Geosyntec consultants

1331 Elmwood Ave., Suite 310
Columbia, South Carolina 29201
PH 803.726.1139
www.geosyntec.com

PROJECT TRANSMITTAL NO.:	N/A

TO:	Engineering Services Division Director	DATE:	18 December 2015
COMPANY	SCDHEC Bureau of Air Quality	PROJECT NAME:	Air Quality Construction Permit Application, DCG Moore Compressor Station
ADDRESS:	2600 Bull Street Columbia, SC 29201	PROJECT NO.:	GSC5940

TRANSMITTAL

	VIA:	ACTION:	
☒ ENCLOSED/ATTACHED	☒ HAND DELIVERY	☒ FOR APPROVAL	☐ RESUBMIT
	☐ MESSENGER	☐ FOR YOUR USE	☐ RETURN CORRECTED
	☐ FIRST CLASS MALL	☐ AS REQUESTED	☐ FOR COMMENT
☐ UNDER SEPARATE COVER	☐ SPECIAL DELIVERY	☐ APPROVED	
	☐ AIR MAIL	☐ APP'D AS NOTED	
	☒ FEDEX		

NO. OF COPIES	DWG NO.	DESCRIPTION	DATE
2		Air Quality Construction Permit Application, DCG Moore Compressor Station (including electronic copies of SCDHEC application forms and electronic modeling files)	12/18/2015

REMARKS: Dear Director,

Please find attached two hardcopies of the Air Quality Construction Permit Application for the Dominion Carolina Gas Transmission (DCG) Moore Compressor Station in Spartanburg County. If you have any questions, please contact Brandon Mogan, PE by phone at 803.724.3263 or email at bmogan@geosyntec.com.

Thank you.

COPY TO: Richard Kopec, DCG
Geosyntec Project File

FROM: Brandon Mogan, PE

RECEIVED
DEC 21 2015
BUREAU OF AIR QUALITY

Prepared for

Dominion Carolina Gas Transmission, LLC
220 Operation Way, MC J48
Cayce, South Carolina 29033

AIR QUALITY CONSTRUCTION PERMIT APPLICATION

MOORE COMPRESSOR STATION
6890 HIGHWAY 221
MOORE, SOUTH CAROLINA

Prepared by

Geosyntec consultants
engineers | scientists | innovators
1331 Elmwood Avenue, Suite 310
Columbia, South Carolina 29201

Project Number GSC5940

December 2015

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
12/21/15
No. 30362
BRANDON A. MOGAN

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
GEOSYNTEC CONSULTANTS, INC.
No. 773

COPY

Geosyntec consultants

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 1

2. PROJECT DESCRIPTION 2

3. EMISSIONS ESTIMATION 4
   - 3.1 Estimation of Potential Emissions from Primary Emission Units 4
     - 3.1.1 Equipment Leaks 4
   - 3.2 Estimation of Emissions from Insignificant Activities 6
     - 3.2.1 Insignificant Fuel Combustion Equipment 6
     - 3.2.2 Storage Vessels 6
     - 3.2.3 Natural Gas Venting 7

4. REGULATORY APPLICABILITY ANALYSIS AND REQUIREMENTS 11
   - 4.1 Permitting Programs 11
     - 4.1.1 Prevention of Significant Deterioration 11
     - 4.1.2 Nonattainment New Source Review (NNSR) 11
     - 4.1.3 Title V (Part 70) Operating Permit 12
     - 4.1.4 South Carolina Permitting 12
   - 4.2 New Source Performance Standards 12
     - 4.2.1 40 CFR Part 60, Subpart A – NSPS General Provisions 12
     - 4.2.2 40 CFR Part 60, Subparts D, Db, and Dc – NSPS for Steam Generating Units 13
     - 4.2.3 40 CFR 60, Subpart K, Ka, and Kb – NSPS for Volatile Organic Liquid Storage Vessels 13
     - 4.2.4 40 CFR Part 60, Subpart GG – NSPS for Stationary Gas Turbines13
     - 4.2.5 40 CFR Part 60, Subpart KKKK – NSPS for Stationary Combustion Turbines 13
     - 4.2.6 40 CFR Part 60, Subpart OOOO – NSPS for Crude Oil and Natural Gas Production, Transmission and Distribution 14

TABLE OF CONTENTS (Continued)

4.2.7 Proposed 40 CFR Part 60, Subpart OOOOa – Amended NSPS for Crude Oil and Natural Gas Facilities 15
4.2.8 Non-Applicability of Other NSPS 16
4.3 National Emission Standards for HAP 16
4.3.1 40 CFR Part 63, Subpart A – NESHAP General Provisions 16
4.3.2 40 CFR Part 63, Subpart HH – NESHAP for Oil and Natural Gas Production Facilities 17
4.3.3 40 CFR Part 63, Subpart HHH – NESHAP for Natural Gas Transmission and Storage Facilities 17
4.3.4 40 CFR Part 63, Subpart YYYY – NESHAP for Stationary Combustion Turbines 17
4.3.5 40 CFR Part 63, Subpart DDDDD – NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters 17
4.3.6 40 CFR Part 63, Subpart JJJJJJ – NESHAP for Industrial, Commercial, and Institutional Boilers at Area Sources 18
4.3.7 Non-Applicability of Other NESHAP 18
4.4 South Carolina Regulations 18
4.4.1 Standard No. 1 – Fuel Burning Operations 18
4.4.2 Standard No. 2 – Ambient Air Quality Standards 19
4.4.3 Standard No. 3 – Waste Combustion and Reduction 19
4.4.4 Standard No. 4 – Emissions from Process Industries 19
4.4.5 Standard No. 5 – Volatile Organic Compounds 20
4.4.6 Standard No. 5.2 – Control of Oxides of Nitrogen Emissions 20
4.4.7 Standard No. 7 – Prevention of Significant Deterioration 21
4.4.8 Standard No. 8 – Toxic Air Pollutants 21
4.4.9 61-62.7 – Good Engineering Practice Stack Height 22

5. AIR DISPERSION MODELING 23
5.1 Model Selection 23
5.2 Geographic Coordinate System 23

TABLE OF CONTENTS (Continued)

5.3 Meteorological Data 24
5.4 Receptor Grids 24
5.5 Terrain 24
5.6 Building Downwash Analysis 25
5.7 Land Use Analysis 27
5.8 Source Characterization 29
5.9 Background Concentrations and Ambient Standards 29
5.10 Modeling Results 30

LIST OF TABLES

Table 2-1 Moore Compressor Station Primary Emission Units
Table 2-2 Moore Compressor Station Insignificant Activities
Table 3-1 Moore Compressor Station Facility-Wide Estimated Potential Emissions
Table 4-1 Potential Applicability of NSPS OOOOa
Table 5-1 Building Summary
Table 5-2 Land Use Analysis
Table 5-3 Point Source Parameters
Table 5-4 Model Results in Comparison with Ambient Standards

LIST OF FIGURES

Figure 1 Topographic Site Location Map
Figure 2 Facility Layout
Figure 3 Land Use Analysis

TABLE OF CONTENTS (Continued)

LIST OF APPENDICES

Appendix A	SCDHEC Air Quality Construction Permit Application Forms
Appendix B	Emissions Calculations
Appendix C	Process Flow Diagram
Appendix D	Supporting Documentation for Emissions Calculations
Appendix E	Electronic SCDHEC Application Forms and Electronic Modeling Files

1. EXECUTIVE SUMMARY

Dominion Carolina Gas Transmission, LLC (DCG) owns and operates the Moore Compressor Station (facility), a natural gas compressor station located near Moore in Spartanburg County, SC. The primary emission sources at the existing facility include two natural gas-fired combustion turbines (Equipment ID M-1 and M-2), which are each part of a combustion turbine compressor set. These emission units are currently operating under South Carolina Department of Health and Environmental Control (SCDHEC) Air Quality Construction Permit No. 2060-0528-CA while awaiting finalization and issuance of Title V Operating Permit No. TV-2060-0528, which is currently in draft form. DCG proposes to install two (2) additional natural gas-fired combustion turbine compressor sets at the facility. The natural gas-fired combustion turbines will be assigned Equipment ID M-3 and M-4. The purpose of this application is to request an air quality construction permit authorizing the installation of M-3 and M-4 at the facility pursuant to South Carolina Regulation (SC R.) 61-62.1, Section II.A. Applicable SCDHEC air quality construction permit application forms are included with this application as Appendix A.

The facility is an existing major source under the Part 70 (Title V) program, with potential emissions of carbon monoxide (CO) and nitrogen oxides (NO_x) each exceeding the applicable Title V major source threshold of 100 tons per year (tons/yr). Potential emissions from the facility following installation of the proposed combustion turbines will remain below Title V major source thresholds for other criteria pollutants, hazardous air pollutants (HAP), and greenhouse gases (GHG). The facility is currently considered a minor source under the federal Prevention of Significant Deterioration (PSD) program. However, after the installation of the proposed combustion turbines, potential emissions of CO from the facility will exceed the applicable PSD major source threshold of 250 tons/yr, thereafter making the facility an existing PSD major source. Since potential emissions associated with the proposed units do not, by themselves, exceed PSD major source thresholds, the proposed project does not trigger PSD review.

2. PROJECT DESCRIPTION

The existing facility is located near the community of Moore in Spartanburg County, South Carolina. The approximate location of the facility is shown on a United States Geological Survey (USGS) 7.5-minute topographic quadrangle (see Figure 1). The Universal Transverse Mercator (UTM) coordinates of the facility are (approximately) 408.9 kilometers east and 3,854.2 kilometers north (Zone 17).

The facility currently comprises two natural gas-fired combustion turbine compressor sets and associated ancillary equipment. The primary purpose of the facility is to increase pressure in the natural gas transmission pipelines passing through the facility. The activities at the facility generally fall under Standard Industrial Classification (SIC) code 4922 – *Natural Gas Transmission* – and North American Industry Classification System (NAICS) code 486210 – *Pipeline Transportation of Natural Gas*.

DCG is requesting an air quality construction permit from SCDHEC for the installation of two natural gas-fired combustion turbine compressor sets at the facility. Additionally, DCG proposes to install/modify several emission units that are considered insignificant activities exempt from construction permitting requirements in accordance with SC R. 61-62.1, Section II. The emission units proposed to be constructed or modified as a part of this project are summarized in the following tables.

Table 2-1: Moore Compressor Station Primary Emission Units

Equipment ID	Equipment Description	Manufacturer and Model	Rated Capacity (MMBtu/hr)	Emission Point
M-3[a]	Proposed Simple Cycle Combustion Turbine M-3	Solar Saturn 10	16.25	S-3
M-4[a]	Proposed Simple Cycle Combustion Turbine M-4	Solar Saturn 10	16.25	S-4

a. The listed capacity is based on a lower heating value (LHV) of 939.2 British thermal units per standard cubic foot (Btu/scf), an engine inlet temperature of 30 °F, and site elevation.

Table 2-2: Moore Compressor Station Insignificant Activities

IA Equipment ID	Description	Year of Installation/ Modification	Basis for Exemption
IA-PD[a]	Pneumatic Devices	2014/TBD	SC R. 61-62.1, Section II.B.2.h
IA-ST1[b]	200-gallon Lube Oil Storage Tank	2014/TBD	SCDHEC Bureau of Air Quality (BAQ) Exemption List, Section B.5 (Oct. 2015)
IA-ST3[c]	550-gallon Aboveground Condensate Storage Tank	2014/TBD	SC R. 61-62.1, Section II.B.2.h
IA-ST4	1,000-gallon Underground Oily Water Storage Tank	TBD	SC R. 61-62.1, Section II.B.2.h
IA-FBC[d]	Four (4) 0.024 MMBtu/hr Wall-Mounted Catalytic Heaters and one (1) 0.075 MMBtu/hr HVAC Unit	2014/TBD	SC R. 61-62.1, Section II.B.2.b
IA-WSD[e]	Wet Seal Degassing	2014/TBD	SC R. 61-62.1, Section II.B.2.h
IA-BD[f]	Blowdowns	2014/TBD	SC R. 61-62.1, Section II.B.2.h
IA-EL[g]	Equipment Leaks	2014/TBD	SC R. 61-62.1, Section II.B.2.h

a. IA-PD covers emissions from all pneumatic devices at the facility, including pneumatic auxiliary oil pumps and starters. This insignificant activity is being modified to reflect additional pneumatic devices that will be installed as a part of this project.

b. IA-ST1 is being modified to correct the capacity of the tank as well as to account for additional emissions associated with an increase in lube oil throughput attributable to the additional combustion turbine compressor sets that will be installed. No physical changes are being made to this insignificant activity as a part of this project.

c. IA-ST3 is being modified to correct the capacity of the tank as well as to account for additional emissions associated with an increase in condensate throughput. No physical changes are being made to this insignificant activity as a part of this project.

d. IA-FBC covers emissions from all miscellaneous fuel burning sources at the facility. The existing facility comprises two 0.024 MMBtu/hr wall-mounted catalytic heaters and one 0.075 MMBtu/hr HVAC unit. The two catalytic heaters were previously described as 0.045 MMBtu/hr units and are being revised as part of this application. Two additional 0.024 MMBtu/hr wall-mounted catalytic heaters will be installed as a part of this project.

e. IA-WSD covers wet seal degassing emissions from each compressor at the facility. This insignificant activity is being modified to account for wet seal degassing emissions from the compressors that will be installed as a part of this project.

f. IA-BD covers emissions from all blowdowns at the facility. This insignificant activity is being modified to account for the increase in emissions attributable to additional piping and other equipment that will be installed as a part of this project.

g. IA-EL covers emissions from all equipment leaks at the facility. This insignificant activity is being modified to account for the increase in emissions attributable to leaks from additional valves, flanges, and other components that will be installed as a part of this project.

3. EMISSIONS ESTIMATION

Potential emissions of regulated air pollutants from the proposed emission units have been estimated as described in the following sections. Pre- and post-construction facility-wide potential emissions are summarized in Table 3-1.

Table 3-1: Moore Compressor Station Facility-Wide Estimated Potential Emissions

Pollutant	Pre-Construction Potential Emissions (tons/yr)	Post-Construction Potential Emissions (tons/yr)
NO_x	80.2	165.5
CO	130.2	268.9
SO_2	0.1	0.1
VOC	2.4	13.4
PM	0.9	1.8
PM_{10}	0.9	1.8
$PM_{2.5}$	0.9	1.8
CO_2	14,798	30,047
CH_4	29.0	133.3
N_2O	0.4	0.4
GHG (mass)	14,827	30,181
GHG (CO_2e)	15,642	33,508
Formaldehyde	0.12	0.21
Hexane	-	0.36
Total HAP	0.17	0.66

3.1 Estimation of Potential Emissions from Primary Emission Units

3.1.1 Equipment Leaks

The proposed primary emission units include M-3 and M-4, Solar Saturn 10-1400 natural gas-fired simple-cycle combustion turbines which will exhaust through stacks S-

3 and S-4, respectively. Each combustion turbine is part of a combustion turbine compressor set, including a combustion turbine, a compressor, and other ancillary equipment such as a pneumatic starter and lube oil pump. M-3 and M-4 have a manufacturer-predicted heat input rate of 16.25 million British thermal units per hour (MMBtu/hr) based the following operational data: (i) full-load operation; (ii) an inlet air temperature of 30°F; and (iii) a fuel LHV of 939.2 Btu/scf (see Appendix D).

Emissions from M-3 and M-4 are associated with the combustion of natural gas and include criteria pollutants, HAP, and GHG. Potential emissions of NO_x, CO, volatile organic compounds (VOC), and sulfur dioxide (SO_2) from the combustion turbines were estimated using manufacturer-provided hourly emission rate data (see Appendix D).[1] Potential emissions of other criteria pollutants and HAP were estimated using emission factors from EPA's *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition* (AP-42), Section 3.1 for stationary gas turbines. Potential emissions of carbon dioxide (CO_2), methane (CH4), and nitrous oxide (N_2O) were estimated using emission factors for natural gas combustion from 40 CFR Part 98, Subpart C, Tables C-1 and C-2, respectively. Emissions estimates are included with this application as Appendix B.

Estimated emissions of NO_x, CO, and VOC from startup (SU) and shutdown (SD) events were provided by the manufacturer (Solar). Hourly and annual emission rates for these pollutants were calculated both including and excluding startup (SU) and shutdown (SD) events. Hourly emissions estimates inclusive of SU/SD emissions assume one SU and SD event per hour, ten minutes per SU and three minutes per SD event, and full-load operation for the remainder of the hour. Annual emissions estimates inclusive of SU/SD emissions assume 90 SU and 90 SD events per year[2] (each event occurring over a period of ten and three minutes, respectively), with full-load operations occurring for the remainder of the 8,760 hours. Maximum hourly and annual potential emissions estimates for NO_x, CO, and VOC are based on the greater of estimates including SU and SD emissions and those excluding SU and SD emissions (see Appendix B).

---

[1] The manufacturer provided an hourly emission rate for unburned hydrocarbons (UHC). It was conservatively assumed that 20 percent of UHC emissions are VOC.

[2] Expected maximum annual number of startup and shutdown events.

3.2 Estimation of Emissions from Insignificant Activities

This section describes the emission estimation methodologies for the sources that are considered insignificant activities exempt from construction permitting requirements (see Table 2-2).

3.2.1 Insignificant Fuel Combustion Equipment

DCG is proposing to install two additional natural gas-fired catalytic heaters at the facility as a part of this project, expanding the list of equipment under insignificant activity ID IA-FBC. These heaters will be used to ensure adequate operating temperatures for equipment inside the compressor building during periods of cold ambient temperatures. Each catalytic heater will have a rated heat input capacity of 0.024 MMBtu/hr or less. As fuel combustion equipment with a rated heat input capacity less than 10 MMBtu/hr firing only virgin fuels, e.g., natural gas, the proposed catalytic heaters are exempt from construction permitting requirements per SC R. 61-62.1, Section II.B.2.b.

The combustion of natural gas generates emissions of criteria pollutants, HAP, and GHG. Potential emissions from the heaters were estimated using AP-42 Section 1.4 emission factors for natural gas combustion and engineering calculations (see Appendix B).

3.2.2 Storage Vessels

3.2.2.1 Lube Oil Storage Tank

The facility has an existing 200-gallon aboveground lube oil storage tank, IA-ST1, described in previous applications as a 165-gallon tank, the capacity of which is being revised as part of this application. Potential VOC emissions from IA-ST1 are expected to increase after installation of M-3 and M-4 due to the additional lube oil throughput that will be required. Given that IA-ST1 will remain an aboveground storage tank (AST) with a total storage capacity equal to or less than 5,042,000 gallons used to store lube oil, the proposed modification is exempt from construction permitting requirements in accordance with SC R. 61-62.1, Section II.B.3 and SCDHEC BAQ Air Quality Exemption List (October 2015), Section B.5.iv. Potential VOC emissions from IA-ST1 have been estimated using the EPA TANKS model, version 4.09d (see Appendix B).

3.2.2.2 Underground Oily Water Storage Tank

DCG is proposing to install an additional 1,000 gallon underground oily water storage tank (IA-ST4) at the facility as a part of this project. Oil vapors that condense in the oil reservoir vent lines associated with M-3 and M-4 will be routed to this tank for storage. IA-ST4 will be exempt from permitting requirements pursuant to SC R. 61-62.1, Section II.B.2.h since the total uncontrolled emission rate from the tank will be less than five tons/yr for particulate matter (PM), SO_2, NO_x, and CO and less than 1,000 pounds per month (lbs/month) for VOC. Potential VOC emissions from IA-ST4 have been estimated using the EPA TANKS model, version 4.09d (see Appendix B).

3.2.2.3 Aboveground Condensate Storage Tank

The facility has an existing 550-gallon aboveground condensate storage tank, IA-ST3, described in previous applications as a 500-gallon tank, the capacity of which is being revised as part of this application. IA-ST3 is used to store condensate that is removed from natural gas passing through the facility by the scrubbers. Potential VOC emissions from IA-ST3 are expected to increase after installation of M-3 and M-4 due to the additional natural gas that will potentially pass through the facility. However, since the total uncontrolled emission rate from this tank will remain less than five tons/yr for PM, SO_2, NO_x, and CO, and less than 1,000 lb/month for VOC, the modification is exempt from construction permitting requirements per SC R. 61-62.1, Section II.B.2.h. Potential VOC emissions from IA-ST3 have been estimated using the EPA TANKS model, version 4.09d (see Appendix B).

3.2.3 Natural Gas Venting

The equipment discussed in this section will have the potential to emit natural gas into the atmosphere. Venting of natural gas will result in emissions of GHG (CO_2 and CH_4), VOC, and HAP, components of natural gas. Natural gas venting emission estimates have been performed using the average of natural gas composition data from calendar year 2013 through 2014 based on DCG's gas quality report.[3] The DCG gas quality report provides information on the volume fraction of species containing six or more

[3] DCG daily average gas quality report: https://ebb.carolinagastransmission.com/InformationalPostings/GasQuality/Report.aspx, accessed 3 December 2015.

carbon atoms (hexane+). For the purposes of estimating HAP emissions from natural gas venting, it has been conservatively assumed that all such species are hexane, a HAP.

3.2.3.1 Pneumatic Devices (PD)

DCG proposes to increase the number of pneumatic devices (PD) associated with insignificant activity ID IA-PD as a part of this project. The proposed combustion turbine compressor sets will be equipped with a natural gas-driven pneumatic auxiliary oil pump and a natural gas-driven pneumatic starter.[4] Additionally, several miscellaneous natural-gas driven pneumatic devices will be added to the facility for process control (e.g., pneumatic shuttle valves, pneumatic control valves, etc.). For the purpose of this construction permit application, DCG assumes that a total of 27 natural gas-driven PDs will be installed at the facility as a part of this project, bringing the total number of intermittent-bleed PDs associated with IA-PD to 54. The installation of additional PDs at the facility is exempt from construction permitting requirements in accordance with SC R. 61-62.1, Section II.B.2.h because total uncontrolled VOC emissions from pneumatic devices at the facility will remain less than 1,000 lb/month.

During operation, natural gas-driven intermittent-bleed PDs vent natural gas to the atmosphere, resulting in emissions of GHG (CO_2 and CH_4) and VOC. Emissions of GHG and VOC from PDs at the facility have been calculated using methodologies outlined in the applicable subparts of 40 CFR Part 98 and engineering estimates based on best available data (see Appendix B).

3.2.3.2 Wet Seal Degassing (WSD)

Each proposed combustion turbine compressor set will be equipped with a high-pressure oil seal ("wet seal") system composed of a seal oil pump, wet seals, and an oil/gas separator, thus increasing potential emissions associated with insignificant activity ID IA-WSD at the facility. During wet seal system operation, oil from the reservoir is pressurized by the seal oil pump and conveyed to the wet seals where the pressurized seal oil is used to keep natural gas from escaping the compressor. While in the wet seals, the seal oil may become contaminated with natural gas due to the seal oil absorbing natural gas on the inboard side of the compressor. Contaminated seal oil leaving the wet seals is routed through an oil/gas separator, after which recovered

[4] DCG may replace natural gas-driven pneumatic starters and pumps with electric-driven equipment.

natural gas is sent back to the suction side of the compressor and recovered seal oil is routed to the oil reservoir.

Due to inefficiencies in the oil/gas separation process, some of the seal oil may still contain natural gas when it enters the oil reservoir. This gas may flash off in the oil reservoir and be emitted to the atmosphere through the oil reservoir vent, resulting in emissions of GHG (CO_2 and CH_4) and VOC. Since potential emissions of VOC attributable to IA-WSD will remain below 1,000 lb/month, the installation of the proposed WSD systems is exempt from construction permitting requirements in accordance with SC R. 61-62.1, Section II.B.2.h.

Emissions of GHG from WSD associated with the proposed combustion turbine compressor sets have been calculated using the methodologies incorporated in EPA's screening tool for onshore natural gas transmission compression.[5] VOC emissions were estimated using the EPA's screening tool along with assumptions regarding the VOC content of natural gas (see Appendix B). For the purpose of calculating emissions, it was assumed that the high-pressure oil seal system on each proposed combustion turbine compressor set will recover 99 percent[6] of the natural gas from the contaminated seal oil.

3.2.3.3 Blowdowns (BD)

There are several scenarios during which a blowdown event occurs, including: 1) blowdown of the compressors during compressor shutdown; 2) blowdown of the fuel supply system during maintenance; and, 3) blowdown of the facility during an emergency shutdown (ESD) event. Emissions from blowdown events at the facility are currently covered under insignificant ID IA-BD. Potential emissions associated with IA-BD are expected to increase due to the additional equipment (compressors, piping, valves, etc.) that will be added to the facility as a part of this project. Per SC R. 61-62.1, Section II.B.2.h, the increase in emissions associated with IA-BD is exempt from construction permitting requirements because total uncontrolled VOC emissions from IA-BD will remain below 1,000 lb/month.

---

[5] The EPA's screening tool can be found at: http://www.epa.gov/climate/ghgreporting/help/tool2014/documents/SubW_Screening_Tool_Transmission_2014.xls

[6] http://www.epa.gov/gasstar/documents/workshops/2012-annual-conf/smith.pdf

During each blowdown event, natural gas is vented to the atmosphere resulting in emissions of GHG (CO_2 and CH_4) and VOC. Emissions from blowdown events were estimated using methodologies outlined in the applicable subparts of 40 CFR Part 98, and engineering estimates based on best available data (see Appendix B).

3.2.3.4 Equipment Leaks (EL)

Leaking components, such as valves, connectors, open-ended lines, pressure relief valves, and meters, vent natural gas to the atmosphere, thus resulting in emissions of GHG (CO_2 and CH_4) and VOC. Emissions associated with leaks from existing components at the facility are covered under insignificant activity ID IA-EL. DCG is proposing to install additional components at the facility as a part of this project, thus increasing potential emissions from IA-EL. Potential emissions of VOC from IA-EL will remain below 1,000 lbs/month following installation of the additional components. As such, the modification of IA-EL is exempt from permitting requirements per SC R. 61-62.1, Section II.B.2.h.

Emissions from equipment leaks at the facility have been estimated based on methodologies outlined in applicable subparts of 40 CFR Part 98, engineering estimates based on best available data, and results of leak detection events conducted at existing DCG compressor stations and a 20 percent contingency factor (see Appendix B).

4. REGULATORY APPLICABILITY ANALYSIS AND REQUIREMENTS

The applicability of Federal and state air quality regulations to the proposed project is discussed in the following sections.

4.1 Permitting Programs

4.1.1 Prevention of Significant Deterioration

The Federal PSD Program, codified in 40 CFR Part 52.21, requires any new major stationary source of air pollution, and existing major source undergoing a major modification, to obtain a major source air construction permit before commencing construction. The Federal PSD Program applies to new facilities if potential emissions from the facility exceed applicable major source thresholds. For facilities that are not one of the 28 source categories listed in §52.21(b)(1)(i)(a), such as natural gas compressor stations, the major source threshold is 250 tons/yr of any regulated New Source Review (NSR) pollutant. Based on a Supreme Court ruling,[7] GHG emissions are only considered during PSD review when a facility must undergo PSD review for another pollutant and potential emissions of GHG exceed a *de minimis* threshold.

The facility is currently considered a minor source with respect to the PSD program, with potential emissions less than the 250 tons/yr threshold for all regulated NSR pollutants. After completion of the project described herein, facility-wide potential emissions of CO will exceed 250 tons/yr. However, since potential emissions associated with the project will not, by themselves, exceed PSD major source thresholds, the project does not trigger PSD review.

4.1.2 Nonattainment New Source Review (NNSR)

Spartanburg County is listed as either being in attainment or unclassifiable status[8] with all National Ambient Air Quality Standards (NAAQS). Therefore, the provisions of the NNSR Program do not apply to the facility.

---

[7] *Utility Air Regulatory Group v. Environmental Protection Agency et al* decided June 23, 2014. http://www.supremecourt.gov/opinions/13pdf/12-1146_4g18.pdf.

[8] 40 CFR §81.341.

4.1.3 Title V (Part 70) Operating Permit

The Federal Title V operating permit program is codified in 40 CFR Part 70. A Title V operating permit is required for facilities that meet the definition of a major source under §70.2. South Carolina has incorporated the Federal Part 70 program at SC R. 61-62.70. The facility is currently considered a major source of CO and NO_x under the Title V program, operating under SCDHEC Air Quality Construction Permit No. 2060-0528-CA while awaiting finalization and issuance of Title V Operating Permit No. TV-2060-0528, which is currently in draft form. Post-construction facility-wide potential emissions will remain below Title V major source thresholds for all other regulated NSR pollutants, HAP, and GHG. As such, the status of the facility with respect to the Title V program is not expected to change as a result of the proposed project.

4.1.4 South Carolina Permitting

SC R. 61-62.1, Section II.A requires a construction permit to be issued prior commencing construction or modification of any source of air contaminants, unless otherwise exempted. As discussed in Section 3 of this application, the only activity associated with this project that is subject to the construction permitting requirements of SC R. 61-62.1, Section II.A is the construction of M-3 and M-4.

4.2 New Source Performance Standards

Federal New Source Performance Standards (NSPS), codified in 40 CFR Part 60, establish pollutant emission limits and monitoring, reporting, and recordkeeping requirements for various emission sources based on source type and size. The NSPS apply to new, modified, or reconstructed sources. South Carolina has incorporated the Federal NSPS by reference at SC R. 61-62.60. The potentially applicable NSPS are described below.

4.2.1 40 CFR Part 60, Subpart A – NSPS General Provisions

Due to the operation of equipment subject to individual NSPS, the facility is subject to the applicable requirements of 40 CFR Part 60, Subpart A, *General Provisions* (NSPS General Provisions).

4.2.2 40 CFR Part 60, Subparts D, Db, and Dc – NSPS for Steam Generating Units

40 CFR Part 60, Subparts D, Db, and Dc cover steam-generating units. DCG is not proposing to install any steam generating units at the facility as a part of this project. As such, Subparts D, Db, and Dc do not apply.

4.2.3 40 CFR 60, Subpart K, Ka, and Kb – NSPS for Volatile Organic Liquid Storage Vessels

40 CFR Part 60, Subparts K, Ka, and Kb apply to volatile organic liquids (VOL) storage vessels of certain sizes that have been constructed, reconstructed, or modified during various time periods. Subpart K applies to storage vessels constructed, reconstructed, or modified prior to 1978 and Subpart Ka applies to storage vessels constructed reconstructed, or modified prior to 1984. Both Subpart K and Ka apply to storage vessels with a capacity greater than 40,000 gallons. Subpart Kb applies to storage vessels with a capacity greater than or equal to 75 cubic meters (m^3), or approximately 19,813 gallons, that are used to store VOL for which construction, reconstruction, or modification commenced after July 23, 1984. The VOL storage vessels at the facility have capacities less than the 40,000-gallon applicability threshold for Subparts K and Ka, and less than the 19,813-gallon applicability threshold for Subpart Kb. As such, Subparts K, Ka, and Kb do not apply.

4.2.4 40 CFR Part 60, Subpart GG – NSPS for Stationary Gas Turbines

40 CFR Part 60, Subpart GG (Subpart GG) applies to stationary gas turbines with a heat input at peak load greater than or equal to 10 MMBtu/hr, and that were constructed, modified, or reconstructed after October 3, 1977.[9] As discussed below, units M-3 and M-4 are subject to 40 CFR Part 60, Subpart KKKK (Subpart KKKK) and therefore are exempt from Subpart GG per §60.4305(b).

4.2.5 40 CFR Part 60, Subpart KKKK – NSPS for Stationary Combustion Turbines

Subpart KKKK addresses requirements for stationary gas turbines with a heat input at peak load greater than or equal to 10 MMBtu/hr, for which construction, modification,

[9] §60.330(a) and §60.330(b).

or reconstruction commenced after February 18, 2005, per §60.4305(a). The combustion turbines proposed for installation at the facility, Solar Saturn 10 units, were originally constructed by Solar in the 1960s, well before the Subpart KKKK applicability date, and will be refurbished prior to installation at the facility. Consistent with the combustion turbines currently located at the facility (M-1 and M-2), DCG is voluntarily assuming that units M-3 and M-4 will be modified or reconstructed prior to installation at the facility.

Based on manufacturer emissions data provided in Appendix D, the proposed combustion turbines will comply with the applicable Subpart KKKK NO_x emissions limitation of 150 parts per million (ppm) at 15 percent oxygen (O_2).[10] Compliance with the SO_2 emission limitations of Subpart KKKK will be achieved using fuel that meets the sulfur content limits outlined in §60.4330(a)(2). The proposed combustion turbines will be exempt from the fuel sulfur content monitoring requirements of §60.4360 given that DCG's current Federal Energy Regulatory Commission (FERC) tariff, as well as the FERC tarrifs associated with DCG's natural gas suppliers, specifies that the maximum total sulfur content of the natural gas transported in DCG's pipeline system is 20 grains of sulfur or less per 100 standard cubic feet.

4.2.6 40 CFR Part 60, Subpart OOOO – NSPS for Crude Oil and Natural Gas Production, Transmission and Distribution

40 CFR Part 60, Subpart OOOO (Subpart OOOO) applies to certain onshore affected facilities listed in paragraphs (a) through (g) of §60.5365 used in the oil and natural gas production, transmission, and distribution industries that were constructed, reconstructed, or modified after August 23, 2011. The combustion turbine compressor sets are not one of the onshore affected facilities listed in paragraphs (a) through (g) of §60.5365; thus they are not covered under Subpart OOOO. The existing and proposed storage vessels are the only equipment that could potentially be covered under Subpart OOOO. However, because potential emissions from each storage vessel will be less than six tons/yr of VOC, they are not considered affected sources under Subpart OOOO, per §60.5365I.

[10] NO_x emissions limitation for modified or reconstructed combustion turbines with a heat input capacity at peak load less than 50 MMBtu/hr, per NSPS Subpart KKKK, Table 1.

4.2.7 Proposed 40 CFR Part 60, Subpart OOOOa – Amended NSPS for Crude Oil and Natural Gas Facilities

The EPA is proposing to amend the NSPS for crude oil and natural gas facilities.[11] The amended NSPS is proposed to be codified at 40 CFR Part 60, Subpart OOOOa (Subpart OOOOa) and will apply to certain onshore affected facilities that were constructed, reconstructed, or modified after September 18, 2015. Based on this applicability date, it is anticipated that the project will be required to comply with the requirements of Subpart OOOOa, if finalized. The potential applicability of proposed Subpart OOOOa to the project is summarized in the following table:[12]

Table 4-1: Potential Applicability of NSPS OOOOa

NSPS OOOOa Affected Facility	Proposed Citation	Potential NSPS OOOOa Applicability
Centrifugal Compressors Using Wet Seals	§60.5365a(b)	Proposed centrifugal compressors associated with M-3 and M-4.
Reciprocating Compressors	§60.5365a(c)	Not applicable. No reciprocating compressors will be constructed, modified, or reconstructed as a part of this project.
Each continuous bleed natural gas-driven pneumatic controller	§60.5365a(d) (1)	Each new continuous bleed natural gas-driven pneumatic controller. Existing natural gas-driven pneumatic controllers at the facility will only be covered if they are modified or reconstructed.
Each storage vessel affected facility with potential emissions greater than six tons/yr	§60.5365a(e)	Not applicable. Potential VOC emissions from the storage vessels will be less than six tpy.
Each natural gas-driven pneumatic pump	§60.5365a(h) (2)	Each new natural gas-driven pneumatic pump. Existing natural gas-driven pneumatic pumps at the facility will only be covered if they are modified or reconstructed.
The collection of all fugitive emission components	§60.5365a(j)	All fugitive emission components at the facility will be subject to the fugitive emission standards.

[11] 80 FR 56593, September 18, 2015

[12] Affected facilities covered by proposed §60.5365a(a), §60.5365a(d) (2), §60.5365a(f), §60.5365a(g), §60.5365a(h) (1), and §60.5365a(i) are omitted from this summary because they are specific to well sites, i.e., hydraulically fractured or refractured wells, and/or natural gas processing plants.

Uncertainty remains with respect to whether or not Subpart OOOOa will be finalized, or what the final requirements of Subpart OOOOa will entail. Based on the proposed language, Subpart OOOOa will impose emission reduction requirements beyond those required by Subpart OOOO, including: a 95 percent reduction in VOC and CH_4 emissions from centrifugal compressor WSD; the use of low-bleed pneumatic controllers; a 95 percent reduction in VOC and CH_4 emissions from pneumatic pumps (only if an emission control device is already on site); and the implementation of a periodic leak detection and repair program. The facility will comply with the applicable provisions of Subpart OOOOa if and when it becomes final.

4.2.8 Non-Applicability of Other NSPS

NSPS are developed for particular industrial source categories. The applicability of a particular NSPS to a facility can be readily ascertained based on the industrial source category covered. Other than the above-listed Subparts specifically identified as applicable, other NSPS are categorically not applicable to the facility.

4.3 National Emission Standards for HAP

National Emissions Standards for Hazardous Air Pollutants (NESHAP), codified in 40 CFR 61 and 63, regulate HAP emissions from various affected sources. South Carolina has incorporated by reference the NESHAP from 40 CFR 61 and 40 CFR 63 at SC R. 61-62.61 and SC R. 61-62.63, respectively. Based on the type of operations associated with the equipment to be installed or modified as a part of this project, and the type of HAP emitted, no 40 CFR 61 regulations apply to this project. This section identifies and discusses the NESHAP codified in 40 CFR Part 63 that potentially apply to the project.

Note that following completion of the project as described herein, the facility will remain an area source (i.e., not a major source) of HAP as defined in 40 CFR 63.2. Potential emissions of each individual HAP will be less than 10 tons/yr and potential emissions of total HAP will be less than 25 tons/yr.

4.3.1 40 CFR Part 63, Subpart A – NESHAP General Provisions

Given that the project will not involve any equipment subject to an individual NESHAP, 40 CFR Part 63 Subpart A, *General Provisions*, will not apply to the project.

4.3.2 40 CFR Part 63, Subpart HH – NESHAP for Oil and Natural Gas Production Facilities

40 CFR Part 63, Subpart HH (Subpart HH) applies to dehydration units located at natural gas production facilities that are major or area sources of HAP as defined in §63.761. The facility is not a natural gas production facility nor does it operate dehydration units; therefore, Subpart HH does not apply.

4.3.3 40 CFR Part 63, Subpart HHH – NESHAP for Natural Gas Transmission and Storage Facilities

The provisions of 40 CFR Part 63, Subpart HHH (Subpart HHH) apply to natural gas transmission and storage facilities that transport or store natural gas prior to entering the pipeline to a local distribution company or to a final end user (if there is no local distribution company), and that are major sources of HAP emissions as defined in §63.1271. Specifically, Subpart HHH applies to glycol dehydration units at natural gas transmission and storage facilities. The facility meets the definition of "facility" under Subpart HHH. However, Subpart HHH is not applicable given that the facility will remain a minor source of HAP. Additionally, the facility does not have glycol dehydration units and none are proposed to be installed as a part of this project.

4.3.4 40 CFR Part 63, Subpart YYYY – NESHAP for Stationary Combustion Turbines

40 CFR Part 63, Subpart YYYY (Subpart YYYY) applies to stationary combustion turbines located at major sources of HAP constructed after January 14, 2003. Subpart YYYY will not apply to the project because the facility will remain a minor source of HAP.

4.3.5 40 CFR Part 63, Subpart DDDDD – NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters

40 CFR Part 63, Subpart DDDDD (Subpart DDDDD) applies to industrial, commercial, and institutional boilers and process heaters of various sizes and fuel types that are located at major sources of HAP. Following completion of the proposed project, the facility will remain an area source of HAP with heaters used solely for space heating. Units used for comfort heat or space heat are specifically excluded from the definition of process heaters under §63.7575; therefore, Subpart DDDDD does not apply.

4.3.6 40 CFR Part 63, Subpart JJJJJJ – NESHAP for Industrial, Commercial, and Institutional Boilers at Area Sources

40 CFR Part 63, Subpart JJJJJJ (Subpart JJJJJJ) applies to boilers of various sizes that are located at area sources. DCG is proposing to install two catalytic heaters as a part of this project, neither of which meet the definition of industrial, commercial, or institutional boilers;[13] therefore, Subpart JJJJJJ does not apply.

4.3.7 Non-Applicability of Other NESHAP

As with NSPS standards, NESHAP are developed for particular industrial source categories. Therefore, the applicability of a particular NESHAP can be readily ascertained based on the industrial source category covered. All NESHAP regulations in 40 CFR 61 and 40 CFR 63 are not applicable to the proposed project.

4.4 South Carolina Regulations

In addition to Federal air regulations, SC R. 61-62 establishes regulations applicable at the emission unit level (source specific) and at the facility level. The rules also contain requirements related to the need for construction and/or operating permits. Potentially applicable standards under SC R. 61-62 are discussed below. Generally applicable facility provisions (e.g., restrictions on open burning) have been excluded from this discussion.

4.4.1 Standard No. 1 – Fuel Burning Operations

Regulation 61-62.5, Standard No. 1 regulates emissions of PM, SO_2, and opacity from fuel burning operations. Fuel burning operations are defined in Regulation 61-62.1 as:

> *Use of furnace, boiler, device or mechanism used principally but not exclusively, to burn any fuel for the purpose of indirect heating in which the material being heated is not contacted by and adds no substance to the products of combustion.*

There are no processes proposed as a part of this project that meet the definition of fuel burning operations.

---

[13] §63.11193.

4.4.2 Standard No. 2 – Ambient Air Quality Standards

Given that the installation or modification of equipment as described herein will result in an increase in emissions of criteria pollutants, the proposed project is subject to the ambient air quality standards established under SC R. 61-62.5, Standard No. 2 (Standard 2). Compliance with Standard 2 is typically demonstrated using an air dispersion modeling analysis. According to Section 1.2.B of SCDHEC published guidance entitled "Standard 2 and 7 Modeling Exemption and Deferral Guidelines," dated 25 September 2015, emissions from the existing emergency generator, existing comfort heater, and existing and proposed catalytic heaters are not subject to Standard 2 and Standard 7 modeling requirements. [14] Per Section 1.2.C of these guidelines, emissions of PM, PM_{10}, $PM_{2.5}$, and SO_2 are exempt from Standard 2 and Standard 7 modeling requirements because the total estimated post-construction potential emission rate from each unit for each of these pollutants is less than 1.14 pounds per hour (lbs/hr). A demonstration of compliance with Standard 2 using air dispersion modeling is required when emissions of NO_2 and CO exceed 1.14 lbs/hr and 10 lbs/hr, respectively.

A revised Standard 2 compliance demonstration has been performed to include NO_2 and CO emissions from proposed combustion turbines M-3 and M-4, the only pollutants and emission units not exempt from Standard 2 and Standard 7 modeling requirements. The revised compliance demonstration was performed using the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). The air dispersion modeling analysis is discussed in Section 5 of this application.

4.4.3 Standard No. 3 – Waste Combustion and Reduction

SC R. 61-62.5, Standard No. 3 generally regulates all sources that burn any waste other than virgin fuel for any purpose. Fuel burning sources at the facility will only burn virgin fuel; therefore, this standard will not apply.

4.4.4 Standard No. 4 – Emissions from Process Industries

The proposed combustion turbines M-3 and M-4 will be subject to the visible emissions standard outlined in SC R. 61-62.5, Standard No. 4, Section IX, which requires that

[14] https://www.scdhec.gov/environment/docs/Standard2and7ModelingExemptionandDeferralGuidelines.pdf

emissions not exhibit opacity greater than 20 percent for those facilities constructed after December 31, 1985. The proposed combustion turbines will demonstrate compliance with this standard by exclusively firing natural gas.

4.4.5 Standard No. 5 – Volatile Organic Compounds

SC R. 61-62.5, Standard No. 5 regulates VOC emissions from certain processes. However, the facility will not have any of the regulated processes. Thus, this standard does not apply.

4.4.6 Standard No. 5.2 – Control of Oxides of Nitrogen Emissions

SC R. 61-62.5 Standard No. 5.2 (Standard 5.2) applies to any source that has not undergone a NO_x BACT analysis in accordance with SC R. 61-62.5, Standard No. 7, and meets one or more of the following criteria as outlined in Section I(a)(1)-(3) of Standard 5.2:

- Any new source that is constructed after June 25, 2004;
- Any existing source where a burner assembly is replaced with another burner assembly[15] after the effective date of this regulation, regardless of size or age of the burner assembly to be replaced; or,
- Any existing source that is removed from its presently permitted facility and moved to another permitted facility after the effective date of this regulation except process equipment and commercial or industrial boilers that are transferred between facilities within the state under common ownership.

The proposed turbines at the facility will be installed after June 25, 2004 and are, therefore, subject to Standard 5.2.

Standard 5.2 generally requires simple-cycle natural gas-fired combustion turbines with a power output rating of less than 50 megawatts (MW) to limit NO_x emissions to 25 ppm by volume, on a dry basis, corrected to 15 percent oxygen (ppmvdc). However,

[15] The replacement of individual components of the burner (e.g., burner heads, nozzles, or windboxes) does not trigger the applicability of this regulation. Furthermore, the combustion section of a combustion turbine does not meet the definition of a burner assembly under Standard 5.2, per Standard 5.2, Section II(a).

SCDHEC granted a blanket Standard 5.2 alternative NO_x emissions limitation of 150 ppmvd for all Solar Saturn 10 and 20 combustion turbines installed at DCG compressor stations in accordance with SC R. 61-62.5, Standard 5.2, Section III(b) (see Appendix D).[16] Therefore, the proposed combustion turbines will comply with Standard 5.2 by complying with the SCDHEC-approved alternative NO_x emissions limitation.

4.4.7 Standard No. 7 – Prevention of Significant Deterioration

As discussed in Section 4.1.1, PSD review is not required for the proposed changes to the facility. Nevertheless, SC R. 61-62.5, Standard No. 7 (Standard 7) requires minor sources to perform increment modeling for pollutants after a Minor Source Baseline Date has been established for that pollutant for the county in which the facility is located.

The minor source baseline date for PM_{10} and NO_2 has been triggered for Spartanburg County[17], which is a Class II area under Standard 7. However, as previously mentioned, emissions of PM_{10} from the facility are exempt from Standard 7 air dispersion modeling requirements since the estimated potential emission rate is less than 1.14 lbs/hr for each unit.

A revised Standard 7 compliance demonstration has been performed to include NO_2 emissions from proposed combustion turbines M-3 and M-4, the only pollutants and emission units not exempt from Standard 7 modeling requirements. The revised compliance demonstration was performed using AERMOD. The air dispersion modeling analysis is discussed in Section 5 of this application.

4.4.8 Standard No. 8 – Toxic Air Pollutants

SC R. 61-62.5, Standard No. 8 (Standard 8) applies to sources that have the potential to emit toxic air pollutants (TAP), but does not apply to fuel burning sources that only burn virgin fuel, per Section I of Standard 8. Given that the only sources of TAP emissions associated with the project are virgin fuel (natural gas) combustion sources, Standard 8 does not apply to the proposed project.

---

[16] Letter from Fatina Clark of SCDHEC Bureau of Air Quality to Richard Kopec of DCG (formerly CGT) dated March 19, 2014.

[17] SCDHEC, *SC Minor Source Baseline Dates*, dated 8 August 2014, accessed, 4 November 2015.

4.4.9 61-62.7 – Good Engineering Practice Stack Height

Regulation 61-62.7, *Good Engineering Practice Stack Height*, addresses Good Engineering Practice (GEP) stack height as it pertains to compliance with the Standard 2 and Standard 7. As discussed in Section 5, a GEP stack height analysis was performed as part of the revised Standard 2 and Standard 7 compliance demonstration for the facility.

5. AIR DISPERSION MODELING

An air dispersion modeling analysis has been conducted to demonstrate compliance with SC R. 61-62.5, Standard 2 and Standard 7. As previously mentioned, the compliance demonstration is limited to CO and NO_2 for Standard 2 and NO_2 for Standard 7. The methods used in this modeling analysis are consistent with current EPA and SCDHEC procedures and follow the procedures outlined in the SCDHEC Air Quality Modeling Guidelines and AERMOD Guidelines.[18,19,20] Details of the modeling analysis, dispersion model techniques, and modeling results are provided in the following sections.

5.1 Model Selection

The air dispersion modeling analysis was conducted using the latest version of AERMOD, version 15181 of AERMOD to estimate maximum ground-level concentrations. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of surface and elevated sources, as well as simple and complex terrain. Air dispersion modeling was performed using the AERMOD regulatory default options, including the default Ambient Ratio Method (ARM) options for NO_x to NO_2 conversion. The default ARM options assume a 0.75 NO_x to NO_2 conversation ratio for 1-hour NO_2 modeling and a 0.80 NO_x to NO_2 ratio for annual NO_2 modeling.

5.2 Geographic Coordinate System

In this modeling analysis, the location of emission sources, structures, and receptors were represented using the Universal Transverse Mercator (UTM) geographic coordinate system. One UTM zone is present within the State of South Carolina, Zone 17. The location of the facility is approximately 408,932 meters (m) East and 3,854,205 m North in Zone 17. This modeling analysis uses the World Geodetic System of 1984

[18] 40 CFR 51, Appendix W, *Guideline on Air Quality Models*.

[19] South Carolina Department of Health and Environmental Control, *Air Quality Modeling Guidelines*, July 2001.

[20] https://www.scdhec.gov/environment/docs/AERMOD_Guidelines.pdf\

(WGS84[21]), as the geodetic reference system from which the locational data was obtained.

5.3 Meteorological Data

AERMOD utilizes upper air and surface profile data obtained from publicly-available National Weather System (NWS) data (or similar), processed via AERMOD's meteorological data pre-processor, AERMET. Per South Carolina modeling guidelines, the dispersion modeling analysis was performed using 2002 through 2006 preprocessed meteorological data available from the SCDHEC website.[22] As recommended by SCDHEC, surface data from the Greenville-Spartanburg (GSP) surface meteorological station (Station Number 3870) were paired with upper-air data from the Greensboro North Carolina upper air sounding station (Station Number 13723). A surface station base elevation of 972 feet (296.27 meters) was used.[23]

5.4 Receptor Grids

Ground-level concentrations were estimated at receptors placed along the property line and within one Cartesian receptor grid. The property line receptors were spaced 50 meters apart and the grid receptors extending beyond the facility boundary to 1,500 meters were spaced 100 meters apart in all directions per SCDHEC guidance. The resultant maximum concentration occurs well within this distance at a receptor located on the property line.

5.5 Terrain

AERMOD uses advanced terrain characterization to account for the effects of terrain features on plume dispersion and travel. AERMOD's terrain pre-processor, AERMAP (latest version 11103), imports digital terrain data and computes a height scale for each receptor from National Elevation Dataset (NED) data files. A height scale is assigned to

---

[21] As stated in AERMAP User Guide, the WGS84 and the North American Datum of 1983 (NAD83) datum are considered the same for all practical purposes.

[22] https://www.scdhec.gov/Environment/AirQuality/CompliianceandReporting/AirDispersionModeling/ModelingData/

[23] https://www.scdhec.gov/environment/docs/SC02-06_Met_Data-Station_Elevations.pdf

each individual receptor and is used by AERMOD to determine whether the plume will go over or around a hill.

The receptor terrain elevations that were estimated by AERMAP are the highest elevations extracted from USGS 1:24,000 scale (7.5-minute series) NED data for the area in the vicinity of the facility. For each receptor, AERMAP assigns the maximum possible elevation within a box centered on the receptor of concern and extending halfway to each adjacent receptor. Base elevations were assigned to structures and stacks in a similar fashion. This is a conservative technique for estimating terrain elevations as it ensures that the highest terrain elevations are accounted for in the analysis.

5.6 Building Downwash Analysis

Federal regulations at 40 CFR 51, Appendix W (*Guideline on Air Quality Models*) restrict the use of stack heights in excess of GEP stack height in air dispersion modeling analyses. The GEP height of a stack is the greater of: 1) 65 meters (measured from the base elevation of the stack), or 2) the value resulting from applying the following equation:[24]

$$H_g = H + 1.5 * (L)$$

where:

H_g = GEP stack height
H = height of nearby structure
L = lesser dimension, height or projected width, of nearby structure

Aerodynamic downwash has the potential to increase ground-level concentrations from stack sources above the concentrations that would be predicted in the absence of these effects. Under 40 CFR 51, Appendix W, the portion of a stack that is in excess of the GEP stack height is generally not creditable when modeling to determine source impacts, preventing the use of excessively tall stacks to reduce ground-level pollutant concentrations.

[24] 40 CFR Part 51, Section 100, Paragraph (ii).

Downwash is handled in air quality models through the use of arrays of direction-specific building dimensions, determined through the use of EPA's Building Profile Input Program Plume Rise Model Enhancement (BPIP-PRIME) algorithm. BPIP-PRIME generates direction-specific building heights and widths for a given stack. BPIP-PRIME also calculates a GEP stack height above which the downwash from buildings does not have any impact on the emissions from the stack. A BPIP-PRIME analysis was performed for each modeled stack.

Stacks that have a release height lower than their GEP value are modeled at their actual release height. Based on the GEP formula above, BPIP-PRIME calculated a GEP height ranging from approximately 41 feet for S-1 to approximately 38 feet for S-4. The actual stack heights are 25 feet for existing stacks S-1and S-2 and proposed stacks S-3 and S-4, all which are below their respective GEP value. As such, the stacks were modeled at their actual release height.

The input and output files used in the BPIP-PRIME downwash analysis are provided in Appendix E of this application. The output file lists: the names and dimensions of the structures considered; the emissions unit location and height; a summary of the dominant structure for each emissions unit (considering all wind directions); and the actual building height and projected widths for all wind directions. Each building processed using BPIP-PRIME was assigned a unique numerical identification in the model, which corresponds to BPIP-PRIME files. Buildings included in the BPIP-PRIME analysis are listed in Table 5-1 below and illustrated on Figure 2.

Table 5-1: Building Summary

Model Building ID	Building Description	UTM Easting (m)[a]	UTM Northing (m)[a]	Height (ft)	Length (ft)[b]	Width (ft)[b]
OFFICE	Existing Operations Center (Existing)	408,931.1	3,854,214.3	16	50.3	35.3
BLDA	Compressor Building A (Existing)	408,920.9	3,854,190.4	16	50.3	35.3
BLDB	Compressor Building B (Proposed)	408,941.2	3,854,238.3	16	50.3	35.3

a. Location represents the southwest corner of the building.
b. Obtained from civil site plans.

5.7 Land Use Analysis

Varying land use will produce different environmental responses to heating, cooling, albedo, etc., which have an effect on the vertical stability and subsequent behavior of pollutant dispersion. As stated in the July 2001 SCDHEC *Air Quality Modeling Guidelines*[25] (Modeling Guidelines) document, with few exceptions, all of South Carolina is considered to be rural. Typically only areas in the large metropolitan areas of the State (i.e., Greenville/Spartanburg, Columbia, and Charleston) are considered urban.

In accordance with the Modeling Guidelines and *August Auer, 1978*[26] guidance, a 3-km radius domain centered at the facility was considered for the land-use analysis. ArcGIS (Version 10.3) was used for extraction of the land-use values in the domain. The original land-use map for this extraction was obtained from the publically-available USGS 1992 National Land Cover Dataset, as provided in the Modeling Guidelines. The data has 30-meter grid resolution and 21 land-use categories. Commercial/Industrial/Transportation and High Intensity Residential were considered urban while other categories were considered rural. The frequency of the 21 categories were used to determine the total frequency of rural and urban land-use (as a percentage), which was then evaluated according to the Modeling Guidelines in terms of overall dispersion classification as urban or rural. The procedures provided in the Modeling Guidelines classify areas as rural when the frequency of rural land-use categories is 50% or greater.

Figure 3 shows the 3-km radius centered at the facility, overlain on a land-use map. The resulting land-use count and percentages are summarized in Table 5-2. More than 98 percent of the domain surrounding the facility comprises rural land features.

---

[25] SCDHEC's *Air Quality Modeling Guidelines*, dated July 2001 (http://www.scdhec.gov/environment/docs/modguide.pdf).

[26] August H. Auer Jr., 1978: *Correlation of Land Use and Cover with Meteorological Anomalies*. Journal of Applied Meteorology, Volume 17, p. 636–643.

Table 5-2: Land Use Analysis

Category	Land Use Category Description	Number of Grid Cells	Frequency (%)	Dispersion Class
11	Open Water	64	0.208	Rural
21	Low Intensity Residential	277	0.902	Rural
22	High Intensity Residential	7	0.023	Urban
23	Commercial/Industrial/Transportation	340	1.107	Urban
31	Bare Rock/Sand/Clay	14	0.046	Rural
32	Quarries/Strip Mines/Gravel Pits	159	0.517	Rural
33	Transitional	0	0.000	Rural
41	Deciduous Forest	11,302	36.784	Rural
42	Evergreen Forest	6,816	22.184	Rural
43	Mixed Forest	4,585	14.923	Rural
81	Pasture/Hay	3,345	10.887	Rural
82	Row Crops	3,489	11.356	Rural
85	Urban/Recreational Grasses	56	0.182	Rural
91	Woody Wetlands	271	0.882	Rural
92	Emergent Herbaceous Wetlands	0	0.000	Rural
	Total	30,725		
	Rural		98.871	
	Urban		1.129	

5.8 Source Characterization

The AERMOD dispersion model allows for emissions units to be represented as point, area, or volume sources. For point sources with unobstructed vertical releases, it is appropriate to use actual stack parameters (i.e., height, diameter, exhaust gas temperature, and gas exit velocity) in the modeling analysis. The emission units were modeled as point sources using actual stack parameters as presented in Table 5-3.

Table 5-3: Point Source Parameters

Stack ID	Unit ID	UTM Easting (m)	UTM Northing (m)	Stack Height (ft)	Exhaust Temp. (°F)	Exit Flow (ACFM)	Velocity (ft/s)	Stack Diameter (ft)	Raincap (Y/N)	NO_x (lbs/hr)	CO (lbs/hr)
S-1	M-1	408920.95	3854193.59	25	900	27,609	146.49	2	N	9.13	14.83
S-2	M-2	408924.57	3854202.09	25	900	27,609	146.49	2	N	9.13	14.83
S-3	M-3	408941.23	3854241.51	25	933	29,180	154.8	2	N	9.74	16.49
S-4	M-4	408944.73	3854250.11	25	933	29,180	154.8	2	N	9.74	16.49

Note: Emission rates for M-1 and M-2 taken from the August 2013 Air Quality Construction Permit Application for the Moore Compressor Station.

5.9 Background Concentrations and Ambient Standards

SCDHEC provides background concentrations for each criteria pollutant and averaging period for which there is an ambient standard, which are to be incorporated into AAQS compliance demonstrations. The air dispersion modeling analysis performed for this project utilized background concentration data from 2009-2013 monitoring at the Yorkville site in Paulding County, GA for NO_2 and CO. This monitoring station was selected since it is located in a rural area, as is the facility, while the most proximate monitoring stations (Greenville ESC for NO_2 and Parklane for CO) are located in urban areas. Background concentrations were added to the modeled concentrations for the purpose of comparing estimated cumulative ambient impacts to the AAQS. Applicable AAQS and background concentrations used in this modeling analysis are presented in Table 5-4 below.

5.10 Modeling Results

For Standards Nos. 2 and 7, the maximum modeled impacts for NO_2 and CO for the meteorological dataset were compared to the applicable standards for each averaging period. The results of this analysis are presented in Table 5-4 and demonstrate the facility, including the proposed units M-3 and M-4, will be in compliance with Standard 2 and Standard 7 for modeled pollutants. The AERMOD input and output modeling files for each modeled pollutant, along with the AERMAP input and output files are included in electronic format in Appendix E.

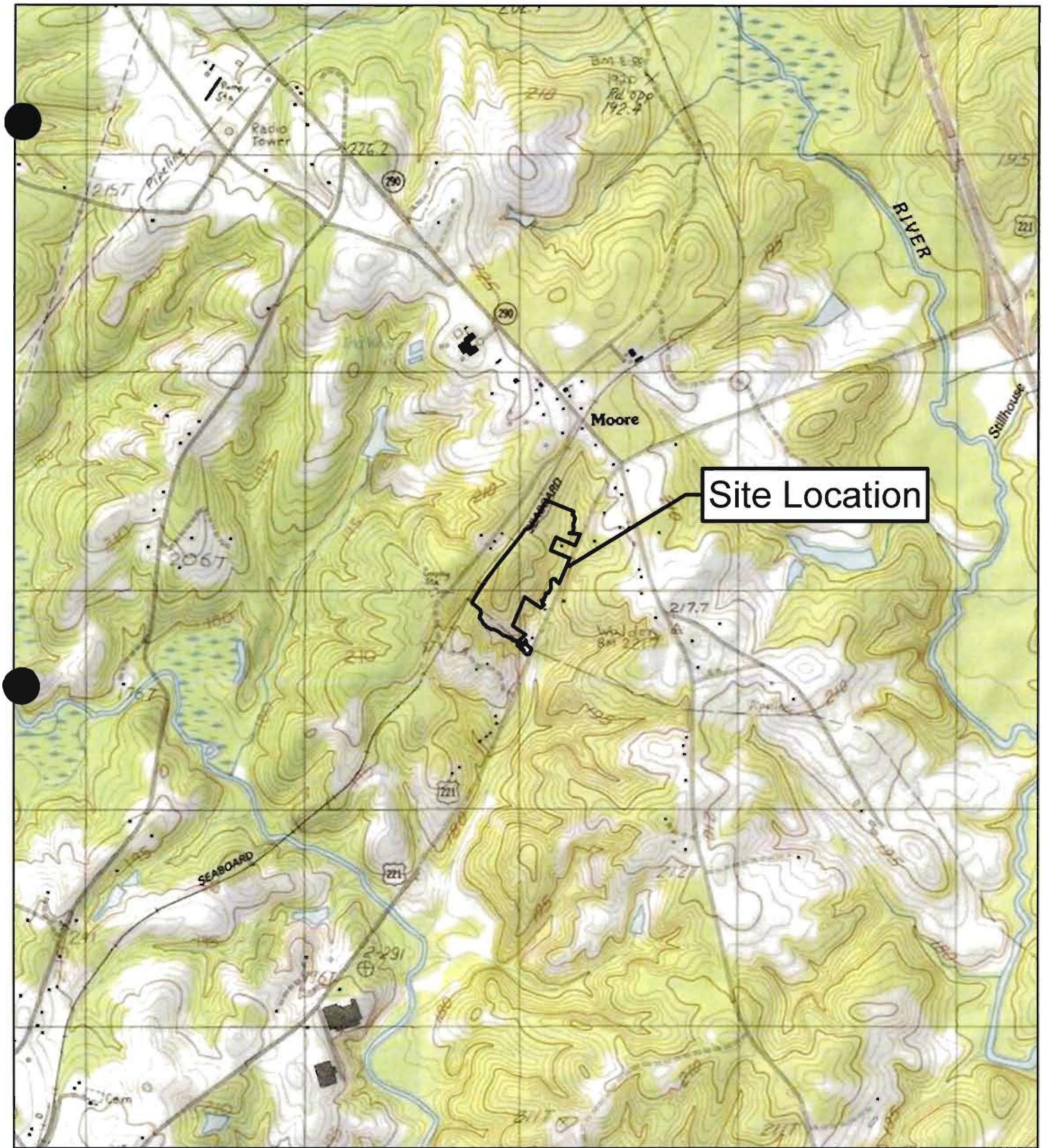
Table 5-4: Model Results in Comparison with Ambient Standards

Pollutant	Averaging Period	Maximum Modeled Results ($\mu g/m^3$)	AAQS[27] ($\mu g/m^3$)	Percent of Standard	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	Percent of Standard (Total)	Shows Compliance? (Yes/No)
Standard 2								
NO_2	Annual[a]	4.49	100	4.5%	5	9.49	9.5%	Yes
	1-hour[b]	101.39	188	53.9%	32.4	133.79	71.2%	Yes
CO	1-hour[c]	313.34	40,000	0.8 %	745	1,058	2.6%	Yes
	8-hour[c]	171.38	10,000	1.7 %	618	789	7.9%	Yes
Standard 7								
NO_2	Annual	4.49	25	18.0%	-	4.49	18.0%	Yes

a. The high first high value is shown for annual NO_2
b. The 8th-highest maximum of daily 1-hour results averaged over five years is shown for 1-hour NO2
c. The high second high value is shown for 1-hour and 8-hour CO.

[27] SC R. 61-62.5, Standard 2

FIGURES



Legend

Property Boundary

N

Copyright:© 2013 National Geographic Society, i-cubed

0 2,000 Feet

Dominion Carolina Gas Transmission, LLC
Moore Compressor Station
Topographic Site Location Map

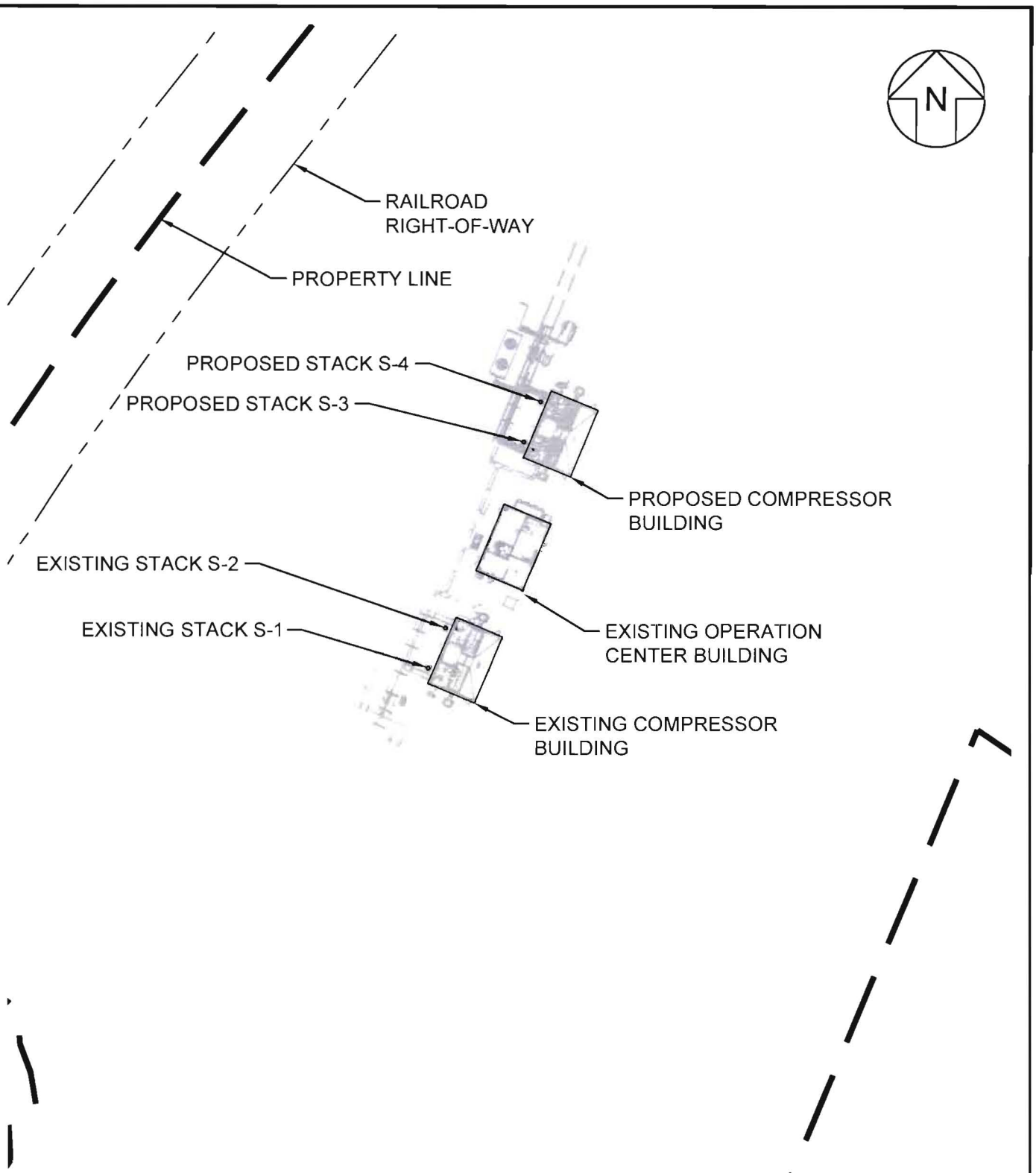
6890 Highway 221
Moore, South Carolina

Geosyntec consultants

Columbia, SC | DECEMBER 2015

Figure 1

P:\PRJ1\A\AirModeling\DCG\T2C_GIS\MXD\Moore_Site Location Map_20151112.mxd 11/12/2015 9:53:00 AM



0 100'
SCALE IN FEET

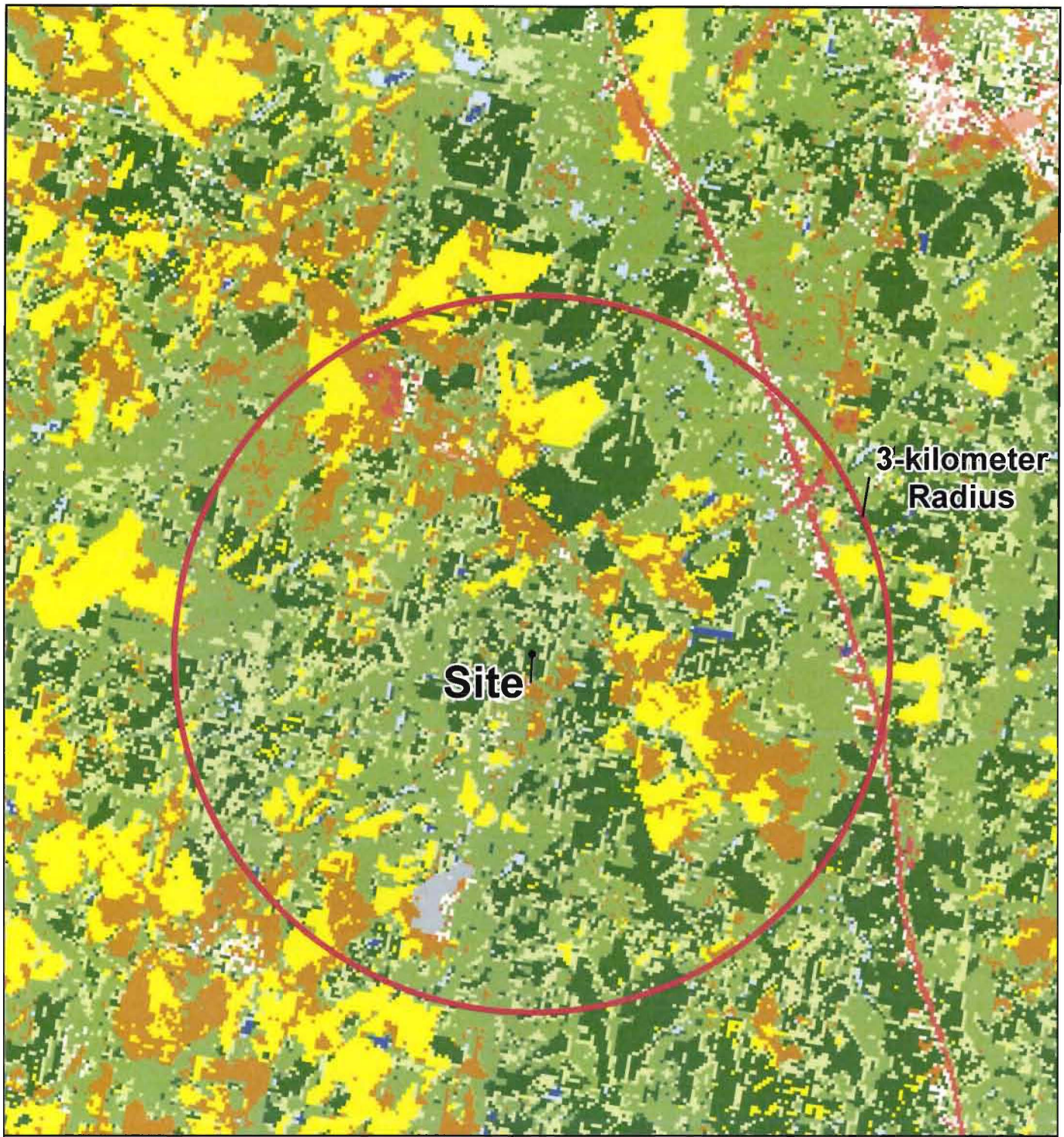
DOMINION CAROLINA GAS TRANSMISSION, LLC
FACILITY LAYOUT
MOORE COMPRESSOR STATION - MOORE, SC
AIR QUALITY CONSTRUCTION PERMIT
APPLICATION

Geosyntec consultants

FIGURE
2

PROJECT NO: GSC5940 | DECEMBER 2015

M:\D\DCG-MOORE-GSC5940\FIGURES\MOORE COMPRESSOR SITE_20151118



Legend

- Open Water
- Low Intensity Residential
- High Intensity Residential
- Commercial/Industrial/Transportation
- Bare Rock/Sand/Clay
- Quarries/Strip Mines/Gravel Pits
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Pasture/Hay
- Row Crops
- Urban/Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetlands

4,000 2,000 0 4,000 Feet

Land Use
DCG Moore Compressor Station
6890 Highway 221
Moore, South Carolina

Note
Land use data from the National Land Cover Dataset 1992 Vogelmann, J.E., S.M. Howard, L. Yang, C. R. Larson, B. K. Wylie, and J. N. Van Driel, 2001. Completion of the 1990's National Land Cover Data Set for the conterminous United States. Photogrammetric Engineering and Remote Sensing 67:650-662.

Geosyntec consultants

Columbia, South Carolina | DECEMBER 2015

Figure 3

P:\PR\11\A\ArkModeling\DCG\T2C_GIS\MXD\Reports_Land_Use.mxd

APPENDIX A

SCDHEC Air Quality Construction Permit Application Forms

RECEIVED
DEC 21 2015
BUREAU OF AIR QUALITY

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Bureau of Air Quality
Construction Permit Application
Facility Information

FACILITY IDENTIFICATION	
SC Air Permit Number (8-digits only) *(Leave blank if one has never been assigned)* 2060 - 0528	Application Date December 2015
Facility Name *(This should be the name used to identify the facility at the physical address listed below)* Moore Compressor Station	Facility Federal Tax Identification Number *(Established by the U.S. Internal Revenue Service to identify a business entity)* 57-0655473

FACILITY PHYSICAL ADDRESS		
Physical Address: 6890 Highway 221		County: Spartanburg
City: Moore	State: SC	Zip Code: 29369
Facility Coordinates *(Facility coordinates should be based at the front door or main entrance of the facility.)*		
Latitude: 34°49'32.18"N	Longitude: 81°59'45.39"W	☐ NAD27 *(North American Datum of 1927)* Or ☒ NAD83 *(North American Datum of 1983)*

CO-LOCATION DETERMINATION
Are there other facilities in close proximity that could be considered co-located? ☒ No ☐ Yes*
List potential co-located facilities, including air permit numbers if applicable:

**If yes, please submit co-location applicability determination details in an attachment to this application.*

COMMUNITY OUTREACH
What are the potential air issues and community concerns? Please provide a brief description of potential air issues and community concerns about the entire facility and/or specific project. Include how these issues and concerns are being addressed, if the community has been informed of the proposed construction project, and if so, how they have been informed. N/A

FACILITY'S PRODUCTS / SERVICES	
Primary Products / Services *(List the primary product and/or service)* Natural Gas Transmission	
Primary SIC Code *(Standard Industrial Classification Codes)* 4922	Primary NAICS Code *(North American Industry Classification System)* 486210
Other Products / Services *(List any other products and/or services)* N/A	
Other SIC Code(s): N/A	Other NAICS Code(s): N/A

AIR PERMIT FACILITY CONTACT *(Person at the facility who can answer technical questions about the facility and permit application.)*			
Title/Position: Env. Program Manager	Salutation: Mr.	First Name: Rick	Last Name: Kopec
Mailing Address: 220 Operation Way, MC J48			
City: Cayce		State: SC	Zip Code: 29033
E-mail Address: richard.l.kopec@dom.com		Phone No.: 803.726.3707	Cell No.: 803.391.1077

One hard copy of the signed permit will be mailed to the designated Air Permit Contact.
If additional individuals need electronic copies of the permit, please provide their names and e-mail addresses.

Name	E-mail Address
Brandon Mogan, PE	BMogan@geosyntec.com

COPY

D H E C

South Carolina Department of Health and Environmental Control

Bureau of Air Quality
Construction Permit Application
Facility Information

CONFIDENTIAL INFORMATION / DATA
Does this application contain confidential information or data? ☒ No ☐ Yes*

**If yes, include a sanitized version of the application for public review and ONLY ONE COPY OF CONFIDENTIAL INFORMATION SHOULD BE SUBMITTED*

LIST OF FORMS INCLUDED (Identify all forms included in the application package)	
Form Name	**Included (Y/N)**
Expedited Review Request (DHEC Form 2212)	☐ Yes ☒ No
Equipment/Processes (DHEC Form 2567)	☒ Yes
Emissions (DHEC Form 2569)	☒ Yes
Regulatory Review (DHEC Form 2570)	☒ Yes
Emissions Point Information (DHEC Form 2573)	☒ Yes ☐ No (If No, Explain)

OWNER OR OPERATOR			
Title/Position: General Manager	Salutation: Mr.	First Name: Keith	Last Name: Windle
Mailing Address: 220 Operations Way, MC J48			
City: Cayce		State: SC	Zip Code: 29033
E-mail Address: keith.windle@dom.com		Phone No.: 803.726.3715	Cell No.: 804.836.5353

OWNER OR OPERATOR SIGNATURE

I certify, to the best of my knowledge and belief, that no applicable standards and/or regulations will be contravened or violated. I certify that any application form, report, or compliance certification submitted in this permit application is true, accurate, and complete based on information and belief formed after reasonable inquiry. I understand that any statements and/or descriptions, which are found to be incorrect, may result in the immediate revocation of any permit issued for this application.

K-W 2 — 12/4/15

Signature of Owner or Operator — Date

PERSON AND/OR FIRM THAT PREPARED THIS APPLICATION (If not the same person as the Professional Engineer who has reviewed and signed this application.)			
Consulting Firm Name: Geosyntec Consultants, Inc.			
Title/Position: Senior Engineer	Salutation: Mr.	First Name: Brandon	Last Name: Mogan
Mailing Address: 1331 Elmwood Avenue, Suite 310			
City: Columbia		State: SC	Zip Code: 29201
E-mail Address: BMogan@geosyntec.com		Phone No.: 803.724.3263	Cell No.: 803.422.5251
SC Professional Engineer License/Registration No. (if applicable): 30362			

PROFESSIONAL ENGINEER INFORMATION			
Consulting Firm Name: Geosyntec Constultants, Inc.			
Title/Position: Senior Engineer	Salutation: Mr.	First Name: Brandon	Last Name: Mogan
Mailing Address: 1331 Elmwood Avenue, Suite 310			
City: Columbia		State: SC	Zip Code: 29201
E-mail Address: BMogan@geosyntec.com		Phone No.: 803.724.3263	Cell No.: 803.422.5251
SC License/Registration No.: 30362			

PROFESSIONAL ENGINEER SIGNATURE

I have placed my signature and seal on the engineering documents submitted, signifying that I have reviewed this construction permit application as it pertains to the requirements of *South Carolina Regulation 61-62, Air Pollution Control Regulations and Standards.*

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 30362 BRANDON A. MOGAN

12/7/15

Signature of Professional Engineer — Date

SOUTH CAROLINA GEOSYNTEC CONSULTANTS, INC. No. 773 CERTIFICATE OF AUTHORIZATION

D H E C

South Carolina Department of Health and Environmental Control

Bureau of Air Quality
Construction Permit Application
Equipment / Processes

APPLICATION IDENTIFICATION		
(Please ensure that the information list in this table is the same on all of the forms and required information submitted in this construction permit application package.)		
Facility Name *(This should be the name used to identify the facility)* Moore Compressor Station	SC Air Permit Number (8-digits only) *(Leave blank if one has never been assigned)* 2060 - 0528	Application Date December 2015

PROJECT DESCRIPTION
Brief Project Description (What, why, how, etc.): The purpose of this application is to obtain a permit to construct additional natural gas compressors at the Moore, SC station. The proposed primary emission sources at the facility include two natural gas-fired combustion turbine compressor sets. The facility also includes several exempt emission sources.

ATTACHMENTS	
☒ Process Flow Diagram	Location in Application: Appendix C
☒ Detailed Project Description	Location in Application: Refer to report narrative

EQUIPMENT / PROCESS INFORMATION

Equipment ID Process ID	Action	Equipment / Process Description	Maximum Design Capacity (Units)	Control Device ID(s)	Pollutants Controlled (Include CAS#)	Capture System Efficiency and Description	Emission Point ID(s)
M-3	☒ Add ☐ Remove ☐ Modify ☐ Other	16.25 MMBtu/hr Simple-Cycle Natural Gas-Fired Combustion Turbine	16.25 MMBtu/hr	N/A	N/A	N/A	S-3
M-4	☒ Add ☐ Remove ☐ Modify ☐ Other	16.25 MMBtu/hr Simple-Cycle Natural Gas-Fired Combustion Turbine	16.25 MMBtu/hr	N/A	N/A	N/A	S-4
	☐ Add ☐ Remove ☐ Modify ☐ Other						
	☐ Add ☐ Remove ☐ Modify ☐ Other						

CONTROL DEVICE INFORMATION					
Control Device ID	Action	Control Device Description	Maximum Design Capacity (Units)	Inherent/Required/Voluntary (Explain)	Destruction/Removal Efficiency Determination
	☐ Add ☐ Remove ☐ Modify ☐ Other				
	☐ Add ☐ Remove ☐ Modify ☐ Other				
	☐ Add ☐ Remove ☐ Modify ☐ Other				
	☐ Add ☐ Remove ☐ Modify ☐ Other				
	☐ Add ☐ Remove ☐ Modify ☐ Other				

N/A

RAW MATERIAL AND PRODUCT INFORMATION			
Equipment ID Process ID Control Device ID	Raw Material(s)	Product(s)	Fuels Combusted
M-3	Natural Gas	Natural Gas	Natural Gas
M-4	Natural Gas	Natural Gas	Natural Gas

MONITORING AND REPORTING INFORMATION					
Equipment ID Process ID Control Device ID	Pollutant(s)/Parameter(s) Monitored	Monitoring Frequency	Reporting Frequency	Monitoring/Reporting Basis	Averaging Period(s)
M-3	N/A	N/A	N/A	N/A	N/A
M-4	N/A	N/A	N/A	N/A	N/A

D H E C

South Carolina Department of Health and Environmental Control

Bureau of Air Quality
Construction Permit Application
Emissions

APPLICATION IDENTIFICATION *(Please ensure that the information list in this table is the same on all of the forms and required information submitted in this construction permit application package.)*		
Facility Name *(This should be the name used to identify the facility)*	SC Air Permit Number (8-digits only) *(Leave blank if one has never been assigned)*	Application Date
Moore Compressor Station	2060 - 0528	December 2015

ATTACHMENTS *(Check all the appropriate checkboxes if included as an attachment)*	
☒ Sample Calculations, Emission Factors Used, etc.	☒ Detailed Explanation of Assumptions, Bottlenecks, etc.
☒ Supporting Information: Manufacturer's Data, etc.	☐ Source Test Information
☐ Details on Limits Being Taken for Limited Emissions	☐ NSR Analysis

SUMMARY OF PROJECTED CHANGE IN FACILITY WIDE POTENTIAL EMISSIONS
(Calculated at maximum design capacity.)

Pollutants	Emission Rates Prior to Construction / Modification (tons/year)			Emission Rates After Construction / Modification (tons/year)		
	Uncontrolled	Controlled	Limited	Uncontrolled	Controlled	Limited
Particulate Matter (PM)	0.9	No Controls	No Limits	1.8	No Controls	No Limits
Particulate Matter <10 Microns (PM_{10})	0.9			1.8		
Particulate Matter <2.5 Microns ($PM_{2.5}$)	0.9			1.8		
Sulfur Dioxide (SO_2)	0.1			0.1		
Nitrogen Oxides (NO_x)	80.2			165.5		
Carbon Monoxide (CO)	130.2			268.9		
Volatile Organic Compounds (VOC)	2.4			13.4		
Lead (Pb)	-			-		
Highest HAP Prior to Construction (CAS #: 50-00-0)	0.12			0.21		
Highest HAP After Construction (CAS #: 110-54-3)	-			0.36		
Total HAP Emissions*	0.17			0.66		

Include emissions from exempt equipment and emission increases from process changes that were exempt from construction permits.
(*All HAP emitted from the various equipment or processes must be listed in the appropriate "Potential Emission Rates at Maximum Design Capacity" Table)

POTENTIAL EMISSION RATES AT MAXIMUM DESIGN CAPACITY									
Equipment ID / Process ID	Emission Point ID	Pollutants (Include CAS #)	Calculation Methods / Limits Taken / Other Comments	Uncontrolled		Controlled		Limited	
				lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr

See Appendix B

D H E C

South Carolina Department of Health and Environmental Control

Bureau of Air Quality
Construction Permit Application
Regulatory Review

APPLICATION IDENTIFICATION *(Please ensure that the information list in this table is the same on all of the forms and required information submitted in this construction permit application package.)*		
Facility Name *(This should be the name used to identify the facility)*	SC Air Permit Number (8-digits only) *(Leave blank if one has never been assigned)*	Application Date
Moore Compressor Station	2060 - 0528	December 2015

STATE AND FEDERAL AIR POLLUTION CONTROL REGULATIONS AND STANDARDS
(If not listed below add any additional regulations that are triggered.)

Regulation	Applicable		Include all limits, work practices, monitoring, record keeping, etc.		
	Yes	No	Explain Applicability Determination	List the specific limitations and/or requirements that apply.	How will compliance be demonstrated?
Regulation 61-62.1, Section II(E) Synthetic Minor Construction Permits	☐	☒	Major Source	N/A	N/A
Regulation 61-62.1, Section II(G) Conditional Major Operating Permits	☐	☒	Major Source	N/A	N/A
Regulation 61-62.5, Standard No. 1 Emissions from Fuel Burning Operations	☐	☒	No sources in this applicable category. See Report Section 4.4.1	N/A	N/A
Regulation 61-62.5, Standard No. 2 Ambient Air Quality Standards	☒	☐	See Report Section 4.4.2	See Report Section 4.4.2	See Report Section 4.4.2
Regulation 61-62.5, Standard No. 3 Waste Combustion and Reduction	☐	☒	Project does not contain any waste combustion. See section 4.4.3	N/A	N/A
Regulation 61-62.5, Standard No. 4 Emissions from Process Industries	☒	☐	See Report Section 4.4.4	Opacity < = 20%	See Report Section 4.4.4
Regulation 61-62.5, Standard No. 5 Volatile Organic Compounds	☐	☒	Project does not contain applicable source category. See Report Section 4.4.5	N/A	N/A
Regulation 61-62.5, Standard No. 5.2 Control of Oxides of Nitrogen	☒	☐	See Report Section 4.4.6	See Report Section 4.4.6	See Report Section 4.4.6
Regulation 61-62.5, Standard No. 7 Prevention of Significant Deterioration*	☒	☐	See Report Section 4.4.7	See Report Section 4.4.7	See Report Section 4.4.7
Regulation 61-62.5, Standard No. 7.1 Nonattainment New Source Review*	☐	☒	Not in nonattainment area.	N/A	N/A
Regulation 61-62.5, Standard No. 8 Toxic Air Pollutants	☐	☒	See Report Section 4.4.8	See Report Section 4.4.8	See Report Section 4.4.8
Regulation 61-62.70 Title V Operating Permit Program	☒	☐	Facility-wide emissions are greater than major source thresholds for two pollutants: CO and NOx	See Report Section 4.1.3	See Report Section 4.1.3

STATE AND FEDERAL AIR POLLUTION CONTROL REGULATIONS AND STANDARDS *(If not listed below add any additional regulations that are triggered.)*					
Regulation	**Applicable**		**Include all limits, work practices, monitoring, record keeping, etc.**		
	Yes	**No**	**Explain Applicability Determination**	**List the specific limitations and/or requirements that apply.**	**How will compliance be demonstrated?**
Regulation 61-62.72 Acid Rain	☐	☒	No sources in this applicable category.	N/A	N/A
Regulation 61-62.96 Nitrogen Oxides Budget Trading Program	☐	☒	No sources in this applicable category.	N/A	N/A
Regulation 61-62.99 Nitrogen Oxides Budget Program Requirements for Stationary Sources Not In the Trading Program	☐	☒	No sources in this applicable category.	N/A	N/A
40 CFR Part 64 - Compliance Assurance Monitoring (CAM)	☐	☒	No sources in this applicable category.	N/A	N/A
40 CFR 60 Subpart A - General Provisions	☒	☐	See Report Section 4.2.1	N/A	N/A
40 CFR 60 Subparts D, Db, and Dc – NSPS for Steam Generating Units	☐	☒	See Report Section 4.2.2	N/A	N/A
40 CFR 60 Subpart K, Ka, and Kb – NSPS for Volatile Organic Liquid Storage Vessels	☐	☒	See Report Section 4.2.3	N/A	N/A
40 CFR Part 60, Subpart GG – NSPS for Stationary Gas Turbines	☐	☒	See Report Section 4.2.4	N/A	N/A
40 CFR Part 60, Subpart IIII – Stationary Compression Ignition Engines	☐	☒	No sources in this applicable category.	N/A	N/A
40 CFR 60 Subpart JJJJ – Stationary Spark Ignition Combustion Engines	☐	☒	No sources in this applicable category.	N/A	N/A
40 CFR 60 Subpart KKKK – Stationary Gas Turbines	☒	☐	See Report Section 4.2.5	See Report Section 4.2.5	See Report Section 4.2.5
40 CFR 60 Subpart OOOO – NSPS for Crude Oil and Natural Gas Production, and Transmission and Distribution	☐	☒	See Report Section 4.2.6	N/A	N/A
Other 40 CFR Part 60 Subparts	☐	☒	See Report Section 4.2.9	N/A	N/A
40 CFR 61 Subpart A - General Provisions	☐	☒	No pollutant-specific standards are applicable at the facility	N/A	N/A
40 CFR 63 Subpart A - General Provisions	☐	☒	See Report Section 4.3.1	See Report Section 4.3.1	See Report Section 4.3.1
40 CFR Part 63, Subpart HH – NESHAP for Oil and Natural Gas Production Facilities	☐	☒	See Report Section 4.3.2	N/A	N/A

STATE AND FEDERAL AIR POLLUTION CONTROL REGULATIONS AND STANDARDS *(If not listed below add any additional regulations that are triggered.)*					
Regulation	**Applicable**		**Include all limits, work practices, monitoring, record keeping, etc.**		
	Yes	**No**	**Explain Applicability Determination**	**List the specific limitations and/or requirements that apply.**	**How will compliance be demonstrated?**
40 CFR Part 63, Subpart HHH – NESHAP for Natural Gas Transmission and Storage Facilities	☐	☒	See Report Section 4.3.3	N/A	N/A
40 CFR Part 63, Subpart EEEE – Organic Liquids Distribution (non-gasoline)	☐	☒	N/A	N/A	N/A
40 CFR Part 63, Subpart YYYY – NESHAP for Stationary Combustion Turbines	☐	☒	See Report Section 4.3.4	N/A	N/A
40 CFR Part 63, Subpart ZZZZ – Reciprocating Internal Combustion Engines	☐	☒	No sources in this applicable category.	N/A	N/A
40 CFR Part 63, Subpart DDDDD – NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters	☐	☒	See Report Section 4.3.5	N/A	N/A
40 CFR Part 63, Subpart JJJJJJ – NESHAP for Industrial, Commercial, and Institutional Boilers at Area Sources	☐	☒	See Report Section 4.3.6	N/A	N/A
Other 40 CFR 63 Subparts	☐	☒	See Report 4.3.7	N/A	N/A

* Green House Gas emissions must be quantified if these regulations are triggered.

D H E C

South Carolina Department of Health and Environmental Control

Bureau of Air Quality
Emission Point Information

A. APPLICATION IDENTIFICATION	
1. Facility Name: Moore Compressor Station	
2. SC Air Permit Number (if known; 8-digits only): 2060 - 0528	3. Application Date: December 2015
4. Project Description: The purpose of this application is to obtain a permit to construct two (2) natural gas compressors at the Moore, SC station. The primary emission sources at the facility will be the two (2) proposed and two (2) existing Saturn 10 simple-cycle natural gas-fired combustion turbine compressor sets.	

B. FACILITY INFORMATION	
1. Is your company a Small Business? ☐ Yes ☒ No	2. If a Small Business or small government facility, is Bureau assistance being requested? ☐ Yes ☒ No
3. Are other facilities collocated for air compliance? ☐ Yes ☒ No	4. If Yes, provide permit numbers of collocated facilities:

C. AIR CONTACT			
Consulting Firm Name (if applicable): Geosyntec Consultants, Inc.			
Title/Position: Engineer	Salutation: Mr.	First Name: Brandon	Last Name: Mogan
Mailing Address: 1331 Elmwood Avenue, Suite 310			
City: Columbia		State: SC	Zip Code: 29201
E-mail Address: BMogan@geosyntec.com		Phone No.: 803.724.3263	Cell No.: 803.422.5251

D. EMISSION POINT DISPERSION PARAMETERS
Source data requirements are based on the appropriate source classification. Each emission point is classified as a point, area, volume, or flare source. Contact the Bureau of Air Quality for clarification of data requirements. Include sources on a scaled site map. Also, a picture of area or volume sources would be helpful but is not required. A user generated document or spreadsheet may be substituted in lieu of this form provided all of the required emission point parameters are submitted in the same order, units, etc. as presented in these tables.
Abbreviations / Units of Measure: UTM = Universal Transverse Mercator; °N = Degrees North; °W = Degrees West; m = meters; AGL = Above Ground Level; ft = feet; ft/s = feet per second; ° = Degrees; °F = Degrees Fahrenheit

E. POINT SOURCE DATA

(Point sources such as stacks, chimneys, exhaust fans, and vents.)

Emission Point ID	Description/Name	Point Source Coordinates Projection: NAD83				Release Height AGL (ft)	Temp. (°F)	Exit Velocity (ft/s)	Inside Diameter (ft)	Discharge Orientation	Rain Cap? (Y/N)	Distance To Nearest Property Boundary (ft)	Building		
		UTM E (m)	UTM N (m)	Lat (°N)	Long (°W)								Height (ft)	Length (ft)	Width (ft)
S-3	Turbine M-3 (Stack S-3)	408941.2	3854241.5			25	933	154.8	2	Vertical	N	See Modeling Files	See Modeling Files	See Modeling Files	See Modeling Files
S-4	Turbine M-4 (Stack S-4)	408944.7	3854250.1			25	933	154.8	2	Vertical	N	See Modeling Files	See Modeling Files	See Modeling Files	See Modeling Files

F. AREA SOURCE DATA

(Area sources such as storage piles, and other sources that have low level or ground level releases with no plumes.)

Emission Point ID	Description/Name	Area Source Coordinates Projection:				Release Height AGL (ft)	Easterly Length (ft)	Northerly Length (ft)	Angle From North (°)	Distance To Nearest Property Boundary (ft)
		UTM E (m)	UTM N (m)	Lat (°N)	Long (° W)					
	N/A									

G. VOLUME SOURCE DATA

(Volume sources such as building fugitives that have initial dispersion vertical depth prior to release.)

Emission Point ID	Description/Name	Volume Source Coordinates Projection:				Release Height AGL (ft)	Initial Horizontal Dimension (ft)	Initial Vertical Dimension (ft)	Distance To Nearest Property Boundary (ft)
		UTM E (m)	UTM N (m)	Lat (°N)	Long (° W)				
	N/A								

Bureau of Air Quality
Emission Point Information

H. FLARE SOURCE DATA
(Point sources where the combustion takes place at the tip of the stack.)

Emission Point ID	Description/Name	Flare Source Coordinates Projection:				Release Height AGL (ft)	Heat Release Rate (BTU/hr)	Distance To Nearest Property Boundary (ft)	Building		
		UTM E (m)	UTM N (m)	Lat (°N)	Long (° W)				Height (ft)	Length (ft)	Width (ft)
	N/A										

I. AREA CIRCULAR SOURCE DATA

Emission Point ID	Description/Name	Area Circular Source Coordinates Projection:				Release Height AGL (ft)	Radius of Area (ft)	Distance To Nearest Property Boundary (ft)
		UTM E (m)	UTM N (m)	Lat (°N)	Long (° W)			
	N/A							

J. AREA POLY SOURCE DATA

Emission Point ID	Description/Name	Area Poly Source Coordinates Projection:		Release Height AGL (ft)	Number of Vertices
		UTM E (m)	UTM N (m)		
	N/A				

K. OPEN PIT SOURCE DATA

Emission Point ID	Description/Name	Open Pit Source Coordinates Projection:		Release Height AGL (ft)	Easterly Length (ft)	Northerly Length (ft)	Volume (ft^3)	Angle From North (°)
		UTM E (m)	UTM N (m)					
	N/A							

L. EMISSION RATES						
Emission Point ID	Pollutant Name	CAS #	Emission Rate (lb/hr)	Same as Permitted (1)	Controlled or Uncontrolled	Averaging Period
S-3	NOx	N/A	9.74	☒ Yes ☐ No	Uncontrolled	1-hr, Annual
S-3	CO	630-08-0	16.49	☒ Yes ☐ No	Uncontrolled	1-hr, 8-hr
S-4	NOx	N/A	9.74	☒ Yes ☐ No	Uncontrolled	1-hr, Annual
S-4	CO	630-08-0	16.49	☒ Yes ☐ No	Uncontrolled	1-hr, 8-hr
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		
				☐ Yes ☐ No		

(1) Any difference between the rates used for permitting and the air compliance demonstration must be explained in the application report.

APPENDIX B

Emissions Calculations

Equipment ID	M-1[1]		M-2[1]		M-3		M-4		IA-EG1[1]		IA-ST1[3]		IA-ST2[1]		IA-ST3[3]		IA-ST4[2]		IA-FBC[3]		IA-PD[3]		IA-WSD[3]		IA-BD[3]		IA-EL[3]		Facility-wide Total (Prior to Construction)		Facility-wide Total (After Construction)	
Emission Unit Description	Combustion Turbine		Combustion Turbine		Combustion Turbine		Combustion Turbine		Emergency Generator		Lube Oil Storage Tank		Underground Oily Water Storage Tank		Aboveground Condensate Storage		Underground Oily Water Storage Tank		Catalytic Heaters, Comfort Heater		Pneumatic Devices		Wet Seal Degassing		Equipment Blowdowns		Equipment Leaks					
Model Number	Saturn 10-1300		Saturn 10-1300		Saturn 10-1400		Saturn 10-1400																									
Fuel	Natural gas		Natural gas		Natural gas		Natural gas		Natural Gas										Natural gas		Natural Gas											
Stack ID	S-1		S-2		S-3		S-4		Not Assigned		Not Assigned		Not Assigned		Not Assigned		Not Assigned		Not Assigned		Not Assigned		N/A		N/A		N/A					
Capacity	15.21	MMBtu/hr	15.21	MMBtu/hr	1488	HP	1488	HP	125	kW	200	gallons	1,000	gallon	550	gallon	1,000	gallon	N/A		N/A		N/A		N/A		N/A					
Pollutants	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)[4]	(tons/yr)	(lb/hr)[4]	(tons/yr)	(lb/hr)[4]	(tons/yr)	(lb/hr)[4]	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
NOx	9.13	40.0	9.13	40.0	9.74	42.7	9.74	42.7	0.55	1.4E-01									1.7E-02	7.3E-02									18.82	80.2	38.30	165.5
CO	14.83	65.0	14.83	65.0	16.49	69.3	16.49	69.3	1.10	0.3									1.4E-02	6.2E-02									30.78	130.2	63.76	268.9
SO_2	8.58E-03	3.8E-02	8.58E-03	3.8E-02	3.00E-03	1.3E-02	3.00E-03	1.3E-02	1.18E-03	3.0E-04									1.0E-04	4.4E-04									0.02	0.1	0.02	0.1
VOC	3.19E-02	0.1	3.19E-02	0.1	0.53	2.0	0.53	2.0	2.01	5.0E-01	5.61E-03	2.5E-02	3.77E-03	1.6E-02	9.71E-03	4.3E-02	3.77E-03	1.6E-02	9.2E-04	4.0E-03	0.33	1.5	0.15	0.7	0.35	1.5	1.11	4.9	2.44	2.4	5.11	13.4
PM	0.10	0.4	0.10	0.4	0.10	0.4	0.10	0.4	2.01E-02	5.0E-03									1.3E-03	5.6E-03									0.22	0.9	0.42	1.8
PM_{10}	0.10	0.4	0.10	0.4	0.10	0.4	0.10	0.4	2.01E-02	5.0E-03									1.3E-03	5.6E-03									0.22	0.9	0.42	1.8
$PM_{2.5}$	0.10	0.4	0.10	0.4	0.10	0.4	0.10	0.4	2.01E-02	5.0E-03									1.3E-03	5.6E-03									0.22	0.9	0.42	1.8
CO_2	1,673	7,328	1,673	7,328	1,740	7,621	1,740	7,621	221.27	55.3									20.12	88.1	0.18	0.8	7.97E-02	0.3	1.85E-01	0.8	5.82E-01	2.5	3,587	14,798	7,069	30,047
CH_4	0.13	0.6	0.13	0.6	0.03	0.1	0.03	0.1	2.51	0.6									3.9E-04	1.7E-03	5.14	22.5	2.34	10.2	5.43	23.8	17.07	74.7	8.99	29.0	32.81	133.3
N_2O	4.56E-02	0.2	4.56E-02	0.2	3.28E-03	1.4E-02	3.28E-03	1.4E-02											3.7E-04	1.6E-03									0.09	0.4	0.10	0.4
GHG (mass)	1,673	7,329	1,673	7,329	1,740	7,622	1,740	7,622	223.78	55.9									20.12	88.1	5.31	23.3	2.42	10.6	5.61	24.6	17.65	77.3	3,596	14,827	7,102	30,181
GHG (CO_2e)	1,690	7,402	1,690	7,402	1,742	7,629	1,742	7,629	284.13	71.0									20.24	88.6	128.55	563	58.5	256.3	135.84	595.0	427.22	1,871.2	3,839	15,642	7,918	33,508
Formaldehyde[5]	1.1E-02	4.7E-02	1.1E-02	4.7E-02	1.1E-02	4.7E-02	1.1E-02	4.7E-02	1.06E-01	2.7E-02									1.3E-05	5.5E-05									0.13	0.12	0.15	0.21
Hexane[5]																			3.0E-04	1.3E-03	0.01	0.06	6.32E-03	0.03	0.01	0.06	0.05	0.20			0.08	0.36
Total HAP	1.6E-02	6.8E-02	1.6E-02	6.8E-02	1.5E-02	6.7E-02	1.5E-02	6.7E-02	1.45E-01	3.6E-02									3.2E-04	1.4E-03	0.01	0.06	6.32E-03	0.03	0.01	0.06	0.05	0.20	0.18	0.17	0.29	0.66

Notes

1) Existing equipment that is not being modified as part of this construction permit application

2) IA-ST4 is proposed to be substantially similar to IA-ST2. As such, new emission calculations have not been provided for IA-ST4 as a part of this application.

3) Existing equipment that is being modified as part of this construction permit application to accommodate the proposed combustion turbines.

4) lb/hr = tons/yr * 2,000 lb/ton / 8,760 hr/yr

5) Formaldehyde was the highest single HAP on a facility-wide basis prior to construction. After construction, hexane is the highest single HAP on a facility-wide basis. However, it may not be the highest single HAP on an emission unit level.

Solar Saturn 10-1400 Combustion Turbine
Potential to Emit Calculations

Source Designation:	M-3
Manufacturer:	Solar Turbines
Model:	Saturn 10-1400
Fuel Used:	Natural Gas
Control Device:	None
Emission Point Name:	S-3

Manufacturer Performance Data:

Lower Heating Value (LHV) (Btu/scf):	939.2	[1]
Lower Heating Value (LHV) (Btu/lbm):	20,612	[1]
Fuel Flow (lbm/hr):	788	[1]
Fuel Flow (scfm):	288.32	[1]
Fuel Flow (scf/hr):	17,299	[1]
Heat Input (LHV) (MMBtu/hr):	16.25	[1]
Emission Rate Data, Full Load		
NOx Emission Rate (lbs/hr):	9.74	[1]
CO Emission Rate (lbs/hr):	15.82	[1]
UHC Emission Rate (lbs/hr):	2.26	[1]
SO2 Emission Rate (lbs/hr):	0.003	[1]
Emission Rate Data, Startup		
NOx Emissions (lb/event):	0.8	[2]
CO Emissions (lb/event):	1.7	[2]
UHC Emissions (lb/event):	0.3	[2]
Emission Rate Data, Shutdown		
NOx Emissions (lb/event):	0.8	[2]
CO Emissions (lb/event):	2.4	[2]
UHC Emissions (lb/event):	0.6	[2]

Notes:

[1] Performance data based on Solar Turbines Emission and Performance Data Estimates for Solar Saturn 10-1400 at 30°F.

[2] Startup/shutdown emissions data provided in 21 October 2015 e-mail from Trevor Miller, Solar Turbines, to DCG.

Operational Parameters:

Total Annual Hours of Operation (hr/yr):	8,760	-
Annual Number of Startups:	90	[1]
Approximate Duration of Startup (mins):	10	[2]
Annual Number of Shutdowns:	90	[1]
Approximate Duration of Shutdown (mins):	3	[3]

Notes:

[1] DCG-estimated annual number of unit startup/shutdowns.

[2] Approximate startup duration based on 21 October 2015 e-mail from Trevor Miller, Solar Turbines, to DCG.

[3] Approximate shutdown duration set at the conservative end of the typical range based on DCG experience.

Continued on next page

Criteria Pollutant & Greenhouse Gas Emissions Estimates

Pollutant	Emission Factors[1],[2] (lb/MMBtu)	Hourly Emission Rate, Excluding SU/SD[3],[4] (lb/hr)	Hourly Emission Rate, Including SU/SD[3],[5],[6] (lb/hr)	Maximum Hourly Emission Rate[7] (lb/hr)	Annual PTE, Excluding SU/SD[8] (tons/yr)	Annual PTE, Including SU/SD[6],[9] (tons/yr)	Maximum Annual PTE[10] (tons/yr)
NO_x	-	9.74	9.23	9.74	42.66	42.64	42.66
CO	-	15.82	16.49	16.49	69.29	69.32	69.32
SO_2	-	0.003	-	0.003	0.013	-	0.013
VOC	-	0.45	0.53	0.53	1.98	1.98	1.98
PM (Filterable + Condensable)	6.08E-03	9.88E-02	-	9.88E-02	0.43	-	0.43
PM_{10} (Filterable + Condensable)	6.08E-03	9.88E-02	-	9.88E-02	0.43	-	0.43
$PM_{2.5}$ (Filterable + Condensable)	6.08E-03	9.88E-02	-	9.88E-02	0.43	-	0.43
CO_2	107.08	1,740	-	1,740	7,621	-	7,621
CH_4	2.02E-03	3.28E-02	-	3.28E-02	0.14	-	0.14
N_2O	2.02E-04	3.28E-03	-	3.28E-03	0.014	-	0.014
Total GHG (mass basis) [11]	-	-	-	1,740	-	-	7,622
Total GHG (CO2e basis) [12]	-	-	-	1,742	-	-	7,629

Notes:

[1] PM, PM10, and PM2.5 emission factors from AP-42, 5th ed., Seciton 3.1: Stationary Gas Turbines, Table 3.1-2a (April 2000). Conservatively assume that PM = PM10 = PM2.5. Emission factors are adjusted to be based on LHV for consistency with manufacturer data by multiplying by a factor of LHV/HHV.

Natural Gas HHV from AP-42, 5th ed., Section 3.1 = 1,020 Btu/scf

[2] CO2, CH4, and N2O emission factors from 40 CFR Part 98 Subpart C, Table C-1: Default CO2 Emission Factors and High Heat Values for Various Types of Fuel, for natural gas combustion, converted from kg/MMBtu to lb/MMBtu. Emission factors are adjusted to be based on LHV for consistency with manufacturer data by multiplying by a factor of LHV/HHV.

Natural Gas HHV from 40 CFR Part 98 Subpart C, Table C-1 = 1,026 Btu/scf

[3] Hourly emission rates for NOx, CO, SO2, and UHC provided by manufacturer, based on full-load operation at 30°F. VOC emissions assoumed to be 20% of UHC emissions.

[4] Hourly emission rates for particulates, CO2, CH4, and N2O calculated using emission factors and unit heat input, i.e., Hourly Emission Rate (lb/hr) = Emission Factor (lb/MMBtu) * Heat Input (MMBtu/hr).

[5] Hourly Emission Rate, including SU/SD, estimated assuming that the unit is started and stopped in the same hour and that the unit runs at full-load for the remainder of the hour. Example calculation:
Hourly Emission Rate, Including SU/SD = Startup Emissions (lb/event) * 1 event/hr + Shutdown Emission (lb/event) * 1 event/hr + Hourly Emission Rate (lb/hr) * (60 - (Approx. Startup Duration + Approx. Shutdown Duration))/60.

[6] Startup/shutdown emissions data for SO2, particulates, CO2, CH4, and N2O are not available.

[7] The maximum hourly emission rate is the worst-case value between the Hourly Emission Rate, Excluding SU/SD, and the Hourly Emission Rate, Including SU/SD.

[8] Annual PTE, Excluding SU/SD (tons/yr) = Hourly Emission Rate, Excluding SU/SD (lb/hr) * 8,760 hrs/yr * 1 ton/2000 lbs.

[9] Annual PTE, Including SU/SD, estimated based on the anticipated annual number of unit startups and shutdowns, the approximate duration of each startup and shutdown, and assuming that the unit runs at full-load for the remainder of the year.

[10] Maximum Annual PTE is the worst-case value between the Annual PTE, Excluding SU/SD, and the Annual PTE, Including SU/SD.

[11] Total GHG (mass basis) = CO2 + CH4 + N2O

[12] Total GHG (CO2e basis) = CO2 + CH4 * CH4 Global Warming Potential (GWP) + N2O * N2O GWP. GWP for CH4 and N2O from 40 CFR Part 98, Subpart A, Table A-1: GWP CH4 = 25, GWP N2O = 298.

Continued on next page

Hazardous Air Pollutant Emission Factors and Potential Emission Calculations:

HAP	Emission Factor (LHV)[1] (lb/MMBtu)	Hourly Emission Rate[2] (lb/hr)	Annual PTE[3] (tons/yr)
1,3-Butadiene	3.96E-07	6.43E-06	2.82E-05
Acetaldehyde	3.68E-05	5.99E-04	2.62E-03
Acrolein	5.89E-06	9.58E-05	4.19E-04
Benzene	1.10E-05	1.80E-04	7.86E-04
Ethylbenzene	2.95E-05	4.79E-04	2.10E-03
Formaldehyde	6.54E-04	1.06E-02	4.65E-02
Naphthalene	1.20E-06	1.95E-05	8.52E-05
PAH	2.03E-06	3.29E-05	1.44E-04
Propylene Oxide	2.67E-05	4.34E-04	1.90E-03
Toluene	1.20E-04	1.95E-03	8.52E-03
Xylene	5.89E-05	9.58E-04	4.19E-03
	Total HAP	0.02	0.07

Notes:

[1] AP-42, 5th ed., Section 3.1: Stationary Gas Turbines, Table 3.1-3 (April 2000). Emission factors are adjusted to be based on LHV by multiplying by a factor of LHV/HHV.

Natural Gas HHV from AP-42, 5th ed., Section 3.1 = 1,020 Btu/scf

[2] Hourly Emission Rate (lb/hr) = Emission Factor (lb/MMBtu) * Heat Input (MMBtu/hr).

[3] Potential Emissions (tons/yr) = Potential Emissions (lb/hr) × 8,760 hrs/yr × 1 ton/2,000 lb.

Solar Saturn 10-1400 Combustion Turbine
Potential to Emit Calculations

Source Designation:	M-4
Manufacturer:	Solar Turbines
Model:	Saturn 10-1400
Fuel Used:	Natural Gas
Control Device:	None
Emission Point Name:	S-4

Manufacturer Performance Data:

Lower Heating Value (LHV) (Btu/scf):	939.2	[1]
Lower Heating Value (LHV) (Btu/lbm):	20,612	[1]
Fuel Flow (lbm/hr):	788	[1]
Fuel Flow (scfm):	288.32	[1]
Fuel Flow (scf/hr):	17,299	[1]
Heat Input (LHV) (MMBtu/hr):	16.25	[1]
Emission Rate Data, Full Load		
NOx Emission Rate (lbs/hr):	9.74	[1]
CO Emission Rate (lbs/hr):	15.82	[1]
UHC Emission Rate (lbs/hr):	2.26	[1]
SO2 Emission Rate (lbs/hr):	0.003	[1]
Emission Rate Data, Startup		
NOx Emissions (lb/event):	0.8	[2]
CO Emissions (lb/event):	1.7	[2]
UHC Emissions (lb/event):	0.3	[2]
Emission Rate Data, Shutdown		
NOx Emissions (lb/event):	0.8	[2]
CO Emissions (lb/event):	2.4	[2]
UHC Emissions (lb/event):	0.6	[2]

Notes:

[1] Performance data based on Solar Turbines Emission and Performance Data Estimates for Solar Saturn 10-1400 at 30°F.

[2] Startup/shutdown emissions data provided in 21 October 2015 e-mail from Trevor Miller, Solar Turbines, to DCG.

Operational Parameters:

Total Annual Hours of Operation (hr/yr):	8,760	-
Annual Number of Startups:	90	[1]
Approximate Duration of Startup (mins):	10	[2]
Annual Number of Shutdowns:	90	[1]
Approximate Duration of Shutdown (mins):	3	[3]

Notes:

[1] DCG-estimated annual number of unit startup/shutdowns.

[2] Approximate startup duration based on 21 October 2015 e-mail from Trevor Miller, Solar Turbines, to DCG.

[3] Approximate shutdown duration set at the conservative end of the typical range based on DCG experience.

Continued on next page

Criteria Pollutant & Greenhouse Gas Emissions Estimates

Pollutant	Emission Factors[1],[2] (lb/MMBtu)	Hourly Emission Rate, Excluding SU/SD[3],[4] (lb/hr)	Hourly Emission Rate, Including SU/SD[3],[5],[6] (lb/hr)	Maximum Hourly Emission Rate[7] (lb/hr)	Annual PTE, Excluding SU/SD[8] (tons/yr)	Annual PTE, Including SU/SD[6],[9] (tons/yr)	Maximum Annual PTE[10] (tons/yr)
NO_x	-	9.74	9.23	9.74	42.66	42.64	42.66
CO	-	15.82	16.49	16.49	69.29	69.32	69.32
SO_2	-	0.003	-	0.003	0.013	-	0.013
VOC	-	0.45	0.53	0.53	1.98	1.98	1.98
PM (Filterable + Condensable)	6.08E-03	9.88E-02	-	9.88E-02	0.43	-	0.43
PM_{10} (Filterable + Condensable)	6.08E-03	9.88E-02	-	9.88E-02	0.43	-	0.43
$PM_{2.5}$ (Filterable + Condensable)	6.08E-03	9.88E-02	-	9.88E-02	0.43	-	0.43
CO_2	107.08	1,740	-	1,740	7,621	-	7,621
CH_4	2.02E-03	3.28E-02	-	3.28E-02	0.14	-	0.14
N_2O	2.02E-04	3.28E-03	-	3.28E-03	0.014	-	0.014
Total GHG (mass basis) [11]	-	-	-	1,740	-	-	7,622
Total GHG (CO2e basis) [12]	-	-	-	1,742	-	-	7,629

Notes:

[1] PM, PM10, and PM2.5 emission factors from AP-42, 5th ed., Seciton 3.1: Stationary Gas Turbines, Table 3.1-2a (April 2000). Conservatively assume that PM = PM10 = PM2.5. Emission factors are adjusted to be based on LHV for consistency with manufacturer data by multiplying by a factor of LHV/HHV.

Natural Gas HHV from AP-42, 5th ed., Section 3.1 = 1,020 Btu/scf

[2] CO2, CH4, and N2O emission factors from 40 CFR Part 98 Subpart C, Table C-1: Default CO2 Emission Factors and High Heat Values for Various Types of Fuel, for natural gas combustion, converted from kg/MMBtu to lb/MMBtu. Emission factors are adjusted to be based on LHV for consistency with manufacturer data by multiplying by a factor of LHV/HHV.

Natural Gas HHV from 40 CFR Part 98 Subpart C, Table C-1 = 1,026 Btu/scf

[3] Hourly emission rates for NOx, CO, SO2, and UHC provided by manufacturer, based on full-load operation at 30°F. VOC emissions assoumed to be 20% of UHC emissions.

[4] Hourly emission rates for particulates, CO2, CH4, and N20 calculated using emission factors and unit heat input, i.e., Hourly Emission Rate (lb/hr) = Emission Factor (lb/MMBtu) * Heat Input (MMBtu/hr).

[5] Hourly Emission Rate, including SU/SD, estimated assuming that the unit is started and stopped in the same hour and that the unit runs at full-load for the remainder of the hour. Example calculation:
Hourly Emission Rate, Including SU/SD = Startup Emissions (lb/event) * 1 event/hr + Shutdown Emission (lb/event) * 1 event/hr + Hourly Emission Rate (lb/hr) * (60 - (Approx. Startup Duration + Approx. Shutdown Duration))/60.

[6] Startup/shutdown emissions data for SO2, particulates, CO2, CH4, and N2O are not available.

[7] The maximum hourly emission rate is the worst-case value between the Hourly Emission Rate, Excluding SU/SD, and the Hourly Emission Rate, Including SU/SD.

[8] Annual PTE, Excluding SU/SD (tons/yr) = Hourly Emission Rate, Excluding SU/SD (lb/hr) * 8,760 hrs/yr * 1 ton/2000 lbs.

[9] Annual PTE, Including SU/SD, estimated based on the anticipated annual number of unit startups and shutdowns, the approximate duration of each startup and shutdown, and assuming that the unit runs at full-load for the remainder of the year.

[10] Maximum Annual PTE is the worst-case value between the Annual PTE, Excluding SU/SD, and the Annual PTE, Including SU/SD.

[11] Total GHG (mass basis) = CO2 + CH4 + N2O

[12] Total GHG (CO2e basis) = CO2 + CH4 * CH4 Global Warming Potential (GWP) + N2O * N2O GWP. GWP for CH4 and N2O from 40 CFR Part 98, Subpart A, Table A-1: GWP CH4 = 25, GWP N2O = 298.

Continued on next page

Hazardous Air Pollutant Emission Factors and Potential Emission Calculations:

HAP	Emission Factor (LHV)[1] (lb/MMBtu)	Hourly Emission Rate[2] (lb/hr)	Annual PTE[3] (tons/yr)
1,3-Butadiene	3.96E-07	6.43E-06	2.82E-05
Acetaldehyde	3.68E-05	5.99E-04	2.62E-03
Acrolein	5.89E-06	9.58E-05	4.19E-04
Benzene	1.10E-05	1.80E-04	7.86E-04
Ethylbenzene	2.95E-05	4.79E-04	2.10E-03
Formaldehyde	6.54E-04	1.06E-02	4.65E-02
Naphthalene	1.20E-06	1.95E-05	8.52E-05
PAH	2.03E-06	3.29E-05	1.44E-04
Propylene Oxide	2.67E-05	4.34E-04	1.90E-03
Toluene	1.20E-04	1.95E-03	8.52E-03
Xylene	5.89E-05	9.58E-04	4.19E-03
	Total HAP	0.02	0.07

Notes:

[1] AP-42, 5th ed., Section 3.1: Stationary Gas Turbines, Table 3.1-3 (April 2000). Emission factors are adjusted to be based on LHV by multiplying by a factor of LHV/HHV.

Natural Gas HHV from AP-42, 5th ed., Section 3.1 = 1,020 Btu/scf

[2] Hourly Emission Rate (lb/hr) = Emission Factor (lb/MMBtu) * Heat Input (MMBtu/hr).

[3] Potential Emissions (tons/yr) = Potential Emissions (lb/hr) × 8,760 hrs/yr × 1 ton/2,000 lb.

EQUIRED

Estimate post-modification emissions from the 165 gallon lube oil storage tank (IA-ST1).

GIVEN

Turnovers per year =	4		*(Actual number of turnovers from 2014 SCDHEC Emissions Inventory (2) multiplied by a factor of 2 to account for addition of M-3 and M-4)*
Tank size =	200	gallons	
Throughput =	800	gallons	*(200 gallons * 4 turnovers per year)*
Contingency factor =	2.6		

SOLUTION

Actual Emissions:

Actual losses =	18.89	lb/yr	*(Actual emissions estimate from TANKS 4.0.9d, conservatively assume all losses are VOC)*

Scaled Up Potential Emissions:

Total VOC emissions =	49.1	lb/yr	*(18.89 lb/yr * 2.6)*
	5.61E-03	lb/hr	*(49.1 lb/yr / 8,760 hrs/yr)*
	2.5E-02	ton/yr	*(49.1 lb/yr / 2,000 lbs/ton)*

EQUIRED

Estimate post-modification emissions from the 500 gallon aboveground condensate storage tank (IA-ST3).

GIVEN

Turnovers per year =	2		*(Actual number of turnovers from 2014 SCDHEC Emissions Inventory (1) multiplied by a factor of 2 to account for addition of M-3 and M-4)*
Tank size =	550	gallons	
Throughput =	1,100	gallons	*(550 gallons * 2 turnovers per year)*

SOLUTION

Actual Emissions:

Actual losses =	32.72	lb/yr	*(Actual emissions from TANKS 4.0.9d, conservatively assume all losses are VOC)*
Safety factor =	2.6	safety factor	*(From Facility's Initial Title V Permit Application)*

Scaled Up Potential Emissions:

Total VOC emissions =	85.1	lb/yr	*(32.72 lb/yr * 2.6)*
	9.71E-03	lb/hr	
	4.3E-02	ton/yr	

REQUIRED

Estimate potential emissions from the exempt fuel combustion sources at the facility following installation of the two proposed catalytic heaters.

GIVEN

Fuel =	Natural Gas		
Maximum Run Hours =	8,760	hours/yr	
Equipment Description	Two new catalytic heaters (0.024 MMBtu/hr), two existing catalytic heaters (0.024 MMBtu/hr), and one existing HVAC unit (0.075 MMBtu/hr)		
No. of Catalytic Heaters =	4		
Catalytic Heaters Size =	0.024	MMBtu/hr	
No. of Comfort Heaters =	1		
Comfort Heater Size =	0.075	MMBtu/hr	
Total Fuel Combustion Heat Input Rating =	0.171	MMBtu/hr	
Higher Heating Value (HHV) of Fuel =	1,020	MMBtu/MMscf	
Max Hours of Operation =	8,760	hr/yr	
Max Natural Gas Usage =	1.68E-04	MMscf/hr	*(0.171 MMBtu/hr / 1,020 MMBtu/MMscf)*
Annual Fuel Use =	1.469	MMscf/yr	*(1.68E-04 MMscf/hr * 8,760 hr/yr)*
CO_2 GWP =	1		*(40 CFR 98 Table A-1)*
CH_4 GWP =	25		*(40 CFR 98 Table A-1)*
N_2O GWP =	298		*(40 CFR 98 Table A-1)*
Emission Factors			
NOx EF =	100	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-1, uncontrolled small boilers (<100 MMBtu/hr))*
CO EF =	84	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-1, uncontrolled small boilers (<100 MMBtu/hr))*
SO_2 EF =	0.6	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-2)*
VOC EF =	5.5	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-2)*
PM =	7.6	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-2)*
PM_{10} =	7.6	lb/MMscf	*(Conservatively assume PM = PM_{10} = $PM_{2.5}$)*
$PM_{2.5}$ =	7.6	lb/MMscf	*(Conservatively assume PM = PM_{10} = $PM_{2.5}$)*
CO_2 EF =	120,000	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-2)*
CH_4 EF =	2.3	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-2)*
N_2O EF =	2.2	lb/MMscf	*(Emission Factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-2)*

SOLUTION

Emission Calculations = Fuel use (MMscf/hr) x EF (lb/MMscf) x Number of Units = lb Pollutant/hr

NOx =	1.68E-02	lb/hr	7.3E-02	tpy
CO =	1.41E-02	lb/hr	6.2E-02	tpy
SO_2 =	1.01E-04	lb/hr	4.4E-04	tpy
VOC =	9.22E-04	lb/hr	4.0E-03	tpy
PM =	1.27E-03	lb/hr	5.6E-03	tpy
PM_{10} =	1.27E-03	lb/hr	5.6E-03	tpy
$PM_{2.5}$ =	1.27E-03	lb/hr	5.6E-03	tpy
CO_2 =	2.01E+01	lb/hr	88.1	tpy
CH_4 =	3.86E-04	lb/hr	1.7E-03	tpy
N_2O =	3.69E-04	lb/hr	1.6E-03	tpy

GHG Emissions (Mass) = CO_2 Emissions + CH_4 Emissions + N_2O Emissions
= 20.118 lb/hr + 3.86E-04 lb/hr + 3.69E-04 lb/hr
= 20.12 lb/hr
= 88.1 tons/yr

GHG Emissions (CO2e) = CO_2 Emissions * CO_2 GWP + CH_4 Emissions * CH_4 GWP
+ N_2O Emissions * N_2O GWP
= 20.118 lb/hr * 1 + 3.86E-04 lb/hr * 25 + 3.69E-04 lb/hr * 298
= 20.24 lb/hr
= 88.6 tons/yr

Continued on next page

HAP Emissions				
		Emission Factor*	Estimated Potential Emissions	
Pollutants	Pollutant Type	lb/MMscf	(lb/hr)	(tons/yr)
2-Methylnaphthalene	POM	2.4E-05	4.0E-09	1.8E-08
3-Methylchloranthrene	POM	1.8E-06	3.0E-10	1.3E-09
7,12-Dimethylbenz(a)anthracene	POM	1.6E-05	2.7E-09	1.2E-08
Acenaphthene	POM	1.8E-06	3.0E-10	1.3E-09
Acenaphthylene	POM	1.8E-06	3.0E-10	1.3E-09
Anthracene	POM	2.4E-06	4.0E-10	1.8E-09
Benz(a)anthracene	POM	1.8E-06	3.0E-10	1.3E-09
Benzene	HAP	2.1E-03	3.5E-07	1.5E-06
Benzo(a)pyrene	POM	1.2E-06	2.0E-10	8.8E-10
Benzo(b)fluoranthene	POM	1.8E-06	3.0E-10	1.3E-09
Benzo(g,h,i)perylene	POM	1.2E-06	2.0E-10	8.8E-10
Benzo(k)fluoranthene	POM	1.8E-06	3.0E-10	1.3E-09
Chrysene	POM	1.8E-06	3.0E-10	1.3E-09
Dibenzo(a,h)anthracene	POM	1.2E-06	2.0E-10	8.8E-10
Dichlorobenzene	HAP	1.2E-03	2.0E-07	8.8E-07
Fluoranthene	POM	3.0E-06	5.0E-10	2.2E-09
Fluorene	POM	2.8E-06	4.7E-10	2.1E-09
Formaldehyde	HAP	7.5E-02	1.3E-05	5.5E-05
Hexane	HAP	1.80	3.0E-04	1.3E-03
Indeno(1,2,3-cd)pyrene	POM	1.8E-06	3.0E-10	1.3E-09
Naphthalene	HAP	6.1E-04	1.0E-07	4.5E-07
Phenanathrene	POM	1.7E-05	2.9E-09	1.2E-08
Pyrene	POM	5.0E-06	8.4E-10	3.7E-09
Toluene	HAP	3.4E-03	5.7E-07	2.5E-06
Arsenic	HAP	2.0E-04	3.4E-08	1.5E-07
Beryllium	HAP	1.2E-05	2.0E-09	8.8E-09
Cadmium	HAP	1.1E-03	1.8E-07	8.1E-07
Chromium	HAP	1.4E-03	2.3E-07	1.0E-06
Cobalt	HAP	8.4E-05	1.4E-08	6.2E-08
Manganese	HAP	3.8E-04	6.4E-08	2.8E-07
Mercury	HAP	2.6E-04	4.4E-08	1.9E-07
Nickel	HAP	2.1E-03	3.5E-07	1.5E-06
Selenium	HAP	2.4E-05	4.0E-09	1.8E-08
Total POM	HAP	8.8E-05	1.5E-08	6.5E-08
Highest Single HAP	Hexane	1.80	3.0E-04	1.3E-03
Total HAP	-	1.89	3.2E-04	1.4E-03

*Emission factors from EPA AP-42, Chapter 1, Section 4, Table 1.4-3 (Organic Compounds) and Table 1.4-4 (Metals)

QUIRED

Estimate potential emissions from venting natural gas (NG) powered intermittent bleed (IB) pneumatic devices (PD) following completion of the project.

GIVEN

IB PD Emission Factor (IB PD EF) =	2.35	scf NG/hr-PD	*(40 CFR Part 98, Subpart W, Table W-3)*
No. of IB PD at Moore (IB PD Count) =	54	PD	*(Provided via email dated November 9, 2015)*
% CH_4 =	95.6%		*(Average from DCG Gas Quality Report, 2013-2014)*
% CO_2 =	1.2%		*(Average from DCG Gas Quality Report, 2013-2014)*
% VOC =	0.2%		*(Average from DCG Gas Quality Report, 2013-2014)*
% HAP =	0.01%		*(Hexane+, Average from DCG Gas Quality Report, 2013-2014)*
Assumed Leakage Time =	8760	hr/yr	*(24 hr/day * 365 days/yr)*
Specific Gravity of NG =	0.58		*(Average SG from DCG Gas Quality Report, 2013-2014)*
ρ_{air} =	0.0346	kg/cf	*(@ 60°F & 14 psia)*
ρ_{NG} =	0.0202	kg/cf	*(0.58 * 0.0346 kg/cf)*
ρ_{CH4} =	0.0192	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36 @60°F & 14 psia)*
ρ_{CO2} =	0.0526	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36 @60°F & 14 psia)*
CH_4 GWP =	25	tons CO2e/ton CH4	*(40 CFR Part 98, Subpart A, Table A-1)*
CO_2 GWP =	1	tons CO_2e/ton CO_2	*(40 CFR Part 98, Subpart A, Table A-1)*

SOLUTION

Estimate potential emissions of CH_4, CO_2, and VOC from the PDs at the facility generally following the methodology outlined in 40 CFR Part 98, Subpart W related to PDs (98.233(a)). The methodology in Subpart W has been modified to accommodate the estimation of VOC and HAP emissions from the PDs at the facility and to use 2013-2014 average gas composition data from the DCG Gas Quality Report.

IB PDs

1) Estimate the potential volume of NG vented from the IB PDs at the proposed facility.

IB PD Vol NG Emissions (V_{NG}) = IB PD Count * IB PD EF * 8760 hr/yr
= 54 PD * 2.35 scf NG/hr-PD * 8760 hr/yr
= 1,111,644 scf NG/yr

2) Estimate the potential volume of CH_4, CO_2, VOC, and HAP vented from the IB PDs at the proposed facility.

IB PD Vol CH4 Emissions (V_{CH4}) = V_{NG} * VOL_{CH4}
= 1,111,644 scf NG/yr * 0.956
= 1,062,732 scf CH4/yr

IB PD Vol CO2 Emissions (V_{CO2}) = V_{NG} * VOL_{CO2}
= 1,111,644 scf NG/yr * 0.012
= 13,229 scf CO2/yr

IB PD Vol VOC Emissions (V_{VOC}) = V_{NG} * VOL_{VOC}
= 1,111,644 scf NG/yr * 0.002
= 2,668 scf VOC/yr

IB PD Vol HAP Emissions (V_{HAP}) = V_{NG} * % HAP
= 1,111,644 scf NG/yr * 0.01%
= 111 scf HAP/yr

3) Given the density of NG, CH_4, and CO_2 along with the volumetric emissions of NG, CH_4, CO_2, and VOC, estimate the density of VOCs.

ρ_{VOC} = [(ρ_{NG} * V_{NG}) - (ρ_{CH4} * V_{CH4}) - (ρ_{CO2} * V_{CO2})] / V_{VOC}
= [(0.0202 kg/cf * 1,111,644 scf NG/yr) - (0.0192 kg/cf * 1,062,732 scf CH4/yr) - (0.0526 kg/cf * 13,229 scf CO2/yr)] / 2,668 scf VOC/yr
= 0.4963 kg/cf

ρ_{HAP} = 0.4963 kg/cf *(Assumed to be the same as ρ_{VOC})*

Continued on next page

Use the density of CH_4, CO_2, VOC, and HAP to estimate potential mass emissions of CH_4, CO_2, VOCs, and HAP from IB PDs at the facility.

IB PD Mass CH4 Emissions (M_{CH4}) = V_{CH4} * ρ_{CH4} * 1 ton/907.2 kg
= 1,062,732 scf CH4/yr * 0.0192 kg/cf * 1 ton/907.2 kg
= 22.5 tons CH4/yr

IB PD Mass CO2 Emissions (M_{CO2}) = V_{CO2} * ρ_{CO2} * 1 ton/907.2 kg
= 13,229 scf CO2/yr * 0.0526 kg/cf * 1 ton/907.2 kg
= 0.8 tons CO2/yr

IB PD Mass VOC Emissions (M_{VOC}) = V_{VOC} * ρ_{VOC} * 1 ton/907.2 kg
= 2,668 scf VOC/yr * 0.4963 kg/cf * 1 ton/907.2 kg
= 1.5 tons VOC/yr

IB PD Mass HAP Emissions (M_{HAP}) = V_{HAP} * ρ_{HAP} * 1 ton/907.2 kg
= 111 scf HAP/yr * 0.4963 kg/cf * 1 ton/907.2 kg
= 0.06 tons VOC/yr

5) Calculate potential GHG emissions from IB PDs at the facility on a CO_2 equivalent basis.

IB PD GHG CO_2e Emissions = M_{CH4} * CH_4 GWP + M_{CO2} * CO_2 GWP
= 22.5 tons CH4/yr * 25 tons CO2e/ton CH4 + 0.77 tons CO2/yr * 1 tons CO2e/ton CO2
= 563.1 tons CO_2e/yr

SUMMARY

Pollutant	IB PDs (tons/yr)	Total PDs (tons/yr)
CH_4	22.5	22.5
CO_2	0.8	0.8
GHG (mass basis)	23.3	23.3
GHG (CO_2e basis)	563.1	563.1
VOC	1.5	1.5
HAP	0.06	0.06

Note:

1) HAP emissions are based on the cumulative volume fraction of hydrocarbons that contain six or more carbon atoms (hexane+), thus they are a conservative estimate of HAP emissions.

REQUIRED

Estimate potential emissions from wet seal degassing (W5D) at the compressor station following installation of M-3 and M-4.

GIVEN

EPA Screening Tool Data

Number of Compressors =	4	units	*(including the units to be installed as a part of this Project)*
Single Centrifugal Compressor Venting Emissions =	5,791	m tons CO_2e/yr	*(EPA Screening Tool for NG Transmission for 1 units)*
Centrifugal Compressor Venting Emissions =	23,164	m tons CO_2e/yr	*(5,791 m tons CO2e/yr * 4 units)*
CH_4-CO2e Conversion Factor =	0.000479	m tons CO_2e/cf CH_4	*(EPA Screening Tool for NG Transmission; Guidance & Sources tab)*
Centrifugal Compressor Venting Emissions =	48,359,081	cf CH_4/yr	*(23,164 m tons CO2e/yr / 0.000479 m tons CO2e/cf CH4)*

Recovery Efficiency

Assumed Recovery Efficiency =	99%	*(EPA Presentation: http://www.epa.gov/gasstar/documents/workshops/2012-annual-conf/smith.pdf)*

Standard Data

% CH_4 =	95.6%		*(Average from DCG Gas Quality Report, 2013-2014)*
% CO_2 =	1.2%		*(Average from DCG Gas Quality Report, 2013-2014)*
% VOC =	0.2%		*(Average from DCG Gas Quality Report, 2013-2014)*
% HAP =	0.01%		*(Hexane+, Average from DCG Gas Quality Report, 2013-2014)*
ρ_{CH4} =	0.0192	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36)*
ρ_{CH4} =	2.12E-05	ton/cf	*(0.0192 kg/cf * 2.205-lb/kg /2000 lb/ton)*
ρ_{CO2} =	0.0526	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36)*
ρ_{CO2} =	5.80E-05	ton/cf	*(0.0526 kg/cf * 2.205-lb/kg /2000 lb/ton)*
ρ_{VOC} =	0.4963	kg/cf	*(See Pneumatic Device Emissions Calculations)*
ρ_{VOC} =	5.47E-04	ton/cf	*(0.4963 kg/cf * 2.205-lb/kg /2000 lb/ton)*
ρ_{HAP} =	0.4963	kg/cf	*(See Pneumatic Device Emissions Calculations)*
ρ_{HAP} =	5.47E-04	ton/cf	*(0.4963 kg/cf * 2.205-lb/kg /2000 lb/ton)*
CH_4 GWP =	25	tons CO_2e/ton CH_4	*(40 CFR Part 98, Subpart A, Table A-1)*
CO_2 GWP =	1	tons CO_2e/ton CO_2	*(40 CFR Part 98, Subpart A, Table A-1)*

SOLUTION

Unrecovered NG Venting

Unrecovered NG Venting = Centrifugal Compressor Venting Emissions / Volume Fraction CH4
= 48,359,081 cf CH4/yr / 0.956
= 50,584,813 cf NG/yr

Unrecovered CH_4, CO_2, VOC, and HAP Venting

Uncontrolled CH_4 Emissions = Unrecovered NG Venting * ρCH_4 * Volume Fraction CH_4
= 50,584,813 cf NG/yr * 2.12E-05 ton/cf * 0.956
= 1,023.7 tons/yr

Unrecovered CO_2 Emissions = Unrecovered NG Venting * ρCO_2 * Volume Fraction CO_2
= 50,584,813 cf NG/yr * 5.80E-05 ton/cf * 0.012
= 34.9 tons/yr

Unrecovered VOC Emissions = Unrecovered NG Venting * ρVOC* Volume Fraction VOC
= 50,584,813 cf NG/yr * 5.47E-04 ton/cf * 0.002
= 66.4 tons/yr

Unrecovered HAP Emissions = Unrecovered NG Venting * ρHAP* % HAP
= 50,584,813 cf NG/yr * 5.47E-04 ton/cf * 0.01%
= 2.8 tons/yr

Potential Emissions

Potential CH_4 Emissions = Unrecovered CH_4 Emissions * (1 - Assumed Recovery Efficiency)
= 1,024 tons/yr * (1 - 0.99)
= 10.2 tons/yr

Potential CO_2 Emissions = Unrecovered CO_2 Emissions * (1 - Assumed Recovery Efficiency)
= 35 tons/yr * (1 - 0.99)
= 0.3 tons/yr

Continued on next page

Potential VOC Emissions = Unrecovered VOC Emissions * (1 - Assumed Recovery Efficiency)
= 66 tons/yr * (1 - 0.99)
= 0.7 tons/yr

Potential HAP Emissions = Unrecovered HAP Emissions * (1 - Assumed Recovery Efficiency)
= 2.8 tons/yr * (1 - 0.99)
= 0.03 tons/yr

GHG Summary

WSD GHG CO2e Emissions = Potential CH_4 Emissions * CH_4 GWP + Potential CO_2 Emissions * CO_2 GWP
= 10.24 tons/yr * 25 tons CO2e/ton CH4 + 0.35 tons/yr * 1 tons CO2e/ton CO2
= 256.3 tons CO2e/yr

SUMMARY

Pollutant	WSD Emissions (tons/yr)
CH_4	10.2
CO_2	0.3
GHG (mass basis)	10.6
GHG (CO_2e basis)	256.3
VOC	0.7
HAP	0.03

Note:

1) HAP emissions are based on the cumulative volume fraction of hydrocarbons that contain six or more carbon atoms (hexane+), thus they are a conservative estimate of HAP emissions.

REQUIRED

Estimate potential emissions from venting natural gas (NG) to the atmosphere during equipment blowdowns at the compressor station following completion of the project.

GIVEN

Compressor Blowdown Data

Number of Compressors =	4	units	*(Moore Compressor Station)*
Number of Shutdown Events per compressor =	90	events/unit-yr	*(Provided via email dated November 9, 2015)*
Number of Shutdown Events (N_{comp}) =	360	events/yr	*(90 events/unit-yr * 4 units)*
Vol. between isolation valves (V_{comp}) =	17.45	cf/unit	*(DCG estimate)*
Max. Pressure (P_{comp}) =	1,200	psia	*(Worst-case scenario assumption)*
Temp @ P_{comp} (T_{comp}) =	200	Deg F	*(DCG estimate)*

Fuel Supply System Blowdown Data

Vol. of NG emitted during blowdown =	3,000	scf/event	*(DCG estimated value @ 150 psi and 150 deg F for similar Compressor Station)*
No. blowdowns (N_{fs}) =	3	events/yr	*(Worst-case scenario assumption)*
Annual volume of NG emitted (Vol NG_{FS}) =	9,000	scf/yr	*(3 events/yr * 3,000 scf/event)*

ESD Blowdown Data

Vol. of NG emitted during blowdown =	256,000	scf/event	*(DCG estimated value @ 900 psi and 90 deg F for similar Compressor Station, multiplied by a factor of 2 to account for addition of M-3 and M-4)*
No. blowdowns (N_{ESD}) =	3	events/yr	*(Worst-case scenario assumption)*
Annual volume of NG emitted (Vol NG_{ESD}) =	768,000	scf/yr	*(3 events/yr * 256,000 scf/event)*

Standard Data

Standard Temperature (T_s) =	60	deg F	*(definition of 'standard', 40 CFR Part 98, Subpart A)*
Standard Pressure (P_s) =	14.7	psia	*(definition of 'standard', 40 CFR Part 98, Subpart A)*
% CH_4 =	95.6%		*(Average from DCG Gas Quality Report, 2013-2014)*
% CO_2 =	1.2%		*(Average from DCG Gas Quality Report, 2013-2014)*
% VOC =	0.2%		*(Average from DCG Gas Quality Report, 2013-2014)*
% HAP =	0.01%		*(Hexane+, Average from DCG Gas Quality Report, 2013-2014)*
ρ_{CH4} =	0.0192	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36)*
ρ_{CO2} =	0.0526	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36)*
ρ_{VOC} =	0.4963	kg/cf	*(See Pneumatic Device Emissions Calculations)*
ρ_{HAP} =	0.4963	kg/cf	*(See Pneumatic Device Emissions Calculations)*
CH_4 GWP =	25	tons CO_2e/ton CH_4	*(40 CFR Part 98, Subpart A, Table A-1)*
CO_2 GWP =	1	tons CO_2e/ton CO_2	*(40 CFR Part 98, Subpart A, Table A-1)*
Purge Factor (C) =	1		*(40 CFR Part 98, Subpart W, Eq W-14a, not purged)*

SOLUTION

Estimate potential emissions of CH_4, CO_2, VOC, and HAP from equipment blowdowns at the facility generally following the methodology outlined in 40 CFR Part 98, Subpart W related to equipment blowdowns (98.233(v)). The methodologies in Subpart W have been modified to accommodate the estimation of VOC and HAP emissions from equipment blowdowns at the facility and to use 2013-2014 average gas composition data from the DCG Gas Quality Report.

1) Estimate the potential amount of NG vented to the atmosphere due to compressor shutdowns at the facility.

$$\text{Vol } NG_{comp} = N_{comp} * [V_{comp} * (((459.67 + T_s)*P_{comp}) / ((459.67 + T_{comp}) * P_s)) - V_{comp} * C]$$

(40 CFR Part 98, Subpart W, Eq W-14A)

$$= 360 * [17.45 * (((459.67 + 60) * 1200) / ((459.67 + 200) * 14.7)) - 17.45 * 1]$$

$$= 397{,}701 \text{ scf/yr}$$

2) Estimate total amount of NG vented to the atmosphere due to equipment blowdowns by adding the CGT-estimated values for fuel supply and ESD blowdowns to the above-calculated value.

$$\text{Vol } NG_{Total} = \text{Vol } NG_{FS} + \text{Vol } NG_{ESD} + \text{Vol } NG_{Comp}$$

$$= 9{,}000 \text{ scf/yr} + 768{,}000 \text{ scf/yr} + 397{,}701 \text{ scf/yr}$$

$$= 1{,}174{,}701 \text{ scf/yr}$$

Continued on next page

Estimate the potential volume of CH_4, CO_2, VOC, and HAP vented during equipment blowdowns at the facility.

Vol CH_4 Emissions (V_{CH4}) = Vol NG_{Total} * VOL_{CH4}
= 1,174,701 scf/yr * 0.956
= 1,123,014 scf/yr

Vol CO_2 Emissions (V_{CO2}) = Vol NG_{Total} * VOL_{CO2}
= 1,174,701 scf/yr * 0.012
= 13,979 scf/yr

Vol VOC Emissions (V_{VOC}) = Vol NG_{Total} * VOL_{VOC}
= 1,174,701 scf/yr * 0.002
= 2,819 scf/yr

Vol HAP Emissions (V_{HAP}) = Vol NG_{Total} * % HAP
= 1,174,701 scf/yr * 0.01%
= 117 scf/yr

4) Estimate potential mass emissions of CH_4, CO_2, VOC, and HAP from equipment blowdowns at the facility.

Mass CH_4 Emissions (M_{CH4}) = V_{CH4} * ρ_{CH4} * 1 ton/907.2 kg
= 1,123,014 scf/yr * 0.0192 kg/cf * 1 ton/907.2 kg
= 23.8 tons CH4/yr

Mass CO_2 Emissions (M_{CO2}) = V_{CO2} * ρ_{CO2} * 1 ton/907.2 kg
= 13,979 scf/yr * 0.0526 kg/cf * 1 ton/907.2 kg
= 0.8 tons CO2/yr

Mass VOC Emissions (M_{VOC}) = V_{VOC} * ρ_{VOC} * 1 ton/907.2 kg
= 2,819 scf/yr * 0.4963 kg/cf * 1 ton/907.2 kg
= 1.5 tons VOC/yr

Mass HAP Emissions (M_{HAP}) = V_{HAP} * ρ_{HAP} * 1 ton/907.2 kg
= 117 scf/yr * 0.4963 kg/cf * 1 ton/907.2 kg
= 0.06 tons HAP/yr

5) Calculate potential GHG emissions from equipment blowdowns at the proposed on a CO_2 equivalent basis.

CHB PD GHG CO_2e Emissions = M_{CH4} * CH4 GWP + M_{CO2} * CO2 GWP
= 23.8 tons CH4/yr * 25 tons CO2e/ton CH4 + 0.8 tons CO2/yr * 1 tons CO2e/ton CO2
595.0 tons CO_2e/yr

SUMMARY

Pollutant	Equipment Blowdown Emissions (tons/yr)
CH_4	23.8
CO_2	0.8
GHG (mass basis)	24.6
GHG (CO_2e basis)	595.0
VOC	1.5
HAP	0.06

Note:
1) HAP emissions are based on the cumulative volume fraction of hydrocarbons that contain six or more carbon atoms (hexane+), thus they are a conservative estimate of HAP emissions.

REQUIRED

Estimate potential emissions from venting natural gas (NG) to the atmosphere due to leaky equipment at the compressor station following completion of the project.

GIVEN

Assumed Leakage Time (T_{Valve}) =	8760	hr/yr	
% CH_4 =	95.6%	CH_4	*(Average from DCG Gas Quality Report, 2013-2014)*
% CO_2 =	1.2%	CO_2	*(Average from DCG Gas Quality Report, 2013-2014)*
% VOC =	0.2%	VOC	*(Average from DCG Gas Quality Report, 2013-2014)*
% HAP =	0.01%	HAP	*(Average % Hexane from DCG Gas Quality Report, 2013-2014)*
ρ_{CH4} =	0.0192	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36)*
ρ_{CO2} =	0.0526	kg/cf	*(40 CFR Part 98, Subpart W, 98.233(v), eq W-36)*
ρ_{VOC} =	0.4963	kg/cf	*(See Pneumatic Device Emissions Calculations)*
ρ_{HAP} =	0.4963	kg/cf	*(See Pneumatic Device Emissions Calculations)*
CH_4 GWP =	25	tons CO_2e/ton CH_4	
CO_2 GWP =	1	tons CO_2e/ton CO_2	
Contingency Factor =	1.2		*(Conservative Assumption)*

SOLUTION

Estimate potential emissions of CH4, CO2, and VOC from equipment leaks at the facility generally following the methods and emission factors (EF) outlined in 40 CFR Part 98, Subpart W related to equipment leaks (98.233(q),(r),&(v)). The methodologies in Subpart W have been modified to accommodate the estimation of VOC emissions from equipment leaks at the facility. The following table summarizes the emissions of CH4, CO2, and VOC from the facility.

Component Type [1]	Number of Leaks [2]	EF (scf/hr-component) [1]	NG Volume (scf/yr) [3]	Mass Emissions (tons/yr) [4]				GHG CO_2e[6]
				CH_4	CO_2	VOC	HAP[5]	
Compressor Components, Gas Service - Connector	15	5.59	734,526	17.8	0.6	1.2	0.0	446.5
Compressor Components, Gas Service - Meter	0	19.33	-	-	-	-	-	0.0
Compressor Components, Gas Service - Open Ended Line	2	17.27	302,570	7.3	0.3	0.5	0.02	183.9
Compressor Components, Gas Service - Pressure Relief Valve	0	39.66	-	-	-	-	-	0.0
Compressor Components, Gas Service - Valve	7	14.84	909,989	22.1	0.8	1.4	0.1	553.1
Non-compressor Components, Gas Service - Connector	17	5.71	850,333	20.6	0.7	1.3	0.1	516.8
Non-compressor Components, Gas Service - Meter	0	2.93	-	-	-	-	-	0.0
Non-compressor Components, Gas Service - Open Ended Line	0	11.27	-	-	-	-	-	0.0
Non-compressor Components, Gas Service - Pressure Relief Valve	0	2.01	-	-	-	-	-	0.0
Non-compressor Components, Gas Service - Valve	5	6.42	281,196	6.8	0.2	0.4	0.02	170.9
Total			**3,078,614**	**74.7**	**2.5**	**4.9**	**0.2**	**1,871.2**

Notes:

1) 40 CFR Part 98, Subpart W, Table W-3.

2) Maximum number of Leaks detected during five DCG compressor station monitoring events.

3) NG Volume (scf/yr) = Number of Leaks (components) * NG EF (scf/hr/component) * 8,760 hr/yr.

4) Mass Emissions (tons/yr) = NG Volume (scf/yr) * $VOL_{pollutant}$ * $\rho_{pollutant}$ * / 907.2 kg/ton * Contingency Factor

5) Based on the cumulative volume fraction of hydrocarbons that contain six or more carbon atoms (hexane+), thus a conservative estimate of HAP.

6) GHG CO2e emissions = Mass $Emissions_{CH4}$ * GWP_{CH4} + Mass $Emissions_{CO2}$ * GWP_{CO2}

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	MCS - Lube Oil Storage
City:	Moore
State:	South Carolina
Company:	DCG - Moore
Type of Tank:	Horizontal Tank
Description:	200 gal lube oil storage tank (4 turnovers)

Tank Dimensions

Shell Length (ft).		5.00
Diameter (ft):		3.00
Volume (gallons):		200.00
Turnovers:		4.00
Net Throughput(gal/yr):		800.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n).	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig)	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Greenville-S'burg, South Carolina (Avg Atmospheric Pressure = 14.25 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

MCS - Lube Oil Storage - Horizontal Tank
Moore, South Carolina

Mixture/Component	Month	Daily Liquid Surf Temperature (deg F) Avg	Min	Max	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg	Min	Max	Vapor Mol Weight	Liquid Mass Fract	Vapor Mass Fract	Mol Weight	Basis for Vapor Pressure Calculations
Crude oil (RVP 5)	All	61 86	56 32	67 41	59 98	2 9848	2 6755	3 3221	50 0000			207 00	Option 4 RVP=5

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

MCS - Lube Oil Storage - Horizontal Tank
Moore, South Carolina

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Crude oil (RVP 5)	2.13	16.75	18.89

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification.	MCS - Condensate Storage Tank
City:	Moore
State	South Carolina
Company:	DCG - Moore
Type of Tank	Horizontal Tank
Description.	550 gal condensate storage tank (2 turnovers) Crude oil used as a surrogate

Tank Dimensions

Shell Length (ft):		5.32
Diameter (ft):		4.00
Volume (gallons)		550 00
Turnovers.		2.00
Net Throughput(gal/yr):		1,100 00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig).	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Greenville-S'burg, South Carolina (Avg Atmospheric Pressure = 14 25 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

MCS - Condensate Storage Tank - Horizontal Tank
Moore, South Carolina

Mixture/Component	Month	Daily Liquid Surf Temperature (deg F) Avg	Min	Max	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg	Min	Max	Vapor Mol Weight	Liquid Mass Fract	Vapor Mass Fract	Mol Weight	Basis for Vapor Pressure Calculations
Crude oil (RVP 5)	All	61.86	56.32	67.41	59.98	2.9848	2.6755	3.3221	50.0000			207.00	Option 4: RVP=5

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

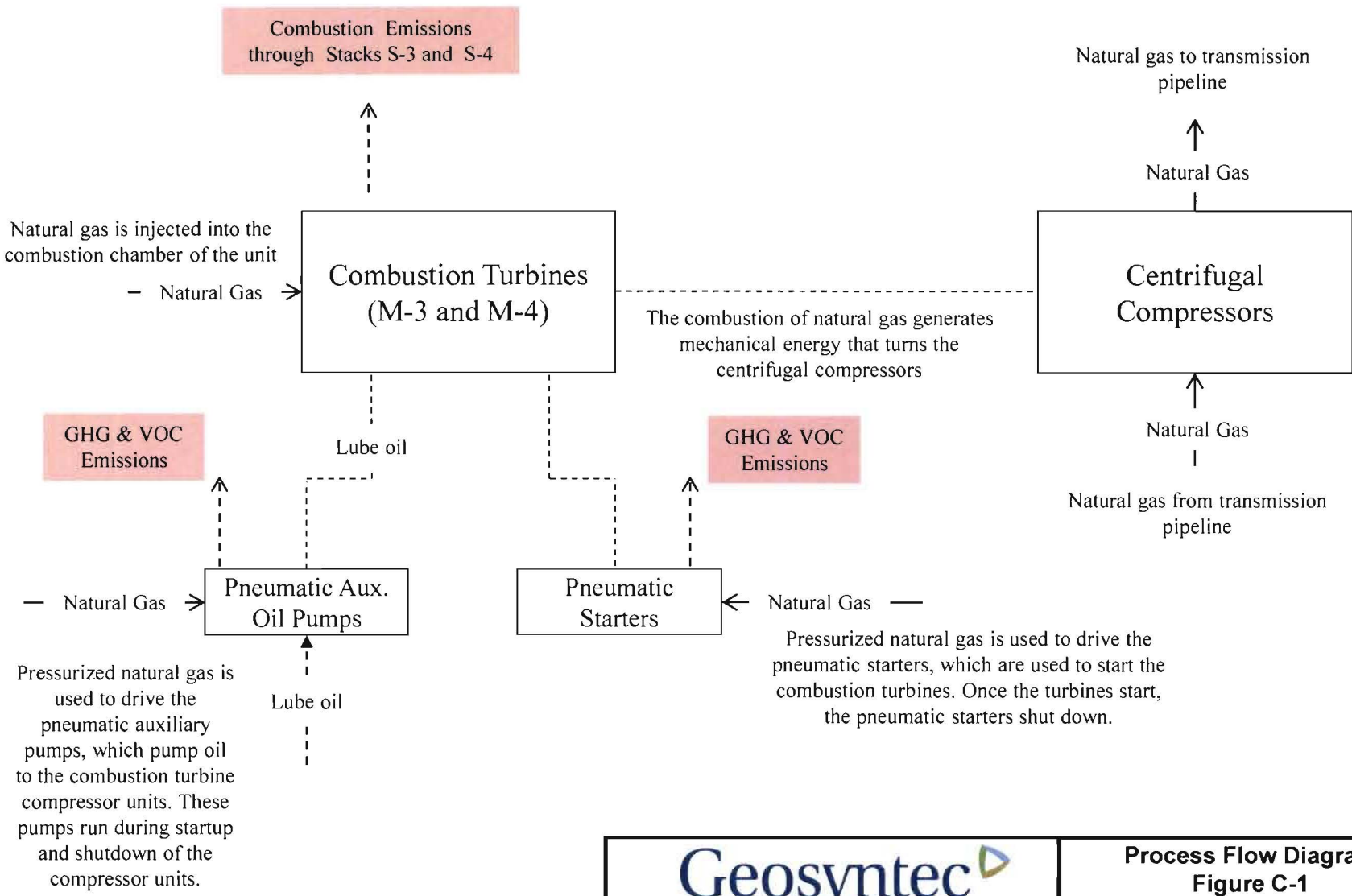
Emissions Report for: Annual

MCS - Condensate Storage Tank - Horizontal Tank
Moore, South Carolina

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Crude oil (RVP 5)	2.93	29 79	32 72

APPENDIX C

Process Flow Diagram



Geosyntec consultants

Process Flow Diagram
Figure C-1

Moore Compressor Station
Moore, Spartanburg County, SC

APPENDIX D

Supporting Documentation for Emissions Calculations

Jeffrey Barwick

From: Brandon Mogan
Sent: Friday, October 23, 2015 8:40 AM
To: Jeffrey Barwick
Subject: FW: Fwd: T2C Air Permitting Data Needs
Attachments: image001.jpg

From: Kennie W Mckenzie (Energy - 2T) [mailto:Kennie.W.Mckenzie@dom.com]
Sent: Thursday, October 22, 2015 3:43 PM
To: Brandon Mogan <BMogan@Geosyntec.com>
Cc: Richard L Kopec (Energy - 2) <Richard.L.Kopec@dom.com>
Subject: FW: Fwd: T2C Air Permitting Data Needs

FYI

From: Trevor S. Miller [Miller_Trevor_S@solarturbines.com]
Sent: Thursday, October 22, 2015 1:36 PM
To: Kennie W Mckenzie (Energy - 2T)
Subject: Re: Fwd: T2C Air Permitting Data Needs

Kennie,

Assumes ISO conditions: 59F, 60% RH, sea level, no losses

Assumes unit is operating at full load prior to shutdown.

Assumes natural gas fuel; ES 9-98 compliant.

Trevor S. Miller
Customer Service Account Manager
Solar Turbines Inc.
Email: Miller_Trevor_S@solarturbines.com
Office: 504-734-8241
Cell: 630-258-1972

CONFIDENTIALITY NOTICE: This e-mail and any files attached may contain confidential information that is legally privileged, and may be restricted from disclosure by corporate confidentiality guidelines, or applicable state and federal law. It is intended solely for the person or entity to whom the e-mail was addressed. If you are not the intended recipient of this message, be advised that any dissemination, distribution, or use of the contents of this message is strictly prohibited.

From: Trevor S. Miller/1G/Caterpillar
To: "Kennie W Mckenzie (Energy - 2T)" <Kennie.W.Mckenzie@dom.com>
Date: 10/22/2015 11:46 AM
Subject: Re: Fwd: T2C Air Permitting Data Needs

Kennie,

I have put the request into our environmental group.

Thank you,

Trevor S. Miller
Customer Service Account Manager
Solar Turbines Inc.
Email: Miller_Trevor_S@solarturbines.com
Office: 504-734-8241
Cell: 630-258-1972

CONFIDENTIALITY NOTICE: This e-mail and any files attached may contain confidential information that is legally privileged, and may be restricted from disclosure by corporate confidentiality guidelines, or applicable state and federal law. It is intended solely for the person or entity to whom the e-mail was addressed. If you are not the intended recipient of this message, be advised that any dissemination, distribution, or use of the contents of this message is strictly prohibited.

From: "Kennie W Mckenzie (Energy - 2T)" <Kennie.W.Mckenzie@dom.com>
To: "Trevor S. Miller" <Miller_Trevor_S@solarturbines.com>
Date: 10/22/2015 10:10 AM
Subject: Fwd: T2C Air Permitting Data Needs

Trevor - Can you assist with the question below?
Thanks
Kennie

Sent from my iPhone

Begin forwarded message:

From: Jeffrey Barwick <JBarwick@Geosyntec.com>
Date: October 22, 2015 at 10:43:22 AM EDT
To: "Kennie W Mckenzie (Energy - 2T)" <Kennie.W.Mckenzie@dom.com>
Cc: "Richard L Kopec (Energy - 2)" <Richard.L.Kopec@dom.com>, Brandon Mogan <BMogan@Geosyntec.com>
Subject: RE: T2C Air Permitting Data Needs

Kennie,

With regard to the startup and shutdown emissions, would you please have Solar clarify the operating conditions (temperature, relative humidity) on which the data below is based?

Thanks!

Jeffrey Barwick, PE
Air Quality Engineer
Geosyntec Consultants, Inc | 104 S Main St, Suite 115 | Greenville, SC 29601

O: 864.478.1170 | C: 803.983.3119 | jbarwick@geosyntec.com
vCard | LinkedIn | Website
From: Brandon Mogan
Sent: Thursday, October 22, 2015 9:19 AM
To: Kennie W Mckenzie (Energy - 2T) <Kennie.W.Mckenzie@dom.com>
Cc: Richard L Kopec (Energy - 2) <Richard.L.Kopec@dom.com>; Jeffrey Barwick <JBarwick@Geosyntec.com>
Subject: RE: T2C Air Permitting Data Needs

Kennie,

This is perfect for Moore. We will need the exact same information for the Dorchester units.

Thanks,

Brandon A. Mogan, PE, LEED AP
Senior Engineer

1331 Elmwood Avenue, Suite 310
Columbia, SC 29201

Phone: 803.422.5251
www.Geosyntec.com

From: Kennie W Mckenzie (Energy - 2T) [mailto:Kennie.W.Mckenzie@dom.com]
Sent: Wednesday, October 21, 2015 7:58 PM
To: Brandon Mogan <BMogan@Geosyntec.com>
Cc: Richard L Kopec (Energy - 2) <Richard.L.Kopec@dom.com>
Subject: Fwd: T2C Air Permitting Data Needs

Brandon - See details below from Solar. Let me know if you additional information.

Thanks
Kennie

Sent from my iPhone

Begin forwarded message:
From: "Trevor S. Miller" <Miller_Trevor_S@solarturbines.com>
Date: October 21, 2015 at 5:36:28 PM EDT
To: "Kennie W Mckenzie (Energy - 2T)" <Kennie.W.Mckenzie@dom.com>
Subject: RE: T2C Air Permitting Data Needs
Kennie,

Sorry for the delay.

Please find attached the Saturn 10 - T1400 Predicted Emissions and Performance.

As for the startup and shutdown emissions please use the following as PIL 170 is only for SoLoNOx engines.

Saturn 10 - T1400 SU/SD estimates:

Assumes 10 minute start-up

SU
NOx 0.8 lbs/event
CO 1.7 lbs/event
UHC 0.3 lbs/event

SD
NOx 0.8 lbs/event
CO 2.4 lbs/event
UHC 0.6 lbs/event

Please let me know if you need anything else.

Trevor S. Miller
Customer Service Account Manager
Solar Turbines Inc.
Email: Miller_Trevor_S@solarturbines.com
Office: 504-734-8241
Cell: 630-258-1972

CONFIDENTIALITY NOTICE: This e-mail and any files attached may contain confidential information that is legally privileged, and may be restricted from disclosure by corporate confidentiality guidelines, or applicable state and federal law. It is intended solely for the person or entity to whom the e-mail was addressed. If you are not the intended recipient of this message, be advised that any dissemination, distribution, or use of the contents of this message is strictly prohibited.

From: "Kennie W Mckenzie (Energy - 2T)" <Kennie.W.Mckenzie@dom.com>
To: "Trevor S. Miller" <Miller_Trevor_S@solarturbines.com>
Date: 10/19/2015 12:39 PM
Subject: RE: T2C Air Permitting Data Needs

Trevor - Can you provide any updates on the requests for emissions data below? We need some of this information to move forward with air permitting.

Thanks,
Kennie McKenzie, P.E.
Dominion Carolina Gas Transmission
Engineer - System Planning
803 726-3800
803 206-2867

From: Kennie W Mckenzie (Energy - 2T)
Sent: Wednesday, September 23, 2015 8:52 AM
To: Trevor S. Miller
Subject: Fwd: T2C Air Permitting Data Needs

Trevor - see the 2nd and 3rd bullet below for requests related to emissions data.
Thanks
Kennie

Sent from my iPhone

Begin forwarded message:

From: Brandon Mogan <BMogan@Geosyntec.com>
Date: September 21, 2015 at 3:12:29 PM EDT
To: "Kennie W Mckenzie (Energy - 2T)" <Kennie.W.Mckenzie@dom.com>
Cc: "Rick Kopec (richard.l.kopec@dom.com)" <richard.l.kopec@dom.com>, Jeffrey Barwick <JBarwick@Geosyntec.com>
Subject: T2C Air Permitting Data Needs

Kennie,

Per our discussion last week, there is some information we need to obtain/confirm to get us moving on the air permitting for the T2C project. To that end, we have prepared the attached Excel spreadsheet to summarize the information that we need. We have pre-populated the spreadsheet (yellow highlights) with some information from our files and simply need you to confirm that the information will remain accurate going forward. The blue cells indicate information that DCG will need to provide. As we discussed last week, you are also going to send us:

- CAD files showing proposed building/unit locations, stack locations, and other information such as proposed property line, fence line, etc.
- Solar Emissions Data Sheet – We are attaching a data sheet from a previous project for your reference. Note that the data should be based on site conditions over a range of air temperature scenarios.
- Startup/Shutdown emissions information – As we discussed on the phone, some regulatory changes are going to require us to address emission from startup/shutdown. We identified the attached letter where Solar provided startup/shutdown emissions data to one of their clients. See if they can get you a similar letter.

If you'd like to chat through this quickly, feel free to give me a call.

Regards,

Brandon A. Mogan, PE, LEED AP
Senior Engineer

1331 Elmwood Avenue, Suite 310
Columbia, SC 29201

Phone: 803.422.5251
www.Geosyntec.com

CONFIDENTIALITY NOTICE: This electronic message contains information which may be legally confidential and or privileged and does not in any case represent a firm ENERGY COMMODITY bid or offer relating thereto which binds the sender without an additional express written confirmation to that effect. The information is intended solely for the individual or entity named above and access by anyone else is

unauthorized. If you are not the intended recipient, any disclosure, copying, distribution, or use of the contents of this information is prohibited and may be unlawful. If you have received this electronic transmission in error, please reply immediately to the sender that you have received the message in error, and delete it. Thank you.

CONFIDENTIALITY NOTICE: This electronic message contains information which may be legally confidential and or privileged and does not in any case represent a firm ENERGY COMMODITY bid or offer relating thereto which binds the sender without an additional express written confirmation to that effect. The information is intended solely for the individual or entity named above and access by anyone else is unauthorized. If you are not the intended recipient, any disclosure, copying, distribution, or use of the contents of this information is prohibited and may be unlawful. If you have received this electronic transmission in error, please reply immediately to the sender that you have received the message in error, and delete it. Thank you.

CONFIDENTIALITY NOTICE: This electronic message contains information which may be legally confidential and or privileged and does not in any case represent a firm ENERGY COMMODITY bid or offer relating thereto which binds the sender without an additional express written confirmation to that effect. The information is intended solely for the individual or entity named above and access by anyone else is unauthorized. If you are not the intended recipient, any disclosure, copying, distribution, or use of the contents of this information is prohibited and may be unlawful. If you have received this electronic transmission in error, please reply immediately to the sender that you have received the message in error, and delete it. Thank you.

CONFIDENTIALITY NOTICE: This electronic message contains information which may be legally confidential and or privileged and does not in any case represent a firm ENERGY COMMODITY bid or offer relating thereto which binds the sender without an additional express written confirmation to that effect. The information is intended solely for the individual or entity named above and access by anyone else is unauthorized. If you are not the intended recipient, any disclosure, copying, distribution, or use of the contents of this information is prohibited and may be unlawful. If you have received this electronic transmission in error, please reply immediately to the sender that you have received the message in error, and delete it. Thank you.

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 21-Oct-15
RUN BY: Trevor S Miller

--- Summary of Emissions for point number 1

SATURN 10-1400 CS/MD STANDARD GAS
ORIGINAL STANDARD COMBUSTOR
EMISSIONS DATA REV. 0.4

ESTIMATED ENGINE EMISSION AT 0.01529 SD NAT GAS FUEL/AIR RATIO

0.00 PERCENT OPACITY SMOKE EMISSION

NOX	CO	UHC	SO2	
12.36	20.06	2.87	0.004	g/(kg Fuel)
150.00	400.00	100.00	0.032	PPMvd at 15% O2
9.74	15.82	2.26	0.003	lbm/hr
42.67	69.27	9.92	0.013	ton/yr
1.106	1.796	0.257	0.0003	g/GJ (GAS TURBINE SHAFT PWR)
2.97	4.82	0.69	0.001	g/(Hp-hr) (GAS TURBINE SHAFT PWR)
311.14	505.13	72.33	0.093	mg/Nm3 at 15% O2, DRY BASIS (1 ATM, 0 C)
0.600	0.973	0.139	0.0002	lbm/MMBtu (Fuel LHV)
257.74	418.43	59.92	0.077	g/GJ (Fuel LHV)
124.65	332.40	83.10	0.027	PPMv at 16% O2 Dry
0.541	0.878	0.126	0.0002	lbm/MMBtu (Fuel HHV)
8.78	14.25	2.04	0.003	lbm/(MW-hr) (GAS TURBINE SHAFT PWR)

SO2 EMISSION DEPENDS ON SULFUR CONTENT IN FUEL. THE CURRENT ESTIMATE IS
BASED ON THE ASSUMPTION OF 100 PERCENT CONVERSION OF FUEL SULFUR TO SO2.
SULFUR CONTENT = 1.9 PPMW

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 21-Oct-15
RUN BY: Trevor S Miller

--- Summary of Emissions for point number 2

SATURN 10-1400 CS/MD STANDARD GAS
ORIGINAL STANDARD COMBUSTOR
EMISSIONS DATA REV. 0.4

ESTIMATED ENGINE EMISSION AT 0.01520 SD NAT GAS FUEL/AIR RATIO

0.00 PERCENT OPACITY SMOKE EMISSION

NOX	CO	UHC	SO2	
12.35	20.04	2.87	0.004	g/(kg Fuel)
150.00	400.00	100.00	0.032	PPMvd at 15% O2
9.50	15.43	2.21	0.003	lbm/hr
41.62	67.57	9.68	0.012	ton/yr
1.107	1.798	0.257	0.0003	g/GJ (GAS TURBINE SHAFT PWR)
2.97	4.83	0.69	0.001	g/(Hp-hr) (GAS TURBINE SHAFT PWR)
311.31	505.41	72.37	0.093	mg/Nm3 at 15% O2, DRY BASIS (1 ATM, 0 C)
0.599	0.972	0.139	0.0002	lbm/MMBtu (Fuel LHV)
257.45	417.97	59.85	0.077	g/GJ (Fuel LHV)
124.65	332.40	83.10	0.027	PPMv at 16% O2 Dry
0.540	0.877	0.126	0.0002	lbm/MMBtu (Fuel HHV)
8.79	14.27	2.04	0.003	lbm/(MW-hr) (GAS TURBINE SHAFT PWR)

SO2 EMISSION DEPENDS ON SULFUR CONTENT IN FUEL. THE CURRENT ESTIMATE IS
BASED ON THE ASSUMPTION OF 100 PERCENT CONVERSION OF FUEL SULFUR TO SO2.
SULFUR CONTENT = 1.9 PPMW

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 21-Oct-15
RUN BY: Trevor S Miller

--- Summary of Emissions for point number 3

SATURN 10-1400 CS/MD STANDARD GAS
ORIGINAL STANDARD COMBUSTOR
EMISSIONS DATA REV. 0.4

ESTIMATED ENGINE EMISSION AT 0.01512 SD NAT GAS FUEL/AIR RATIO

0.00 PERCENT OPACITY SMOKE EMISSION

NOX	CO	UHC	SO2	
12.33	20.01	2.87	0.004	g/(kg Fuel)
150.00	400.00	100.00	0.032	PPMvd at 15% O2
9.25	15.02	2.15	0.003	lbm/hr
40.53	65.79	9.42	0.012	ton/yr
1.110	1.801	0.258	0.0003	g/GJ (GAS TURBINE SHAFT PWR)
2.98	4.84	0.69	0.001	g/(Hp-hr) (GAS TURBINE SHAFT PWR)
311.56	505.82	72.43	0.093	mg/Nm3 at 15% O2, DRY BASIS (1 ATM, 0 C)
0.598	0.971	0.139	0.0002	lbm/MMBtu (Fuel LHV)
257.06	417.33	59.76	0.077	g/GJ (Fuel LHV)
124.65	332.40	83.10	0.027	PPMv at 16% O2 Dry
0.539	0.876	0.125	0.0002	lbm/MMBtu (Fuel HHV)
8.80	14.29	2.05	0.003	lbm/(MW-hr) (GAS TURBINE SHAFT PWR)

SO2 EMISSION DEPENDS ON SULFUR CONTENT IN FUEL. THE CURRENT ESTIMATE IS
BASED ON THE ASSUMPTION OF 100 PERCENT CONVERSION OF FUEL SULFUR TO SO2.
SULFUR CONTENT = 1.9 PPMW

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 21-Oct-15
RUN BY: Trevor S Miller

--- Summary of Emissions for point number 4

SATURN 10-1400 CS/MD STANDARD GAS
ORIGINAL STANDARD COMBUSTOR
EMISSIONS DATA REV. 0.4

ESTIMATED ENGINE EMISSION AT 0.01505 SD NAT GAS FUEL/AIR RATIO

0.00 PERCENT OPACITY SMOKE EMISSION

NOX	CO	UHC	SO2	
12.30	19.97	2.86	0.004	g/(kg Fuel)
150.00	400.00	100.00	0.032	PPMvd at 15% O2
9.00	14.61	2.09	0.003	lbm/hr
39.40	63.97	9.16	0.012	ton/yr
1.116	1.811	0.259	0.0003	g/GJ (GAS TURBINE SHAFT PWR)
2.99	4.86	0.70	0.001	g/(Hp-hr) (GAS TURBINE SHAFT PWR)
311.92	506.41	72.51	0.093	mg/Nm3 at 15% O2, DRY BASIS (1 ATM, 0 C)
0.597	0.969	0.139	0.0002	lbm/MMBtu (Fuel LHV)
256.52	416.46	59.63	0.077	g/GJ (Fuel LHV)
124.65	332.40	83.10	0.027	PPMv at 16% O2 Dry
0.538	0.874	0.125	0.0002	lbm/MMBtu (Fuel HHV)
8.85	14.37	2.06	0.003	lbm/(MW-hr) (GAS TURBINE SHAFT PWR)

SO2 EMISSION DEPENDS ON SULFUR CONTENT IN FUEL. THE CURRENT ESTIMATE IS BASED ON THE ASSUMPTION OF 100 PERCENT CONVERSION OF FUEL SULFUR TO SO2.
SULFUR CONTENT = 1.9 PPMW

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 21-Oct-15
RUN BY: Trevor S Miller

--- Summary of Emissions for point number 5

SATURN 10-1400 CS/MD STANDARD GAS
ORIGINAL STANDARD COMBUSTOR
EMISSIONS DATA REV. 0.4

ESTIMATED ENGINE EMISSION AT 0.01499 SD NAT GAS FUEL/AIR RATIO

0.00 PERCENT OPACITY SMOKE EMISSION

NOX	CO	UHC	SO2	
12.27	19.91	2.85	0.004	g/(kg Fuel)
150.00	400.00	100.00	0.032	PPMvd at 15% O2
8.73	14.18	2.03	0.003	lbm/hr
38.26	62.11	8.89	0.011	ton/yr
1.124	1.825	0.261	0.0003	g/GJ (GAS TURBINE SHAFT PWR)
3.02	4.90	0.70	0.001	g/(Hp-hr) (GAS TURBINE SHAFT PWR)
312.42	507.22	72.63	0.093	mg/Nm3 at 15% O2, DRY BASIS (1 ATM, 0 C)
0.595	0.966	0.138	0.0002	lbm/MMBtu (Fuel LHV)
255.79	415.27	59.46	0.076	g/GJ (Fuel LHV)
124.65	332.40	83.10	0.027	PPMv at 16% O2 Dry
0.537	0.871	0.125	0.0002	lbm/MMBtu (Fuel HHV)
8.92	14.48	2.07	0.003	lbm/(MW-hr) (GAS TURBINE SHAFT PWR)

SO2 EMISSION DEPENDS ON SULFUR CONTENT IN FUEL. THE CURRENT ESTIMATE IS
BASED ON THE ASSUMPTION OF 100 PERCENT CONVERSION OF FUEL SULFUR TO SO2.
SULFUR CONTENT = 1.9 PPMW

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 21-Oct-15
RUN BY: Trevor S Miller

--- Summary of Emissions for point number 6

SATURN 10-1400 CS/MD STANDARD GAS
ORIGINAL STANDARD COMBUSTOR
EMISSIONS DATA REV. 0.4

ESTIMATED ENGINE EMISSION AT 0.01494 SD NAT GAS FUEL/AIR RATIO

0.00 PERCENT OPACITY SMOKE EMISSION

NOX	CO	UHC	SO2	
12.22	19.84	2.84	0.004	g/(kg Fuel)
150.00	400.00	100.00	0.032	PPMvd at 15% O2
8.44	13.71	1.96	0.003	lbm/hr
36.99	60.05	8.60	0.011	ton/yr
1.137	1.846	0.264	0.0003	g/GJ (GAS TURBINE SHAFT PWR)
3.05	4.96	0.71	0.001	g/(Hp-hr) (GAS TURBINE SHAFT PWR)
313.11	508.32	72.79	0.093	mg/Nm3 at 15% O2, DRY BASIS (1 ATM, 0 C)
0.593	0.962	0.138	0.0002	lbm/MMBtu (Fuel LHV)
254.80	413.67	59.23	0.076	g/GJ (Fuel LHV)
124.65	332.40	83.10	0.027	PPMv at 16% O2 Dry
0.535	0.868	0.124	0.0002	lbm/MMBtu (Fuel HHV)
9.02	14.65	2.10	0.003	lbm/(MW-hr) (GAS TURBINE SHAFT PWR)

SO2 EMISSION DEPENDS ON SULFUR CONTENT IN FUEL. THE CURRENT ESTIMATE IS
BASED ON THE ASSUMPTION OF 100 PERCENT CONVERSION OF FUEL SULFUR TO SO2.
SULFUR CONTENT = 1.9 PPMW

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 21-Oct-15
RUN BY: Trevor S Miller

SATURN 10-1400
CS/MD
STANDARD
GAS
TSE-2 REV. 0.1
ES-1556
ES-1556

DATA FOR NOMINAL PERFORMANCE

*** SER REQUIRED FOR LOW CO COMBUSTOR,
BUT NOT FOR ORIGINAL STANDARD COMBUSTOR. ***

Fuel Type		SD NATURAL GAS
Elevation	feet	705
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	4.0
Accessory on GP Shaft	HP	27.0

Engine Inlet Temp.	deg F	30.0	40.0	50.0	60.0	70.0	80.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Elevation Loss	HP	38	37	36	35	34	32
Inlet Loss	HP	27	26	26	26	25	25
Exhaust Loss	HP	12	12	12	12	12	12
Off-Optimum NPT Loss	HP	55	51	45	40	34	28
Driven Equipment Speed	RPM	22300	22300	22300	22300	22300	22300
Optimum Equipment Speed	RPM	27517	27321	27087	26809	26517	26160
Gas Generator Speed	RPM	22429	22379	22329	22288	22255	22225
Specified Load	HP	FULL	FULL	FULL	FULL	FULL	FULL
Net Output Power	HP	1488	1450	1409	1363	1313	1255
Fuel Flow	mmBtu/hr	16.25	15.87	15.47	15.08	14.68	14.25
Heat Rate	Btu/HP-hr	10916	10940	10979	11064	11176	11353
Therm Eff	%	23.308	23.259	23.175	22.998	22.768	22.413
Inlet Air Flow	lbm/hr	51565	50636	49650	48581	47491	46264
Engine Exhaust Flow	lbm/hr	52219	51274	50271	49186	48080	46835
PCD	psiG	81.5	79.9	78.2	76.3	74.4	72.3
Compensated PTIT	deg F	1245	1245	1245	1245	1245	1245
PT Exit Temperature	deg F	933	937	941	947	952	959
Exhaust Temperature	deg F	933	937	941	947	952	959

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400

Hexane (C_6H_{14})	=	0.0400
Carbon Dioxide (CO_2)	=	0.4400
Hydrogen Sulfide (H_2S)	=	0.0001
Nitrogen (N_2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

!!! PLEASE, SUBMIT INQUIRY ON GAS FUEL SUITABILITY TO SAN DIEGO !!!

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer: *Carolina Gas Transmission*	Model: **SATURN 10-1400**
Job ID: **NO15-00747**	Package Type: **CS/MD**
Run By: **Trevor S Miller** — Date Run: **21-Oct-15**	Match: **STANDARD**
Engine Performance Code: **REV. 4.16.1.18.10** — Engine Performance Data: **REV. 0.1**	Fuel System: **GAS**
	Fuel Type: **SD NATURAL GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	705
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	4.0
Accessory on GP Shaft	HP	27.0

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	30.0	40.0	50.0	60.0	70.0	80.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	22300	22300	22300	22300	22300	22300
Specified Load	HP	FULL	FULL	FULL	FULL	FULL	FULL
Net Output Power	HP	1488	1450	1409	1363	1313	1255
Fuel Flow	mmBtu/hr	16.25	15.87	15.47	15.08	14.68	14.25
Heat Rate	Btu/HP-hr	10916	10940	10979	11064	11176	11353
Therm Eff	%	23.308	23.259	23.175	22.998	22.768	22.413
Engine Exhaust Flow	lbm/hr	52219	51274	50271	49186	48080	46835
PT Exit Temperature	deg F	933	937	941	947	952	959
Exhaust Temperature	deg F	933	937	941	947	952	959

Fuel Gas Composition (Volume Percent)

Methane (CH4)	92.79
Ethane (C2H6)	4.16
Propane (C3H8)	0.84
N-Butane (C4H10)	0.18
N-Pentane (C5H12)	0.04
Hexane (C6H14)	0.04
Carbon Dioxide (CO2)	0.44
Hydrogen Sulfide (H2S)	0.0001
Nitrogen (N2)	1.51

Fuel Gas Properties

LHV (Btu/Scf)	939.2	Specific Gravity	0.5970	Wobbe Index at 60F	1215.6

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 30-Oct-15
RUN BY: Trevor S Miller

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 1

HP= 1488, %Full Load=100.0, Elev= 705ft, %RH= 60.0, Temperature= 30.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.18	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0022	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400
Hexane (C6H14)	=	0.0400
Carbon Dioxide (CO2)	=	0.4400
Hydrogen Sulfide (H2S)	=	0.0001
Nitrogen (N2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

788.	lbm/hr	FUEL FLOW
288.32	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
11545.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
31748.	Acfm	ACTUAL EXHAUST FLOW CFm
52219.	lbm/hr	EXHAUST GAS FLOW
28.61	---	MOLECULAR WEIGHT OF EXHAUST GAS
65.42	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.91	2.65	5.38	75.85	15.21	VOLUME PERCENT WET
0.96	2.80	0.00	80.16	16.08	VOLUME PERCENT DRY
661.	2126.	1769.	38779.	8884.	lbm/hr
0.84	2.70	2.24	49.20	11.27	g/(g FUEL)

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 30-Oct-15
RUN BY: Trevor S Miller

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 2

HP= 1450, %Full Load=100.0, Elev= 705ft, %RH= 60.0, Temperature= 40.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.18	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0032	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400
Hexane (C6H14)	=	0.0400
Carbon Dioxide (CO2)	=	0.4400
Hydrogen Sulfide (H2S)	=	0.0001
Nitrogen (N2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

770.	lbm/hr	FUEL FLOW
281.53	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
11342.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
31273.	Acfm	ACTUAL EXHAUST FLOW CFm
51274.	lbm/hr	EXHAUST GAS FLOW
28.60	---	MOLECULAR WEIGHT OF EXHAUST GAS
65.79	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.91	2.63	5.51	75.74	15.22	VOLUME PERCENT WET
0.96	2.78	0.00	80.15	16.11	VOLUME PERCENT DRY
649.	2074.	1780.	38040.	8731.	lbm/hr
0.84	2.69	2.31	49.42	11.34	g/(g FUEL)

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 30-Oct-15
RUN BY: Trevor S Miller

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 3

HP= 1409, %Full Load=100.0, Elev= 705ft, %RH= 60.0, Temperature= 50.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.18	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0047	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400
Hexane (C6H14)	=	0.0400
Carbon Dioxide (CO2)	=	0.4400
Hydrogen Sulfide (H2S)	=	0.0001
Nitrogen (N2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

751.	lbm/hr	FUEL FLOW
274.56	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
11130.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
30779.	Acfm	ACTUAL EXHAUST FLOW CFm
50271.	lbm/hr	EXHAUST GAS FLOW
28.57	---	MOLECULAR WEIGHT OF EXHAUST GAS
66.14	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.90	2.61	5.70	75.57	15.21	VOLUME PERCENT WET
0.96	2.77	0.00	80.14	16.13	VOLUME PERCENT DRY
635.	2019.	1808.	37244.	8564.	lbm/hr
0.85	2.69	2.41	49.62	11.41	g/(g FUEL)

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 30-Oct-15
RUN BY: Trevor S Miller

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 4

HP= 1363, %Full Load=100.0, Elev= 705ft, %RH= 60.0, Temperature= 60.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.18	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0068	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400
Hexane (C6H14)	=	0.0400
Carbon Dioxide (CO2)	=	0.4400
Hydrogen Sulfide (H2S)	=	0.0001
Nitrogen (N2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

731.	lbm/hr	FUEL FLOW
267.52	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
10902.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
30260.	Acfm	ACTUAL EXHAUST FLOW CFm
49186.	lbm/hr	EXHAUST GAS FLOW
28.54	---	MOLECULAR WEIGHT OF EXHAUST GAS
66.42	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.90	2.59	5.99	75.33	15.19	VOLUME PERCENT WET
0.96	2.75	0.00	80.13	16.15	VOLUME PERCENT DRY
620.	1964.	1860.	36368.	8374.	lbm/hr
0.85	2.68	2.54	49.72	11.45	g/(g FUEL)

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 30-Oct-15
RUN BY: Trevor S Miller

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 5

HP= 1313, %Full Load=100.0, Elev= 705ft, %RH= 60.0, Temperature= 70.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.18	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0097	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400
Hexane (C6H14)	=	0.0400
Carbon Dioxide (CO2)	=	0.4400
Hydrogen Sulfide (H2S)	=	0.0001
Nitrogen (N2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

712.	lbm/hr	FUEL FLOW
260.47	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
10674.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
29745.	Acfm	ACTUAL EXHAUST FLOW CFm
48080.	lbm/hr	EXHAUST GAS FLOW
28.50	---	MOLECULAR WEIGHT OF EXHAUST GAS
66.69	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.90	2.57	6.39	75.00	15.14	VOLUME PERCENT WET
0.96	2.74	0.00	80.12	16.17	VOLUME PERCENT DRY
604.	1907.	1942.	35451.	8174.	lbm/hr
0.85	2.68	2.73	49.79	11.48	g/(g FUEL)

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 30-Oct-15
RUN BY: Trevor S Miller

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 6

HP= 1255, %Full Load=100.0, Elev= 705ft, %RH= 60.0, Temperature= 80.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.18	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0136	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400
Hexane (C6H14)	=	0.0400
Carbon Dioxide (CO2)	=	0.4400
Hydrogen Sulfide (H2S)	=	0.0001
Nitrogen (N2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

691.	lbm/hr	FUEL FLOW
252.80	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
10420.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
29180.	Acfm	ACTUAL EXHAUST FLOW CFm
46835.	lbm/hr	EXHAUST GAS FLOW
28.43	---	MOLECULAR WEIGHT OF EXHAUST GAS
66.94	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.89	2.54	6.94	74.56	15.07	VOLUME PERCENT WET
0.96	2.73	0.00	80.12	16.19	VOLUME PERCENT DRY
587.	1843.	2058.	34404.	7942.	lbm/hr
0.85	2.67	2.98	49.78	11.49	g/(g FUEL)

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.16.1.18.10
CUSTOMER: Carolina Gas Transmission
JOB ID: NO15-00747

DATE RUN: 30-Oct-15
RUN BY: Trevor S Miller

SATURN 10-1400
CS/MD
STANDARD
GAS
TSE-2 REV. 0.1
ES-1556
ES-1556

DATA FOR NOMINAL PERFORMANCE

*** SER REQUIRED FOR LOW CO COMBUSTOR,
BUT NOT FOR ORIGINAL STANDARD COMBUSTOR. ***

Fuel Type		SD NATURAL GAS
Elevation	feet	705
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	4.0
Accessory on GP Shaft	HP	27.0

Engine Inlet Temp.	deg F	30.0	40.0	50.0	60.0	70.0	80.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Elevation Loss	HP	38	37	36	35	34	32
Inlet Loss	HP	27	26	26	26	25	25
Exhaust Loss	HP	12	12	12	12	12	12
Off-Optimum NPT Loss	HP	55	51	45	40	34	28
Driven Equipment Speed	RPM	22300	22300	22300	22300	22300	22300
Optimum Equipment Speed	RPM	27517	27321	27087	26809	26517	26160
Gas Generator Speed	RPM	22429	22379	22329	22288	22255	22225
Specified Load	HP	FULL	FULL	FULL	FULL	FULL	FULL
Net Output Power	HP	1488	1450	1409	1363	1313	1255
Fuel Flow	mmBtu/hr	16.25	15.87	15.47	15.08	14.68	14.25
Heat Rate	Btu/HP-hr	10916	10940	10979	11064	11176	11353
Therm Eff	%	23.308	23.259	23.175	22.998	22.768	22.413
Inlet Air Flow	lbm/hr	51565	50636	49650	48581	47491	46264
Engine Exhaust Flow	lbm/hr	52219	51274	50271	49186	48080	46835
PCD	psiG	81.5	79.9	78.2	76.3	74.4	72.3
Compensated PTIT	deg F	1245	1245	1245	1245	1245	1245
PT Exit Temperature	deg F	933	937	941	947	952	959
Exhaust Temperature	deg F	933	937	941	947	952	959

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	=	92.7899
Ethane (C2H6)	=	4.1600
Propane (C3H8)	=	0.8400
N-Butane (C4H10)	=	0.1800
N-Pentane (C5H12)	=	0.0400

Hexane (C_6H_{14})	=	0.0400
Carbon Dioxide (CO_2)	=	0.4400
Hydrogen Sulfide (H_2S)	=	0.0001
Nitrogen (N_2)	=	1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

D H E C
PROMOTE PROTECT PROSPER
Catherine B. Templeton, Director
Promoting and protecting the health of the public and the environment

March 19, 2014

Richard Kopec
Carolina Gas Transmission
220 Operation Way, MC J48
Cayce, SC 29033

Re: SC Regulation 61-62.5, Standard 5.2 – Case by Case NO_x limit determination for Solar Saturn 10 and 20 Combustion Turbines

Dear Mr. Kopec:

The Bureau of Air Quality (Bureau) has received and reviewed your submittal dated February 7, 2014, for the request referenced above. From the information provided in your submittal, it is the Bureau's understanding that this determination is for the installation of Solar Saturn 10 and 20 Combustion Turbines at Carolina Gas Transmission compressor stations in accordance with SC Regulation 61-62.5, Standard 5.2, Section III (b).

The Bureau will allow the following alternative NOx limits for existing Solar Saturn 10 and 20 combustion turbines:

Alternative Case by Case NOx Limits	
Combustion Turbine	**Alternate Limit**
Solar Saturn 10	150 ppmv at 15% O_2 dry
Solar Saturn 20	100 ppmv at 15% O_2 dry

Carolina Gas Transmission must comply with the following conditions:

1. The appropriate permit application must be submitted for each combustion turbine in accordance with SC Regulation 61-62.1, Section II.

2. The application should reference this letter in the SC Regulation 61-62.5, Standard 5.2 regulatory applicability section of the permit application.

3. The facility will be required to perform tune-ups every two years in accordance with the manufacturer's specifications or with good engineering practices.

If you have any comments or questions, you may contact me at 803-898-4072 or by email at clarkfaw@dhec.sc.gov.

Sincerely,

Fatina Ann Washburn Clark

Fatina Ann Washburn Clark
Engineering Services Division
Bureau of Air Quality

September 6, 1995

MEMORANDUM

SUBJECT: Calculating Potential to Emit (PTE) for Emergency Generators

FROM: John S. Seitz, Director
Office of Air Quality Planning and Standards (MD-10)

TO: Director, Air, Pesticides and Toxics Management Division, Regions I and IV
Director, Air and Waste Management Division, Region II
Director, Air, Radiation and Toxics Division, Region III
Director, Air and Radiation Division, Region V
Director, Air, Pesticides and Toxics Division, Region VI
Director, Air and Toxics Division, Regions VII, VIII, IX, and X

The purpose of this guidance is to address the determination of PTE for emergency electrical generators.

Background

In a memorandum dated January 25, 1995, the Environmental Protection Agency (EPA) addressed a number of issues related to the determination of a source's PTE under section 112 and title V of the Clean Air Act (Act). One of the issues discussed in the memorandum was the term "maximum capacity of a stationary source to emit under its physical and operational design," which is part of the definition of "potential to emit." The memorandum clarified that inherent physical limitations, and operational design features which restrict the potential emissions of individual emission units, can be taken into account. This clarification was intended to address facilities for which the theoretical use of equipment is much higher than could ever actually occur in practice. For such facilities, if their

physical limitations or operational design features are not taken

into account, the potential emissions could be overestimated and consequently the source owner could be subject to the Act requirements affecting major sources. Although such source owners could in most cases readily accept enforceable limitations restricting the operation to its designed level, EPA believes this administrative requirement for such sources to be unnecessary and burdensome.

On the topic of "physical and operational design," the January 25 memorandum provided a general discussion. In addition, EPA committed to providing technical assistance on the type of inherent physical and operational design features that may be considered acceptable in determining the potential to emit for certain individual small source categories. The EPA is currently conducting category-specific analyses in support of this effort, and hopes as a result of these analyses to generate more general guidance on this issue as well.

The purpose of this memorandum is to address the issue of PTE as it relates specifically to emergency generators. There is a significant level of interest in this source category because there are many thousands of locations for which an emergency generator is the only emitting source. Moreover, based on a review of this source category, there exists a readily identifiable constraint on the operational design of emergency generators. Hence, the EPA believes it would be useful to provide today's guidance before the entire effort is complete.

The policies set forth in this memorandum are intended solely as guidance, do not represent final Agency action, and cannot be relied upon to create any rights enforceable by any party.

Guidance for Emergency Generators

For purposes of today's guidance, an "emergency generator" means a generator whose sole function is to provide back-up power when electric power from the local utility is interrupted. The emission source for such generators is typically a gasoline or diesel-fired engine, but can in some cases include a small gas turbine. Emissions consist primarily of carbon monoxide and nitrogen oxides. Other criteria pollutants, and hazardous air pollutants, are also emitted, but at much lower levels. Emissions occur only during emergency situations (i.e., where electric power from the local utility is interrupted), and for a very short time to perform maintenance checks and operator training.

The EPA believes that generators devoted to emergency uses are clearly constrained in their operation, in the sense that, by definition and design, they are used only during periods where electric power from public utilities is unavailable. Two factors indicate that this constraint is in fact "inherent." First, while the combined period for such power outages during any one year will vary somewhat, an upper bound can be estimated which would never be expected to be exceeded absent extraordinary circumstances. Second, the duration of these outages are entirely beyond the control of the source, and when they do occur (except in the case of a major catastrophe) rarely last more than a day.

For emergency generators, EPA has determined that a reasonable and realistic "worst-case" estimate of the number of hours that power would be expected to be unavailable from the local utility may be considered in identifying the "maximum capacity" of such generators for the purpose of estimating their PTE. Consequently, EPA does not recommend the use of 8760 hours per year (i.e., full-year operation) for calculating the PTE for emergency generators. Instead, EPA recommends that the potential to emit be determined based upon an estimate of the maximum amount of hours the generator could operate, taking into account (1) the number of hours power would be expected to be unavailable and (2) the number of hours for maintenance activities.

The EPA believes that 500 hours is an appropriate default assumption for estimating the number of hours that an emergency generator could be expected to operate under worst-case conditions. Alternative estimates can be made on a case-by-case basis where justified by the source owner or permitting authority (for example, if historical data on local power outages indicate that a larger or smaller number would be appropriate). Using the 500 hour default assumption, EPA has performed a number of calculations for some typically-sized emergency generators. These calculations indicate that these generators, in and of themselves, rarely emit at major source levels. (Of course, there may be unusual circumstances where these calculations would not be representative, for example where many generators are present that could operate simultaneously).

Cautions

Today's guidance is only meant to address emergency generators as described. Specifically, the guidance does not address: (1) peaking units at electric utilities; (2) generators at industrial facilities that typically operate at low rates, but are not confined to emergency purposes; and (3) any standby

generator that is used during time periods when power is available from the utility. This guidance is also not intended to discourage permitting authorities from establishing operational limitations in construction permits when such limitations are deemed appropriate or necessary. Additionally, this memorandum is not intended to be used as the basis to rescind any such restrictions already in place.

Distribution/Further Information

The Regional Offices should send this memorandum to States within their jurisdiction. Questions concerning specific issues and cases should be directed to the appropriate Regional Office. Regional Office staff may contact Tim Smith of the Integrated Implementation Group at 919-541-4718. The document is also available on the technology transfer network (TTN) bulletin board, under "Clean Air Act" - "Title V" - "Policy Guidance Memos". (Readers unfamiliar with this bulletin board may obtain access by calling the TTN help line at 919-541-5384).

cc: Air Branch Chief, Region I-X
Regional Air Counsels, Region I-X
Adan Schwartz (2344)
Tim Smith (MD-12)

Onshore Natural Gas Transmission

11/29/2013

INSTRUCTIONS:

Data Collection Year 2014 and later - This tool has been updated from previous versions to account for a change in the global warming potential (GWP) of methane (CH4) that is applicable in 2014 and later years. This tool should not be used for years 2011 to 2013. For years 2011 to 2013, use the version of the tool that is in the GHGRP Applicability Tool archive.

This sheet provides a simple tool for estimating equipment leak and vented emissions from natural gas transmission. Enter the required information into the "Input Data" field for each source of emissions at your facility. The tool will automatically sum emissions from each input and provide a total estimate of annual CO_2e equipment leak and vented emissions. Enter this total into the CO_2e emissions field for natural gas transmission in the applicability tool.

For screening purposes related to co-located industry segments, emissions from all applicable industry segments should be combined to determine whether the emissions from the facility with the co-located industry segments would exceed the 25,000 metric ton CO_2e reporting threshold.

Methane Emissions Source	Input Data	Units	Emissions (metric tons CO_2e/year)
Reciprocating compressor rod packing venting		number of compressor cylinders	0
		operating factor (decimal form)*	
Centrifugal compressor venting	1	number of compressors	5,791
	1	operating factor (decimal form)*	
Blowdown vent stacks (to atmosphere)		number of times the compressor starts annually	0
Equipment Leaks & Pneumatic Devices**	Not required *(see note below)*	None	1,583
		Transmission Total (metric tons CO_2e/year)	7,374

Please see the "Guidance & Sources" tab for further information on the calculation methodologies of the above emissions sources.

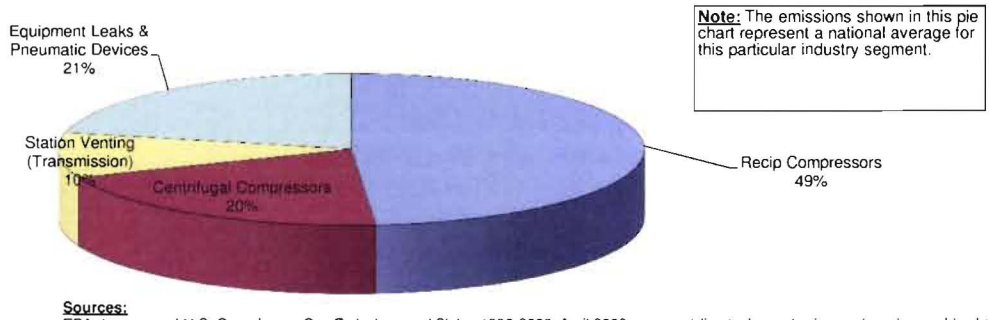
Notes:

The emissions factors and calculation methods used in this tool are based on publicly available sources including: the Technical Support Document for Subpart W; the U.S. GHG Inventory; and the 2009 API Compendium. More details can be found in the Guidance and Sources tab of this worksheet. This tool is only a guide to help companies determine their Subpart W applicability. The results of this tool are not legally binding. A reporter must make the final determination regarding their Subpart W applicability.

*This is defined as the fraction of time the process unit is operating in a calendar year. For example, a 90% operating factor would be entered as 0.9 because the unit is in operation for 90% of the year.

**"Equipment Leaks & Pneumatic Devices" are estimated in this tool as 21% of total natural gas transmission emissions. User input is not required to calculate emissions from these sources; they are estimated (based on the other emissions) using the percentages shown in the pie chart.

Estimate of natural gas transmission emissions. This pie chart is used to estimate emissions from selected sources in the tool.



Note: The emissions shown in this pie chart represent a national average for this particular industry segment.

Sources:

EPA. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006. April 2008. epa.gov/climatechange/emissions/usgginv_archive.html

EPA. Background Technical Support Document (docket # EPA-HQ-OAR-2009-0923) for Subpart W. <www.regulations.gov>. EPA revised.

Applicability Tool Disclaimer

The content provided in the applicability tool is intended solely as compliance assistance for potential reporters to aid in assessing whether they are required to report under the Greenhouse Gas Mandatory Reporting Rule. Any variation between the rule and the information provided in this tool is unintentional, and, in the case of such variations, the requirements of the rule govern. The applicability tool and its contents do not constitute rulemaking or a decision by EPA and may not be relied upon to create a substantive or procedural right or benefit enforceable by law, or in equity, by any person. While this tool is designed to help potential reporters comply with the rule, compliance with all Federal, State, and Local laws and regulations remains the sole responsibility of each facility owner or operator subject to those laws and regulations. Use of this tool does not constitute an assessment by EPA of the applicability of the rule to any particular facility. In any particular case, EPA will make its assessment by applying the law and regulations to the specific facts of the case. No information entered by the user is maintained by EPA, and any results generated by the applicability tool, along with additional information entered by the user,

APPENDIX E

Electronic SCDHEC Application Forms and Electronic Modeling Files (*On Compact Disc*)