERGY LLC	CA	Gas turbine simple-cycle	49.95	MW	Water injection and SCR	2.5	PPMV
OH-0333	DAYTON POWER & LIGHT ENERGY LLC	OH	Turbines (4), simple-cycle, natural gas	15020	H/YR	dry low NO_X burners	161	LB/H
NJ-0075	BAYONNE ENERGY CENTER	NJ	COMBUSTION TURBINES, SIMPLE-CYCLE , ROLLS ROYCE, 8	603	MMBTU/H	SELECTIVE CATALYTIC REDUCTION SYSTEM (SCR) AND WET LOW-EMISSION (WLE) COMBUSTORS SUBJECT TO LAER	2.5	PPMVD@15%O_2
TX-0540	BOSQUE COUNTY POWER PLANT	TX	ELECTRICAL GENERATION	170	MW	BACT IS 9 PPMVD AT 15% O2 THROUGH THE USE OF DRY LOW-NO_X (DLN) COMBUSTERS WHEN THE COMBUSTION TURBINE IS OPERATING IN THE SIMPLE-CYCLE MODE.	2	PPMVD
FL-0310	SHADY HILLS GENERATING STATION	FL	TWO SIMPLE-CYCLE COMBUSTION TURBINE - MODEL 7FA	170	MW	FIRING NATURAL GAS AND USING DLN 2.6 COMBUSTORS TO MINIMIZE NO_X EMISSSIONS.	9	PPMVD @ 15% O_2
CA-1176	ORANGE GROVE PROJECT	CA	Gas turbine simple-cycle	49.8	MW	SCR water injection	2.5	PPM
MD-0040	CPV ST CHARLES	MD	COMBUSTION TURBINES (2)			DRY LOW NO_X BURNER AND SCR	2	PPMVD @ 15% O_2
CA-1175	ESCONDIDO ENERGY CENTER LLC	CA	Gas turbine simple-cycle	46.5	MW	SCR water injection	2.5	PPMV@15% O_2
MN-0075	GREAT RIVER ENERGY - ELK RIVER STATION	MN	COMBUSTION TURBINE GENERATOR	2169	MMBTU/H	DRY LOW-NO_X COMBUSTION WHEN COMBUSTING NATURAL GAS	9	PPM
OK-0127	WESTERN FARMERS ELECTRIC ANADARKO	OK	COMBUSTION TURBINE PEAKING UNIT(S)	462.7	MMBTU/H	WATER INJECTION	25	PPM
LA-0224	ARSENAL HILL POWER PLANT	LA	SCN-3 COLD STARTUP CTG-1 SCN-7 COLD STARTUP CTG-2	2110	MMBTU/H	COMPLETE EVENTS AS QUICKLY AS POSSIBLE ACCORDING TO MANUFACTURER'S RECOMMENDED PROCEDURES.	400	LB/H
LA-0224	ARSENAL HILL POWER PLANT	LA	SCN-5 SHUTDOWN CTG-1 / SCN-9 SHUTDOWN CTG-2	2110	MMBTU/H	COMPLETE EVENTS AS QUICKLY AS POSSIBLE ACCORDING TO MANUFACTURER'S RECOMMENDED PROCEDURES.	400	LB/H

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
CO-0064	RAWHIDE ENERGY STATION	CO	UNIT F COMBUSTION TURBINE	1400	MMBTU/H	DRY LOW NO_X COMBUSTION SYSTEM	9	PPMVD
LA-0219	CREOLE TRAIL LNG IMPORT TERMINAL	LA	GAS TURBINE GENERATOR NOS. 1-4	30	MW EA.	DRY LOW EMISSIONS (DLE) COMBUSTION TECHNOLOGY WITH LEAN PREMIX OF AIR AND FUEL	29	LB/H
OK-0120	PSO RIVERSIDE JENKS POWER STA	OK	COMBUSTION TURBINES			DRY-LOW NO_X BURNERS	9	PPMVD
FL-0285	PROGRESS BARTOW POWER PLANT	FL	SIMPLE-CYCLE COMBUSTION TURBINE (ONE UNIT)	1972	MMBTU/H	WATER INJECTION DRY LOW NO_X	15	PPMVD
FL-0300	JACKSONVILLE ELECTRIC AUTHORITY/JEA	FL	SIMPLE-CYCLE TURBINE 172 MW	1804	MMBTU/H	NATURAL GAS AS PRIMARY FUEL WITH 0.05% SULFUR DISTILLATE AS BACKUP. USES WATER INJECTION WHEN FIRING OIL.	15	PPM @ 15% 0_2 (GAS)
FL-0287	OLEANDER POWER PROJECT	FL	SIMPLE-CYCLE COMBUSTION TURBINE	190	MW	DLN COMBUSTORS WATER INJECTION	9	PPM @15% O_2
NV-0046	GOODSPRINGS COMPRESSOR STATION	NV	LARGE COMBUSTION TURBINE - SIMPLE-CYCLE	97.81	MMBTU/H	THE $SOLONO_X$ BURNER IN EACH TURBINE UTILIZES THE DRY LOW-NO_X TECHNOLOGY TO CONTROL NO_X EMISSIONS.	25	PPMVD
FL-0279	TEC/POLK POWER ENERGY STATION	FL	SIMPLE-CYCLE GAS TURBINE	1834	MMBTU/H	DRY LOW NO_X	9	PPMVD @ 15% O_2
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	TURBINES WITHOUT 165 MMBTU/HR DUCT BURNERS	75	MW	LOW NOX BURNERS AND SCR	18.5	LB/H
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	TURBINES WITH 165 MMBTU/HR DUCT BURNERS	75	MW	LOW NO_X BURNERS	21.4	LB/H
TX-0504	NAVASOTA POWER GENERATION FACILITY	TX	STARTUP, SHUTDOWN, MAINTENANCE	75	MW	none listed	600	LB/H
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING NATURAL GAS W/O BURNERS	80	MW	LOW NO_X BURNERS AND SCR	62	LB/H
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING NATURAL GAS W/ BURNERS	80	MW	LOW NO_X BURNERS AND SCR	106.5	LB/H
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINE (1), SIMPLE-CYCLE	1115	MMBTU/H	DRY LOW NO_X burners	62	LB/H
OH-0253	DAYTON POWER AND LIGHT	OH	COMBUSTION TURBINES (2), SIMPLE-CYCLE	1115	MMBTU/H	none listed	113	LB/H

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
	COMPANY							
WI-0240	WE ENERGIES CONCORD	WI	COMBUSTION TURBINE, 100 MW, NATURAL GAS	100	mw	WATER INJECTION	25	PPMDV @ 15% O_2
OH-0304	ROLLING HILLS GENERATING PLANT	OH	NATURAL GAS FIRED TURBINES (5)	209	MW	DRY LOW NO_X BURNERS	117	LB/H
DISTILLATE OIL FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle Turbine	171	MW	DLN, WATER INJECTION	42	PPMVD @ 15% O_2
TX-0699	TURBINE OVERHAUL CENTER	TX	Turbine test cell	0		good combustion practices		
OH-0353	G.E. AIRCRAFT ENGINES PEEBLES FACILITY	OH	Jet Engine Test Stand	0		none listed	2255.9	LB/H
MI-0400	WOLVERINE POWER	MI	Turbine generator (EUBLACKSTART)	540	MMBTU/H	none listed	0.16	LB/MMBTU
OH-0333	DAYTON POWER & LIGHT ENERGY LLC	OH	Turbines (4), simple-cycle, fuel oil #2	4216	H/YR	Water injection	269	LB/H
MA-0035	THOMAS H. WATSON GENERATING STATION	MA	SIMPLE-CYCLE GAS TURBINE	9519	BTU/KW-H	none listed		
NV-0047	NELLIS AIR FORCE BASE	NV	AIRCRAFT ENGINE TESTING	11490	LB/H	GOOD MANAGEMENT PRACTICE	57.65	LB/1000 LB FUEL
OH-0311	G.E. AIRCRAFT ENGINES PEEBLES TEST FACILITY	OH	JET ENGINE TEST STAND 3A			BACT IS BASED ON DESIGN EMISSION LEVELS AND HAS BEEN DETERMINED TO BE NO CONTROL.	2875	LB/H
OH-0306	G.E. AIRCRAFT ENGINES-PEEBLES TEST	OH	JET ENGINE TEST STAND			none listed	3113.4	LB/H
TX-0506	NRG TEXAS ELECTRIC POWER GENERATION	TX	TURBINE FIRING FUEL OIL W/O BURNERS	80	MW	LOW NO_X BURNERS AND SCR	320	LB/H
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINES (2), SIMPLE-CYCLE	1115	MMBTU/H	WATER INJECTION	195	LB/H
OH-0253	DAYTON POWER AND LIGHT COMPANY	OH	COMBUSTION TURBINE (1), SIMPLE-CYCLE	1115	MMBTU/H	WATER INJECTION	195	LB/H
WI-0240	WE ENERGIES CONCORD	WI	COMBUSTION TURBINE, 100 MW, #2 FUEL OIL	100	mw	WATER INJECTION	65	PPMDV @ 15% O_2

BACT Table 4
Summary of RBLC Determinations
Simple-Cycle Combustion Turbines > 25 MW Output – PM Emissions

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
NATURAL GAS FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle turbine	171	MW	Premixing of fuel and air enhances combustion efficiency and minimizes emissions.	14	LB/H
TX-0788	NECHES STATION	TX	Large Combustion Turbines > 25 MW	232	MW	good combustion practices, low sulfur fuel	13.4	LB/H
TX-0777	UNION VALLEY ENERGY CENTER	TX	Simple-cycle Turbine	183	MW	pipeline quality natural gas, good combustion practices	8.6	LB/H
TX-0769	VAN ALSTYNE ENERGY CENTER (VAEC)	TX	Simple-cycle Turbine	183	MW	Pipeline Quality Natural Gas	8.6	LB/H
TX-0764	NACOGDOCHES POWER ELECTRIC GENERATING PLANT	TX	Natural Gas Simple-cycle Turbine (>25 MW)	232	MW	Pipeline quality natural gas; limited hours; good combustion practices.	12.09	LB/HR
TX-0768	SHAWNEE ENERGY CENTER	TX	Simple-cycle turbines greater than 25 megawatts (MW)	230	MW	Pipeline quality natural gas; limited hours; good combustion practices.	84.1	LB/HR
FL-0355	FORT MYERS PLANT	FL	Combustion Turbines	2262.4	MMBtu/hr gas	Use of clean fuels	2	GR S / 100 SCF GAS
FL-0354	LAUDERDALE PLANT	FL	Five 200-MW combustion turbines	2100	MMBtu/hr (approx)	Clean fuel prevents PM formation	2	GR. S / 100 SCF
TX-0733	ANTELOPE ELK ENERGY CENTER	TX	Simple-cycle Turbine & Generator	202	MW	Pipeline quality natural gas; limited hours; good combustion practices.		
TX-0694	INDECK WHARTON ENERGY CENTER	TX	(3) combustion turbines	220	MW	none listed		
TX-0696	ROANS PRAIRIE GENERATING STATION	TX	(2) simple-cycle turbines	600	MW	none listed		
TX-0672	CORPUS CHRISTI LIQUEFACTION PLANT	TX	Refrigeration compressor turbines	40000	hp	none listed	0.72	LB/H
TX-0695	ECTOR COUNTY ENERGY CENTER	TX	(2) combustion turbines	180	MW	none listed		
MD-0044	COVE POINT LNG TERMINAL	MD	2 COMBUSTION TURBINES	130	MW	EXCLUSIVE USE OF FACILITY PROCESS FUEL GAS OR PIPELINE QUALITY NATURAL GAS AND GOOD COMBUSTION PRACTICES	0.007	LB/MMBTU

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
CO-0075	PUEBLO AIRPORT GENERATING STATION	CO	Turbine - simple-cycle gas	375	MMBTU/H	Firing of pipeline quality natural gas as defined in 40 CFR Part 72. Specifically, the owner or the operator shall demonstrate that the natural gas burned has total sulfur content less than 0.5 grains/100 SCF.	4.8	LB/H
TX-0691	PH ROBINSON ELECTRIC GENERATING STATION	TX	(6) simple-cycle turbines	65	MW	none listed		
FL-0346	LAUDERDALE PLANT	FL	Five 200-MW combustion turbines	2000	MMBtu/hr (approx)	Good combustion practice and low-sulfur fuel		
TX-0693	ANTELOPE ELK ENERGY CENTER	TX	combustion turbine	202	MW	none listed		
*ND-0030	LONESOME CREEK GENERATING STATION	ND	Natural Gas Fired Simple-cycle Turbines	412	MMBTU/H	none listed	5	LB/H
*ND-0029	PIONEER GENERATING STATION	ND	Natural gas-fired turbines	451	MMBTU/H	none listed	5.4	LB
TX-0701	ECTOR COUNTY ENERGY CENTER	TX	Simple-cycle Combustion Turbines	180	MW	Firing pipeline quality natural gas and good combustion practices		
*ND-0028	R.M. HESKETT STATION	ND	Combustion Turbine	986	MMBTU/H	Good combustion practices.	7.3	LB/H
LA-0258	CALCASIEU PLANT	LA	TURBINE EXHAUST STACK NO. 1 & NO. 2	1900	MM BTU/H EACH	USE OF PIPELINE NATURAL GAS	17	LB/H
NJ-0076	PSEG FOSSIL LLC KEARNY GENERATING STATION	NJ	SIMPLE-CYCLE TURBINE	8940000	MMBtu/year (HHV)	Good combustion practice, Use of Clean Burning Fuel: Natural gas	6	LB/H
DISTILLATE OIL FIRED TURBINES								
TX-0794	BRAZOS ELECTRIC COOPERATIVE: HILL COUNTY GENERATING FACILITY	TX	Simple-cycle Turbine	171	MW	combustor designed for complete combustion and therefore minimizes emissions	9.8	LB/H
MI-0400	WOLVERINE POWER SUPPLY COOPERATIVE, INC.:	MI	Turbine generator (EUBLACKSTART)	540	MMBTU/H	none listed	16.2	LB/H

BACT Table 5
Summary of RBLC Determinations
Simple-Cycle Combustion Turbines > 25 MW Output – GHG Emissions

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
NATURAL GAS FIRED TURBINES								
LA-0316	CAMERON LNG FACILITY	LA	Gas turbines (9 units)	1069	mm btu/hr	good combustion practices and fueled by natural gas; Use high thermal efficiency turbines		
*TX-0816	CORPUS CHRISTI LIQUEFACTION	TX	Refrigeration compressor turbines	40000	HP	none listed	1793574	T CO_{2e}/YR
IL-0121	INVENERGY NELSON EXPANSION LLC	IL	Two Simple-cycle Combustion Turbines	190	MW	Turbine-generator design and proper operation		
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle turbine	171	MW	none listed	1434	LB CO_{2e} /MWH
TX-0788	NECHES STATION	TX	Large Combustion Turbines; 25 MW	232	MW	good combustion practices	1341	LB CO_{2e} /MW H
LA-0307	MAGNOLIA LNG FACILITY	LA	Gas Turbines (8 units)	333	mm btu/hr	good combustion/operating/maintenance practices and fueled by natural gas; use intake air chiller		
TX-0778	UNION VALLEY ENERGY CENTER	TX	Simple-cycle Turbine	183	MW	none listed	1461	LB CO_2e /MW H
TX-0775	CLEAR SPRINGS ENERGY CENTER (CSEC)	TX	Simple-cycle Turbine	183	MW	Low carbon fuel, good combustion, efficient combined cycle design	1461	LB CO_{2e} /MW H
TX-0771	SHAWNEE ENERGY CENTER	TX	Simple-cycle turbines greater than 25 megawatts (MW)	230	MW	none listed	1398	LB CO_{2e} /MWH
FL-0355	FORT MYERS PLANT	FL	Combustion Turbines	2262.4	MMBtu/hr gas	Use of low-emitting fuel and efficient turbine	1374	LB CO_{2E} / MWH
*TX-0735	ANTELOPE ELK ENERGY CENTER	TX	Simple-cycle Turbine & Generator	202	MW	Energy efficiency, good design & combustion practices	1304	LB CO_2/MWHR
TX-0679	CORPUS CHRISTI LIQUEFACTION PLANT	TX	Refrigeration Compressor Turbines	40000	hp	install efficient turbines, follow the turbine manufacturers emission-related written instructions for maintenance activities including prescribed maintenance intervals to assure good combustion and efficient operation. Compressors shall be inspected and maintained according to a written maintenance plan to maintain efficiency.	146754	TPY CO_{2e}
TX-0753	GUADALUPE GENERATING STATION	TX	Simple-cycle Combustion Turbine Generator	10673	Btu/kWh	none listed	1293.3	LB CO_2/MWHR (GROSS)

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
TX-0753	GUADALUPE GENERATING STATION	TX	Simple-cycle Combustion Turbine Generator	10673	Btu/kWh	none listed	1293.3	LB CO_2/MWHR (GROSS)
TX-0758	ECTOR COUNTY ENERGY CENTER	TX	Simple-cycle Combustion Turbine, GE 7FA.03	11707	Btu/kWh (HHV)	none listed	1393	LB CO_2/MWHR (GROSS)
TX-0758	ECTOR COUNTY ENERGY CENTER	TX	Simple-cycle Combustion Turbine-MSS	0		none listed	21	TON CO_{2E}/EVENT
MD-0043	PERRYMAN GENERATING STATION	MD	(2) 60-MW SIMPLE-CYCLE COMBUSTION TURBINES, FIRING NATURAL GAS	120	MW	USE OF NATURAL GAS. ENERGY EFFICIENCY DESIGN - USE OF INLET FOGGING/WET COMPRESSION, INSULATION BLANKETS TO REDUCE HEAT LOSS, AND FUEL GAS PREHEATING.	1394	LB CO_{2E}/MWH
MD-0044	COVE POINT LNG TERMINAL	MD	2 COMBUSTION TURBINES	130	MW	HIGH EFFICIENCY GE 7EA CTS WITH HRSGS EQUIPPED WITH DLN1 COMBUSTORS AND EXCLUSIVE USE OF FACILITY PROCESS FUEL GAS OR PIPELINE QUALITY NATURAL GAS	117	LB CO_{2e}/MMBTU
CO-0075	PUEBLO AIRPORT GENERATING STATION	CO	Turbine - simple-cycle gas	375	MMBTU/H	Good Combustion Control	1600	LB CO_{2e}/MWH GROSS
TX-0757	INDECK WHARTON ENERGY CENTER	TX	Simple-cycle Combustion Turbine, GE 7FA.05	0		none listed	1276	LB CO_2/MWHR (GROSS)
TX-0757	INDECK WHARTON ENERGY CENTER	TX	Simple-cycle Combustion Turbine, SGT-5000F(5)	0		none listed	1337	LB CO_2/MWHR (GROSS)
OR-0050	TROUTDALE ENERGY CENTER, LLC	OR	GE LMS-100 combustion turbines, simple-cycle with water injection	1690	MMBTU/H	Thermal efficiency Clean fuels	1707	LB OF CO_2 /GROSS MWH
*ND-0030	LONESOME CREEK GENERATING STATION	ND	Natural Gas Fired Simple-cycle Turbines	412	MMBTU/H	High efficiency turbines	220122	TONS CO_{2e}
ND-0029	PIONEER GENERATING STATION	ND	Natural gas-fired turbines	451	MMBTU/H	none listed	243147	T CO_{2e} /12 MON ROLL TOTAL
ND-0028	R.M. HESKETT STATION	ND	Combustion Turbine	986	MMBTU/H	none listed	413198	TONS CO_{2e} /12 MONTH
CA-1223	PIO PICO ENERGY CENTER	CA	COMBUSTION TURBINES (NORMAL OPERATION)	300	MW	none listed	1328	LB CO2e /MW-H
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Refrigeration Compressor Turbines (16)	286	MMBTU/H	Good combustion/operating practices and fueled by natural gas - use GE LM2500+G4 turbines	4872107	TONS CO_{2e} /YR

RBLCID	FACILITY NAME	STATE	PROCESS NAME	THROUGHPUT	THROUGHPUT UNIT	CONTROL METHOD	EMISSION LIMIT	EMISSION LIMIT UNIT
LA-0257	SABINE PASS LNG TERMINAL	LA	Simple-cycle Generation Turbines (2)	286	MMBTU/H	Good combustion/operating practices and fueled by natural gas - use GE LM2500+G4 turbines	4872107	TONS CO_{2e} /YR
DISTILLATE OIL FIRED TURBINES								
TX-0794	HILL COUNTY GENERATING FACILITY	TX	Simple-cycle Turbine	171	MW	none listed	1434	LB CO_{2e}/MWH

Appendix D

Facility-Wide Toxic Pollutant Emission Rate (TPER) Analysis and Toxics Modeling Tables

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Table D-1 Summary of Facility-Wide Potential Emissions

Pollutant	HAP?	ES-CT-1	ES-CT-2	ES-CT-3	ES-CT-4	ES-CT-5	Emergency Generator	Fire Pump	Black-Start Emergency Generator	Tower Backup Generator	Existing Fuel Tanks	Facility Total	
		No. 2 Fuel Oil/Natural Gas					No. 2 Fuel Oil	No. 2 Fuel Oil	No. 2 Fuel Oil	Propane	No. 2 Fuel Oil		
Criteria Compounds		**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**lb/yr**	**tpy**
TSP		31.91	31.91	31 91	31.91	31.91	0.21	0.07	0.19	0.00		320,083.64	160.04
PM-10		31.91	31.91	31 91	31.91	31.91	0.21	0.07	0.19	0.00		320,083.64	160.04
PM-2.5		31.91	31.91	31 91	31.91	31.91	0.21	0.07	0.19	0.00		320,083.64	160.04
SO2		49.68	49.68	49 68	49.68	49.68	0.04	0.01	0 00	0.00		496,886.89	248.44
NOX		507 63	507 63	507.63	507.63	507 63	2.60	0.88	3 33	0.03		5,089,945.70	2,544 97
VOC		23.82	23.82	23 82	23.82	23.82	0.21	0.07	0.48	0.00	0 65	241,047.85	120.52
CO		464.41	464.41	464.41	464.41	464.41	0.56	0.19	4.10	0.02		4,653,819.47	2,326 91
Greenhouse Gas Compounds		**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**lb/yr**	**tpy**
CO_2		862,757.30	862,757.30	862,757 30	862,757.30	862,757.30	114.79	37 95	249.73	28.48		8.63E+09	4 31E+06
CH_4		19.52	19.52	19 52	19.52	19.52	0 005	0 002	0.010	0 001		1.95E+05	97 60
N_2O		2 56	2.56	2.56	2 56	2 56	0 001	0.0003	0 0020	0.0003		2.56E+04	12 80
CO_2e		864,008.00	864,008.00	864,008 00	864,008.00	864,008.00	115.19	38 08	250 59	28 60		8.64E+09	4 32E+06
Metal Compounds		**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**tpy**
Antimony	Y	0.14	0.14	0.14	0.14	0.14						0 69	0.00
Arsenic	Y	22.62	22.62	22 62	22.62	22.62	0 006	0 002	0.012			113.11	0.06
Barium		55.33	55.33	55 33	55.33	55.33						276.66	0.14
Beryllium	Y	0.71	0.71	0.71	0.71	0.71	0 004	0 001	0.009			3 58	0.00
Cadmium	Y	21.97	21.97	21 97	21.97	21.97	0 004	0 001	0.009			109.87	0.05
Chromium (Total)	Y	36.96	36.96	36 96	36.96	36.96	0 004	0 001	0.009			184.80	0.09
Chromium VI													
Cobalt	Y	4 50	4.50	4.50	4 50	4 50						22.49	0.01
Copper		21.19	21.19	21.19	21.19	21.19	0 008	0 003	0.018			105.98	0.05
Lead	Y	31.72	31.72	31.72	31.72	31.72	0 013	0 004	0.028			158.65	0.08
Manganese	Y	1,457.35	1,457 35	1,457 35	1,457.35	1,457 35	0 008	0 003	0.018			7,286.78	3.64
Mercury	Y	5 31	5.31	5.31	5 31	5 31	0 004	0 001	0.009			26.58	0.01
Molybdenum		13.14	13.14	13.14	13.14	13.14						65.72	0.03
Nickel	Y	33.55	33.55	33 55	33.55	33.55	0 004	0 001	0.009			167.77	0.08
Selenium	Y	46.26	46.26	46 26	46.26	46.26	0 021	0 007	0.046			231.38	0.12
Silver		0.12	0.12	0.12	0.12	0.12						0 58	0.00
Vanadium		128 63	128 63	128.63	128.63	128 63						643.13	0.32
Zinc		353 86	353 86	353.86	353.86	353 86	0 006	0 002	0.012			1,769.34	0.88

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Table D-1 Summary of Facility-Wide Potential Emissions

Pollutant	HAP?	ES-CT-1	ES-CT-2	ES-CT-3	ES-CT-4	ES-CT-5	Emergency Generator	Fire Pump	Black-Start Emergency Generator	Tower Backup Generator	Existing Fuel Tanks	Facility Total	
		No. 2 Fuel Oil/Natural Gas					No. 2 Fuel Oil	No. 2 Fuel Oil	No. 2 Fuel Oil	Propane	No. 2 Fuel Oil		
Organic Compounds		**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**tpy**
Acetaldehyde	Y	487 50	487 50	487.50	487.50	487 50	1.08	0.36	0 08			2,439.01	1.22
Acrolein	Y	78.00	78.00	78 00	78.00	78.00	0.13	0.04	0 02			390.20	0.20
Ammonia													
Benzene	Y	247.40	247.40	247.40	247.40	247.40	1.31	0.43	2 38		1 30	1,242.40	0.62
Butadiene, 1,3-	Y	34.66	34.66	34 66	34.66	34.66	0.06	0.02				173.40	0.09
Ethylbenzene	Y	390 00	390 00	390.00	390.00	390 00					2 60	1,952.60	0.98
Formaldehyde	Y	9,168.05	9,168 05	9,168 05	9,168.05	9,168 05	1.66	0.55	0 24			45,842 68	22 92
Naphthalene	Y	80.21	80.21	80 21	80.21	80.21	0.12	0.04	0.40		3 38	404.98	0.20
Polyaromatic Compounds (PACs)		20.16	20.16	20.16	20.16	20.16	0.00	0.00	0 01			100.83	0.05
Propylene Oxide	Y	353.44	353.44	353.44	353.44	353.44						1,767.19	0.88
Sulfuric Acid		992 35	992 35	992.35	992.35	992 35						4,961.77	2.48
Toluene	Y	1,584.38	1,584 38	1,584 38	1,584.38	1,584.38	0.58	0.19	0 86		9.10	7,932.60	3.97
Xylenes	Y	780 00	780 00	780.00	780.00	780 00	0.40	0.13	0 59		6 50	3,907.63	1.95
Polycyclic Organic Matter		**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**tpy**
Acenaphthene	Y						0.0020	0.0007	0 0143			0 02	0.00
Acenaphthylene	Y						0.0071	0.0024	0 0283			0 04	0.00
Anthracene	Y						0.0026	0.0009	0 0038			0 01	0.00
Benz(a)anthracene	Y						0.0024	0.0008	0 0019			0 01	0.00
Benzo(a)Pyrene	Y						0.0003	0.0001	0 0008			0 00	0.00
Benzo(b)fluoranthene	Y						0.0001	0.0000	0 0034			0 00	0.00
Benzo(k)fluoranthene	Y						0.0002	0.0001	0 0007			0 00	0.00
Benzo(g,h,i)perylene	Y						0.0007	0.0002	0 0017			0 00	0.00
Chrysene	Y						0.0005	0.0002	0 0047			0 01	0.00
Dibenzo(a,h)anthracene	Y						0.0008	0.0003	0 0011			0 00	0.00
Fluoranthene	Y						0.0107	0.0035	0 0123			0 03	0.00
Fluorene	Y						0.0411	0.0136	0 0392			0 09	0.00
Indo(1,2,3-cd)pyrene	Y						0.0005	0.0002	0 0013			0 00	0.00
Phenanthrene	Y						0.0414	0.0137	0.1250			0.18	0.00
Pyrene	Y						0.0067	0.0022	0 0114			0 02	0.00
Total POM	Y	100.37	100 37	100.37	100.37	100 37	0.2366	0.0782	0 6494			502.83	0.25
HAPs		**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**lb/yr**	**tpy**
Total HAPs		**14,965.09**	**14,965.09**	**14,965.09**	**14,965.09**	**14,965.09**	**5.76**	**1.90**	**5.62**		**22.88**	74,861 62	37.43

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
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Table D-2: **5 Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines (ES-CT-1 through ES-CT-5)**

Number of Units	**5**		
Natural Gas		**No. 2 Fuel Oil**	
Potential Operating Hours:	**6,500**	Potential Operating Hours:	**1,000**
Maximum Capacity (MMBtu/hr):	**1,875**	Maximum Capacity (MMBt	**1,839**
Heating Value of Fuel (MMBtu/MMscf)[1]:	**1,020**		

	Emission Factors						Emissions												
Compound Categories	No.2 Fuel Oil		Reference	Natural Gas		Reference	No.2 Fuel Oil				Natural Gas				Maximum Emissions [8]			
	Value	Units		Value	Units		lb/hr	lb/day	lb/yr	tons/yr	lb/hr	lb/day	lb/yr	tons/yr	lb/hr	lb/day	lb/yr	tons/yr
Criteria Compounds:																		
TSP	0.0135	lb/MMBtu	2	0.0032	lb/MMBtu	2	1.24E+02	2.98E+03	1.24E+05	6.21E+01	3.00E+01	7.20E+02	1.95E+05	9.75E+01	1.24E+02	2.98E+03	3.19E+05	160
PM-10	0.0135	lb/MMBtu	2	0.0032	lb/MMBtu	2	1.24E+02	2.98E+03	1.24E+05	6.21E+01	3.00E+01	7.20E+02	1.95E+05	9.75E+01	1.24E+02	2.98E+03	3.19E+05	160
PM-2.5	0.0135	lb/MMBtu	2	0.0032	lb/MMBtu	2	1.24E+02	2.98E+03	1.24E+05	6.21E+01	3.00E+01	7.20E+02	1.95E+05	9.75E+01	1.24E+02	2.98E+03	3.19E+05	160
SO2	0.0474	lb/MMBtu	2	0.0010	lb/MMBtu	2	4.36E+02	1.05E+04	4.36E+05	2.18E+02	9.38E+00	2.25E+02	6.09E+04	3.05E+01	4.36E+02	1.05E+04	4.97E+05	248
NOx	0.1710	lb/MMBtu	2	0.0575	lb/MMBtu	2	1.57E+03	3.77E+04	1.57E+06	7.86E+02	5.39E+02	1.29E+04	3.50E+06	1.75E+03	1.57E+03	3.77E+04	5.08E+06	2,538
VOC	0.0047	lb/MMBtu	2	0.0032	lb/MMBtu	2	4.32E+01	1.04E+03	4.32E+04	2.16E+01	3.00E+01	7.20E+02	1.95E+05	9.75E+01	4.32E+01	1.04E+03	2.38E+05	119
CO	0.1240	lb/MMBtu	2	0.0575	lb/MMBtu	2	1.14E+03	2.74E+04	1.14E+06	5.70E+02	5.39E+02	1.29E+04	3.50E+06	1.75E+03	1.14E+03	2.74E+04	4.64E+06	2,322
Greenhouse Gas Compounds:																		
CO_2	163.05	lb/MMBtu	3	116.98	lb/MMBtu	3	1.50E+06	3.60E+07	1.50E+09	7.50E+05	1.10E+06	2.63E+07	7.13E+09	3.56E+06	1.50E+06	3.60E+07	8.63E+09	4.31E+06
CH_4	6.61E-03	lb/MMBtu	3	2.20E-03	lb/MMBtu	3	6.08E+01	1.46E+03	6.08E+04	3.04E+01	2.07E+01	4.96E+02	1.34E+05	6.72E+01	6.08E+01	1.46E+03	1.95E+05	97.58
N_2O	1.32E-03	lb/MMBtu	3	2.20E-04	lb/MMBtu	3	1.22E+01	2.92E+02	1.22E+04	6.08E+00	2.07E+00	4.96E+01	1.34E+04	6.72E+00	1.22E+01	2.92E+02	2.56E+04	12.80
CO_2e			3			3	1.50E+06	3.61E+07	1.50E+09	7.52E+05	1.10E+06	2.63E+07	7.14E+09	3.57E+06	1.50E+06	3.61E+07	8.64E+09	4.32E+06
Metal Compounds:																		
Antimony	7.50E-08	lb/MMBtu	6				6.90E-04	1.66E-02	6.90E-01	3.45E-04					6.90E-04	1.66E-02	6.90E-01	0.00
Arsenic	1.10E-05	lb/MMBtu	5	1.96E-07	lb/MMBtu	4	1.01E-01	2.43E+00	1.01E+02	5.06E-02	1.84E-03	4.41E-02	1.19E+01	5.97E-03	1.01E-01	2.43E+00	1.13E+02	0.06
Barium	1.50E-06	lb/MMBtu	6	4.31E-06	lb/MMBtu	4	1.38E-02	3.31E-01	1.38E+01	6.90E-03	4.04E-02	9.71E-01	2.63E+02	1.31E-01	4.04E-02	9.71E-01	2.77E+02	0.14
Beryllium	3.10E-07	lb/MMBtu	5	1.18E-08	lb/MMBtu	4	2.85E-03	6.84E-02	2.85E+00	1.43E-03	1.10E-04	2.65E-03	7.17E-01	3.58E-04	2.85E-03	6.84E-02	3.57E+00	0.00
Cadmium	4.80E-06	lb/MMBtu	5	1.08E-06	lb/MMBtu	4	4.41E-02	1.06E+00	4.41E+01	2.21E-02	1.01E-02	2.43E-01	6.57E+01	3.29E-02	4.41E-02	1.06E+00	1.10E+02	0.05
Chromium (Total)	1.10E-05	lb/MMBtu	5	1.37E-06	lb/MMBtu	4	1.01E-01	2.43E+00	1.01E+02	5.06E-02	1.29E-02	3.09E-01	8.36E+01	4.18E-02	1.01E-01	2.43E+00	1.85E+02	0.09
Chromium VI																		
Cobalt	1.90E-06	lb/MMBtu	6	8.24E-08	lb/MMBtu	4	1.75E-02	4.19E-01	1.75E+01	8.74E-03	7.72E-04	1.85E-02	5.02E+00	2.51E-03	1.75E-02	4.19E-01	2.25E+01	0.01
Copper	6.00E-06	lb/MMBtu	5	8.33E-07	lb/MMBtu	4	5.52E-02	1.32E+00	5.52E+01	2.76E-02	7.81E-03	1.88E-01	5.08E+01	2.54E-02	5.52E-02	1.32E+00	1.06E+02	0.05
Lead	1.40E-05	lb/MMBtu	5	4.90E-07	lb/MMBtu	4	1.29E-01	3.09E+00	1.29E+02	6.44E-02	4.60E-03	1.10E-01	2.99E+01	1.49E-02	1.29E-01	3.09E+00	1.59E+02	0.08
Manganese	7.90E-04	lb/MMBtu	5	3.73E-07	lb/MMBtu	4	7.26E+00	1.74E+02	7.26E+03	3.63E+00	3.49E-03	8.38E-02	2.27E+01	1.14E-02	7.26E+00	1.74E+02	7.29E+03	3.64
Mercury	1.20E-06	lb/MMBtu	5	2.55E-07	lb/MMBtu	4	1.10E-02	2.65E-01	1.10E+01	5.52E-03	2.39E-03	5.74E-02	1.55E+01	7.77E-03	1.10E-02	2.65E-01	2.66E+01	0.01
Molybdenum				1.08E-06	lb/MMBtu	4					1.01E-02	2.43E-01	6.57E+01	3.29E-02	1.01E-02	2.43E-01	6.57E+01	0.03
Nickel	4.60E-06	lb/MMBtu	5	2.06E-06	lb/MMBtu	4	4.23E-02	1.02E+00	4.23E+01	2.11E-02	1.93E-02	4.63E-01	1.25E+02	6.27E-02	4.23E-02	1.02E+00	1.68E+02	0.08
Selenium	2.50E-05	lb/MMBtu	5	2.35E-08	lb/MMBtu	4	2.30E-01	5.52E+00	2.30E+02	1.15E-01	2.21E-04	5.29E-03	1.43E+00	7.17E-04	2.30E-01	5.52E+00	2.31E+02	0.12
Silver	6.30E-08	lb/MMBtu	6				5.79E-04	1.39E-02	5.79E-01	2.90E-04					5.79E-04	1.39E-02	5.79E-01	0.00
Vanadium	5.50E-05	lb/MMBtu	6	2.25E-06	lb/MMBtu	4	5.06E-01	1.21E+01	5.06E+02	2.53E-01	2.11E-02	5.07E-01	1.37E+02	6.87E-02	5.06E-01	1.21E+01	6.43E+02	0.32
Zinc	4.00E-06	lb/MMBtu	5	2.84E-05	lb/MMBtu	4	3.68E-02	8.83E-01	3.68E+01	1.84E-02	2.67E-01	6.40E+00	1.73E+03	8.66E-01	2.67E-01	6.40E+00	1.77E+03	0.88
Organic Compounds:																		
Acetaldehyde				4.00E-05	lb/MMBtu	7					3.75E-01	9	2.44E+03	1.22E+00	3.75E-01	9.00E+00	2.44E+03	1.22
Acetophenone																		
Acrolein				6.40E-06	lb/MMBtu	7					6.00E-02	1.44	3.90E+02	1.95E-01	6.00E-02	1.44E+00	3.90E+02	0.20
Acrylonitrile																		
Allyl Chloride (3-Chloropropylene)																		
Ammonia																		
Benzene	5.50E-05	lb/MMBtu	7	1.20E-05	lb/MMBtu	7	5.06E-01	1.21E+01	5.06E+02	2.53E-01	1.13E-01	2.7	7.31E+02	3.66E-01	5.06E-01	1.21E+01	1.24E+03	0.62
Benzyl Chloride																		
Biphenyl																		
Bis (2-Ethyl Hexyl Phthalate)																		
Bromodichloromethane																		
Bromoform																		

Table D-2: **5 Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines (ES-CT-1 through ES-CT-5)**

Number of Units	**5**		
Natural Gas		**No. 2 Fuel Oil**	
Potential Operating Hours:	**6,500**	Potential Operating Hours:	**1,000**
Maximum Capacity (MMBtu/hr):	**1,875**	Maximum Capacity (MMBt	**1,839**
Heating Value of Fuel (MMBtu/MMscf)[1]:	**1,020**		

	Emission Factors						Emissions											
Compound Categories	**No.2 Fuel Oil**		**Reference**	**Natural Gas**		**Reference**	**No.2 Fuel Oil**				**Natural Gas**				**Maximum Emissions [8]**			
	Value	**Units**		**Value**	**Units**		**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Butadiene, 1,3-	1.60E-05	lb/MMBtu	7	4.30E-07	lb/MMBtu	7	1.47E-01	3.53E+00	1.47E+02	7.36E-02	4.03E-03	0.09675	2.62E+01	1.31E-02	1.47E-01	3.53E+00	1.73E+02	0.09
Carbon Disulfide																		
Carbon Tetrachloride (Tetrachloromethane)																		
Chloroacetophenone, 2-																		
Chlorobenzene																		
Chloroform																		
Cumene																		
Cyanide																		
Dibenzofurans																		
Dibromoethane, 1,2- (Ethylene Dibromide)																		
Dibutyl Phthalate																		
Dichlorobenzene, 1,4-																		
Dichlorodifluoromethane (CFC-12)																		
Dimethyl Phthalate																		
Dimethyl Sulfate																		
Dimethylbenz(a)Anthracene, 7,12-																		
Dinitrotoluene, 2,4-																		
Dinitrotoluene, 2,6-																		
Ethyl Chloride																		
Ethylbenzene				3.20E-05	lb/MMBtu	7					3.00E-01	7.2	1.95E+03	9.75E-01	3.00E-01	7.20E+00	1.95E+03	0.98
Ethylene Dichloride																		
Formaldehyde	2.80E-04	lb/MMBtu	7	7.10E-04	lb/MMBtu	7	2.57E+00	6.18E+01	2.57E+03	1.29E+00	6.66E+00	159.75	4.33E+04	2.16E+01	6.66E+00	1.60E+02	4.58E+04	22.92
Hexachlorobenzene																		
Hexane																		
Hydrogen Chloride																		
Hydrogen Fluoride																		
Isophorone																		
Methyl Bromide (Bromomethane)																		
Methyl Chloride (Chloromethane)																		
Methyl Chloroform (1,1,1-Trichloroethane)																		
Methyl Ethyl Ketone																		
Methyl Hydrazine																		
Methyl Iodide (Iodomethane)																		
Methyl Isobutyl Ketone																		
Methyl Methacrylate																		
Methyl Tert Butyl Ether																		
Methylene Chloride (Dichloromethane)																		
Methylchloranthrene, 3-																		
Methylnaphthalene, 2-																		
Naphthalene	3.50E-05	lb/MMBtu	7	1.30E-06	lb/MMBtu	7	3.22E-01	7.72E+00	3.22E+02	1.61E-01	1.22E-02	0.2925	7.92E+01	3.96E-02	3.22E-01	7.72E+00	4.01E+02	0.20
Nitroaniline, 4-																		
P-Cresol (4-Methyl Phenol)																		
Phenol																		
Polyaromatic Compounds (PACs)	5.00E-06	lb/MMBtu	7	9.00E-07	lb/MMBtu	7	4.60E-02	1.10E+00	4.60E+01	2.30E-02	8.44E-03	0.2025	5.48E+01	2.74E-02	4.60E-02	1.10E+00	1.01E+02	0.05
Polychlorinated Biphenyls																		
Propionaldehyde																		
Propylene Oxide				2.90E-05	lb/MMBtu	7					2.72E-01	6.525	1.77E+03	8.84E-01	2.72E-01	6.53E+00	1.77E+03	0.88
Styrene																		
Sulfuric Acid	9.44E-06	lb/MMBtu	6	8.00E-05	lb/MMBtu	2	8.68E-02	2.08E+00	8.68E+01	4.34E-02	7.50E-01	18	4.88E+03	2.44E+00	7.50E-01	1.80E+01	4.96E+03	2.48
Tetrachloroethane, 1,1,1,2-																		
Tetrachloroethylene																		

Table D-2: **5 Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines (ES-CT-1 through ES-CT-5)**

Number of Units	**5**		
Natural Gas		**No. 2 Fuel Oil**	
Potential Operating Hours:	**6,500**	Potential Operating Hours:	**1,000**
Maximum Capacity (MMBtu/hr):	**1,875**	Maximum Capacity (MMBt	**1,839**
Heating Value of Fuel (MMBtu/MMscf)[1]:	**1,020**		

Compound Categories	Emission Factors						Emissions											
	No.2 Fuel Oil		Reference	Natural Gas		Reference	No.2 Fuel Oil				Natural Gas				Maximum Emissions [8]			
	Value	Units		Value	Units		lb/hr	lb/day	lb/yr	tons/yr	lb/hr	lb/day	lb/yr	tons/yr	lb/hr	lb/day	lb/yr	tons/yr
Toluene				1.30E-04	lb/MMBtu	7					1.22E+00	29.25	7.92E+03	3.96E+00	1.22E+00	2.93E+01	7.92E+03	3.96
Trichlorobenzene, 1,2,4-																		
Trichloroethylene																		
Trichlorofluoromethane																		
Trimethylbenzene, 1,2,4-																		
Vinyl Acetate																		
Vinyl Chloride																		
Xylenes				6.40E-05	lb/MMBtu	7					6.00E-01	14.4	3.90E+03	1.95E+00	6.00E-01	1.44E+01	3.90E+03	1.95
Polycyclic Organic Matter:																		
Total POM	4.00E-05	lb/MMBtu	7	2.20E-06	lb/MMBtu	7	3.68E-01	8.83E+00	3.68E+02	1.84E-01	2.06E-02	0.495	1.34E+02	6.70E-02	3.68E-01	8.83E+00	5.02E+02	0.25

References:

1. Heat content of 1,020 mmbtu/mmscf obtained from USEPA's AP-42, Chapter 1.4 and Appendix A.
2. BACT Emission Limits from Title V Permit
3. 40 CFR Part 98, Subpart C, Table C-1 and C-2 for natural gas and distillate fuel oil No. 2, converting kg/MMBtu to lb/MMBtu using 2.2046. CO2e calculated by using Eq. A-1 with GWPs from Table A-1 in 40 CFR Part 98, Subpart A.
4. USEPA's AP-42, Chapter 1.4, Tables 1.4-2,-4. Note that metals are not included in AP-42 Chapter 3.1 for turbines combusting natural gas, therefore metals were conservatively estimated using AP-42 Chapter 1.4.
5. USEPA's AP-42, Chapter 3.1, Table 3.1-5 (Uncontrolled). Note that not all metals are included in AP-42 Chapter 3.1 for turbines combusting No. 2 fuel oil, therefore those metals were conservatively estimated using AP-42 Chapter 1.3.
6. EPRI Report, Guidelines for Estimating Trace Substance Emissions from Fossil-Fuel-Fired Steam Electric Power Plants, 2014 Technical Report
7. USEPA's AP-42, Chapter 3.1, Table 3.1-3 and 3.1-4 (Uncontrolled).
8. Hourly emissions are based on the rated capacity (MMBtu/hr) for 5 units; the daily maximum is this value times 24. The Maximum Emissions for hourly and daily are calculated as the maximum of either natural gas or No. 2 Fuel Oil. The annual Criteria Compound Maximum Emissions are based on 1,000 hrs/yr on No.2 Fuel Oil and 6,500 hrs/yr on natural gas. Annual Maximum Emissions for all other compounds are overly conservative and equal the sum of emissions from 1,000 hrs/year on No.2 Fuel Oil and 6,500 hrs/yr on natural gas.

Duke Energy Carolinas, LLC

Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Table D-3: Estimation of Sulfuric Acid Emissions from a Simple Cycle Combustion Turbine

Formation of sulfuric acid from the combustion of fuel oil in a simple cycle combustion turbine may be calculated as follows:

$$\boxed{EM_{SC} = K * F1 * E2_{NG}}$$

Where:
EM_{sc} is sulfuric acid emissions from the unit
K is a molecular weight and conversion constant
F1 is a fuel impact factor
$E2_{NG}$ is calculated or measured emissions of SO_2

The F1 factor for simple cycle combustion turbines is a function of stack temperature, as sulfuric acid vapor is related to the temperature of the exhaust. The following table combines the temperature-based SO_3 to H_2SO_4 conversion with the SO_2 to SO_3 conversion to yield the Fuel Impact Factor, F1.

Stack Temperature (^oF)	F1 Factor	
300	0.055	
400	0.055	
500	0.047	
600	0.022	
700	0.0055	
750	0.0027	
800	0.0013	
850	0.00071	
900	0.00039	
950	0.00022	
1000	**0.00013**	*Average Stack Temperature for SCCT's*
1050	0.00008	
1100	0.00005	
1150	0.00003	
1200	0.00002	

No. 2 Fuel Oil Combustion

1.531 K, Molecular Weight and Conversion Constant
98.07 Molecular Weight of Sulfuric Acid
64.04 Molecular Weight of Sulfur Dioxide
0.0474 lb/MMBtu, Permit limit for sulfur dioxide when firing fuel oil
9.44E-06 lb/MMBtu, Estimated maximum sulfuric acid emissions when firing fuel oil

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Table D-4: **300 kw (402 hp) No. 2 Fuel Oil-fired Stand-by Emergency Generator (ES-EG-1)**

Number of Units	**1**
Total Potential Operating Hours:	**500**
Horsepower (hp):	**402**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**2.8161**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Criteria Compounds:							
TSP	0.30	lb/MMBtu	4	8.45E-01	2.03E+01	4.22E+02	2.11E-01
PM-10	0.30	lb/MMBtu	4	8.45E-01	2.03E+01	4.22E+02	2.11E-01
PM-2.5	0.30	lb/MMBtu	4	8.45E-01	2.03E+01	4.22E+02	2.11E-01
SO2	0.05	lb/MMBtu	4	1.41E-01	3.38E+00	7.04E+01	3.52E-02
NOX	3.7	lb/MMBtu	4	1.04E+01	2.50E+02	5.21E+03	2.60E+00
VOC	0.3	lb/MMBtu	4	8.45E-01	2.03E+01	4.22E+02	2.11E-01
CO	0.8	lb/MMBtu	4	2.25E+00	5.41E+01	1.13E+03	5.63E-01
Greenhouse Gas Compounds:							
CO_2	163.05	lb/MMBtu	2	4.59E+02	1.10E+04	2.30E+05	1.15E+02
CH_4	6.61E-03	lb/MMBtu	2	1.86E-02	4.47E-01	9.31E+00	4.66E-03
N_2O	1.32E-03	lb/MMBtu	2	3.73E-03	8.94E-02	1.86E+00	9.31E-04
CO_2e			2	4.61E+02	1.11E+04	2.30E+05	1.15E+02
Metal Compounds:							
Antimony							
Arsenic	4.00E-06	lb/MMBtu	3	1.13E-05	2.70E-04	5.63E-03	2.82E-06
Barium							
Beryllium	3.00E-06	lb/MMBtu	3	8.45E-06	2.03E-04	4.22E-03	2.11E-06
Cadmium	3.00E-06	lb/MMBtu	3	8.45E-06	2.03E-04	4.22E-03	2.11E-06
Chromium (Total)	3.00E-06	lb/MMBtu	3	8.45E-06	2.03E-04	4.22E-03	2.11E-06
Chromium VI							
Cobalt							
Copper	6.00E-06	lb/MMBtu	3	1.69E-05	4.06E-04	8.45E-03	4.22E-06
Lead	9.00E-06	lb/MMBtu	3	2.53E-05	6.08E-04	1.27E-02	6.34E-06
Manganese	6.00E-06	lb/MMBtu	3	1.69E-05	4.06E-04	8.45E-03	4.22E-06
Mercury	3.00E-06	lb/MMBtu	3	8.45E-06	2.03E-04	4.22E-03	2.11E-06
Molybdenum							
Nickel	3.00E-06	lb/MMBtu	3	8.45E-06	2.03E-04	4.22E-03	2.11E-06
Selenium	1.50E-05	lb/MMBtu	3	4.22E-05	1.01E-03	2.11E-02	1.06E-05
Silver							
Vanadium							
Zinc	4.00E-06	lb/MMBtu	3	1.13E-05	2.70E-04	5.63E-03	2.82E-06
Organic Compounds:							
Acetaldehyde	7.67E-04	lb/MMBtu	1	2.16E-03	5.18E-02	1.08E+00	5.40E-04
Acetophenone							
Acrolein	9.25E-05	lb/MMBtu	1	2.60E-04	6.25E-03	1.30E-01	6.51E-05
Acrylonitrile							
Allyl Chloride (3-Chloropropylene)							
Ammonia							
Benzene	9.33E-04	lb/MMBtu	1	2.63E-03	6.31E-02	1.31E+00	6.57E-04
Benzyl Chloride							
Biphenyl							
Bis (2-Ethyl Hexyl Phthalate)							
Bromodichloromethane							
Bromoform							
Butadiene, 1,3-	3.91E-05	lb/MMBtu	1	1.10E-04	2.64E-03	5.51E-02	2.75E-05
Carbon Disulfide							
Carbon Tetrachloride (Tetrachloromethane)							
Chloroacetophenone, 2-							
Chlorobenzene							
Chloroform							

Table D-4: **300 kw (402 hp) No. 2 Fuel Oil-fired Stand-by Emergency Generator (ES-EG-1)**

Number of Units	**1**
Total Potential Operating Hours:	**500**
Horsepower (hp):	**402**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**2.8161**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Cumene							
Cyanide							
Dibenzofurans							
Dibromoethane, 1,2- (Ethylene Dibromide)							
Dibutyl Phthalate							
Dichlorobenzene, 1,4-							
Dichlorodifluoromethane (CFC-12)							
Dimethyl Phthalate							
Dimethyl Sulfate							
Dimethylbenz(a)Anthracene, 7,12-							
Dinitrotoluene, 2,4-							
Dinitrotoluene, 2,6-							
Ethyl Chloride							
Ethylbenzene							
Ethylene Dichloride							
Formaldehyde	1.18E-03	lb/MMBtu	1	3.32E-03	7.98E-02	1.66E+00	8.31E-04
Hexachlorobenzene							
Hexane							
Hydrogen Chloride							
Hydrogen Fluoride							
Isophorone							
Methyl Bromide (Bromomethane)							
Methyl Chloride (Chloromethane)							
Methyl Chloroform (1,1,1-Trichloroethane)							
Methyl Ethyl Ketone							
Methyl Hydrazine							
Methyl Iodide (Iodomethane)							
Methyl Isobutyl Ketone							
Methyl Methacrylate							
Methyl Tert Butyl Ether							
Methylene Chloride (Dichloromethane)							
Methylchloranthrene, 3-							
Methylnaphthalene, 2-							
Naphthalene	8.48E-05	lb/MMBtu	1	2.39E-04	5.73E-03	1.19E-01	5.97E-05
Nitroaniline, 4-							
P-Cresol (4-Methyl Phenol)							
Phenol							
Polyaromatic Compounds (PACs)	3.08E-06	lb/MMBtu	5	8.67E-06	2.08E-04	4.34E-03	2.17E-06
Polychlorinated Biphenyls							
Propionaldehyde							
Propylene Oxide							
Styrene							
Sulfuric Acid	3.80E-03	lb/MMBtu	4				
Tetrachloroethane, 1,1,1,2-							
Tetrachloroethylene							
Toluene	4.09E-04	lb/MMBtu	1	1.15E-03	2.76E-02	5.76E-01	2.88E-04
Trichlorobenzene, 1,2,4-							
Trichloroethylene							
Trichlorofluoromethane							
Trimethylbenzene, 1,2,4-							
Vinyl Acetate							
Vinyl Chloride							
Xylenes	2.85E-04	lb/MMBtu	1	8.03E-04	1.93E-02	4.01E-01	2.01E-04
Polycyclic Organic Matter:							
Acenaphthene	1.42E-06	lb/MMBtu	1	4.00E-06	9.60E-05	2.00E-03	1.00E-06
Acenaphthylene	5.06E-06	lb/MMBtu	1	1.42E-05	3.42E-04	7.12E-03	3.56E-06
Anthracene	1.87E-06	lb/MMBtu	1	5.27E-06	1.26E-04	2.63E-03	1.32E-06
Benz(a)anthracene	1.68E-06	lb/MMBtu	1	4.73E-06	1.14E-04	2.37E-03	1.18E-06

Table D-4: **300 kw (402 hp) No. 2 Fuel Oil-fired Stand-by Emergency Generator (ES-EG-1)**

Number of Units	**1**
Total Potential Operating Hours:	**500**
Horsepower (hp):	**402**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**2.8161**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Benzidine							
Benzo(b)fluoranthene	9.91E-08	lb/MMBtu	1	2.79E-07	6.70E-06	1.40E-04	6.98E-08
Benzo(k)fluoranthene	1.55E-07	lb/MMBtu	1	4.36E-07	1.05E-05	2.18E-04	1.09E-07
Benzo(g,h,i)perylene	4.89E-07	lb/MMBtu	1	1.38E-06	3.30E-05	6.89E-04	3.44E-07
Benzo(a)pyrene	1.88E-07	lb/MMBtu	1	5.29E-07	1.27E-05	2.65E-04	1.32E-07
Chrysene	3.53E-07	lb/MMBtu	1	9.94E-07	2.39E-05	4.97E-04	2.49E-07
Dibenzo(a,h)anthracene	5.83E-07	lb/MMBtu	1	1.64E-06	3.94E-05	8.21E-04	4.10E-07
Fluoranthene	7.61E-06	lb/MMBtu	1	2.14E-05	5.14E-04	1.07E-02	5.36E-06
Fluorene	2.92E-05	lb/MMBtu	1	8.22E-05	1.97E-03	4.11E-02	2.06E-05
Indo(1,2,3-cd)pyrene	3.75E-07	lb/MMBtu	1	1.06E-06	2.53E-05	5.28E-04	2.64E-07
Phenanthrene	2.94E-05	lb/MMBtu	1	8.28E-05	1.99E-03	4.14E-02	2.07E-05
Pyrene	4.78E-06	lb/MMBtu	1	1.35E-05	3.23E-04	6.73E-03	3.37E-06
Total POM	1.68E-04	lb/MMBtu	1	4.73E-04	1.14E-02	2.37E-01	1.18E-04

References:

1. USEPA's AP-42, Chapter 3.3.
2. 40 CFR Part 98, Subpart C, Table C-1 and C-2 for distillate fuel oil No. 2, converting kg/MMBtu to lb/MMBtu using 2.2046.
   CO2e calculated by using Eq. A-1 with GWPs from Table A-1 in 40 CFR Part 98, Subpart A.
3. USEPA's AP-42, Chapter 1.3.
4. BACT Emission Limits from Title V Permit
5. Air Emissions Inventory

Duke Energy Carolinas, LLC

Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Table D-5: **133 hp No.2 Fuel Oil-Fired Fire Water Pump (ES-FP-1)**

Number of Units	**1**
Total Potential Operating Hours:	**500**
Horsepower (hp):	**133**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**0.931**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Criteria Compounds:							
TSP	0.30	lb/MMBtu	4	2.79E-01	6.70E+00	1.40E+02	6.98E-02
PM-10	0.30	lb/MMBtu	4	2.79E-01	6.70E+00	1.40E+02	6.98E-02
PM-2.5	0.30	lb/MMBtu	4	2.79E-01	6.70E+00	1.40E+02	6.98E-02
SO2	0.05	lb/MMBtu	4	4.66E-02	1.12E+00	2.33E+01	1.16E-02
NOX	3.8	lb/MMBtu	4	3.54E+00	8.49E+01	1.77E+03	8.84E-01
VOC	0.3	lb/MMBtu	4	2.79E-01	6.70E+00	1.40E+02	6.98E-02
CO	0.8	lb/MMBtu	4	7.45E-01	1.79E+01	3.72E+02	1.86E-01
Greenhouse Gas Compounds:							
CO_2	163.05	lb/MMBtu	2	1.52E+02	3.64E+03	7.59E+04	3.80E+01
CH_4	6.61E-03	lb/MMBtu	2	6.16E-03	1.48E-01	3.08E+00	1.54E-03
N_2O	1.32E-03	lb/MMBtu	2	1.23E-03	2.96E-02	6.16E-01	3.08E-04
CO_2e			2	1.52E+02	3.66E+03	7.62E+04	3.81E+01
Metal Compounds:							
Antimony							
Arsenic	4.00E-06	lb/MMBtu	3	3.72E-06	8.94E-05	1.86E-03	9.31E-07
Barium							
Beryllium	3.00E-06	lb/MMBtu	3	2.79E-06	6.70E-05	1.40E-03	6.98E-07
Cadmium	3.00E-06	lb/MMBtu	3	2.79E-06	6.70E-05	1.40E-03	6.98E-07
Chromium (Total)	3.00E-06	lb/MMBtu	3	2.79E-06	6.70E-05	1.40E-03	6.98E-07
Chromium VI							
Cobalt							
Copper	6.00E-06	lb/MMBtu	3	5.59E-06	1.34E-04	2.79E-03	1.40E-06
Lead	9.00E-06	lb/MMBtu	3	8.38E-06	2.01E-04	4.19E-03	2.09E-06
Manganese	6.00E-06	lb/MMBtu	3	5.59E-06	1.34E-04	2.79E-03	1.40E-06
Mercury	3.00E-06	lb/MMBtu	3	2.79E-06	6.70E-05	1.40E-03	6.98E-07
Molybdenum							
Nickel	3.00E-06	lb/MMBtu	3	2.79E-06	6.70E-05	1.40E-03	6.98E-07
Selenium	1.50E-05	lb/MMBtu	3	1.40E-05	3.35E-04	6.98E-03	3.49E-06
Silver							
Vanadium							
Zinc	4.00E-06	lb/MMBtu	3	3.72E-06	8.94E-05	1.86E-03	9.31E-07
Organic Compounds:							
Acetaldehyde	7.67E-04	lb/MMBtu	1	7.14E-04	1.71E-02	3.57E-01	1.79E-04
Acetophenone							
Acrolein	9.25E-05	lb/MMBtu	1	8.61E-05	2.07E-03	4.31E-02	2.15E-05
Acrylonitrile							
Allyl Chloride (3-Chloropropylene)							
Ammonia							
Benzene	9.33E-04	lb/MMBtu	1	8.69E-04	2.08E-02	4.34E-01	2.17E-04
Benzyl Chloride							
Biphenyl							
Bis (2-Ethyl Hexyl Phthalate)							
Bromodichloromethane							
Bromoform							
Butadiene, 1,3-	3.91E-05	lb/MMBtu	1	3.64E-05	8.74E-04	1.82E-02	9.10E-06
Carbon Disulfide							
Carbon Tetrachloride (Tetrachloromethane)							
Chloroacetophenone, 2-							
Chlorobenzene							
Chloroform							
Cumene							
Cyanide							

Table D-5: **133 hp No.2 Fuel Oil-Fired Fire Water Pump (ES-FP-1)**

Number of Units	**1**
Total Potential Operating Hours:	**500**
Horsepower (hp):	**133**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**0.931**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Dibenzofurans							
Dibromoethane, 1,2- (Ethylene Dibromide)							
Dibutyl Phthalate							
Dichlorobenzene, 1,4-							
Dichlorodifluoromethane (CFC-12)							
Dimethyl Phthalate							
Dimethyl Sulfate							
Dimethylbenz(a)Anthracene, 7,12-							
Dinitrotoluene, 2,4-							
Dinitrotoluene, 2,6-							
Ethyl Chloride							
Ethylbenzene							
Ethylene Dichloride							
Formaldehyde	1.18E-03	lb/MMBtu	1	1.10E-03	2.64E-02	5.49E-01	2.75E-04
Hexachlorobenzene							
Hexane							
Hydrogen Chloride							
Hydrogen Fluoride							
Isophorone							
Methyl Bromide (Bromomethane)							
Methyl Chloride (Chloromethane)							
Methyl Chloroform (1,1,1-Trichloroethane)							
Methyl Ethyl Ketone							
Methyl Hydrazine							
Methyl Iodide (Iodomethane)							
Methyl Isobutyl Ketone							
Methyl Methacrylate							
Methyl Tert Butyl Ether							
Methylene Chloride (Dichloromethane)							
Methylchloranthrene, 3-							
Methylnaphthalene, 2-							
Naphthalene	8.48E-05	lb/MMBtu	1	7.89E-05	1.89E-03	3.95E-02	1.97E-05
Nitroaniline, 4-							
P-Cresol (4-Methyl Phenol)							
Phenol							
Polyaromatic Compounds (PACs)	3.08E-06	lb/MMBtu	5	2.87E-06	6.88E-05	1.43E-03	7.17E-07
Polychlorinated Biphenyls							
Propionaldehyde							
Propylene Oxide							
Styrene							
Sulfuric Acid	3.80E-03	lb/MMBtu	4				
Tetrachloroethane, 1,1,1,2-							
Tetrachloroethylene							
Toluene	4.09E-04	lb/MMBtu	1	3.81E-04	9.14E-03	1.90E-01	9.52E-05
Trichlorobenzene, 1,2,4-							
Trichloroethylene							
Trichlorofluoromethane							
Trimethylbenzene, 1,2,4-							
Vinyl Acetate							
Vinyl Chloride							
Xylenes	2.85E-04	lb/MMBtu	1	2.65E-04	6.37E-03	1.33E-01	6.63E-05
Polycyclic Organic Matter:							
Acenaphthene	1.42E-06	lb/MMBtu	1	1.32E-06	3.17E-05	6.61E-04	3.31E-07
Acenaphthylene	5.06E-06	lb/MMBtu	1	4.71E-06	1.13E-04	2.36E-03	1.18E-06
Anthracene	1.87E-06	lb/MMBtu	1	1.74E-06	4.18E-05	8.70E-04	4.35E-07
Benz(a)anthracene	1.68E-06	lb/MMBtu	1	1.56E-06	3.75E-05	7.82E-04	3.91E-07
Benzidine							
Benzo(b)fluoranthene	9.91E-08	lb/MMBtu	1	9.23E-08	2.21E-06	4.61E-05	2.31E-08
Benzo(k)fluoranthene	1.55E-07	lb/MMBtu	1	1.44E-07	3.46E-06	7.22E-05	3.61E-08

Table D-5: **133 hp No.2 Fuel Oil-Fired Fire Water Pump (ES-FP-1)**

Number of Units	**1**
Total Potential Operating Hours:	**500**
Horsepower (hp):	**133**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**0.931**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Benzo(g,h,i)perylene	4.89E-07	lb/MMBtu	1	4.55E-07	1.09E-05	2.28E-04	1.14E-07
Benzo(a)pyrene	1.88E-07	lb/MMBtu	1	1.75E-07	4.20E-06	8.75E-05	4.38E-08
Chrysene	3.53E-07	lb/MMBtu	1	3.29E-07	7.89E-06	1.64E-04	8.22E-08
Dibenzo(a,h)anthracene	5.83E-07	lb/MMBtu	1	5.43E-07	1.30E-05	2.71E-04	1.36E-07
Fluoranthene	7.61E-06	lb/MMBtu	1	7.08E-06	1.70E-04	3.54E-03	1.77E-06
Fluorene	2.92E-05	lb/MMBtu	1	2.72E-05	6.52E-04	1.36E-02	6.80E-06
Indo(1,2,3-cd)pyrene	3.75E-07	lb/MMBtu	1	3.49E-07	8.38E-06	1.75E-04	8.73E-08
Phenanthrene	2.94E-05	lb/MMBtu	1	2.74E-05	6.57E-04	1.37E-02	6.84E-06
Pyrene	4.78E-06	lb/MMBtu	1	4.45E-06	1.07E-04	2.23E-03	1.11E-06
Total POM	1.68E-04	lb/MMBtu	1	1.56E-04	3.75E-03	7.82E-02	3.91E-05

References:

1. USEPA's AP-42, Chapter 3.3.
2. 40 CFR Part 98, Subpart C, Table C-1 and C-2 for distillate fuel oil No. 2, converting kg/MMBtu to lb/MMBtu using 2.2046.
   CO2e calculated by using Eq. A-1 with GWPs from Table A-1 in 40 CFR Part 98, Subpart A.
3. USEPA's AP-42, Chapter 1.3.
4. BACT Emission Limits from Title V Permit
5. Air Emissions Inventory

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Table D-6: **3,100 kw No. 2 Fuel Oil-fired Black-start Emergency Generator (ES-EGEN-1)**

Number of Units	**1**
Total Potential Operating Hours:	**100**
Horsepower (hp):	**4,376**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**30.632**

	Emission Factors			Emissions			
Compound Categories	Value	Units	Reference	lb/hr	lb/day	lb/yr	tons/yr
Criteria Compounds:							
TSP	0.40	g/HP-hr	4	3.86E+00	9.26E+01	3.86E+02	1.93E-01
PM-10	0.40	g/HP-hr	4	3.86E+00	9.26E+01	3.86E+02	1.93E-01
PM-2.5	0.40	g/HP-hr	4	3.86E+00	9.26E+01	3.86E+02	1.93E-01
SO2	1.21E-05	lb/HP-hr	1	5.31E-02	1.27E+00	5.31E+00	2.66E-03
NOX	6.9	g/HP-hr	4	6.66E+01	1.60E+03	6.66E+03	3.33E+00
VOC	1.0	g/HP-hr	4	9.65E+00	2.32E+02	9.65E+02	4.82E-01
CO	8.5	g/HP-hr	4	8.20E+01	1.97E+03	8.20E+03	4.10E+00
Greenhouse Gas Compounds:							
CO_2	163.05	lb/MMBtu	2	4.99E+03	1.20E+05	4.99E+05	2.50E+02
CH_4	6.61E-03	lb/MMBtu	2	2.03E-01	4.86E+00	2.03E+01	1.01E-02
N_2O	1.32E-03	lb/MMBtu	2	4.05E-02	9.72E-01	4.05E+00	2.03E-03
CO_2e			2	5.01E+03	1.20E+05	5.01E+05	2.51E+02
Metal Compounds:							
Antimony							
Arsenic	4.00E-06	lb/MMBtu	3	1.23E-04	2.94E-03	1.23E-02	6.13E-06
Barium							
Beryllium	3.00E-06	lb/MMBtu	3	9.19E-05	2.21E-03	9.19E-03	4.59E-06
Cadmium	3.00E-06	lb/MMBtu	3	9.19E-05	2.21E-03	9.19E-03	4.59E-06
Chromium (Total)	3.00E-06	lb/MMBtu	3	9.19E-05	2.21E-03	9.19E-03	4.59E-06
Chromium VI							
Cobalt							
Copper	6.00E-06	lb/MMBtu	3	1.84E-04	4.41E-03	1.84E-02	9.19E-06
Lead	9.00E-06	lb/MMBtu	3	2.76E-04	6.62E-03	2.76E-02	1.38E-05
Manganese	6.00E-06	lb/MMBtu	3	1.84E-04	4.41E-03	1.84E-02	9.19E-06
Mercury	3.00E-06	lb/MMBtu	3	9.19E-05	2.21E-03	9.19E-03	4.59E-06
Molybdenum							
Nickel	3.00E-06	lb/MMBtu	3	9.19E-05	2.21E-03	9.19E-03	4.59E-06
Selenium	1.50E-05	lb/MMBtu	3	4.59E-04	1.10E-02	4.59E-02	2.30E-05
Silver							
Vanadium							
Zinc	4.00E-06	lb/MMBtu	3	1.23E-04	2.94E-03	1.23E-02	6.13E-06
Organic Compounds:							
Acetaldehyde	2.52E-05	lb/MMBtu	1	7.72E-04	1.85E-02	7.72E-02	3.86E-05
Acetophenone							
Acrolein	7.88E-06	lb/MMBtu	1	2.41E-04	5.79E-03	2.41E-02	1.21E-05
Acrylonitrile							
Allyl Chloride (3-Chloropropylene)							
Ammonia							
Benzene	7.76E-04	lb/MMBtu	1	2.38E-02	5.70E-01	2.38E+00	1.19E-03
Benzyl Chloride							
Biphenyl							
Bis (2-Ethyl Hexyl Phthalate)							
Bromodichloromethane							
Bromoform							
Butadiene, 1,3-							
Carbon Disulfide							
Carbon Tetrachloride (Tetrachloromethane)							
Chloroacetophenone, 2-							
Chlorobenzene							
Chloroform							

Table D-6: **3,100 kw No. 2 Fuel Oil-fired Black-start Emergency Generator (ES-EGEN-1)**

Number of Units	**1**
Total Potential Operating Hours:	**100**
Horsepower (hp):	**4,376**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**30.632**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Cumene							
Cyanide							
Dibenzofurans							
Dibromoethane, 1,2- (Ethylene Dibromide)							
Dibutyl Phthalate							
Dichlorobenzene, 1,4-							
Dichlorodifluoromethane (CFC-12)							
Dimethyl Phthalate							
Dimethyl Sulfate							
Dimethylbenz(a)Anthracene, 7,12-							
Dinitrotoluene, 2,4-							
Dinitrotoluene, 2,6-							
Ethyl Chloride							
Ethylbenzene							
Ethylene Dichloride							
Formaldehyde	7.89E-05	lb/MMBtu	1	2.42E-03	5.80E-02	2.42E-01	1.21E-04
Hexachlorobenzene							
Hexane							
Hydrogen Chloride							
Hydrogen Fluoride							
Isophorone							
Methyl Bromide (Bromomethane)							
Methyl Chloride (Chloromethane)							
Methyl Chloroform (1,1,1-Trichloroethane)							
Methyl Ethyl Ketone							
Methyl Hydrazine							
Methyl Iodide (Iodomethane)							
Methyl Isobutyl Ketone							
Methyl Methacrylate							
Methyl Tert Butyl Ether							
Methylene Chloride (Dichloromethane)							
Methylchloranthrene, 3-							
Methylnaphthalene, 2-							
Naphthalene	1.30E-04	lb/MMBtu	1	3.98E-03	9.56E-02	3.98E-01	1.99E-04
Nitroaniline, 4-							
P-Cresol (4-Methyl Phenol)							
Phenol							
Polyaromatic Compounds (PACs)	2.97E-06	lb/MMBtu	5	9.10E-05	2.18E-03	9.10E-03	4.55E-06
Polychlorinated Biphenyls							
Propionaldehyde							
Propylene Oxide							
Styrene							
Sulfuric Acid							
Tetrachloroethane, 1,1,1,2-							
Tetrachloroethylene							
Toluene	2.81E-04	lb/MMBtu	1	8.61E-03	2.07E-01	8.61E-01	4.30E-04
Trichlorobenzene, 1,2,4-							
Trichloroethylene							
Trichlorofluoromethane							
Trimethylbenzene, 1,2,4-							
Vinyl Acetate							
Vinyl Chloride							
Xylenes	1.93E-04	lb/MMBtu	1	5.91E-03	1.42E-01	5.91E-01	2.96E-04
Polycyclic Organic Matter:							
Acenaphthene	4.68E-06	lb/MMBtu	1	1.43E-04	3.44E-03	1.43E-02	7.17E-06
Acenaphthylene	9.23E-06	lb/MMBtu	1	2.83E-04	6.79E-03	2.83E-02	1.41E-05
Anthracene	1.23E-06	lb/MMBtu	1	3.77E-05	9.04E-04	3.77E-03	1.88E-06
Benz(a)anthracene	6.22E-07	lb/MMBtu	1	1.91E-05	4.57E-04	1.91E-03	9.53E-07

Table D-6: **3,100 kw No. 2 Fuel Oil-fired Black-start Emergency Generator (ES-EGEN-1)**

Number of Units	**1**
Total Potential Operating Hours:	**100**
Horsepower (hp):	**4,376**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**30.632**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Benzidine							
Benzo(b)fluoranthene	1.11E-06	lb/MMBtu	1	3.40E-05	8.16E-04	3.40E-03	1.70E-06
Benzo(k)fluoranthene	2.18E-07	lb/MMBtu	1	6.68E-06	1.60E-04	6.68E-04	3.34E-07
Benzo(g,h,i)perylene	5.56E-07	lb/MMBtu	1	1.70E-05	4.09E-04	1.70E-03	8.52E-07
Benzo(a)pyrene	2.57E-07	lb/MMBtu	1	7.87E-06	1.89E-04	7.87E-04	3.94E-07
Chrysene	1.53E-06	lb/MMBtu	1	4.69E-05	1.12E-03	4.69E-03	2.34E-06
Dibenzo(a,h)anthracene	3.46E-07	lb/MMBtu	1	1.06E-05	2.54E-04	1.06E-03	5.30E-07
Fluoranthene	4.03E-06	lb/MMBtu	1	1.23E-04	2.96E-03	1.23E-02	6.17E-06
Fluorene	1.28E-05	lb/MMBtu	1	3.92E-04	9.41E-03	3.92E-02	1.96E-05
Indo(1,2,3-cd)pyrene	4.14E-07	lb/MMBtu	1	1.27E-05	3.04E-04	1.27E-03	6.34E-07
Phenanthrene	4.08E-05	lb/MMBtu	1	1.25E-03	3.00E-02	1.25E-01	6.25E-05
Pyrene	3.71E-06	lb/MMBtu	1	1.14E-04	2.73E-03	1.14E-02	5.68E-06
Total POM	2.12E-04	lb/MMBtu	1	6.49E-03	1.56E-01	6.49E-01	3.25E-04

References:

1. USEPA's AP-42, Chapter 3.4. S_1=0.0015
2. 40 CFR Part 98, Subpart C, Table C-1 and C-2 for distillate fuel oil No. 2, converting kg/MMBtu to lb/MMBtu using 2.2046. CO2e calculated by using Eq. A-1 with GWPs from Table A-1 in 40 CFR Part 98, Subpart A.
3. USEPA's AP-42, Chapter 1.3.
4. BACT Emission Limits from Title V Permit
5. Air Emissions Inventory

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Table D-7: **5 kw (6.7 hp) Propane-fired Microwave Communication Tower Backup Emergency Generator (IS-4)**

Number of Units	**1**
Total Potential Operating Hours:	**8,760**
Horsepower (hp):	**6.7**
Btu/hp-hr:	**7000**
Maximum Capacity (MMBtu/hr):	**0.047**
Heat Content (MMBtu/1000 gallons)	**90.5**

	Emission Factors			Emissions			
Compound Categories	**Value**	**Units**	**Reference**	**lb/hr**	**lb/day**	**lb/yr**	**tons/yr**
Criteria Compounds:							
TSP	0.01	b/MMBtu	1	3.63E-04	8.71E-03	3.18E+00	1.59E-03
PM-10	0.01	b/MMBtu	1	3.63E-04	8.71E-03	3.18E+00	1.59E-03
PM-2.5	0.01	b/MMBtu	1	3.63E-04	8.71E-03	3.18E+00	1.59E-03
SO2	0.02	b/MMBtu	1	8.45E-04	2.03E-02	7.40E+00	3.70E-03
NOX	0.144	b/MMBtu	1	6.74E-03	1.62E-01	5.90E+01	2.95E-02
VOC	0.011	b/MMBtu	1	5.18E-04	1.24E-02	4.54E+00	2.27E-03
CO	0.083	b/MMBtu	1	3.89E-03	9.33E-02	3.41E+01	1.70E-02
Greenhouse Gas Compounds:							
CO_2	138.60	b/MMBtu	2	6.50E+00	1.56E+02	5.70E+04	2.85E+01
CH_4	6.61E-03	b/MMBtu	2	3.10E-04	7.45E-03	2.72E+00	1.36E-03
N_2O	1.32E-03	b/MMBtu	2	6.21E-05	1.49E-03	5.44E-01	2.72E-04
CO_2e			2	6.53E+00	1.57E+02	5.72E+04	2.86E+01

References:

1. USEPA's AP-42, Chapter 1.5.
2. 40 CFR Part 98, Subpart C, Table C-1 and C-2 for distillate fuel oil No. 2, converting kg/MMBtu to lb/MMBtu using 2.2046.
   CO2e calculated by using Eq. A-1 with GWPs from Table A-1 in 40 CFR Part 98, Subpart A.

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Rockingham County Combustion Turbine Facility

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Table D-8: **2 No. 2 Fuel Oil Tanks (ES-FT-1 and ES-FT-2)**

ES-FT-1 Capacity	1,700,000	gallons
ES-FT-2 Capacity	1,700,000	gallons
Total Capactity	3,400,000	gallons
VOC BACT Emission Limit (total):	**1,300**	lbs/yr

Compound Categories	Fraction	Reference	Emissions			
			lb/hr	lb/day	lb/yr	tons/yr
Organic Compounds:						
Benzene	1.00E-03	TANKS	1.48E-04	3.56E-03	1.30E+00	6.50E-04
Ethylbenzene	2.00E-03	TANKS	2.97E-04	7.12E-03	2.60E+00	1.30E-03
Naphthalene	2.60E-03	TANKS	3.86E-04	9.26E-03	3.38E+00	1.69E-03
Toluene	7.00E-03	TANKS	1.04E-03	2.49E-02	9.10E+00	4.55E-03
Xylenes	5.00E-03	TANKS	7.42E-04	1.78E-02	6.50E+00	3.25E-03

References:

EPA TANKS software program

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
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Table D-9: TPER Analysis

Pollutant	Facility Total			NC TPER				Exceed any TPER?
				Carcinogens	Chronic Toxicants	Acute Systemic Toxicants	Acute Irritants	
	lb/yr	lb/day	lb/hr	lb/yr	lb/day	lb/hr	lb/hr	
Metal Compounds:								
Arsenic	1.13E+02	2.43E+00	1.01E-01	0.053				Yes
Beryllium	3.58E+00	7.09E-02	2.95E-03	0.280				Yes
Cadmium	1.10E+02	1.06E+00	4.42E-02	0.370				Yes
Chromium VI					0.026			No
Manganese	7.29E+03	1.74E+02	7.26E+00		0.630			Yes
Mercury	2.66E+01	2.67E-01	1.11E-02		0.013			Yes
Nickel	1.68E+02	1.02E+00	4.24E-02		0.130			Yes
Organic Compounds:								
Acetaldehyde	2.44E+03	9.09E+00	3.79E-01				6.800	No
Acrolein	3.90E+02	1.45E+00	6.06E-02				0.020	Yes
Benzene	1.24E+03	1.28E+01	5.33E-01	8.100				Yes
Benzo(a)Pyrene	1.14E-03	2.06E-04	8.58E-06	2.200				No
Butadiene, 1,3-	1.73E+02	3.53E+00	1.47E-01	11.000				Yes
Formaldehyde	4.58E+04	1.60E+02	6.66E+00				0.040	Yes
Hexane					23.000			No
Sulfuric Acid	4.96E+03	1.80E+01	7.50E-01		0.250	0.025		Yes
Toluene	7.93E+03	2.95E+01	1.23E+00		98.000		14.400	No
Xylenes	3.91E+03	1.46E+01	6.08E-01		57.000		16.400	No

Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility
Reidsville, NC
Rockingham County

Modeling Parameters and Results

Table D-10
Source Parameters - Potential
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Point Sources																			
Source ID	**Source Description**	**Easting (X)**	**Northing (Y)**	**Base Elevation**	**Stack Height**	**Temperature**	**Exit Velocity**	**Stack Diameter**	**Acrolein**	**Arsenic**	**Beryllium**	**Benzene**	**Butadiene, 1,3-**	**Cadmium**	**Formaldehyde**	**Manganese**	**Mercury**	**Nickel**	**Sulfuric Acid**
		(m)	(m)	(m)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)
BLKSTDGN	Black Start Emergency Generator (ES-EGEN-1)	605041.3	4021178.4	247.8	12 31	751.30	46.75	0.56	6.94E-08	3.52E-08	2.64E-08	6.84E-06	--	2.64E-08	6.95E-07	5.29E-08	2.64E-08	2.64E-08	--
FIREPUMP	133 hp No.2 Fuel Oil-Fired Fire Water Pump (ES-FP-1)	605107.6	4021240.5	247.8	6.10	915.01	24.32	0.13	1.24E-07	5.36E-09	4.02E-09	1.25E-06	5.24E-08	4.02E-09	1.58E-06	8.03E-09	4.02E-09	4.02E-09	--
NGCT1	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-1)	605037.3	4021073.2	247.8	18.29	764.82	28.24	7.01	1.12E-03	3.25E-04	1.03E-05	3.56E-03	4.99E-04	3.16E-04	1.32E-01	2.10E-02	7.64E-05	4.83E-04	1.43E-02
NGCT2	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-2)	605037.9	4021116.0	247.8	18.29	764.82	28.24	7.01	1.12E-03	3.25E-04	1.03E-05	3.56E-03	4.99E-04	3.16E-04	1.32E-01	2.10E-02	7.64E-05	4.83E-04	1.43E-02
NGCT3	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-3)	605039.6	4021157.2	247.8	18.29	764.82	28.24	7.01	1.12E-03	3.25E-04	1.03E-05	3.56E-03	4.99E-04	3.16E-04	1.32E-01	2.10E-02	7.64E-05	4.83E-04	1.43E-02
NGCT4	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-4)	605039.6	4021199.5	247.8	18.29	764.82	28.24	7.01	1.12E-03	3.25E-04	1.03E-05	3.56E-03	4.99E-04	3.16E-04	1.32E-01	2.10E-02	7.64E-05	4.83E-04	1.43E-02
NGCT5	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-5)	605040.2	4021241.7	247.8	18.29	764.82	28.24	7.01	1.12E-03	3.25E-04	1.03E-05	3.56E-03	4.99E-04	3.16E-04	1.32E-01	2.10E-02	7.64E-05	4.83E-04	1.43E-02
EG_1	300 kw (402 hp) No. 2 Fuel Oil-fired Stand-by Emergency Generator (ES-EG-1)	604993.0	4021178.0	247.8	6.10	699.80	57.91	0.13	3.75E-07	1.62E-08	1.22E-08	3.78E-06	1.58E-07	1.22E-08	4.78E-06	2.43E-08	1.22E-08	1.22E-08	--

Table D-11
Summary of Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Compound	Year	Averaging Period	Maximum Concentration (ug/m^3)	AAL (ug/m^3)	Percent of AAL (%)	Opt Factor
Acrolein	2017	1 - Hour	5.34E-03	80	0.01%	14668.4
Arsenic	2014	Annual	1.42E-05	2.10E-03	0.68%	144.8
Beryllium	2014	Annual	5.72E-07	4.10E-03	0.01%	7029.1
Benzene	2014	Annual	1.91E-04	1.20E-01	0.16%	616.1
Butadiene, 1,3-	2014	Annual	2.25E-05	4.40E-01	0.01%	19132.1
Cadmium	2014	Annual	1.38E-05	5.50E-03	0.25%	390.7
Formaldehyde	2017	1 - Hour	6.28E-01	150	0.42%	234.1
Manganese	2013	24 - Hour	8.56E-03	31	0.03%	3547.7
Mercury	2013	24 - Hour	3.13E-05	6.00E-01	0.01%	18783.8
Nickel	2013	24 - Hour	1.97E-04	6	0.003%	29832.8
Sulfuric Acid	2017	1 - Hour	6.80E-02	100	0.07%	1441.0
	2013	24 - Hour	5.83E-03	12	0.05%	2016.8

Table D-12
Summary of Acrolein Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	1 - Hour	2.05E-03	605500.00	4018750.00	80	0.003%
2014	1 - Hour	1.64E-03	606300.00	4020100.00	80	0.002%
2015	1 - Hour	2.57E-03	609500.00	4019500.00	80	0.003%
2016	1 - Hour	1.69E-03	605500.00	4020700.00	80	0.002%
2017	1 - Hour	5.34E-03	604864.70	4021397.10	80	0.007%

Table D-13
Summary of Arsenic Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	Annual	8.66E-06	605300.00	4021400.00	2.10E-03	0.41%
2014	Annual	1.42E-05	605500.00	4021600.00	2.10E-03	0.68%
2015	Annual	6.78E-06	605300.00	4021400.00	2.10E-03	0.32%
2016	Annual	1.10E-05	605500.00	4021500.00	2.10E-03	0.52%
2017	Annual	1.30E-05	605500.00	4021500.00	2.10E-03	0.62%

Table D-14
Summary of Beryllium Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	Annual	5.10E-07	605177.50	4021389.60	4.10E-03	0.01%
2014	Annual	5.72E-07	605300.00	4021400.00	4.10E-03	0.01%
2015	Annual	4.45E-07	605201.60	4021389.10	4.10E-03	0.01%
2016	Annual	4.84E-07	605300.00	4021400.00	4.10E-03	0.01%
2017	Annual	5.46E-07	605300.00	4021400.00	4.10E-03	0.01%

Table D-15
Summary of Benzene Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	Annual	1.65E-04	605201.60	4021389.10	1.20E-01	0.14%
2014	Annual	1.91E-04	605300.00	4021400.00	1.20E-01	0.16%
2015	Annual	1.44E-04	605201.60	4021389.10	1.20E-01	0.12%
2016	Annual	1.61E-04	605300.00	4021400.00	1.20E-01	0.13%
2017	Annual	1.81E-04	605300.00	4021400.00	1.20E-01	0.15%

Table D-16
Summary of Butadiene, 1,3- Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	Annual	1.51E-05	605300.00	4021400.00	4.40E-01	0.003%
2014	Annual	2.25E-05	605500.00	4021600.00	4.40E-01	0.005%
2015	Annual	1.23E-05	605300.00	4021400.00	4.40E-01	0.003%
2016	Annual	1.76E-05	605500.00	4021500.00	4.40E-01	0.004%
2017	Annual	2.07E-05	605500.00	4021500.00	4.40E-01	0.005%

Table D-17
Summary of Cadmium Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	Annual	8.36E-06	605300.00	4021400.00	5.50E-03	0.15%
2014	Annual	1.38E-05	605500.00	4021600.00	5.50E-03	0.25%
2015	Annual	6.54E-06	605322.00	4021386.40	5.50E-03	0.12%
2016	Annual	1.06E-05	605500.00	4021500.00	5.50E-03	0.19%
2017	Annual	1.26E-05	605500.00	4021500.00	5.50E-03	0.23%

Table D-18
Summary of Formaldehyde Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	1 - Hour	2.41E-01	605500.00	4018750.00	150	0.16%
2014	1 - Hour	1.93E-01	606300.00	4020100.00	150	0.13%
2015	1 - Hour	3.03E-01	609500.00	4019500.00	150	0.20%
2016	1 - Hour	1.99E-01	605500.00	4020700.00	150	0.13%
2017	1 - Hour	6.28E-01	604864.70	4021397.10	150	0.42%

Table D-19
Summary of Manganese Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	24 - Hour	8.56E-03	605500.00	4020700.00	31	0.03%
2014	24 - Hour	6.48E-03	605500.00	4020600.00	31	0.02%
2015	24 - Hour	7.69E-03	605500.00	4020600.00	31	0.02%
2016	24 - Hour	6.99E-03	605500.00	4020700.00	31	0.02%
2017	24 - Hour	7.81E-03	605400.00	4020700.00	31	0.03%

Table D-20
Summary of Mercury Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	24 - Hour	3.13E-05	605500.00	4020700.00	6.00E-01	0.005%
2014	24 - Hour	2.37E-05	605500.00	4020600.00	6.00E-01	0.004%
2015	24 - Hour	2.82E-05	605500.00	4020600.00	6.00E-01	0.005%
2016	24 - Hour	2.55E-05	605500.00	4020700.00	6.00E-01	0.004%
2017	24 - Hour	2.86E-05	605500.00	4021500.00	6.00E-01	0.005%

Table D-21
Summary of Nickel Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	UTM Coordinates Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	24 - Hour	1.97E-04	605500.00	4020700.00	6	0.003%
2014	24 - Hour	1.49E-04	605500.00	4020600.00	6	0.002%
2015	24 - Hour	1.77E-04	605500.00	4020600.00	6	0.003%
2016	24 - Hour	1.61E-04	605500.00	4020700.00	6	0.003%
2017	24 - Hour	1.80E-04	605400.00	4020700.00	6	0.003%

Table D-22
Summary of Sulfuric Acid Modeling Analysis - Baseline
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Year	Averaging Period	Maximum Concentration (ug/m^3)	UTM Coordinates Easting (m)	Northing (m)	AAL (ug/m^3)	Percent of AAL (%)
2013	1 - Hour	2.61E-02	605500.00	4018750.00	100	0.03%
2014	1 - Hour	2.09E-02	606300.00	4020100.00	100	0.02%
2015	1 - Hour	3.28E-02	609500.00	4019500.00	100	0.03%
2016	1 - Hour	2.15E-02	605500.00	4020700.00	100	0.02%
2017	1 - Hour	6.80E-02	604864.70	4021397.10	100	0.07%
2013	24 - Hour	5.83E-03	605500.00	4020700.00	12	0.05%
2014	24 - Hour	4.41E-03	605500.00	4020600.00	12	0.04%
2015	24 - Hour	5.23E-03	605500.00	4020600.00	12	0.04%
2016	24 - Hour	4.76E-03	605500.00	4020700.00	12	0.04%
2017	24 - Hour	5.32E-03	605400.00	4020700.00	12	0.04%

Table D-23
Summary of Optimized Toxic Air Pollutant Modeling Results
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Compound	Averaging Period	Maximum Concentration (µg/m3)	Year	AAL (µg/m3)	Percent of AAL (%)
Acrolein	1 - Hour	7.87E+01	2017	80	98%
Arsenic	Annual	2.06E-03	2014	2.10E-03	98%
Beryllium	Annual	4.00E-03	2014	4.10E-03	98%
Benzene	Annual	1.17E-01	2014	1.20E-01	98%
Butadiene, 1,3-	Annual	4.31E-01	2014	4.40E-01	98%
Formaldehyde	1 - Hour	1.47E+02	2017	150	98%
Manganese	24 - Hour	3.03E+01	2013	31	98%
Mercury	24 - Hour	5.90E-01	2013	6.00E-01	98%
Nickel	24 - Hour	5.88E+00	2013	6	98%
Sulfuric Acid	1 - Hour	9.80E+01	2017	100	98%
	24 - Hour	1.17E+01	2013	12	98%

Table D-24
Optimized Emission Rates
Duke Energy Carolinas, LLC
Rockingham County Combustion Turbine Facility

Point Sources																				
Source ID	Source Description	Easting (X)	Northing (Y)	Base Elevation	Stack Height	Temperature	Exit Velocity	Stack Diameter	Acrolein	Arsenic	Beryllium	Benzene	Butadiene, 1,3-	Cadmium	Formaldehyde	Manganese	Mercury	Nickel	Hourly Sulfuric Acid	Daily Sulfuric Acid
		(m)	(m)	(m)	(m)	(K)	(m/s)	(m)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)
BLKSTDGN	Black Start Emergency Generator (ES-EGEN-1)	605041.3	4021178.4	247.8	12.31	751.30	46.75	0.56	1.02E-03	5.10E-06	1.86E-04	4 21E-03	--	1.03E-05	1.63E-04	1.88E-04	4 97E-04	7.89E-04	--	--
FIREPUMP	133 hp No.2 Fuel Oil-Fired Fire Water Pump (ES-FP-1)	605107.6	4021240 5	247.8	6.10	915.01	24.32	0.13	1.82E-03	7.76E-07	2.82E-05	7.70E-04	1.00E-03	1.57E-06	3.70E-04	2.85E-05	7.55E-05	1.20E-04	--	--
NGCT1	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-1)	605037.3	4021073 2	247.8	18.29	764.82	28.24	7.01	1.65E+01	4.71E-02	7.21E-02	2.19E+00	9.54E+00	1.23E-01	3.09E+01	7.44E+01	1.44E+00	1.44E+01	2.06E+01	2.88E+01
NGCT2	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-2)	605037.9	4021116 0	247.8	18.29	764.82	28.24	7.01	1.65E+01	4.71E-02	7.21E-02	2.19E+00	9.54E+00	1.23E-01	3.09E+01	7.44E+01	1.44E+00	1.44E+01	2.06E+01	2.88E+01
NGCT3	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-3)	605039.6	4021157 2	247.8	18.29	764.82	28.24	7.01	1.65E+01	4.71E-02	7.21E-02	2.19E+00	9.54E+00	1.23E-01	3.09E+01	7.44E+01	1.44E+00	1.44E+01	2.06E+01	2.88E+01
NGCT4	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-4)	605039.6	4021199 5	247.8	18.29	764.82	28.24	7.01	1.65E+01	4.71E-02	7.21E-02	2.19E+00	9.54E+00	1.23E-01	3.09E+01	7.44E+01	1.44E+00	1.44E+01	2.06E+01	2.88E+01
NGCT5	Natural Gas/No. 2 Fuel Oil-Fired Simple-Cycle Turbines1 (ES-CT-5)	605040.2	4021241.7	247.8	18.29	764.82	28.24	7.01	1.65E+01	4.71E-02	7.21E-02	2.19E+00	9.54E+00	1.23E-01	3.09E+01	7.44E+01	1.44E+00	1.44E+01	2.06E+01	2.88E+01
EG_1	300 kw (402 hp) No. 2 Fuel Oil-fired Stand-by Emergency Generator (ES-EG-1)	604993.0	4021178 0	247.8	6.10	699.80	57.91	0.13	5.50E-03	2.35E-06	8.54E-05	2 33E-03	3.03E-03	4.75E-06	1.12E-03	8.62E-05	2.28E-04	3.63E-04	--	--

Appendix E

Dispersion Modeling Archive - Electronic Files