MVP Southgate Project

Docket No. CP19-XX-000

Resource Report 9 – Air and Noise Quality

November 2018

MVP Southgate Project
Resource Report 9 – Air and Noise Quality

Resource Report 9 – Filing Requirements	
Information	**Location in Resource Report**
Minimum Filing Requirements	
1. Describe existing air quality in the vicinity of the project. (§ 380.12(k)(1)) • Identify criteria pollutants that may be emitted above EPA-identified significance levels.	Section 9.2.1
2. Quantify the existing noise levels (day-night sound level (Ldn) and other applicable noise parameters) at noise sensitive areas and at other areas covered by relevant state and local noise ordinances. (§ 380.12(k)(2)) • If new compressor station sites are proposed, measure or estimate the existing ambient sound environment based on current land uses and activities. • For existing compressor stations (operated at full load), include the results of a sound level survey at the site property line and nearby noise-sensitive areas. • Include a plot plan that identifies the locations and duration of noise measurements. • All surveys must identify the time of day, weather conditions, wind speed and direction, engine load, and other noise sources present during each measurement.	Section 9.3.3
3. Quantify existing and proposed emissions of compressor equipment, plus construction emissions, including nitrogen oxides (NOx) and carbon monoxide (CO), and the basis for these calculations. Summarize anticipated air quality impacts for the project. (§ 380.12(k)(3)) • Provide the emission rate of NOx from existing and proposed facilities, expressed in pounds per hour and tons per year for maximum operating conditions, include supporting calculations, emission factors, fuel consumption rate, and annual hours of operation.	Section 9.2.2, Appendix 9-A, Appendix 9-B, Appendix 9-C, Appendix 9-D
4. Describe the existing compressor units at each station where new, additional, or modified compressor units are proposed, including the manufacturer, model number, and horsepower of the compressor units. For proposed new, additional, or modified compressor units include the horsepower, type, and energy source. (§ 380.12(k)(4))	There are no existing compressor units
5. Identify any nearby noise-sensitive area by distance and direction from the proposed compressor unit building/enclosure. (§ 380.12(k)(4))	Section 9.3.3
6. Identify any applicable state or local noise regulations. (§ 380.12(k)(4)) • Specify how the facility will meet the regulations.	Section 9.3.2
7. Calculate the noise impact at noise-sensitive areas of the proposed compressor unit modifications or additions, specifying how the impact was calculated, including manufacturer's data and proposed noise control equipment. (§ 380.12(k)(4))	Section 9.3.5
Additional Information Often Missing and Resulting in Data Requests	
8. Include climate information as part of the air quality information provided for the project area.	Section 9.2.1.1
9. Identify potentially applicable federal and state air quality regulations.	Section 9.2.4
10. Provide construction emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for proposed pipelines and aboveground facilities.	Section 9.2.5, Appendix 9-A
11. Provide copies of state and federal applications for air permits.	Appendix 9-C

Resource Report 9 – Filing Requirements	
Information	**Location in Resource Report**
12. Provide operation and fugitive emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for pipelines and aboveground facilities.	Section 9.2.5.2, Appendix 9-B
13. Provide air quality modeling for entire compressor stations.	Appendix 9-D
14. Identify temporary and permanent emissions sources that may have cumulative air quality effects in addition to those resulting from the project.	Section 9.2.6, Table 9.2-9
Noise and Vibration (see further discussion below)	
15. Describe the existing noise environment and ambient noise surveys for compressor stations, liquefied natural gas facilities, meter and regulation facilities, and drilling locations.	Section 9.3.3
16. Identify any state or local noise regulations applicable to construction and operation of the project.	Section 9.3.2
17. Indicate whether construction activities would occur over 24-hour periods.	Section 9.3.4
18. Discuss construction noise impacts and quantify construction noise impacts from drilling, pile driving, dredging, etc.	Section 9.3.4.3
19. Quantify operation noise from aboveground facilities, including blowdowns.	Section 9.3.5
20. Describe the potential for the operation of the proposed facilities to result in an increase in perceptible vibration and how this would be prevented.	Section 9.3.5.4
21. Identify temporary and permanent noise sources that may have cumulative noise effects in addition to those resulting from the project.	Section 9.3.7

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AIR AND NOISE QUALITY

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LIST OF ACRONYMS AND ABBREVIATIONS

AQCR	air quality control region
BACT	Best Available Control Technology
Btu	British thermal unit
CAA	Clean Air Act
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
CSR	Virginia Code of State Rules
dB	decibels
dBA	A-weighted decibels
ESD	emergency shutdown
FERC or Commission	Federal Energy Regulatory Commission
GHG	greenhouse gas
HAP	hazardous air pollutant
HDD	horizontal directional drill
hp	horsepower
Hz	Hertz
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
L_P	sound pressure level
L_W	sound power level
MACT	Maximum Available Control Technology
MMBtu/hr	million British thermal units per hour
Mountain Valley	Mountain Valley Pipeline, LLC
MRR	Greenhouse Gas Mandatory Reporting Rule
NAAQS	National Ambient Air Quality Standards
NCAC	North Carolina Administrative Code
NCDC	National Climatic Data Center's
NESHAP	National Emission Standards for Hazardous Air Pollutants
NNSR	Nonattainment NSR
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
NSAs	noise sensitive areas
NSPS	New Source Performance Standards
NSR	New Source Review

O_3	ozone
OGI	optical gas imaging
Pb	lead
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
Project or Southgate Project	MVP Southgate Project
PSD	Prevention of Significant Deterioration
SO_2	sulfur dioxide
SOP	State operating permits
Title V	Federal Title V operating permit program
tpy	tons per year
Transco	Transcontinental Gas Pipe Line Company, LLC
U.S.	United States
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compounds

RESOURCE REPORT 9
AIR AND NOISE QUALITY

9.1 INTRODUCTION

Mountain Valley Pipeline, LLC ("Mountain Valley") is seeking a Certificate of Public Convenience and Necessity from the Federal Energy Regulatory Commission ("FERC" or "Commission") pursuant to Section 7(c) of the Natural Gas Act to construct and operate the MVP Southgate Project ("Southgate Project" or "Project"). The Southgate Project facilities will be located in Pittsylvania County, Virginia and Rockingham and Alamance counties, North Carolina. See Resource Report 1 (General Project Description) for additional Project information.

9.1.1 Environmental Resource Report Organization

Resource Report 9 includes discussion of Air Quality and Noise in the Southgate Project area as well as potential Project-related impacts. Resource Report 9 is prepared and organized according to the FERC *Guidance Manual for Environmental Report Preparation* issued February 2017. Air quality resources and potential air impacts associated with the Southgate Project are discussed in Section 9.2. A summary of the regional climate and existing air quality is provided in Section 9.2.1, and a discussion of Project-related emissions is located in Section 9.2.2. An overview of the air permitting requirements are discussed in Section 9.2.3, a discussion of applicable regulatory requirements in Section 9.2.4, an analysis of General Conformity in Section 9.2.5, and a summary of air quality mitigation measures in Section 9.2.6. Noise quality resources and potential impacts from the Southgate Project are discussed in Section 9.3. Section 9.3.1 provides background information on noise, Section 9.3.2 provides a description of the applicable regulatory requirements applicable to noise, Section 9.3.3 identifies the existing in-air acoustic conditions and presents noise modeling results, Section 9.3.4 discusses construction noise, Section 9.3.5 discusses Project operation noise, Section 9.3.6 discusses post-construction sound survey, and Section 9.3.7 discusses cumulative effects.

9.2 AIR QUALITY

Potential short-term and temporary air quality impacts may result from construction activities necessary to install the pipeline, metering and regulating sites, and compressor station. Long-term air impacts may result from the operation of the turbines and other equipment. From a regulatory standpoint, the emissions and associated air quality impacts are addressed in two separate ways:

1) Construction Permitting – Construction (and operation) permitting addresses the emissions and associated impacts from the operational equipment and sources at the Southgate Project facilities. Depending on the major/minor status of the Project and the location of the Project, Prevention of Significant Deterioration ("PSD"), Nonattainment NSR ("NNSR"), and/or associated state permitting programs ensure that the proposed installation of new air emissions sources (i.e., operational equipment) meet required emission levels, install appropriate control technologies, and meet other regulatory requirements, where appropriate. The regulatory applicability of permitting programs to the Project is discussed in Section 9.2.4. The Project performed air quality modeling of the emissions of all criteria pollutants resulting from the Project. This modeling assessment demonstrates that all National Ambient Air Quality Standards ("NAAQS") standards are met during operation of the Project. The modeling approach and results are

assessed in detail in Appendix 9-D (Modeling Report) and are not discussed further as part of the regulatory requirements and compliance demonstrations of Sections 9.2.4 through 9.2.6.

2) General Conformity – General Conformity addresses the sources of emissions not covered by permitting actions (e.g., construction activities or an increase in traffic to the sites) and ensures that they comply with the applicable State Implementation Plan(s). Generally, these include the short-term/temporary emissions from construction activities and new emissions increases from non-permitted emission sources such as mobile sources. General Conformity, discussed in Section 9.2.5, is only applicable in maintenance/non-attainment areas. All counties that are impacted by the Southgate Project are in attainment for all criteria pollutants (USEPA, 2018). As such, General Conformity does not apply. However, the Southgate Project has included the construction emissions per the FERC's *Guidance Manual for Environmental Report Preparation* issued February 2017.

9.2.1 Existing Air Quality

9.2.1.1 Climate

The climate in the Southgate Project area is primarily continental in character but is subject to modification by the Atlantic Ocean; the proper classification for the climate is "modified continental." The mid- latitude site location and proximity to the Atlantic Ocean exposes the region to a variety of meteorological conditions and events. Varying weather conditions can occur in the Project area including tropical storms and hurricanes, thunderstorms, and droughts. The mid-latitude location exposes the area to large annual ranges in temperatures. Cold outbreaks originating from the northern latitudes contrast significantly with the heat and humidity that is often transported from the Gulf of Mexico. The primary interaction point between these mid-latitude regions results in weather characterized by frequent, sometimes powerful, change. At times, mesoscale influences alter this meteorological variety.

Southcentral Virginia and northern North Carolina have a varied climate. The eastern half of each state, including the eastern shores, lie within the Humid Subtropical climate zone. This region experiences hot, humid summers and mild to cool winters, with evenly dispersed precipitation. The western half of the states are within the transition zone between the Humid Subtropical and Humid Continental zones, with more mild summertime temperatures and colder winters that experience frequent subfreezing low temperatures and moderate snowfall (Britannica, 2018).

In the Southgate Project area, summers are warm and humid and winters are cold, but not severe. Thunderstorms can occur at any time but are most frequent during the late spring and summer. The storms are most often accompanied by downpours and gusty winds but are not usually severe. Tornadoes, which infrequently occur, have resulted in significant damage. Severe hailstorms have occurred in the spring. Tropical storms can bring heavy rain, high winds and flooding in the late summer and fall.

The National Climatic Data Center's ("NCDC") 1981-2010 Climate Normals (NCDC, 2012) were evaluated from meteorological stations located in Chatham, Pittsylvania County, Virginia, and in Reidsville, Rockingham County, North Carolina. Temperatures near the Project facilities are generally highest in July and lowest in January. Maximum temperatures of 90 degrees Fahrenheit (°F) or higher occur about 20-28 days per year on average, while minimum temperatures of 0°F or lower occur less than one day per year on average. The mean annual precipitation is about 45 to 46 inches, with monthly average precipitation ranging from a low of about 3.0 inches in February to a maximum of about 4.8

inches in July. Precipitation of 0.01 inch or greater occurs on about 115 days per year on average. Precipitation of 1.0 inch or greater occurs on average about 12 days per year. The average annual snowfall for the region is approximately 4 to 9 inches. The average annual wind speed for Chatham, VA is 7.4 miles per hour, with a prevailing wind direction from the west-southwest. The average annual wind speed for Reidsville, NC is 7.1 miles per hour, with a prevailing wind direction from the southwest.

Table 9.2-1 provides a summary of the climate parameters associated with the Southgate Project compressor station.

Table 9.2-1

Climate Parameters at the Compressor Station Location

Compressor Station	Monitoring Station	ID	Approximate Distance and Direction from Existing Monitoring Station to Compressor Station	Average Daily Minimum Temperature – January (°F)	Average Daily Maximum Temperature – July (°F)	Annual Precipitation (inches)
Lambert	Chatham, VA	USC00441614	6 km west	22.8	86.3	45.2
km = kilometer						

9.2.1.2 National Ambient Air Quality Standards

NAAQS have been established for each of the following criteria air pollutants: particulate matter with an aerodynamic diameter of 10 microns or less (“PM_{10}”), particulate matter with an aerodynamic diameter of 2.5 microns or less (“$PM_{2.5}$”), sulfur dioxide (“SO_2”), ozone (“O_3”), nitrogen dioxide (“NO_2”), carbon monoxide (“CO”), and lead (“Pb”). Standards are designated as primary or secondary. Primary standards are set at a level designed to protect public health. Secondary standards are set to protect welfare values such as vegetation, visibility, and property values. NAAQS values are listed in the Code of Federal Regulations (“CFR”) at 40 CFR Part 50. The current NAAQS for these criteria pollutants are summarized in Table 9.2-2. Footnotes to Table 9.2-2 explain how compliance with each NAAQS is assessed.

Note that both states have adopted State Ambient Air Quality Standards that are equivalent to the NAAQS.

Table 9.2-2

National Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Averaging Period	Standards	
		Primary	Secondary
SO_2	1-hour [l,m]	75 ppb 196 µg/m^3	--
	3-hour [b]	--	0.5 ppm 1300 µg/m^3
	Annual [a,m]	0.03 ppm 80 µg/m^3	--
	24-hour [b,m]	0.14 ppm 365 µg/m^3	--
PM_{10}	24-hour [d]	150 µg/m^3	150 µg/m^3
$PM_{2.5}$ (2012 Standard)	Annual [e,]	12.0 µg/m^3	15.0 µg/m^3
$PM_{2.5}$ (2006 Standard)	24-hour [f]	35 µg/m^3	35 µg/m^3
NO_2	Annual [a]	0.053 ppm (53 ppb) 100 µg/m^3	0.053 ppm (53 ppb) 100 µg/m^3
	1-hour [c]	100 ppb 188 ug/m^3	--
CO	8-hour [b]	9 ppm 10,000 µg/m^3	--
	1-hour [b]	35 ppm 40,000 µg/m^3	--
O_3 (2008 Standard)	8-hour [g,h]	0.075 ppm	0.075 ppm
O_3 (2015 Standard)	8-Hour[i]	0.070 ppm	0.070 ppm
O_3	1-hour [j,k]	0.12 ppm	0.12 ppm
Pb	Rolling 3-month [a]	0.15 µg/m^3	0.15 µg/m^3

Table 9.2-2

National Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Averaging Period	Standards	
		Primary	Secondary

Notes:
a/ Not to be exceeded.
b/ Not to be exceeded more than once per year.
c/ Compliance based on 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area.
d/ Not to be exceeded more than once per year on average over 3 years.
e/ Compliance based on 3-year average of weighted annual mean $PM_{2.5}$ concentrations at community-oriented monitors.
f/ Compliance based on 3-year average of 98th percentile of 24-hour concentrations at each population-oriented monitor within an area.
g/ Compliance based on 3-year average of fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area.
h/ The 2008 8-hour ozone standard will remain in effect until one year after an area is designated for the 2015 8-hour ozone standard, which corresponds with January 16, 2019 based upon attainment designations for the 2015 ozone standard issued on January 16, 2018.
i/ Permit applications that have not met U.S. Environmental Protection Agency's ("USEPA's") grandfathering criteria would have to demonstrate that the proposed project does not cause or contribute to a violation of any revised ozone standards that are in effect when the permit is issued, including the 2015 revised standards.
j/ Maximum 1-hour daily average not to be exceeded more than one day per calendar year on average.
k/ The 1-hour ozone standard has been revoked in all areas in which Project activities will occur.
l/ Compliance based on 3-year average of 99th percentile of the daily maximum 1-hour average at each monitor within an area.
m/ The 24-hour and annual average primary standards for SO_2 have been revoked.

ppm = parts per million by volume.
ppb = parts per billion by volume.
$\mu g/m^3$ = micrograms per cubic meter.

9.2.1.3 Section 107 Attainment Status Designations

The standard method for characterizing existing air quality in a given area is to identify the attainment status of the air quality control region ("AQCR") in which it is located. An AQCR, as defined in Section 107 of the Clean Air Act ("CAA"), is a federally-designated area in which NAAQS must be met. An implementation plan is developed for each AQCR describing how ambient air quality standards will be achieved and maintained.

The U.S. Environmental Protection Agency ("USEPA") designates the attainment status of an area on a pollutant-specific basis based on whether an area meets the NAAQS. Areas that meet the NAAQS are termed "attainment areas." Areas that do not meet the NAAQS are termed "nonattainment areas." Areas for which insufficient data are available to determine attainment status are termed "unclassified areas." Areas formerly designated as nonattainment areas that have subsequently reached attainment are termed "maintenance areas."

The attainment status designations appear at 40 CFR Part 81. The attainment status of a region, in conjunction with projected emission rates or emissions increases, determines the regulatory review process for a new project. The Lambert Compressor Station and associated pipeline in Virginia is located in AQCR 143, the Central Virginia Intrastate AQCR. These facilities are in a region that is designated as attainment/unclassifiable for all criteria air pollutants (USEPA, 2018).

The pipeline in North Carolina is located in AQCR 150, the Northern Piedmont Intrastate AQCR. This region is designated as attainment/unclassifiable for all criteria air pollutants (USEPA, 2018).

9.2.1.4 Existing Ambient Background Levels

The Southgate Project is located in Pittsylvania County, Virginia and in Rockingham and Alamance counties, North Carolina. These counties contain ambient air quality monitors that collect data concerning existing levels of various air pollutants. Summary data from the USEPA AirData database were reviewed to characterize existing concentrations at the Project for comparison with NAAQS. Specifically, data from the closest ambient air quality monitoring stations were used to represent existing air quality at the Project. If no county data were available, data from a nearby county were used as a substitute (USEPA, 2017).

Ambient air quality monitoring data from the 3-year period 2015-2017 are summarized in Table 9.2-3 for monitoring stations nearest to the Southgate Project. Table 9.2-3 lists the maximum annual mean concentration and/or a near-maximum short-term concentration by station. Second-high short-term concentrations are listed for most pollutants, but Table 9.2-3 includes the fourth-highest 8-hour average concentration for ozone, the 98th percentile 1-hour average concentration for NO_2, the 98th percentile 24-hour average concentration for $PM_{2.5}$, and the 99th percentile 1-hour average concentration for SO_2, consistent with the structure of the NAAQS for those pollutants and averaging periods.

Table 9.2-3

Existing Ambient Background Levels in the Vicinity of the Lambert Compressor Station

Pollutant	Averaging Period	Monitoring Station	AQS Site ID	County	State	Approx. Distance from Facility (km)	Background Concentration	Primary NAAQS	Units a/
Ozone	8-hour	Reidsville	37-033-0001	Caswell	NC	59	0.064	0.070	ppm
CO	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	1.1	35	ppm
CO	8-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	0.7	9	ppm
NO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	33.3	100	ppb
NO_2	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	5.7	53	ppb
PM_{10}	24-hour	Mendenhall School	37-081-0013	Guilford	NC	90	35	150	ug/m^3
$PM_{2.5}$	24-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	15.7	35	ug/m^3
$PM_{2.5}$	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	7.0	12	ug/m^3
SO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	4.0	75	ppb
SO_2	24-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	2.8	140	ppb
SO_2	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	0.4	30	ppb

a/ ppm = parts per million by volume. ppb = parts per billion by volume. µg/m3 = micrograms per cubic meter.

9.2.1.5 Federal Class I Areas

Federal Class I areas are certain areas established by Congress, such as wilderness areas and national parks, that are afforded special protection under the Clean Air Act. Once designated as a Class I area, an area cannot be re-designated to another (lower) classification. Class I areas are allowed the smallest degree of air quality deterioration through New Source Review ("NSR") / PSD permitting, and special considerations must be made in the NSR permitting process when a Class I area is located close to a site. The Southgate Project is not anticipated to require major source PSD review and thus, Class I air quality modeling will not be required. Regardless, the Class I areas nearest to the location of the Lambert Compressor Station have been identified. The Class I areas are listed in Table 9.2-4.

Table 9.2-4

Federal Class I Areas Closest to the Lambert Compressor Station

Class I Area	Managing Agency	Direction from Lambert	Distance to Compressor Station	
			Kilometers	Miles
James River Face Wilderness Area, VA	U.S. Forest Service	North	81	50
Shenandoah National Park, VA	National Park Service	North	143	89

9.2.2 Project Emissions

9.2.2.1 Construction

Construction activities associated with the Southgate Project will result in temporary increases in emissions of some pollutants due to the use of non-stationary equipment powered by diesel fuel or gasoline engines; the temporary generation of fugitive dust due to disturbance of the ground surface, vegetation clearing, and other dust generating actions; and indirect emissions attributable to workers commuting to and from work sites during construction. Detailed construction emissions calculations along with the methodology and emissions factors used are provided in Appendix 9-A.

These sources are not considered stationary sources, and their impacts will generally be temporary and localized. Therefore, the emissions are not required to be evaluated as part of the PSD or NNSR major source determination analysis. Furthermore, the emissions from construction activities are not expected to cause or significantly contribute to an exceedance of the NAAQS.

Potential emissions from construction of the Southgate Project are presented in Section 9.2.5.

9.2.2.2 Operation (including maintenance and malfunctions)

The following sections list the equipment to be installed at the Lambert Compressor Station. Emission calculations have been performed and are presented in Appendix 9-B for these emission sources. The Southgate Project has included volatile organic compounds ("VOC") and greenhouse gas ("GHG") emissions from blowdown events at the compressor station using the following assumptions:

- While only 8 blowdown events are planned per year, due to system testing and maintenance activities, permitting will reflect 16 for the compressors in case additional blowdown events become necessary.

Lambert Compressor Station

The Lambert Compressor Station will involve the installation of:

- Two (2) turbines for the compression and transmission of natural gas;
- Five (5) microturbines to provide power;
- One (1) fuel gas heater;
- Two (2) produced fluids tanks and associated loadout; and
- Associated piping and components.

Operational emission estimates associated with fugitive gas releases from the pipeline, valves, meter stations, regulation facilities, and pig launcher/receivers along the pipeline are provided in Appendix 9-B. The calculations in Appendix 9-B are based on a methodology described in Interstate Natural Gas Association of America guidelines[1] and a representative natural gas sample, which is also included in Appendix 9-B.

9.2.2.3 Decommissioning

Decommissioning is not currently planned. Mountain Valley will obtain the necessary state and federal permits for decommissioning at the end of the useful Project life.

9.2.3 Air Permitting Requirements

The Virginia Code of State Rules ("CSR") require sources of air contamination to notify the state and receive a permit to construct, modify, relocate and operate the stationary source, unless otherwise exempt. The Southgate Project will submit the necessary construction permit applications and other relevant documentation prior to construction. A copy of the minor source air permit application for Lambert Station is included in Appendix 9-C [*Note: Appendix 9-C to be provided in a supplemental filing*].

9.2.4 Regulatory Review and Applicability

This section lists federal and state air quality regulations that may be applicable to the Southgate Project.

9.2.4.1 Prevention of Significant Deterioration Source Classification

Federal construction permitting programs regulate new and modified sources of attainment pollutants under PSD and new and modified sources of non-attainment pollutants under NNSR. PSD regulations apply when a new source is constructed in which emissions exceed PSD major source thresholds, an existing minor source undergoes a modification in which emission increases exceed PSD major source

[1] Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage, Volume 1 - GHG Emission Estimation Methodologies and Procedures, Interstate Natural Gas Association of America, September 28, 2005

thresholds, or an existing major source undergoes a modification in which emission increases exceed PSD significant emission rates. The Lambert Compressor Station will be designed as a minor source with respect to PSD, as shown in Table 9.2-5. As such, PSD permitting is not triggered.

Table 9.2-5

Emissions from Compressor Station versus NSR Major Source Thresholds

Pollutant	Lambert Compressor Station Site-Wide PTE (TPY) a/	Major Source Threshold (TPY)	NSR Program	Subject to Major NSR?
NO_2	55.58	250	PSD	NO
PM_{10}	14.96	250	PSD	NO
$PM_{2.5}$	14.96	250	PSD	NO
CO	66.08	250	PSD	NO
SO_2	5.25	250	PSD	NO
VOC	9.07	250	PSD	NO

a/ PTE includes emissions from fugitive sources. PTE = potential to emit

NNSR regulations apply only in areas designated as non-attainment. The compressor station will be located in Pittsylvania County, Virginia, which is designated as attainment/unclassifiable areas for all criteria pollutants (USEPA, 2018) Therefore, NNSR regulations do not apply.

9.2.4.2 Title V Operating Permit Program

Title 40 of the Code of Federal Regulations, Chapter 70 (40 CFR 70) establishes the Federal Title V operating permit program ("Title V"). Virginia has incorporated the provisions of this federal program in its Title V operating permit program in Virginia 45 CSR 30. The major source thresholds with respect to the Virginia and North Carolina Title V operating permit program regulations are 10 tons per year ("tpy") of a single hazardous air pollutant ("HAP"), 25 tpy of any combination of HAP and 100 tpy of all other regulated pollutants, except GHG.[2]

The potential emissions of all regulated pollutants at the Lambert Compressor Station will be below the corresponding Title V thresholds. Therefore, the Lambert Compressor Station is not anticipated to be a major source for Title V purposes.

9.2.4.3 New Source Performance Standards

New Source Performance Standards ("NSPS"), located in 40 CFR 60, require new, modified, or reconstructed sources to control emissions to the level achievable by the best demonstrated technology as specified in the applicable provisions. Moreover, any source subject to an NSPS is also subject to the general provisions of NSPS Subpart A, except where expressly noted. The following is a summary of applicability and non-applicability determinations for NSPS regulations of relevance to the facilities.

[2] On June 23, 2014, the U.S Supreme Court decision in the case of *Utility Air Regulatory Group v. EPA* effectively changed the permitting procedures for GHGs under the PSD and Title V programs.

NSPS Subpart Dc – Steam Generating Units

Subpart Dc, Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units, applies to all steam generating units with a heat input greater than or equal to 10 million British thermal units per hour ("MMBtu/hr") and less than 100 MMBtu/hr. No units at the facilities meet the definition of a steam generating unit nor have a heat input greater than 10 MMBtu/hr; therefore, the requirements of this subpart will not apply.

NSPS Subpart GG – Stationary Gas Turbines

Subpart GG, Standards of Performance for Stationary Gas Turbines, applies to all gas turbines with a heat input at peak load greater than or equal to 10 MMBtu/hr based on the lower heating value of the fuel fired. This standard was promulgated in 1979. The applicability of Subpart KKKK, promulgated in 2006, is similar to that of Subpart GG and applies to stationary combustion turbines that commence construction after February 18, 2005. Turbines subject to Subpart KKKK are specifically exempt from the requirements of Subpart GG per 40 CFR § 60.4305(b). As such, this subpart does not apply to the proposed Solar turbines at the compressor station, which are subject to the requirements of Subpart KKKK as discussed in the below section. The proposed generators have a heat input less than 10 MMBtu/hr and are not subject to the requirements of Subpart GG.

NSPS Subparts K, Ka, and Kb – Storage Vessels for Petroleum Liquids/Volatile Organic Liquids

These subparts apply to storage tanks of certain sizes constructed, reconstructed, or modified during various time periods. Subpart K applies to storage tanks constructed, reconstructed, or modified prior to 1978, and Subpart Ka to those constructed, reconstructed, or modified prior to 1984. All storage tanks located at the compressor station will be constructed after these dates; therefore, the requirements of Subparts K and Ka do not apply. Subpart Kb applies to volatile organic liquid storage tanks constructed, reconstructed, or modified after July 23, 1984 with a capacity equal to or greater than 75 m^3 (approximately 19,813 gallons). All storage tanks at the compressor station will be new construction but will not have a capacity greater than 75 m^3. Therefore, Subpart Kb does not apply to the storage tanks at the compressor station.

NSPS Subpart JJJJ – Stationary Spark Ignition Internal Combustion Engines

Subpart JJJJ, Standards of Performance for Stationary Spark Ignition Internal Combustion Engines, applies to manufacturers, owners and operators of stationary spark engines. There will be no stationary spark engines installed at the compressor station. Therefore, this subpart is not applicable to the Southgate Project.

NSPS Subpart KKKK – Stationary Combustion Turbines

Subpart KKKK, Standards of Performance for Stationary Combustion Turbines, applies to stationary combustion units with a heat input at peak load equal to or greater than 10 MMBtu/hr, based on the higher heating value of the fuel, commencing construction after February 18, 2005. The generators at the compressor station will each have a heat input less than 10 MMBtu/hr. Therefore, they are not subject to this standard.

The proposed Solar turbines for the Lambert Compressor Station will be subject to the nitrogen oxide ("NO_X") emissions limitations in NSPS KKKK. Turbines with a rated capacity between 50 to 850 MMBtu/hr at peak load are limited to NO_X emissions of 25 ppm at 15 percent O_2 when firing natural gas. The Solar turbines that will be installed at the station are equipped with lean pre-mix combustion technology and are guaranteed by the manufacturer to emit a maximum of 15 ppm of NO_X at 15 percent O_2 under variable turbine load conditions when firing on natural gas. This vendor guarantee is below the NSPS KKKK standard.

The Southgate Project will perform annual performance tests in accordance with §60.4340(a) and§ 60.4400 to demonstrate compliance with the NO_X emission limitations, or as an alternative, will continuously monitor the appropriate parameters to determine whether each turbine is operating in low-NO_X mode in accordance with §60.4340(b)(2)(ii) and §60.4355(a). The Solar turbines will also comply with the SO_2 emission limits in NSPS KKKK. The Southgate Project will comply with the SO_2 requirements by the exclusive use of natural gas which contains total potential sulfur emissions less than 0.060-pound SO_2/MMBtu heat input in accordance with §60.4330(a)(2).

NSPS Subpart OOOO – Natural Gas Production, Transmission, and Storage

Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution, applies to facilities that commenced construction, reconstruction, or modification after August 23, 2011 and on or before September 18, 2015. This NSPS was published in the Federal Register on August 16, 2012 and was subsequently amended. The list of potentially affected facilities includes:

- Gas wellheads;
- Centrifugal compressors located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment;
- Reciprocating compressors located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment;
- Continuous bleed natural gas-driven pneumatic controllers with a bleed rate of greater than 6 standard cubic feet per hour located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment (excluding natural gas processing plants);
- Continuous bleed natural gas-driven pneumatic controllers located at natural gas processing plants;
- Storage vessels in the production, processing, or transmission and storage segments; and
- Sweetening units located onshore that process natural gas produced from either onshore or offshore wells.

Since the compressor station will be constructed after September 18, 2015, this subpart does not apply to any sources at the facility.

NSPS Subpart OOOOa - Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution

40 CFR Part 60, Subpart OOOOa applies to sources that are constructed/modified/reconstructed after September 18, 2015 including centrifugal compressors, reciprocating compressors, pneumatic controllers, pneumatic pumps, storage vessels, equipment leaks and sweetening units within the crude oil and natural gas sector. In the natural gas transmission segment, Subpart OOOOa defines standards for each of these affected facilities, except for pneumatic pumps and sweetening units.

Centrifugal compressors with wet seals constructed after September 18, 2015 are subject to the control, recordkeeping, and reporting requirements of Subpart OOOOa. Mountain Valley will not be installing any centrifugal compressors with wet seals as part of the Southgate Project. Any new natural gas pneumatic controller installed will have a bleed rate less than or equal to six standard cubic feet per hour, as required by Subpart OOOOa.

The regulatory standards applicable to storage vessels are detailed in 40 CFR §60.5395a. The only tanks that fall under the Subpart's definition of a "storage vessel" are the produced fluid storage tanks; however, these tanks will have potential VOC emissions below 6 tpy each. As such, per §60.5365a(e), these tanks are not storage vessel affected facility under the rule.

Subpart OOOOa has added Leak Detection and Repair requirements for new or modified compressor stations in the transmission segment. For equipment leaks, Subpart OOOOa requires quarterly surveys using optical gas imaging ("OGI") technology and subsequent repair of any identified leaks. The Southgate Project will comply with all applicable leak detection provisions of Subpart OOOOa.

9.2.4.4 National Emission Standards for Hazardous Air Pollutants

Regulatory requirements for facilities subject to National Emission Standards for Hazardous Air Pollutants ("NESHAP") standards, otherwise known as Maximum Available Control Technology ("MACT") Standards for source categories, are contained in 40 CFR Part 63. 40 CFR Part 61 NESHAP standards are defined for specific pollutants while Part 63 NESHAPs are defined for source categories where allowable emission limits are established on the basis of a MACT determination for a particular major source. A major source of HAP is defined as having potential emissions in excess of 25 tpy for total HAP and/or potential emissions in excess of 10 tpy for any individual HAP. Area sources consist of smaller-size facilities that release lesser quantities of toxic pollutants into the air and are defined as sources that emit less than 10 tpy of a single air toxin or less than 25 tpy of a combination of air toxins. Part 63 NESHAPs apply to sources in specifically-regulated industrial source categories (CAA Section 112(d)) or on a case-by-case basis (Section 112(g)) for facilities not regulated as a specific industrial source type.

Potential HAP emissions from the compressor station will be below the major source thresholds (i.e., less than 10 tpy of individual HAP and 25 tpy of total HAP) and therefore, the facility will be an area source of HAP. The potential applicability of specific MACT standards to the compressor station is discussed below.

NESHAP Subpart HH – Natural Gas Production Facilities

This standard applies to sources at natural gas production facilities that are major or area sources of HAP emissions. The Lambert Compressor Station is a transmission facility; therefore, the facility will not be subject to Subpart HH.

NESHAP Subpart HHH – Natural Gas Transmission and Storage Facilities

This standard applies to sources at natural gas transmission and storage facilities that are major sources of HAP emissions located downstream of the point of custody transfer (after processing and/or treatment in the production sector), but upstream of the distribution sector. The Lambert Compressor Station is a transmission facility and an area (not major) source of HAP emissions. Therefore, the facility will not be subject to Subpart HHH.

NESHAP Subpart YYYY – Stationary Combustion Turbines.

Stationary combustion turbines located at facilities that are major sources of HAPs are potentially subject to Subpart YYYY, NESHAP for Stationary Combustion Turbines. Subpart YYYY establishes emissions and operating limitations for lean premix gas-fired, lean premix oil-fired, diffusion flame gas-fired and diffusion flame oil-fired stationary combustion turbines. The Lambert Compressor Station is an area (not major) source of HAP and therefore is not subject to the requirements of this subpart.

NESHAP Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines

Stationary reciprocating internal combustion engines at both area and major sources of HAP emissions are potentially subject to Subpart *ZZZZ – NESHAP for Stationary Reciprocating Internal Combustion Engines*. There are no proposed stationary reciprocating internal combustion engines at the compressor station. Therefore, the station is not subject to this subpart.

NESHAP Subpart DDDDD – Industrial, Commercial, and Institutional Boilers and Process Heaters (Major Source Boiler MACT)

This MACT standard applies to industrial, commercial, and institutional boilers of various sizes and fuel types at major sources of HAP. The facility is an area (not major) source of HAP; therefore, the requirements of this subpart will not apply.

NESHAP Subpart JJJJJJ – Industrial, Commercial, and Institutional Boilers (Area Source Boiler MACT)

This MACT standard applies to industrial, commercial, and institutional boilers of various sizes and fuel types. The rule does not apply to natural gas fired boilers and does not apply to process heaters at area sources. The fuel heaters are natural gas-fired and are specifically exempt from this subpart. Therefore, the requirements of this subpart will not apply.

9.2.4.5 Greenhouse Gas Reporting Rule

Per 40 CFR §98.2(a)(2), facilities that contain a source category listed in Table A-4 and emit 25,000 metric tons or more per year of carbon dioxide equivalent (“CO_2e”) in combined emissions from stationary fuel combustion units, miscellaneous uses of carbonate, and all applicable source categories in Tables A-3 and A-4 are subject to reporting under the Greenhouse Gas Mandatory Reporting Rule

("MRR"). Table A-4 of 40 CFR 98 Subpart A includes Petroleum and Natural Gas Systems. Greenhouse gas emissions from the compressor station are over 25,000 metric tpy on a potential basis. The actual emissions will be calculated annually following support W applicability and calculation methodology and compared with the 25,000 metric tpy of CO_2 to address the applicability of the rule. The Southgate Project will meet all requirements of the MRR for the new compressor station, as applicable. No other subparts under the MRR are applicable to the compressor station.

9.2.4.6 Virginia Air Quality Regulations

The Lambert Compressor Station is subject to regulations contained in the Virginia CSR, which requires sources of air contamination to notify the state and receive a permit to construct, modify, relocate and operate the stationary source, unless otherwise exempt. The air quality regulations for the Commonwealth of Virginia are codified in Title 9 of the Virginia Administrative Code (9 VAC) Agency 5, State Air Pollution Control Board. The following sections present a discussion of potentially applicable Virginia air quality regulations.

9 VAC 5-20: General Provisions on Air Pollution Control

The General Provisions on Air Pollution Control contain provisions to secure and maintain all air quality levels in Virginia. Under 9 VAC 5-20-170, the air pollution control board may require an owner of a stationary source to submit a control program, in a form and manner satisfactory to the board, showing how compliance shall be achieved. For cases of equipment maintenance or malfunctions, 9 VAC 5-20-180 will require the facility record and notify the board of such instances.

9 VAC 5-30: Ambient Air Quality Standards

Ambient air quality standards are required to assure that ambient concentrations of air pollutants are consistent with established criteria and shall serve as the basis for effective and reasonable management of the air resources. Depending on the ambient air quality concentrations, air dispersion modeling may be required. State operating permits ("SOP") are covered in 9 VAC 5-80, which is discussed in more detail below.

9 VAC 5-50: New and Modified Sources

The owner or operator of a new or modified emission source must achieve compliance with all standards of performance prescribed under this chapter within 60 days of achieving maximum production rate, but no later than 180 days after initial startup. Upon the request of the board, the owner or operator may be requested to continuously monitor emissions and process parameters by procedures and methods acceptable to the board. Performance tests will include odor, toxic pollutants, dust, and visible emissions testing. Recordkeeping and reporting requirements include notification of startup, shutdown, malfunction, performance tests, monitoring device malfunctions or repairs, monitoring start and end times. Records must be kept for at least 5 years.

In addition, new or modified stationary sources under Article 6 may be required to demonstrate the use of Best Available Control Technology ("BACT") under 9 VAC 5-50-260. A copy of the air permit application for Lambert Station, which includes BACT applicability and assessment is included in Appendix 9-C.

9 VAC 5-50-80: Visible Emission Standards

Standards for visible emissions from affected facilities are included within 9 VAC 5-50-80. This standard prohibits affected facilities from operating equipment with visible emissions, which exhibit greater than 20 percent opacity, except for one six-minute period in any one hour with no more than 30 percent opacity. Emissions units at the Lambert Compressor Station will comply with the visible emissions standard using EPA Method 9, except during start-up, shutdown, and malfunction.

9 VAC 5-50-90: Fugitive Dust Emissions

The 9 VAC 5-50-90 rule states that during construction and operation of an affected facility, an owner or operator should take reasonable precautions to prevent particulate matter from becoming airborne from any materials or property to be handled, transported, stored, used, constructed, altered, or repaired. The Lambert Compressor Station will be constructed using the fugitive dust mitigation measures discussed in Section 9.2.6 to minimize fugitive dust emissions.

9 VAC 5-60: Hazardous Air Pollutant Sources

Standards and criteria on regulated HAPs are included within 9 VAC 5-60. Emissions testing and recordkeeping is also included in this chapter. A source is exempt from this chapter if the source emits less than the Federal standards for HAP emissions. Air dispersion modeling is required based on the site-specific emissions calculations.

9 VAC 5-80-50: Federal Operating Permits

A Federal operating permit is required for any major source or an area source subject to a standard, limitation, or other requirement under Sections 111-112 of the Clean Air Act, unless otherwise exempt. A copy of the air permit application for Lambert Station, which includes an applicability assessment for major source federal operating permits is included in Appendix 9-C.

9 VAC 5-80: State Operating Permits

Article 6 permitting must be completed before construction of a new source, per 9 VAC 5-80-1100. Virginia's SOPs are most often used by stationary sources to establish federally enforceable limits on potential emissions to avoid major NSR permitting (PSD and NNSR permits), Title V permitting, and/or major source MACT applicability. When a source chooses to use a SOP to limit their emissions below major source permitting thresholds, it is commonly referred to as a "synthetic minor" source. SOPs can also be used to combine multiple permits from a stationary source into one permit or to implement emissions trading requirements.

A copy of air permit application for Lambert Station, which includes an applicability assessment for SOP regulations is included in Appendix 9-C.

9 VAC 5-80-1100: Construction Permits

Article 6 permitting must be completed before construction of a new source. The required Form 7 application forms and attachments are included in the VADEQ air permit application provided in Appendix 9-C to satisfy this requirement for the construction of sources at the facility.

9 VAC 5-85: Permits for Stationary Sources of Pollutants Subject To Regulation

This chapter contains definitions and general provisions which are essentially identical to those discussed in chapter 5-20 above.

9 VAC 5-130: Open Burning

Open burning is permitted on site for the destruction of clean burning waste and debris waste resulting from the development or modification of roads and highways, pipelines, buildings, or from any other clearing operations. Open burning is prohibited from May 1 through September 30. The contractor(s) may utilize open burning as a means of disposing of land-clearing waste during construction of the Southgate Project. The Project's contractor(s) will comply with the provisions of 9 VAC 5-130 during construction.

9.2.4.7 Chemical Accident Prevention Provisions

EPA has established accidental release prevention and risk management plan requirements as part of 40 CFR Part 68 (Chemical Accident Prevention Provisions). Part 68 lists regulated substances along with thresholds for determining the applicability of the associated requirements. If a regulated substance is handled, stored, or processed in greater than threshold quantities at a stationary source, then a risk management plan must be prepared (40 CFR Sections 68.10(a) and 68.12(a)).

Except for constituents of natural gas, such as ethane and methane, the Southgate Project is not expected to produce, process, handle, or store any substance regulated under Part 68 in quantities exceeding applicability thresholds.

9.2.4.8 North Carolina Air Quality Regulations

15A NCAC 02D.1900: Open Burning

This rule outlines the requirements for permissible open burning during land clearing and right of way maintenance. Contractor(s) may utilize open burning as a means of disposing of land-clearing waste during construction of the Southgate Project. This rule regulates items such as the timing, location, meteorological conditions, and type of waste for burning. The Project's contractor(s) will comply will all provisions of 15A NCAC 02D.1900 during construction.

9.2.5 General Conformity

Under the Clean Air Act, a General Conformity analysis is required for any project that requires federal action. General Conformity applies to those emission generating activities resulting from the Project that are not already covered by permitting and located in an area that is designated as nonattainment or a maintenance area (40 CFR 93.153(b)).

The Lambert Compressor Station and pipeline in Virginia is located in AQCR 143, the Central Virginia Intrastate AQCR. These facilities are in a region that is designated as attainment/unclassifiable for all criteria air pollutants. The pipeline in North Carolina is located in AQCR 150, the Northern Piedmont Intrastate AQCR. This region is designated as attainment/unclassifiable for all criteria air pollutants. Therefore, a General Conformity analysis is not required for the Southgate Project.

Construction emissions are presented in Section 9.2.5.1 per FERC's *Guidance Manual for Environmental Report Preparation* issued February 2017. Operation emissions are presented in Section 9.2.5.2.

9.2.5.1 Construction Emissions

The use of equipment to construct the Southgate Project will result in temporary, short-term emissions of air pollutants that will be restricted to the construction period for the compressor station and pipeline and will terminate once construction has been completed. Construction for the Project is expected to take place in 2020. In addition, some right-of-way restoration will occur in 2021.

Construction activities can generally be categorized into the following activities:

- Construction Equipment Engines – Emissions associated with off-road construction equipment such as air compressors, backhoes, cranes, and other construction equipment;
- On-Road Vehicle Travel – Emissions from commuter buses, passenger vehicles, and diesel or gasoline trucks;
- Construction Vehicle Travel – Emissions associated with on-road vehicle travel by dump trucks, light/medium duty trucks, and water/fuel trucks;
- Earthmoving Fugitives – Emissions resulting from bulldozing, grading, and land disturbance; and
- Wind Erosion – Emissions resulting from soil piles.

Emissions from these source categories were calculated using emission factors and USEPA models from the following sources:

- WRAP Fugitive Dust Handbook, Countess Environmental, September 2006;
- USEPA NONROAD2008a Model; and
- USEPA MOVES2014a Vehicle Emission Modeling Software.

Note that fugitive dust emissions from on-road construction equipment and on-road commuter traffic are included in the emission calculations provided in Appendix 9-A. Additionally, note that for the types of sources of GHG emissions associated with Southgate Project construction, total carbon dioxide ("CO_2") is essentially the same as carbon dioxide equivalents (CO_2e) because the CO_2 component of CO_2e for these sources is much greater than 99 percent.

Compressor Station and Meter Station Emissions

Emissions from the compressor station and meter stations were estimated based on the type of construction activity occurring and the length of time that type of activity was expected to last at each station. The total emissions are based on the year the construction is expected to occur at each station and exhibited in Tables 9.2-6 through 9.2-7. Detailed construction emissions calculations along with the methodology and emissions factors used are provided in Appendix 9-A.

Pipeline Emissions

Emissions from the construction of the pipeline are calculated based on the length of pipeline being constructed in each county. Emissions were estimated based on the type of construction activity occurring and the length of time that type of activity was expected to last within each county of pipeline construction. The total emissions expected to occur for each construction year by county are exhibited in Tables 9.2-6 through 9.2-7. Detailed construction emissions calculations along with the methodology and emissions factors used are provided in Appendix 9-A.

9.2.5.2 Operations Emissions

Emissions from operating the equipment at the new Lambert Compressor Station are a result of combustion of natural gas in compressor turbines at the station. The main emission sources at the compressor station are the natural gas turbines and the generators. Emissions of all pollutants have been minimized through the selection of the most fuel-efficient turbines. Larger turbines, with greater horsepower ("hp") output, are more efficient. More efficient models use less fuel and produce fewer emissions for the same hp output. The new compressor station will utilize the largest, most efficient turbines that meet the pipeline operational requirements. The generators that will be installed as part of the Southgate Project have very low emissions compared to viable alternatives, such as reciprocating internal combustion engines. Table 9.2-8 presents the operational emissions potential to emit in tons per year.

For the natural gas turbines, the Southgate Project is planning to purchase and install Solar turbines at the compressor station which are equipped with SoLoNOx, Solar's emission reduction technology. SoLoNOx is a lean, pre-mixed technology that controls the air to fuel ratio and the temperature of the flame to reduce NOX emissions without significantly increasing CO. As noted in section 9.2.4.3, the manufacturer's guaranteed NOX emissions of 15 ppm are below the 25 ppm limit of NSPS Subpart KKKK. Further, the Project will further mitigate these emissions through the development and implementation of an Operation and Maintenance Plan that is consistent with the manufacturer's recommendations for good combustion practices. Proper operation and preventative maintenance activities will ensure that emissions from the turbines will be minimized and continue to meet or exceed the applicable emission standards.

Table 9.2-6

Estimated Construction Emissions from the MVP Southgate Project – 2020

SOURCE	2020 CONSTRUCTION EMISSIONS (TPY)							
	CO_2	CO	NO_x	PM_{10}	PM_{25}	SO_2	VOC	HAPS
Lambert Compressor Station/Interconnect:								
Construction Equipment Engines	7,664	15.26	22.16	1.64	1.64	0.0413	3.13	0.18
On-Road Vehicle Travel	470	3.77	0.46	0.09	0.02	0.0033	0.13	0.05
Off-Road Vehicle Travel	1,766	5.78	3.87	0.46	0.20	0.0144	0.50	0.11
Earthmoving Fugitives	N/A	N/A	N/A	12.28	1.23	N/A	N/A	N/A
Wind Erosion	N/A	N/A	N/A	1.77	0.27	N/A	N/A	N/A
Open Burning	65	2.88	0.08	0.35	0.35	N/A	0.49	N/A
Lambert Total	**9,966**	**27.68**	**26.57**	**16.58**	**3.71**	**0.0589**	**4.25**	**0.34**

Table 9.2-6

Estimated Construction Emissions from the MVP Southgate Project – 2020

SOURCE	2020 CONSTRUCTION EMISSIONS (TPY)							
	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
Meter Stations:								
Construction Equipment Engines	4,411	7.61	13.04	0.91	0.91	0.0238	1.71	0.10
On-Road Vehicle Travel	150	1.26	0.13	0.03	0.01	0.0010	0.04	0.02
Off-Road Vehicle Travel	1,855	4.52	4.46	0.51	0.24	0.0155	0.53	0.11
Earthmoving Fugitives	N/A	N/A	N/A	3.36	0.34	N/A	N/A	N/A
Wind Erosion	N/A	N/A	N/A	0.48	0.07	N/A	N/A	N/A
Open Burning	4	0.17	0.005	0.02	0.02	N/A	0.03	N/A
Meter Station Total	**6,420**	**13.56**	**17.64**	**5.31**	**1.58**	**0.0403**	**2.31**	**0.22**
Pipeline:								
Construction Equipment Engines	83,586	71.95	196.60	11.22	11.22	0.4379	24.76	1.92
On-Road Vehicle Travel	2,822	25.24	2.10	0.50	0.10	0.0190	0.75	0.32
Off-Road Vehicle Travel	1,464	6.50	2.77	0.36	0.15	0.0115	0.41	0.11
Earthmoving Fugitives	N/A	N/A	N/A	935.18	93.52	N/A	N/A	N/A
Wind Erosion	N/A	N/A	N/A	134.61	20.19	N/A	N/A	N/A
Open Burning	8,805	387.62	11.07	47.07	47.07	N/A	66.45	N/A
Pipeline Total	**96,677**	**491.31**	**212.55**	**1128.93**	**172.25**	**0.4684**	**92.37**	**2.35**
Pipeline in Pittsylvania, VA	32,549	176.77	71.28	21.29	21.08	0.1564	33.01	0.78
Pipeline in Rockingham, NC	32,502	177.58	71.15	21.39	21.20	0.1558	33.16	0.78
Pipeline in Alamance, NC	31,626	136.96	70.11	16.46	16.26	0.1562	26.19	0.78
2020 TOTAL:	**113,062**	**532.5**	**256.8**	**1150.8**	**177.5**	**0.6**	**98.9**	**2.9**

N/A indicates that the specific pollutant emissions are not expected from that source.

Table 9.2-7

Estimated Construction Emissions from the MVP Southgate Project – 2021

SOURCE	2021 CONSTRUCTION EMISSIONS (TPY)							
	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
Lambert Compressor Station/Interconnect:								
Construction Equipment Engines	1,929	2.14	4.46	0.34	0.34	0.0101	0.69	0.04
On-Road Vehicle Travel	95	0.65	0.12	0.02	0.01	0.0007	0.03	0.01
Off-Road Vehicle Travel	233	0.84	0.49	0.06	0.03	0.0019	0.07	0.02
Earthmoving Fugitives	N/A	N/A	N/A	6.14	0.61	N/A	N/A	N/A
Wind Erosion	N/A	N/A	N/A	0.88	0.13	N/A	N/A	N/A
Open Burning	0	0	0	0	0	N/A	0	N/A
Lambert Total	**2,257**	**3.62**	**5.07**	**7.44**	**1.12**	**0.0126**	**0.78**	**0.07**
Meter Stations:								
Construction Equipment Engines	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
On-Road Vehicle Travel	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
Off-Road Vehicle Travel	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00

Table 9.2-7

Estimated Construction Emissions from the MVP Southgate Project – 2021

SOURCE	2021 CONSTRUCTION EMISSIONS (TPY)							
	CO_2	**CO**	**NOx**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**VOC**	**HAPS**
Earthmoving Fugitives	N/A	N/A	N/A	0.00	0.00	N/A	N/A	N/A
Wind Erosion	N/A	N/A	N/A	0.00	0.00	N/A	N/A	N/A
Open Burning	0	0	0	0	0	N/A	0	N/A
Meter Station Total	**0**	**0.00**	**0.00**	**0.00**	**0.00**	**0.0000**	**0.00**	**0.00**
Pipeline:								
Construction Equipment Engines	4,417	2.21	5.93	0.32	0.32	0.0221	1.14	0.10
On-Road Vehicle Travel	292	1.75	0.43	0.06	0.02	0.0022	0.08	0.03
Off-Road Vehicle Travel	131	0.60	0.24	0.03	0.01	0.0010	0.04	0.01
Earthmoving Fugitives	N/A	N/A	N/A	545.52	54.55	N/A	N/A	N/A
Wind Erosion	N/A	N/A	N/A	78.52	11.78	N/A	N/A	N/A
Open Burning	0	0	0	0	0	N/A	0	N/A
Pipeline Total	**4,840**	**4.56**	**6.61**	**624.46**	**66.68**	**0.0253**	**1.26**	**0.14**
Pipeline in Pittsylvania, VA	1,629	1.53	2.25	226.62	24.19	0.0086	0.42	0.05
Pipeline in Rockingham, NC	1,594	1.51	2.15	240.54	25.67	0.0083	0.41	0.04
Pipeline in Alamance, NC	1,617	1.52	2.21	157.29	16.82	0.0085	0.42	0.05
2021 TOTAL:	**7,097**	**8.2**	**11.7**	**631.9**	**67.8**	**0.04**	**2.0**	**0.2**

N/A indicates that the specific pollutant emissions are not expected from that source.

Table 9.2-8

Operational and Fugitive Emissions from the Lambert Compressor Station Equipment

Pollutant	Equipment PTE (TPY)	Fugitive PTE (TPY)	Total PTE (TPY)
NO_2	55.58	0.0	55.58
PM_{10}	14.96	0.0	14.96
$PM_{2.5}$	14.96	0.0	14.96
CO	66.08	0.0	66.08
SO_2	5.25	0.0	5.25
VOC	7.89	1.18	9.07

9.2.6 Air Quality Mitigation Measures

Construction Emissions

The construction emissions associated with the Southgate Project are temporary in nature and are expected to have minimal impact on the air quality in the surrounding area. However, the Project will implement various mitigation measures to minimize construction emissions. These include:

- The Southgate Project will avoid unnecessary construction activities leading to increased emissions, where possible;

- The Southgate Project will utilize low sulfur diesel fuel with a maximum sulfur content of 15 ppm based upon the requirements of 40 CFR Part 80;
- The Southgate Project will, when practical, request that contractor(s) use newer model equipment that are equipped with the latest emission reduction technologies that are in compliance with EPA's mobile source emission standards;
- The Southgate Project will follow manufacturer's operating recommendations regarding good combustion practices to ensure that fuel efficiency is maximized, and engines are operated such that emissions are minimized;
- The Southgate Project will implement the fugitive dust control measures as described below; and
- The Southgate Project will avoid idling of the construction equipment to the extent possible.

The fugitive dust control measures will include the following specific steps to be taken during construction:

- Fugitive dust emissions from vegetation removal, clearing and grading, cutting and filling, topsoil removal, trenching, backfilling and stockpile storage will be controlled to a great extent by following the construction sequencing and disturbing limited areas at a time;
- Fugitive dust emissions generated by motorized equipment and miscellaneous vehicle traffic will be controlled by wet suppression as necessary;
- Fugitive dust emissions from paved roads will be controlled with a combination of water trucks, power washers, sweeping and/or vacuuming. If necessary, additional potential sources of water for dust control may include other municipal systems, groundwater supply wells, and/or approved surface waters;
- Track out of loose materials will be controlled using rock construction entrances on access roads that begin at a junction with paved roads; and
- When environmental conditions are dry, inspection of dust control measures will be conducted daily.

The Southgate Project performed a complete air dispersion modeling analysis, which is presented in Appendix 9-D, to ensure that the concentration levels from the emission sources at the compressor station will not exceed the NAAQS levels. Table 9.2-9 presents the list of the major existing and reasonably foreseeable future projects that may cumulatively or additively impact air quality along with an approximate distance from the nearest Project facility. Operation of the existing and reasonably foreseeable major air emissions sources listed in Table 9.2-9 will have air emissions associated with them; however, the other sources of air emissions from operation of these recent or planned projects are or will be controlled in accordance with state and federal air pollution laws and regulations. Additionally, Transcontinental Gas Pipe Line Company, LLC ("Transco") will need to obtain FERC authorization for the natural gas transmission projects associated with modifications at Transco Stations 165 and 166 prior to construction and operation; the review of those projects will include a detailed air quality assessment for construction and operation.

Table 9.2-9 Major Air Quality Facilities Within 20-miles of the Lambert Compressor Station		
County / State	**Facility**	**Approximate Distance to The Lambert Station (miles)**
Pittsylvania, VA	Transco - Station 165	<1
Pittsylvania, VA	Transco - Station 166	<1
Pittsylvania, VA	Arkema Inc.	5
Pittsylvania, VA	Owens-Brockway Glass Container Inc.	16
Pittsylvania, VA	Intertape Polymer Corporation	16
Pittsylvania, VA	Elkay Wood Product Company	17
Pittsylvania, VA	Dominion - Pittsylvania Power Station	19

The existing and proposed offsite major air emissions sources are or will be operated in compliance with all applicable state and federal air regulations; including, stack testing, recordkeeping, reporting, and monitoring requirements to establish compliance with federally enforceable emissions standards. Because operation of the Southgate Project, along with the other existing and proposed major Title V projects/facilities, will be regulated by the VADEQ and NCDEQ through the air permitting process, the cumulative effect of operation of the Project with other projects is not expected to result in adverse air quality impacts.

Climate Change and Greenhouse Gases

Construction activities will result in temporary increases in GHG emissions due to the use of non-stationary equipment powered by diesel fuel or gasoline engines and indirect emissions attributable to workers commuting to and from work sites during construction. These sources are not considered stationary sources, and their impacts will generally be temporary and localized. The Southgate Project will, to the extent practical, employ good management practices, as described above, to limit these emissions.

With respect to operational emissions, USEPA has not published formal white papers for different industries to discuss available GHG control technologies. In permitting guidance, USEPA agrees that energy efficiency improvements will satisfy the control requirements for GHGs in most cases. As such, operational GHG emissions would be expected to be limited to the use of energy efficient design and the minimization of GHG releases through standard work practices for the natural gas industry. The use of the combustion turbines represents one element of the Southgate Project's energy efficient design.

Fugitive GHG (and to a lesser extent, VOC) leaks will be minimized by adhering to good operating and maintenance practices and meeting the requirements of the federal NSPS OOOOa regulation. Mountain Valley designed the Southgate Project to reduce GHG emissions where technically and economically feasible. In addition, the Project reviewed USEPA's voluntary Natural Gas Star program for potential emission reduction measures, and Table 9.2-10 summarizes the feasibility of various measures for the Project. Total, site-wide VOC and GHG emissions from fugitive and blowdown sources are estimated to be low and well below major source permitting thresholds. Therefore, any additional emission reduction will not be cost effective due to the minimal emission reductions achieved.

Natural gas that will flow on the Southgate Project will be received at either the Mountain Valley Pipeline interconnection near Chatham, Virginia or from East Tennessee at the LN 3600 Interconnect near Eden, North Carolina. Accordingly, any GHGs attributable to this natural gas that could subsequently be attributed to a downstream use will either: (1) already have been considered as part of the Commission's upstream pipeline approval; or (2) is not an incremental increase in natural gas being transported but rather represents a different utilization of the upstream pipeline capacity. Therefore, it would be double counting if these GHG emissions were to be considered as part of the Southgate Project, and such downstream GHG emissions should not be attributed to the Project. Using good management practices and energy efficient design, the Project employed measures to minimize GHG emissions and any resulting impact on climate change.

Table 9.2-10

Summary of Natural Gas Star Program

Energy Star Project[3]	Feasibility Assessment
Replace Gas Starters with Air or Nitrogen	Feasible – Gas starters may be replaced with air.
Reduce Natural Gas Venting with Fewer Compressor Engine Startups and Improved Engine Ignition	Feasible – Turbines are intended to operate at all times other than preventative maintenance shutdowns. The Project's preventative maintenance program will reduce starts related to unanticipated shutdown/repairs.
Reducing Methane Emissions from Compressor Rod Packing Systems	Not feasible – This reduction strategy is applicable to older compressors with potentially worn packing. Compressors are equipped with newly installed packing by design. The Project will follow the manufacturer's recommended procedures for proper maintenance and inspection of compressor rod packing systems and comply with NSPS OOOOa.
Test and Repair Pressure Safety Valves	Feasible - Completed by the Project on periodic basis.
Eliminate Unnecessary Equipment and/or Systems	The Project will only be installing what is required for this application.
Install Automated Air/Fuel Ratio Controls	Feasible – Turbines will be equipped with state-of-the art AFR (air-to- fuel-ratio) controllers/SoLoNOx technology.
Install Electric Motor Starters	The turbines are intended to operate at all times therefore the number of starts is minimized and the potential methane reductions would be small. Nonetheless, current design includes electric motor starts.
Reducing Emissions When Taking Compressors Off-Line	Feasible - Blowdown gas may be injected into the fuel gas recovery system. However, the proposed facility is a gathering facility that is expected to operate at or near 100% capacity year-round. Shutdown events are expected to be very infrequent, and the current design of the station does not allow for recycling of turbine blowdowns.
Replace Compressor Cylinder Unloaders	Not Applicable.

[3] https://www.epa.gov/natural-gas-star-program/recommended-technologies-reduce-methane-emissions

Table 9.2-10

Summary of Natural Gas Star Program

Energy Star Project[3]	Feasibility Assessment
Install Electric Compressors	Not Feasible - Electric compressors are cost prohibitive even if electric supply is available. As stated in the NG Star fact sheet "The capital costs and the electricity costs, however, are higher for an electric motor compared to those for a gas driven engine. The savings from maintenance costs relative to the cost of energy will not be justified unless the engine is at the end of its economic life."
Wet Seal Degassing Recovery System for Centrifugal Compressors	Turbine centrifugal compressors will be dry seal.

9.3 Noise

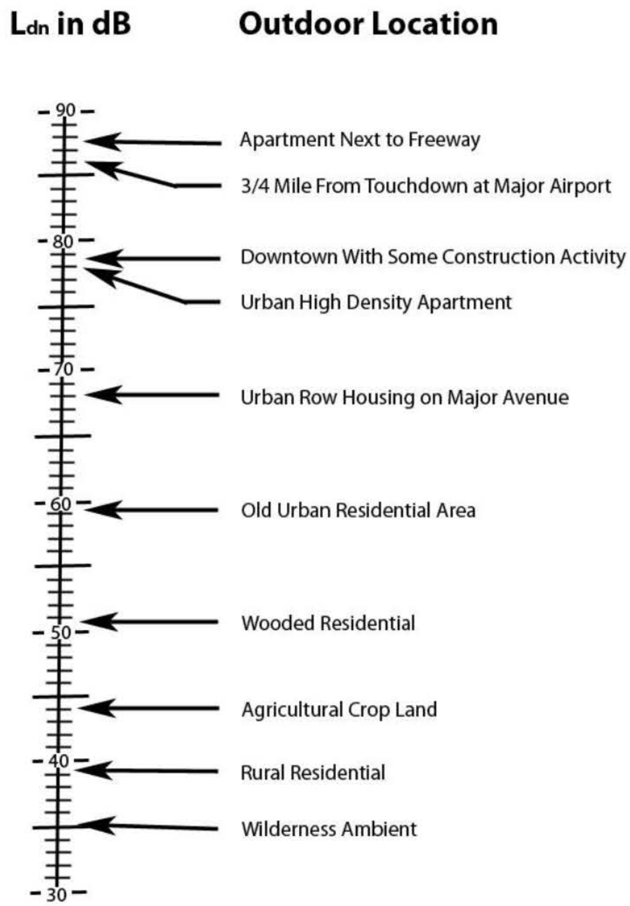
This section provides an overview of the noise generating equipment for the Project, the noise study approach for each compressor station, meter stations, locations of horizontal directional drill ("HDD") and railroad conventional bores, a description of noise associated with construction activities, and a discussion of typical noise mitigation methods for the type of equipment associated with each component of the Project. Environmental noise will be generated during construction and operation of the compressor station and meter stations associated with the Project. There will also be noise associated with the construction of the meter stations and the pipeline.

9.3.1 Background Information on Sound and Noise

A sound source is defined by a sound power level ("L_W"), which is the rate at which acoustical energy is radiated outward and is expressed in units of watts. A sound pressure level ("L_P") is a measure of fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated from information associated with the source sound power level and surrounding environment. Sound power cannot be measured directly but can be calculated from measurements of sound intensity or sound pressure at a given distance from the source.

The perception of sound as "noise" is influenced by several technical factors such as intensity, sound quality, tonality, duration, and existing background levels. Sound levels are presented on a logarithmic scale to account for the large range of acoustic pressures that the human ear is exposed to and are expressed in units of decibels ("dB"). Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is used to determine tonal characteristics. The unit of frequency is Hertz ("Hz") which is a measure of the cycles per second of the sound pressure waves. Typically, the frequency analysis examines 11 octave (or 33 1/3 octave) bands ranging from 16 Hz (low) to 16,000 Hz (high). One-third (1/3) octave bands have one third the width of full octave bands, which gives a higher resolution and a more detailed description of the frequency content of the sound. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter.

The A-weighted filter is applied to compensate for the frequency response of the human auditory system and sound exposure in acoustic assessments and is designated in A-weighted decibels ("dBA"). Environmental noise is commonly described in terms of equivalent sound level ("L_{eq}"). The L_{eq} value, conventionally expressed in dBA, is the energy-averaged, A-weighted sound level for the complete time period represented as a steady, continuous sound level. Another common noise descriptor used when assessing environmental noise is the day-night sound level ("L_{dn}"), which is calculated by averaging the 24-hour hourly L_{eq} levels at a given location and adding 10 dB to noise emitted during the nighttime period (10:00 p.m. to 7:00 a.m.) to account for the increased sensitivity of people to hear noises that occur at night. The L_{max} is the maximum instantaneous sound level as measured during a specified time period. It can also be used to quantify the time-varying maximum instantaneous sound pressure level (as generated by equipment or an activity) or a manufacturer maximum source emission level. Estimates of common noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in Figure 9.3-1a.



(Adapted from USEPA, 1974)

Figure 9.3-1a. Environmental Sound Pressure Levels (L_{dn})

9.3.2 Applicable Noise Regulations

The Southgate Project pipeline is located in Virginia and North Carolina and crosses portions of three counties. The Project reviewed federal, state, county, and local noise regulations to identify regulations that may be applicable to construction and operation. A regulatory search found no state noise standards applicable to the Project; however, there are several federal requirements and county noise regulations that are potentially applicable to the Project as described in Sections 9.3.2.1 and 9.3.2.2, respectively.

9.3.2.1 FERC Requirements

The FERC noise regulations, set forth in 18 CFR §380.12(k)(2), require an applicant to identify existing noise sensitive areas ("NSAs") within one mile of Project facilities (e.g., residences, schools, churches) and quantitatively describe existing sound levels at NSAs and at other areas covered by relevant state and local noise ordinances. The following stipulations are given:

- If new compressor station sites are proposed, measure or estimate the existing ambient sound environment based on current land uses and activities;
- For existing compressor stations (operated at full load), include the results of a sound level survey at the site property line and nearby NSAs;
- Include a plot plan that identifies the locations and duration of noise measurements; and
- All surveys must identify the time of day, weather conditions, wind speed and direction, engine load and other noise sources present during each measurement.

In addition, the FERC requirement for noise quality, in the absence of any applicable state or local noise regulation, is that the post-construction noise attributable to any new compressor station and associated pipeline facilities must not exceed an L_{dn} of 55 dBA at any pre-existing NSA such as schools, hospitals, or residences. This criterion limits the sound level contribution from the Project at any pre-existing NSA to 55 dBA (L_{dn}). An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA L_{eq} for facilities that operate at a constant level of noise.

Regarding HDD construction sites, conditions set forth by the FERC typically require that the sound attributable to drilling operations should not exceed 55 dBA (L_{dn}) at any NSA during HDD operations. If this sound criterion/guideline is expected to exceed this level at any nearby NSA, it is generally necessary to describe noise mitigation measures/options which would be implemented during the drilling activity to reduce the noise impact of the drilling operations and achieve the sound criterion/guideline.

As per FERC's *Guidance Manual for Environmental Report Preparation* issued February 2017, "Construction activity that would or may occur during nighttime hours should be performed with the goal that the activity contribute noise levels below 55 dBA L_{dn} and 48.6 dBA L_{eq}, or no more than 10 dBA over background if ambient noise levels are above 55 dBA L_{dn}." at all surrounding NSAs. NSAs are typically residences, schools, churches, or hospitals.

In addition to the 55 dBA L_{dn} and 48.6 dBA L_{eq} nighttime sound level targets, for this Project, the nighttime construction noise has been compared to the existing nighttime ambient sound levels, to calculate the short-term increase in sound levels expected due to the construction activities.

9.3.2.2 County Limits

The three counties that the Project crosses have noise ordinances that may be applicable to the Project. Table 9.3-1 provides a summary of the noise limits identified within the ordinances. The Pittsylvania

County ordinance is the only one that provides quantitative limits. Both Rockingham County and Alamance County have ordinances that are primarily nuisance-based and provide no numerical limits.

The Pittsylvania County limits apply at the property boundary of the noise source or at any point within any other affected property, rather than at the NSA structure, so they cannot be directly compared to the FERC sound level requirements. The Pittsylvania County ordinance has an exemption for construction provided it takes place between 7:00 a.m. and 10:00 p.m. The Lambert Compressor Station is located in Pittsylvania County, Virginia. The sound levels from the station have been evaluated against both the FERC and the county sound level requirements.

Table 9.3-1

Noise Level Limits for Counties with Noise Ordinances Crossed by the MVP Southgate Project

County, State	Daytime (7 AM – 10 PM)	Nighttime (10 PM – 7 AM)
Pittsylvania, Virginia	Residential: 57 L_{eq} dBA Industrial: 77 L_{eq} dBA	Residential: 52 L_{eq} dBA Industrial: 77 L_{eq} dBA
Rockingham, North Carolina	Not Applicable (Nuisance based)	
Alamance, North Carolina	Not Applicable (Nuisance based)	

9.3.3 Existing Sound Environment

The existing sound environment surrounding each compressor station, meter station, HDD work area or railroad crossing was quantified during a baseline environmental sound level survey in the vicinity of each site. Sound levels were measured at accessible locations near the NSAs at each site. Observations of the primary existing environmental sound sources were documented.

Type 1 sound level instrumentation was used with field calibration conducted before and after each measurement. Windscreens were installed on all microphones. All instrumentation has current laboratory certification. Weather conditions during each survey were recorded, and the measurements were taken during weather periods appropriate for environmental sound level surveys.

Insect activity was the dominant source of ambient noise at most of the measurement locations. Because insect activity varies seasonally, insect noise may not be present during substantial portions of the year. Ambient data are therefore presented both as measured with the insect noise present, and with the insect noise filtered out by omitting sound energy in the whole octave bands above 1000 Hz in accordance with American National Standard method (ANSI/ASA, 2014). For the purposes of evaluating operational sound level impact, the insect-filtered data is used as the primary point of comparison to be conservative. However, if construction is going to be taking place in the spring or summer when insects will be present, it may be more appropriate to compare construction sound levels to the unfiltered ambient data.

9.3.3.1 Lambert Compressor Station

The Lambert Compressor Station site is located in Pittsylvania County, Virginia approximately 3.0 miles east of Chatham, Virginia. The area surrounding the station is mostly rural consisting of a mix of forest and open land, though there are several residences and Highway 57 within a one-mile radius of the station site. There is an existing Transco compressor station located just northeast of the site. The four closest

NSAs were identified, all residences. Figure 9.3-1 (Appendix 9-E) shows the NSAs in proximity of the Lambert Compressor Station and sound level measurement locations.

Table 9.3-2 shows the weather conditions at the start of the environmental sound level survey.

Table 9.3-2

Weather Conditions during the Lambert Compressor Station Sound Level Survey

Dates	July 18 – July 19, 2018
Temperature Range	81-86° F
Relative Humidity Range	48-64%
Wind Speed	1-4 mph
Wind From	S, W, SSW
Precipitation	none

Table 9.3-3 shows the measured daytime and nighttime sound levels (L_{eq}, dBA) as well as the equivalent day-night sound levels (L_{dn}, dBA). The measured sound level results at NSA 3 was higher than other locations due to traffic on Highway 57. Measurement locations are shown on Figure 9.3-1 (Appendix 9-E).

Table 9.3-3

Existing Sound Level Measurement Results – Lambert Compressor Station

Monitoring Location	Measurement Duration	All Octave Bands Included			Processed to Remove Insect Noise a/		
		Measured Day Average	Measured Night Average	Measured Day-Night Average	Measured Day Average	Measured Night Average	Measured Day-Night Average
	HH:MM	L_{eq} dBA	L_{eq} dBA	L_{dn} dBA	L_{eq} dBA	L_{eq} dBA	L_{dn} dBA
NSA 1	24:00	42.6	44.5	50.7	36.8	40.8	46.8
NSA 2	24:00						
NSA 3	24:00	61.8	56.3	64.0	60.4	55.1	62.8
NSA 4	24:00	56.4	46.5	56.4	38.6	38.4	44.8

a/ Insect noise was removed by omitting sound energy in the whole octave bands above 1000 Hz in accordance with American National Standard method (ANSI/ASA, 2014)

9.3.3.2 Meter Stations

There are currently four-meter (interconnect) stations planned as part of the Project.

Lambert Interconnect

The Lambert Interconnect will be located on the same site as the Lambert Compressor Station. The noise analysis for this interconnect has been included in the Lambert Compressor Station analysis. The NSAs for this site are therefore the same as for the Lambert Compressor Station. See Figure 9.3-1 (Appendix 9-E) for the meter station, compressor station, NSAs, and measurement locations for this site.

LN 3600 Interconnect

The LN 3600 Interconnect site is located in Rockingham County, North Carolina approximately 4 miles northeast of Meadow Summit, North Carolina. The closest NSA to the site is a residence. See Figure 9.3-2 (Appendix 9-E) for the NSA and measurement locations for this site. See Figure 9.3-2 (Appendix 9-E) for the meter station, compressor station, NSAs, and measurement locations for this site.

T-15 Dan River Interconnect

The T-15 Dan River Interconnect site is located in Rockingham County, North Carolina approximately 5.0 miles east of Eden, North Carolina. The closest NSA to the site is a residence. See Figure 9.3-3 (Appendix 9-E) for the NSA and measurement locations for this site.

T-21 Haw River Interconnect

The T-21 Haw River Interconnect is located in Alamance County, North Carolina approximately 2.0 miles southeast of Graham, North Carolina. The closest NSA to the site is a residence. See Figure 9.3-4 (Appendix 9-E) for the NSA and measurement locations for this site.

Ambient sound levels were measured for 24 hours from July 16 to July 17, 2018. Table 9.3-4 shows the weather conditions during the meter station sound level surveys.

Table 9.3-4

Weather Conditions during the Meter Station Sound Level Surveys

Station	LN 3600 Interconnect	T-15 Dan River Interconnect	T-21 Haw River Interconnect
Dates	July 16 – July 17, 2018	July 16 – July 17	July 16 – July 17
Temperature Range	84 - 92 °F	83 - 94° F	91 – 92° F
Relative Humidity Range	52 – 72	47 - 71%	51 – 62%
Wind Speed	2 - 3 mph	2 - 3 mph	1 mph
Wind From	West	NNW	NNW
Precipitation	none	none	none

Table 9.3-5 shows the measured daytime and nighttime sound levels (L_{eq}, dBA) as well as the equivalent day-night sound levels (L_{dn}, dBA) near the meter stations.

Table 9.3-5

Existing Sound Level Measurement Results – Meter Stations

Monitoring Location	Measurement Duration	All Octave Bands Included			Processed to Remove Insect Noise a/		
		Measured Day Average	Estimated Night Average	Estimated Day-Night Average	Measured Day Average	Estimated Night Average	Estimated Day-Night Average
	HH:MM	L_{eq} dBA	L_{eq} dBA	L_{dn} dBA	L_{eq} dBA	L_{eq} dBA	L_{dn} dBA
LN 3600 Interconnect	24:00	54.3	54.3	60.7	47.2	42.1	49.7
T-15 Dan River Interconnect	24:00	64.7	59.7	67.3	63.1	57.1	65.0
T-21 Haw River Interconnect	24:00	64.9	60.6	67.9	62.8	57.2	65.0

a/ Insect noise was removed by omitting sound energy in the whole octave bands above 1000 Hz in accordance with American National Standard method (ANSI/ASA, 2014)

9.3.3.3 Horizontal Directional Drilling and Railroad Crossing Sites

The HDD method will be used to cross the Dan River in Virginia and the Stony Creek Reservoir in North Carolina. In addition, there will be four railroad crossings that will be performed using the direct bore method and will likely require nighttime construction work. A noise evaluation has been performed for each HDD site and railroad crossing. An ambient noise survey at the potential HDD and railroad crossing sites was conducted to quantify the current ambient sound levels around each site and to document/identify existing NSAs. All NSAs are residences.

Table 9.3-6 shows the weather conditions during the HDD and railroad crossing sound level measurements.

Table 9.3-6

Weather Conditions during the HDD / Railroad Crossing Sound Level Surveys

Location	HDD: Stony Creek Reservoir	HDD: Dan River	Railroad Crossing 1	Railroad Crossing 2	Railroad Crossing 3	Railroad Crossing 4
Dates	July 18, 2018	July 16, 2018	July 16, 2018	July 16, 2018	July 17, 2018	July 18, 2018
Temperature	75° F	80° F	80° F	80° F	82° F	80° F
Relative Humidity	89%	70%	71%	74%	69%	53%
Wind Speed	0 mph	0 mph	1 mph	0 mph	0 mph	0 mph
Wind From	N/A	N/A	W	N/A	N/A	N/A
Precipitation	none	none	none	none	none	none

Figures 9.3-5 through 9.3-10 (Appendix 9-E) show the HDD and railroad crossing work areas along with the identified NSAs and sound level measurement locations. Table 9.3-7 shows the measured daytime and nighttime sound levels (L_{eq}, dBA) as well as the equivalent day-night sound levels (L_{dn}, dBA) near the HDD work areas and railroad crossings.

At all HDD and railroad crossing locations, short-duration nighttime measurements were taken near the closest NSA. Effort was made to exclude noise from passing vehicles from the measurements. Daytime levels were estimated by applying the average day-night sound level difference from a nearby 24-hour measurement location. The average day-night difference from the overnight measurement location closest to each HDD and railroad crossing location was applied to the short-duration data collected to estimate the nighttime level. The average day-night difference of 5 dB from the T-21 Haw River Interconnect measurement position was applied at the Stony Creek Reservoir HDD site and railroad crossing 4, and the average day-night difference of 5.5 dB from the T-15 Dan River Interconnect measurement location was applied to the other four locations.

Table 9.3-7

Existing Sound Level Measurement Results – HDD and Railroad Crossings

Monitoring Location and MP	Measurement Duration	All Octave Bands Included			Processed to Remove Insect Noise a/		
		Estimated Day Average	Measured Night Average	Estimated Day-Night Average	Estimated Day Average	Measured Night Average	Estimated Day-Night Average
	HH:MM	L_{eq} dBA	L_{eq} dBA	L_{dn} dBA	L_{eq} dBA	L_{eq} dBA	L_{dn} dBA
HDD: Stony Creek Reservoir, MP 63.6	00:10	52.8	47.8	55.4	37.1	32.1	39.7
HDD: Dan River, MP 30.2	00:10	61.6	56.1	63.9	40.5	35.0	42.8
Railroad Crossing 1, MP 5.4	00:10	60.4	54.9	62.7	56.6	51.1	58.9
Railroad Crossing 2, MP 25.1	00:10	63.0	57.5	65.3	38.8	33.3	41.1
Railroad Crossing 3, MP 39.8	00:10	54.9	49.4	57.2	43.2	37.7	45.5
Railroad Crossing 4, MP 69.3	00:10	58.3	53.3	60.9	46.3	41.3	48.9

a/ Insect noise was removed by omitting sound energy in the whole octave bands above 1000 Hz in accordance with American National Standard method (ANSI/ASA, 2014)

9.3.4 Project Construction Noise

9.3.4.1 Pipeline Construction Noise and Mitigation

Potential impacts from pipeline construction could include short-term increases in sound. Construction of the pipeline will generate noise from heavy machinery and equipment as construction moves in phases along the right-of-way (see Resource Report 1 for description of pipeline construction). Sound from pipeline construction will generally be temporary, sporadic, and short-term in any one location along the pipeline route. Because of the temporary and generally daytime nature of pipeline construction activities, no special noise mitigation or noise monitoring program will be implemented during the construction phase, except in locations where blasting or HDDs are required. These special cases are discussed below.

9.3.4.2 Compressor Station and Meter Station Construction Noise and Mitigation

Potential impacts at compressor and meter station locations could include short-term increases in sound levels during construction. Only standard construction equipment will be used in the construction of the stations, with no dynamic compaction or pile driving expected. Most construction will occur during daytime working hours of 7:00 a.m. until 7:00 p.m. Emergencies or other non-typical circumstances may necessitate limited nighttime work. The highest sound levels during construction are expected during the early earthmoving phase. Equipment that may be operating during this phase would include bulldozers, front end loaders, dump trucks, generators, etc.

Based on the equipment usage predictions, a sound level calculation was performed for compressor station and meter station construction using the Federal Highway Administration's Roadway Construction Noise Model version 1.1 (FHWA, 2008) The following equipment was included in the construction evaluation:

Daytime Civil Work – total sound power level of 123.9 dBA Lw

- Three (3) Excavators, Komatsu 228 or similar
- Three (3) Bulldozers, Cat D6 or similar
- Three (3) Dump trucks, 26-ton, articulated
- One (1) Generator
- Three (3) Drilling rigs
- Two (2) Pile augers
- One (1) Roller, smooth drum, 25 ton, Bomag or similar

Nighttime Civil Work – total sound power level of 120.2 dBA L_w

- Two (2) Excavators, Komatsu 228 or similar
- Two (2) Bulldozers, Cat D6 or similar
- Two (2) Dump trucks, 26 ton, articulated
- Three (3) Light plants
- One (1) Roller, smooth drum, 25 ton, Bomag or similar

Table 9.3-8 shows a summary of the predicted short-term, daytime construction sound levels at the NSAs for the compressor station and meter stations. The worst-case NSAs are not necessarily the closest NSAs due to terrain shielding between the compressor stations and the NSAs.

As shown in Table 9.3-8, the predicted construction sound levels are all below 55 dBA L_{dn} at the Lambert Compressor Station NSAs, low enough that no special noise mitigation or noise monitoring program will be implemented during daytime only construction. Some of the construction sound level contributions exceed 55 dBA L_{dn} at NSAs close to the T-15 Dan River and T-21 Haw River Interconnects. However, ambient sound levels at those locations are well above 55 dBA L_{dn} and the temporary sound level increase expected during construction is less than 6 decibels during the day and 3.1 decibels for the 24-hour L_{dn}. At all other NSAs, the expected construction sound levels are lower than 55 dBA L_{dn}.

Table 9.3-8

Predicted Temporary Sound Levels Due to Construction, Single 12-Hour Daytime Shift

Compressor / Meter Station	NSA	Existing Ambient Sound Levels, dBA a/			Predicted Sound Level –Single Daytime Shift, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Day	L_{dn}	Day	L_{dn}	Day	L_{dn}
Lambert Compressor Station / Interconnect	1	36.8	40.8	46.8	48.7	46.6	49.0	49.7	12.2	2.9
	2				46.5	44.4	46.9	48.8	10.2	2.0
	3	60.4	55.1	62.8	43.8	41.7	60.5	62.8	0.1	0.0
	4	38.6	38.4	44.8	42.7	40.7	44.1	46.3	5.5	1.4
LN 3600 Interconnect	3	47.2	42.1	49.7	51.2	49.1	52.7	52.4	5.4	2.7
T-15 Dan River Interconnect	1	63.1	57.1	65.0	64.7	62.7	67.0	67.0	3.9	2.0
T-21 Haw River Interconnect	1	62.8	57.2	65.0	67.1	65.1	68.5	68.1	5.6	3.1

a/ To be conservative, ambient levels have been processed to remove insect noise.

Work will primarily be conducted between 6:00 a.m. and 7:00 p.m. or sunset, whichever is later. Nighttime work will be conducted for specific situations related to safety, permit compliance, or construction activities that cannot be stopped until completion (e.g. HDD, conventional bores, dry waterbody crossings). Low noise generating activities (e.g. x-ray, inspections, hydrostatic test, drying, etc.) may also occur during limited nighttime hours.

Table 9.3-9 shows the predicted temporary nighttime sound level impact for 24-hour construction activities. As shown in this table, nighttime construction sound levels are above 48.6 dBA and 55 dBA L_{dn} at certain NSAs. As shown in Table 9.3-9, the predicted construction sound levels are all below 55 dBA L_{dn} at the Lambert Compressor Station NSAs, just above 55 dBA L_{dn} at the LN 3600 Interconnect NSA, and less than 10 dB above the ambient at the T-15 Dan River and T-21 Haw River Interconnects. With the exception of the LN 3600 Interconnect, the predicted levels are low enough that no special noise mitigation or noise monitoring program should be required for 24-hour construction. However, due to the uncertainty of the equipment that might be operating during night construction, the Project will develop a nighttime construction noise management plan if nighttime construction is required at the compressor station or meter stations. This noise management plan will outline the specific equipment that will be operating at night, the location of the equipment, and will predict the sound levels from the expected nighttime equipment. The management plan will include specific noise mitigation, such as noise barriers, quieter equipment, or partial equipment enclosures to ensure that sound levels at the NSAs do not exceed 48.6 dBA at night or 55 dBA L_{dn} overall or 10 dB over the ambient for the T-15 Dan River and T-21 Haw River Interconnects with ambient levels that exceed 55 dBA L_{dn}.

Table 9.3-9

Predicted Temporary Sound Levels Due to Construction, 24-Hour Construction Activities

Compressor / Meter Station	NSA	Existing Ambient Sound Levels, dBA a/			Predicted Sound Level –Single Daytime Shift, dBA		Construction Plus Ambient, dBA		Temporary Increase in Sound Level, dBA	
		Day	Night	L_{dn}	Night	L_{dn}	Night	L_{dn}	Night	L_{dn}
Lambert Compressor Station / Interconnect	1	36.8	40.8	46.8	45.9	53.1	47.1	54.0	6.3	7.2
	2				43.7	50.9	45.5	52.3	4.7	5.5
	3	60.4	55.1	62.8	41.0	48.2	55.3	63.0	0.2	0.1
	4	38.6	38.4	44.8	40.0	47.1	42.3	49.1	3.9	4.3
LN 3600 Interconnect	3	47.2	42.1	49.7	48.5	55.4	49.4	56.4	7.3	6.7
T-15 Dan River Interconnect	1	63.1	57.1	65.0	62.0	69.2	63.2	70.6	6.2	5.6
T-21 Haw River Interconnect	1	62.8	57.2	65.0	64.4	71.5	65.2	72.4	8.0	7.4

a/: To be conservative, ambient levels have been processed to remove insect noise.

9.3.4.3 Blasting

Blasting may be necessary for ditch excavation in locations where shallow bedrock is encountered. Most of the energy released during blasting goes towards rock breakage and movement, but a small portion passes outside the intended work zone in the form of ground or air vibrations. Air vibrations are pressure waves generated by the blast, referred to as "airblast" or "air overpressure". High frequency pressure waves (above about 20 Hz) may be heard as sound, while lower frequency pressure waves may be felt rather than heard, similar to a gust of wind. In general, surface detonations involving unconfined or poorly-confined blasts will cause audible noise; well-confined blasts, such as those used to excavate rock, generate lower frequency effects with airblast energy predominantly in the inaudible range. For this reason, and because noise from blasting is inherently short-term, there are often no audible noise limits for blasting projects. Blast emission criteria are specified on the basis of safe limits designed to minimize the risk of cosmetic damage such as surface cracks due to either vibration or airblast.

The Project has developed a Project Blasting Plan (see Resource Report 6 – Appendix 6-D). When the locations and extent of blasting is known, a noise and vibration assessment will be completed for residences and historical structures that could be affected by blasting. Noise and vibration due to blasting will be evaluated in accordance with the International Society of Explosives Engineers Blasters'

Handbook, which contains recommended ground vibration limits. If necessary, charge size per delay will be reduced to ensure these limits are not exceeded to prevent structural damage to nearby buildings.

9.3.4.4 Horizontal Directional Drilling and Railroad Crossing Construction Noise and Mitigation

The HDD method will be used to install the pipeline underneath the Dan River in Virginia and Stony Creek Reservoir in North Carolina. In addition, there will be four railroad crossings that will performed using the conventional bore method that will likely require nighttime construction work. A noise evaluation has been performed for each HDD site and railroad crossing.

Equipment Data

The HDD entry and exit sites will have several sound sources in operation during the temporary construction work. On the entry side, sound sources will include the drilling rig itself, mud pumps, generators, drilling mud mixers, shale shakers, light plants, and the driving engines associated with this equipment. Additional sound sources include mobile equipment such as cranes, front-end loaders, forklifts, and trucks. On the exit side, less equipment is required, typically including a backhoe or bulldozer, and possibly a generator and light plant. The actual equipment used, and the site layout and configuration, will depend on the drilling contractor(s) selected for the Project, the site conditions, and other factors. Typical sound power levels (L_w) for peak HDD construction operations based on measurements of previous HDD operations are shown in Table 9.3.10, below. These levels will be used in all HDD calculations in this study.

Table 9.3-10

Sound Power Levels of HDD and Railroad Crossing Equipment

Octave Band Center Frequency, Hz	Unweighted Sound Power Level at Octave Band Center Frequency									Total
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
HDD Entry Site	118	115	112	114	112	109	108	106	98	115
HDD Exit Site	110	108	105	102	100	98	95	92	88	103
Railroad crossing: Auger Boring Machine	116	117	124	107	95	100	97	99	79	110
Railroad crossing: Backhoe	114	115	122	106	93	98	95	97	77	108
Railroad crossing: Light Plant	88	93	93	98	93	88	83	78	73	94

For the conventional bore crossings of the railroads, an auger boring machine will be used similar to the Barbco HD48RCBM. That manufacturer reports that the auger produces sound level of 87 dBA at 20 feet. A standard diesel-powered engine spectrum was applied to the reported sound levels, and six light plants and two backhoes were included (or similar engine-driven earthmovers) at each railroad crossings.

Sound level data for the ancillary equipment were derived from the Federal Highway Administration's Roadway Construction Noise Model (FHWA 2008)[4]. The sources were used as inputs in a three-dimensional computer noise model developed using CadnaA acoustical modeling software.

These values represent conservative estimates without assumption of any additional noise control treatments. These levels do assume that all original equipment manufacturer noise control treatments are correctly installed and that all operating equipment is well-maintained and in good operating condition. These levels also assume some slight typical shielding and screening effects from the tanks and trailers that are used in typical construction operations.

Operations Schedule

The current drilling operation plan is to perform HDD activities whenever dictated by schedule or operations, 24-hours per day if necessary. As such, all calculations are based on the maximum HDD activity sound power levels shown in Table 9.3-10 without any adjustment for reduced activities during nighttime hours.

For the railroad crossings, 24-hour construction activities will be required for two to three days at each crossing. The duration could extend up to 14 days if problems are encountered during construction. The pipeline construction beyond the railroad crossing locations will take place during daytime unless otherwise specified.

Calculations

A noise model was developed for each HDD work area and railroad crossing using CadnaA version 2018 build 161.4801. The models were used to calculate the expected temporary sound level contributions due to the HDD and railroad crossing equipment. The ISO 9613-2 standard was used to calculate the divergence, atmospheric absorption, foliage, and ground absorption for the path from the HDD entry or exit site to the closest NSA.

Since the drilling direction has not been decided, two models were constructed for each HDD location, with each side modeled as both entry and exit. The models were used to identify both the worst-case NSA (i.e., the NSA likely to experience the highest noise) for either drilling direction and how many NSAs will potentially be affected. If the calculations indicated that the sound level at the worst-case NSA would exceed the sound level target, the required noise mitigation has been evaluated to meet the targets. A summary of the calculation results for all of the NSAs and railroad crossings is included in Table 9.3-11 below.

Predicted Temporary Sound Level Impact

The predicted HDD and railroad crossing equipment sound level contribution for each NSA was calculated using the noise model. The calculated sound level contribution was then combined with the

[4] FHWA (2008) Roadway Construction Noise Model, Federal Highway Administration, US Department of Transportation. Version 1.1, December 8, 2008.

measured ambient sound levels to determine the potential short-term sound level impact of the HDD or railroad crossing activities.

Noise Mitigation for HDD and Railroad Sites

For those HDD or railroad crossing sites where the predicted HDD or boring activity sound levels at the NSAs are predicted to be greater than 55 dBA L_{dn}, noise mitigation for the equipment or compensation/relocation will likely be necessary in order to achieve the noise goals. For noise mitigation on HDD or conventional bore equipment, engine exhaust and barrier treatments are typically used to reduce the sound level contribution to less than 55 dBA L_{dn}. Typically, all engines on power units, gensets, etc. would be fitted with residential-grade exhaust mufflers, and temporary barriers may be installed between the HDD / conventional bore site and the nearest NSAs. Secondary noise control treatments may be required, depending on the actual equipment and site layout used.

As an alternative to these primary and/or secondary noise control treatments, the Project may consider offering the residents compensation or temporary relocation as a means of reducing the temporary construction noise impact. If all impacted residents choose to accept temporary relocation compensation, then temporary barriers or other treatments will not be necessary.

Table 9.3-11 provides a summary of the Noise Quality Analysis for the planned HDD and railroad crossing sites at the closest NSA to the entry and exit side of the planned HDD and assumes that a "standard" drilling rig is employed (i.e., no additional noise mitigation measures included).

Table 9.3-11

Predicted Temporary Sound Levels Due to HDD / Railroad Crossing

HDD and Railroad Crossing	Distance and Direction of the Closest NSA to Site Center	Existing Ambient	Calculated Sound Level		Existing Ambient L_{dn} Plus L_{dn} of Operations	Temporary Change in the Ambient Sound Level
		L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{dn} dBA	L_{dn} dBA
Dan River HDD	1400 feet N	39.7	46.5	52.9	53.1	13.4
Stony Creek Reservoir HDD	300 feet NW	42.8	54.2	60.6	60.7	17.9
Railroad Crossing 1	3550 feet E	58.9	38.7	45.1	59.0	0.2
Railroad Crossing 2	3000 feet S	41.1	31.9	38.3	42.9	1.8
Railroad Crossing 3	250 feet NW	45.5	63.1	69.5	69.5	24.1
Railroad Crossing 4	700 feet N	48.9	50.3	56.7	57.4	8.5

Railroad Crossings 1 and 2 are located in Pittsylvania County and therefore are subject to the county noise ordinance. Construction noise is exempt from the Pittsylvania County noise ordinance if it occurs between 7:00 a.m. and 10:00 p.m. However, if nighttime construction is necessary, the sound due to construction is expected to be less than 52 dBA at the nearest resident's property line for both locations.

The acoustical assessment indicates that the noise of HDD operations at the entry site for the planned HDD crossing at the Stony Creek Reservoir could exceed 55 dBA L_{dn} at the closest NSAs. Noise from the direct bore work at Railroad Crossings 3 and 4 will likely also exceed 55 dBA L_{dn} at the closest NSAs.

HDD activities can occur over the course of several weeks, so compensation or relocation are typically not practical for HDD work areas. Railroad crossings typically take one to three days, so compensation or relocation of affected residents of the most impacted NSAs is a practical noise mitigation option.

Noise mitigation for the Stony Creek Reservoir HDD site will likely take the form of a noise barrier, erected between the HDD site and the closest NSAs. Calculations indicate that an approximately 12 decibel reduction in the HDD site sound level contributions are possible through the implementation of a series of 12-14 foot tall noise barriers located approximately 20 feet from the primary noise generating equipment at the HDD site. Similar reductions would be expected for the direct bore equipment at the railroad crossings. Table 9.3-12 shows the predicted sound levels with a noise barrier in place for the Stony Creek Reservoir HDD site and at Railroad Crossings 3 and 4.

Even with noise barriers in place, it is likely that the sound levels due to the direct bore at Railroad Crossing 3 will exceed 55 dBA L_{dn} due to the close proximity of the NSA to the work area. Due to the short-term nature of the railroad crossing work, temporary compensation or relocation of the effected residents is likely the most efficient method.

Table 9.3-12

Predicted Temporary Sound Levels Due to HDD / Railroad Crossings with Noise Mitigation

HDD Crossing (Entry or Exit Site)	Distance and Direction of the Closest NSA to Site Center	Existing Ambient	Calculated L_{dn} of the Operations	Existing Ambient L_{dn} Plus L_{dn} of Operations	Temporary Change in the Ambient Sound Level
		L_{dn} dBA	L_{dn} dBA	L_{dn} dBA	L_{dn} dBA
Stony Creek Reservoir HDD	300 feet NW	42.8	48.7	49.7	6.9
Railroad Crossing 3	250 feet NW	45.5	57.5	57.8	12.3
Railroad Crossing 4	700 feet N	48.9	44.7	50.3	1.4

9.3.5 Project Operation Noise

9.3.5.1 Compressor and Meter Station Operational Noise and Mitigation

The Project has developed noise models for the Lambert Compressor Station using the most current station designs and manufacturer specifications.

The following equipment items were considered significant sound sources in the model:

- Noise from the turbine exhaust, including the exhaust outlet and noise radiated from the exhaust ductwork, expansion joints, and silencer shell;
- Noise from the turbine intake air system, including the inlet opening and noise radiated from the silencer/ductwork shell and any duct joints;
- Turbine/Compressor casing noise that penetrates the building and building ventilation openings;
- Noise from the lube oil/auxiliary cooler and gas aftercooler; and
- Noise radiated by aboveground station piping.

Noise Model Methodology

The noise model for each compressor station was developed using CadnaA, version 2018 build 161.4801, a commercial noise modeling package developed by DataKustik GmbH. The software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, reflections from surfaces and other sound propagation properties. The software is based on published engineering standards. The ISO 9613 standard was used for air absorption and other noise propagation calculations. To be conservative, no foliage was included in the noise model. The model presents a worst-case prediction without any influence of trees or vegetation.

Noise Model Inputs

Sound power and sound pressure level data for the equipment in the noise models were taken from manufacturer data (if available) or from measurements of similar equipment at other compressor stations or interconnects. An exhaust system consistent with the planned turbine installations and current vendor proposals for the Project was modeled assuming an exhaust height of 45.5 feet above grade. The Lambert Compressor Station was modeled with one 10,915 hp Titan 130 turbine and one 15,900 hp Mars 100 turbine.

Table 9.3-13 shows the sound pressure levels and sound power levels used to model the Project compressor station and interconnect equipment along with the source of the information.

Table 9.3-13

Sound Pressure Levels (L_p) and Sound Power Levels (L_w) for Station Equipment

Source	Linear L_p or L_w at Octave Center Frequency									Total
	31.5	63	125	250	500	1k	2k	4k	8k	dBA
Lambert Compressor Station										
Solar Mars 100 Silenced Exhaust and Breakout, Sound Pressure Level at 200 ft., L_p a/	56	56	52	46	39	35	34	34	34	43
Solar Mars 100 Unsilenced Inlet, Sound Pressure Level at 50 ft., L_p b/	81	87	93	94	95	97	100	129	121	130
Solar Taurus 70 Exhaust, Sound Pressure Level with Silencer at 200 ft., L_p a/	67	65	50	45	36	33	34	31	34	44
Solar Taurus 70 Intake, Sound Pressure Level at 50 ft., L_p b/	81	86	96	98	98	101	106	139	122	140
Solar 90 dBA Lube Oil Cooler, Sound Pressure Level at 50 ft., L_p b/	64	71	68	61	56	53	49	45	39	60
Total Sound Power Level of Each Gas Aftercooler, L_w c/	95	95	94	91	86	84	78	72	66	89
Solar Mars 100 Inlet Breakout, Total L_w d/	89	77	75	80	70	68	70	77	63	80
Solar Taurus 70 Exhaust Breakout, Total L_w d/	96	98	95	95	89	87	96	95	84	100
Solar Taurus 70 Inlet Breakout, Total L_w d/	103	91	89	94	84	82	84	91	77	95
Sound Level in Compressor Building at Inner Wall Surface, L_p d/	83	83	94	97	96	95	97	105	95	107
Unlagged Suction Piping, Total L_w per unit d/	96	98	97	92	93	98	113	102	92	114
Unlagged Discharge Piping, Total L_w per unit d/	90	86	86	92	97	90	102	94	83	104
Fuel Gas Skid, L_w d/	-	-	-	85	85	66	72	67	66	84
Capstone C-1000 Generator, Sound Pressure Level at 10 meters L_p e/	71	71	69	61	62	58	54	58	57	65
54” Building Wall Panel Fan, L_w d/	101	101	98	94	93	90	86	83	82	95
Unit Venting f/	137	125	114	103	95	96	97	99	97	107
Interconnects										
Meter Station Piping d/	31	49	56	62	69	74	77	79	64	83
Flow Control Valves d/	72	77	73	73	74	76	78	80	67	84

a/ Manufacturer’s quote provided by Mountain Valley.
b/ From Solar.
c/ From Moore Fan Datasheet
d/ Based on measurements of similar installed equipment.
e/ From Capstone
f/ As specified by Mountain Valley

Each compressor building will include wall exhaust fans and an acoustically baffled roof ridge vent. The sound levels due to intake ductwork, exhaust system ductwork, and suction and discharge piping were based on sound level measurements of similar equipment at existing compressor stations. The gas cooler sound power levels were taken from a manufacturer datasheet. The lube oil cooler sound power levels were supplied by Solar.

Noise Control Treatments

The noise models include certain noise control treatments as part of the compressor station design; however, there are many different combinations of noise control mitigation measures that would provide similar noise control. As the station design is finalized, noise mitigation treatments will also be finalized and will be modified as needed to ensure each station operates in compliance with FERC and local sound level requirements. Noise control treatments included in the noise model are shown in Table 9.3-14 and summarized below.

Table 9.3-14

Modeled Noise Control Treatments, Insertion Loss (IL) or Transmission Loss (TL)

Source	Treatment Description	Modeled Treatment Performance								
		31.5	63	125	250	500	1k	2k	4k	8k
Lambert Compressor Station										
Mars 100 Turbine Inlet	Stock Mars 100 Inlet Silencer, DIL	2	4	7	16	40	50	51	55	55
	Pulse Updraft Filter	2	4	8	9	13	26	27	27	33
	Combined Silencer and Filter Performance	4	8	15	25	53	76	78	82	88
Taurus 70 Turbine Inlet	Stock Taurus 70 Inlet Silencer, DIL	1	2	4	6	22	43	47	55	52
	Pulse Updraft Filter	2	4	8	9	13	26	27	27	33
	Combined Silencer and Filter Performance	3	6	12	15	35	69	74	82	85
Compressor Building	STC-40 Wall and Roof System, TL	10	15	22	34	49	54	55	56	58
Personnel Door	Insulated Personnel Door, TL	2	7	12	17	18	19	22	30	35
Equipment Door	Insulated Roll-up Door, TL	2	7	12	17	18	19	22	30	35
Building Ventilation	Three-foot silencers and lined hoods, DIL	0	2	7	16	25	32	32	21	14
Ridge Vent	Acoustic Baffle, TL	0	0	0	4	6	9	9	14	9
Comp. Suction and Discharge Piping	Lagging (ISO Type B2), DIL	0	0	0	0	6	15	24	33	42

Compressor Building Walls and Roof

The compressor buildings will include a minimum STC-40 wall and roof system. The compressor buildings will have no windows, skylights, or translucent panels. The building will be well sealed with no cracks or gaps, and all piping penetrations through the building walls will be flashed and caulked. The interior surfaces of the compressor building walls have been modeled as acoustically absorptive with an average Noise Reduction Coefficient of 0.8 or better.

Compressor Building Doors and Ventilation

The compressor buildings will have standard insulated overhead doors and industrial metal doors with good perimeter seals, all meeting defined acoustic transmission loss specifications. All building ventilation openings should include standard acoustical louvers or silencers to meet the Project requirements.

Turbine Exhaust Silencers and Breakout

The manufacturer warrants that the sound pressure level for the Mars 100 unit exhaust system at a distance of 200 feet from the exhaust will not exceed 45 dBA and the entire exhaust system for the Taurus 70 unit exhaust system will not exceed 45 dBA at a distance of 200 feet. The breakout noise generated by the exhaust system ductwork was included at this level.

Turbine Intake Silencers and Breakout

The sound pressure level of the intake system was warranted by the manufacturer to not exceed 73 dBA at 50 feet from the air inlet. This level includes the performance of the entire system, including any filter insertion losses and breakout noise.

Station Piping

Noise from centrifugal compressors can cause significant noise radiation from connected piping. To the extent practical, suction and discharge piping will be run underground. No acoustical lagging was included in the compressor station models, but aboveground main gas piping can be acoustically lagged as necessary.

Noise Modeling Results

The predicted sound levels from the acoustic modeling for the Lambert Compressor Station is shown in Figure 9.3-11, (Appendix 9-E) and the predicted sound levels due to meter station operations are shown in Figures 9.3-12 through 9.3-14 (Appendix 9-E). Predicted noise impacts on the nearest NSAs to each station are presented in Table 9.3-15. Site locations, layouts, and modeled equipment were determined from best available information and incorporated site-specific sound mitigation measures for these compressor and meter stations such as acoustical building enclosures, turbine intake and exhaust silencers.

Table 9.3-15

Predicted Sound Levels – Compressor and Meter Station

Compressor/ Meter Station	NSA	Distance from Compressor Station to NSA (feet)	Direction	Measured Existing Ambient (L_{dn} dBA)	Estimated Contribution of Station Equipment (L_{eq} dBA / L_{dn} dBA)		Combined, All Sources Including Ambient (L_{dn} dBA)	Increase Above Existing Condition (dB)
Lambert Compressor Station	1	3,480	WSW	46.8	41.6	48.0	50.5	3.7
	2	3,500	SW		35.2	41.6	47.9	1.1
	3	3,290	SE	62.8	34.3	40.7	62.8	0.0
	4	3,800	N	44.8	33.0	39.4	45.9	1.1
LN 3600 Interconnect	1	3,010	SE	49.7	41.6	48.0	50.5	3.7
T-15 Dan River Interconnect	1	750	S	65.0	40.4	46.8	65.1	0.1
T-21 Haw River Interconnect	1	550	N	65.0	35.4	41.8	65.0	0.0

As demonstrated by the noise model results, operation of the compressor and meter stations, with the noise mitigation included in the design, will contribute sound levels of less than 55 dBA L_{dn} at all NSAs. The predicted increase in the ambient sound levels ranges from 0.0 to 4.2 dB and is less than 10 decibels at all NSAs. The stations are predicted to operate in full compliance with FERC noise regulations.

Lambert Compressor Station is subject to the Pittsylvania County noise ordinance which limits sound levels at the station property line to 57 dBA during the day and 52 dBA at night for residential areas and to 77 dBA during both day and night for industrial areas. The parcels along the northeast property line are zoned industrial. The highest predicted sound level at the station property line is 65 dBA at the northeast property line adjacent to the Transco station. This is less than the 77 dBA limit for industrial areas. The highest predicted station sound level at a non-industrial property line is 51.9 dBA at the property line southeast of the station. This is just below than the nighttime limit of 52 dBA for agricultural property. The station is, therefore, predicted to comply with the Pittsylvania County noise ordinance.

9.3.5.2 Compressor Station Unit Venting Noise and Mitigation

Under certain circumstances, the pressure in the compressor casing and unit piping must be released in a controlled manner. These events are called unit venting and occur when a unit is shut down for an extended period. During venting, the high-pressure gas in the system is released in a controlled fashion through a silencer. Venting events may cause a temporary increase in sound level that usually lasts for approximately five minutes.

Compressor units will vent through silencers to limit the noise during venting. A compressor unit venting scenario was modeled for the Lambert station using a silencer designed to limit the maximum sound level due to venting to less than 85 dBA at 3 feet from each silencer.

Table 9.3-16 shows sound level predictions for the NSA at which the compressor station unit venting is predicted to be loudest. The worst-case NSA is not necessarily the closest NSA due to terrain shielding between the station and NSAs. The unit venting sound level is compared to the nighttime average level at the NSA to show the potential short-term sound level impact at the station. The predicted unit venting sound levels are low, with the highest predicted sound level of 36.5 dBA at NSA 1 of the Lambert Compressor Station.

Table 9.3-16

Lambert Compressor Station Unit Venting Sound Level Prediction

Worst Case NSA	Measured Existing Ambient, Night Average (L_{eq} dBA)	Estimated Contribution of Unit Venting (L_{eq} dBA)	Combined Venting and Ambient (L_{eq} dBA)	Short-term Sound Level Increase During Venting (dB)
1	44.5	36.5	45.1	0.6

9.3.5.3 Emergency Shutdown Noise and Mitigation

The compressor station has an emergency shutdown ("ESD") system that automatically halts operation of the station in the event of an irregularity. This results in full station venting during which the gas from all station piping is released in a controlled manner. These events are extremely rare and take place only in the event of an emergency or when the system is tested once every year. Residents will be notified in advance of the annual ESD system test.

The sound level due to an ESD event will be high enough to be audible within a one-mile radius and is intended to function as an alarm to notify nearby residents of a potential emergency.

9.3.5.4 Vibration

Large turbine exhausts, such as those present at the Lambert compressor station can be a source of low-frequency noise. Low-frequency noise can result in acoustically induced vibrations if the sound pressure level is above 65 dB in the 31.5 Hz octave band or above 75 dB in the 63 Hz octave band. The model predicts the station contribution will be 50 dB at 31.5 Hz and 50 dB at 63 Hz at the closest NSA to Lambert Compressor Station. Therefore, low-frequency noise induced vibration of structures should not be a concern.

9.3.6 Post Construction Sound Survey

As per FERC requirements, the Project will undertake post-construction sound level testing at the compressor station within 60 days of the station being placed into constant service. The testing will consist of sound level measurements at the closest NSAs with the station equipment in full-load operation. If full-load operation is not possible, then appropriate adjustments will be applied to the measured levels to estimate the sound levels under full-load conditions. The measured levels, along with the measurement methodology, measurement equipment used, station operating and weather conditions during the testing will be included in a report that will be submitted to the Commission. If the station sound level contributions are found to exceed the Commission's sound level limits, then the reports will include the noise mitigation or equipment modifications that will be implemented to bring the station sound level contributions to below 55 dBA L_{dn}.

9.3.7 Cumulative Effect

Section 1.10 of Resource Report 1 discusses the reasonably foreseeable future actions that have been included in the cumulative impacts assessment for the Project, with the projects considered shown in Table 1.10-1. Generally, the cumulative impact assessment radius for noise is one mile. Of the projects listed in Table 1.10-1, only the Mountain Valley Pipeline and Stony Mill Road Construction are within one mile of the Southgate Project.

The Mountain Valley Pipeline Project is under construction and should be complete by the time that construction begins on the Southgate Project, so there is limited opportunity for cumulative construction noise impacts. In addition, there are no Mountain Valley Pipeline aboveground facilities (compressor stations or meter stations) within one mile of any of the Southgate Project aboveground facilities, so there are no cumulative operational noise impacts expected.

The Stony Mill Road construction project is a small road construction project at the intersection of Stony Mill Road and Tunstall High Road in Pittsylvania County, Virginia. There are no Southgate Project compressor stations, meter stations, HDDs, or railroad crossings within one mile of this project, so the only potential cumulative noise impact that could arise would be during pipeline construction. At the 0.5-mile distance from the pipeline corridor to the intersection, it is not expected that pipeline construction activities will be a significant noise source. No cumulative noise impacts are expected for the Stony Mill Road construction.

9.4 References

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MVP Southgate Project

Docket No. CP19-XX-000

Resource Report 9

Appendix 9-A

Construction Emissions Calculations

Table 9-A1

MVP Southgate Project
Construction Period Emissions Summary

County	Activity	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
		CO_2	CO	NOx	PM_{10}	PM_{25}	SO_2	VOC	HAPS	CO_2	CO	NOx	PM_{10}	PM_{25}	SO_2	VOC	HAPS
Pittsylvania, VA	Non-Road and On-Road Construction Vehicles and Worker Commutes	39,222.0	59.5	93.7	6.2	5.7	0.2	12.4	1.1	3,885.8	5.2	7.3	0.6	0.5	0.0	1.2	0.1
	Fugitive Dust	0.0	0.0	0.0	402.3	42.8	0.0	0.0	0.0	0.0	0.0	0.0	233.5	24.8	0.0	0.0	0.0
	Open Burning	3,293.1	145.0	4.1	17.6	17.6	0.0	24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	**42,515.0**	**204.4**	**97.9**	**426.1**	**66.1**	**0.2**	**37.3**	**1.1**	**3,885.8**	**5.2**	**7.3**	**234.1**	**25.3**	**0.0**	**1.2**	**0.1**
Rockingham, NC	Non-Road and On-Road Construction Vehicles and Worker Commutes	33,527.6	43.4	78.8	5.0	4.6	0.2	10.1	0.9	1,594.3	1.5	2.1	0.1	0.1	0.0	0.4	0.0
	Fugitive Dust	0.0	0.0	0.0	414.9	44.1	0.0000	0.0	0.0	0.0	0.0	0.0	240.4	25.6	0.0	0.0	0.0
	Open Burning	3,255.1	143.3	4.1	17.4	17.4	0.0	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	**36,782.7**	**186.7**	**82.9**	**437.2**	**66.1**	**0.2**	**34.7**	**0.9**	**1,594.3**	**1.5**	**2.1**	**240.5**	**25.7**	**0.0**	**0.4**	**0.0**
Alamance, NC	Non-Road and On-Road Construction Vehicles and Worker Commutes	31,438.9	39.0	73.1	4.5	4.2	0.2	9.4	0.9	1,616.8	1.5	2.2	0.1	0.1	0.0	0.4	0.0
	Fugitive Dust	0.0	0.0	0.0	270.5	28.8	0.0	0.0	0.0	0.0	0.0	0.0	157.2	16.7	0.0	0.0	0.0
	Open Burning	2,325.7	102.4	2.9	12.4	12.4	0.0	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	**33,764.6**	**141.4**	**76.0**	**287.5**	**45.4**	**0.2**	**27.0**	**0.9**	**1,616.8**	**1.5**	**2.2**	**157.3**	**16.8**	**0.0**	**0.4**	**0.0**
PROJECT TOTAL		**113,062.3**	**532.5**	**256.8**	**1,150.8**	**177.5**	**0.6**	**98.9**	**2.9**	**7,097.0**	**8.2**	**11.7**	**631.9**	**67.8**	**0.04**	**2.0**	**0.2**

Table 9-A2

MVP Southgate Project
Construction Period Work Activity Emissions Summary

Summary of Non-Road Emissions

Activity	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
H-605 and H-650 Pipeline - Pittsylvania County, VA	27,862	23.98	65.53	3.74	3.74	0.1460	8.25	0.64	1,472	0.74	1.98	0.11	0.11	0.0074	0.38	0.03
H-650 Pipeline - Rockingham County, NC	27,862	23.98	65.53	3.74	3.74	0.1460	8.25	0.64	1,472	0.74	1.98	0.11	0.11	0.0074	0.38	0.03
H-650 Pipeline - Alamance County, NC	27,862	23.98	65.53	3.74	3.74	0.1460	8.25	0.64	1,472	0.74	1.98	0.11	0.11	0.0074	0.38	0.03
Lambert Compressor Station/ Interconnect	7,664	15.26	22.16	1.64	1.64	0.0413	3.13	0.18	1,929	2.14	4.46	0.34	0.34	0.0101	0.69	0.04
LN 3600 Interconnect	1,470	2.54	4.35	0.30	0.30	0.0079	0.57	0.03	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
T-15 Dan River Interconnect	1,470	2.54	4.35	0.30	0.30	0.0079	0.57	0.03	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
T-21 Haw River Interconnect	1,470	2.54	4.35	0.30	0.30	0.0079	0.57	0.03	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
TOTAL	**95,660**	**94.81**	**231.81**	**13.77**	**13.77**	**0.5030**	**29.60**	**2.20**	**6,346**	**4.35**	**10.38**	**0.65**	**0.65**	**0.0322**	**1.83**	**0.14**

Summary of On-Road Construction Vehicle Emissions including Material Deliveries/Removals and Worker Commutes

Activity	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
H-605 and H-650 Pipeline - Pittsylvania County, VA	972	8.52	0.77	0.17	0.04	0.0066	0.26	0.11	113	0.60	0.19	0.03	0.01	0.0009	0.03	0.01
H-650 Pipeline - Rockingham County, NC	900	8.30	0.61	0.15	0.03	0.0060	0.24	0.10	78	0.57	0.09	0.02	0.00	0.0006	0.02	0.01
H-650 Pipeline - Alamance County, NC	950	8.42	0.73	0.17	0.04	0.0064	0.25	0.11	101	0.59	0.15	0.02	0.01	0.0008	0.03	0.01
Lambert Compressor Station/ Interconnect	470	3.77	0.46	0.09	0.02	0.0033	0.13	0.05	95	0.65	0.12	0.02	0.01	0.0007	0.03	0.01
LN 3600 Interconnect	50	0.42	0.04	0.01	0.00	0.0003	0.01	0.01	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
T-15 Dan River Interconnect	50	0.42	0.04	0.01	0.00	0.0003	0.01	0.01	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
T-21 Haw River Interconnect	50	0.42	0.04	0.01	0.00	0.0003	0.01	0.01	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
TOTAL	**3,442**	**30.27**	**2.69**	**0.61**	**0.13**	**0.0233**	**0.91**	**0.39**	**386**	**2.40**	**0.56**	**0.08**	**0.03**	**0.0029**	**0.11**	**0.03**

Summary of Off-Road Vehicle Travel

Activity	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
H-605 and H-650 Pipeline - Pittsylvania County, VA	488	2.17	0.92	0.12	0.05	0.0038	0.14	0.04	44	0.20	0.08	0.01	0.00	0.0003	0.01	0.00
H-650 Pipeline - Rockingham County, NC	488	2.17	0.92	0.12	0.05	0.0038	0.14	0.04	44	0.20	0.08	0.01	0.00	0.0003	0.01	0.00
H-650 Pipeline - Alamance County, NC	488	2.17	0.92	0.12	0.05	0.0038	0.14	0.04	44	0.20	0.08	0.01	0.00	0.0003	0.01	0.00
Lambert Compressor Station/ Interconnect	1,766	5.78	3.87	0.46	0.20	0.0144	0.50	0.11	233	0.84	0.49	0.06	0.03	0.0019	0.07	0.02
LN 3600 Interconnect	618	1.51	1.49	0.17	0.08	0.0052	0.18	0.04	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
T-15 Dan River Interconnect	618	1.51	1.49	0.17	0.08	0.0052	0.18	0.04	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
T-21 Haw River Interconnect	618	1.51	1.49	0.17	0.08	0.0052	0.18	0.04	0	0.00	0.00	0.00	0.00	0.0000	0.00	0.00
TOTAL	**5,086**	**16.80**	**11.09**	**1.32**	**0.59**	**0.0413**	**1.44**	**0.33**	**364**	**1.43**	**0.74**	**0.09**	**0.04**	**0.0029**	**0.10**	**0.03**

Summary of Open Burning Emissions

Activity	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS	CO_2	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPS
H-605 and H-650 Pipeline - Pittsylvania County, VA	3,228	142.10	4.06	17.26	17.26	0.0	24.4	NA	0	0	0	0	0	0	0	NA
H-650 Pipeline - Rockingham County, NC	3,251	143.13	4.09	17.38	17.38	0.0	24.5	NA	0	0	0	0	0	0	0	NA
H-650 Pipeline - Alamance County, NC	2,326	102.39	2.93	12.43	12.43	0.0	17.6	NA	0	0	0	0	0	0	0	NA
Lambert Compressor Station/ Interconnect	65	2.88	0.08	0.35	0.35	0.0	0.5	NA	0	0	0	0	0	0	0	NA
LN 3600 Interconnect	2	0.09	0.002	0.01	0.01	0.0	0.01	NA	0	0	0	0	0	0	0	NA
T-15 Dan River Interconnect	2	0.09	0.002	0.01	0.01	0.0	0.01	NA	0	0	0	0	0	0	0	NA
T-21 Haw River Interconnect	0	0.00	0.00	0.00	0.00	0.0	0.0	NA	0	0	0	0	0	0	0	NA
TOTAL	**8,874**	**390.67**	**11.16**	**47.44**	**47.44**	**0.0**	**66.97**	**0.00**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.00**

Summary of Fugitive Dust Emissions

Activity	2020 Emission Totals (Tons)		2021 Emission Totals (Tons)	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
H-605 and H-650 Pipeline - Pittsylvania County, VA	388	41.27	226.48	24.07
H-650 Pipeline - Rockingham County, NC	412	43.81	240.41	25.55
H-650 Pipeline - Alamance County, NC	269	28.64	157.15	16.70
Lambert Compressor Station/ Interconnect	14	1.49	7.02	0.75
LN 3600 Interconnect	1	0.12	0.00	0.00
T-15 Dan River Interconnect	2	0.17	0.00	0.00
T-21 Haw River Interconnect	1	0.12	0.00	0.00
TOTAL	1,088	115.61	631.07	67.08

Table 9-A3

MVP Southgate Project

Fugitive Dust Emissions During Construction

Facility	County	Disturbed Acreage	Construction Duration (months)	Exposed Soils (acre-months)	Total PM Emissions (tons)				Earth Moving - Total PM Emissions (tons)				Wind Erosion - Total PM Emissions (tons)			
					2020		2021		2020		2021		2020		2021	
					PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Pipeline	Pittsylvania, VA	514.2	19	9,770	388.25	41.27	226.48	24.07	339.40	33.94	197.98	19.80	48.85	7.33	28.50	4.27
	Rockingham, NC	545.9	19	10,372	412.14	43.81	240.41	25.55	360.28	36.03	210.16	21.02	51.86	7.78	30.25	4.54
	Alamance, NC	356.8	19	6,780	269.40	28.64	157.15	16.70	235.51	23.55	137.38	13.74	33.90	5.08	19.77	2.97
Lambert Compressor Station/ Interconnect	Pittsylvania, VA	18.6	18	335	14.05	1.49	7.02	0.75	12.28	1.23	6.14	0.61	1.77	0.27	0.88	0.13
LN 3600 Interconnect	Rockingham, NC	3.5	5	18	1.10	0.12	0.00	0.00	0.97	0.10	0.00	0.00	0.14	0.02	0.00	0.00
T-15 Dan River Interconnect	Rockingham, NC	5.2	5	26	1.62	0.17	0.00	0.00	1.42	0.14	0.00	0.00	0.20	0.03	0.00	0.00
T-21 Haw River Interconnect	Alamance, NC	3.6	5	18	1.12	0.12	0.00	0.00	0.98	0.10	0.00	0.00	0.14	0.02	0.00	0.00
				Total	**27,318**	**1087.68**	**115.61**	**631.07**	**67.08**	**950.82**	**95.08**	**551.66**	**55.17**	**136.86**	**20.53**	**79.41**	**11.91**

Fugitive Dust Emission Factors (Construction)

PM_{10}[2] 5.50E-02 ton/acre-month

$PM_{2.5}$[1,2] 5.50E-03 ton/acre-month

[1]WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1.

[2]WRAP Fugitive Dust Handbook, Table 3-2, level 1, average conditions

Fugitive Dust Emission Factors (Wind Erosion)

PM_{10}[3] 7.92E-03 ton/acre-month

$PM_{2.5}$[3,4] 1.19E-03 ton/acre-month

[3]Wind erosion of exposed areas (seeded land, stripped or graded overburden) = 0.38 ton TSP/acre/yr (WRAP Fugitive Dust Handbook, Table 11-6)

[4]PM_{10}/TSP = 0.5, $PM_{2.5}$/PM_{10} = 0.15, (**WRAP Fugitive Dust Handbook**, Section 7-2)

[5]Water and other approved dust suppressants would be used at construction sites (50% minumum control applied per WRAP Fugitive Dust Handbook).

Table 9-A4

H-605 and H-650 Pipeline Construction Equipment Air Emissions - Pittsylvania County

MVP Southgate Project
H-605 and H-650 Pipeline, Pittsylvania, VA

On-site Road and Nonroad Construction Equipment	Equipment Engine HP	Fuel		Schedule		SCC	Number of Operating Hours		NONROAD2008a Emission Factor (g/hp-hr)								Engine Load Factor
		Diesel	Gasoline	days/week	hours/day		2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Nonroad construction equipment																	
Light plants	15	X		2	4	2270002027	2,149	277	588.92	2.36	4.48	0.35	0.35	0.0040	0.45	0.01	0.43
Bore rigs	250	X		6	10	2270002033	2,080	0	530.27	0.68	2.86	0.15	0.15	0.0031	0.24	0.01	0.43
HDD Reaming/Pullback Rig	875	X		6	10	2270002033	2,080	0	530.03	1.09	4.71	0.18	0.18	0.0031	0.32	0.01	0.43
HDD Assist Reaming/Pilot Hole Rig	440	X		6	10	2270002033	2,080	0	530.35	0.88	3.08	0.14	0.14	0.0031	0.22	0.01	0.43
Excavators (CAT 345C)	325	X		6	10	2270002036	71,240	3,640	536.38	0.38	1.00	0.05	0.05	0.0028	0.14	0.01	0.59
Excavators (JD 350G LC)	271	X		6	10	2270002036	8,060	0	536.40	0.17	0.53	0.02	0.02	0.0026	0.13	0.01	0.59
Excavators (CAT 320DL)	148	X		6	10	2270002036	71,240	3,900	536.39	0.23	0.56	0.04	0.04	0.0027	0.14	0.01	0.59
Off-highway trucks -1-2.5 ton trucks (CAT 725)	309	X		6	8	2270002051	6,656	1,456	536.40	0.20	0.52	0.02	0.02	0.0026	0.13	0.01	0.59
Water Truck	175	X		6	10	2270002051	4,160	1,560	536.41	0.12	0.32	0.01	0.01	0.0026	0.13	0.01	0.59
Utility Truck	100	X		6	10	2270002051	10,140	2,080	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Tractors, loaders, and backhoes (CAT 450F)	144	X		6	6	2270002066	1,560	0	625.13	1.65	2.76	0.34	0.34	0.0036	0.44	0.01	0.21
Dozers (CAT D6K)	125	X		6	10	2270002069	49,920	4,160	536.38	0.28	0.72	0.05	0.05	0.0027	0.14	0.01	0.59
Dozers (CAT D7E)	235	X		6	10	2270002069	49,400	3,900	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59
Off- highway tractors (John Deere 6115D)	115	X		6	6	2270002051	1,404	468	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	248	X		6	10	2270002081	3,120	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Feller Buncher (CAT 553C)	173	X		6	10	2270002081	260	0	536.28	0.61	1.44	0.14	0.14	0.0029	0.17	0.01	0.59
Logging Skidder (CAT 525C)	182	X		6	10	2270002081	780	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Chipper (Bandit 1850)	250	X		6	10	2270002081	780	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Sideboom (CAT 583T Pipelayer)	347	X		6	10	2270002081	37,700	0	536.26	0.95	2.24	0.14	0.14	0.0031	0.18	0.01	0.59
Bending Machine	175	X		6	10	2270002081	3,900	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Stump Grinder (Vermeer SC252)	27	X		6	10	2270002081	1,560	0	595.69	0.38	3.16	0.04	0.04	0.0030	0.15	0.01	0.59
Chain Saw	10	X		6	10	2270002081	7,540	0	594.37	4.49	4.32	0.35	0.35	0.0040	0.56	0.01	0.59
Nonroad Industrial Equipment																	
Bobcat with sweeper attachment	70	X		6	2	2270003040	572	364	589.79	1.16	3.25	0.14	0.14	0.0033	0.18	0.01	0.43
Bobcat with brush hog attachement	70	X		6	2	2270003040	312	0	589.79	1.16	3.25	0.14	0.14	0.0033	0.18	0.01	0.43
Nonroad Commercial Equipment																	
Pumps	15	X		6	6	2270006010	13,416	1,092	588.81	2.43	4.59	0.36	0.36	0.0040	0.49	0.01	0.43
Air compressors	275	X		6	10	2270006015	18,200	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Welders	55	X		6	9	2270006025	19,422	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Pressure washers	5	X		6	4	2270006030	2,392	728	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Hydro power units	200	X		6	10	2270006035	520	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
On-road construction vehicles							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								
Light duty gasoline vehicles (< 6,000 lb GVW)	150		X	6	2		46,800	1,560	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Heavy duty gasoline vehicles (>6,000 lb GVW)	300		X	6	2		393,120	39,000	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Light duty diesel vehicles (< 6,000 lb GVW)	150	X		6	2		82,680	10,920	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	300	X		6	2		42,120	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Deliveries / Removals	Empty Vehicle Weight (tons)	Full Vehicle Weight (tons)	Round Trip Distance (miles)				Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
On-road delivery vehicles																	
Heavy duty diesel vehicles (>6,000 lb GVW) Pipe / Materials Truck	11	21.5	70				74,620	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
On-road material removal vehicles																	
Heavy duty diesel vehicles (>6,000 lb GVW)	11	21.5	70				23,660	23,660	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Construction Areas							Potential Open Burning Area (acres)		AP-42 Section 13 Southern Region Emission Factors (tons/acre) 2014 Climate Registry Default Emission Factors for CO_2								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Potential Open Burning of Forested Area							226	0	14.31	0.63	0.02	0.08	0.08	0.00	0.11	NA	
Construction Workers							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Worker Commutes							1,833,171	125,306	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	

On-site Road and Nonroad Construction Equipment	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs
Nonroad construction equipment																
Light plants	9.00	0.04	0.07	0.005	0.005	0.0001	0.007	0.000	1.16	0.00	0.01	0.001	0.001	0.0000	0.001	0.000
Bore rigs	130.70	0.17	0.70	0.036	0.036	0.0008	0.060	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
HDD Reaming/Pullback Rig	457.24	0.94	4.06	0.157	0.157	0.0027	0.272	0.011	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
HDD Assist Reaming/Pilot Hole Rig	230.06	0.38	1.33	0.060	0.060	0.0014	0.094	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 345C)	8076.65	5.70	15.00	0.819	0.819	0.0417	2.101	0.185	412.68	0.29	0.77	0.042	0.042	0.0021	0.107	0.009
Excavators (JD 350G LC)	761.97	0.24	0.75	0.030	0.030	0.0037	0.191	0.017	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 320DL)	3678.05	1.56	3.83	0.244	0.244	0.0182	0.935	0.084	201.35	0.09	0.21	0.013	0.013	0.0010	0.051	0.005
Off-highway trucks -1-2.5 ton trucks (CAT 725)	717.48	0.26	0.70	0.028	0.028	0.0035	0.179	0.016	156.95	0.06	0.15	0.006	0.006	0.0008	0.039	0.004
Water Truck	253.97	0.06	0.15	0.005	0.005	0.0012	0.063	0.006	95.24	0.02	0.06	0.002	0.002	0.0005	0.023	0.002
Utility Truck	353.74	0.10	0.22	0.008	0.008	0.0017	0.087	0.008	72.56	0.02	0.04	0.002	0.002	0.0004	0.018	0.002
Tractors, loaders, and backhoes (CAT 450F)	32.51	0.09	0.14	0.018	0.018	0.0002	0.023	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Dozers (CAT D6K)	2176.73	1.15	2.92	0.207	0.207	0.0109	0.571	0.050	181.39	0.10	0.24	0.017	0.017	0.0009	0.048	0.004
Dozers (CAT D7E)	4049.71	1.54	5.08	0.220	0.220	0.0201	1.039	0.093	319.71	0.12	0.40	0.017	0.017	0.0016	0.082	0.007
Off- highway tractors (John Deere 6115D)	56.33	0.02	0.03	0.001	0.001	0.0003	0.014	0.001	18.78	0.01	0.01	0.000	0.000	0.0001	0.005	0.000
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	269.88	0.23	0.67	0.043	0.043	0.0014	0.081	0.006	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Feller Buncher (CAT 553C)	15.69	0.02	0.04	0.004	0.004	0.0001	0.005	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Logging Skidder (CAT 525C)	49.51	0.04	0.12	0.008	0.008	0.0003	0.015	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chipper (Bandit 1850)	68.01	0.06	0.17	0.011	0.011	0.0004	0.020	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Sideboom (CAT 583T Pipelayer)	4562.39	8.12	19.09	1.169	1.169	0.0261	1.524	0.105	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Bending Machine	238.05	0.20	0.59	0.038	0.038	0.0013	0.071	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Stump Grinder (Vermeer SC252)	16.32	0.01	0.09	0.001	0.001	0.0001	0.004	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chain Saw	29.15	0.22	0.21	0.017	0.017	0.0002	0.027	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Industrial Equipment																
Bobcat with sweeper attachment	11.19	0.02	0.06	0.003	0.003	0.0001	0.003	0.000	7.12	0.01	0.04	0.002	0.002	0.0000	0.002	0.000
Bobcat with brush hog attachement	6.11	0.01	0.03	0.001	0.001	0.0000	0.002	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Commercial Equipment																
Pumps	56.16	0.23	0.44	0.034	0.034	0.0004	0.046	0.001	4.57	0.02	0.04	0.003	0.003	0.0000	0.004	0.000
Air compressors	1257.68	2.09	7.29	0.463	0.463	0.0075	0.659	0.029	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Welders	268.43	0.45	1.56	0.099	0.099	0.0016	0.141	0.006	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Pressure washers	3.01	0.00	0.02	0.001	0.001	0.0000	0.002	0.000	0.91	0.00	0.01	0.000	0.000	0.0000	0.000	0.000
Hydro power units	26.13	0.04	0.15	0.010	0.010	0.0002	0.014	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road construction vehicles																
Light duty gasoline vehicles (< 6,000 lb GVW)	22.55	0.21	0.02	0.004	0.001	0.0002	0.006	0.003	0.75	0.01	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty gasoline vehicles (>6,000 lb GVW)	189.43	1.75	0.13	0.032	0.006	0.0013	0.050	0.022	18.79	0.17	0.01	0.003	0.001	0.0001	0.005	0.002
Light duty diesel vehicles (< 6,000 lb GVW)	182.97	0.14	0.52	0.055	0.028	0.0016	0.053	0.008	24.17	0.02	0.07	0.007	0.004	0.0002	0.007	0.001
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	93.21	0.07	0.26	0.028	0.014	0.0008	0.027	0.004	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Deliveries / Removals	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles																
Heavy duty diesel vehicles (>6,000 lb GVW) Pipe / Materials Truck	35.96	0.33	0.02	0.006	0.001	0.0002	0.009	0.004	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road material removal vehicles																
Heavy duty diesel vehicles (>6,000 lb GVW)	52.36	0.04	0.15	0.016	0.008	0.0005	0.015	0.002	52.36	0.04	0.15	0.016	0.008	0.0005	0.015	0.002
Construction Areas	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area	3,227.75	142.10	4.06	17.26	17.26	0.00	24.36	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA
Construction Workers	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes	883.34	8.15	0.59	0.151	0.028	0.0059	0.233	0.102	60.38	0.56	0.04	0.010	0.002	0.0004	0.016	0.007

Table 9-A5

H-650 Pipeline Construction Equipment Air Emissions - Rockingham County

MVP Southgate Project
H-650 Pipeline, Rockingham, NC

On-site Road and Nonroad Construction Equipment	Equipment Engine HP	Fuel		Schedule		SCC	Number of Operating Hours		NONROAD2008a Emission Factor (g/hp-hr)								Engine Load Factor	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
		Diesel	Gasoline	days/week	hours/day		2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs
Nonroad construction equipment																																	
Light plants	15	X		2	4	2270002027	2,149	277	588.92	2.36	4.48	0.35	0.35	0.0040	0.45	0.01	0.43	9.00	0.04	0.07	0.005	0.005	0.0001	0.007	0.000	1.16	0.00	0.01	0.001	0.001	0.0000	0.001	0.000
Bore rigs	250	X		6	10	2270002033	2,080	0	530.27	0.68	2.86	0.15	0.15	0.0031	0.24	0.01	0.43	130.70	0.17	0.70	0.036	0.036	0.0008	0.060	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
HDD Reaming/Pullback Rig	875	X		6	10	2270002033	2,080	0	530.03	1.09	4.71	0.18	0.18	0.0031	0.32	0.01	0.43	457.24	0.94	4.06	0.157	0.157	0.0027	0.272	0.011	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
HDD Assist Reaming/Pilot Hole Rig	440	X		6	10	2270002033	2,080	0	530.35	0.88	3.08	0.14	0.14	0.0031	0.22	0.01	0.43	230.06	0.38	1.33	0.060	0.060	0.0014	0.094	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 345C)	325	X		6	10	2270002036	71,240	3,640	536.38	0.38	1.00	0.05	0.05	0.0028	0.14	0.01	0.59	8076.65	5.70	15.00	0.819	0.819	0.0417	2.101	0.185	412.68	0.29	0.77	0.042	0.042	0.0021	0.107	0.009
Excavators (JD 350G LC)	271	X		6	10	2270002036	8,060	0	536.40	0.17	0.53	0.02	0.02	0.0026	0.13	0.01	0.59	761.97	0.24	0.75	0.030	0.030	0.0037	0.191	0.017	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 320DL)	148	X		6	10	2270002036	71,240	3,900	536.39	0.23	0.56	0.04	0.04	0.0027	0.14	0.01	0.59	3678.05	1.56	3.83	0.244	0.244	0.0182	0.935	0.084	201.35	0.09	0.21	0.013	0.013	0.0010	0.051	0.005
Off-highway trucks -1-2.5 ton trucks (CAT 725)	309	X		6	8	2270002051	6,656	1,456	536.40	0.20	0.52	0.02	0.02	0.0026	0.13	0.01	0.59	717.48	0.26	0.70	0.028	0.028	0.0035	0.179	0.016	156.95	0.06	0.15	0.006	0.006	0.0008	0.039	0.004
Water Truck	175	X		6	10	2270002051	4,160	1,560	536.41	0.12	0.32	0.01	0.01	0.0026	0.13	0.01	0.59	253.97	0.06	0.15	0.005	0.005	0.0012	0.063	0.006	95.24	0.02	0.06	0.002	0.002	0.0005	0.023	0.002
Utility Truck	100	X		6	10	2270002051	10,140	2,080	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59	353.74	0.10	0.22	0.008	0.008	0.0017	0.087	0.008	72.56	0.02	0.04	0.002	0.002	0.0004	0.018	0.002
Tractors, loaders, and backhoes (CAT 450F)	144	X		6	6	2270002066	1,560	0	625.13	1.65	2.76	0.34	0.34	0.0036	0.44	0.01	0.21	32.51	0.09	0.14	0.018	0.018	0.0002	0.023	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Dozers (CAT D6K)	125	X		6	10	2270002069	49,920	4,160	536.38	0.28	0.72	0.05	0.05	0.0027	0.14	0.01	0.59	2176.73	1.15	2.92	0.207	0.207	0.0109	0.571	0.050	181.39	0.10	0.24	0.017	0.017	0.0009	0.048	0.004
Dozers (CAT D7E)	235	X		6	10	2270002069	49,400	3,900	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59	4049.71	1.54	5.08	0.220	0.220	0.0201	1.039	0.093	319.71	0.12	0.40	0.017	0.017	0.0016	0.082	0.007
Off- highway tractors (John Deere 6115D)	115	X		6	6	2270002051	1,404	468	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59	56.33	0.02	0.03	0.001	0.001	0.0003	0.014	0.001	18.78	0.01	0.01	0.000	0.000	0.0001	0.005	0.000
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	248	X		6	10	2270002081	3,120	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	269.88	0.23	0.67	0.043	0.043	0.0014	0.081	0.006	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Feller Buncher (CAT 553C)	173	X		6	10	2270002081	260	0	536.28	0.61	1.44	0.14	0.14	0.0029	0.17	0.01	0.59	15.69	0.02	0.04	0.004	0.004	0.0001	0.005	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Logging Skidder (CAT 525C)	182	X		6	10	2270002081	780	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	49.51	0.04	0.12	0.008	0.008	0.0003	0.015	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chipper (Bandit 1850)	250	X		6	10	2270002081	780	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	68.01	0.06	0.17	0.011	0.011	0.0004	0.020	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Sideboom (CAT 583T Pipelayer)	347	X		6	10	2270002081	37,700	0	536.26	0.95	2.24	0.14	0.14	0.0031	0.18	0.01	0.59	4562.39	8.12	19.09	1.169	1.169	0.0261	1.524	0.105	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Bending Machine	175	X		6	10	2270002081	3,900	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	238.05	0.20	0.59	0.038	0.038	0.0013	0.071	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Stump Grinder (Vermeer SC252)	27	X		6	10	2270002081	1,560	0	595.69	0.38	3.16	0.04	0.04	0.0030	0.15	0.01	0.59	16.32	0.01	0.09	0.001	0.001	0.0001	0.004	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chain Saw	10	X		6	10	2270002081	7,540	0	594.37	4.49	4.32	0.35	0.35	0.0040	0.56	0.01	0.59	29.15	0.22	0.21	0.017	0.017	0.0002	0.027	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Industrial Equipment																																	
Bobcat with sweeper attachment	70	X		6	2	2270003040	572	364	589.79	1.16	3.25	0.14	0.14	0.0033	0.18	0.01	0.43	11.19	0.02	0.06	0.003	0.003	0.0001	0.003	0.000	7.12	0.01	0.04	0.002	0.002	0.0000	0.002	0.000
Bobcat with brush hog attachement	70	X		6	2	2270003040	312	0	589.79	1.16	3.25	0.14	0.14	0.0033	0.18	0.01	0.43	6.11	0.01	0.03	0.001	0.001	0.0000	0.002	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Commercial Equipment																																	
Pumps	15	X		6	6	2270006010	13,416	1,092	588.81	2.43	4.59	0.36	0.36	0.0040	0.49	0.01	0.43	56.16	0.23	0.44	0.034	0.034	0.0004	0.046	0.001	4.57	0.02	0.04	0.003	0.003	0.0000	0.004	0.000
Air compressors	275	X		6	10	2270006015	18,200	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	1257.68	2.09	7.29	0.463	0.463	0.0075	0.659	0.029	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Welders	55	X		6	9	2270006025	19,422	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	268.43	0.45	1.56	0.099	0.099	0.0016	0.141	0.006	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Pressure washers	5	X		6	4	2270006030	2,392	728	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	3.01	0.00	0.02	0.001	0.001	0.0000	0.002	0.000	0.91	0.00	0.01	0.000	0.000	0.0000	0.000	0.000
Hydro power units	200	X		6	10	2270006035	520	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	26.13	0.04	0.15	0.010	0.010	0.0002	0.014	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road construction vehicles							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)																								
Light duty gasoline vehicles (< 6,000 lb GVW)	150		X	6	2		46,800	1,560	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		22.55	0.21	0.02	0.004	0.001	0.0002	0.006	0.003	0.75	0.01	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty gasoline vehicles (>6,000 lb GVW)	300		X	6	2		393,120	39,000	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		189.43	1.75	0.13	0.032	0.006	0.0013	0.050	0.022	18.79	0.17	0.01	0.003	0.001	0.0001	0.005	0.002
Light duty diesel vehicles (< 6,000 lb GVW)	150	X		6	2		82,680	10,920	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		182.97	0.14	0.52	0.055	0.028	0.0016	0.053	0.008	24.17	0.02	0.07	0.007	0.004	0.0002	0.007	0.001
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	300	X		6	2		42,120	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		93.21	0.07	0.26	0.028	0.014	0.0008	0.027	0.004	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Deliveries / Removals	Empty Vehicle Weight (tons)	Full Vehicle Weight (tons)	Round Trip Distance (miles)				Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)									2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles																																	
Heavy duty diesel vehicles (>6,000 lb GVW) Pipe / Materials Truck	11	21.5	70				35,350	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		17.03	0.16	0.01	0.003	0.001	0.0001	0.004	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road material removal vehicles																																	
Heavy duty diesel vehicles (>6,000 lb GVW)	11	21.5	70				0	8,050	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000	17.81	0.01	0.05	0.005	0.003	0.0002	0.005	0.001
Construction Areas							Potential Open Burning Area (acres)		AP-42 Section 13 Southern Region Emission Factors (tons/acre) 2014 Climate Registry Default Emission Factors for CO_2									2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area							227	0	14.31	0.63	0.02	0.08	0.08	0.00	0.11	NA		3,251.16	143.13	4.09	17.38	17.38	0.00	24.54	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA
Construction Workers							Number of Vehicle Miles		MOVES Emission Factors (g/VMT)									2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes							1,833,171	125,306	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		883.34	8.15	0.59	0.151	0.028	0.0059	0.233	0.102	60.38	0.56	0.04	0.010	0.002	0.0004	0.016	0.007

Table 9-A6

H-650 Pipeline Construction Equipment Air Emissions - Alamance County

MVP Southgate Project
H-650 Pipeline, Alamance, NC

On-site Road and Nonroad Construction Equipment	Equipment Engine HP	Fuel		Schedule		SCC	Number of Operating Hours		NONROAD2008a Emission Factor (g/hp-hr)								Engine Load Factor
		Diesel	Gasoline	days/week	hours/day		2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Nonroad construction equipment																	
Light plants	15	X		2	4	2270002027	2,149	277	588.92	2.36	4.48	0.35	0.35	0.0040	0.45	0.01	0.43
Bore rigs	250	X		6	10	2270002033	2,080	0	530.27	0.68	2.86	0.15	0.15	0.0031	0.24	0.01	0.43
HDD Reaming/Pullback Rig	875	X		6	10	2270002033	2,080	0	530.03	1.09	4.71	0.18	0.18	0.0031	0.32	0.01	0.43
HDD Assist Reaming/Pilot Hole Rig	440	X		6	10	2270002033	2,080	0	530.35	0.88	3.08	0.14	0.14	0.0031	0.22	0.01	0.43
Excavators (CAT 345C)	325	X		6	10	2270002036	71,240	3,640	536.38	0.38	1.00	0.05	0.05	0.0028	0.14	0.01	0.59
Excavators (JD 350G LC)	271	X		6	10	2270002036	8,060	0	536.40	0.17	0.53	0.02	0.02	0.0026	0.13	0.01	0.59
Excavators (CAT 320DL)	148	X		6	10	2270002036	71,240	3,900	536.39	0.23	0.56	0.04	0.04	0.0027	0.14	0.01	0.59
Off-highway trucks -1-2.5 ton trucks (CAT 725)	309	X		6	8	2270002051	6,656	1,456	536.40	0.20	0.52	0.02	0.02	0.0026	0.13	0.01	0.59
Water Truck	175	X		6	10	2270002051	4,160	1,560	536.41	0.12	0.32	0.01	0.01	0.0026	0.13	0.01	0.59
Utility Truck	100	X		6	10	2270002051	10,140	2,080	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Tractors, loaders, and backhoes (CAT 450F)	144	X		6	6	2270002066	1,560	0	625.13	1.65	2.76	0.34	0.34	0.0036	0.44	0.01	0.21
Dozers (CAT D6K)	125	X		6	10	2270002069	49,920	4,160	536.38	0.28	0.72	0.05	0.05	0.0027	0.14	0.01	0.59
Dozers (CAT D7E)	235	X		6	10	2270002069	49,400	3,900	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59
Off- highway tractors (John Deere 6115D)	115	X		6	6	2270002051	1,404	468	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	248	X		6	10	2270002081	3,120	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Feller Buncher (CAT 553C)	173	X		6	10	2270002081	260	0	536.28	0.61	1.44	0.14	0.14	0.0029	0.17	0.01	0.59
Logging Skidder (CAT 525C)	182	X		6	10	2270002081	780	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Chipper (Bandit 1850)	250	X		6	10	2270002081	780	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Sideboom (CAT 583T Pipelayer)	347	X		6	10	2270002081	37,700	0	536.26	0.95	2.24	0.14	0.14	0.0031	0.18	0.01	0.59
Bending Machine	175	X		6	10	2270002081	3,900	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Stump Grinder (Vermeer SC252)	27	X		6	10	2270002081	1,560	0	595.69	0.38	3.16	0.04	0.04	0.0030	0.15	0.01	0.59
Chain Saw	10	X		6	10	2270002081	7,540	0	594.37	4.49	4.32	0.35	0.35	0.0040	0.56	0.01	0.59
Nonroad Industrial Equipment																	
Bobcat with sweeper attachment	70	X		6	2	2270003040	572	364	589.79	1.16	3.25	0.14	0.14	0.0033	0.18	0.01	0.43
Bobcat with brush hog attachement	70	X		6	2	2270003040	312	0	589.79	1.16	3.25	0.14	0.14	0.0033	0.18	0.01	0.43
Nonroad Commercial Equipment																	
Pumps	15	X		6	6	2270006010	13,416	1,092	588.81	2.43	4.59	0.36	0.36	0.0040	0.49	0.01	0.43
Air compressors	275	X		6	10	2270006015	18,200	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Welders	55	X		6	9	2270006025	19,422	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Pressure washers	5	X		6	4	2270006030	2,392	728	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Hydro power units	200	X		6	10	2270006035	520	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
On-road construction vehicles							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								
Light duty gasoline vehicles (< 6,000 lb GVW)	150		X	6	2		46,800	1,560	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Heavy duty gasoline vehicles (>6,000 lb GVW)	300		X	6	2		393,120	39,000	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Light duty diesel vehicles (< 6,000 lb GVW)	150	X		6	2		82,680	10,920	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	300	X		6	2		42,120	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Deliveries / Removals	Empty Vehicle Weight (tons)	Full Vehicle Weight (tons)	Round Trip Distance (miles)				Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
On-road delivery vehicles																	
Heavy duty diesel vehicles (>6,000 lb GVW) Pipe / Materials Truck	11	21.5	70				55,300	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
On-road material removal vehicles																	
Heavy duty diesel vehicles (>6,000 lb GVW)	11	21.5	70				18,200	18,200	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Construction Areas							Potential Open Burning Area (acres)		AP-42 Section 13 Southern Region Emission Factors (tons/acre) 2014 Climate Registry Default Emission Factors for CO_2								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Potential Open Burning of Forested Area							163	0	14.31	0.63	0.02	0.08	0.08	0.00	0.11	NA	
Construction Workers							Number of Vehicle Miles		MOVES Emission Factors (g/VMT)								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Worker Commutes							1,833,171	125,306	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	

On-site Road and Nonroad Construction Equipment	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs
Nonroad construction equipment																
Light plants	9.00	0.04	0.07	0.005	0.005	0.0001	0.007	0.000	1.16	0.00	0.01	0.001	0.001	0.0000	0.001	0.000
Bore rigs	130.70	0.17	0.70	0.036	0.036	0.0008	0.060	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
HDD Reaming/Pullback Rig	457.24	0.94	4.06	0.157	0.157	0.0027	0.272	0.011	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
HDD Assist Reaming/Pilot Hole Rig	230.06	0.38	1.33	0.060	0.060	0.0014	0.094	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 345C)	8076.65	5.70	15.00	0.819	0.819	0.0417	2.101	0.185	412.68	0.29	0.77	0.042	0.042	0.0021	0.107	0.009
Excavators (JD 350G LC)	761.97	0.24	0.75	0.030	0.030	0.0037	0.191	0.017	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 320DL)	3678.05	1.56	3.83	0.244	0.244	0.0182	0.935	0.084	201.35	0.09	0.21	0.013	0.013	0.0010	0.051	0.005
Off-highway trucks -1-2.5 ton trucks (CAT 725)	717.48	0.26	0.70	0.028	0.028	0.0035	0.179	0.016	156.95	0.06	0.15	0.006	0.006	0.0008	0.039	0.004
Water Truck	253.97	0.06	0.15	0.005	0.005	0.0012	0.063	0.006	95.24	0.02	0.06	0.002	0.002	0.0005	0.023	0.002
Utility Truck	353.74	0.10	0.22	0.008	0.008	0.0017	0.087	0.008	72.56	0.02	0.04	0.002	0.002	0.0004	0.018	0.002
Tractors, loaders, and backhoes (CAT 450F)	32.51	0.09	0.14	0.018	0.018	0.0002	0.023	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Dozers (CAT D6K)	2176.73	1.15	2.92	0.207	0.207	0.0109	0.571	0.050	181.39	0.10	0.24	0.017	0.017	0.0009	0.048	0.004
Dozers (CAT D7E)	4049.71	1.54	5.08	0.220	0.220	0.0201	1.039	0.093	319.71	0.12	0.40	0.017	0.017	0.0016	0.082	0.007
Off- highway tractors (John Deere 6115D)	56.33	0.02	0.03	0.001	0.001	0.0003	0.014	0.001	18.78	0.01	0.01	0.000	0.000	0.0001	0.005	0.000
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	269.88	0.23	0.67	0.043	0.043	0.0014	0.081	0.006	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Feller Buncher (CAT 553C)	15.69	0.02	0.04	0.004	0.004	0.0001	0.005	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Logging Skidder (CAT 525C)	49.51	0.04	0.12	0.008	0.008	0.0003	0.015	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chipper (Bandit 1850)	68.01	0.06	0.17	0.011	0.011	0.0004	0.020	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Sideboom (CAT 583T Pipelayer)	4562.39	8.12	19.09	1.169	1.169	0.0261	1.524	0.105	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Bending Machine	238.05	0.20	0.59	0.038	0.038	0.0013	0.071	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Stump Grinder (Vermeer SC252)	16.32	0.01	0.09	0.001	0.001	0.0001	0.004	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chain Saw	29.15	0.22	0.21	0.017	0.017	0.0002	0.027	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Industrial Equipment																
Bobcat with sweeper attachment	11.19	0.02	0.06	0.003	0.003	0.0001	0.003	0.000	7.12	0.01	0.04	0.002	0.002	0.0000	0.002	0.000
Bobcat with brush hog attachement	6.11	0.01	0.03	0.001	0.001	0.0000	0.002	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Commercial Equipment																
Pumps	56.16	0.23	0.44	0.034	0.034	0.0004	0.046	0.001	4.57	0.02	0.04	0.003	0.003	0.0000	0.004	0.000
Air compressors	1257.68	2.09	7.29	0.463	0.463	0.0075	0.659	0.029	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Welders	268.43	0.45	1.56	0.099	0.099	0.0016	0.141	0.006	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Pressure washers	3.01	0.00	0.02	0.001	0.001	0.0000	0.002	0.000	0.91	0.00	0.01	0.000	0.000	0.0000	0.000	0.000
Hydro power units	26.13	0.04	0.15	0.010	0.010	0.0002	0.014	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road construction vehicles																
Light duty gasoline vehicles (< 6,000 lb GVW)	22.55	0.21	0.02	0.004	0.001	0.0002	0.006	0.003	0.75	0.01	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty gasoline vehicles (>6,000 lb GVW)	189.43	1.75	0.13	0.032	0.006	0.0013	0.050	0.022	18.79	0.17	0.01	0.003	0.001	0.0001	0.005	0.002
Light duty diesel vehicles (< 6,000 lb GVW)	182.97	0.14	0.52	0.055	0.028	0.0016	0.053	0.008	24.17	0.02	0.07	0.007	0.004	0.0002	0.007	0.001
Heavy duty diesel vehicles (>6,000 lb GVW) Gang Bus	93.21	0.07	0.26	0.028	0.014	0.0008	0.027	0.004	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Deliveries / Removals	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles																
Heavy duty diesel vehicles (>6,000 lb GVW) Pipe / Materials Truck	26.65	0.25	0.02	0.005	0.001	0.0002	0.007	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road material removal vehicles																
Heavy duty diesel vehicles (>6,000 lb GVW)	40.28	0.03	0.11	0.012	0.006	0.0004	0.012	0.002	40.28	0.03	0.11	0.012	0.006	0.0004	0.012	0.002
Construction Areas	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area	2,325.68	102.39	2.93	12.43	12.43	0.00	17.55	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA
Construction Workers	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes	883.34	8.15	0.59	0.151	0.028	0.0059	0.233	0.102	60.38	0.56	0.04	0.010	0.002	0.0004	0.016	0.007

Table 9-A7

Lambert Compressor Station Construction Equipment Air Emissions - Pittsylvania County

MVP Southgate Project
Lambert Compressor Station, Pittsylvania County, VA

On-site Road and Nonroad Construction Equipment	Equipment Engine HP	Fuel		Schedule		SCC	Number of Operating Hours		NONROAD2008a Emission Factor (g/hp-hr)								Engine Load Factor	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
		Diesel	Gasoline	days/week	hours/day		2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs
Nonroad construction equipment																																	
Pavers (CAT AP655D Track Asphalt Paver)	174	X		6	10	2270002003	1,040	260	536.36	0.38	0.91	0.08	0.08	0.0028	0.15	0.01	0.59	63.12	0.04	0.11	0.009	0.009	0.0003	0.017	0.001	15.78	0.01	0.03	0.002	0.002	0.0001	0.004	0.000
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	19	X		6	10	2270002006	9,360	3,120	588.51	4.46	4.45	0.38	0.38	0.0040	0.58	0.01	0.43	49.61	0.38	0.38	0.032	0.032	0.0003	0.049	0.001	16.54	0.13	0.13	0.011	0.011	0.0001	0.016	0.000
Light plants	15	X		6	10	2270002027	14,560	3,120	588.92	2.36	4.48	0.35	0.35	0.0040	0.45	0.01	0.43	60.96	0.24	0.46	0.036	0.036	0.0004	0.047	0.001	13.06	0.05	0.10	0.008	0.008	0.0001	0.010	0.000
Excavators (CAT 345C)	325	X		6	10	2270002036	7,280	2,860	536.38	0.38	1.00	0.05	0.05	0.0028	0.14	0.01	0.59	825.35	0.58	1.53	0.084	0.084	0.0043	0.215	0.019	324.24	0.23	0.60	0.033	0.033	0.0017	0.084	0.007
Excavators (JD 350G LC)	271	X		6	10	2270002036	3,900	1,560	536.40	0.17	0.53	0.02	0.02	0.0026	0.13	0.01	0.59	368.70	0.12	0.36	0.014	0.014	0.0018	0.093	0.008	147.48	0.05	0.15	0.006	0.006	0.0007	0.037	0.003
Excavators (CAT 320DL)	148	X		6	10	2270002036	2,860	1,560	536.39	0.23	0.56	0.04	0.04	0.0027	0.14	0.01	0.59	147.66	0.06	0.15	0.010	0.010	0.0007	0.038	0.003	80.54	0.03	0.08	0.005	0.005	0.0004	0.020	0.002
Concrete or stone industrial saws	10	X		6	10	2270002039	4,680	520	594.37	4.50	4.32	0.36	0.36	0.0040	0.56	0.01	0.59	18.09	0.14	0.13	0.011	0.011	0.0001	0.017	0.000	2.01	0.02	0.01	0.001	0.001	0.0000	0.002	0.000
Off-highway trucks -1-2.5 ton trucks (CAT 725)	309	X		6	10	2270002051	7,800	3,640	536.40	0.20	0.52	0.02	0.02	0.0026	0.13	0.01	0.59	840.80	0.31	0.82	0.033	0.033	0.0041	0.210	0.019	392.37	0.14	0.38	0.015	0.015	0.0019	0.098	0.009
Water Truck	175	X		6	10	2270002051	3,640	1,560	536.41	0.12	0.32	0.01	0.01	0.0026	0.13	0.01	0.59	222.22	0.05	0.13	0.004	0.004	0.0011	0.055	0.005	95.24	0.02	0.06	0.002	0.002	0.0005	0.023	0.002
Utility Truck	100	X		6	6	2270002051	3,432	1,248	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59	119.73	0.03	0.07	0.003	0.003	0.0006	0.030	0.003	43.54	0.01	0.03	0.001	0.001	0.0002	0.011	0.001
Rough terrain forklifts (CASE 588H)	78	X		6	10	2270002057	6,760	1,560	595.59	1.46	1.48	0.18	0.18	0.0032	0.18	0.01	0.59	204.24	0.50	0.51	0.063	0.063	0.0011	0.061	0.004	47.13	0.12	0.12	0.015	0.015	0.0003	0.014	0.001
Rubber tire front loaders (CAT 972K)	288	X		6	6	2270002060	1,716	936	536.36	0.30	0.95	0.05	0.05	0.0027	0.15	0.01	0.59	172.39	0.10	0.30	0.016	0.016	0.0009	0.047	0.004	94.03	0.05	0.17	0.009	0.009	0.0005	0.026	0.002
Tractors, loaders, and backhoes (CAT 450F)	144	X		6	8	2270002066	2,288	1,248	625.13	1.65	2.76	0.34	0.34	0.0036	0.44	0.01	0.21	47.68	0.13	0.21	0.026	0.026	0.0003	0.034	0.001	26.01	0.07	0.11	0.014	0.014	0.0002	0.018	0.001
Dozers (CAT D6K)	125	X		6	10	2270002069	5,720	3,120	536.38	0.28	0.72	0.05	0.05	0.0027	0.14	0.01	0.59	249.42	0.13	0.33	0.024	0.024	0.0013	0.065	0.006	136.05	0.07	0.18	0.013	0.013	0.0007	0.036	0.003
Dozers (CAT D7E)	235	X		6	6	2270002069	312	0	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59	25.58	0.01	0.03	0.001	0.001	0.0001	0.007	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Loaders (Tracked - CAT 953D)	148	X		6	6	2270002072	5,928	1,872	624.59	2.33	3.58	0.44	0.44	0.0037	0.61	0.01	0.21	126.85	0.47	0.73	0.089	0.089	0.0008	0.124	0.002	40.06	0.15	0.23	0.028	0.028	0.0002	0.039	0.001
Off- highway tractors (John Deere 6115D)	115	X		6	10	2270002051	1,560	1,560	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59	62.58	0.02	0.04	0.001	0.001	0.0003	0.015	0.001	62.58	0.02	0.04	0.001	0.001	0.0003	0.015	0.001
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	248	X		6	10	2270002081	1,560	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	134.94	0.11	0.34	0.022	0.022	0.0007	0.040	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Logging Skidder (CAT 525C)	182	X		6	10	2270002081	1,560	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	99.03	0.08	0.25	0.016	0.016	0.0005	0.030	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chipper (Bandit 1850)	250	X		6	10	2270002081	1,560	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	136.03	0.11	0.34	0.022	0.022	0.0007	0.041	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Stump Grinder (Vermeer SC252)	27	X		6	10	2270002081	1,560	0	595.69	0.38	3.16	0.04	0.04	0.0030	0.15	0.01	0.59	16.32	0.01	0.09	0.001	0.001	0.0001	0.004	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chain Saw	10		X	6	10	2265002081	3,120	0	1046.69	278.54	1.97	0.11	0.11	0.0191	4.90	0.23	0.48	17.28	4.60	0.03	0.002	0.002	0.0003	0.081	0.004	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Industrial Equipment																																	
Aerial Lifts	49	X		6	10	2270003010	24,960	2,600	692.66	4.22	4.79	0.63	0.63	0.0042	1.05	0.01	0.21	196.10	1.19	1.36	0.179	0.179	0.0012	0.296	0.003	20.43	0.12	0.14	0.019	0.019	0.0001	0.031	0.000
Self-propelled sweeping and scrubbing vehicles	70	X		6	5	2270003030	1,560	650	589.89	0.74	3.08	0.08	0.08	0.0031	0.15	0.01	0.43	30.53	0.04	0.16	0.004	0.004	0.0002	0.008	0.001	12.72	0.02	0.07	0.002	0.002	0.0001	0.003	0.000
Hydraulic Crane	268	X		6	10	2270002045	5,200	260	530.57	0.22	1.02	0.04	0.04	0.0027	0.15	0.01	0.43	350.47	0.14	0.67	0.027	0.027	0.0018	0.097	0.008	17.52	0.01	0.03	0.001	0.001	0.0001	0.005	0.000
Marooka	250	X		6	6	2270002069	2,496	312	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59	217.68	0.08	0.27	0.012	0.012	0.0011	0.056	0.005	27.21	0.01	0.03	0.001	0.001	0.0001	0.007	0.001
Nonroad Commercial Equipment																																	
Generator set (specify kW)	94	X		6	10	2270006005	17,160	7,800	589.21	1.80	3.24	0.31	0.31	0.0035	0.36	0.01	0.43	450.48	1.38	2.48	0.238	0.238	0.0027	0.278	0.009	204.77	0.63	1.13	0.108	0.108	0.0012	0.126	0.004
Pumps	15	X		6	5	2270006010	9,620	780	588.81	2.43	4.59	0.36	0.36	0.0040	0.49	0.01	0.43	40.27	0.17	0.31	0.025	0.025	0.0003	0.033	0.001	3.27	0.01	0.03	0.002	0.002	0.0000	0.003	0.000
Air compressors	275	X		6	10	2270006015	7,280	520	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	503.07	0.84	2.92	0.185	0.185	0.0030	0.264	0.012	35.93	0.06	0.21	0.013	0.013	0.0002	0.019	0.001
Welders	55	X		6	10	2270006025	17,160	3,120	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	237.16	0.39	1.37	0.087	0.087	0.0014	0.124	0.006	43.12	0.07	0.25	0.016	0.016	0.0003	0.023	0.001
Pressure washers	5	X		6	5	2270006030	2,340	1,040	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	2.94	0.00	0.02	0.001	0.001	0.0000	0.002	0.000	1.31	0.00	0.01	0.000	0.000	0.0000	0.001	0.000
Hydro power units	200	X		6	10	2270006035	3,120	520	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	156.80	0.26	0.91	0.058	0.058	0.0009	0.082	0.004	26.13	0.04	0.15	0.010	0.010	0.0002	0.014	0.001
On-road construction vehicles							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)																								
Light duty gasoline vehicles (< 6,000 lb GVW)	150		X	6	2		101,400	35,100	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		48.86	0.45	0.03	0.008	0.002	0.0003	0.013	0.006	16.91	0.16	0.01	0.003	0.001	0.0001	0.004	0.002
Heavy duty gasoline vehicles (>6,000 lb GVW)	300		X	6	5		731,250	126,750	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		352.36	3.25	0.24	0.060	0.011	0.0023	0.093	0.041	61.08	0.56	0.04	0.010	0.002	0.0004	0.016	0.007
Light duty diesel vehicles (< 6,000 lb GVW)	150	X		6	5		271,050	46,800	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		599.83	0.46	1.70	0.179	0.091	0.0053	0.175	0.025	103.57	0.08	0.29	0.031	0.016	0.0009	0.030	0.004
Heavy duty diesel vehicles (>6,000 lb GVW)	300	X		6	5		66,300	23,400	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		146.72	0.11	0.41	0.044	0.022	0.0013	0.043	0.006	51.78	0.04	0.15	0.015	0.008	0.0005	0.015	0.002

Deliveries / Removals	Empty Vehicle Weight (tons)	Full Vehicle Weight (tons)	Round Trip Distance (miles)	Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
				2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles																													
Heavy duty diesel vehicles (>6,000 lb GVW)	11	50	200	127,000	48,000	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	61.20	0.56	0.04	0.010	0.002	0.0004	0.016	0.007	23.13	0.21	0.02	0.004	0.001	0.0002	0.006	0.003
On-road material removal vehicles																													
Heavy duty diesel vehicles (>6,000 lb GVW)	11	21	200	28,000	12,000	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	61.96	0.05	0.18	0.018	0.009	0.0005	0.018	0.003	26.56	0.02	0.08	0.008	0.004	0.0002	0.008	0.001

Construction Areas	Potential Open Burning Area (acres)		AP-42 Section 13 Southern Region Emission Factors (tons/acre) 2014 Climate Registry Default Emission Factors for CO_2								2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area	5	0	14.31	0.63	0.02	0.08	0.08	0.00	0.11	NA	65.33	2.88	0.08	0.35	0.35	0.00	0.49	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA

Construction Workers	Number of Vehicle Miles		MOVES Emission Factors (g/VMT)								2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes	615,729	93,086	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	296.70	2.74	0.20	0.051	0.009	0.0020	0.078	0.034	44.85	0.41	0.03	0.008	0.001	0.0003	0.012	0.005

Table 9-A8

Lambert Interconnect Construction Equipment Air Emissions - Pittsylvania County

MVP Southgate Project
Lambert Interconnect, Pittsylvania County, VA

On-site Road and Nonroad Construction Equipment	Equipment Engine HP	Fuel: Diesel	Fuel: Gasoline	Schedule: days/week	Schedule: hours/day	SCC	Number of Operating Hours: 2020	Number of Operating Hours: 2021	NONROAD2008a Emission Factor (g/hp-hr): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	Engine Load Factor
Nonroad construction equipment																	
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	19	X		6	10	2270002006	2,080	0	588.51	4.46	4.45	0.38	0.38	0.0040	0.58	0.01	0.43
Light plants	15	X		6	10	2270002027	3,640	0	588.92	2.36	4.48	0.35	0.35	0.0040	0.45	0.01	0.43
Excavators (CAT 345C)	325	X		6	10	2270002036	2,080	0	536.38	0.38	1.00	0.05	0.05	0.0028	0.14	0.01	0.59
Excavators (JD 350G LC)	271	X		6	10	2270002036	1,040	0	536.40	0.17	0.53	0.02	0.02	0.0026	0.13	0.01	0.59
Excavators (CAT 320DL)	148	X		6	10	2270002036	260	0	536.39	0.23	0.56	0.04	0.04	0.0027	0.14	0.01	0.59
Concrete or stone industrial saws	10	X		6	10	2270002039	780	0	594.37	4.50	4.32	0.36	0.36	0.0040	0.56	0.01	0.59
Off-highway trucks -1-2.5 ton trucks (CAT 725)	309	X		6	10	2270002051	1,040	0	536.40	0.20	0.52	0.02	0.02	0.0026	0.13	0.01	0.59
Water Truck	175	X		6	10	2270002051	1,300	0	536.41	0.12	0.32	0.01	0.01	0.0026	0.13	0.01	0.59
Utility Truck	100	X		6	6	2270002051	1,560	0	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Rough terrain forklifts (CASE 588H)	78	X		6	10	2270002057	1,300	0	595.59	1.46	1.48	0.18	0.18	0.0032	0.18	0.01	0.59
Rubber tire front loaders (CAT 972K)	288	X		6	6	2270002060	468	0	536.36	0.30	0.95	0.05	0.05	0.0027	0.15	0.01	0.59
Tractors, loaders, and backhoes (CAT 450F)	144	X		6	8	2270002066	1,040	0	625.13	1.65	2.76	0.34	0.34	0.0036	0.44	0.01	0.21
Dozers (CAT D6K)	125	X		6	10	2270002069	1,300	0	536.38	0.28	0.72	0.05	0.05	0.0027	0.14	0.01	0.59
Loaders (Tracked - CAT 953D)	148	X		6	6	2270002072	780	0	624.59	2.33	3.58	0.44	0.44	0.0037	0.61	0.01	0.21
Off- highway tractors (John Deere 6115D)	115	X		6	10	2270002051	520	0	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	248	X		6	10	2270002081	520	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Logging Skidder (CAT 525C)	182	X		6	10	2270002081	260	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Chipper (Bandit 1850)	250	X		6	10	2270002081	260	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Stump Grinder (Vermeer SC252)	27	X		6	10	2270002081	260	0	595.69	0.38	3.16	0.04	0.04	0.0030	0.15	0.01	0.59
Chain Saw	10		X	6	10	2265002081	520	0	1046.69	278.54	1.97	0.11	0.11	0.0191	4.90	0.23	0.48
Nonroad Industrial Equipment																	
Aerial Lifts	49	X		6	10	2270003010	1,300	0	692.66	4.22	4.79	0.63	0.63	0.0042	1.05	0.01	0.21
Self-propelled sweeping and scrubbing vehicles	70	X		6	5	2270003030	650	0	589.89	0.74	3.08	0.08	0.08	0.0031	0.15	0.01	0.43
Hydraulic Crane	268	X		6	10	2270002045	780	0	530.57	0.22	1.02	0.04	0.04	0.0027	0.15	0.01	0.43
Marooka	250	X		6	6	2270002069	780	0	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59
Nonroad Commercial Equipment																	
Pumps	15	X		6	5	2270006010	2,080	0	588.81	2.43	4.59	0.36	0.36	0.0040	0.49	0.01	0.43
Air compressors	275	X		6	10	2270006015	3,120	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Welders	55	X		6	10	2270006025	2,340	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Pressure washers	5	X		6	5	2270006030	520	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Hydro power units	200	X		6	10	2270006035	1,040	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
On-road construction vehicles							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								
Light duty gasoline vehicles (< 6,000 lb GVW)	150		X	6	10		156,000	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Heavy duty gasoline vehicles (>6,000 lb GVW)	300		X	6	5		97,500	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Light duty diesel vehicles (< 6,000 lb GVW)	150	X		6	10		175,500	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Heavy duty diesel vehicles (>6,000 lb GVW)	300	X		6	5		48,750	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	

On-site Road and Nonroad Construction Equipment	2020 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs	2021 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs
Nonroad construction equipment																
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	11.02	0.08	0.08	0.007	0.007	0.0001	0.011	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Light plants	15.24	0.06	0.12	0.009	0.009	0.0001	0.012	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 345C)	235.81	0.17	0.44	0.024	0.024	0.0012	0.061	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (JD 350G LC)	98.32	0.03	0.10	0.004	0.004	0.0005	0.025	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 320DL)	13.42	0.01	0.01	0.001	0.001	0.0001	0.003	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Concrete or stone industrial saws	3.02	0.02	0.02	0.002	0.002	0.0000	0.003	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Off-highway trucks -1-2.5 ton trucks (CAT 725)	112.11	0.04	0.11	0.004	0.004	0.0005	0.028	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Water Truck	79.36	0.02	0.05	0.002	0.002	0.0004	0.020	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Utility Truck	54.42	0.02	0.03	0.001	0.001	0.0003	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rough terrain forklifts (CASE 588H)	39.28	0.10	0.10	0.012	0.012	0.0002	0.012	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rubber tire front loaders (CAT 972K)	47.02	0.03	0.08	0.004	0.004	0.0002	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Tractors, loaders, and backhoes (CAT 450F)	21.67	0.06	0.10	0.012	0.012	0.0001	0.015	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Dozers (CAT D6K)	56.69	0.03	0.08	0.005	0.005	0.0003	0.015	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Loaders (Tracked - CAT 953D)	16.69	0.06	0.10	0.012	0.012	0.0001	0.016	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Off- highway tractors (John Deere 6115D)	20.86	0.01	0.01	0.000	0.000	0.0001	0.005	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	44.98	0.04	0.11	0.007	0.007	0.0002	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Logging Skidder (CAT 525C)	16.50	0.01	0.04	0.003	0.003	0.0001	0.005	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chipper (Bandit 1850)	22.67	0.02	0.06	0.004	0.004	0.0001	0.007	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Stump Grinder (Vermeer SC252)	2.72	0.00	0.01	0.000	0.000	0.0000	0.001	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chain Saw	2.88	0.77	0.01	0.000	0.000	0.0001	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Industrial Equipment																
Aerial Lifts	10.21	0.06	0.07	0.009	0.009	0.0001	0.015	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Self-propelled sweeping and scrubbing vehicles	12.72	0.02	0.07	0.002	0.002	0.0001	0.003	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Hydraulic Crane	52.57	0.02	0.10	0.004	0.004	0.0003	0.015	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Marooka	68.02	0.03	0.09	0.004	0.004	0.0003	0.017	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Commercial Equipment																
Pumps	8.71	0.04	0.07	0.005	0.005	0.0001	0.007	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Air compressors	215.60	0.36	1.25	0.079	0.079	0.0013	0.113	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Welders	32.34	0.05	0.19	0.012	0.012	0.0002	0.017	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Pressure washers	0.65	0.00	0.00	0.000	0.000	0.0000	0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Hydro power units	52.27	0.09	0.30	0.019	0.019	0.0003	0.027	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road construction vehicles																
Light duty gasoline vehicles (< 6,000 lb GVW)	75.17	0.69	0.05	0.013	0.002	0.0005	0.020	0.009	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty gasoline vehicles (>6,000 lb GVW)	46.98	0.43	0.03	0.008	0.001	0.0003	0.012	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Light duty diesel vehicles (< 6,000 lb GVW)	388.38	0.30	1.10	0.116	0.059	0.0034	0.114	0.016	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty diesel vehicles (>6,000 lb GVW)	107.88	0.08	0.30	0.032	0.016	0.0009	0.032	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000

Deliveries / Removals	Empty Vehicle Weight (tons)	Full Vehicle Weight (tons)	Round Trip Distance (miles)	Number of Vehicle Miles Traveled: 2020	2021	MOVES Emission Factors (g/VMT): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles													
Heavy duty gasoline vehicles (>6,000 lb GVW)			50	1,250	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05
Heavy duty diesel vehicles (>6,000 lb GVW)			50	2,250	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05
On-road material removal vehicles													
Heavy duty diesel vehicles (>6,000 lb GVW)			50	2,250	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08

Deliveries / Removals	2020 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	2021 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles																
Heavy duty gasoline vehicles (>6,000 lb GVW)	0.60	0.01	0.00	0.000	0.000	0.0000	0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty diesel vehicles (>6,000 lb GVW)	1.08	0.01	0.00	0.000	0.000	0.0000	0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road material removal vehicles																
Heavy duty diesel vehicles (>6,000 lb GVW)	4.98	0.00	0.01	0.001	0.001	0.0000	0.001	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000

Construction Areas	Potential Open Burning Area (acres): 2020	2021	AP-42 Section 13 Southern Region Emission Factors (tons/acre) 2014 Climate Registry Default Emission Factors for CO_2: CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area	0	0	14.31	0.63	0.02	0.08	0.08	0.00	0.11	NA

Construction Areas	2020 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	2021 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA

Construction Workers	Number of Vehicle Miles: 2020	2021	MOVES Emission Factors (g/VMT): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes	90,000	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05

Construction Workers	2020 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	2021 Emission Totals (Tons): CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes	43.37	0.40	0.03	0.007	0.001	0.0003	0.011	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000

Table 9-A9

LN 3600 and T-15 Dan River Interconnect Construction Equipment Air Emissions - Rockingham County

MVP Southgate Project
LN 3600 and T-15 Dan River Interconnects, Rockingham County, NC

On-site Road and Nonroad Construction Equipment	Equipment Engine HP	Fuel		Schedule		SCC	Number of Operating Hours		NONROAD2008a Emission Factor (g/hp-hr)								Engine Load Factor
		Diesel	Gasoline	days/week	hours/day		2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Nonroad construction equipment																	
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	19	X		6	10	2270002006	4,160	0	588.51	4.46	4.45	0.38	0.38	0.0040	0.58	0.01	0.43
Light plants	15	X		6	10	2270002027	7,280	0	588.92	2.36	4.48	0.35	0.35	0.0040	0.45	0.01	0.43
Excavators (CAT 345C)	325	X		6	10	2270002036	4,160	0	536.38	0.38	1.00	0.05	0.05	0.0028	0.14	0.01	0.59
Excavators (JD 350G LC)	271	X		6	10	2270002036	2,080	0	536.40	0.17	0.53	0.02	0.02	0.0026	0.13	0.01	0.59
Excavators (CAT 320DL)	148	X		6	10	2270002036	520	0	536.39	0.23	0.56	0.04	0.04	0.0027	0.14	0.01	0.59
Concrete or stone industrial saws	10	X		6	10	2270002039	1,560	0	594.37	4.50	4.32	0.36	0.36	0.0040	0.56	0.01	0.59
Off-highway trucks -1-2.5 ton trucks (CAT 725)	309	X		6	10	2270002051	2,080	0	536.40	0.20	0.52	0.02	0.02	0.0026	0.13	0.01	0.59
Water Truck	175	X		6	10	2270002051	2,600	0	536.41	0.12	0.32	0.01	0.01	0.0026	0.13	0.01	0.59
Utility Truck	100	X		6	6	2270002051	3,120	0	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Rough terrain forklifts (CASE 588H)	78	X		6	10	2270002057	2,600	0	595.59	1.46	1.48	0.18	0.18	0.0032	0.18	0.01	0.59
Rubber tire front loaders (CAT 972K)	288	X		6	6	2270002060	936	0	536.36	0.30	0.95	0.05	0.05	0.0027	0.15	0.01	0.59
Tractors, loaders, and backhoes (CAT 450F)	144	X		6	8	2270002066	2,080	0	625.13	1.65	2.76	0.34	0.34	0.0036	0.44	0.01	0.21
Dozers (CAT D6K)	125	X		6	10	2270002069	2,600	0	536.38	0.28	0.72	0.05	0.05	0.0027	0.14	0.01	0.59
Loaders (Tracked - CAT 953D)	148	X		6	6	2270002072	1,560	0	624.59	2.33	3.58	0.44	0.44	0.0037	0.61	0.01	0.21
Off- highway tractors (John Deere 6115D)	115	X		6	10	2270002051	1,040	0	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	248	X		6	10	2270002081	1,040	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Logging Skidder (CAT 525C)	182	X		6	10	2270002081	520	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Chipper (Bandit 1850)	250	X		6	10	2270002081	520	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59
Stump Grinder (Vermeer SC252)	27	X		6	10	2270002081	520	0	595.69	0.38	3.16	0.04	0.04	0.0030	0.15	0.01	0.59
Chain Saw	10		X	6	10	2265002081	1,040	0	1046.69	278.54	1.97	0.11	0.11	0.0191	4.90	0.23	0.48
Nonroad Industrial Equipment																	
Aerial Lifts	49	X		6	10	2270003010	2,600	0	692.66	4.22	4.79	0.63	0.63	0.0042	1.05	0.01	0.21
Self-propelled sweeping and scrubbing vehicles	70	X		6	5	2270003030	1,300	0	589.89	0.74	3.08	0.08	0.08	0.0031	0.15	0.01	0.43
Hydraulic Crane	268	X		6	10	2270002045	1,560	0	530.57	0.22	1.02	0.04	0.04	0.0027	0.15	0.01	0.43
Marooka	250	X		6	6	2270002069	1,560	0	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59
Nonroad Commercial Equipment																	
Pumps	15	X		6	5	2270006010	4,160	0	588.81	2.43	4.59	0.36	0.36	0.0040	0.49	0.01	0.43
Air compressors	275	X		6	10	2270006015	6,240	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Welders	55	X		6	10	2270006025	4,680	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Pressure washers	5	X		6	5	2270006030	1,040	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
Hydro power units	200	X		6	10	2270006035	2,080	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43
On-road construction vehicles							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)								
Light duty gasoline vehicles (< 6,000 lb GVW)	150		X	6	10		312,000	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Heavy duty gasoline vehicles (>6,000 lb GVW)	300		X	6	5		195,000	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Light duty diesel vehicles (< 6,000 lb GVW)	150	X		6	10		351,000	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Heavy duty diesel vehicles (>6,000 lb GVW)	300	X		6	5		97,500	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Deliveries / Removals	**Empty Vehicle Weight (tons)**	**Full Vehicle Weight (tons)**	**Round Trip Distance (miles)**				**Number of Vehicle Miles Traveled**		**MOVES Emission Factors (g/VMT)**								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
On-road delivery vehicles																	
Heavy duty gasoline vehicles (>6,000 lb GVW)			50				2,500	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
Heavy duty diesel vehicles (>6,000 lb GVW)			50				4,500	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	
On-road material removal vehicles																	
Heavy duty diesel vehicles (>6,000 lb GVW)			50				4,500	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08	
Construction Areas							**Potential Open Burning Area (acres)**		**AP-42 Section 13 Southern Region Emission Factors (tons/acre) 2014 Climate Registry Default Emission Factors for CO_2**								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Potential Open Burning of Forested Area							0.3	0	14.31	0.63	0.02	0.08	0.08	0.00	0.11	NA	
Construction Workers							**Number of Vehicle Miles**		**MOVES Emission Factors (g/VMT)**								
							2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	
Worker Commutes							180,000	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05	

On-site Road and Nonroad Construction Equipment	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs
Nonroad construction equipment																
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	22.05	0.17	0.17	0.014	0.014	0.0001	0.022	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Light plants	30.48	0.12	0.23	0.018	0.018	0.0002	0.023	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 345C)	471.63	0.33	0.88	0.048	0.048	0.0024	0.123	0.011	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (JD 350G LC)	196.64	0.06	0.19	0.008	0.008	0.0010	0.049	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 320DL)	26.85	0.01	0.03	0.002	0.002	0.0001	0.007	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Concrete or stone industrial saws	6.03	0.05	0.04	0.004	0.004	0.0000	0.006	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Off-highway trucks -1-2.5 ton trucks (CAT 725)	224.21	0.08	0.22	0.009	0.009	0.0011	0.056	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Water Truck	158.73	0.04	0.10	0.003	0.003	0.0008	0.039	0.004	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Utility Truck	108.84	0.03	0.07	0.002	0.002	0.0005	0.027	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rough terrain forklifts (CASE 588H)	78.55	0.19	0.19	0.024	0.024	0.0004	0.023	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rubber tire front loaders (CAT 972K)	94.03	0.05	0.17	0.009	0.009	0.0005	0.026	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Tractors, loaders, and backhoes (CAT 450F)	43.34	0.11	0.19	0.024	0.024	0.0003	0.031	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Dozers (CAT D6K)	113.37	0.06	0.15	0.011	0.011	0.0006	0.030	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Loaders (Tracked - CAT 953D)	33.38	0.12	0.19	0.024	0.024	0.0002	0.033	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Off- highway tractors (John Deere 6115D)	41.72	0.01	0.03	0.001	0.001	0.0002	0.010	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	89.96	0.08	0.22	0.014	0.014	0.0005	0.027	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Logging Skidder (CAT 525C)	33.01	0.03	0.08	0.005	0.005	0.0002	0.010	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chipper (Bandit 1850)	45.34	0.04	0.11	0.007	0.007	0.0002	0.014	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Stump Grinder (Vermeer SC252)	5.44	0.00	0.03	0.000	0.000	0.0000	0.001	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chain Saw	5.76	1.53	0.01	0.001	0.001	0.0001	0.027	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Industrial Equipment																
Aerial Lifts	20.43	0.12	0.14	0.019	0.019	0.0001	0.031	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Self-propelled sweeping and scrubbing vehicles	25.44	0.03	0.13	0.003	0.003	0.0001	0.006	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Hydraulic Crane	105.14	0.04	0.20	0.008	0.008	0.0005	0.029	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Marooka	136.05	0.05	0.17	0.007	0.007	0.0007	0.035	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Commercial Equipment																
Pumps	17.42	0.07	0.14	0.011	0.011	0.0001	0.014	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Air compressors	431.21	0.72	2.50	0.159	0.159	0.0026	0.226	0.010	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Welders	64.68	0.11	0.37	0.024	0.024	0.0004	0.034	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Pressure washers	1.31	0.00	0.01	0.000	0.000	0.0000	0.001	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Hydro power units	104.53	0.17	0.61	0.038	0.038	0.0006	0.055	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road construction vehicles																
Light duty gasoline vehicles (< 6,000 lb GVW)	150.34	1.39	0.10	0.026	0.005	0.0010	0.040	0.017	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty gasoline vehicles (>6,000 lb GVW)	93.96	0.87	0.06	0.016	0.003	0.0006	0.025	0.011	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Light duty diesel vehicles (< 6,000 lb GVW)	776.75	0.60	2.20	0.232	0.117	0.0068	0.227	0.033	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty diesel vehicles (>6,000 lb GVW)	215.77	0.17	0.61	0.064	0.033	0.0019	0.063	0.009	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Deliveries / Removals	**2020 Emission Totals (Tons)**								**2021 Emission Totals (Tons)**							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles																
Heavy duty gasoline vehicles (>6,000 lb GVW)	1.20	0.01	0.00	0.000	0.000	0.0000	0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty diesel vehicles (>6,000 lb GVW)	2.17	0.02	0.00	0.000	0.000	0.0000	0.001	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road material removal vehicles																
Heavy duty diesel vehicles (>6,000 lb GVW)	9.96	0.01	0.03	0.003	0.002	0.0001	0.003	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Construction Areas	**2020 Emission Totals (Tons)**								**2021 Emission Totals (Tons)**							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area	3.92	0.17	0.00	0.02	0.02	0.00	0.03	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA
Construction Workers	**2020 Emission Totals (Tons)**								**2021 Emission Totals (Tons)**							
	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes	86.74	0.80	0.06	0.015	0.003	0.0006	0.023	0.010	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000

Table 9-A10

T-21 Haw River Interconnect Construction Equipment Air Emissions - Alamance County

MVP Southgate Project
T-21 Haw River Interconnect, Alamance County, NC

On-site Road and Nonroad Construction Equipment	Equipment Engine HP	Fuel		Schedule		SCC	Number of Operating Hours		NONROAD2008a Emission Factor (g/hp-hr)								Engine Load Factor	2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
		Diesel	Gasoline	days/week	hours/day		2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAPs
Nonroad construction equipment																																	
Small handheld, walk-behind, or single person sized tampers or rammers (BoMag 8500 compactor)	19	X		6	10	2270002006	2,080	0	588.51	4.46	4.45	0.38	0.38	0.0040	0.58	0.01	0.43	11.02	0.08	0.08	0.007	0.007	0.0001	0.011	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Light plants	15	X		6	10	2270002027	3,640	0	588.92	2.36	4.48	0.35	0.35	0.0040	0.45	0.01	0.43	15.24	0.06	0.12	0.009	0.009	0.0001	0.012	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 345C)	325	X		6	10	2270002036	2,080	0	536.38	0.38	1.00	0.05	0.05	0.0028	0.14	0.01	0.59	235.81	0.17	0.44	0.024	0.024	0.0012	0.061	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (JD 350G LC)	271	X		6	10	2270002036	1,040	0	536.40	0.17	0.53	0.02	0.02	0.0026	0.13	0.01	0.59	98.32	0.03	0.10	0.004	0.004	0.0005	0.025	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Excavators (CAT 320DL)	148	X		6	10	2270002036	260	0	536.39	0.23	0.56	0.04	0.04	0.0027	0.14	0.01	0.59	13.42	0.01	0.01	0.001	0.001	0.0001	0.003	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Concrete or stone industrial saws	10	X		6	10	2270002039	780	0	594.37	4.50	4.32	0.36	0.36	0.0040	0.56	0.01	0.59	3.02	0.02	0.02	0.002	0.002	0.0000	0.003	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Off-highway trucks -1-2.5 ton trucks (CAT 725)	309	X		6	10	2270002051	1,040	0	536.40	0.20	0.52	0.02	0.02	0.0026	0.13	0.01	0.59	112.11	0.04	0.11	0.004	0.004	0.0005	0.028	0.003	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Water Truck	175	X		6	10	2270002051	1,300	0	536.41	0.12	0.32	0.01	0.01	0.0026	0.13	0.01	0.59	79.36	0.02	0.05	0.002	0.002	0.0004	0.020	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Utility Truck	100	X		6	6	2270002051	1,560	0	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59	54.42	0.02	0.03	0.001	0.001	0.0003	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rough terrain forklifts (CASE 588H)	78	X		6	10	2270002057	1,300	0	595.59	1.46	1.48	0.18	0.18	0.0032	0.18	0.01	0.59	39.28	0.10	0.10	0.012	0.012	0.0002	0.012	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rubber tire front loaders (CAT 972K)	288	X		6	6	2270002060	468	0	536.36	0.30	0.95	0.05	0.05	0.0027	0.15	0.01	0.59	47.02	0.03	0.08	0.004	0.004	0.0002	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Tractors, loaders, and backhoes (CAT 450F)	144	X		6	8	2270002066	1,040	0	625.13	1.65	2.76	0.34	0.34	0.0036	0.44	0.01	0.21	21.67	0.06	0.10	0.012	0.012	0.0001	0.015	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Dozers (CAT D6K)	125	X		6	10	2270002069	1,300	0	536.38	0.28	0.72	0.05	0.05	0.0027	0.14	0.01	0.59	56.69	0.03	0.08	0.005	0.005	0.0003	0.015	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Loaders (Tracked - CAT 953D)	148	X		6	6	2270002072	780	0	624.59	2.33	3.58	0.44	0.44	0.0037	0.61	0.01	0.21	16.69	0.06	0.10	0.012	0.012	0.0001	0.016	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Off- highway tractors (John Deere 6115D)	115	X		6	10	2270002051	520	0	536.41	0.15	0.33	0.01	0.01	0.0026	0.13	0.01	0.59	20.86	0.01	0.01	0.000	0.000	0.0001	0.005	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Rock Drill Machine (JOHN HENRY drill on CAT320DL)	248	X		6	10	2270002081	520	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	44.98	0.04	0.11	0.007	0.007	0.0002	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Logging Skidder (CAT 525C)	182	X		6	10	2270002081	260	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	16.50	0.01	0.04	0.003	0.003	0.0001	0.005	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chipper (Bandit 1850)	250	X		6	10	2270002081	260	0	536.32	0.45	1.33	0.09	0.09	0.0029	0.16	0.01	0.59	22.67	0.02	0.06	0.004	0.004	0.0001	0.007	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Stump Grinder (Vermeer SC252)	27	X		6	10	2270002081	260	0	595.69	0.38	3.16	0.04	0.04	0.0030	0.15	0.01	0.59	2.72	0.00	0.01	0.000	0.000	0.0000	0.001	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Chain Saw	10		X	6	10	2265002081	520	0	1046.69	278.54	1.97	0.11	0.11	0.0191	4.90	0.23	0.48	2.88	0.77	0.01	0.000	0.000	0.0001	0.013	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Industrial Equipment																																	
Aerial Lifts	49	X		6	10	2270003010	1,300	0	692.66	4.22	4.79	0.63	0.63	0.0042	1.05	0.01	0.21	10.21	0.06	0.07	0.009	0.009	0.0001	0.015	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Self-propelled sweeping and scrubbing vehicles	70	X		6	5	2270003030	650	0	589.89	0.74	3.08	0.08	0.08	0.0031	0.15	0.01	0.43	12.72	0.02	0.07	0.002	0.002	0.0001	0.003	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Hydraulic Crane	268	X		6	10	2270002045	780	0	530.57	0.22	1.02	0.04	0.04	0.0027	0.15	0.01	0.43	52.57	0.02	0.10	0.004	0.004	0.0003	0.015	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Marooka	250	X		6	6	2270002069	780	0	536.39	0.20	0.67	0.03	0.03	0.0027	0.14	0.01	0.59	68.02	0.03	0.09	0.004	0.004	0.0003	0.017	0.002	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Nonroad Commercial Equipment																																	
Pumps	15	X		6	5	2270006010	2,080	0	588.81	2.43	4.59	0.36	0.36	0.0040	0.49	0.01	0.43	8.71	0.04	0.07	0.005	0.005	0.0001	0.007	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Air compressors	275	X		6	10	2270006015	3,120	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	215.60	0.36	1.25	0.079	0.079	0.0013	0.113	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Welders	55	X		6	10	2270006025	2,340	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	32.34	0.05	0.19	0.012	0.012	0.0002	0.017	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Pressure washers	5	X		6	5	2270006030	520	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	0.65	0.00	0.00	0.000	0.000	0.0000	0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Hydro power units	200	X		6	10	2270006035	1,040	0	530.15	0.88	3.07	0.20	0.20	0.0031	0.28	0.01	0.43	52.27	0.09	0.30	0.019	0.019	0.0003	0.027	0.001	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road construction vehicles							Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)																								
Light duty gasoline vehicles (< 6,000 lb GVW)	150		X	6	10		156,000	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		75.17	0.69	0.05	0.013	0.002	0.0005	0.020	0.009	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty gasoline vehicles (>6,000 lb GVW)	300		X	6	5		97,500	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		46.98	0.43	0.03	0.008	0.001	0.0003	0.012	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Light duty diesel vehicles (< 6,000 lb GVW)	150	X		6	10		175,500	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		388.38	0.30	1.10	0.116	0.059	0.0034	0.114	0.016	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty diesel vehicles (>6,000 lb GVW)	300	X		6	5		48,750	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		107.88	0.08	0.30	0.032	0.016	0.0009	0.032	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000

Deliveries / Removals	Empty Vehicle Weight	Full Vehicle Weight	Round Trip Distance				Number of Vehicle Miles Traveled		MOVES Emission Factors (g/VMT)									2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	(tons)	(tons)	(miles)				2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
On-road delivery vehicles																																	
Heavy duty gasoline vehicles (>6,000 lb GVW)			50				1,250	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		0.60	0.01	0.00	0.000	0.000	0.0000	0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
Heavy duty diesel vehicles (>6,000 lb GVW)			50				2,250	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		1.08	0.01	0.00	0.000	0.000	0.0000	0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000
On-road material removal vehicles																																	
Heavy duty diesel vehicles (>6,000 lb GVW)			50				2,250	0	2007.61	1.54	5.67	0.60	0.30	0.0176	0.59	0.08		4.98	0.00	0.01	0.001	0.001	0.0000	0.001	0.000	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000

Construction Areas	Potential Open Burning Area (acres)		AP-42 Section 13 Southern Region Emission Factors (tons/acre) 2014 Climate Registry Default Emission Factors for CO_2									2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Potential Open Burning of Forested Area	0	0	14.31	0.63	0.02	0.08	0.08	0.00	0.11	NA		0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA

Construction Workers	Number of Vehicle Miles		MOVES Emission Factors (g/VMT)									2020 Emission Totals (Tons)								2021 Emission Totals (Tons)							
	2020	2021	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP		CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP	CO2	CO	NOx	PM10	PM25	SO2	VOC	HAP
Worker Commutes	90,000	0	437.15	4.03	0.29	0.07	0.01	0.0029	0.12	0.05		43.37	0.40	0.03	0.007	0.001	0.0003	0.011	0.005	0.00	0.00	0.00	0.000	0.000	0.0000	0.000	0.000

MVP Southgate Project

Docket No. CP19-XX-000

Resource Report 9

Appendix 9-B
Operational Emissions Calculations

MVP Southgate Project
Lambert Compressor Station

Table B-1. Total Facility Potential Emissions Summary

Proposed Sources	NOx	CO	VOC	SO2	PM/PM-10/ PM-2.5	CO2	Total HAPS	CH4	N2O	CO2e
Solar Taurus 70	21.81	25.85	3.16	2.07	5.96	46,418	1.26	0.88	0.09	46,466
Solar Mars 100	31.66	35.18	3.85	3.00	8.65	67,393	1.90	1.27	0.13	67,463
Capstone C200 Microturbines (5 Units)	1.81	4.79	0.44	0.17	0.33	5,841.0	0.21	0.11	0.011	5,847
Fuel Gas Heater	0.31	0.26	0.02	0.018	0.02	394.5	0.01	0.01	0.001	395
Produced Fluids Tanks	-	-	0.43	-	-	-	-	-	-	4.2
Blowdowns	-	-	0.46	-	-	0.23	0.02	44.35	-	1,109
Station Fugitives	-	-	0.72	-	-	0.36	0.03	69.59	-	1,740
Totals (ton/year)	**55.58**	**66.08**	**9.07**	**5.25**	**14.96**	**120,047**	**3.43**	**116.20**	**0.23**	**123,024**

MVP Southgate Project
Lambert Compressor Station

Table B-2. Solar Taurus 70 Specifications

Fuel	Natural Gas						
Load	50	50	50	50	50	50	50
Hp Output (Net)	5,896	5,896	5,791	5,678	9,657	8,832	8,474
Ambient Temperature (F)	below 0	0	20	40	60	80	100
% RH	60	60	60	60	60	60	60
Elevation ft	660	660	660	660	660	660	660
Fuel LHV (Btu/scf)	989.20	989.20	989.20	989.20	989.20	989.20	989.20
Heat Input LHV (MMBtu/hr)	60.78	60.78	58.84	56.89	53.59	50.22	46.71
Heat Input HHV (MMBtu/hr) (=LHV*1.1125)	67.62	67.62	65.46	63.29	59.62	55.87	51.96
Exhaust lb/hr	193,726	193,726	184,513	175,520	164,699	154,855	144,524
Exhaust ACFM	111,151	111,151	107,948	104,557	100,113	95,916	91,765
Stack Height (ft)	50	50	50	50	50	50	50
Stack Height (m)	15.24	15.24	15.24	15.24	15.24	15.24	15.24
Stack Equiv Diameter (ft)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Stack Exhaust Velocity (m/s)	28.76	28.76	27.93	27.05	25.90	24.82	23.74
Exhaust Temperature (F)	886	886	912	937	964	989	1016
Exhaust Temperature (K)	747.6	747.6	762.0	775.9	790.9	804.8	819.8
NO_x ppm@ 15% O_2	120	15	15	15	15	15	15
NO_x lb/hr	29.120	3.640	3.520	3.400	3.190	2.970	2.730
NO_x g/s	3.669	0.459	0.444	0.428	0.402	0.374	0.344
CO ppm@ 15% O_2	150	25	25	25	25	25	25
CO lb/hr	22.200	3.700	3.580	3.450	3.240	3.020	2.770
CO g/s	2.797	0.466	0.451	0.435	0.408	0.381	0.349
UHC ppm@ 15% O_2	50	25	25	25	25	25	25
UHC lb/hr	4.240	2.120	2.050	1.980	1.860	1.730	1.590
VOC ppm@ 15% O_2 (20% of UHC)	10	5	5	5	5	5	5
VOC lb/hr	0.848	0.424	0.410	0.396	0.372	0.346	0.318
sulfur gr/100 scf	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SO_2 lb/hr	0.352	0.352	0.341	0.329	0.310	0.291	0.270
SO_2 g/s	0.044	0.044	0.043	0.042	0.039	0.037	0.034
Particulates lb/MMBtu	0.015	0.015	0.015	0.015	0.015	0.015	0.015
$PM_{10/2.5}$ lb/hr	1.01	1.01	0.98	0.95	0.89	0.84	0.78
$PM_{10/2.5}$ g/s	0.128	0.128	0.124	0.120	0.113	0.106	0.098
CO_2 lb/mmBtu	117	117	117	117	117	117	117
CO_2 lb/hr	7,904	7,904	7,651	7,398	6,969	6,531	6,074
CH_4 lb/mmBtu	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
CH_4 lb/hr	0.1491	0.1491	0.1443	0.1395	0.1314	0.1232	0.1146
N_2O lb/mmBtu	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
N_2O lb/hr	0.0149	0.0149	0.0144	0.0140	0.0131	0.0123	0.0115
CO_2e lb/mmBtu	117.0	117.0	117.0	117.0	117.0	117.0	117.0
CO_2e lb/hr	7,912	7,912	7,659	7,406	6,976	6,537	6,080

Fuel							
Load	75	75	75	75	75	75	75
Hp Output (Net)	8,844	8,844	8,686	8,518	7,876	10,056	9,603
Ambient Temperature (F)	below 0	0	20	40	60	80	100
% RH	60	60	60	60	60	60	60
Elevation ft	660	660	660	660	660	660	660
Fuel LHV (Btu/scf)	989.20	989.20	989.20	989.20	989.20	989.20	989.20
Heat Input LHV (MMBtu/hr)	73.56	73.56	71.10	68.60	64.39	60.11	55.59
Heat Input HHV (MMBtu/hr) (=LHV*1.1125)	81.84	81.84	79.10	76.32	71.63	66.87	61.84
Exhaust lb/hr	218,893	218,893	209,712	200,406	187,412	174,269	159,827
Exhaust ACFM	124,004	124,004	120,454	116,562	111,039	105,408	99,557
Stack Height (ft)	50	50	50	50	50	50	50
Stack Height (m)	15.24	15.24	15.24	15.24	15.24	15.24	15.24
Stack Equiv Diameter (ft)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Stack Exhaust Velocity (m/s)	32.08	32.08	31.16	30.16	28.73	27.27	25.76
Exhaust Temperature (F)	869	869	887	904	928	955	988
Exhaust Temperature (K)	738.2	738.2	748.2	757.6	770.9	785.9	804.3
NO_x ppm@ 15% O_2	120	15	15	15	15	15	15
NO_x lb/hr	35.280	4.410	4.260	4.100	3.840	3.560	3.250
NO_x g/s	4.445	0.556	0.537	0.517	0.484	0.449	0.410
CO ppm@ 15% O_2	150	25	25	25	25	25	25
CO lb/hr	26.880	4.480	4.320	4.160	3.890	3.610	3.300
CO g/s	3.387	0.564	0.544	0.524	0.490	0.455	0.416
UHC ppm@ 15% O_2	50	25	25	25	25	25	25
UHC lb/hr	5.120	2.560	2.480	2.380	2.230	2.070	1.890
VOC ppm@ 15% O_2 (20% of UHC)	10	5	5	5	5	5	5
VOC lb/hr	1.024	0.512	0.496	0.476	0.446	0.414	0.378
sulfur gr/100 scf	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SO_2 lb/hr	0.426	0.426	0.412	0.397	0.373	0.348	0.322
SO_2 g/s	0.054	0.054	0.052	0.050	0.047	0.044	0.041
Particulates lb/MMBtu	0.015	0.015	0.015	0.015	0.015	0.015	0.015
$PM_{10/2.5}$ lb/hr	1.23	1.23	1.19	1.14	1.07	1.00	0.93
$PM_{10/2.5}$ g/s	0.155	0.155	0.149	0.144	0.135	0.126	0.117
CO_2 lb/mmBtu	117	117	117	117	117	117	117
CO_2 lb/hr	9,566	9,566	9,246	8,921	8,373	7,817	7,229
CH_4 lb/mmBtu	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
CH_4 lb/hr	0.1804	0.1804	0.1744	0.1683	0.1579	0.1474	0.1363
N_2O lb/mmBtu	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
N_2O lb/hr	0.0180	0.0180	0.0174	0.0168	0.0158	0.0147	0.0136
CO_2e lb/mmBtu	117.0	117.0	117.0	117.0	117.0	117.0	117.0
CO_2e lb/hr	9,576	9,576	9,255	8,930	8,382	7,825	7,236

Fuel							
Load	100	100	100	100	100	100	100
Hp Output (Net)	11,792	11,792	11,581	11,358	10,502	11,189	10,796
Ambient Temperature (F)	below 0	0	20	40	60	80	100
% RH	60	60	60	60	60	60	60
Elevation ft	660	660	660	660	660	660	660
Fuel LHV (Btu/scf)	989.20	989.20	989.20	989.20	989.20	989.20	989.20
Heat Input LHV (MMBtu/hr)	83.62	83.62	82.54	81.49	76.98	72.04	66.64
Heat Input HHV (MMBtu/hr) (=LHV*1.1125)	93.03	93.03	91.83	90.66	85.64	80.14	74.14
Exhaust lb/hr	231,761	231,761	225,326	218,819	207,302	194,517	179,098
Exhaust ACFM	130,010	130,010	129,423	128,765	124,151	118,653	112,486
Stack Height (ft)	50	50	50	50	50	50	50
Stack Height (m)	15.24	15.24	15.24	15.24	15.24	15.24	15.24
Stack Equiv Diameter (ft)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Stack Exhaust Velocity (m/s)	33.64	33.64	33.48	33.31	32.12	30.70	29.10
Exhaust Temperature (F)	856	856	887	920	943	967	1000
Exhaust Temperature (K)	730.9	730.9	748.2	766.5	779.3	792.6	810.9
NO_x ppm@ 15% O_2	120	15	15	15	15	15	15
NO_x lb/hr	40.160	5.020	4.950	4.880	4.590	4.270	3.900
NO_x g/s	5.060	0.633	0.624	0.615	0.578	0.538	0.491
CO ppm@ 15% O_2	150	25	25	25	25	25	25
CO lb/hr	30.540	5.090	5.020	4.950	4.660	4.330	3.960
CO g/s	3.848	0.641	0.633	0.624	0.587	0.546	0.499
UHC ppm@ 15% O_2	50	25	25	25	25	25	25
UHC lb/hr	5.840	2.920	2.880	2.840	2.670	2.480	2.270
VOC ppm@ 15% O_2 (20% of UHC)	10	5	5	5	5	5	5
VOC lb/hr	1.168	0.584	0.576	0.568	0.534	0.496	0.454
sulfur gr/100 scf	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SO_2 lb/hr	0.484	0.484	0.478	0.472	0.446	0.417	0.386
SO_2 g/s	0.061	0.061	0.060	0.059	0.056	0.053	0.049
Particulates lb/MMBtu	0.015	0.015	0.015	0.015	0.015	0.015	0.015
$PM_{10/2.5}$ lb/hr	1.40	1.40	1.38	1.36	1.28	1.20	1.11
$PM_{10/2.5}$ g/s	0.176	0.176	0.174	0.171	0.162	0.151	0.140
CO_2 lb/mmBtu	117	117	117	117	117	117	117
CO_2 lb/hr	10,874	10,874	10,733	10,597	10,010	9,368	8,666
CH_4 lb/mmBtu	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
CH_4 lb/hr	0.2051	0.2051	0.2024	0.1999	0.1888	0.1767	0.1634
N_2O lb/mmBtu	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
N_2O lb/hr	0.0205	0.0205	0.0202	0.0200	0.0189	0.0177	0.0163
CO_2e lb/mmBtu	117.0	117.0	117.0	117.0	117.0	117.0	117.0
CO_2e lb/hr	10,885	10,885	10,745	10,608	10,021	9,378	8,675

Notes

1. Data provided by Solar for 100%, 75%, and 50% load cases: net output power, fuel flow (MMBtu/hr, LHV), exhaust flow (lb/hr), exhaust temperature, NO_x/CO/UHC concentrations and lb/hr.
2. Below zero and low load operation uses 0°F for operating parameters and uses concentrations from Solar PIL 167. Data for Particulate Matter based upon Solar PIL 171.
3. Greenhouse gases are calculated using emission factors from Part 98, Tables C-1 and C-2 and global warming potentials from Table A-1 (CO_2 = 1, CH_4 = 25, N_2O = 298).
4. VOC as 20% of UHC based on Solar PIL 168 for natural gas.

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Table B-3. Solar Taurus 70 Potential to Emit

Operations	Normal Ambient Temperatures (>0 degrees F)		Startup		Shutdown		Potential to Emit Including Startup/Shutdown during Normal Temperature Operation	Low Ambient Temperatures (<0 degrees F)		Maximum Yearly Potential to Emit (Includes Startup, Shutdown, and Low Temperature Operation)
Maximum Annual Combined Event Frequency	8,760 hrs/yr		52 Events/Yr (10 Minute Event Duration)		52 Events/Year (10 Minute Event Duration)		8,760 hrs/yr	24 hrs/yr		8,760 hrs/yr
Pollutant	Hourly (lb/hr)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Maximum Annual (tpy)	Hourly (lb/hr)	Maximum Annual (tpy)	Maximum Annual (tpy)
NO_X	4.88	21.37	1.00	0.03	1.00	0.03	21.38	40.16	0.48	21.81
CO	4.95	21.68	88.00	2.29	62.00	1.61	25.54	30.54	0.37	25.85
SO2	0.47	2.07	0	0	0	0	2.07	0.48	0.01	2.07
PM10/2.5	1.36	5.96	0	0	0	0	5.96	1.40	0.02	5.96
CO2e	10,608	46,462	0	0	0	0	46,462	10,885	131	46,466
CO2	10,597	46,414	0	0	0	0	46,414	10,874	130	46,418
N2O	0.02	0.09	0	0	0	0	0.09	0.02	0.000	0.09
TOC (Total)	2.84	12.44	88.00	2.29	40.00	1.04	15.74	5.84	0.07	15.78
CH4	0.20	0.88	0	0	0	0	0.88	0.21	0.00	0.88
VOC (Total)	0.57	2.49	17.60	0.46	8.00	0.21	3.15	1.17	0.01	3.16

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Table B-4. Solar Mars 100 Specifications

Fuel	Natural Gas																				
Load	50	50	50	50	50	50	50	75	75	75	75	75	75	75	100	100	100	100	100	100	100
Hp Output (Net)	8,562	8,562	8,300	7,959	7,521	6,986	6,393	12,842	12,842	12,450	11,939	11,282	10,480	9,589	17,123	17,123	16,600	15,918	15,042	13,973	12,786
Ambient Temperature (F)	below 0	0	20	40	60	80	100	below 0	0	20	40	60	80	100	below 0	0	20	40	60	80	100
% RH	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Elevation ft	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660
Fuel LHV (Btu/scf)	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20
Heat Inpu LHV (MMBtu/hr) by volume	71.43	71.43	90.64	86.81	82.93	78.41	74.07	112.88	112.88	108.69	104.25	99.18	93.60	87.86	126.60	126.60	122.73	118.30	113.23	107.44	101.48
Heat Input HHV (MMBtu/hr) (=LHV*1.1125)	79.47	79.47	100.84	96.58	92.26	87.23	82.40	125.58	125.58	120.92	115.98	110.34	104.13	97.74	140.84	140.84	136.54	131.61	125.97	119.53	112.90
Exhaust lb/hr	291,037	291,037	297,633	282,272	267,923	251,220	234,805	346,736	346,736	333,007	318,188	301,449	283,287	264,650	358,083	358,083	349,335	338,647	325,252	309,604	291,077
Exhaust ACFM	137,829	137,829	171,716	166,278	161,598	155,290	148,483	196,724	196,724	190,989	184,855	177,567	169,887	162,347	202,398	202,398	199,459	195,584	190,475	184,076	176,179
Stack Height (ft)	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Stack Height (m)	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24
Stack Equiv Diameter (ft)	7.00		7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Stack Exhaust Velocity (m/s)	18.19	#VALUE!	22.67	21.95	21.33	20.50	19.60	25.97	25.97	25.21	24.40	23.44	22.43	21.43	26.72	26.72	26.33	25.82	25.14	24.30	23.26
Exhaust Temperature (F)	651	651	893	920	951	981	1010	871	871	885	901	918	938	966	866	866	879	893	910	926	947
Exhaust Temperature (K)	617.0	617.0	751.5	766.5	783.7	800.4	816.5	739.3	739.3	747.0	755.9	765.4	776.5	792.0	736.5	736.5	743.7	751.5	760.9	769.8	781.5
NO_x ppm@ 15% O_2	120	15	15	15	15	15	15	120	15	15	15	15	15	15	120	15	15	15	15	15	15
NO_x lb/hr	34.160	4.270	5.430	5.190	4.940	4.640	4.330	54.160	6.770	6.510	6.240	5.910	5.540	5.140	60.800	7.600	7.360	7.080	6.750	6.370	5.940
NO_x g/s	4.304	0.538	0.684	0.654	0.622	0.585	0.546	6.824	0.853	0.820	0.786	0.745	0.698	0.648	7.661	0.958	0.927	0.892	0.851	0.803	0.748
CO ppm@ 15% O_2	150	25	25	25	25	25	25	150	25	25	25	25	25	25	150	25	25	25	25	25	25
CO lb/hr	25.980	4.330	5.510	5.270	5.010	4.710	4.400	41.220	6.870	6.610	6.330	6.000	5.620	5.220	46.260	7.710	7.470	7.180	6.850	6.460	6.030
CO g/s	3.273	0.546	0.694	0.664	0.631	0.593	0.554	5.194	0.866	0.833	0.798	0.756	0.708	0.658	5.829	0.971	0.941	0.905	0.863	0.814	0.760
UHC ppm@ 15% O_2	50	25	25	25	25	25	25	50	25	25	25	25	25	25	50	25	25	25	25	25	25
UHC lb/hr	4.960	2.480	3.150	3.020	2.870	2.700	2.520	7.860	3.930	3.790	3.620	3.440	3.220	2.990	8.840	4.420	4.280	4.120	3.920	3.700	3.450
VOC ppm@ 15% O_2 (20% of UHC)	10	5	5	5	5	5	5	10	5	5	5	5	5	5	10	5	5	5	5	5	5
VOC lb/hr	0.992	0.496	0.630	0.604	0.574	0.540	0.504	1.572	0.786	0.758	0.724	0.688	0.644	0.598	1.768	0.884	0.856	0.824	0.784	0.740	0.690
sulfur gr/100 scf	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SO2 lb/hr	0.414	0.414	0.525	0.503	0.480	0.454	0.429	0.654	0.654	0.629	0.604	0.574	0.542	0.509	0.733	0.733	0.711	0.685	0.656	0.622	0.588
SO2 g/s	0.052	0.052	0.066	0.063	0.060	0.057	0.054	0.082	0.082	0.079	0.076	0.072	0.068	0.064	0.092	0.092	0.090	0.086	0.083	0.078	0.074
Particulates lb/MMBtu	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
$PM_{10/2.5}$ lb/hr	1.19	1.19	1.51	1.45	1.38	1.31	1.24	1.88	1.88	1.81	1.74	1.66	1.56	1.47	2.11	2.11	2.05	1.97	1.89	1.79	1.69
$PM_{10/2.5}$ g/s	0.150	0.150	0.191	0.183	0.174	0.165	0.156	0.237	0.237	0.229	0.219	0.209	0.197	0.185	0.266	0.266	0.258	0.249	0.238	0.226	0.213
CO2 lb/mmBtu	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
CO_2 lb/hr	9,289	9,289	11,787	11,289	10,784	10,196	9,632	14,679	14,679	14,134	13,557	12,897	12,172	11,425	16,463	16,463	15,960	15,384	14,724	13,971	13,196
CH_4 lb/mmBtu	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
CH_4 lb/hr	0.1752	0.1752	0.2223	0.2129	0.2034	0.1923	0.1817	0.2769	0.2769	0.2666	0.2557	0.2433	0.2296	0.2155	0.3105	0.3105	0.3010	0.2901	0.2777	0.2635	0.2489
N_2O lb/mmBtu	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
N_2O lb/hr	0.0175	0.0175	0.0222	0.0213	0.0203	0.0192	0.0182	0.0277	0.0277	0.0267	0.0256	0.0243	0.0230	0.0215	0.0311	0.0311	0.0301	0.0290	0.0278	0.0264	0.0249
CO_2e lb/mmBtu	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0
CO_2e lb/hr	9,298	9,298	11,799	11,300	10,795	10,207	9,642	14,694	14,694	14,149	13,571	12,911	12,184	11,437	16,480	16,480	15,976	15,400	14,740	13,986	13,210

Notes

1. Data provided by Solar for 100%, 75%, and 50% load cases: net output power, fuel flow (MMBtu/hr, LHV), exhaust flow (lb/hr), exhaust temperature, NO_x/CO/UHC concentrations and lb/hr.
2. Below zero and low load operation uses 0°F for operating parameters and uses concentrations from Solar PIL 167. Data for Particulate Matter based upon Solar PIL 171.
3. Greenhouse gases are calculated using emission factors from Part 98, Tables C-1 and C-2 and global warming potentials from Table A-1 (CO_2 = 1, CH_4 = 25, N_2O = 298).
4. VOC as 20% of UHC based on Solar PIL 168 for natural gas.

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Table B-5. Solar Mars 100 Potential to Emit

Operations	**Normal Ambient Temperatures (>0 degrees F)**		**Startup**		**Shutdown**		**Potential to Emit Including Startup/Shutdown during Normal Temperature Operation**	**Low Ambient Temperatures (<0 degrees F)**		**Maximum Yearly Potential to Emit (Includes Startup, Shutdown, and Low Temperature Operation)**
Maximum Annual Combined Event Frequency	8,760 hrs/yr		52 Events/Yr (10 Minute Event Duration)		52 Events/Year (10 Minute Event Duration)		8,760 hrs/yr	24 hrs/yr		8,760 hrs/yr
Pollutant	Hourly (lb/hr)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Maximum Annual (tpy)	Hourly (lb/hr)	Maximum Annual (tpy)	Maximum Annual (tpy)
NO_X	7.08	31.01	1.00	0.03	1.00	0.03	31.01	60.80	0.73	31.66
CO	7.18	31.45	46.00	1.20	82.00	2.13	34.71	46.26	0.56	35.18
SO_2	0.68	3.00	0	0	0	0	3.00	0.73	0.01	3.00
PM10/2.5	1.97	8.65	0	0	0	0	8.65	2.11	0.03	8.65
CO_2e	15,400	67,450	0	0	0	0	67,450	16,480	198	67,463
CO_2	15,384	67,380	0	0	0	0	67,380	16,463	198	67,393
N_2O	0.03	0.13	0	0	0	0	0.13	0.03	0.000	0.13
TOC (Total)	4.12	18.05	20.00	0.52	26.00	0.68	19.21	8.84	0.11	19.26
CH_4	0.29	1.27	0	0	0	0	1.27	0.31	0.00	1.27
VOC (Total)	0.82	3.61	4.00	0.10	5.20	0.14	3.84	1.77	0.02	3.85

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Table B-6. Capstone Microturbine Potential Emissions Summary (C200)

Engine parameters

Power output base load	268.2	hp
Power output base load	200	kW
Heat Input Capacity (HHV)	2.28	MMBtu/hr
Maximum Annual Operation	8760	hr/yr
Number of Units	5	Units

Pollutant	Potential Emissions			
	g/bhp-hr[1]	lb/MMBtu[2]	lb/hr	Total Annual (ton/yr)[3]
NO_x	0.14		0.08	1.81
CO	0.37		0.22	4.79
VOC	0.03		0.02	0.44
PM10/2.5		0.0066	0.02	0.330
SO2		0.0034	0.008	0.1698
CO2e		117.10	266.990	5847.07
CO2		116.9800	266.714	5841.05
CH4		0.0022	0.005	0.11
N2O		0.0002	0.001	0.011

Notes:
[1] NOx, CO, VOC based on vendor data.
[2] Emissions for PM10/PM2.5 and SO2 calculated using AP-42 emission factors (Table 3.1-2a).
Emission for GHGs based upon 40 CFR Part 98, Subpart C.
[3] Represents 5 x Capstone C200 Microturbines, each limited to 8,760 hours / year.

MVP Southgate Project
Lambert Compressor Station

Table B-7. Gas-Fired Heater Potential Emissions Summary

Heater parameters

Heat Input Capacity (HHV)	0.77	MMBtu/hr
Fuel Firing Rate	700	SCF/hr
Maximum Annual Operation	8,760	hr/yr

Pollutant	Potential Emissions		
	lb/mmscf	lb/hr	Total Annual (ton/yr)
NO_x	100	0.07	0.31
CO	84	0.06	0.26
VOC	5.5	0.004	0.017
PM/PM-10/PM-2.5	7.6	0.005	0.023
SO_2 (2)	5.71	0.0040	0.018
CO2e	128,868	90.17	394.93
CO2	128,735	90.07	394.53
CH4	2.42	0.0017	0.01
N2O	0.24	0.00017	0.0007

(1) NO_x, CO, VOC and PM emissions are based upon AP-42 Emission Factors

(2) Emissions of SO_2 from based on mass balance of sulfur in fuel:

Sulfur Content	2.0	grains/100 SCF
Higher Heating Value	1,100	Btu/SCF
Molecular Weight of S =	32	lb/lbmol
Molecular Weight of SO_2 =	64	lb/lbmol

(3) GHG Emissions are based upon 40 CFR Part 98, Subpart C

MVP Southgate Project
Lambert Compressor Station

Table B-8. Fugitive Blowdowns Potential Emissions Summary

Natural Gas Specifications

Constituent	Mol Percent	Molecular Weight	Lb/Lb-Mol NG	Mass Percent	VOC
CO2	0.165	44.01	0.073	0.41%	No
Nitrogen	0.396	28.01	0.111	0.62%	No
Methane	87.823	16.04	14.089	79.08%	No
Ethane	11.303	30.07	3.399	19.08%	No
Propane	0.28	44.10	0.123	0.69%	Yes
i-Butane	0.009	58.12	0.005	0.03%	Yes
i-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Hexane	0.008	86.18	0.007	0.04%	Yes
N-Butane	0.01	58.12	0.006	0.03%	Yes

Notes: Based upon representative gas analyses for Project.

Natural Gas Properties	
Molecular Weight	17.817
Specific Gravity	0.615
lb/Scf	0.047
Scf/lb	21.26

Parameter	Blowdown Events							
	Taurus 70 Shutdown	Mars 100 Shutdown	Pig Receiver	Pig Launcher	Suction Filter	Station Discharge	Miscellaneous Filters	Emergency Station Shutdown (ESD)[1]
Gas Blowdown (scf/event)	42,000	64,000	6,500	13,000	19,000	67,000	3,500	218,000
Blowdowns per Year	12	12	2	2	12	12	12	1
VOC Emissions (lb/event)	16.2	24.6	2.5	5.0	7.3	25.8	1.3	83.9
CO2 Emissions (lb/event)	8.1	12.3	1.25	2.49	3.6	12.8	0.7	41.8
CH4 Emissions (lb/event)	1,562.0	2,380.2	241.7	483.5	706.6	2,491.8	130.2	8,107.5
CO2e Emissions (lb/event)	39,058.1	59,517.1	6,044.7	12,089.4	17,669.1	62,306.9	3,254.8	202,730.0
HAP Emissions (lb/event)	0.8	1.2	0.1	0.2	0.3	1.2	0.1	4.0
VOC Emissions (tpy)	0.0969	0.1477	0.0025	0.0050	0.0439	0.1546	0.0081	0.0419
CO2 Emissions (tpy)	0.0483	0.0736	0.0012	0.0025	0.0219	0.0771	0.0040	0.0209
CH4 Emissions (tpy)	9.4	14.3	0.24	0.48	4.2	15.0	0.8	4.1
CO2e Emissions (tpy)	234.3	357.1	6.0	12.1	106.0	373.8	19.5	101.4
HAP Emissions (tpy)	0.005	0.007	0.00012	0.00024	0.002	0.007	0.0004	0.002

Note: Facility-wide blowdown events may occur for unplanned reasons (e.g. when an unsafe operating condition is detected). To prepare for such events, Mountain Valley Pipeline, LLC must perform ESD testing once every 5 years to ensure proper operation of the ESD system. A full station blowdown will only occur during emegency conditions. Emergency events are expected to be very infrequent and cannot be predicted. Accordingly, emergency station shutdown events are provided for informational purposes only.

MVP Southgate Project
Lambert Compressor Station

Table B-9. Produced Fluids Tank Potential Emissions Summary

Storage Tank Design Data

Capacity (gal)	10,080
Liquids Input Rate (gal/yr)	126,000
Daily Input Rate (bbl/day)	8
Percent Condensate (%)	1
Condensate Throughput (bbl/day)	0.1
Number of Tanks	2
Max. Hours of Operation	8760

Pollutant	Single Tank Total Emissions (Working + Breathing + Flashing)		
	lbs/hr	lbs/year	tons/year
VOC (Total)	0.049	429.2	0.21
CO2e	0.475	4161.0	2.08

Notes: Source - E&P Tanks 2.0

MVP Southgate Project
Lambert Compressor Station

Table B-10. Potential Fugitive Emissions Summary

Component	CH_4 Emission Factor[1,2]	CO_2 Emission Factor[1,2]	Units
Compressor Station Fugitives	135,260.0	7,813.1	lb/station-yr
Centrifugal Compressor Fugitives	467,660.0	27,013.7	lb/compressor-yr

[1]Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage, Volume 1 - GHG Emission Estimation Methodologies and Procedures, Interstate Natural Gas Association of America (INGAA), September 28, 2005. See Table 4.4.

[2]Based on 93.4 vol% CH_4 and 2 vol% CO_2 in natural gas, per INGAA Guideline

Natural Gas Specifications

Constituent	Mol Percent	Molecular Weight	Lb/Lb-Mol NG	Mass Percent	VOC
CO2	0.165	44.01	0.073	0.41%	No
Nitrogen	0.396	28.01	0.111	0.62%	No
Methane	87.823	16.04	14.089	79.08%	No
Ethane	11.303	30.07	3.399	19.08%	No
Propane	0.28	44.10	0.123	0.69%	Yes
i-Butane	0.009	58.12	0.005	0.03%	Yes
i-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Hexane	0.008	86.18	0.007	0.04%	Yes
N-Butane	0.01	58.12	0.006	0.03%	Yes

Natural Gas Properties	
Molecular Weigh	17.817
Specific Gravity	0.615
lb/Scf	0.047
Scf/lb	21.26

Fugitive Componont Leak Emissions

Component Type	Estimated Component Count	Gas Leak Emission Factor		Hourly Average Gas Leak Rate	Annual Gas Leak Rate		Potential VOC Emissions	Potential HAP Emissions	CO_2 Emissions	CH_4 Emissions	CO_2e Emissions
		(scf/hr/component)	Factor Source	(scf/hr)	(scf/year)	lb/year	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
Connectors	1000	0.003	40 CFR 98, Table W-1A	3.00	26,280	1,236	0.01	0.0002	0.003	0.49	12.22
Flanges	500	0.003	40 CFR 98, Table W-1A	1.50	13,140	618	0.00	0.0001	0.001	0.24	6.11
Open-Ended	0	0.061	40 CFR 98, Table W-1A	0	0	0	0	0	0	0	0
Pump Seals	0	13.300	40 CFR 98, Table W-1A	0	0	0	0	0	0	0	0
Valves	100	0.027	40 CFR 98, Table W-1A	2.70	23,652	1,112	0.00	0.0002	0.002	0.44	11.00
Other	0	0.040	40 CFR 98, Table W-1A	0	0	0	0	0	0	0	0

Notes:
1. "Other" equipment types include compressor seals, relief valves, diaphragms, drains, meters, etc
2. The component count is a preliminary estimate based on the proposed design of the station
3. VOC, HAP, CO2, and CH4 emissions are based on fractions of these pollutants in the site-specific gas analysis
4. CO2e calculated using global warming potentials from Part 98, Table A-1 (CO2 = 1, CH4 = 25)

Dry Seal Emissions

Number of Compressors	Leak Rate (scf/hr/compressor)	Annual Natural Gas Released (scf/yr)	Annual Natural Gas Released (lb/yr)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	CO_2 Emissions (tpy)	CH_4 Emissions (tpy)	CO_2e Emissions (tpy)
2	210	3,679,200	173,037	0.71	0.03	0.35	68.4	1,710.7

Notes:
1. Leak rate and seal information from EPA Natural Gas Star Program (https://www.epa.gov/sites/production/files/2016-06/documents/ll_wetseals.pdf)
2. VOC, HAP, CO2, and CH4 emissions are based on fractions of these pollutants in the site-specific gas analysis
3. CO2e calculated using global warming potentials from Part 98, Table A-1 (CO2 = 1, CH4 = 25)

Fugitive Emissions Summary

Segment	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	CO_2 Emissions (tpy)	CH_4 Emissions (tpy)	CO_2e Emissions (tpy)
Compressor Station Fugitives	0.01	0.001	0.01	1.2	29.3
Dry Seal Emissions	0.71	0.03	0.35	68.4	1,710.7
Total	0.72	0.03	0.36	69.6	1,740.1

MVP Southgate Project
Lambert Compressor Station

Table B-11. Proposed Project Potential HAP Emissions Summary

	Solar Taurus 70			Solar Mars 100			Fuel Gas Heater			Capstone Microturbines			
	Emission Factor Basis[1]	Max Hourly	Annual Potential	Emission Factor Basis[1]	Max Hourly	Annual Potential	Emission Factor Basis[2]	Max Hourly	Annual Potential	EF Basis[3]	Max Hourly	Annual Potential	Facility PTE
Hazardous Air Pollutants (HAPs)	lb/MMBtu	lb/hr	tons/year	lb/MMBtu	lb/hr	tons/year	lb/MMBtu	lb/hr	tons/year	lb/MMBtu	lb/hr	tons/year	tons/yr
VOC-HAP													
Acetaldehyde	1.20E-04	1.12E-02	4.89E-02	1.20E-04	1.69E-02	7.40E-02				1.68E-04	3.82E-04	8.37E-03	1.31E-01
Acrolein	1.92E-05	1.79E-03	7.82E-03	1.92E-05	2.70E-03	1.18E-02				2.68E-05	6.11E-05	1.34E-03	2.10E-02
Benzene	3.60E-05	3.35E-03	1.47E-02	3.60E-05	5.07E-03	2.22E-02	2.06E-06	1.59E-06	6.94E-06	5.03E-05	1.15E-04	2.51E-03	3.94E-02
1,3-Butadiene	1.29E-06	1.20E-04	5.26E-04	1.29E-06	1.82E-04	7.96E-04				1.80E-06	4.11E-06	9.00E-05	1.41E-03
Dichlorobenzene							1.18E-06	9.06E-07	3.97E-06				3.97E-06
Ethylbenzene	9.60E-05	8.93E-03	3.91E-02	9.60E-05	1.35E-02	5.92E-02				1.34E-04	3.06E-04	6.70E-03	1.05E-01
Formaldehyde	2.13E-03	1.98E-01	8.68E-01	2.13E-03	3.00E-01	1.31E+00	7.35E-05	5.66E-05	2.48E-04	2.98E-03	6.78E-03	1.49E-01	2.33E+00
Hexane							1.76E-03	1.36E-03	5.95E-03				5.95E-03
Naphthalene	3.90E-06	3.63E-04	1.59E-03	3.90E-06	5.49E-04	2.41E-03	5.98E-07	4.60E-07	2.02E-06	5.45E-06	1.24E-05	2.72E-04	4.27E-03
PAH	6.60E-06	6.14E-04	2.69E-03	6.60E-06	9.30E-04	4.07E-03				9.22E-06	2.10E-05	4.60E-04	7.22E-03
Propylene Oxide	8.70E-05	8.09E-03	3.54E-02	8.70E-05	1.23E-02	5.37E-02				1.22E-04	2.77E-04	6.07E-03	9.52E-02
Toluene	3.90E-04	3.63E-02	1.59E-01	3.90E-04	5.49E-02	2.41E-01	3.33E-06	2.57E-06	1.12E-05	5.45E-04	1.24E-03	2.72E-02	4.27E-01
Xylenes	1.92E-04	1.79E-02	7.82E-02	1.92E-04	2.70E-02	1.18E-01				2.68E-04	6.11E-04	1.34E-02	2.10E-01
Polycyclic Organic Compounds (POM)													
Acenaphthene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Acenaphthylene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Anthracene	2.35E-09	2.19E-07	9.59E-07	2.35E-09	3.31E-07	1.45E-06	2.35E-09	1.81E-09	7.94E-09	2.35E-09	5.36E-09	1.17E-07	2.54E-06
Benz(a)anthracene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Benzo(a)pyrene	1.18E-09	1.09E-07	4.79E-07	1.18E-09	1.66E-07	7.26E-07	1.18E-09	9.06E-10	3.97E-09	1.18E-09	2.68E-09	5.87E-08	1.27E-06
Benzo(b)fluoranthene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Benzo(g,h,i)perylene	1.18E-09	1.09E-07	4.79E-07	1.18E-09	1.66E-07	7.26E-07	1.18E-09	9.06E-10	3.97E-09	1.18E-09	2.68E-09	5.87E-08	1.27E-06
Benzo(k)fluoranthene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Chrysene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Dibenzo(a,h)anthracene	1.18E-09	1.09E-07	4.79E-07	1.18E-09	1.66E-07	7.26E-07	1.18E-09	9.06E-10	3.97E-09	1.18E-09	2.68E-09	5.87E-08	1.27E-06
7,12-Dimethylbenz(a)anthracene	1.57E-08	1.46E-06	6.39E-06	1.57E-08	2.21E-06	9.68E-06	1.57E-08	1.21E-08	5.29E-08	1.57E-08	3.58E-08	7.83E-07	1.69E-05
Fluoranthene	2.94E-09	2.74E-07	1.20E-06	2.94E-09	4.14E-07	1.81E-06	2.94E-09	2.26E-09	9.92E-09	2.94E-09	6.71E-09	1.47E-07	3.17E-06
Fluorene	2.75E-09	2.55E-07	1.12E-06	2.75E-09	3.87E-07	1.69E-06	2.75E-09	2.11E-09	9.26E-09	2.75E-09	6.26E-09	1.37E-07	2.96E-06
3-Methylchloranthrene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
2-Methylnaphthalene	2.35E-08	2.19E-06	9.59E-06	2.35E-08	3.31E-06	1.45E-05	2.35E-08	1.81E-08	7.94E-08	2.35E-08	5.36E-08	1.17E-06	2.54E-05
Indeno(1,2,3-cd)pyrene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Phenanthrene	1.67E-08	1.55E-06	6.79E-06	1.67E-08	2.35E-06	1.03E-05	1.67E-08	1.28E-08	5.62E-08	1.67E-08	3.80E-08	8.32E-07	1.80E-05
Pyrene	4.90E-09	4.56E-07	2.00E-06	4.90E-09	6.90E-07	3.02E-06	4.90E-09	3.77E-09	1.65E-08	4.90E-09	1.12E-08	2.45E-07	5.28E-06
Total POM	8.65E-08	8.04E-06	3.52E-05	8.65E-08	1.22E-05	5.33E-05	8.65E-08	6.66E-08	2.92E-07	8.65E-08	1.97E-07	4.32E-06	9.32E-05
Total HAPs													
												Maximum Individual HAP:	2.3
												Total Project HAPs:	3.4

[1] Emissions based on AP-42 5th Edition, Section 3.1. Emissions based on scaling of AP-42 values using Vendor Guarantee for TOC.

[2] Emissions based on AP-42 5th Edition, Section 1.4.

[3] Emissions based on AP-42 5th Edition, Section 3.1.

MVP Southgate Project
Table B-12: Maintenance Blowdown and Fugitive Emissions - Operational Emissions

Component	County	Length (miles)	Ongoing Operation: Total VOC[1] (lbs)	Total VOC (tons)	Total CO2 (tons)	Methane (tons)	Total CO2e (tons)
Pipeline[3]							
	Pittsylvania, VA	26.5	1,226	0.61	0.122	24.5	611.9
	Rockingham, NC	26.5	1,224	0.61	0.121	24.4	611.0
Mainline	Alamance, NC	20.5	947	0.47	0.094	18.9	472.7
M&R Stations[4]							
Lambert Interconnect	Pittsylvania, VA	NA	1,329	0.665	0.123	26.52	663.2
LN 3600 Interconnect	Rockingham, NC	NA	1,329	0.665	0.123	26.52	663.2
T-15 Dan River Interconnect	Rockingham, NC	NA	1,329	0.665	0.123	26.52	663.2
T-21 Haw River Interconnect	Alamance, NC	NA	1,329	0.665	0.123	26.52	663.2

Notes:
1. Based upon VOC, CO2, and methane contents of 0.82%, 0.165%, and 98.15%, respectively, based upon the expected natural gas composition.
2. The global warming potential of CO2 and Methane is 1 and 25, respectively
3. Based upon the API Compendum Methodology provided below.
4. Estimates based on emission calculation techniques provided in AP-42, 40 CFR Part 98, U.S. EPA's Protocol for Equipment Leak Emissions Estimates (EPA 453/R-95-017) and design data for similar sites.

Summary by County

County	Ongoing Operation: Total VOC	Total CO2e
Pittsylvania, VA	1.28	1,275.1
Rockingham, NC	1.94	1,937.4
Alamance, NC	1.14	1,135.9

Basis - American Petroleum Institute Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry, August 2009 ("API Compendium")

	Fugitive	Blowdown
M&R	Table 6-6	Table 5-26 - Miscellaneous
Pipeline	Table 6-6	Table 5-26 - Pipeline

Fugitive

Table 6-6 Fugitive Emission factors for NG Transmission and Storage Equipment

			EF- ton/mile-hr
Transmission Pipeline	1.32E-06	ton CH4/mile-hr	1.39E-06
Transmission Pipeline - CO2 from Oxidation	4.33E-07	ton CO2/mile-hr	3.57E-08
Transmission Pipeline - CO2 from Leaks	8.69E-08	ton CO2/mile-hr	7.17E-09
		tonVOC/mile-hr	3.48E-08
M&R Stations	1.44E-04	ton CH4/Station-hr	1.52E-04
		ton CO2/Station-hr	7.02E-07
		ton VOC/Station-hr	3.80E-06

Blowdown

Table 5-26 Transmission Segment CH4 Emission Factors for Non-Routine Activities

			ton CH4/Station-yr
Miscellaneous Blowdown (M&R, Pigging, and etc)	23.9752425	ton CH4/Station-yr	25.194
		ton CO2/Station-yr	0.116
		ton VOC/Station-yr	0.631
Transmission Pipeline Venting/Blowdown	0.865864505	ton CH4/mile-yr	0.910
		ton CO2/mile-yr	0.004
		ton VOC/mile-yr	0.023

MVP Southgate Project

Docket No. CP19-XX-000

Resource Report 9

Appendix 9-C

Virginia State Air Permit Application

[To be provided in a supplemental filing.]

MVP Southgate Project

Docket No. CP19-XX-000

Resource Report 9

Appendix 9-D
Lambert Compressor Station Air Quality Modeling Report

Mountain Valley Pipeline, LLC
Lambert Compressor Station
Southgate Project
Air Quality Modeling Report

Prepared for:

Mountain Valley Pipeline, LLC

Prepared by:

TRC Environmental Corporation
1200 Wall Street West, 5th Floor
Lyndhurst, New Jersey 07071

November 2018

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1.0 INTRODUCTION

1.1 Project Overview

Mountain Valley Pipeline, LLC ("Mountain Valley") is seeking a Certificate of Public Convenience and Necessity ("Certificate") from the Federal Energy Regulatory Commission ("FERC") pursuant to Section 7(c) of the Natural Gas Act to construct and operate the MVP Southgate Project ("Project"). The Project will be located in Pittsylvania County, Virginia and Rockingham and Alamance counties, North Carolina. Mountain Valley proposes to construct approximately a 0.4-mile-long 24-inch-diameter pipeline (H-605) and 73 miles of 24- and 16-inch-diameter natural gas pipeline (H-650) to provide timely, cost-effective access to new natural gas supplies to meet the growing needs of natural gas users in the southeastern United States ("U.S."), including for the Project's anchor shipper, a local distribution company serving customers in North Carolina.

In addition to the proposed pipeline, Mountain Valley proposes to construct and operate a new compressor station (Lambert Compressor Station) near the beginning of the pipeline. As part of the Southgate Project and in order to boost pressures on Mountain Valley's transmission pipeline system, Mountain Valley is proposing to construct and operate one Solar Taurus 70 compressor turbine (11,792 hp) and one Solar Mars 100 compressor turbine (17,123 hp) at the Lambert Compressor Station. The Lambert Compressor Station (CS) will be a new natural gas transmission facility covered by Standard Industrial Classification (SIC) 4922. Ancillary project emission sources include five (5) Capstone microturbines rated at 200 kW each, one (1) 0.77 MMBtu/hr natural gas fired heater, and two (2) 10,000 gallon produced fluids tanks.

At the federal level, because the emission increases from the Lambert Compressor Station equipment are less than applicable major source thresholds, the Project will not trigger federal NSR requirements for any regulated air pollutant under either PSD or NNSR permitting programs. At the state level, the Project triggers air permitting through the VADEQ as a minor source of air emissions. If the agency considers that any project triggering minor NSR permitting could threaten attainment with the National Ambient Air Quality Standards (NAAQSs), VADEQ can require air dispersion modeling for the Project. A site wide modeling analysis for criteria pollutants has been performed to demonstrate that the Project will comply with the NAAQS. This report details the NAAQS and toxic air pollutant modeling assessments for the proposed Lambert Compressor Station.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Surroundings

The proposed Lambert Compressor Station, as shown in Figure 2-1, is proposed to be located on an undeveloped parcel of land in a rural area near to Chatham, Virginia. The Lambert Compressor Station will be constructed at the beginning of the pipeline at milepost 0.0 in Pittsylvania County, Virginia on a parcel of land owned by Mountain Valley.

The approximate Universal Transverse Mercator (UTM) coordinates of the facility are: 647,900 meters east and 4,076,900 meters north in Zone 17 (North American Datum of 1983(NAD83)). A detailed plot plan of the proposed facility is shown in Figure 2-2.

2.2 Facility Conceptual Design

As a part of the Southgate Project, Mountain Valley is proposing to install the following equipment at the proposed Lambert Compressor Station:

- One Solar Taurus 70, 11,792 hp natural gas fired turbine-driven compressor unit;
- One Solar Mars 100, 17,123 hp natural gas fired turbine-driven compressor unit;
- Five (5) Capstone Microturbines each rated at 200 kW;
- One 0.77 MMBtu/hr heater; and
- Two 10,000 gallon produced fluids storage tanks.

Potential Project emissions include trivial station blowdowns consisting of two types of gas blowdown events that could occur at the Station: (1) a type of maintenance gas blowdown that could occur when a compressor is stopped and gas between the suction/discharge valves and compressors is vented to the atmosphere via a blowdown vent, and (2) an emergency full station shutdown (ESD) that would only occur infrequently at required U.S. Department of Transportation (DOT) test intervals or in an emergency situation.

The installation of the above equipment will include a number of piping components at the station which could result in additional fugitive emissions due to equipment leaks.

2.2.1 Compressor Turbines

The proposed Solar Taurus 70 and Mars 100 natural gas-fired turbines to be installed at the Lambert Compressor Station will be equipped with Solar's SoLoNOx dry low NOx combustor technology for NOx control. Potential emissions for the Solar Turbines conservatively assume that the units will operate up to 8,760 hours per year and up to 100% rated output. The vendor provided emission rates for normal operating conditions are as follows (all emissions rates are in terms of parts per million dry volume (ppmvd) @ 15% O2):

- 15 ppmvd NOx;
- 25 ppmvd CO;
- 25 ppmvd unburned hydrocarbons (UHC); and
- 5 ppmvd VOC.

Depending upon demand, the turbines may operate at loads ranging from 50% to 100% of full capacity. Because of the different emission rates and exhaust characteristics that occur at different loads and ambient temperatures, a matrix of operating modes is presented. Emission parameters for three turbine loads (50%, 75%, and 100%) and six ambient temperatures (0°F, 20°F, 40°F, 60°F, 80 °F, and 100°F) are accounted for in this air modeling analysis to cover the range of steady-state turbine operations.

At very low load and cold temperature extremes, the turbine system must be controlled differently in order to assure stable operation. The required adjustments to the turbine controls at these conditions cause emissions of NOx, CO and VOC to increase (emission rates of other pollutants are unchanged). Low-load operation (non-normal SoLoNOx operation) of the turbines is expected to occur only during periods of startup and shutdown and for maintenance or unforeseen emergency events.

Similarly, Solar has provided emission estimates for low temperature operation (inlet combustion air temperature less than 0° F and greater than -20° F) in Solar PIL 167 (SoLoNOx Products: Emissions in Non-SoLoNOx Modes). Solar PIL 167 provides estimated pre-control emissions from the turbines at low temperature conditions.

- 120 ppmvd NOx;
- 150 ppmvd CO;
- 50 ppmvd unburned hydrocarbons (UHC); and
- 10 ppmvd VOC.

Mountain Valley reviewed historic meteorological data from the previous five years for the region to estimate the worst-case number of hours per year under sub-zero (less than 0° F) conditions. The annual hours of operation during sub-zero conditions was assumed to be not more than 24 hours per year.

2.2.2 Ancillary Equipment

Mountain Valley is proposing to install five (5) new natural gas fired Capstone C200 (200 kW) microturbines to provide electrical power to the Station. Emissions of NOx, CO, and VOC are based on vendor data. Emission rates for SO_2, particulates, and hazardous air pollutants (HAPs) are based on USEPA AP-42 emission factors (Table 3.1-2a). The emission rates are based on the microturbines operating at peak load.

2.3 Proposed Project Emission Potential

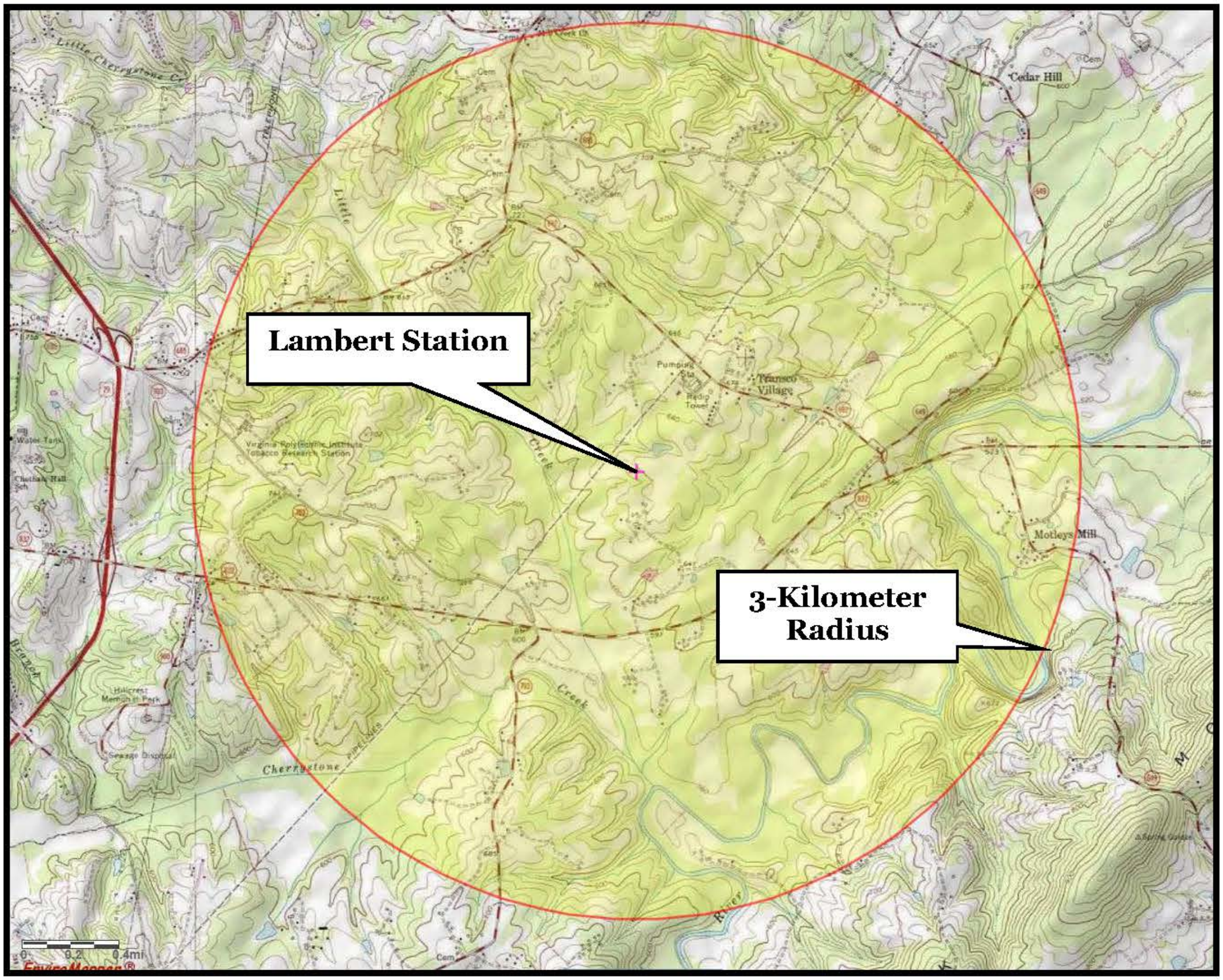
Table 2-1 presents project emission potentials from the new units to be installed as a part of the proposed Lambert Compressor Station.

Table 2-1: Proposed Facility Emissions (tons/year)

Pollutant	Solar Taurus 70 Turbine	Solar Mars 100 Turbine	Capstone Microturbines	Heater	Produced Fluids Tanks	Station Blowdowns	Station Fugitives	Proposed Project Total
NOx	21.81	31.66	1.81	0.31	-	-	-	55.58
VOC	3.16	3.85	0.44	0.02	0.43	0.46	0.72	9.07
CO	25.85	35.18	4.79	0.26	-	-	-	66.08
SO_2	2.07	3.00	0.17	0.018	-	-	-	5.25
$PM_{10}/PM_{2.5}$	5.96	8.65	0.33	0.02	-	-	-	14.96
CO_2e(1)	46,466	67,463	5,847	395	4.2	2,449	1,740	124,364
HAPs	1.26	1.90	0.21	0.01	-	0.05	0.03	3.46
Maximum Individual HAP(2)	0.87	1.31	0.15	0.00025	-	-	-	2.33

(1) Greenhouse gases calculated as CO_2e.

(2) The individual HAP with the highest total annual emission rate is formaldehyde.

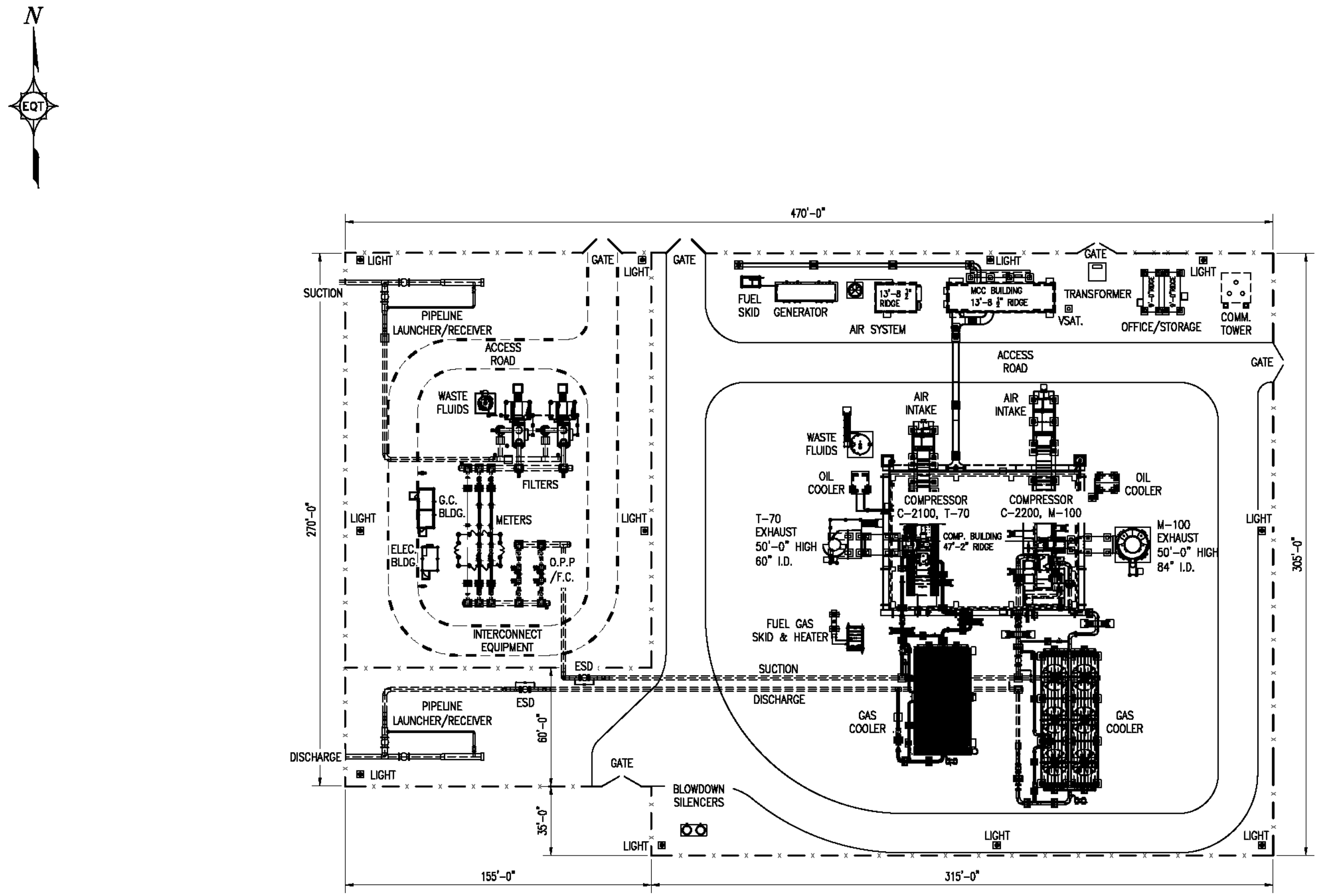


Mountain Valley Pipeline, LLC
Lambert Compressor Station
Pittsylvania County, Virginia

Figure 2-1. Site Location Map

Source: USGS, USEPA EJSCREEN

Figure 2-2: Facility Plot Plan



REFERENCE DRAWINGS		NO.	DATE	REVISION	BY	CHK	APPD	NO.	DATE	REVISION	BY	CHK	APPD
DRAWING NUMBER	DRAWING TITLE	P	8-14-2018	PRELIMINARY	#	#	#	#	#	#	#	#	#
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TO THE BEST OF MY KNOWLEDGE, ALL COMPONENTS OF THIS DRAWING ARE DESIGNED IN ACCORDANCE WITH APPLICABLE GUIDELINES AND SPECIFICATIONS

DOUG MACE — MECHANICAL DESIGN ENGINEER — DATE: 8-14-2018

— ELECTRICAL DESIGN ENGINEER — DATE:

NOTE: ANY CHANGES TO THE DESIGN SHOWN ON THIS DRAWING MUST BE APPROVED BY THE DESIGN ENGINEER.

Mountain Valley PIPELINE LLC

PROJECT ID: ######

DRAWING SCALE: 1/32" = 1'-0"

DRAWING TITLE: LAMBERT COMPRESSOR STATION MECHANICAL PIPING PLOT PLAN

FACILITY	STATE	IDENTIFICATION	SERIES	SHEET	REVISION
C	V	LAM	1100	01	P

Plotted by: Mace, Doug on: October 10, 2018 - 2:49 PM

File Path: C:\Working\PROJECTS\SOUTHGATE\PLOT PLAN\Lambert CS 10-10-2018 DKM.DWG

3.0 AIR QUALITY MODELING ANALYSIS

3.1 Background Ambient Air Quality

Background ambient air quality data was obtained from various existing monitoring locations. Based on a review of the locations of Virginia and North Carolina ambient air quality monitoring sites, the closest representative monitoring sites were used to represent the current background air quality in the site area.

The monitoring data for the most recent three years (2015 – 2017) are presented and compared to the NAAQS in Table 3-1. The maximum measured concentrations for each of these pollutants during the last three years are all below applicable standards and are used as representative background values for comparison of facility concentrations to the NAAQS.

3.2 Modeling Methodology

An air quality modeling analysis was performed consistent with the procedures found in the following documents: Virginia Modeling Guideline for Air Quality Permits (VADEQ, 2015), Guideline on Air Quality Models (Revised) (USEPA, 2017), and New Source Review Workshop Manual (USEPA, 1990).

3.2.1 Model Selection

The USEPA has compiled a set of preferred and alternative computer models for the calculation of pollutant impacts. The selection of a model depends on the characteristics of the source, as well as the nature of the surrounding study area. Of the four classes of models available, the Gaussian type model is the most widely used technique for estimating the impacts of nonreactive pollutants.

The AERMOD model was designed for assessing pollutant concentrations from a wide variety of sources (point, area, and volume). AERMOD is currently recommended by the USEPA for modeling studies in rural or urban areas, flat or complex terrain, and transport distances less than 50 kilometers, with one hour to annual averaging times.

Table 3-1: Maximum Measured Ambient Air Quality Concentrations

Pollutant	Averaging Period	Monitoring Station	AQS Site ID	County	State	Approx. Distance from Facility (km)	Background Concentration	Primary NAAQS	Units a/
CO	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	1.1	35	ppm
CO	8-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	0.7	9	ppm
NO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	33.3	100	ppb
NO_2	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	5.7	53	ppb
PM_{10}	24-hour	Mendenhall School	37-081-0013	Guilford	NC	90	35	150	ug/m³
$PM_{2.5}$	24-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	15.7	35	ug/m³
$PM_{2.5}$	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	7.0	12	ug/m³
SO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	4.0	75	ppb

a/ ppm = parts per million by volume. ppb = parts per billion by volume. μg/m3 = micrograms per cubic meter.

The latest version of USEPA's AERMOD model (Version 18081) was used in the analysis. AERMOD was applied with the regulatory default options and 5-years (2013-2017) of hourly meteorological data consisting of surface data observed at the Danville Regional Airport meteorological station (WBAN #13728) and upper air data collected from Greensboro, North Carolina upper air sounding station (WBAN #13723).

3.2.2 Urban/Rural Area Analysis

A land cover classification analysis was performed to determine whether the URBAN option in the AERMOD model should be used in quantifying ground-level concentrations. The methodology utilized to determine whether the project is located in an urban or rural area is described below.

The following classifications relate the colors on a United States Geological Survey (USGS) topographic quadrangle map to the land use type that they represent:

- Blue – water (rural);
- Green – wooded areas (rural);
- White – parks, unwooded, non-densely packed structures (rural);
- Purple – industrial; identified by large buildings, tanks, sewage disposal or filtration plants, rail yards, roadways, and, intersections (urban);
- Pink – densely packed structures (urban); and,
- Red – roadways and intersections (urban)

The USGS map covering the area within a 3-kilometer radius of the facility (Figure 2-1) was reviewed and indicated that the clear majority of the surrounding area is denoted as green or white, which represent wooded areas, parks, and non-densely packed structures (all designated as rural land uses). Although a small percent of the surrounding area is designated as urban land use, the "AERMOD Implementation Guide" published on August 3, 2015 cautions users against applying the Land Use Procedure on a source-by-source basis and instead to consider the potential for urban heat island influences across the full modeling domain. This approach is consistent with the fact that the urban heat island is not a localized effect, but is more regional in character.

Because the urban heat island is more of a regional effect, the Urban Source option in AERMOD was not utilized since the area within 3 kilometers of the facility as well as the full modeling domain (20 kilometers by 20 kilometers) is predominantly rural.

3.2.3 Good Engineering Practice Stack Height

Section 123 of the Clean Air Act (CAA) required the USEPA to promulgate regulations to assure that the degree of emission limitation for the control of any air pollutant under an applicable State Implementation Plan (SIP) was not affected by (1) stack heights that exceed Good Engineering Practice (GEP) or (2) any other dispersion technique. The USEPA provides specific guidance for determining GEP stack height and for determining whether building downwash will occur in the Guidance for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations), (USEPA, 1985). GEP is defined as "...the height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, and wakes that may be created by the source itself, or nearby structures, or nearby terrain "obstacles"."

The GEP definition is based on the observed phenomenon of atmospheric flow in the immediate vicinity of a structure. It identifies the minimum stack height at which significant adverse aerodynamics (downwash) are avoided. The USEPA GEP stack height regulations (40 CFR 51.100) specify that the GEP stack height (H_{GEP}) be calculated in the following manner:

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

Where: H_B = the height of adjacent or nearby structures, and
L = the lesser dimension (height or projected width of the adjacent or nearby structures).

A detailed plot plan of the proposed facility is shown in Figure 2-2. A GEP stack height analysis was conducted using the USEPA approved Building Profile Input Program with PRIME (BPIPPRM, version 04274). The maximum calculated GEP stack height for the new emission sources is 117.9 feet; the controlling structure is the proposed compressor building (peak height of 47.17 feet). As such, all of the exhaust stacks are subject to downwash and the downwash parameters from the BPIP program were included in the AERMOD analysis.

While the proposed exhaust stacks are lower than the calculated GEP height, the modeling analysis demonstrates that the proposed exhaust stack heights will result in potential air quality impacts that are lower than the NAAQS and VADEQ's Significant Ambient Air Concentrations for toxic air pollutants.

3.2.4 *Meteorological Data*

If at least one year of hourly on-site meteorological data is not available, the application of the AERMOD dispersion model requires five years of hourly meteorological data that are representative of the project site. In addition to being representative, the data must meet quality and completeness requirements per USEPA guidelines. The closest source of representative hourly surface meteorological data is Danville Regional Airport located in Danville, VA, approximately 18 miles to the south of the Lambert Compressor Station.

The meteorological data at the Danville Regional Airport is recorded by an Automated Surface Observing System (ASOS) that records 1-minute measurements of wind direction and wind speed along with hourly surface observations necessary. The USEPA AERMINUTE program was used by the VADEQ to process 1-minute ASOS wind data (2013 – 2017) from the Danville Regional Airport surface station in order to generate hourly averaged wind speed and wind direction data to supplement the standard hourly ASOS observations. The hourly averaged wind speed and direction data generated by AERMINUTE was merged with the aforementioned hourly surface data.

The AERMOD assessment utilized five (5) years (2013–2017) of concurrent meteorological data collected from a meteorological tower at the Danville Regional Airport and from radiosondes launched from Greensboro, North Carolina. Both the surface and upper air sounding data were processed by the VADEQ using AERMOD's meteorological processor, AERMET (version 18081). The output from AERMET was used as the meteorological database for the modeling analysis and consists of a surface data file and a vertical profile data file. This data, which were prepared and processed to AERMOD format by the VADEQ, was provided for use in the modeling analyses for the proposed facility.

3.3 Receptor Grid

3.3.1 *Basic Grid*

The AERMOD model requires receptor data consisting of location coordinates and ground-level elevations. The receptor generating program, AERMAP (Version 18081), was used to develop a complete receptor grid to a distance of 10 kilometers from the proposed facility. AERMAP uses digital elevation model (DEM) or the National Elevation Dataset (NED) data obtained from the USGS. The preferred elevation dataset based on NED data was used in AERMAP to process the receptor grid. This is currently the preferred data to be used with AERMAP as indicated in the USEPA AERMOD

Implementation Guide published August 3, 2015. AERMAP was run to determine the representative elevation for each receptor using 1/3 arc second NED files that were obtained for an area covering at least 10 kilometers in all directions from the proposed facility. The NED data was obtained through the USGS Seamless Data Server (http://seamless.usgs.gov/index.php).

The following rectangular (i.e. Cartesian) receptors were used to assess the air quality impact of the proposed facility:

- Fine grid receptors (100 meter spacing) for a 20 km (east-west) x 20 km (north-south) grid centered on the proposed facility site.
- Fine grid receptors (50 meter spacing) for a 2 km (east-west) x 2 km (north-south) grid centered on the proposed facility site.

3.3.2 Property Line Receptors

The facility will have a fenced property line that precludes public access to the site. Ambient air is therefore defined as the area at and beyond the fence. The modeling receptor grid includes receptors spaced at 25-meter intervals along the entire fence line. Any Cartesian receptors located within the fence line were removed.

3.4 Selection of Sources for Modeling

The emission sources responsible for most of the potential emissions from the Lambert Compressor Station are the two Solar combustion turbines. These units were included in and are the main focus of the modeling analyses. The modeling includes consideration of operation over a range of turbine loads, ambient temperatures, and operating scenarios.

Ancillary sources (Capstone microturbines) were also included in the modeling for appropriate pollutants and averaging periods.

3.4.1 Emission Rates and Exhaust Parameters

The dispersion modeling analysis was conducted with emission rates and flue gas exhaust characteristics (flow rate and temperature) that are expected to represent the range of possible operation parameters for the proposed natural gas fired turbines. Because emission rates and flue gas characteristics for a given turbine load vary as a function of ambient temperature and fuel use, data were derived for a number of ambient temperature cases for natural gas fuel at 100%, 75% and 50% operating loads. The temperatures were:

- 0°F, 20°F, 40°F, 60°F, 80°F and 100°F.

To be conservative and limit the number of cases to be modeled, the modeling analyses were conducted using the lowest stack exhaust temperature and exit velocity coupled with the maximum emission rate over all ambient temperature cases for each operating load. Tables 3-2 and 3-3 summarize the stack parameters and emission rates that were used in the modeling for the two compressor turbines.

Table 3-2: Stack Parameters and Emission Rates – Proposed Solar Taurus 70 Compressor Turbine

Parameter		Values		
Load		50%	75	100%
Stack Height (m)		15.24	15.24	15.24
Stack Diameter (m)		1.52	1.52	1.52
Exhaust Velocity (m/s)		23.74	25.76	29.10
Exhaust Temperature (K)		747.6	738.2	730.9
Pollutant Emissions (g/s)	NOx	0.459	0.556	0.633
	CO	0.466	0.564	0.641
	SO_2	0.044	0.054	0.061
	$PM_{10}/PM_{2.5}$	0.128	0.155	0.176
	Formaldehyde	0.018	0.022	0.025

Table 3-3: Stack Parameters and Emission Rates – Proposed Solar Mars 100 Compressor Turbine

Parameter		Values		
Load		50%	75	100%
Stack Height (m)		15.24	15.24	15.24
Stack Diameter (m)		2.13	2.13	2.13
Exhaust Velocity (m/s)		18.19	21.43	23.26
Exhaust Temperature (K)		617.0	739.3	736.5
Pollutant Emissions (g/s)	NOx	0.684	0.853	0.958
	CO	0.694	0.866	0.971
	SO_2	0.066	0.082	0.092
	$PM_{10}/PM_{2.5}$	0.191	0.237	0.266
	Formaldehyde	0.027	0.034	0.038

Table 3-4 provide the stack parameters and emission rates for the Capstone microturbines.

Table 3-4: Stack Parameters and Emission Rates – Proposed Mircoturbines

Parameter		Values
Stack Height (m)		3.89
Stack Diameter (m)		0.30
Exhaust Velocity (m/s)		32.18
Exhaust Temperature (K)		552.6
Pollutant Emissions (g/sec)	NO_X	0.010
	CO	0.0276
	SO_2	0.001
	PM10/PM2.5	0.0019
	Formaldehyde	0.00085

3.5 Maximum Modeled Facility Concentrations

Table 3-5 presents the maximum modeled air quality concentrations of the proposed facility calculated by AERMOD. As shown in this table, the maximum modeled concentrations when combined with a representative background concentration as provided in Table 3-5, are less than the applicable NAAQS for all pollutants.

Table 3-5: Facility Maxi mum Modeled Concentrations Compared to NAAQS

Pollutant	Averaging Period	NAAQS (μg/m³)	Maximum Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m³)
CO	1-Hour	40,000	59.1	1,265	1,324.1
	8-Hour	10,000	54.0	805	859.0
SO_2	1-Hour	196	4.1	10.5	14.6
	3-Hour	1,300	3.7	10.5	14.2
PM10	24-Hour	150	7.4	35	42.4
PM2.5	24-Hour	35	3.3[a]	15.7	19.0
	Annual	12	0.2	7	7.2
NO_2	1-Hour	188	31.5[b]	62.6	94.1
	Annual	100	0.9[b]	10.7	11.6

[a]Conservatively based upon maximum 98% percentile daily maximum modeled concentrations.

[b]Based upon USEPA Ambient Ratio Method 2 (ARM2) modeling guidance.

3.6 Toxic Air Pollutant Analysis

New and modified sources that emit toxic pollutants must meet the standards in 9 VAC 5-60-300. Virginia defines a toxic pollutant in 9 VAC 5-60-310 as "any air pollutant listed in §112(b) of the federal Clean Air Act, as revised by 40 CFR §63.60, or any other air pollutant that the board determines, through adoption of regulation, to present a significant risk to public health." As HAPs are emitted from the proposed sources at the Lambert Compressor Station, Mountain Valley completed a dispersion modeling evaluation to confirm the Project complies with toxic air pollutant requirements in Virginia.

The Project emissions of toxic air pollutants were compared to the exemption thresholds contained in 9VAC5-60-300C. The only toxic air pollutant that is potentially emitted above the exemption thresholds is formaldehyde. Thus, an air quality dispersion modeling analysis is required by VADEQ to demonstrate that the emissions of formaldehyde will not cause, or contribute to, any significant ambient air concentration that may cause, or contribute to, the endangerment of human health.

An air toxics modeling analysis was conducted for formaldehyde by comparing the modeled 1-hour and annual formaldehyde impacts to the VADEQ's Significant Ambient Air Concentrations (SAAC) for formaldehyde. The SAAC is the concentration of a toxic pollutant in the ambient air that, if exceeded, may have an adverse effect to human health.

As shown in Table 3-6, the maximum modeled impacts are well below the SAACs and thus, the Project complies with the VADEQ toxic pollutant requirements.

Table 3-6: Toxic Air Pollutant Impact Analysis

Pollutant	Averaging Period	VADEQ Screening Level($\mu g/m^3$)	Maximum Modeled Concentration ($\mu g/m^3$)
Formaldehyde	1-Hour	62.5	2.1
	Annual	2.4	0.1

3.7 References

USEPA, 2015. AERMOD Implementation Guide. AERMOD Implementation Workgroup, Office of Air Quality Planning and Standards, Air Quality Assessment Division, Research Triangle Park, North Carolina. August 3, 2015.

USEPA, 2014. Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard. USEPA. September 30, 2014.

USEPA, 2011. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO_2 NAAQS. USEPA. March 1, 2011.

USEPA, 2017. Guideline on Air Quality Models (Revised). Appendix W to Title 40 U.S. Code of Federal Regulations (CFR) Parts 51 and 52, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. January 7, 2017.

USEPA, 1992. "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised". EPA Document 454/R-92-019, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

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USEPA, 1985. Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations-Revised). EPA-450/4-80-023R. U.S. Environmental Protection Agency.

VADEQ, 2015. "Virginia Modeling Guideline for Air Quality Permits". Office of Air Quality Assessments, Virginia Department of Environmental Quality. March 2015.

MVP Southgate Project

Docket No. PF18-4-000

Resource Report 9

Appendix 9-E

Noise Sensitive/Measurements and Predicted Sound Level Figures

Project:
Southgate Project

Description:
Lambert CS:
Noise Sensitive Areas and
Measurement Locations

Prepared By:
SLR International Corporation

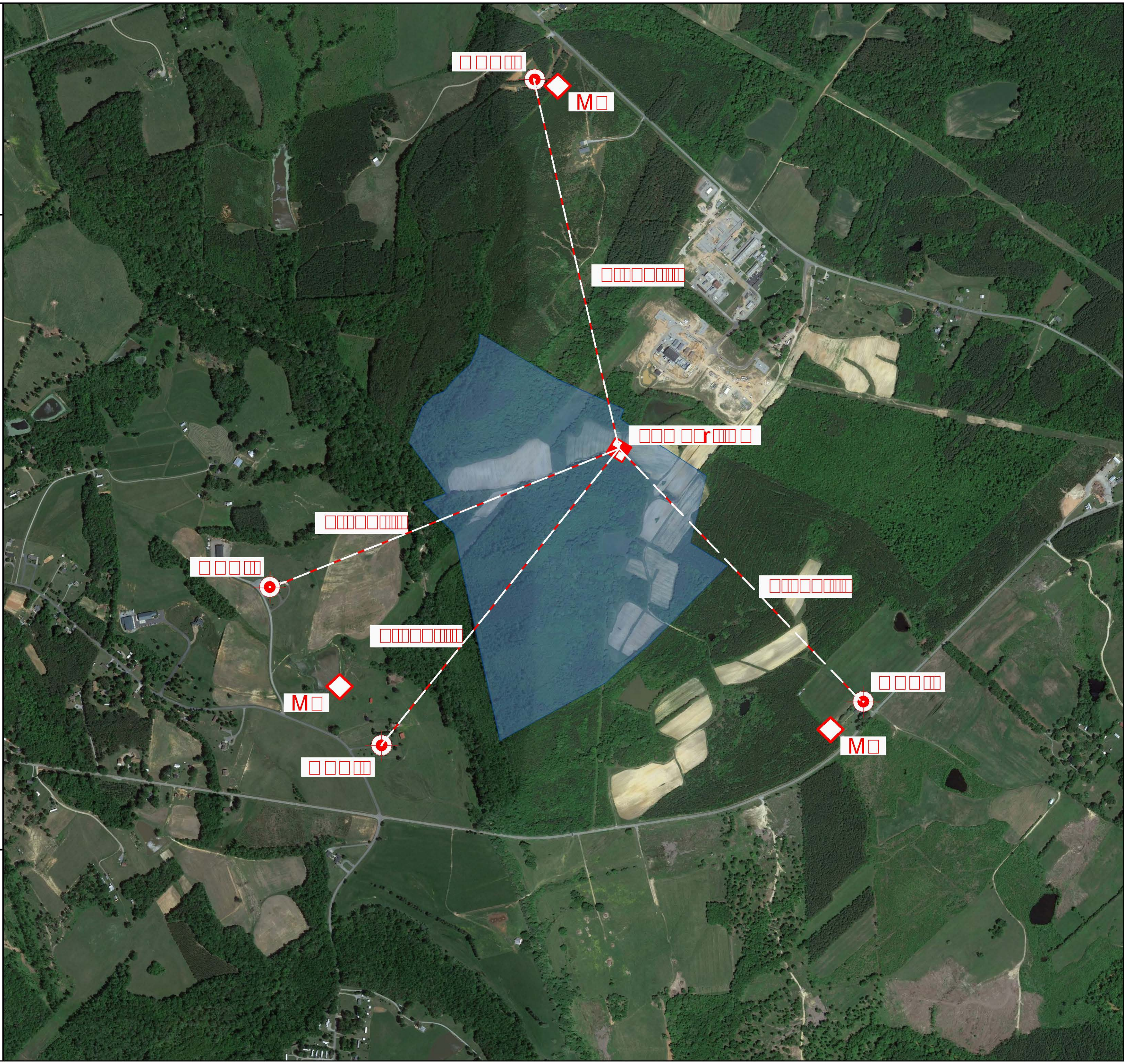
FIGURE 9.3-1 10.12.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- Compressor Station Building

Scale



SLR

6001 Savoy Drive, Suite 215
Houston, Texas 77036-3322
713-789-9400 Tel
713-789-5493 Fax

Project:
Southgate Project

Description:
LN 3600 Interconnect (IC): Noise Sensitive Areas and Measurement Locations

Prepared By:
SLR International Corporation

FIGURE 9.3-2 10.15.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- Interconnect Location

Scale

SLR

6001 Savoy Drive, Suite 215
Houston, Texas 77036-3322
713-789-9400 Tel
713-789-5493 Fax

Project:
Southgate Project

Description:
T-15 Dan River Interconnect (IC): Noise Sensitive Areas and Measurement Locations

Prepared By:
SLR International Corporation

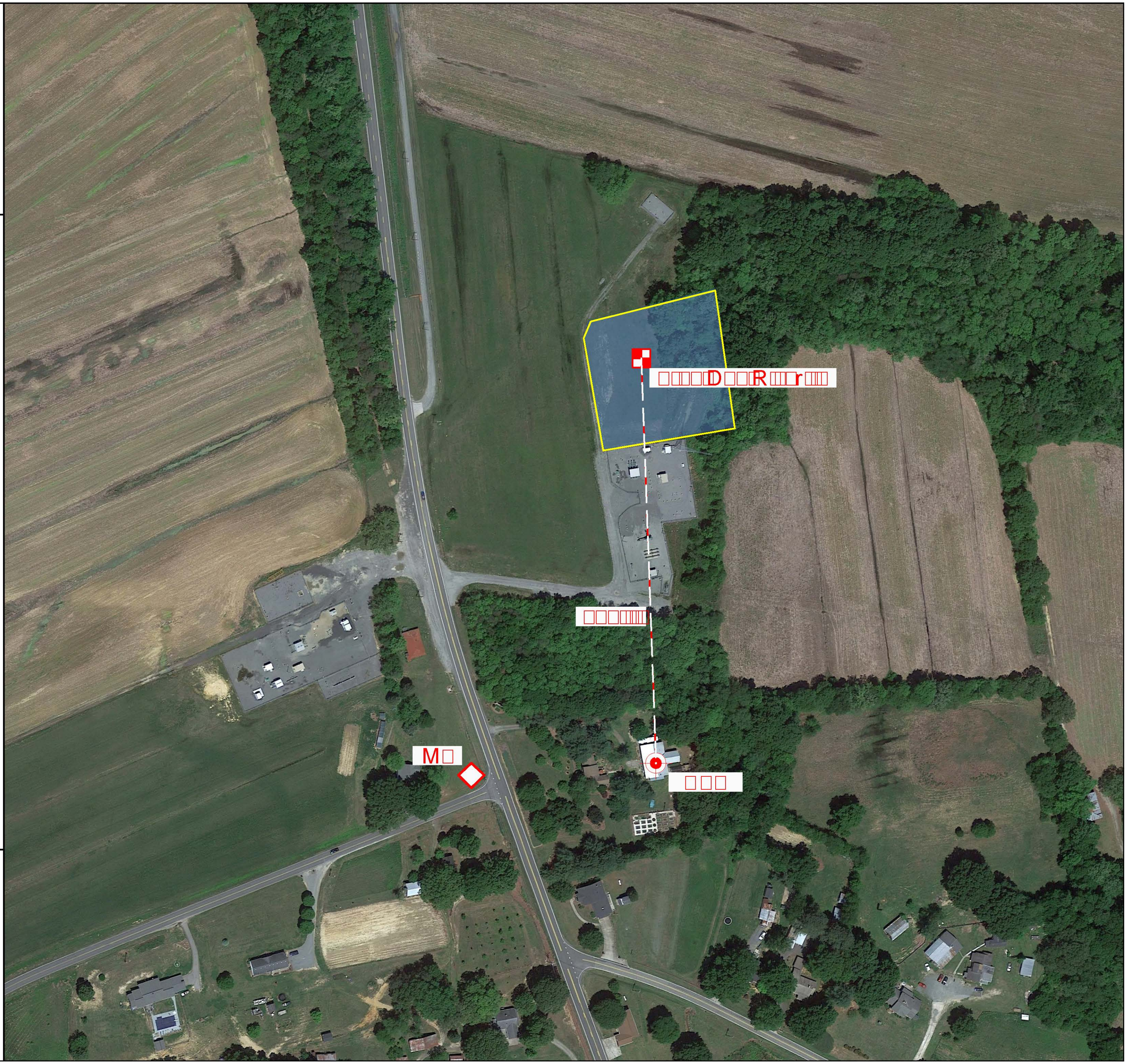
FIGURE 9.3-3 08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- Interconnect Location

Scale



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Project:
Southgate Project

Description:
T-21 Haw River Interconnect (IC): Noise Sensitive Areas and Measurement Locations

Prepared By:
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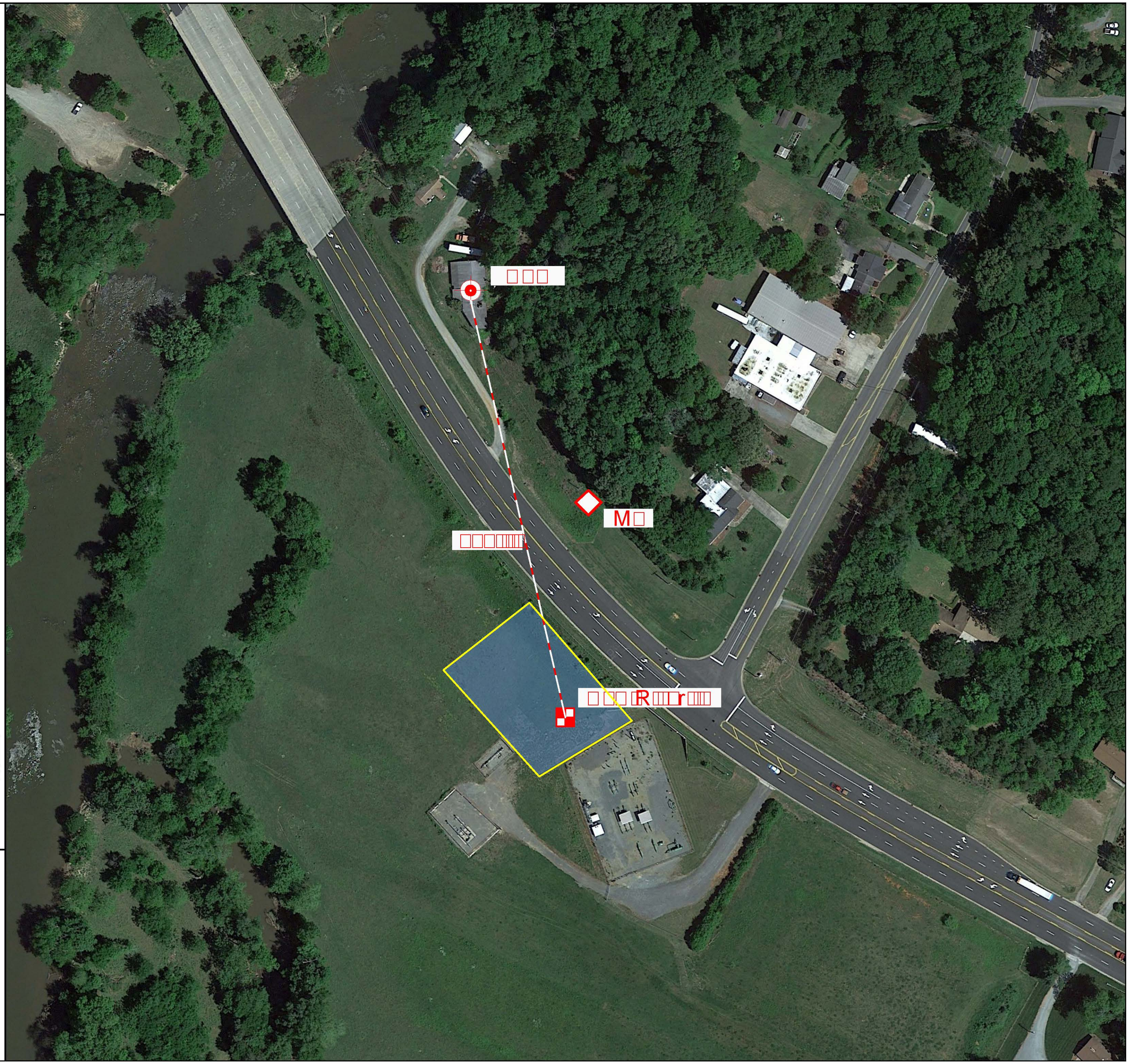
FIGURE 9.3-4 08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- HDD Location

Scale



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Project:
Southgate Project

Description:
Stony Creek Reservoir HDD: Noise Sensitive Areas and Measurement Locations

Prepared By:
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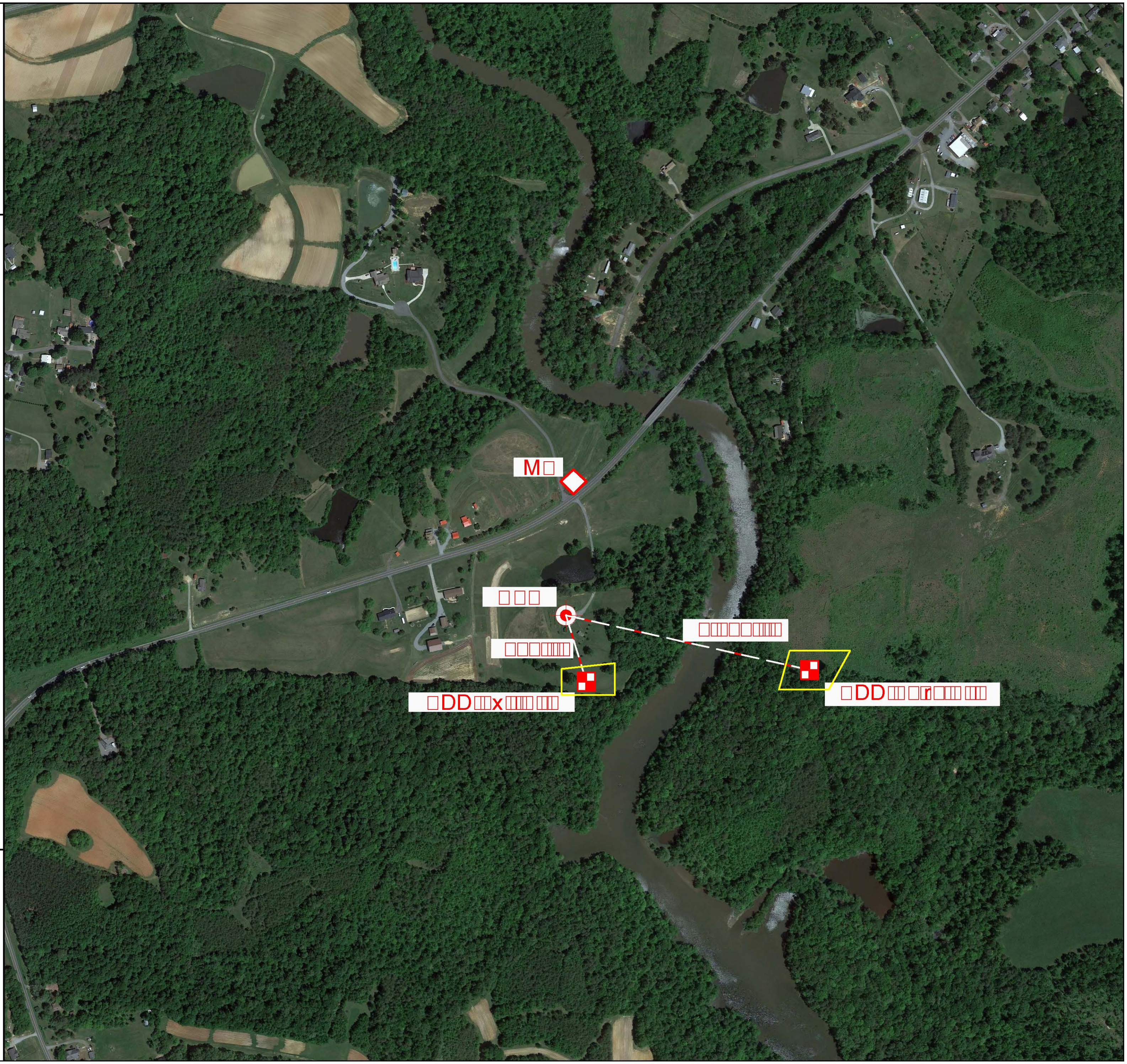
FIGURE 9.3-5 08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- HDD Location

Scale



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Project:
Southgate Project

Description:
Dan River HDD:
Noise Sensitive Areas and
Measurement Locations

Prepared By:
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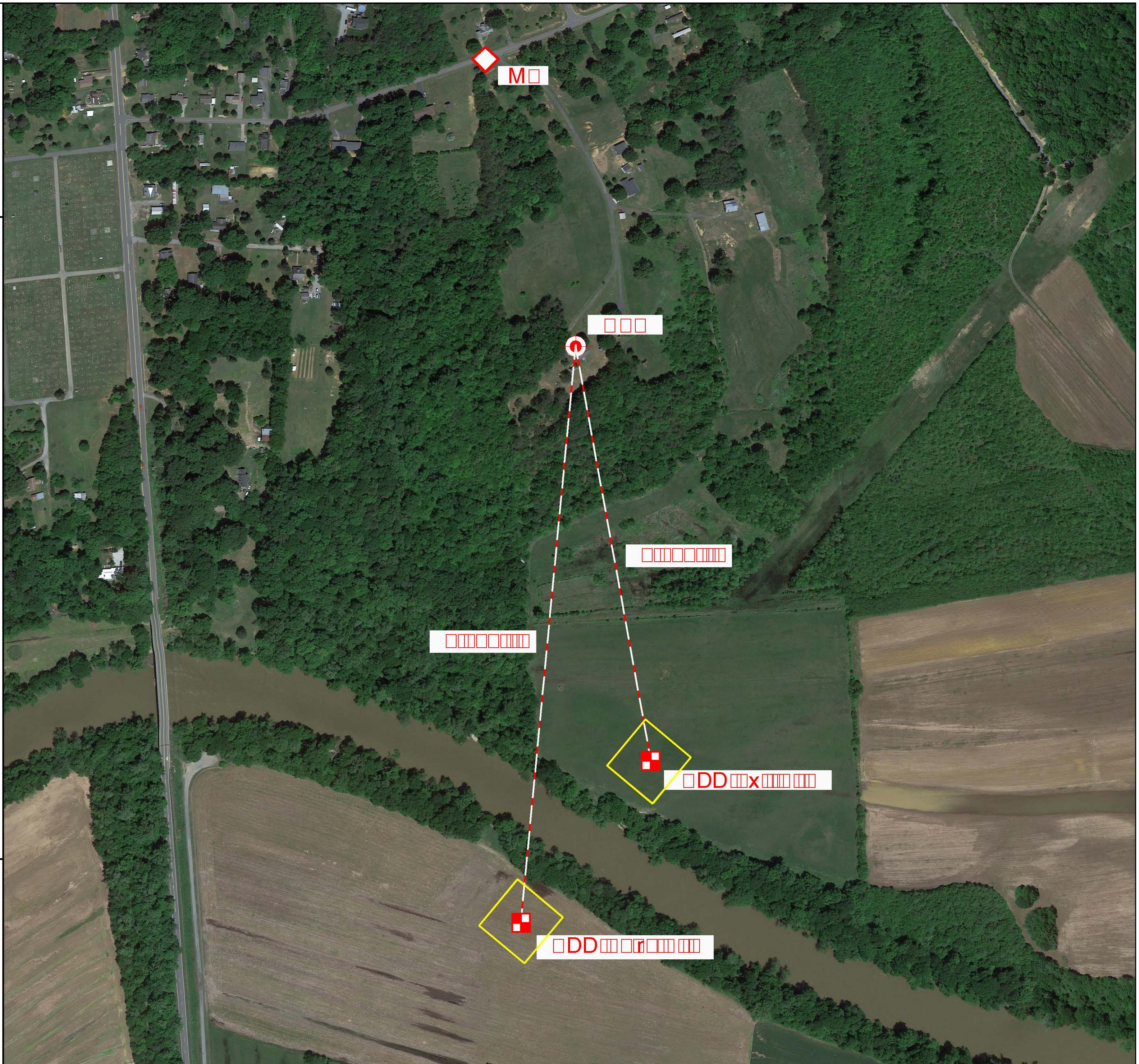
FIGURE 9.3-6   08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- HDD Location

Scale



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Project:
Southgate Project

Description:
Railroad Crossing #1:
Noise Sensitive Areas and
Measurement Locations

Prepared By:
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FIGURE 9.3-7 08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- RR Crossing

Scale

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Project:
Southgate Project

Description:
Railroad Crossing #2:
Noise Sensitive Areas and
Measurement Locations

Prepared By:
SLR International Corporation

FIGURE 9.3-8 08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- RR Crossing

Scale

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Project:
Southgate Project

Description:
Railroad Crossing #3:
Noise Sensitive Areas and
Measurement Locations

Prepared By:
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FIGURE 9.3-9 08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- RR Crossing

Scale

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Project:
Southgate Project

Description:
Railroad Crossing #4:
Noise Sensitive Areas and
Measurement Locations

Prepared By:
SLR International Corporation

FIGURE 9.3-10 08.03.2018

N

Legend

- Noise Sensitive Area (NSA)
- Measurement Location (ML)
- RR Crossing

Scale

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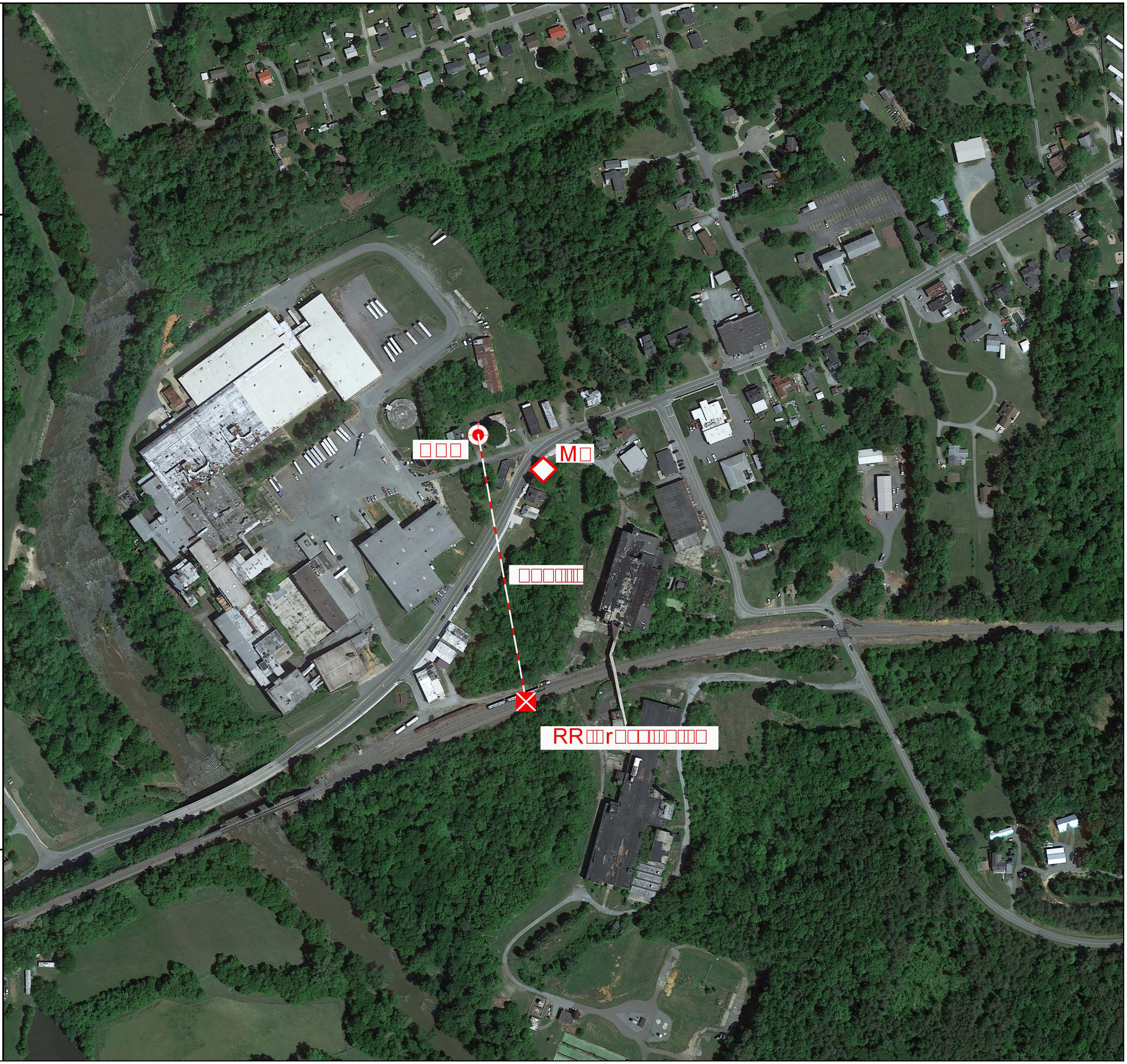
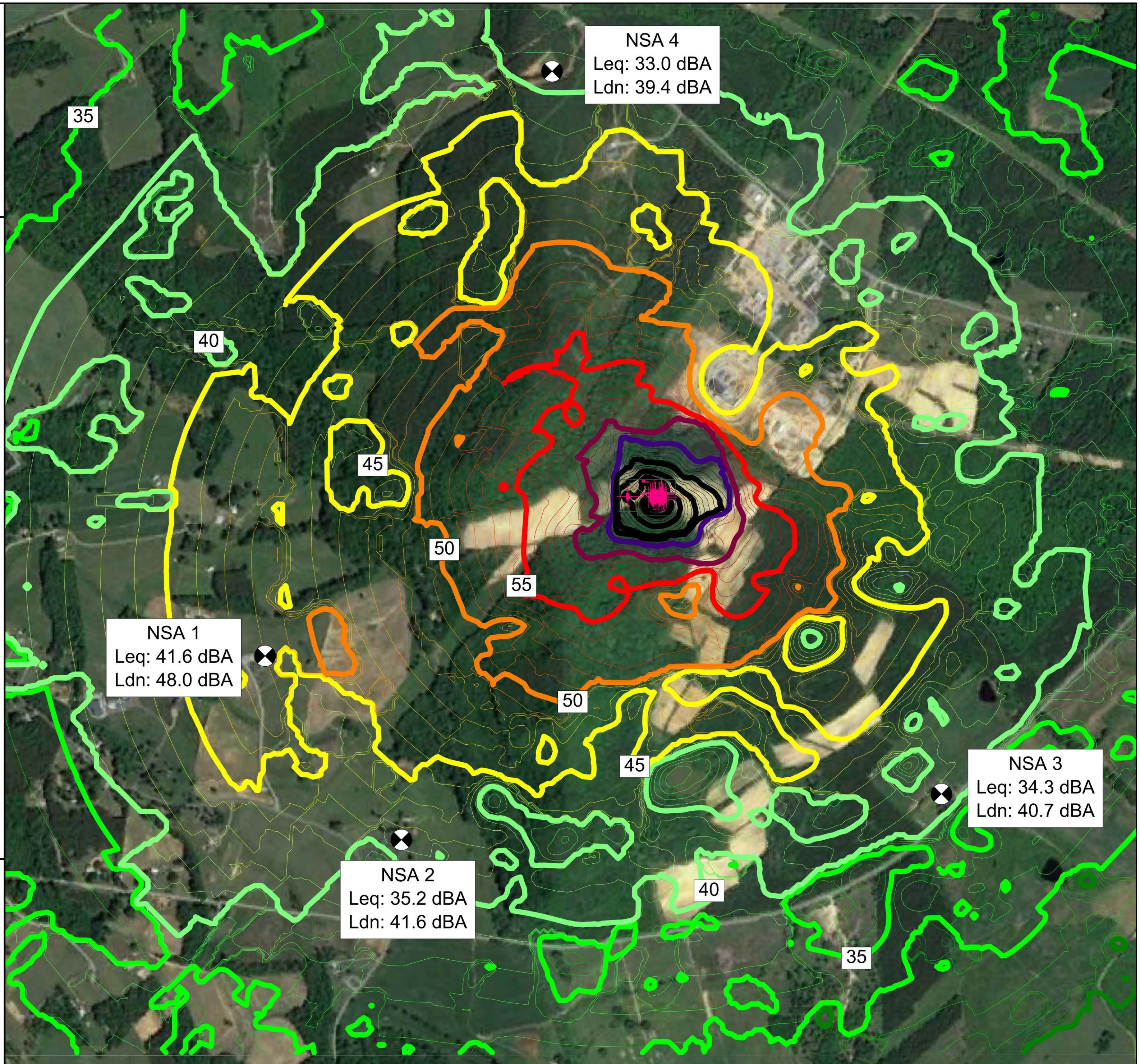


Project:
Southgate Project

Description:
Lambert Compressor Station (CS):
Noise Contour, dBA Ldn

Prepared By:
SLR International Corporation

FIGURE 9.3-11 10.15.2018



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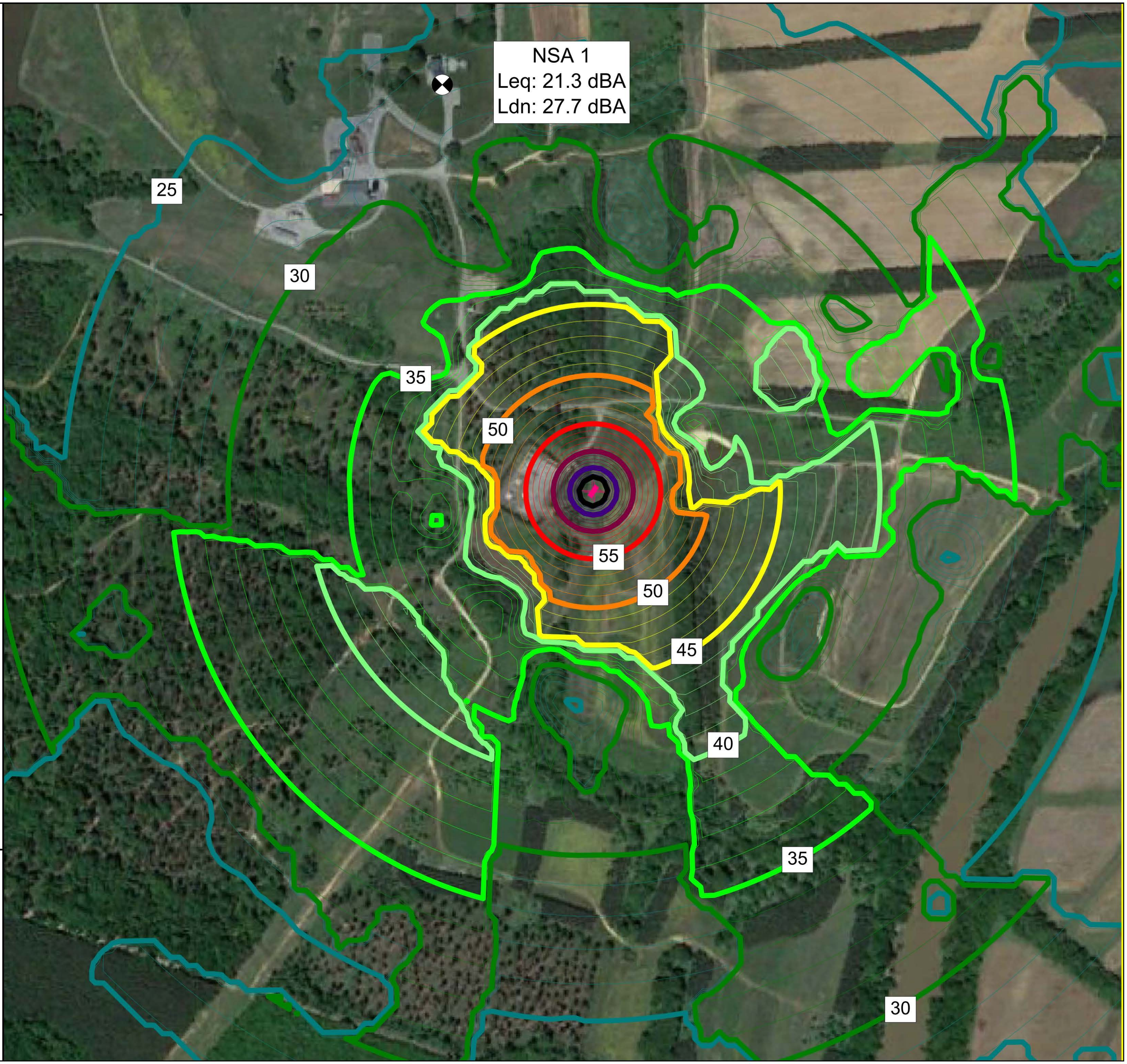
Project:
Southgate Project

Description:
LN 3600 (IC):
Noise Contour, dBA Ldn

Prepared By:
SLR International Corporation

FIGURE 9.3-12 10.15.2018



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Project:
Southgate Project

Description:
T-15 Dan River Interconnect (IC): Noise Contour, dBA Ldn

Prepared By:
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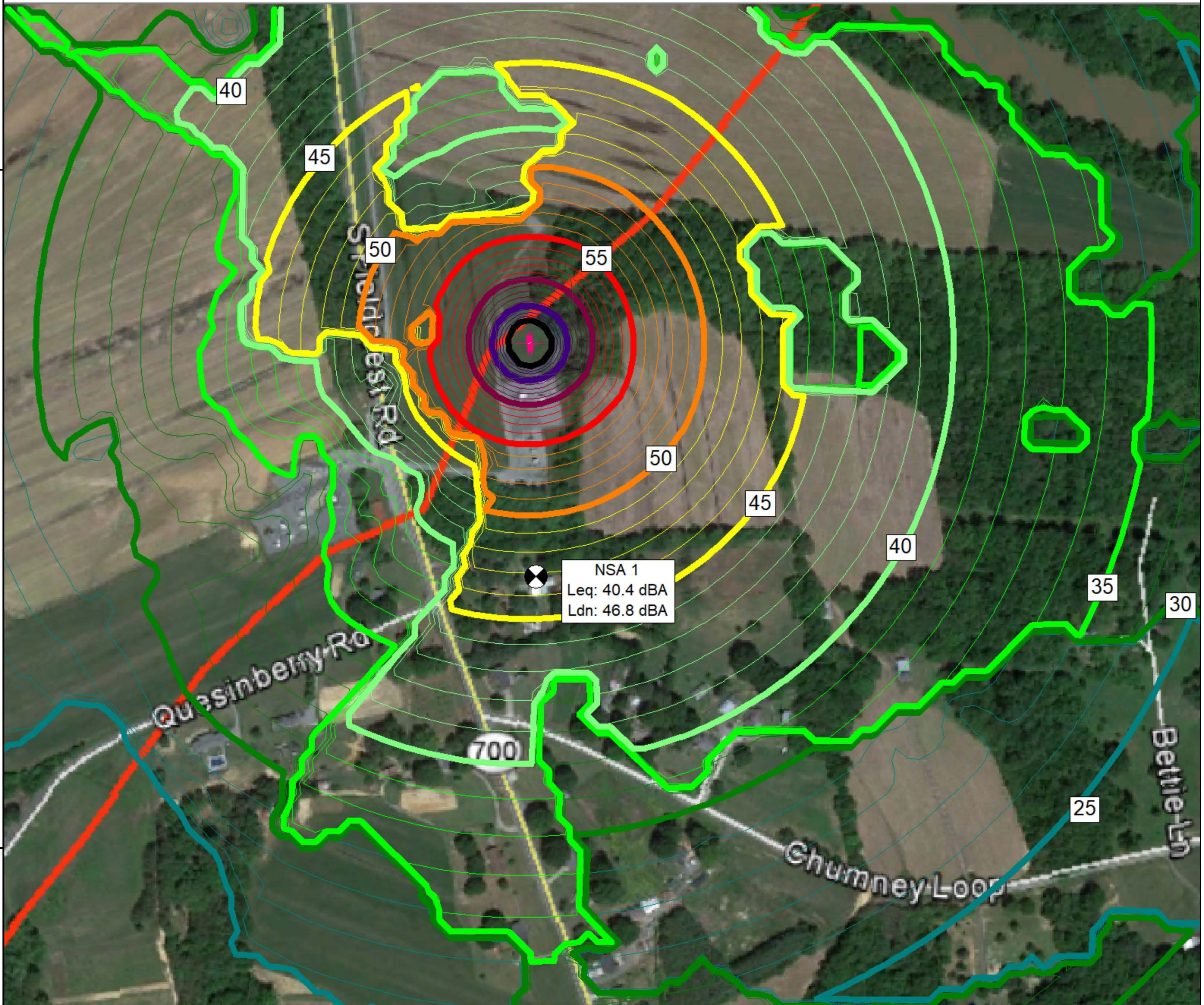
FIGURE 9.3-13 08.03.2018



N

Legend

Noise Sensitive Area (NSA)

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Project:
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Description:
T-21 Haw River Interconnect (IC): Noise Contour, dBA Ldn

Prepared By:
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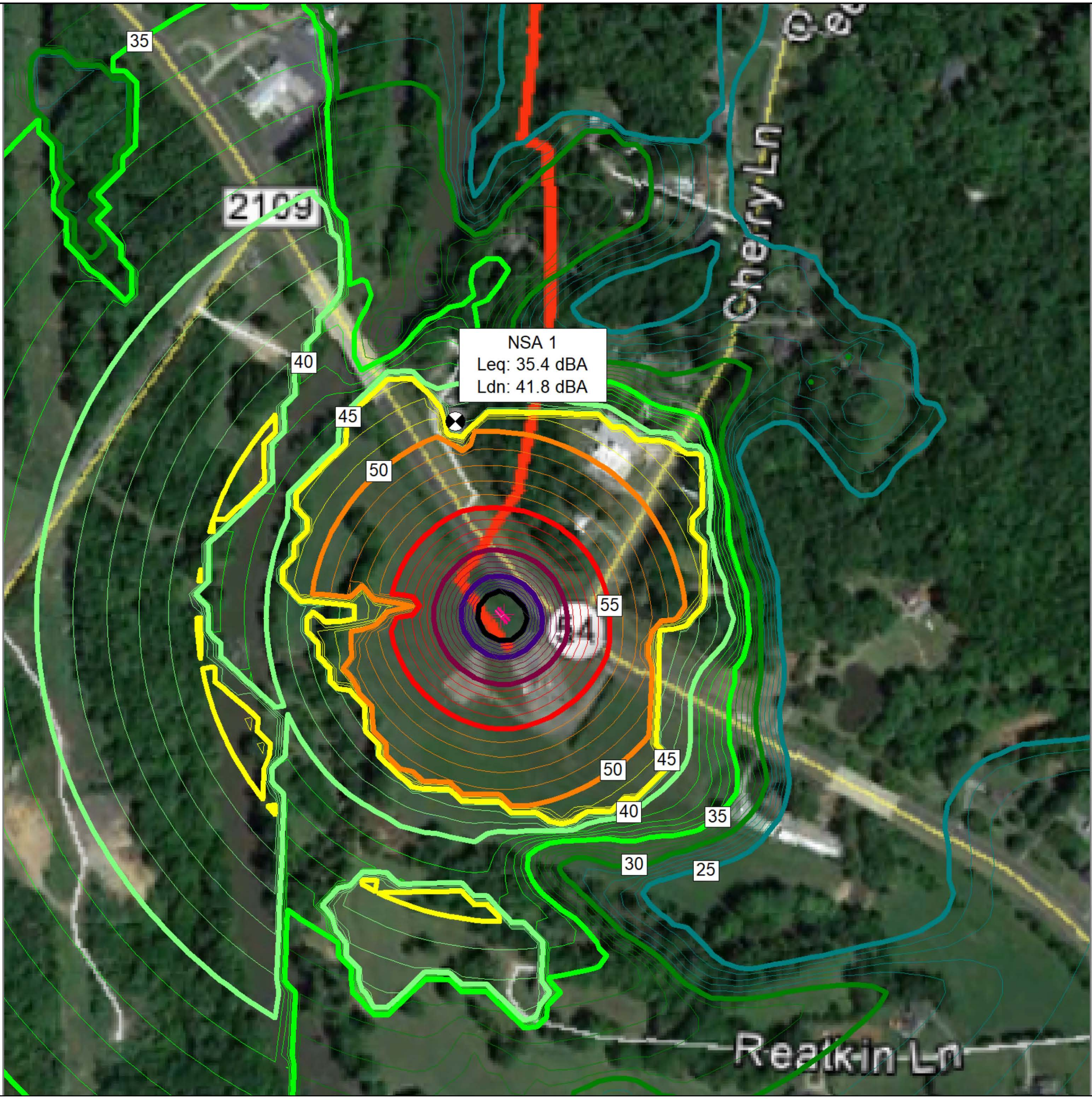
FIGURE 9.3-14 08.03.2018



Legend

Noise Sensitive Area (NSA)

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