Resource Report 9
Air and Noise Quality

FERC Docket No. CP22-___-000

Equitrans, L.P.
Ohio Valley Connector Expansion
Wetzel County, West Virginia
Greene County, Pennsylvania
and Monroe County, Ohio

January 2022

EQUITRANS℠

Public Information

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AQCR	Air Quality Control Region
BACT	best available control technologies
BAT	best available technology
CAA	Clean Air Act
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon dioxide equivalent
dB	decibels
dBA	A-weighted decibels
dscfm	dry standard cubic feet per minute
Equitrans	Equitrans, L.P.
FERC or Commission	Federal Energy Regulatory Commission
GHG	Greenhouse Gas
GP-5	General Permit 5
gr/dscf	grains per dry standard cubic foot
HAPs	Hazardous Air Pollutants
HCHO	formaldehyde
HP	horsepower
Hz	Hertz
kW	kilowatt
lb/MMBtu	pounds per million British thermal units
LDAR	Leak Detection and Repair
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
L_{max}	maximum sound level
L_n	nighttime sound level
L_p	sound pressure level
L_W	sound power level
MACT	Maximum Achievable Control Technology
MMBtu/hr	million British thermal units per hour
MOVES3	Motor Vehicle Emission Simulator
mph	miles per hour
MRR	Mandatory Reporting Rule
N_2O	Nitrous Oxide
N/A	not applicable

Acronyms and Abbreviations (continued)

NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NNSR	Non-Attainment New Source Review
NO_2	nitrogen dioxide
NSAs	noise sensitive areas
NSPS	New Source Performance Standards
NSR	New Source Review
NOx	Oxides of Nitrogen
OAC	Ohio Administrative Code
OTR	ozone transport region
PA	Pennsylvania
PM	Particulate Matter
PM_{10}	particulate matter with an aerodynamic diameter of ≤ 10 microns
$PM_{2.5}$	particulate matter with an aerodynamic diameter of ≤ 2.5 microns
ppb	Parts per billion
ppm	Parts per million
Ppmvd	parts per million by volume
Project	Ohio Valley Connector Expansion Project
PSD	Prevention of Significant Deterioration
psia	pounds per square inch atmosphere
PTE	potential to emit
RACT	Reasonably Available Control Technology
SAAQS	State Ambient Air Quality Standards
SCFH	Standard Cubic Feet per Hour
SIP	State Implementation Plan
SLR	SLR International Corporation
SO_2	Sulfur Dioxide
tpy	tons per year
$\mu g/m^3$	micrograms per cubic meter
US	United States
USEPA	United States Environmental Protection Agency
VA	Virginia
VOC	Volatile Organic Compound
WV	West Virginia
WVDEP	West Virginia Department of Environmental Protection

9.0 Air and Noise Quality

A detailed description and overview map of Equitrans, L.P.'s (Equitrans') Ohio Valley Connector Expansion Project (Project) are provided in Resource Report 1, General Project Description.

Resource Report 9 describes the existing air quality and noise conditions associated with the Project, evaluates the preliminary air and noise impacts from construction and operation of the proposed Project, and identifies proposed mitigation measures to avoid or minimize potential impacts. Section 9.1 characterizes the air quality and air quality impacts. Section 9.2 provides information on noise and noise impacts.

9.1 Air Quality

9.1.1. Existing Air Quality

Descriptions of the climatological and existing air quality conditions in the vicinity of the Project are provided in Sections 9.1.1.1 and 9.1.1.3.

9.1.1.1 Local Climate and Meteorology

The Cygrymus Compressor Station, Corona Compressor Station and Plasma Compressor Station and associated pipeline work in Monroe County, Ohio (OH), Greene County, Pennsylvania (PA) and Wetzel County, West Virginia (WV) are in a temperate continental climate. This climate is characterized by warm summers and cold winters with lacking extremes in temperature and precipitation (www.climate.gov, 2021). Table 9.1-1 summarizes a selection of climate parameters for Project Sites using climate data for the 1991 to 2020 period.

Table 9.1-1

Selected Climate Parameters for Project Sites

Project Site	Site Location (County, State)	Weather Monitoring Station Location and ID	Approx. Site Distance and Direction from Station (km / direction)	Average Daily Minimum Temperature January (°F)	Average Daily Maximum Temperature July (°F)	Average Annual Precipitation (inches)
Corona Compressor Station	Wetzel County, WV	Mannington, WV 00465626	3 km East	18.7	84.1	51.4
Pipeline Work						
Cygrymus Compressor Station	Greene County, PA	Burton, WV 00461290	10 km South	18.6	84.3	50.6
Pipeline Work						
Plasma Compressor Station	Monroe County, OH	Moundsville, WV 00466248	13 km Northeast	19.7	85.8	46.1

Source: National Centers for Environmental Information (2021)

9.1.1.2 National Ambient Air Quality Standards

The Clean Air Act (CAA) requires the United States (US) Environmental Protection Agency (USEPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The CAA identifies two national ambient air quality standards: primary, which provide public health protection; and secondary, which provide public welfare protection Table 9.1-2 summarizes the NAAQS in effect.

Table 9.1-2

National Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS (micrograms per cubic meter)	
		Primary	Secondary
Lead	Rolling 3-month Average	0.15 µg/m^3	Same as Primary
Particulate matter with an aerodynamic diameter of ≤ 10 microns (PM_{10})	24-hour	150 µg/m^3	Same as Primary
Particulate matter with an aerodynamic diameter of ≤ 2.5 microns ($PM_{2.5}$)	Annual (arithmetic mean)	12 µg/m^3	15 µg/m^3
	24-hour	35 µg/m^3	Same as Primary
Nitrogen Dioxide (NO_2)	Annual (arithmetic mean)	53 parts per billion (ppb) (100 µg/m^3)	Same as Primary
	1-hour	100 ppb (188 µg/m^3)	None
Sulfur Dioxide (SO_2)	3-hour	None	0.5 parts per million (ppm) (1,300 µg/m^3)
	1-hour	75 ppb (196 µg/m^3)	None
Carbon Monoxide (CO)	8-hour	9 ppm (10,000 µg/m^3)	None
	1-hour	35 ppm (40,000 µg/m^3)	None
Ozone	8-hour	70 ppb (137 µg/m^3)	Same as Primary

Source: USEPA (2021a)

Pennsylvania has State Ambient Air Quality Standards (SAAQS) for beryllium, fluoride, and hydrogen sulfide as codified in Title 25, Chapter 131, Section 3 of the Pennsylvania Code (25 PA Code §131.03). The Cygrymus Compressor Station is not expected to be a source of these state-specified pollutants. West Virginia does not have SAAQS. Ohio maintains a list of SAAQS in Ohio Administrative Code (OAC) 3745-25-02. The Ohio SAAQS are consistent with the NAAQS except additional standards are defined including a 24-hour average and annual average SO_2 standard. These additional SAAQS match prior SO_2 NAAQS at 0.14 ppm (365 µg/m3) and 0.03 ppm (80 µg/m3), respectively.

9.1.1.3 Background Ambient Air Quality of Criteria Pollutants

Ambient air quality monitoring data is collected by state and federal agencies to determine ambient air quality for a region. These data are used by the regulatory agencies to compare a region's air quality to the NAAQS. Tables 9.1-3 through 9.1-5 present recent existing ambient air quality data from representative monitoring stations surrounding the Corona, Cygrymus, and Plasma Compressor Station sites. These monitoring stations were chosen as the nearest station to the Project Site or due to similarities in land use and topography between the monitoring stations and the Site. Data quality and quantity were also considered.

Table 9.1-3

Ambient Concentrations for Corona Compressor Station and Wetzel County Pipeline Work

Pollutant	Averaging Period	Rank[1]	Years	Concentration (µg/m³)	Monitoring Station ID	Distance to Compressor Station (km)
Lead	3-month	H1H	2018-2020	0.01	39-167-0008 Washington County, OH	89
PM_{10}	24-hour	H2H	2018-2020	54.0	39-013-0006 Belmont County, OH	48
$PM_{2.5}$	24-hour	H8H (3yr Avg)	2018-2020	16.1	54-049-0006 Marion County, WV	32
	Annual	H1H (3yr Avg)	2018-2020	7.4		
NO_2	1-hour	H8H (3yr Avg)	2018-2020	30.7	42-051-0524 Fayette County, PA	47
	Annual	1H	2018-2020	5.3		
SO_2	1-hour	H4H (3yr Avg)	2018-2020	23.6	54-051-1002 Marshall County, WV	43
	3-hour	H2H	2018-2020	30.4		
CO	1-hour	H2H	2018-2020	1,145.6	39-067-0005 Harrison County, OH	90
	8-hour	H2H	2018-2020	916.5		
Ozone	8-hour	H4H (3yr Avg)	2018-2020	119.8	42-059-0002 Greene County, PA	35

Source: USEPA (2021b)

Notes:

1 H1H = highest 1st high value; H2H = highest 2nd high value; H4H = 4th highest value; H8H = 8th highest value

Table 9.1-4

Ambient Concentrations for Cygrymus Compressor Station and Greene County Pipeline Work

Pollutant	Averaging Period	Rank[1]	Years	Concentration (µg/m³)	Monitoring Station ID	Distance to Compressor Station (km)
Lead	3-month	H1H	2018-2020	0.08	39-029-0019 Columbiana County, OH	100
PM_{10}	24-hour	H2H	2018-2020	54.0	39-013-0006 Belmont County, OH	39
$PM_{2.5}$	24-hour	H8H (3yr Avg)	2018-2020	13.3	42-059-0002 Greene County, PA	14
	Annual	1H (3yr Avg)	2018-2020	6.4		
NO_2	1-hour	H8H (3yr Avg)	2018-2020	30.7	42-051-0524 Fayette County, PA	53
	Annual	1H	2018-2020	5.3		

Table 9.1-4 (continued)

Pollutant	Averaging Period	Rank[1]	Years	Concentration (μg/m³)	Monitoring Station ID	Distance to Compressor Station (km)
SO_2	1-hour	H4H (3yr Avg)	2018-2020	23.6	54-051-1002 Marshall County, WV	35
	3-hour	H2H	2018-2020	30.4		
CO	1-hour	H2H	2018-2020	1,145.6	39-067-0005 Harrison County, OH	79
	8-hour	H2H	2018-2020	916.5		
Ozone	8-hour	H4H (3yr Avg)	2018-2020	119.8	42-059-0002 Greene County, PA	14

Source: USEPA (October, 2021b)

Notes:

1 H1H = highest 1st high value; H2H = highest 2nd high value; H4H = 4th highest value; H8H = 8th highest value

Table 9.1-5

Ambient Concentrations for Plasma Compressor Station

Pollutant	Averaging Period	Rank[1]	Years	Concentration (μg/m³)	Monitoring Station ID	Distance to Compressor Station (km)
Lead	3-month	H1H	2018-2020	0.01	39-167-0008 Washington County, OH	72
PM_{10}	24-hour	H2H	2018-2020	54.0	39-013-0006 Belmont County, OH	19
$PM_{2.5}$	24-hour	H8H (3yr Avg)	2018-2020	19.5	54-051-1002 Marshall County, WV	16
	Annual	1H (3yr Avg)	2018-2020	8.6		
NO_2	1-hour	H8H (3yr Avg)	2018-2020	55.8	39-013-0006 Belmont County, OH	19
	Annual	1H	2018-2020	14.5		
SO_2	1-hour	H4H (3yr Avg)	2018-2020	23.6	54-051-1002 Marshall County, WV	16
	3-hour	H2H	2018-2020	30.4		
CO	1-hour	H2H	2018-2020	1,145.6	39-067-0005 Harrison County, OH	56
	8-hour	H2H	2018-2020	916.5		
Ozone	8-hour	H4H (3yr Avg)	2018-2020	123.7	54-069-0010 Ohio County, WV	34

Source: USEPA (2021b)

Notes:

1 H1H = highest 1st high value; H2H = highest 2nd high value; H4H = 4th highest value; H8H = 8th highest value

9.1.1.4 Attainment Status Designations

Area that does not meet the NAAQS for the corresponding pollutant is known as a non-attainment area. If an area was designated nonattainment, but now attains the standard and has a USEPA-approved plan to maintain the standard, then the area is designated a maintenance area. Attainment status is defined in Title 40 of the Code of Federal Regulations (CFR) Part 81 Section 339 (40 CFR 81.339) for PA, Section 349 for WV and Section 336 for OH. The attainment statuses for the Project area are listed in Table 9.1-6. Pennsylvania is in the Ozone Transport Region, which is a group of states in the northeastern US required by the CAA to install a level of controls for the pollutants that form ozone, even if they meet the ozone standards. Therefore, the entire states in this region are classified as moderate nonattainment for ozone.

Table 9.1-6

Air Quality Control Regions and NAAQS Attainment Status for Project Counties

State	County	Air Quality Control Region[1]	Pollutant Standard	Attainment Status[2,3,4,5]
WV	Wetzel	N/A	All	None
PA	Greene (Partial)	Pittsburgh-Beaver Valley, PA	1997 $PM_{2.5}$ 2006 $PM_{2.5}$	Maintenance area Maintenance area
OH	Monroe	N/A	All	None

Source: USEPA (2021c)

Notes:

1 N/A = not applicable.

2 The entire Commonwealth of Pennsylvania is in the Northeast Ozone Transport Region; however, all Project counties (or the portion of counties) have been designated attainment or unclassified for all criteria pollutants.

3 The primary annual 1997 $PM_{2.5}$ standard was revoked on October 24, 2016 (Federal Register, Volume 81, No. 164, August 24, 2016).

4 The primary and secondary 1997 8-hour ozone standard was revoked on April 6, 2015 (Federal Register, Volume 80, No. 44, March 6, 2015). Greene County, PA was a maintenance area for this standard.

5 Part of Greene County (Monongahela Township) is a maintenance area for the 1997 and 2006 $PM_{2.5}$ NAAQS. The project is not in this township.

9.1.1.5 Class 1 Areas

Federal Class I areas are areas established by Congress that are afforded special protection under the CAA. Once designated as a Class I area, that area cannot be redesignated to another (less restrictive) classification. Class II areas are all other areas outside of those initially designated as Class I. Class I areas are allowed the smallest degree of air quality deterioration (compared to other areas with different class designations) through New Source Review (NSR) permitting, and special considerations must be made in the NSR permitting process when a Class I area is near a proposed project site. NSR regulations are discussed in Section 9.1.2.1. NSR applicability will be evaluated once the Project is finalized, and Class I modeling requirements would be reviewed if the Project requires Prevention of Significant Deterioration (PSD) review. However, preliminary potential emission estimates indicate all three compressor stations will remain minor sources and therefore not subject to NSR/PSD permitting or Class I modeling (see Section 9.1.2.1). The Class I areas nearest to the Project locations have been identified in Tables 9.1-7 through 9.1-9.

Table 9.1-7

Federal Class I Areas Closest to the Corona Compressor Station

Class I Area	Managing Agency	Direction from Station	Approximate Distance from Compressor Station (km)
Otter Creek, WV	US Forest Service	Southeast	91
Dolly Sods, WV	US Forest Service	Southeast	111
Shenandoah, Virginia (VA)	National Park Service	Southeast	201
James River Face, VA	US Forest Service	Southeast	232

Table 9.1-8

Federal Class I Areas Closest to the Plasma Compressor Station

Class I Area	Managing Agency	Direction from Station	Approximate Distance from Compressor Station (km)
Otter Creek, WV	US Forest Service	Southeast	135
Dolly Sods, WV	US Forest Service	Southeast	155
Shenandoah, VA	National Park Service	Southeast	244
James River Face, VA	US Forest Service	Southeast	268

Table 9.1-9

Federal Class I Areas Closest to the Cygrymus Compressor Station

Class I Area	Managing Agency	Direction from Station	Approximate Distance from Compressor Station (km)
Otter Creek, WV	US Forest Service	Southeast	99
Dolly Sods, WV	US Forest Service	Southeast	117
Shenandoah, VA	National Park Service	Southeast	205
James River Face, VA	US Forest Service	Southeast	249

9.1.2 Regulatory Requirements

This section lists air quality regulations that may be applicable to the Project based on the design.

In accordance with 42 U.S.C. § 7407, each federally-delegated state agency has the primary responsibility for managing air quality within the entire geographic area comprising such state. This is achieved through the federally-approved state implementation plans (SIP), which identify how the NAAQS will be achieved and maintained within each air quality control region (AQCR). Each action evaluated is required to comply with applicable federal and state air permitting regulations to conform to the federally-approved SIP standards, minimizing impacts to the existing air quality. These actions undergo strict air permitting requirements to minimize air quality impacts within the AQCR by identifying the best available control technologies (BACT), adopting all applicable New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and Maximum Achievable Control Technology (MACT) emission standards and operational requirements. At 10 miles, permitted emissions from facilities within each AQCR evaluated are anticipated to have dispersed significantly with ambient air, minimizing the potential for long-term cumulative impacts. In fact, model predicted concentrations associated with the Project's operational emissions drop below levels that USEPA would consider causing or contributing to an ambient air quality standard exceedance at approximately one-half mile.

9.1.2.1 Major New Source Review and Title V Operating Permits

The CAA Title V Operating Permit program applies to stationary sources with the potential to emit (PTE) over 100 tons per year (tpy), or a lower major source threshold defined by nonattainment status, of individual criteria air pollutant, 10 tpy of individual Hazardous Air Pollutant (HAP), or 25 tpy of combined HAPs. Since the Cygrymus Compressor Station is in Greene County, PA, which is in the ozone transport region, a major source threshold of 50 tons per year (tpy) is applicable for Volatile Organic Compounds (VOC).

The federal NSR program applies to major stationary sources. The NSR permitting regulations are comprised of two programs: 1) PSD for projects in areas where pollutant levels have met the NAAQS; and 2) Non-attainment NSR (NNSR) for projects in areas where pollutant levels have not attained the corresponding NAAQS. The NSR program (including both NNSR and PSD) regulates the installation of new major sources or major modifications to existing major sources and includes control technology reviews and ambient impact analyses. The Cygrymus Compressor Station is in a portion of Greene County which is classified as attainment with all NAAQS except for ozone. The state of PA is in the ozone transport region (OTR) and therefore the state is classified as moderate nonattainment for ozone. The Plasma and Corona Compressor Stations are in areas designated as attainment for all criteria pollutants.

The estimated potential emissions from each compressor station, after the implementation of the Project, are shown in Tables 9.1-10 through 9.1-12. Maximum potential emissions for each compressor station will not exceed the major source thresholds for Title V. Therefore, each compressor station will be a minor source with respect to the Title V Program after the construction of the Project. Additionally, each compressor station will be a minor source of all regulated pollutants under the NSR programs; therefore, NSR will not be triggered by this Project.

Table 9.1-10

Cygrymus Compressor Station Emissions Summary

Pollutant	Potential Site-Wide PTE (tpy)[1]	Major Source Threshold (tpy)	Program	Subject to Program?
PM_{10}	9.05	100 250	Title V PSD	No No
$PM_{2.5}$	9.05	100 250	Title V PSD	No No
SO_2	2.96	100 250	Title V PSD	No No
CO	18.62	100 250	Title V PSD	No No
Oxides of Nitrogen (NO_X)	35.46	100 100	Title V NNSR[2]	No No
VOC	9.30	50 50	Title V NNSR	No No
Carbon Dioxide (CO_2)	110,141	N/A[3]	PSD	No
Methane (CH_4)	401.00	N/A[3]	PSD	No
Nitrous Oxide (N_2O)	0.21	N/A[3]	PSD	No
Carbon Dioxide equivalent (CO_2e)	120,228	N/A[3]	PSD	No

Table 9.1-10 (continued)

Pollutant	Potential Site-Wide PTE (tpy)[1]	Major Source Threshold (tpy)	Program	Subject to Program?
Total HAPs	2.98	25	Title V	No
Formaldehyde (HCHO[4])	1.11	10	Title V	No

Notes:
1 PTE includes site-wide emissions from all sources, including storage tanks, fugitive leaks, and blowdowns.
2 NO_2 is a regulated PSD pollutant with a major source threshold of 250 tpy.
3 N/A = not applicable. Only applicable if another pollutant exceeds major source threshold for PSD.
4 HCHO is the greatest single HAP emitted at the facility.

Table 9.1-11

Corona Compressor Station Emissions Summary

Pollutant	Potential Site-Wide PTE (tpy)[1]	Major Source Threshold (tpy)	Program	Subject to Program?
PM_{10}	17.02	100 250	Title V PSD	No No
$PM_{2.5}$	17.02	100 250	Title V PSD	No No
SO_2	4.21	100 250	Title V PSD	No No
CO	17.00	100 250	Title V PSD	No No
NO_X	54.08	100 250	Title V PSD	No No
VOC	5.09	100 250	Title V PSD	No No
CO_2	145,857	N/A[2]	PSD	No
CH_4	444.62	N/A[2]	PSD	No
N_2O	0.27	N/A[2]	PSD	No
CO_2e	157,054	N/A[2]	PSD	No
Total HAPs	1.14	25	Title V	No
HCHO[3]	0.72	10	Title V	No

Notes:
1 PTE includes site-wide emissions from all sources, including storage tanks, fugitive leaks, and blowdowns.
2 N/A = not applicable. Only applicable if another pollutant exceeds major source threshold for PSD.
3 HCHO is the greatest HAP emitted at the facility.

Table 9.1-12

Plasma Compressor Station Emissions Summary

Pollutant	Potential Site-Wide PTE (tpy)[a]	Major Source Threshold (tpy)	Program	Subject to Program?
PM_{10}	23.00	100 250	Title V PSD	No No
$PM_{2.5}$	23.00	100 250	Title V PSD	No No

Table 9.1-12 (continued)

Pollutant	Potential Site-Wide PTE (tpy)[1]	Major Source Threshold (tpy)	Program	Subject to Program?
SO_2	5.66	100 250	Title V PSD	No No
CO	22.04	100 250	Title V PSD	No No
NO_X	72.50	100 250	Title V PSD	No No
VOC	11.76	100 250	Title V PSD	No No
CO_2	195,718	NA[2]	PSD	No
CH_4	567.33	NA[2]	PSD	No
N_2O	0.37	NA[2]	PSD	No
CO_2e	210,010	NA[2]	PSD	No
Total HAPs	1.52	25	Title V	No
HCHO[3]	0.97	10	Title V	No

Notes:
[1] PTE includes site-wide emissions from all sources, including storage tanks, fugitive leaks, and blowdowns.
[2] N/A = not applicable. Only applicable if another pollutant exceeds major source threshold for PSD.
[3] HCHO is the single HAP emitted at the facility.

9.1.2.2 New Source Performance Standards (NSPS)

Pennsylvania, WV, and OH have received delegation from USEPA to regulate facilities subject to NSPS. Regulatory requirements for facilities subject to NSPS are contained in the respective state implementation plans and 40 CFR Part 60. The potential applicability of NSPS standards to the proposed operations at the compressor stations are:

- 40 CFR Part 60 Subpart Dc – Steam Generating Units;
- 40 CFR Part 60 Subpart GG – Stationary Gas Turbines;
- 40 CFR Part 60 Subpart K/Ka/Kb – Storage Vessels for Petroleum Liquids/Volatile Organic Liquids;
- 40 CFR Part 60 Subpart KKKK – Stationary Combustion Turbines; and
- 40 CFR Part 60 Subpart OOOOa – Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced after September 18, 2015.

NSPS Subpart Dc

Subpart Dc, Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units, applies to 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 and 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 like that of Subpart GG and applies to stationary combustion turbines that commence construction after February 18, 2005. Turbines subject to Subpart KKKK are exempt from the requirements of Subpart GG. As such, this subpart does not apply to the proposed turbines at the compressor stations. The proposed microturbines are not subject to the requirements of Subpart GG based on a heat input less than or equal to 10 MMBtu/hr.

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 at the compressor 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 cubic meters (m_3) (approximately 19,813 gallons). All storage tanks at the compressor stations were constructed after this date, but do not have a capacity greater than 75 m^3. Therefore, Subpart Kb does not apply to the storage tanks at the compressor stations.

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 microturbines at the compressor stations will each have a heat input less than 10 MMBtu/hr. Therefore, they are not subject to this standard.

The proposed Solar Taurus 70 turbines for the Cygrymus Compressor Station, Solar Mars 100 turbine for the Corona Compressor Station, and Solar Titan 130 turbine for the Plasma Compressor Station will be subject to the NO_X emissions limitations in 40 CFR 60.4320(a). Turbines with a rated capacity of 50 < MMBtu/hr ≤ 850 MMBtu/hr at peak load are limited to NO_X emissions of 25 ppm at 15 percent O2 when firing natural gas. The proposed turbines are equipped with lean pre-mix combustion technology and guaranteed by the manufacturer to emit a maximum of nine ppm of NO_X at 15 percent O_2 under variable turbine load conditions when firing natural gas. This vendor guarantee is well below the NSPS KKKK standard.

Equitrans will perform annual performance tests in accordance with 40 CFR 60.4340(a) and 60.4400 to demonstrate compliance with the NO_X emission limitations, or, as an alternative, will monitor the appropriate parameters to determine whether the turbines are operating in low-NO_X mode in accordance with §60.4340(b)(2)(ii) and §60.4355(a). The Solar turbines must comply with the SO_2 emission limits in 40 CFR 60.4330. Equitrans 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 and will be in accordance with 40 CFR 60.4330(a)(2).

NSPS Subpart OOOOa – Crude Oil and Natural Gas Facilities

Subpart OOOOa, Standards of Performance for Crude Oil and Natural Gas Facilities, applies to affected facilities that commenced construction, reconstruction, or modification after September 18, 2015. The list of potentially affected facilities under this Subpart includes:

- Gas wellheads;
- Centrifugal compressors using wet seals and not located at a well site, or an adjacent well site and servicing more than one well site;

- Reciprocating compressors not located at a well site, or an adjacent well site and servicing more than one well site;
- Continuous bleed natural gas-driven pneumatic controllers with a bleed rate of greater than six Standard Cubic Feet per Hour (scfh) (excluding those at natural gas processing plants);
- Continuous bleed natural gas-driven pneumatic controllers at natural gas processing plants;
- Storage vessels with potential VOC emissions equal to or greater than six tpy;
- Sweetening units located onshore that process natural gas produced from onshore or offshore wells;
- Pneumatic pumps; and
- The collection of fugitive emission components.

Equitrans will comply with the applicable portions of the rule and the construction/installation permits for the compressor stations will likely identify the subject equipment.

Controllers will be run on instrument air and the centrifugal compressors are equipped with dry seals. Potential VOC emissions from storage vessels are less than six tpy. Therefore, the affected facilities are expected to be limited to fugitive emissions components for the compressor stations. Compliance with the fugitive emission component requirements includes the implementation of a leak detection and repair program consistent with 40 CFR 60.5397a.

USEPA proposed new requirements for equipment constructed after November 15, 2021. As the proposed rules are not final, Equitrans cannot outline specific requirements at this time, but will comply with the final rules.

9.1.2.3 National Emission Standards for Hazardous Air Pollutants

Regulatory requirements for facilities subject to NESHAP standards, otherwise known as MACT Standards for source categories, are contained in 40 CFR Part 63. Part 61 NESHAP standards are defined for specific pollutants, while Part 63 NESHAPs are defined for source categories where allowable emission limits are established based on a MACT determination for a particular major source. A major source of HAP is defined as having potential emissions more than 25 tpy for total HAP and/or potential emissions more than 10 tpy for individual HAP. 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.

Historically, NESHAPs have only been applicable to major sources of HAP. However, recently the USEPA has been promulgating area source NESHAP standards to address area (or minor) source categories that represent 90 percent of the emissions of a specific list of urban air toxics under Section 112(c) of the Clean Air Act. Potential, post-Project, HAP emissions from the three compressor stations will be below the major source thresholds, and therefore, the facilities will be area sources of HAP. The potential applicability of specific MACT standards to the Project is discussed below.

NESHAP Subpart HH – Oil and Natural Gas Production Facilities

This standard applies to equipment at natural gas production facilities that are major or area sources of HAP emissions. The compressor stations are not part of the natural gas production facility definition (they are in the transmission and storage sector. The Project does not involve installation of dehydration units and therefore Subpart HH does not apply.

NESHAP Subpart HHH – Natural Gas Transmission and Storage Facilities

This standard applies to equipment at natural gas transmission and storage facilities that are major sources of HAP emissions downstream of the point of custody transfer (after processing and/or treatment in the production sector), but upstream of the distribution sector. The compressor stations are minor sources of HAP. Therefore, this subpart is not applicable.

NESHAP Subpart YYYY – Stationary Combustion Turbines

Stationary combustion turbines 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 three compressor stations are minor sources of HAP and therefore are not subject to the requirements of this subpart.

NESHAP Subpart DDDDD – Industrial, Commercial, and Institutional Boilers (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 three compressor stations are minor sources of HAP and therefore are not subject to the requirements of this subpart.

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 proposed, small natural-gas fired heaters are natural gas-fired and are therefore exempt from this subpart. Therefore, the requirements of this subpart will not apply.

9.1.2.4 Greenhouse Gas Reporting Rule

As set forth in 40 CFR §98.2(a)(2), facilities that contain a source category listed in Table A-4 of the regulation and emit 25,000 metric tons per year of 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 (GHG) Mandatory Reporting Rule (MRR). Table A-4 of 40 CFR 98 Subpart A includes Petroleum and Natural Gas Systems. Annual Greenhouse Gas emissions from the facilities included as part of the Project would be calculated and compared with the 25,000 metric tons per year of CO_2e to address the applicability of the rule and would report GHG emissions as required under 40 CFR 98 Subpart W (Petroleum and Natural Gas Systems).

9.1.2.5 PA Regulations

The PA Code contains regulations that fall under two categories: the regulations that are generally applicable (permitting requirements), and those that have specific applicability (sulfur compound emissions from combustion units). The generally applicable requirements are straightforward (filing of emission statements) and, as such, are not discussed in further detail. The specific requirements associated with the Cygrymus Compressor Station are discussed in the following section.

25 PA Code §§123.1 and 123.2 – Prohibition of Certain Fugitive Emissions and Fugitive Particulate Matter

25 PA Code §§123.1 and 123.2 state exceptions to fugitive emissions sources and methods for controlling fugitive emissions. Due to the nature of the activities at the Cygrymus Compressor Station, it is unlikely that fugitive particulate matter emissions will be emitted under normal operating conditions. However, Equitrans will take measures to ensure fugitive particulate matter emissions will not cross the property boundary should emissions occur. Particulate emissions from the pipeline will result from its construction, but will be temporary in nature.

Equitrans will ensure compliance with this requirement and follow the fugitive dust control measures discussed herein.

25 PA Code §§123.11 and 123.13 – Particulate Emissions: Combustion Units

25 PA Code §123.11 Particulate Emissions: Combustion Units defines particulate matter emissions for combustion units. Combustion units are defined in §121.1 as stationary equipment used to burn fuel primarily for the purpose of producing power or heat by indirect heat transfer such as boilers. This definition does not apply to the proposed fuel gas heaters, Solar turbines, and microturbines at the Cygrymus Compressor Station. As such, the particulate matter emissions limitations for processes in 25 PA Code §123.13 Particulate Emissions: Processes apply to these units instead.

25 PA Code §123.13 defines particulate matter emissions limitations for processes. For processes excluded from Table 1 of §123.13(b), particulate emissions are limited to 0.04 grains per dry standard cubic foot (gr/dscf) and 0.02 gr/dscf for exhaust flowrates less than 150,000 dry standard cubic feet per minute (dscfm) and greater than 300,000 dscfm, respectively. Particulates from equipment with exhaust flowrates between 150,000 dscfm and 300,000 dscfm are limited to the allowable emission rate calculated using the formula in §123.13(c)(1)(ii). As all proposed combustion sources at the facility will be fueled exclusively with pipeline quality natural gas, potential particulate emissions from all sources are expected to comply with these requirements.

25 PA Code §123.21 – Sulfur Compound Emissions: General

25 PA Code §123.21 Sulfur Compound Emissions: General states that the concentration of sulfur oxides in the effluent gas may not exceed 500 parts per million by volume (ppmvd). The proposed combustion equipment at the Cygrymus Compressor Station will combust pipeline quality natural gas exclusively, and the sulfur oxide emissions are expected to be below this concentration level in the combustion exhaust.

25 PA Code §123.31 – Odor Emissions

25 PA Code §123.31 Odor Emissions prohibits the emission of malodorous air contaminants from sources that are detectable outside the facility fence line. This regulation applies to the facility in general. Equitrans will take measures to minimize odor from the Cygrymus Compressor Station operations by using pressure/vacuum reliefs on the produced fluid storage tank to minimize atmospheric venting under normal operations and conducting a Leak Detection and Repair (LDAR) program.

25 PA Code §123.41 and §123.43 – Visible Emissions: Limitations

25 PA Code §123.41 **–** Visible Emissions: Limitations state that a facility may not emit visible emissions equal to or greater than 20 percent for a period or periods aggregating more than three minutes in one hour, or equal to or greater than 60 percent at any time. This standard applies to the proposed combustion units at the Cygrymus Compressor Station. The use of pipeline quality natural gas as fuel will ensure compliance with this requirement.

25 PA Code §127.11 – Plan Approval Requirements

25 PA Code §127.11 outlines requirements for Plan Approvals required to authorize construction or modification of air contamination sources. Construction, installation, modification, or reactivation of air contaminant sources or air pollution control devices is prohibited unless otherwise approved by the Department. The construction of new equipment at the proposed Cygrymus Compressor Station is subject to pre-construction permitting requirements under this requirement. A General Permit 5 (GP-5) application will be submitted to the agency to authorize construction and operation of the site. The GP-5 permit contains emission limits and work practices consistent with best available technology, which meet and/or exceed state and federal regulations.

25 PA Code §129.57 – Storage Tanks ≤ 40,000 Gallons Containing VOCs.

25 PA Code §129.57 contains requirements for storage vessels less than 40,000 gallons in capacity that contain VOCs. Under this section, above-ground storage tanks with a capacity greater than or equal to 2,000 gallons which contain VOCs with a vapor pressure greater than 1.5 pounds per square inch atmosphere (psia) must be equipped with pressure relief valves which are maintained in good operating condition and which are set to release at no less than 0.7 pounds per square inch gage (psig) of pressure or 0.3 psig of vacuum (or the highest possible pressure and vacuum in accordance with state or local fire codes or the National Fire Prevention Association guidelines). The proposed produced fluid storage tanks for the Cygrymus Compressor Station are greater than 2,000 gallons in capacity but will not contain VOCs with a vapor pressure greater than 1.5 psia. As such, these tanks are not subject to the requirements. The pressure settings of the produced fluids tank meet the pressure and vacuum settings of this rule.

25 PA Code §129.91 and §129.96 – Control of Major Sources of NOx and VOCs

25 PA Code §129.91 and §129.96 establish control standards for major stationary sources of NO_X and VOC under the Reasonably Available Control Technology (RACT) program. Major stationary sources of NO_X and VOC are defined in 25 PA Code §121.1. The Cygrymus Compressor Station is in the OTR, and therefore the applicable major source thresholds are 100 tons per year of NO_X and 50 tons per year of VOC.

This regulation will not apply because the Cygrymus Compressor Station will not have estimated potential emissions of NO_X more than 100 tpy or VOC more than 50 tpy.

25 PA Code §131 – Ambient Air Quality Standards

25 PA Code §131 references NAAQS for criteria pollutants and establishes SAAQS for settled particulate, beryllium, fluorides, and hydrogen sulfide. As discussed in Section 9.1.2.1., the Project will not trigger NSR, and the associated emissions of criteria pollutants would not be anticipated to exceed the corresponding NAAQS. The Project will not emit quantifiable amounts of beryllium, fluorides, or hydrogen sulfide, and as such the corresponding SAAQS would not apply.

25 PA Code §135 – Reporting of Sources

25 PA Code §135 includes requirements for submittal of emissions data to the Department for the purposes of evaluating the effectiveness of regulations, identifying available or potential emission offsets, and maintaining an accurate inventory of air contaminant emissions for air quality assessment and planning activities. As the proposed Cygrymus Compressor Station is considered part of an oil and natural gas system, emissions from the sources at the site will be subject to reporting and recordkeeping requirements under this section. As such, Equitrans will submit annual emissions inventory data by March 1 each year per the Department's requirements.

9.1.2.6 WV Regulations

Segments of the proposed Project (pipeline work and Corona Compressor Station modification) are potentially subject to regulations contained in the WV Code of State Rules (CSR), Chapter 45.The specific requirements associated with this Project are discussed in the following sections. Since the design is in preliminary phases, the requirements that generally apply to the Project are discussed in this section.

45 CSR 4 – To Prevent and Control the Discharge of Air Pollutants into the Air Which Causes or Contributes to an Objectionable Odor

According to 45 CSR 4-3:

> *No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public.*

The Project is subject to this requirement. However, emissions from the pipeline will result from its construction, will be temporary in nature, and production of objectionable odor from these operations is unlikely. Due to the nature of the process at the Corona Compressor Station, production of objectionable odor from the facility is unlikely.

45 CSR 13: Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation

According to 45 CSR 13-5:

> *No person shall cause, suffer, allow or permit the construction, modification, relocation and operation of any stationary source to be commenced without notifying the Secretary of such intent and obtaining a permit to construct, modify, relocate and operate the stationary source as required in this rule or any other applicable rule promulgated by the Secretary.*

The Corona Compressor Station is authorized via a Regulation 13 Permit to Construct (R13 Permit). Equitrans will apply for modification of that permit to seek proper approval from the WV Department of Environmental Protection (WVDEP).

45 CSR 17 – To Prevent and Control Particulate Matter Air Pollution from Materials Handling, Preparation, Storage and Other Sources of Fugitive Particulate Matter

According to 45 CSR 17-3.1:

> *No person shall cause, suffer, allow or permit fugitive particulate matter to be discharged beyond the boundary lines of the property lines of the property on which the discharge originates or at any public or residential location, which causes or contributes to statutory air pollution.*

Particulate emissions from the pipeline will result from its construction, but will be temporary in nature. Due to the nature of the activities at the Corona Compressor Station, it is unlikely that fugitive particulate matter emissions will be emitted under normal operating conditions. Equitrans will take all measures necessary to ensure compliance with this requirement.

9.1.2.7 OH Regulations

The Plasma Compressor Station is potentially subject to regulations contained in the OH Administrative Code (OAC), Chapter 3745 (OAC 3745). The specific requirements associated with the Project are discussed in the following section. With respect to air permitting requirements, Equitrans will submit a Permit-to-Install and Operate (PTIO) for the new equipment in accordance with OAC 3745-31. The permitting requirement includes an evaluation of best available technology and emissions of toxic air contaminants.

OAC 3745-17-07 – Control of Visible Particulate Emissions from Stationary Sources

OAC 3745-17-07(A) limits visible particulate emissions from all stacks to less than 20 percent opacity, as a six-minute average, except during periods of startup, shutdown, and malfunction. However, visible emissions may exceed 20 percent opacity, as a six-minute average, but not for more than six consecutive minutes in a one-hour period. Visible emissions may not exceed

60 percent opacity, as a six-minute average, at any time. The exhaust stack associated with the compressor turbine will be subject to this visible emissions standard.

OAC 3745-17-08 – Restriction of Emission of Fugitive Dust

Per OAC 3745-17-08(A)(1), the requirements of OAC 3745-17-08 apply to fugitive dust sources within "Appendix A" areas. Monroe County is an Appendix A area and fugitive dust will result from construction-related activities. Therefore, construction activities for the pipeline will comply with the applicable portions of this requirement. There are no other proposed fugitive dust sources as part of the Project at the Plasma Compressor Station.

OAC 3745-17-10 – Restrictions on Particulate Emissions from Fuel Burning Equipment

OAC 3745-17-10 applies to facilities in which fuel, including products or by-products of a manufacturing process, is burned for the primary purpose of producing heat or power by indirect heat transfer. The combustion sources that are part of the proposed Project include the following:

- One new gas-fired compressor turbines; and
- One new gas-fired heater.

The gas-fired turbine will not be subject to the requirements of this rule given that these sources do not produce heat or power by indirect heat transfer. Furthermore, the gas-fired heater is exempt from the requirements of this rule given that it is de minimis emission sources, in accordance with OAC 3745-15-05(B).

OAC 3745-17-11 – Restrictions of Particulate Emissions from Industrial Processes

The emission limits of OAC 3745-17-11 apply to any operation, process, or activity that releases or may release particulate emissions into the ambient air. As described in OAC 3745-17-11(B)(4), particulate emissions from stationary gas turbines are limited to 0.040 pounds per million British thermal units (lb/MMBtu) of heat input. The gas-fired turbine to be installed at the Plasma Compressor Station will be subject to this emissions standard.

OAC 3745-110 – Nitrogen Oxides: Reasonably Available Control Technology

The provisions of OAC 3745 110 contain NO_X emissions limitations for various types of stationary combustion turbines. However, the emissions limits established for the compressor turbines are less stringent than those contained within 40 CFR 60 Subpart KKKK. As such, the NSPS limitation will take precedent for the proposed turbine like the permit language for the existing turbines.

Furthermore, the proposed heater has a maximum heat input capacity of 1.15 MMBtu/hr. Any boiler with a maximum heat input capacity of less than 20 MMBtu/hr is considered exempt from the requirements of OAC 3745-110 per OAC 3745-110-03(K)(1).

9.1.2.8 General Conformity

General conformity regulations implement the Section 176(c) of the Clean Air Act which prohibits federal agencies from taking actions that may cause or contribute to violations of the NAAQS in an area working to attain or maintain the standards. To meet this Clean Air Act requirement, a federal agency must demonstrate that every action undertaken, approved, permitted or supported will conform to the appropriate state, tribal, or federal implementation plan.

Because the Federal Energy Regulatory Commission (FERC or Commission) is a federal agency and is the authority from which Equitrans must obtain a certificate authorizing the construction and operation of the pipeline and compressor station, as well as the demolition of the compressor station, it is necessary to undertake a conformity evaluation for the various aspects of the project.

The first step of the conformity evaluation is an analysis of applicability of the general conformity rule to the Project. The applicability analysis starts with the determination of whether each of the areas in the Project will be conducted in is designated as nonattainment or maintenance for one or more pollutants for which a NAAQS exists. Monroe County, Ohio and Wetzel County, WV are classified as attainment/unclassifiable for all NAAQS. Hence the general conformity rule does not apply to work on components of the Project that will be in these states. However, review of the attainment status of Greene County in PA indicates the county is classified as nonattainment and/or maintenance for one or more pollutants. Therefore, the applicability of the general conformity rule must be analyzed for Project emissions occurring in that county. The attainment status of Greene County, PA with NAAQS is listed in Table 9.1-6 for pollutants for which the county is classified as other than attainment/unclassifiable.

The assessment of conformity must include emissions of air pollutants associated with the Project that will be released during construction, demolition, and operation. Emissions that will occur during operation of the compressor station and pipeline will be subject to the air permitting programs and air quality rules and standards administered by the State of PA. Equitrans will apply for and obtain a valid air quality construction permit (GP-5) for the Cygrymus Compressor Station and operate the station pursuant to the air permit issued by PA. Because the air quality programs under which the Cygrymus Compressor Station will be constructed and operated will have been administered in accordance with PA's approved SIP, the emissions from operation of the station may be presumed to conform to PA's SIP and are therefore exempted from the general conformity rule.

Emissions from construction of the pipeline and construction at the modified Cygrymus Compressor Station are not subject to state air quality permitting and must be assessed against the applicability criteria in the general conformity rule to determine requirements of the rule may be applicable. An exception to the applicability of the general conformity rule is for actions that result in emissions below "de minimis" thresholds prescribed in the rule. The de minimis thresholds for pollutants which Greene County, PA, are classified as nonattainment or maintenance are listed in Table 9.1-13 (see *italics*). Maximum annual construction related emissions are anticipated to be below the NOx and VOC thresholds in Table 9.1-13. Detailed calculations of emissions from pipeline and compressor station construction activities will be provided in a subsequent filing, and operational emissions calculations are provided in Appendix 9-B. As estimated emissions are expected to be under the de minimis thresholds, the Project construction-related activities are exempt from the requirements of the general conformity rule.

Table 9.1-13

General Conformity Thresholds

Pollutant/Non-Attainment Area	TPY Threshold
Ozone (VOCs or NOx)	
Serious Non-Attainment Areas	50
Severe Non-Attainment Areas	25
Extreme Non-Attainment Areas	10
Other Ozone Non-Attainment Areas outside an Ozone Transport Region	100
Other Ozone Non-Attainment Areas inside an Ozone Transport Region	
VOCs	*50*
NOx	*100*
Carbon Monoxide (CO) (all non-attainment areas)	100
SO_2 or NO_2 (all non-attainment areas)	100

Table 9.1-13 (continued)

Pollutant/Non-Attainment Area	TPY Threshold
PM_{10}	
Moderate Non-Attainment Areas	100
Serious Non-Attainment Areas	70
$PM_{2.5}$	
Direct Emissions	100
SO_2	100
NOx (unless determined not to be a significant precursor)	100
VOCs or Ammonia (if determined to be significant precursors)	100
Lead (all non-attainment areas)	25

9.1.3 Air Quality Impacts

Both the short-term and long-term air quality impacts associated with the Project are analyzed below. Short-term air quality impacts would be temporary and would result from construction activities necessary to install the pipeline, turbines, and other equipment at the compressor stations. Additional short-term air quality impacts would result from construction activities necessary for the mainline valve and blowdown assemblies. However, such construction activities would last for only a couple of days (two days or less of heavy equipment) and would involve significantly less equipment than construction of other Project sites such as the compressor stations. Operational air impacts from these operations are minimal and/or not foreseeable as emissions and are expected to occur one time per year, on average, in the event of pre-planned maintenance or emergency situations. Long-term impacts would result from the operation of the engines and other equipment at the compressor stations.

From a regulatory standpoint, the emissions and associated air quality impacts are addressed in two separate ways:

- *Pre-construction Permitting* – Pre-construction permitting addresses the emissions and associated impacts that would occur from the operational equipment at the facilities. Depending on the major/minor source status of the proposed equipment, the project location, and the federal and state permits required, pre-construction permitting would ensure the installation of new air emissions sources (operational equipment) would meet required emission levels through the installation of appropriate control technologies, as well as other regulatory requirements, where appropriate. A pollutant that triggers a PSD and/or NNSR major source threshold would be subject to additional review and requirements. Air emissions from the Project would comply with applicable federal and state air quality regulations, including the establishment of best available technology (BAT). As a result, the air emissions associated with the Project's stationary sources would be below PSD permitting thresholds such that PSD requirements including air dispersion modeling are not triggered. Even though these requirements are not triggered, air dispersion modeling was performed to evaluate impacts on air quality resulting from the Project. This modeling is included as Appendix 9-C. NSR and PSD permitting regulations are discussed in Section 9.1.2.1.
- *General Conformity Analysis* – the General Conformity rule addresses the sources of emissions in non-attainment or maintenance areas not covered by permitting actions and ensures they conform to the applicable tribal or state implementation plan(s) (SIP). Generally, these include the short-term

emissions from construction activities and new emissions increases from non-permitted emission sources, such as mobile sources (trucks, bulldozers). Section 9.1.2.8. discusses the General Conformity analysis.

9.1.3.1 Construction Emissions

The construction emissions associated with the pipelines and the compressor stations are expected to have minimal impact on the air quality in the surrounding area. These emissions, will be calculated using publicly available emissions factors such as those contained within USEPA's Motor Vehicle Emission Simulator (MOVES3) (USEPA, 2021e) and USEPA's AP-42, compilation of air emissions factors (USEPA, 2021f).

Equitrans would implement mitigation measures to minimize construction emissions. These include:

- avoiding unnecessary construction activities leading to increased emissions, where possible;
- following manufacturer's operating recommendations regarding good combustion practices to ensure fuel efficiency is maximized and engines are operated such that emissions are minimized;
- requiring contractors to follow local, state, and federal emission standards and air quality regulations applicable to their fleet and equipment; and
- using fugitive dust control measures such as water suppression, enclosures, or other techniques.

9.1.3.2 Operational Emissions

Emissions from operating the equipment at the compressor stations result from combustion of natural gas in the turbines, microturbines, and heaters, fugitive emissions from the operation of ancillary equipment at the stations (leaks and blowdowns), and flashing, breathing, and working losses from the produced fluids tanks. These emissions are detailed on an equipment-level basis in Appendix 9-B (Operational Emissions Calculations) as summarized in Tables 9.1-10 through 9.1-12.

Emissions of pollutants have been minimized through the selection of the most 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 Project will utilize the largest most efficient turbines that meet the pipeline operational requirements.

For the natural gas turbines, Equitrans is planning to purchase and install Solar turbines at the three compressor stations 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 NO_X emissions without significantly increasing CO. As noted in Section 9.1.2.2, the manufacturer's guaranteed NO_X emissions of nine ppm are below the 25-ppm limit of NSPS Subpart KKKK. This emission rate meets or exceeds state regulations for control of NO_X from turbines. Additionally, the installation of oxidation catalysts on the new units (although not required at Corona or Plasma) further reduces CO and VOC emissions. Although not required, Equitrans is adding oxidation catalysts to the turbines at Corona and Plasma to reduce emissions from the facilities. Further, Equitrans will mitigate these emissions through the development and implementation of an Operation and Maintenance Plan that is in line with the manufacturer's recommendations for good combustion practices. Proper operation and preventative maintenance activities will ensure emissions from the turbines will be minimized and continue to meet the emission standards.

Equitrans has modeled the emissions from Project operation including the installation of lower emitting units and oxidation catalysts. Although these voluntary measures are not required to meet state-level emission requirements, the enforceable emission limits incorporated into the state-issued permits for each facility will be based on the voluntary measures included. Table 9.1-14 summarizes the emission reductions from the voluntary measures proposed in the Project.

Table 9.1-14

Voluntary Reduction Emissions Summary

Facility	Pollutant	Potential Site-Wide PTE (tpy)	Potential Site-Wide PTE with Voluntary Reductions (tpy)	Emission Reduction (tpy)
Corona Compressor Station	Oxides of Nitrogen (NO_X)	89.87	72.5	17.37
	CO	79.05	22.04	57.01
	VOC	15.02	11.76	3.26
	Formaldehyde	4.23	0.97	3.26
Plasma Compressor Station	Oxides of Nitrogen (NO_X)	66.91	54.08	12.83
	CO	58.91	17.00	41.91
	VOC	7.48	5.09	2.39
	Formaldehyde	3.12	0.72	2.40

Table 9.1-15

Summary of Project Compressor Stations

Facility	Horsepower Increase[1]	Municipality	County
Cygrymus Compressor Station	22,032	Gilmore	Greene
Corona Compressor Station	16,399	Brink	Wetzel
Plasma Compressor Station	23,497	Clarington	Monroe

Notes:

[1] The increase in HP is limited to the new turbines (does not include the compressor engine to be removed at the Cygrymus Compressor Station). Rating is at 0°F.

Cygrymus Compressor Station

The CAT 3606 gathering unit compressor and associated piping and ancillary facilities at the station will be removed, and the station pad and remaining facilities will be transferred to Equitrans prior to construction to make space for the proposed two Solar Taurus 70 turbines, rated at 11,016 HP each. The turbines will be equipped with oxidation catalysts. The new turbines will have electric start. The turbines will drive centrifugal compressors equipped with dry seals. Five microturbines, each rated at 200 kilowatts (kW), will be installed for site power. Ancillary equipment includes new pig launcher/receiver and heaters. There is a dehydrator with associated reboiler and control device, miscellaneous tanks, and an emergency generator. Post-Project emissions are included in Table 9.1-18.

Corona Compressor Station

The Project will include the installation of a Solar Mars 100 turbine, rated at 16,399 HP. The new turbine will have an electric start and the existing turbine will be converted to electric start. The turbine will drive a centrifugal compressor equipped with dry seals. Two microturbines, each rated at 200 kW, will be installed for site power. Ancillary equipment includes new pig launcher/receivers and heaters. Post-Project emissions are included in Table 9.1-17.

Plasma Compressor Station

The Project will include the installation of a Solar Titan 130 turbine, rated at 23,497 HP. The new turbine will have an electric start and the existing turbines will be converted to electric start. The turbine will drive a centrifugal compressor equipped with dry seals. Two microturbines, each rated at 200 kW, will be installed for site power. Ancillary equipment includes new pig launcher/receivers and heaters. Post-Project emissions are included in Table 9.1-19.

Other Sources of Air Emissions

The Project will involve the installation of two valve yards, including pig launcher/receivers, and the expansion of an existing interconnect with additional pig launcher/receivers. Emissions from these locations are summarized in Table 9.1-16.

Table 9.1-16

Summary of Project Operational PTE Emissions for Pipeline Pigging and Fugitives – Annual (tpy)

Pipeline Valve Yard/Interconnect	Emission Source	Criteria Pollutants	HAP		GHG		
		VOC	Single HAP	Total HAP	CO_2	CH_4	CO_2e
Liberty Valve Yard	Pipeline Blowdowns	<0.01	<0.01	<0.01	<0.01	0.32	8.00
	Pipeline Fugitives	<0.01	<0.01	<0.01	<0.01	0.24	6.07
Ohio Valley Connector Interconnect	Pipeline Blowdowns	<0.01	<0.01	<0.01	<0.01	0.92	22.90
	Pipeline Fugitives	<0.01	<0.01	<0.01	<0.01	0.24	6.07
Shough Creek Valve Yard	Pipeline Blowdowns	<0.01	<0.01	<0.01	<0.01	0.24	4.04
	Pipeline Fugitives	<0.01	<0.01	<0.01	<0.01	0.16	5.95
Total Pipeline Pigging Emissions		<0.01	<0.01	<0.01	**0.01**	**2.12**	**53.03**

9.1.3.3 Air Quality Impact Analysis

An air dispersion modeling analysis of these operational emissions from each of the compressor stations was performed as outlined in Appendix 9-C (Modeling Files). USEPA's AERMOD model was applied and showed the air emissions from the compressor stations do not cause or contribute to an exceedance of the NAAQS (USEPA), 2021d. Further information regarding model inputs and detailed model results is provided in Appendix 9-C.

The modeled impacts from the project sources are below the level USEPA has determined will not cause or contribute to ambient air quality exceedances at 0.5 miles. Isopleth maps for each of the stations for pollutant standards of interest (one-hour NO_2 and both $PM_{2.5}$ standards) are provided as Appendix 9-D. The maps indicate project source model-predicted concentrations.

Table 9.1-17

Model Impacts for Corona Compressor Station

Pollutant	Averaging Period[1]	Modeled Concentration (μg/m^3)	Ambient Background Concentration (μg/m^3)	Total Concentration (μg/m^3)	NAAQS (μg/m^3)	% of Standard
NO_2	1-hour	43.1	30.7	73.8	188	39.3
	Annual	4.7	5.3	10.0	100	10.0
SO_2	1-hour	2.3	23.6	25.9	196	13.2
	3-hour	2.4	30.4	32.8	1,300	2.5
CO	1-hour	43.7	1,145.6	1,189.3	40,000	3.0
	8-hour	24.1	916.5	940.6	10,000	9.4
PM_{10}	24-hour	6.2	54.0	60.2	150	40.2
$PM_{2.5}$	24-hour	3.7	16.1	19.8	35	56.7
	Annual	0.7	7.4	8.1	12	67.2

Notes:

[1] AERMOD results shown represent the worst-case result for each pollutant averaging period consider the load analysis performed for the station.

Key:

μg/m^3 = micrograms per cubic meter
CO = carbon monoxide
NAAQS = National Ambient Air Quality Standards
NO_2 = nitrogen dioxide
PM_{10} = particulate matter with an aerodynamic diameter of ≤ 10 microns
$PM_{2.5}$ = particulate matter with an aerodynamic diameter of ≤ 2.5 microns
SO_2 = sulfur dioxide

Table 9.1-18

Model Impacts for Cygrymus Compressor Station

Pollutant	Averaging Period[1]	Modeled Concentration (μg/m^3)	Ambient Background Concentration (μg/m^3)	Total Concentration (μg/m^3)	NAAQS (μg/m^3)	% of Standard
NO_2	1-hour	32.4	30.7	63.1	188	33.6
	Annual	4.6	5.3	9.9	100	9.9
SO_2	1-hour	2.0	23.6	25.6	196	13.0
	3-hour	2.0	30.4	32.4	1,300	2.5
CO	1-hour	67.5	1,145.6	1,213.1	40,000	3.0
	8-hour	45.0	916.5	961.5	10,000	9.6
PM_{10}	24-hour	3.7	54.0	57.7	150	38.4
$PM_{2.5}$	24-hour	2.5	13.3	15.8	35	45.2
	Annual	0.5	6.4	6.9	12	57.3

Table 9.1-18 (continued)

Notes:

[1] AERMOD results shown represent the worst-case result for each pollutant averaging period consider the load analysis performed for the station.

Key:

$\mu g/m^3$ = micrograms per cubic meter
CO = carbon monoxide
NAAQS = National Ambient Air Quality Standards
NO_2 = nitrogen dioxide
PM_{10} = particulate matter with an aerodynamic diameter of ≤ 10 microns
$PM_{2.5}$ = particulate matter with an aerodynamic diameter of ≤ 2.5 microns
SO_2 = sulfur dioxide

Table 9.1-19

Model Impacts for Plasma Compressor Station

Pollutant	Averaging Period[1]	Modeled Concentration ($\mu g/m^3$)	Ambient Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	% of Standard
NO_2	1-hour	27.1	55.8	82.9	188	44.1
	Annual	1.6	14.5	16.1	100	16.1
SO_2	1-hour	3.0	23.6	26.6	196	13.6
	3-hour	3.2	30.4	33.6	1,300	2.6
CO	1-hour	57.4	1,145.6	1,203.0	40,000	3.0
	8-hour	27.8	916.5	944.3	10,000	9.4
PM_{10}	24-hour	3.1	54.0	57.1	150	38.1
$PM_{2.5}$	24-hour	1.4	19.5	21.0	35	59.9
	Annual	0.2	8.6	8.8	12	73.6

Notes:

[1] AERMOD results shown represent the worst-case result for each pollutant averaging period consider the load analysis performed for the station.

Key:

$\mu g/m^3$ = micrograms per cubic meter
CO = carbon monoxide
NAAQS = National Ambient Air Quality Standards
NO_2 = nitrogen dioxide
PM_{10} = particulate matter with an aerodynamic diameter of ≤ 10 microns
$PM_{2.5}$ = particulate matter with an aerodynamic diameter of ≤ 2.5 microns
SO_2 = sulfur dioxide

9.1.3.1 Air Quality Impact Analysis – Non-Criteria Pollutants

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. Equitrans will, to the extent practical, employ good management practices to limit these emissions. The proposed project uses existing infrastructure (compressor stations and supporting equipment), which minimizes the impacts of GHG emissions from project construction and results in less land clearing for the project.

Regarding operational emissions, USEPA has published formal white papers for different industries to discuss available GHG control technologies. In permitting guidance, USEPA agrees energy efficiency improvements will satisfy the control requirements for GHGs in most cases. As such, operational GHG emissions would be limited to the use of energy efficient design and the minimization of GHG releases through good work practices for the natural gas industry. The use of the combustion turbines represents one element of the 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. Equitrans will implement a leak detection and repair program for fugitive emissions at each of the compressor stations. Equitrans believes the proposed project is designed to reduce GHG emissions where technically and economically feasible. In addition, Equitrans has reviewed USEPA's voluntary Natural Gas Star program for potential emission reduction measures and summarized them in Table 9.1-20.

Table 9.1-20

Summary of Natural Gas Star Program

Project	Feasibility Assessment
Replace gas starters with air or nitrogen	New compressors purchased with electric starters. Existing compressors will be converted to electric starters
Reduce Natural Gas Venting with Fewer Startups and Improved Ignition	Feasible – Turbines are intended to operate at all times other than preventative maintenance shutdowns. The SoLoNox ignition control system qualifies as upgraded ignition. Equitrans reduces the number of starts with pressurized hold.
Reducing Methane Emissions from Compressor Rod Packing Systems	Not Applicable – the project includes new centrifugal compressors equipped with dry seals.
Test and Repair Pressure Safety Valves	Feasible – Completed by Equitrans on periodic basis. Equitrans uses safety relief valves for thermal protection only, over pressure protection for process is accommodated by primary and redundant controls and control valves. Leaks associated with small thermal relief valves are minimal as thermal relief valves do not relieve.
Eliminate Unnecessary Equipment and/or Systems	Equitrans will install what is required for this application.
Install Automated Air/Fuel Ratio Controls	Feasible – Turbines will be equipped with state-of-the art SoLoNO$_X$ technology.
Install Electric Motor Starters	Feasible – New compressors purchased with electric starters. Existing compressors will be converted to electric starters.
Reducing Emissions When Taking Compressors Off-Line	Feasible – Compressors that go off-line short term (up to three days) will stay in pressurized hold at suction pressure. Equalizing to suction pressure prevents a unit blow down. The stations are expected to operate at or near 100 percent capacity year-round. As such, shutdown events are expected to be infrequent.
Replace Compressor Cylinder Unloaders	Not Applicable.
Install Electric Compressors	Not Feasible – The need for electric substations to support the electric motors would not be feasible to be built on existing station limits of disturbance. Environmental impact to construct high voltage utility lines from substation to compressor sites is discussed in the alternative analysis in Resource Report 10.

Table 9.1-20 (continued)

Project	Feasibility Assessment
Wet Seal Degassing Recovery System for Centrifugal Compressors	Not Applicable – Turbine centrifugal compressors will be dry seal.
Convert Natural Gas Driven Chemical Pumps	All pumps are driven pneumatically with instrument air or electric.
Reduce Frequency of Replacing Modules in Turbine Meters/Replace Bi-Direction Orifice Metering with Ultrasonic Meters	Differential pressure or ultra-sonic flow meters are utilized. Service of internal components is not required.
Redesign Blowdown Systems and Alter ESD Practices	ESD System testing will be altered to allow testing with minimal blowdown to atmosphere. Block valves will be added downstream of the Blow Down Valves to allow testing without discharge to the vent header. The volume between the blow down and block valve only will be vented.
Convert Gas Pneumatic Controls to Instrument Air	All pneumatic controls will utilize instrument air.
Perform Valve Leak Repair During Pipeline Replacement	Equitrans uses all shut down opportunities to service valves and equipment as standard practice.

9.2 Noise

This section provides an overview of the proposed noise generating equipment for the Project, the noise study approach for each aboveground facility, and a discussion of typical noise mitigation methods for the type of equipment associated with each component of the Project.

9.2.1 Background Information on Sound and Noise

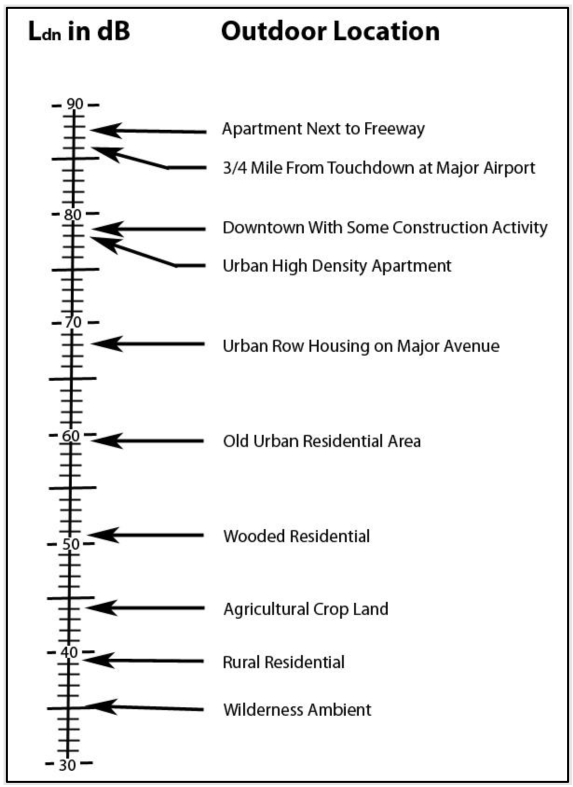
A sound source is defined by a sound power level (L_w), which is the rate at which acoustical energy is radiated outward and expressed in units of decibels. A sound pressure level is a measure of fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated 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 pressure levels are presented on a logarithmic scale, 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 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 one-third octave) bands ranging from 16 Hz (low) to 16,000 Hz (high). One-third 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 described in 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.) for the increased sensitivity of people to hear noises that occur at night. L_p is sound pressure level. The L_{max} is the maximum instantaneous sound level as measured during a specified time period. It can 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 9.2-1a.

Figure 9.2-1a

Environmental Sound Pressure Levels (L_{dn})



(Adapted from USEPA, 1974)

9.2.2 Applicable Noise Regulations

The Project is in Greene County, PA; Wetzel County, WV; and Monroe County, OH. Equitrans reviewed federal, state, county, and local noise regulations to identify regulations applicable to construction and operations. A regulatory search found no county or state noise standards applicable to the Project; however, there are several federal requirements that are potentially applicable to the Project as described in Section 9.2.2.1.

9.2.2.1 FERC Requirements

The FERC noise regulations, set forth in 18 CFR §380.12(k)(2), require an applicant to identify noise sensitive areas (NSAs) within one mile of Project facilities (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 ambient sound environment based on 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.

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 contributes 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 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.

9.2.3 Existing Sound Environment

The existing sound environment surrounding each proposed aboveground facility 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 laboratory certification. Weather conditions during each survey were recorded, and the measurements taken during weather periods appropriate for environmental sound level surveys. Table 9.2-1 summarizes meteorological conditions during the baseline sound surveys.

9.2.3.1 Aboveground Facilities

There are three compressor station modifications planned as part of the Project.

Cygrymus Compressor Station Rebuild

The Cygrymus Compressor Station is in Greene County, PA, approximately two miles southeast of the town of New Freeport. The station is on a ridge and is surrounded by heavily forested and steeply sloped rugged lands, with scattered rural residences. Figures of the Compressor Station and NSAs are within the report included as Appendix 9-E (Noise Study Reports).

Plasma Compressor Station Expansion

The Plasma Compressor Station is in Monroe County, OH, approximately four miles north of the town of Clarington. The station is on a ridge, and it is surrounded by heavily forested and steeply sloped rugged lands, with scattered rural residences. Figures of the Compressor Station and NSAs are within the report included as Appendix 9-E.

Corona Compressor Station

The Corona Compressor Station is in an unincorporated portion of Wetzel County, WV, approximately four miles northeast of the town of Smithfield. The station is on a ridge and surrounded by heavily forested and steeply sloped rugged lands, with scattered rural residences. Figures of the Compressor Station and NSAs are within the report included as Appendix 9-E.

Table 9.2-1

Weather Conditions during the Aboveground Facility Sound Level Surveys

	Cygrymus Compressor Station	Plasma Compressor Station	Corona Compressor Station
Dates	September 9–10, 2021	September 16–17, 2021	September 15–16, 2021
Temperature Range	52 to 70° F	64 to 80° F	66 to 79° F
Relative Humidity Range	61 to 100 Percent	58 to 100 Percent	78 to 100 Percent
Wind Speed	0 to 8 miles per hour (mph)	0 to 6 mph	0 to 9 mph
Wind From	CALM to West	CALM to East Northeast	South to East
Precipitation	Damp	Damp to Dry	Damp

Table 9.2-2 shows the measured daytime and nighttime sound levels (L_{eq}, dBA) as well as the equivalent day-night sound levels (L_{dn}, dBA) at the NSAs. Measurement data were post-processed to remove the contribution from seasonal insect noise, which occurs within the 1,600 hertz and above one-third octave bands. Levels at some NSAs near the Corona compressor station exceeded 55 dBA (L_{dn}) during the baseline sound survey. The operating Corona compressor station was inaudible at the NSA measurement locations, so the ambient sound levels were controlled by other environmental noise sources, such as vehicular traffic on local roadways

Table 9.2-2

Existing Sound Level Measurement Results – Aboveground Facilities[1]

Facility Name	NSA	Measurement Duration (HH:MM)	All Octave Bands Included		
			Measured Day Average (L_{eq} dBA)	Estimated Night Average (L_{eq} dBA)	Estimated Day-Night Average (L_{dn} dBA)
Cygrymus Compressor Station	1	26:15	47.6	43.6	50.8
	2	26:06	55.4	37.5	53.8
	3	26:11	52.7	32.9	50.9
	4	26:15	47.3	32.9	50.9
Plasma Compressor Station	1	25:09	38.8	38.7	45.1
	2	24:37	36.1	31.4	38.9
	3	23:38	35.8	34.8	41.2
	4	25:14	35.3	33.6	40.3
	5	24:42	47.7	40.5	49.0
Corona Compressor Station	1	24:03	52.6	50.1	57.0
	2	23:15	41.9	26.0	40.5
	3	24:03	52.6	50.1	57.0
	4	23:51	57.4	57.3	63.8
	5	18:32	55.4	59.8	65.8

Notes:
[1] Measured Day/Night levels include the sound contribution from existing compressor station equipment.

9.2.4 Project Construction Noise

9.2.4.1 Pipeline Construction Noise and Mitigation

Potential impacts from pipeline construction could include short-term increases in sound. Construction of the pipelines 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 be temporary, sporadic, and short-term in any one location along the pipeline route. No special noise mitigation or noise monitoring program will be implemented during daytime construction. As described in Section 9.2.4.2, if nighttime construction is proposed at the Corona Compressor Station, mitigative measures would be assessed.

9.2.4.2 Aboveground Facility Construction Noise and Mitigation

Potential impacts at station locations could include short-term increases in sound levels during construction. Only standard equipment will be used during construction, with no dynamic compaction or pile driving expected. Most construction will take place during daytime working hours of 7:00 a.m. until 7:00 p.m. Construction sound calculations were performed with the CadnaA propagation model, a commercial noise modeling package developed by DataKustik GmbH. The software considers spreading losses due to distance, ground and atmospheric effects, reflections from surfaces and other sound propagation properties. The software is based on published engineering standards. The modeling accounts for local topography. Construction equipment usage factors were taken from the Federal Highway Administration's Roadway Construction Noise Model (US Department of Transportation, 2006). Usage factor is the percentage of time a given piece of equipment typically operates during a given hour. The equipment included in the construction evaluation for the station is shown in Table 9.2-3 (quantities in parentheses):

Table 9.2-3

Modeled Construction Equipment

Equipment	Quantity	Comment[1]
Diesel Area Light Plant	(8)	N/A
Diesel Generators	(2)	N/A
Diesel Welders	(2)	N/A
Diesel Air Compressors	(2)	N/A
Aerial Platform Lift	(2)	N/A
Dozer	(1)	No Nighttime Operation (ALL Stations)
Crane	(1)	No Nighttime Operation (ALL Stations)
Air Hammer	(1)	No Nighttime Operation (ALL Stations)
Pneumatic noise, Purge, Blowdown	(1)	Plasma Compressor Station – No Nighttime Operation
Skid Steer	(1)	Plasma Compressor Station – No Nighttime Operation
Excavator	(1)	Plasma Compressor Station – No Nighttime Operation
Telehandler	(1)	Plasma Compressor Station – No Nighttime Operation
Truck	(4)	Plasma Compressor Station – No Nighttime Operation
Electric and hand tool	(2)	Plasma Compressor Station – No Nighttime Operation

Table 9.2-3 (continued)

Equipment	Quantity	Comment[1]
Air Mover	(1)	Plasma Compressor Station – No Nighttime Operation
Nitrogen Purge	(1)	Plasma Compressor Station – No Nighttime Operation

Notes:
[1] N/A = not applicable.

Most workers will commute to and from the site during off-peak hours. Some discrete activities (stream crossings, tie-ins, X-ray, hydrostatic testing, purge and packing the facilities) may occur beyond daytime working hours, including overnight construction. Emergencies or other non-typical circumstances may necessitate limited nighttime work. The highest sound levels during construction are expected during necessary earth moving. Equipment that may be operating during earth moving would include bulldozers, front end loaders, dump trucks, and generators. However, most of the major earth moving activity at these stations was completed during the previous initial construction of the station sites.

Table 9.2-4 shows a summary of the predicted short-term, daytime construction sound levels at the NSAs for the aboveground facilities. The highest impact from station construction operations may not correlate with distance in all cases, due to factors such as terrain shielding between the station and NSAs.

As shown in Table 9.2-4, the predicted 12-hour shift Daytime construction-only sound levels are below 55 dBA L_{dn} at the NSAs, which is low enough that no special noise mitigation or noise monitoring program will be implemented during daytime construction.

Table 9.2-4

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

Station(s)	NSA	Existing Ambient Sound Levels, dBA			Predicted Construction-Only 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}
Cygrymus Compressor Station	1	47.6	43.6	50.8	47.6	**44.6**	50.6	51.7	3.0	0.9
	2	55.4	37.5	53.8	45.9	**42.9**	55.9	54.1	0.5	0.3
	3	52.7	32.9	50.9	47.3	**44.3**	53.8	51.8	1.1	0.9
	4	47.3	32.9	50.9	33.1	**30.1**	47.5	50.9	0.2	0.0
Plasma Compressor Station	1	38.8	38.7	45.1	54.0	**51.0**	54.1	52.0	15.3	6.9
	2	36.1	31.4	38.9	48.1	**45.1**	48.4	46.0	12.3	7.1
	3	35.8	34.8	41.2	46.6	**43.6**	46.9	45.6	11.1	4.4
	4	35.3	33.6	40.3	52.4	**49.4**	52.5	49.9	17.2	9.6
	5	47.7	40.5	49.0	55.2	**52.2**	55.9	53.9	8.2	4.9
Corona Compressor Station	1	52.6	50.1	57.0	36.6	**33.6**	52.7	57.0	0.1	0.0
	2	41.9	26.0	40.5	40.2	**37.2**	44.1	42.2	2.2	1.7
	3	52.6	50.1	57.0	32.6	**29.6**	52.6	57.0	0.0	0.0
	4	57.4	57.3	63.8	32.5	**29.5**	57.4	63.8	0.0	0.0
	5	55.4	59.8	65.8	38.7	**35.7**	55.5	65.8	0.1	0.0

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 contributes 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.

Nighttime work at the Cygrymus and Corona stations may occur on an as-needed basis through the duration of the Project. Equitrans does not anticipate major nighttime construction at the Plasma Station. However, should nighttime construction be necessary, night work at Plasma station will only involve limited activities that do not require significant noise-emitting equipment (see Table 9.2-3). For example, nighttime activities would be limited to the operation of light farms or occasional use of platform lifts. Nighttime activities such as manual work, non-destructive testing, and inspections would not result in noticeable increases in the ambient levels.

Table 9.2-6 shows the temporary nighttime sound level impact for 24-hour construction activities. Nighttime construction-only sound levels are below 48.6 dBA (L_n). The cumulative 24-hour day-night levels attributable to construction activity are below 55 dBA L_{dn} at the NSAs.

Table 9.2-5

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

Station	NSA	Existing Ambient Sound Levels, dBA			Calculated Construction Sound Level, dBA			Construction Plus Ambient, dBA	Temporary Increase in Sound Level, dBA
		Day	Night	L_{dn}	L_d	L_n	L_{dn}	L_{dn}	L_{dn}
Cygrymus Compressor Station	1	47.6	43.6	50.8	47.6	**47.0**	**53.5**	55.4	4.6
	2	55.4	37.5	53.8	45.9	**44.1**	**50.8**	55.6	1.8
	3	52.7	32.9	50.9	47.3	**45.0**	**51.7**	54.4	3.5
	4	47.3	32.9	50.9	33.1	**33.1**	**39.5**	51.2	0.3
Plasma Compressor Station	1	38.8	38.7	45.1	54.0	**41.5**	**52.6**	53.3	8.2
	2	36.1	31.4	38.9	48.1	**35.1**	**46.5**	47.2	8.3
	3	35.8	34.8	41.2	46.6	**30.8**	**44.4**	46.1	4.9
	4	35.3	33.6	40.3	52.4	**34.7**	**49.9**	50.4	10.1
	5	47.7	40.5	49.0	55.2	**41.2**	**53.4**	54.7	5.7
Corona Compressor Station	1	52.6	50.1	57.0	36.6	**35.4**	**42.0**	57.1	0.1
	2	41.9	26.0	40.5	40.2	**39.4**	**45.9**	47.0	6.5
	3	52.6	50.1	57.0	32.6	**31.5**	**38.1**	57.1	0.1
	4	57.4	57.3	63.8	32.5	**31.4**	**38.0**	63.8	0.0
	5	55.4	59.8	65.8	38.7	**37.3**	**43.9**	65.8	0.0

If nighttime construction is necessary, the Project will develop a nighttime construction noise management plan. This noise management plan will outline the specific equipment 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 sound levels at the NSAs do not exceed 48.6 dBA at night or 55 dBA L_{dn} overall, or 10 dBA L_{dn} over the ambient.

9.2.5 Project Operation Noise

9.2.5.1 Aboveground Facility Operational Noise and Mitigation

The Project has developed noise models for the Cygrymus, Plasma, and Corona Compressor Stations using designs and manufacturer's specifications.

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

- noise from the flow control valves;
- noise radiated by aboveground station suction and discharge piping;
- turbine inlet and exhaust openings;
- gas aftercoolers;
- turbine lube oil coolers; and
- fuel gas skids.

Noise Model Methodology

The noise model for each station was developed using CadnaA, version 2021 MR2 build 187.5163, a commercial noise modeling package developed by DataKustik GmbH. The software considers spreading losses due to distance, 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 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 the manufacturer specifications for the equipment. Table 9.2-9 shows the sound pressure levels and sound power levels used to model the Project equipment with the source of the Information.

Table 9.2-6

Sound Pressure Levels for Station Equipment

Cygrymus Compressor Station Sources	Linear Sound Pressure Level at Octave Center Frequency									Total dBA
	31.5	63	125	250	500	1k	2k	4k	8k	
Engine Intake, Taurus 70, Unsilenced, L_w[1]	111	117	123	125	125	127	130	159	151	160
Engine Exhaust, Taurus 70, Unsilenced, L_w[1]	123	126	123	127	129	125	119	112	100	130
Unlagged Suction Piping, Per Meter, L_w[2]	94	96	95	90	91	96	111	100	90	113
Unlagged Discharge Piping, Per Meter, L_w[2]	88	84	84	90	95	88	100	92	81	103
Capstone C1000 Generator, L_p[3]	88	84	84	90	95	88	100	92	81	103
Sound Level in Compressor Building at Inner Wall Surface, L_p[2]	78	78	89	92	91	90	92	100	90	102
42" Building Wall Panel Fan, L_w[2]	97	97	101	97	96	96	93	88	81	100
Exhaust Breakout, L_w[2]	93	95	92	92	86	84	93	92	81	98
Intake Breakout, L_w[2]	103	91	89	94	84	82	84	91	77	95
Lube Oil Cooler, L_w[1]	95	102	96	92	87	84	80	76	71	90
Anti-surge Valve, L_w[2]	-	-	-	-	74	80	87	82	77	90

Table 9.2-6 (continued)

Cygrymus Compressor Station Sources	Linear Sound Pressure Level at Octave Center Frequency									Total dBA
	31.5	63	125	250	500	1k	2k	4k	8k	
Sound Power Level of Gas Cooler Fans, Per Fan, L_w[2]	91	91	90	87	82	80	74	68	62	85
Plasma Compressor Station Sources	**Linear Sound Pressure Level at Octave Center Frequency**									**Total dBA**
	31.5	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Existing Unit 1 and Unit 2 Equipment										
Discharge Piping, L_w	61	73	77	84	92	95	102	101	90	105
Gas Aftercooler (per cooler), L_w	66	72	76	83	88	91	92	92	82	97
Building Exhaust (Ridge Vents), L_w	41	58	70	83	83	85	85	94	79	95
Taurus 70 Exhaust Exit (per unit), L_w	70	89	84	80	85	80	81	78	65	92
Station Piping, L_w	52	69	67	67	74	77	85	83	80	89
Fuel Gas Skid, L_w	49	63	63	66	69	75	77	84	84	88
Suction Piping, L_w	48	53	59	65	77	77	86	74	78	88
Lube Oil Cooler (per cooler), L_w	52	72	79	80	80	81	78	74	66	87
Building Ventilation Intake Openings, L_w	51	60	73	77	71	68	71	83	82	87
Building Walls, Roof, and Doors, L_w	57	69	80	84	72	73	71	76	63	87
Dehy Burner, L_w	54	67	75	77	70	68	75	76	66	82
Taurus 70 Air Intake (per unit), L_w	56	71	70	71	74	69	70	72	56	80
Future Unit 3 Titan 130 Equipment										
Engine Intake, Titan 130, Unsilenced, L_w[1]	114	120	126	127	128	130	133	163	155	164
Engine Exhaust, Titan 130, Unsilenced, L_w[1]	124	128	126	129	133	128	120	110	100	133
Unlagged Suction Piping, Per Meter, L_w[2]	94	96	95	90	91	96	111	100	90	113
Fuel Gas Skid, L_w[2]	-	-	-	-	91	96	104	103	99	108
Sound Level in Compressor Building at Inner Wall Surface, L_p[2]	81	85	91	88	88	89	94	101	93	104
Unlagged Discharge Piping, Per Meter, L_w[2]	88	84	84	90	95	88	100	92	81	103
42" Building Wall Panel Fan, L_w[2]	97	97	101	97	96	96	93	88	81	100
Capstone C1000 Generator, L_w[3]	92	90	97	90	88	90	84	87	87	95
Exhaust Breakout, L_w[2]	110	111	102	96	92	85	87	84	78	95
Lube Oil Cooler, L_w[1]	95	102	96	92	87	84	80	76	71	90
Anti-surge valve, L_w[2]	-	-	-	-	74	80	87	82	77	90
Sound Power Level of Gas Cooler Fans, Per Fan, L_w[3]	91	91	90	87	82	80	74	68	62	85
Intake Breakout, L_w[2]	79	88	83	85	68	61	63	64	55	78

Table 9.2-6 (continued)

Corona Compressor Station Sources [4]	Linear Sound Pressure Level at Octave Center Frequency									Total dBA
	31.5	63	125	250	500	1k	2k	4k	8k	
Engine Intake, Mars 100, Unsilenced L_w[1]	113	119	125	126	127	129	132	161	153	162
Engine Exhaust, Mars 100, Unsilenced, L_w[1]	123	127	125	128	132	127	119	109	99	132
Unlagged Suction Piping, Per Meter, L_w[2]	96	98	97	92	93	98	113	102	92	114
Sound Level in Compressor Building at Inner Wall Surface, L_p[2]	86	86	97	100	99	98	100	108	98	110
Fuel Gas Skid, L_w[2]	-	-	-	-	91	96	104	103	99	108
Unlagged Discharge Piping, Per Meter, L_w[2]	90	86	86	92	97	90	102	94	83	104
42" Building Wall Panel Fan, L_w[2]	97	97	101	97	96	96	93	88	81	100
Exhaust Breakout, L_w[2]	95	97	94	94	88	86	95	94	83	99
Intake Breakout, L_w[2]	105	93	91	96	86	84	86	93	79	96
Capstone C1000 Generator, L_w[3]	92	90	97	90	88	90	84	87	87	95
Lube Oil Cooler, L_w[1]	95	102	96	92	87	84	80	76	71	90
Anti-surge Valve, L_w[2]	-	-	-	-	74	80	87	82	77	90
Sound Power Level of Gas Cooler Fans, Per Fan, L_w[3]	91	91	90	97	82	80	74	68	62	85

Notes:

1 From Sound Levels for Solar's Products.
2 From SLR International Corporation (SLR) Data Library from similar projects.
3 From Vendor datasheet.
4 Corona Compressor Station sound level specifications and noise mitigation for the existing and proposed equipment are equivalent.

Noise Control Treatments

To the extent practicable, station piping will run underground. No acoustical lagging was included in the station piping models, but aboveground main gas piping can be acoustically lagged as necessary.

All station expansions will incorporate significant engineering noise controls, described within the sound study technical reports provided in Appendix 9-D. Noise mitigation will include non-standard, low noise equipment where required, such as for outdoor gas aftercoolers and lube oil coolers. Turbine air intakes and exhausts will be equipped with silencers.

Noise Modeling Results

Predicted noise impacts on the nearest NSAs from each compressor station are presented in Table 9.2-7. Site locations, layouts, and modeled equipment were determined from available information. The table presents the measured existing ambient levels and the resulting increases in ambient expected from the new equipment. Ambient levels at the Corona station NSAs were influenced by traffic on local roadways. Levels at some NSAs exceed 55 dBA L_{dn}, but this is due to extraneous noise sources unassociated with the existing compressor station.

Table 9.2-7

Predicted Sound Levels – Aboveground Facilities Compressor Station Operation

Station(s)	NSA	Station(s) Station to NSA (feet)	Direction	Measured Existing Ambient (L_{dn} dBA)	Calculated Contribution of New Station Equipment L_{eq} dBA	L_{dn} dBA	Combined, New Sources Including Ambient (L_{dn} dBA)	Increase Above Existing Condition (dB)
Cygrymus Compressor Station	1	1,945	SSE	50.8	37.1	43.5	51.6	0.7
	2	2,295	NE	53.8	35.9	42.3	54.1	0.3
	3	2,975	N	50.9	37.7	44.1	51.7	0.8
	4	3,420	W	50.9	26.1	32.5	51.0	0.1
Plasma Compressor Station	1	1,980	NW	45.1	33.5	39.9	46.2	1.1
	2	2,320	W	38.9	29.1	35.5	40.5	1.6
	3	3,100	ENE	41.2	24.0	30.4	41.5	0.3
	4	3,140	SSE	40.3	27.5	33.9	41.2	0.9
	5	2,000	NE	49.0	34.6	41.0	49.6	0.6
Corona Compressor Station	1	1,875	N	57.0	25.2	31.6	57.0	0.0
	2	2,070	SSE	40.5	25.9	32.3	41.1	0.6
	3	2,630	N	57.0	21.0	27.4	57.0	0.0
	4	3,135	NW	63.8	19.7	26.1	63.8	0.0
	5	3,075	NE	65.8	25.4	31.8	65.8	0.0

9.2.5.1 Aboveground Facility Operational Noise and Mitigation

As demonstrated by the noise model results, operation of the compressor stations will contribute sound levels of less than 55 dBA L_{dn} at all NSAs. The predicted increases in the ambient sound levels range from 0.0 to 1.6 dBA L_{dn} and are less than 10 decibels at all NSAs. The stations will operate in full compliance with FERC noise regulations, and will not result in the generation of, or exposure of persons to, excessive noise or vibration levels. Though levels at some NSAs near the Corona station exceed 55 dBA Ldn, this is due to other environmental noise sources (local traffic) and not related to compressor station operation.

9.3 References

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APPENDIX 9-A

Construction Emissions Calculations
(To Be Provided in Subsequent Filing)

APPENDIX 9-B
Operational Emissions Calculations

Company Name: Equitrans, LP
Facility Name: Corona Compressor Station
Project Description: Resource Report 9

TABLE 1. Turbine Emissions Calculations

Turbine Information:

Source ID:	C-2100
Manufacturer:	Solar
Model No.:	Mars-100
Fuel Used:	Natural Gas
Fuel Lower Heating Value (Btu/scf):	919.4
Rated Horsepower (bhp):	16,399
Maximum Fuel Consumption at 100% Load (scf/hr):	132,739
Heat Input (MMBtu/hr) - LHV	122.04
Heat Input (MMBtu/hr) - HHV	135.46
Control Device:	None

Operational Details:

Potential Annual Hours of Operation (hr/yr):	8,760
Potential Fuel Consumption (MMscf/yr):	1,162.79
Potential Startup/Shutdown Events (per year):	12

Manufacturer Specific Pollutant Emission Factors:

Pollutant	Uncontrolled Emission Factors	Controlled Emission Factors	Units	Emission Factor Source
NO_X		0.060	lb/MMBtu (LHV)	Manufacturer
CO	0.061	0.012	lb/MMBtu (LHV)	Manufacturer
SO_2		0.003	lb/MMBtu (HHV)	Manufacturer
PM_{10}		0.018	lb/MMBtu (HHV)	Manufacturer
$PM_{2.5}$		0.018	lb/MMBtu (HHV)	Manufacturer
VOC	0.007	0.004	lb/MMBtu (LHV)	20% of UHC per Manufacturer
Formaldehyde	0.003	0.001	lb/MMBtu (HHV)	Manufacturer
CO_2		117.00	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-1
CH_4		0.028	lb/MMBtu (LHV)	80% of UHC per Manufacturer
N_2O		2.2E-04	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-2

*Emission factors from AP-42 and Subpart C are based on HHV. Emission factor basis notes which heat input value is used for calculations.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 1. Turbine Emissions Calculations

Pollutant Emission Rates:

Pollutant	Potential Emissions (lb/hr)[1]	(tpy)[2]
NO_X	7.32	32.08
CO	1.49	7.15
SO_2	0.46	2.02
PM_{10}	2.44	10.68
$PM_{2.5}$	2.44	10.68
VOC	0.51	2.31
Formaldehyde	0.08	0.34
CO_2	15,849	69,424
CH_4	3.42	15.20
N_2O	0.03	0.13
GHG (CO_2e)	15,943	69,843

[1] Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)

[2] Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 1. Turbine Emissions Calculations

Hazardous Air Pollutant (HAP) Emission Rates:

Pollutant	Emission Factor (lb/MMBtu)[3]	Potential Emissions (lb/hr)[1]	(tpy)[2]
HAPs:			
Acetaldehyde	4.00E-05	5.42E-03	2.37E-02
Acrolein	6.40E-06	8.67E-04	3.80E-03
Benzene	1.20E-05	1.63E-03	7.12E-03
1,3-Butadiene	4.30E-07	5.82E-05	2.55E-04
Propylene Oxide	2.90E-05	3.93E-03	1.72E-02
Ethylbenzene	3.20E-05	4.33E-03	1.90E-02
Toluene	1.30E-04	1.76E-02	7.71E-02
Xylene	6.40E-05	8.67E-03	3.80E-02
Polycyclic Organic Matter:			
Naphthalene	1.30E-06	1.76E-04	7.71E-04
PAH	2.20E-06	2.98E-04	1.31E-03
Total HAP (Including HCHO)		**0.12**	**0.53**

[1] Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)
[2] Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable
[3] Emission factors from AP-42 Section 3.1, Table 3.1-3 "Emission Factors for HAPs from Natural Gas Fired Stationary Gas Turbines", April 2000. Factors are based on HHV.

Startup/Shutdown Combustion Emission Factors:

Pollutant	Startup Emissions[1] (lbs/event)	Shutdown Emissions[1] (lbs/event)	Emission Factor Source
NO_X	1	1	Manufacturer
CO	46	58	Manufacturer
VOC	4	6	Manufacturer
CH_4	16.0	22.4	80% of UHC per Manufacturer
CO_2	385	490	Manufacturer

[1] Each startup and shutdown event is estimated to last approximately 10 minutes, per manufacturer.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 2. Turbine Emissions Calculations

Turbine Information:

Source ID:	C-2200
Manufacturer:	Solar
Model No.:	Mars-100
Fuel Used:	Natural Gas
Fuel Lower Heating Value (Btu/scf):	919.4
Rated Horsepower (bhp):	16,399
Maximum Fuel Consumption at 100% Load (scf/hr):	132,739
Heat Input (MMBtu/hr) - LHV	122.04
Heat Input (MMBtu/hr) - HHV	135.46
Control Device:	None

Operational Details:

Potential Annual Hours of Operation (hr/yr):	8,760
Potential Fuel Consumption (MMscf/yr):	1,162.79
Potential Startup/Shutdown Events (per year):	12

Manufacturer Specific Pollutant Emission Factors:

Pollutant	Uncontrolled Emission Factors	Controlled Emission Factors	Units	Emission Factor Source
NO_X		0.036	lb/MMBtu (LHV)	Manufacturer
CO	0.037	0.007	lb/MMBtu (LHV)	Manufacturer
SO_2		0.003	lb/MMBtu (HHV)	Manufacturer
PM_{10}		0.010	lb/MMBtu (HHV)	Manufacturer
$PM_{2.5}$		0.010	lb/MMBtu (HHV)	Manufacturer
VOC	0.004	0.003	lb/MMBtu (LHV)	20% of UHC per Manufacturer
Formaldehyde	0.003	0.001	lb/MMBtu (HHV)	Manufacturer
CO_2		117.00	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-1
CH_4		0.017	lb/MMBtu (LHV)	80% of UHC per Manufacturer
N_2O		2.2E-04	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-2

*Emission factors from AP-42 and Subpart C are based on HHV. Emission factor basis notes which heat input value is used for calculations.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 2. Turbine Emissions Calculations

Pollutant Emission Rates:

Pollutant	Potential Emissions (lb/hr)[1]	(tpy)[2]
NO_X	4.39	19.26
CO	0.90	4.21
SO_2	0.46	2.02
PM_{10}	1.35	5.93
$PM_{2.5}$	1.35	5.93
VOC	0.31	1.38
Formaldehyde	0.08	0.34
CO_2	15,849	69,425
CH_4	2.05	9.12
N_2O	0.03	0.13
GHG (CO_2e)	15,909	69,692

[1] Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)

[2] Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 2. Turbine Emissions Calculations

Hazardous Air Pollutant (HAP) Emission Rates:

Pollutant	Emission Factor (lb/MMBtu)[3]	Potential Emissions (lb/hr)[1]	(tpy)[2]
HAPs:			
Acetaldehyde	4.00E-05	5.42E-03	2.37E-02
Acrolein	6.40E-06	8.67E-04	3.80E-03
Benzene	1.20E-05	1.63E-03	7.12E-03
1,3-Butadiene	4.30E-07	5.82E-05	2.55E-04
Propylene Oxide	2.90E-05	3.93E-03	1.72E-02
Ethylbenzene	3.20E-05	4.33E-03	1.90E-02
Toluene	1.30E-04	1.76E-02	7.71E-02
Xylene	6.40E-05	8.67E-03	3.80E-02
Polycyclic Organic Matter:			
Naphthalene	1.30E-06	1.76E-04	7.71E-04
PAH	2.20E-06	2.98E-04	1.31E-03
Total HAP (Including HCHO)		**0.12**	**0.53**

[1] Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)

[2] Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable

[3] Emission factors from AP-42 Section 3.1, Table 3.1-3 "Emission Factors for HAPs from Natural Gas Fired Stationary Gas Turbines", April 2000. Factors are based on HHV.

Startup/Shutdown Combustion Emission Factors:

Pollutant	Startup Emissions[1] (lbs/event)	Shutdown Emissions[1] (lbs/event)	Emission Factor Source
NO_X	1	1	Manufacturer
CO	18	25	Manufacturer
VOC	2	3	Manufacturer
CH_4	9.6	13.6	80% of UHC per Manufacturer
CO_2	496	642	Manufacturer

[1] Each startup and shutdown event is estimated to last approximately 10 minutes, per manufacturer.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 3. Microturbine Emissions Calculations

Microturbine Unit Information:

Source ID:	G-9401 - G-9405
Manufacturer:	Capstone
Model No.:	C200
Number of Units:	5

Microturbine Fuel Information:

	Per Unit	**As Combined**
Fuel Type:	Natural Gas	Natural Gas
Rated Electrical Power Output (kW):	200	1,000
Rated Electrical Power Output (MW):	0.2	1
Rated Horsepower (bhp):	268.2	1,341
Heat Input (MMBtu/hr)	2.28	11.4
Maximum Fuel Consumption at 100% Loac	2,229	11,147
Maximum Fuel Consumption at 100% Loac	19.53	97.65
Potential Fuel Consumption (MMBtu/yr):	19,973	99,864
Max. Annual Hours of Operation (hr/yr):	8,760	8,760

Microturbine Emissions Data:

Pollutant	**Emission Factors**	**Units**	**Maximum Potential Emissions Per Unit**		**Estimation Basis / Emission Factor Source**
			lbs/hr	**tpy**	
NO_X	0.40	lb/MWhe	0.08	0.35	Manufacturer's Specifications
VOC	0.10	lb/MWhe	0.02	0.09	Manufacturer's Specifications
CO	1.10	lb/MWhe	0.22	0.96	Manufacturer's Specifications
SO_X	0.003	lb/MMBtu	0.01	0.03	AP-42, Table 3.1-2a (Apr-2000)
PM_{10}	0.007	lb/MMBtu	0.02	0.07	AP-42, Table 3.1-2a (Apr-2000)
$PM_{2.5}$	0.007	lb/MMBtu	0.02	0.07	AP-42, Table 3.1-2a (Apr-2000)
GHG (CO_2e)	See Table Below		266	1,166	anufacturer's Specifications / 40 CFR 98, Table C
Other (Total HAP)	See Table Below		<0.01	0.01	AP-42, Table 3.1-3 (Apr-2000)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this engine type, including HCHC

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 3. Microturbine Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Maximum Potential Emissions Per Unit		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	1,330	lb/MWhe	266	1,165	Manufacturer's Specifications
CH_4	0.001	kg/MMBtu	0.01	0.02	40 CFR 98, Tables C-1 & C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
GHG (CO_2e)			**266**	**1,166**	
HAPs:					
1,3-Butadiene	4.3E-07	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Acetaldehyde	4.0E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Acrolein	6.4E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Benzene	1.2E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Ethylbenzene	3.2E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Formaldehyde	7.1E-04	lb/MMBtu	<0.01	0.01	AP-42, Table 3.1-3 (Apr-2000)
Naphthalene	1.3E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
PAH	2.2E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Propylene oxide	2.9E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Toluene	1.3E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Xylene	6.4E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Total HAP			**0.002**	**0.010**	

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 4. Fuel Gas Heater Emissions Calculations

Fuel Gas Heater Information:

Source ID:	H-9300, H-9400
Number of Units:	2

Fuel Gas Heater Information:

Fuel Type:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,023
Heat Input (MMBtu/hr)	1.15
Potential Fuel Consumption (MMBtu/yr):	10,074
Max. Fuel Consumption (MMscf/hr):	0.0011
Max. Fuel Consumption (MMscf/yr):	9.9
Max. Annual Hours of Operation (hr/yr):	8,760

Fuel Gas Heater Information:

Pollutant	Emission Factor	Units	Maximum Potential Emissions Per Unit		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	100	lb/MMScf	0.11	0.49	AP-42, Table 1.4-1 (Jul-1998)
VOC	5.5	lb/MMScf	0.01	0.03	AP-42, Table 1.4-2 (Jul-1998)
CO	84	lb/MMScf	0.09	0.41	AP-42, Table 1.4-1 (Jul-1998)
SO_X	0.6	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
PM_{10}	7.6	lb/MMScf	0.01	0.04	AP-42, Table 1.4-2 (Jul-1998)
$PM_{2.5}$	7.6	lb/MMScf	0.01	0.04	AP-42, Table 1.4-2 (Jul-1998)
Formaldehyde (HCHO)	0.08	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
GHG (CO_2e)	See Table Below		135	590	40 CFR 98, Tables C-1 & C-2
Other (Total HAP)	See Table Below		<0.01	0.01	AP-42, Tables 1.4-3 & 1.4-4 (Jul-1998)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this source type.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 4. Fuel Gas Heater Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Maximum Potential Emissions Per Unit		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	53.06	kg/MMBtu	134.55	589	40 CFR 98, Tables C-1 & C-2
CH_4	0.001	kg/MMBtu	<0.01	0.01	40 CFR 98, Tables C-1 & C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
GHG (CO_2e)			**135**	**590**	
Organic HAPs:					
2-Methylnaphthalene	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
3-Methylchloranthrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthylene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Anthracene	2.40E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benz(a)anthracene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzene	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(a)pyrene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Chrysene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dichlorobenzene	1.20E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluoranthene	3.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluorene	2.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
n-Hexane	1.80E+00	lb/MMscf	<0.01	0.01	AP-42, Table 1.4-3 (Jul-1998)
Indeno(1,2,3-c,d)pyrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Naphthalene	6.10E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Phenanthrene	1.70E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Pyrene	5.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Toluene	3.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Metal HAPs:					
Arsenic	2.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Beryllium	4.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cadmium	1.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Chromium	1.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cobalt	8.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Lead	5.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
Manganese	3.80E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Mercury	2.60E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Nickel	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 4. Fuel Gas Heater Emissions Calculations

Selenium	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Total HAP			**0.002**	**0.01**	

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 5. Storage Tank Emissions Calculations - Produced Fluids Tank

Storage Tank Information:

Source ID:	T001
Tank Capacity (gallons):	8,820
Tank Contents:	Produced Fluids
Annual Throughput (gallons/year):	105,840
Daily Throughput (bbl/day)	7
Percent Condensate	1%
Condensate Throughput (bbl/day)	0.1
Control Type:	None
Control Efficiency:	N/A
Max. Annual Hours of Operation (hr/yr):	8,760

Tank Emissions Data:

Pollutant	Uncontrolled Emissions		Controlled Emissions		Emissions Estimation Method
	lbs/hr	tpy	lbs/hr	tpy	
VOC	<0.01	0.01	<0.01	0.01	BRE ProMax
HAPs	<0.01	0.01	<0.01	0.01	BRE ProMax
CH4	0.08	0.34	0.08	0.34	BRE ProMax
CO2	0.01	0.04	0.01	0.04	BRE ProMax
GHG (CO2e)	1.93	8.44	1.93	8.44	BRE ProMax

Liquid Loading Emissions Data:

Pollutant	Uncontrolled Emissions		Controlled Emissions		Emissions Estimation Method
	lbs/hr	tpy	lbs/hr	tpy	
VOC	<0.01	<0.01	<0.01	<0.01	BRE ProMax
HAPs	<0.01	<0.01	<0.01	<0.01	BRE ProMax
CH4	<0.01	<0.01	<0.01	<0.01	BRE ProMax
CO2	<0.01	<0.01	<0.01	<0.01	BRE ProMax
GHG (CO_2e)	<0.01	0.01	<0.01	0.01	BRE ProMax

Notes:
1. BRE ProMax software estimates working, breathing, and flashing losses and reports as one total.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
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TABLE 6. Miscellaneous Storage Tank Emissions Calculations

Storage Tank Information:

Source ID:	T002	T003	T004	T005	T006
Tank Capacity (gallons):	4,200	2,100	2,100	2,100	2,100
Tank Contents:	Used Oil	Engine Oil	Engine Oil	MEG	MEG
Annual Throughput (gallons/year):	2,100	2,100	2,100	2,100	2,100
Control Type:	None	None	None	None	None
Control Efficiency:	N/A	N/A	N/A	N/A	N/A
Max. Annual Hours of Operation (hr/yr):	8,760	8,760	8760	8,760	8,760

Emissions Data:

Pollutant	**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**	
	lbs/hr	**tpy**	**lbs/hr**	**tpy**	**lbs/hr**	**tpy**	**lbs/hr**	**tpy**	**lbs/hr**	**tpy**
VOC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
HAPs	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:
1. EPA TANKS software run for engine/compressor oil and used oil tanks are using properties of distillate fuel oil #2.
2. EPA TANKS software run for TEG and Used MEG are using properties of propylene glycol.
3. These tanks do not contain hydrocarbons that would be expected to be flashed off at tank operating conditions.

Tank Emissions Data:

Pollutant	**Total Emissions**		**Emissions Estimation Method**
	lbs/hr	**tpy**	
VOC	<0.01	<0.01	EPA Tanks 4.0.9d
HAPs	<0.01	<0.01	EPA Tanks 4.0.9d

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 7. Fugitive and Blowdown Emissions Calculations

Fugitive Component Information:

Component Type	Estimated Component Count	Gas Leak Emission Factor	Average Gas Leak Rate	Max Gas Leak Rate	Potential VOC Emissions	Potential HAP Emissions
		(lb/hr/component)	(lb/hr)	(tpy)	(tpy)	(tpy)
Connectors	1,209	4.4E-04	0.53	2.57	0.01	<0.01
Flanges	1,209	8.6E-04	1.04	5.01	0.01	<0.01
Open-Ended Lines	12	4.4E-03	0.05	0.25	<0.01	<0.01
Pump Seals	2	5.3E-03	0.01	0.05	<0.01	<0.01
Valves	276	9.9E-03	2.74	13.19	0.03	<0.01
Other	12	1.9E-02	0.23	1.12	<0.01	<0.01
Total			**4.61**	**22.20**	**0.04**	**<0.01**

Notes:
1. "Other" equipment type includes compressor seals, relief valves, etc. Default component counts from Subpart W, Table W-1B with a safety factor of 3
2. Emission factors from EPA's Protocol for Equipment Leak Emission Estimates, Table 2-4 (11/1995)
3. Conservatively assumed that maximum leak rate is 10% greater than measured average leak rate for the purposes of establishing PTE.
4. VOC and HAP emissions are based on fractions of these pollutants in the site-specific gas analysis.

GHG Fugitive Emissions from Component Leaks:

Component Type	Estimated Component Count	GHG Emission Factor		CH_4 Emissions	CO_2 Emissions	CO_2e Emissions
		scf/hr/component	Factor Source	(tpy)	(tpy)	(tpy)
Connectors	1,209	0.003	40 CFR 98, Table W-1A	0.65	0.006	16.36
Flanges	1,209	0.003	40 CFR 98, Table W-1A	0.65	0.006	16.36
Open-Ended Lines	12	0.061	40 CFR 98, Table W-1A	0.13	<0.01	3.30
Pump Seals	2	13.3	40 CFR 98, Table W-1A	4.80	0.045	119.95
Valves	276	0.03	40 CFR 98, Table W-1A	1.34	0.013	33.60
Other	12	0.04	40 CFR 98, Table W-1A	0.09	<0.01	2.16
Total				**7.67**	**0.07**	**191.73**

Notes:
1. CH_4 and CO_2 emissions are based on fractions of these pollutants in the site-specific gas analysis.
2. Emissions are calculated in accordance with Equations W-32a, W-35 and W-36 in Subpart W of 40 CFR 98.
3. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 7. Fugitive and Blowdown Emissions Calculations

Dry Seal Emissions

Unit	Number of Compressors	Leak Rate (scfm)	Total Volume NG Emitted (scf/yr)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	Potential CO_2 Emissions (tpy)	Potential CH_4 Emissions (tpy)	Potential CO_2e Emissions (tpy)
Mars-100	2	17	17,870,400	0.77	<0.01	3.45	367.84	9199.33
Total				**0.77**	**<0.01**	**3.45**	**367.84**	**9,199.33**

1. Leak rate from manufacturer.
2. GHG Calculated in accordance with Equations W-35 and W-36 in Subpart W of 40 CFR 98.
3. HAP/VOC Calculation: VOC emissions (tpy) = Volume vented (scf/yr) / 379 (scf/lbmol gas) x MW of gas (lb/lbmol) x wt% VOC/HAP x (1 ton/2000lb)

Vented Blowdown Emissions

Blowdown Emissions Sources	Vented Gas Volume Per Blowdown Event (scf)	Number of Blowdown Events per year	Total Volume NG Emitted (scf/yr)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	Potential CH_4 Emissions[1] (tpy)	Potential CO_2 Emissions[1] (tpy)	Potential CO_2e Emissions (tpy)
Station ESD Vent	305,839	1	305,839	0.01	<0.01	6.30	0.06	157
Suction Filter	21,340	12	256,083	0.01	<0.01	5.27	0.05	132
Pig Receiver	2,007	3	6,021	<0.01	<0.01	0.12	<0.01	3
Pig Launcher	14,959	3	44,878	<0.01	<0.01	0.92	0.01	23
Centrifugal Compressors	64,204	24	1,540,905	0.07	<0.01	31.72	0.30	793
Total				**0.09**	**<0.01**	**44.3**	**0.42**	**1,109**

1. HAP/VOC Calculation: VOC emissions (tpy) = Volume vented (scf/yr) / 379 (scf/lbmol gas) x MW of gas (lb/lbmol) x wt% VOC/HAP x (1 ton/2000lb)
2. GHG Calculated in accordance with Equations W-35 and W-36 in Subpart W of 40 CFR 98.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 8. Site-Specific Gas Analysis

Sample Location: Lumberport H557
Sample Date: 8/5/2014
HHV (Btu/scf): 1,023
MW (lb/lbmol): 16.47

Constituent	Natural Gas Stream Speciation (Vol. %)	Natural Gas Stream Speciation (Wt. %)
N2	0.2780	0.473
METHANE	97.2570	94.684
CO2	0.3330	0.890
ETHANE	2.0580	3.756
PROPANE	0.0740	0.198
I-BUTANE	0.0000	0.000
N-BUTANE	0.0000	0.000
I-PENTANE	0.0000	0.000
N-PENTANE	0.0000	0.000
I-HEXANES	0.0000	0.000
N-HEXANE	0.0000	0.000
BENZENE	0.0000	0.000
CYCLOHEXANE	0.0000	0.000
HEPTANES	0.0000	0.000
TOLUENE	0.0000	0.000
2,2,4 Trimethylpentane	0.0000	0.000
N-OCTANE	0.0000	0.000
E-BENZENE	0.0000	0.000
m,o,&p-XYLENE	0.0000	0.000
I-NONANES	0.0000	0.000
N-NONANE	0.0000	0.000
I-DECANES	0.0000	0.000
N-DECANE	0.0000	0.000
I-UNDECANES +	0.0000	0.000
Totals	100.000	100.000

TOC (Total)	99.39	98.64
VOC (Total)	0.07	0.20
HAP (Total)	0.00	0.00

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 9. Atmospheric Emissions from Each Source at the Facility

Source	Status	Pollutants																					
		VOC		NO_X		CO		HCHO		Total HAPs		PM_{10}		$PM_{2.5}$		SO_X		CO_2		CH_4		N_2O	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Turbine 1	Existing	0.51	2.31	7.32	32.08	1.49	7.15	0.08	0.34	0.12	0.53	2.44	10.68	2.44	10.68	0.46	2.02	15849	69424	3.42	15.20	0.03	0.13
Turbine 2	New	0.31	1.38	4.39	19.26	0.90	4.21	0.08	0.34	0.12	0.53	1.35	5.93	1.35	5.93	0.46	2.02	15849	69425	2.05	9.12	0.03	0.13
Microturbine 1	Existing	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 2	Existing	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 3	Existing	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 4	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 5	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Fuel Gas Heater 1	Existing	0.01	0.03	0.11	0.49	0.09	0.41	<0.01	<0.01	<0.01	0.01	0.01	0.04	0.01	0.04	<0.01	<0.01	135	589	<0.01	0.01	<0.01	<0.01
Fuel Gas Heater 2	New	0.01	0.03	0.11	0.49	0.09	0.41	<0.01	<0.01	<0.01	0.01	0.01	0.04	0.01	0.04	<0.01	<0.01	135	589	<0.01	0.01	<0.01	<0.01
Produced Fluids Tank (T001)	Existing	<0.01	0.01	--	--	--	--	--	--	<0.01	0.01	--	--	--	--	--	--	0.01	0.04	0.08	0.34	--	--
Misc Storage Tanks (T002-T006	Existing	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--
Blowdowns	Modified	0.02	0.09	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	0.09	0.42	10.12	44.33	--	--
Compressors	Modified	0.18	0.77	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	0.79	3.45	83.98	367.84	--	--
Fugitive Leaks	Modified	0.01	0.04	--	--	--	--	---	---	<0.01	<0.01	--	--	--	--	--	--	0.02	0.07	1.75	7.67	--	--
Liquid Loading	Modified	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	<0.01	<0.01	--	--
Facility-Wide		**1.14**	**5.09**	**12.34**	**54.08**	**3.68**	**17.00**	**0.16**	**0.72**	**0.26**	**1.14**	**3.89**	**17.02**	**3.89**	**17.02**	**0.96**	**4.21**	**33298**	**145857**	**101.43**	**444.62**	**0.06**	**0.27**

Notes:
1. PM_{10} and $PM_{2.5}$ emissions are filterable + condensable.

Bryan Research & Engineering, LLC

BR&E ProMax® 5.0

Simulation Report

Client Name: Corona Station
Location: Storage Tank Calculations
Job:

ProMax Filename: Corona Tank Emissions
ProMax Version: 5.0.21256.0
Property Stencil Name: Tank-1
Property Stencil Flowsheet: Flowsheet1

Emission Summary [Total]

Component Subset	**Tank Losses [ton/yr]**	Flashing Losses [ton/yr]	Working Losses [ton/yr]	Breathing Losses [ton/yr]	**Loading Losses [ton/yr]**
VOCs [C3+]	**0.012**	0.012	0.000	0.000	**0.000**
HAPs	**0.012**	0.012	0.000	0.000	**0.000**
BTEX	**0.012**	0.012	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

Bryan Research & Engineering, LLC
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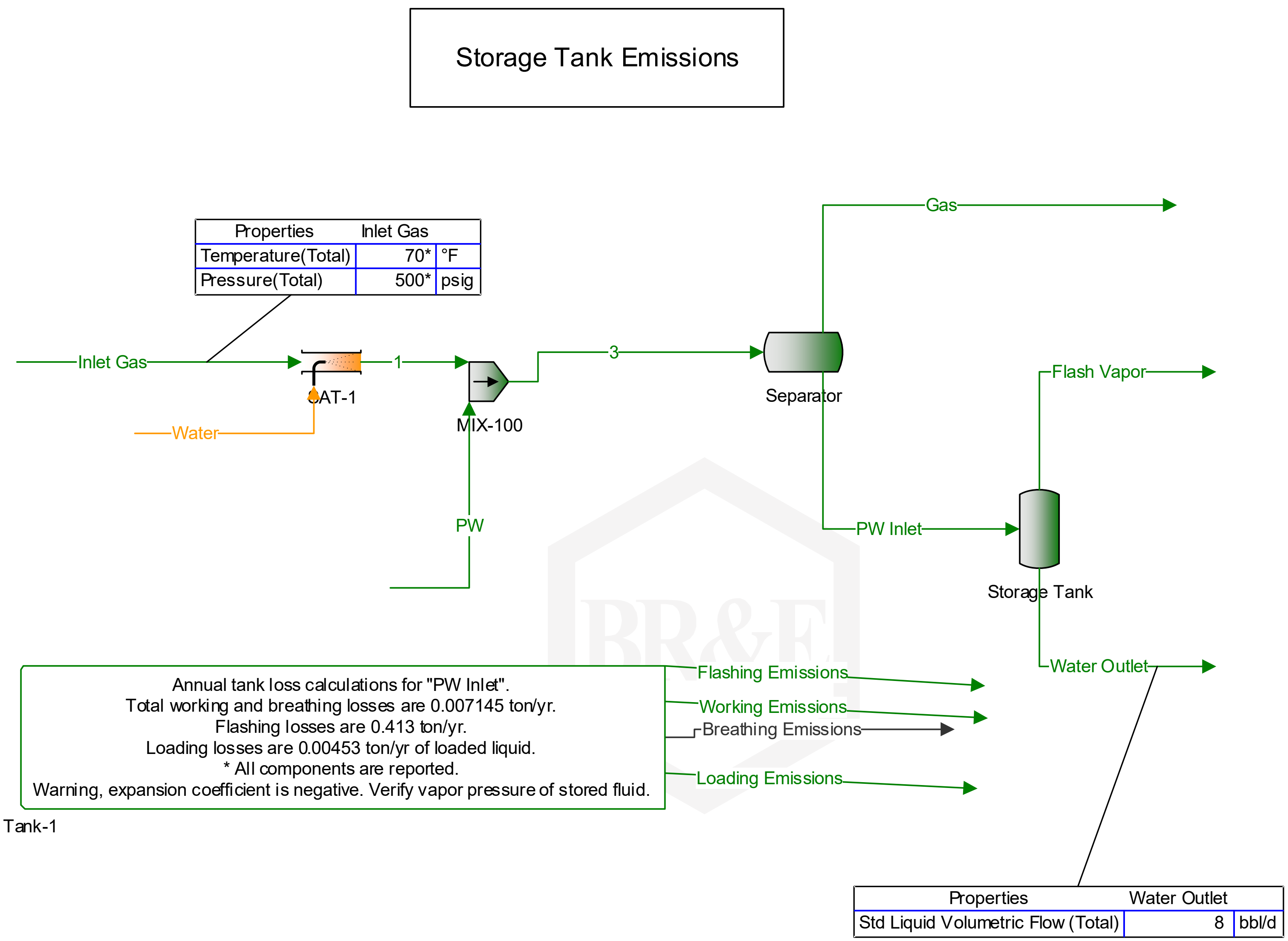
Report Navigator can be activated via the ProMax Navigator Toolbar.

Flowsheet1


Storage Tank Emissions
Properties | Inlet Gas
Temperature(Total) | 70* | °F
Pressure(Total) | 500* | psig
Inlet Gas
SAT-1
1
Water
MIX-100
PW
3
Separator
Gas
PW Inlet
Flash Vapor
Storage Tank
Water Outlet
Annual tank loss calculations for "PW Inlet".
Total working and breathing losses are 0.007145 ton/yr.
Flashing losses are 0.413 ton/yr.
Loading losses are 0.00453 ton/yr of loaded liquid.
* All components are reported.
Warning, expansion coefficient is negative. Verify vapor pressure of stored fluid.
Tank-1
Flashing Emissions
Working Emissions
Breathing Emissions
Loading Emissions
Properties | Water Outlet
Std Liquid Volumetric Flow (Total) | 8 | bbl/d

Inlet Stream Summary				
Stream Name		Inlet Gas	PW	Water
Stream Flowsheet		Flowsheet1	Flowsheet1	Flowsheet1
Temperature	°F	70.000	70.000	428.212
Pressure	psig	500.000	500.000	500.000
Standard Vapor Volumetric Flow	MSCFD	500000.000	57.082	682.354
Standard Liquid Volumetric Flow	bbl/d	203600.347	7.739	276.056
Vapor Fraction	(%)	100.000	0.000	42.402
Component		[Mol%]	[Mol%]	[Mol%]
Carbon Dioxide		0.333	0.000	0.000
Nitrogen		0.278	0.000	0.000
Oxygen		0.000	0.000	0.000
Methane		97.257	0.000	0.000
Ethane		2.058	0.000	0.000
Propane		0.074	0.000	0.000
Isobutane		0.000	0.000	0.000
n-Butane		0.000	0.000	0.000
i-Pentane		0.000	0.000	0.000
n-Pentane		0.000	0.000	0.000
Cyclopentane		0.000	0.000	0.000
n-Hexane		0.000	0.000	0.000
Cyclohexane		0.000	0.000	0.000
Heptane		0.000	0.000	0.000
Methylcyclohexane		0.000	0.000	0.000
2,2,4-Trimethylpentane		0.000	0.000	0.000
Benzene		0.000	0.000	15.000
Toluene		0.000	0.000	5.000
Ethylbenzene		0.000	0.000	5.000
m-Xylene		0.000	0.000	15.000
Octane		0.000	0.000	0.000
Water		0.000	100.000	60.000

Flowsheet Information			
Tank Losses Stencil Name		Tank-1	
Tank Losses Stencil Reference Stream		PW Inlet	
Tank Name		Storage Tank	
Tank Inlet Stream		PW Inlet	

Tank Characteristics			
Tank Type		Vertical Cylinder	
Time Frame		Year	
Material Category		Light Organics	
Number of Tanks		1.000	
Shell Height	[ft]	15.000	
Diameter [ft]	[ft]	10.000	
Maximum Liquid Height	[%] | [ft]	90.000	13.500
Average Liquid Height	[%] | [ft]	50.000	7.500
Minimum Liquid Height	[%] | [ft]	10.000	1.500
Sum of Increases in Liquid Level	[ft/yr]	-	
Tank Volume	[gal] | [bbl]	8812.779	209.828
Insulation		Uninsulated	
Bolted or Riveted Construction		FALSE	
Vapor Balance Tank		FALSE	
Paint Characteristics			
Shell Color		Dark Green	
Shell Paint Condition		Average	
Roof Color		Dark Green	
Roof Paint Condition		Average	
Roof Characteristics			
Type		Cone	
Diameter	[ft]	-	
Slope	[ft/ft]	0.063	
Breather Vent Settings			
Breather Vacuum Pressure	[psig]	-0.300	
Breather Vent Pressure	[psig]	0.700	

Loading Loss Parameters		
Cargo Carrier		Tank Truck or Rail Tank Car
Land Based Mode of Operation		Submerged Loading: Dedicated Normal Service
Marine Based Mode of Operation		-
Overall Reduction Efficiency	[%]	0.000

Meteorological Data			
Location		Pittsburgh, PA	
Average Atmospheric Pressure	[psia]	14.100	
Maximum Average Temperature	[°F]	60.400	
Minimum Average Temperature	[°F]	42.800	
Solar Insolation	[BTU/ft^2*day]	1170.000	
Average Wind Speed	[mph]	7.800	
Tank Conditions			
Flashing Temperature	[°F]	65.347	
Maximum Liquid Surface Temperature	[°F]	65.347	
Average Liquid Surface Temperature	[°F]	57.523	
Set Bulk Temperature to Stream Temperature?		FALSE	
Bulk Liquid Temperature	[°F]	54.759	
Net Throughput	[bbl/day] | [bbl/yr]	7.997	2918.773
Net Throughput Per Tank	[bbl/day] | [bbl/yr]	7.997	2918.773
Annual Turnovers Per Tank		8.693	
Residual Liquid	[bbl/day]		
Residual Liquid Per Tank	[bbl/day]	0.000	
Raoult's Law Used for Vapor Pressure Calc?		TRUE	
Vapor Pressure @ Minimum Liquid Surface Temperature	[psia]	0.204	
Vapor Pressure @ Maximum Liquid Surface Temperature	[psia]	0.341	
True Vapor Pressure @ Average Liquid Surface Temperature	[psia]	0.264	

Emission Summary [Total]					
Component Subset	**Tank Losses**	Flashing Losses	Working Losses	Breathing Losses	**Loading Losses**
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	**[ton/yr]**
VOCs [C3+]	**0.012**	0.012	0.000	0.000	**0.000**
HAPs	**0.012**	0.012	0.000	0.000	**0.000**
BTEX	**0.012**	0.012	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

Emission Summary [Per Tank]					
Component Subset	**Tank Losses**	Flashing Losses	Working Losses	Breathing Losses	**Loading Losses**
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	**[ton/yr]**
VOCs [C3+]	**0.012**	0.012	0.000	0.000	**0.000**
HAPs	**0.012**	0.012	0.000	0.000	**0.000**
BTEX	**0.012**	0.012	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

Stream Properties							
		Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
Molecular Weight	[lb/lbmol]	18.017	17.929	19.336	19.336	19.336	-
Net Ideal Gas Heating Value	[BTU/scf]	-	890.381	54.657	54.657	54.657	-
Specific Gravity		0.998	-	-	-	-	-
Reid Vapor Pressure	[psi]	1.163	-	-	-	-	-
API Gravity		10.073	-	-	-	-	-
Standard Vapor Volumetric Flow	[scf/d]	-	47.894	0.768	0.000	0.487	-
Standard Liquid Volumetric Flow	[bbl/d]	8.019	-	-	-	-	-

Stream Mass Flow [Total]							
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual	Total Emissions
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]
Carbon Dioxide	0.063	0.038	0.001	0.000	0.001	-	0.039
Nitrogen	0.001	0.001	0.000	0.000	0.000	-	0.001
Oxygen	0.000	0.000	0.000	0.000	0.000	-	0.000
Methane	0.346	0.336	0.000	0.000	0.000	-	0.336
Ethane	0.018	0.017	0.000	0.000	0.000	-	0.017
Propane	0.001	0.001	0.000	0.000	0.000	-	0.001
Isobutane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Butane	0.000	0.000	0.000	0.000	0.000	-	0.000
i-Pentane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Pentane	0.000	0.000	0.000	0.000	0.000	-	0.000
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Hexane	0.000	0.000	0.000	0.000	0.000	-	0.000
Cyclohexane	0.000	0.000	0.000	0.000	0.000	-	0.000
Heptane	0.000	0.000	0.000	0.000	0.000	-	0.000
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-	0.000
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-	0.000
Benzene	0.028	0.005	0.000	0.000	0.000	-	0.005
Toluene	0.007	0.002	0.000	0.000	0.000	-	0.002
Ethylbenzene	0.006	0.001	0.000	0.000	0.000	-	0.001
m-Xylene	0.012	0.004	0.000	0.000	0.000	-	0.004
Octane	0.000	0.000	0.000	0.000	0.000	-	0.000
Water	511.134	0.009	0.006	0.000	0.004	-	0.015

Stream Compostion						
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
	[Mol%]	[Mol%]	[Mol%]	[Mol%]	[Mol%]	[Mol%]
Carbon Dioxide	0.005	3.755	5.425	5.425	5.425	-
Nitrogen	0.000	0.141	0.003	0.003	0.003	-
Oxygen	0.000	0.000	0.000	0.000	0.000	-
Methane	0.076	90.843	5.695	5.695	5.695	-
Ethane	0.002	2.442	0.166	0.166	0.166	-
Propane	0.000	0.055	0.001	0.001	0.001	-
Isobutane	0.000	0.000	0.000	0.000	0.000	-
n-Butane	0.000	0.000	0.000	0.000	0.000	-
i-Pentane	0.000	0.000	0.000	0.000	0.000	-
n-Pentane	0.000	0.000	0.000	0.000	0.000	-
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-
n-Hexane	0.000	0.000	0.000	0.000	0.000	-
Cyclohexane	0.000	0.000	0.000	0.000	0.000	-
Heptane	0.000	0.000	0.000	0.000	0.000	-
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-
Benzene	0.001	0.267	0.004	0.004	0.004	-
Toluene	0.000	0.074	0.000	0.000	0.000	-
Ethylbenzene	0.000	0.058	0.000	0.000	0.000	-
m-Xylene	0.000	0.159	0.000	0.000	0.000	-
Octane	0.000	0.000	0.000	0.000	0.000	-
Water	99.915	2.206	88.707	88.707	88.707	-
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
	[Mass%]	[Mass%]	[Mass%]	[Mass%]	[Mass%]	[Mass%]
Carbon Dioxide	0.012	9.217	12.346	12.346	12.346	-
Nitrogen	0.000	0.220	0.005	0.005	0.005	-
Oxygen	0.000	0.000	0.000	0.000	0.000	-
Methane	0.068	81.285	4.724	4.724	4.724	-
Ethane	0.003	4.095	0.257	0.257	0.257	-
Propane	0.000	0.135	0.001	0.001	0.001	-
Isobutane	0.000	0.000	0.000	0.000	0.000	-
n-Butane	0.000	0.000	0.000	0.000	0.000	-
i-Pentane	0.000	0.000	0.000	0.000	0.000	-
n-Pentane	0.000	0.000	0.000	0.000	0.000	-
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-
n-Hexane	0.000	0.000	0.000	0.000	0.000	-
Cyclohexane	0.000	0.000	0.000	0.000	0.000	-
Heptane	0.000	0.000	0.000	0.000	0.000	-
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-
Benzene	0.006	1.162	0.018	0.018	0.018	-
Toluene	0.001	0.381	0.001	0.001	0.001	-
Ethylbenzene	0.001	0.346	0.000	0.000	0.000	-
m-Xylene	0.002	0.942	0.000	0.000	0.000	-
Octane	0.000	0.000	0.000	0.000	0.000	-
Water	99.906	2.217	82.646	82.646	82.646	-

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 1. Turbine Emissions Calculations

Turbine Information:

Source ID:	C2100, C2200
Manufacturer:	Solar
Model No.:	Taurus-70
Fuel Used:	Natural Gas
Fuel Lower Heating Value (Btu/scf):	935.6
Rated Horsepower (bhp):	11,016
Maximum Fuel Consumption at 100% Load (scf/hr):	88,670
Heat Input (MMBtu/hr) - LHV	82.96
Heat Input (MMBtu/hr) - HHV	92.09
Control Device:	Oxidation Catalyst

Operational Details:

Potential Annual Hours of Operation (hr/yr):	8,760
Potential Fuel Consumption (MMscf/yr):	776.75
Potential Startup/Shutdown Events (per yea	12

Manufacturer Specific Pollutant Emission Factors:

Pollutant	Emission Factors	Units	Emission Factor Source
NO_X	0.036	lb/MMBtu (LHV)	Manufacturer
CO	0.007	lb/MMBtu (LHV)	Manufacturer
SO_2	0.003	lb/MMBtu (HHV)	Manufacturer
PM_{10}	0.010	lb/MMBtu (HHV)	Manufacturer
$PM_{2.5}$	0.010	lb/MMBtu (HHV)	Manufacturer
VOC	0.003	lb/MMBtu (LHV)	20% of UHC per Manufacturer
Formaldehyde	0.001	lb/MMBtu (HHV)	Manufacturer
CO_2	117.00	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-1
CH_4	0.017	lb/MMBtu (LHV)	80% of UHC per Manufacturer
N_2O	2.2E-04	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-2

*Emission factors from AP-42 and Subpart C are based on HHV. Emission factor basis notes which heat input value is used for calculations.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 1. Turbine Emissions Calculations

Pollutant Emission Rates:

Pollutant	Potential Emissions (lb/hr)[1]	(tpy)[2]
NO_X	2.99	13.09
CO	0.61	3.13
SO_2	0.31	1.37
PM_{10}	0.92	4.03
$PM_{2.5}$	0.92	4.03
VOC	0.21	1.04
Formaldehyde	0.05	0.23
CO_2	10,774	47,193
CH_4	1.39	6.60
N_2O	0.02	0.09
GHG (CO_2e)	10,815	47,385

Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)

Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable

Company Name: Equitrans, LP
Facility Name: Cygrymus Compressor Station
Project Description: Resource Report 9

TABLE 1. Turbine Emissions Calculations

Hazardous Air Pollutant (HAP) Emission Rates:

Pollutant	Emission Factor (lb/MMBtu)[3]	Potential Emissions (lb/hr)[1]	(tpy)[2]
HAPs:			
Acetaldehyde	4.00E-05	3.68E-03	1.61E-02
Acrolein	6.40E-06	5.89E-04	2.58E-03
Benzene	1.20E-05	1.11E-03	4.84E-03
1,3-Butadiene	4.30E-07	3.96E-05	1.73E-04
Propylene Oxide	2.90E-05	2.67E-03	1.17E-02
Ethylbenzene	3.20E-05	2.95E-03	1.29E-02
Toluene	1.30E-04	1.20E-02	5.24E-02
Xylene	6.40E-05	5.89E-03	2.58E-02
Polycyclic Organic Matter:			
Naphthalene	1.30E-06	1.20E-04	5.24E-04
PAH	2.20E-06	2.03E-04	8.87E-04
Total HAP (Including HCHO)		**0.08**	**0.36**

Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)
Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable
Emission factors from AP-42 Section 3.1, Table 3.1-3 "Emission Factors for HAPs from Natural Gas Fired Stationary Gas Turbines", April 2000. Factors are based on HHV.

Startup/Shutdown Combustion Emission Factors:

Pollutant	Startup Emissions[1] (lbs/event)	Shutdown Emissions[1] (lbs/event)	Emission Factor Source
NO_X	1	1	Manufacturer
CO	37	36	Manufacturer
VOC	10	10	Manufacturer
CH_4	41.6	41.6	80% of UHC per Manufacturer
CO_2	381	295	Manufacturer

Each startup and shutdown event is estimated to last approximately 10 minutes, per manufacturer.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 2. Microturbine Emissions Calculations

Microturbine Unit Information:

Source ID:	G-9401 - G-9405
Manufacturer:	Capstone
Model No.:	C200
Number of Units:	5

Microturbine Fuel Information:

	Per Unit	As Combined
Fuel Type:	Natural Gas	Natural Gas
Rated Electrical Power Output (kW):	200	1,000
Rated Electrical Power Output (MW):	0.2	1
Rated Horsepower (bhp):	268.2	1,341
Heat Input (MMBtu/hr)	2.28	11.4
Maximum Fuel Consumption at 100% Load (scf/hr):	2,198	10,989
Maximum Fuel Consumption at 100% Load (mmscf/y	19.25	96.26
Potential Fuel Consumption (MMBtu/yr):	19,973	99,864
Max. Annual Hours of Operation (hr/yr):	8,760	8,760

Microturbine Emissions Data:

Pollutant	Emission Factors	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	0.40	lb/MWhe	0.08	0.35	Manufacturer's Specifications
VOC	0.10	lb/MWhe	0.02	0.09	Manufacturer's Specifications
CO	1.10	lb/MWhe	0.22	0.96	Manufacturer's Specifications
SO_X	0.003	lb/MMBtu	0.01	0.03	AP-42, Table 3.1-2a (Apr-2000)
PM_{10}	0.007	lb/MMBtu	0.02	0.07	AP-42, Table 3.1-2a (Apr-2000)
$PM_{2.5}$	0.007	lb/MMBtu	0.02	0.07	AP-42, Table 3.1-2a (Apr-2000)
GHG (CO_2e)	See Table Below		266	1,166	Manufacturer's Specifications / 40 CFR 98, Table C-2
Other (Total HAP)	See Table Below		<0.01	0.01	AP-42, Table 3.1-3 (Apr-2000)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this engine type, including HCHO.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 2. Microturbine Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	1,330	lb/MWhe	266	1,165	Manufacturer's Specifications
CH_4	0.001	kg/MMBtu	0.01	0.02	40 CFR 98, Table C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Table C-2
GHG (CO_2e)			**266**	**1,166**	
HAPs:					
1,3-Butadiene	4.3E-07	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Acetaldehyde	4.0E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Acrolein	6.4E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Benzene	1.2E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Ethylbenzene	3.2E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Formaldehyde	7.1E-04	lb/MMBtu	<0.01	0.01	AP-42, Table 3.1-3 (Apr-2000)
Naphthalene	1.3E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
PAH	2.2E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Propylene oxide	2.9E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Toluene	1.3E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Xylene	6.4E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Total HAP			**0.002**	**0.010**	

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 3. Fuel Gas Heater Emissions Calculations

Fuel Gas Heater Information:

Source ID:	H-9110
Number of Units:	1

Fuel Gas Heater Information:

Fuel Type:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,037
Heat Input (MMBtu/hr)	1.15
Potential Fuel Consumption (MMBtu/yr):	10,074
Max. Fuel Consumption (MMscf/hr):	0.0011
Max. Fuel Consumption (MMscf/yr):	9.7
Max. Annual Hours of Operation (hr/yr):	8,760

Fuel Gas Heater Information:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	100	lb/MMScf	0.11	0.49	AP-42, Table 1.4-1 (Jul-1998)
VOC	5.5	lb/MMScf	0.01	0.03	AP-42, Table 1.4-2 (Jul-1998)
CO	84	lb/MMScf	0.09	0.41	AP-42, Table 1.4-1 (Jul-1998)
SO_X	0.6	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
PM_{10}	7.6	lb/MMScf	0.01	0.04	AP-42, Table 1.4-2 (Jul-1998)
$PM_{2.5}$	7.6	lb/MMScf	0.01	0.04	AP-42, Table 1.4-2 (Jul-1998)
Formaldehyde (HCHO)	0.08	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
GHG (CO_2e)	See Table Below		135	590	40 CFR 98, Tables C-1 & C-2
Other (Total HAP)	See Table Below		<0.01	0.01	AP-42, Tables 1.4-3 & 1.4-4 (Jul-1998)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this source type.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 3. Fuel Gas Heater Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	53.06	kg/MMBtu	134.55	589	40 CFR 98, Tables C-1 & C-2
CH_4	0.001	kg/MMBtu	<0.01	0.01	40 CFR 98, Tables C-1 & C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
GHG (CO_2e)			**135**	**590**	
Organic HAPs:					
2-Methylnaphthalene	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
3-Methylchloranthrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthylene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Anthracene	2.40E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benz(a)anthracene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzene	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(a)pyrene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Chrysene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dichlorobenzene	1.20E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluoranthene	3.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluorene	2.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
n-Hexane	1.80E+00	lb/MMscf	<0.01	0.01	AP-42, Table 1.4-3 (Jul-1998)
Indeno(1,2,3-c,d)pyrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Naphthalene	6.10E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Phenanthrene	1.70E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Pyrene	5.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Toluene	3.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Metal HAPs:					
Arsenic	2.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Beryllium	4.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cadmium	1.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Chromium	1.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cobalt	8.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Lead	5.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
Manganese	3.80E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Mercury	2.60E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Nickel	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 3. Fuel Gas Heater Emissions Calculations

Selenium	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Total HAP			**0.002**	**0.01**	

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 4. Fuel Gas Heater Emissions Calculations

Fuel Gas Heater Information:

Source ID:	H-9310
Number of Units:	1

Fuel Gas Heater Information:

Fuel Type:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,037
Heat Input (MMBtu/hr)	0.38
Potential Fuel Consumption (MMBtu/yr):	3,329
Max. Fuel Consumption (MMscf/hr):	0.0004
Max. Fuel Consumption (MMscf/yr):	3.2
Max. Annual Hours of Operation (hr/yr):	8,760

Fuel Gas Heater Information:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	100	lb/MMScf	0.04	0.16	AP-42, Table 1.4-1 (Jul-1998)
VOC	5.5	lb/MMScf	<0.01	0.01	AP-42, Table 1.4-2 (Jul-1998)
CO	84	lb/MMScf	0.03	0.13	AP-42, Table 1.4-1 (Jul-1998)
SO_X	0.6	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
PM_{10}	7.6	lb/MMScf	<0.01	0.01	AP-42, Table 1.4-2 (Jul-1998)
$PM_{2.5}$	7.6	lb/MMScf	<0.01	0.01	AP-42, Table 1.4-2 (Jul-1998)
Formaldehyde (HCHO)	0.08	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
GHG (CO_2e)	See Table Below		45	195	40 CFR 98, Tables C-1 & C-2
Other (Total HAP)	See Table Below		<0.01	<0.01	AP-42, Tables 1.4-3 & 1.4-4 (Jul-1998)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this source type.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 4. Fuel Gas Heater Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	53.06	kg/MMBtu	44.46	195	40 CFR 98, Tables C-1 & C-2
CH_4	0.001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
GHG (CO_2e)			**45**	**195**	
Organic HAPs:					
2-Methylnaphthalene	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
3-Methylchloranthrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthylene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Anthracene	2.40E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benz(a)anthracene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzene	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(a)pyrene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Chrysene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dichlorobenzene	1.20E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluoranthene	3.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluorene	2.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
n-Hexane	1.80E+00	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Indeno(1,2,3-c,d)pyrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Naphthalene	6.10E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Phenanthrene	1.70E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Pyrene	5.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Toluene	3.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Metal HAPs:					
Arsenic	2.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Beryllium	4.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cadmium	1.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Chromium	1.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cobalt	8.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Lead	5.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
Manganese	3.80E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Mercury	2.60E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Nickel	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 4. Fuel Gas Heater Emissions Calculations

Selenium	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Total HAP			**0.001**	**0.00**	

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 5. Storage Tank Emissions Calculations - Produced Fluids Tank

Storage Tank Information:

Source ID:	T01-T02
Tank Capacity (gallons):	8,820
Tank Contents:	Produced Fluids
Annual Throughput (gallons/year):	52,920
Daily Throughput (bbl/day)	3
Percent Condensate	1%
Condensate Throughput (bbl/day)	0.0
Control Type:	None
Control Efficiency:	N/A
Max. Annual Hours of Operation (hr/yr)	8,760

Tank Emissions Data (Per Tank):

Pollutant	Uncontrolled Emissions		Controlled Emissions		Emissions Estimation Method
	lbs/hr	tpy	lbs/hr	tpy	
VOC	<0.01	<0.01	<0.01	<0.01	BRE ProMax
HAPs	<0.01	<0.01	<0.01	<0.01	BRE ProMax
CH4	0.02	0.08	0.02	0.08	BRE ProMax
CO2	<0.01	0.01	<0.01	0.01	BRE ProMax
GHG (CO2e)	0.47	2.08	0.47	2.08	BRE ProMax

Notes:
1. BRE ProMax software estimates working, breathing, and flashing losses and reports as one total.

Loading Emissions Information:

Pollutant	Uncontrolled Emissions		Controlled Emissions		Emissions Estimation Method
	lbs/hr	tpy	lbs/hr	tpy	
VOC	<0.01	<0.01	<0.01	<0.01	BRE ProMax
HAPs	<0.01	<0.01	<0.01	<0.01	BRE ProMax
CH4	<0.01	<0.01	<0.01	<0.01	BRE ProMax
CO2	<0.01	<0.01	<0.01	<0.01	BRE ProMax
GHG (CO2e)	<0.01	<0.01	<0.01	<0.01	BRE ProMax

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 6. Miscellaneous Storage Tank Emissions Calculations

Storage Tank Information:

Source ID:	T003	T004
Tank Capacity (gallons):	2,016	550
Tank Contents:	Used Oil	TEG
Annual Throughput (gallons/year):	2,100	504
Control Type:	None	None
Control Efficiency:	N/A	N/A
Max. Annual Hours of Operation (hr/yr):	8,760	8,760

Emissions Data:

Pollutant	**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**	
	lbs/hr	**tpy**	**lbs/hr**	**tpy**
VOC	<0.01	<0.01	<0.01	<0.01
HAPs	<0.01	<0.01	<0.01	<0.01

Notes:
1. EPA TANKS software run for used oil tank used properties of distillate fuel oil #2.
2. EPA TANKS software run for TEG used properties of propylene glycol.
3. These tanks do not contain hydrocarbons that would be expected to be flashed off at tank operating condi

Tank Emissions Data:

Pollutant	**Total Emissions**		**Emissions Estimation Method**
	lbs/hr	**tpy**	
VOC	<0.01	<0.01	EPA Tanks 4.0.9d
HAPs	<0.01	<0.01	EPA Tanks 4.0.9d

Company Name: Equitrans, LP
Facility Name: Cygrymus Compressor Station
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TABLE 7. Fugitive and Blowdown Emissions Calculations

Fugitive Component Information:

Component Type	Estimated Component Count	Gas Leak Emission Factor (lb/hr/component)	Average Gas Leak Rate (lb/hr)	Max Gas Leak Rate (tpy)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)
Connectors	1,450	4.4E-04	0.64	3.08	0.02	<0.01
Flanges	495	8.6E-04	0.43	2.05	0.02	<0.01
Open-Ended Lines	20	4.4E-03	0.09	0.42	<0.01	<0.01
Pump Seals	2	5.3E-03	0.01	0.05	<0.01	<0.01
Valves	570	9.9E-03	5.65	27.25	0.21	0.01
Other	72	1.9E-02	1.40	6.73	0.05	<0.01
Total			**8.22**	**39.58**	**0.31**	**0.02**

Notes:
1. "Other" equipment types include compressor seals, relief valves, diaphragms, drains, meters, etc.
2. Emission factors from EPA's Protocol for Equipment Leak Emission Estimates, Table 2-4 (11/1995)
3. Conservatively assumed that maximum leak rate is 10% greater than measured average leak rate for the purposes of establishing PTE.
4. VOC and HAP emissions are based on fractions of these pollutants in the site-specific gas analysis.

GHG Fugitive Emissions from Component Leaks:

Component Type	Estimated Component Count	GHG Emission Factor		CH_4 Emissions	CO_2 Emissions	CO_2e Emissions
		scf/hr/component	Factor Source	(tpy)	(tpy)	(tpy)
Connectors	1,450	0.003	40 CFR 98, Table W-1A	0.77	0.005	19.25
Flanges	495	0.003	40 CFR 98, Table W-1A	0.26	<0.01	6.57
Open-Ended Lines	20	0.061	40 CFR 98, Table W-1A	0.22	<0.01	5.40
Pump Seals	2	13.3	40 CFR 98, Table W-1A	4.71	0.033	117.71
Valves	570	0.03	40 CFR 98, Table W-1A	2.72	0.019	68.10
Other	72	0.04	40 CFR 98, Table W-1A	0.51	<0.01	12.74
Total				**9.19**	**0.06**	**229.78**

Notes:
1. CH_4 and CO_2 emissions are based on fractions of these pollutants in the site-specific gas analysis.
2. Emissions are calculated in accordance with Equations W-32a, W-35 and W-36 in Subpart W of 40 CFR 98.
3. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 7. Fugitive and Blowdown Emissions Calculations

Dry Seal Emissions

Compressor ID	Number of Compressors	Leak Rate (scf/hr/seal)	Total Volume NG Emitted (scf/yr)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	Potential CO_2 Emissions (tpy)	Potential CH_4 Emissions (tpy)	Potential CO_2e Emissions (tpy)
T-70	2	1020	17,870,400	3.07	0.17	2.54	360.99	9027.37
Total				**3.07**	**0.17**	**2.54**	**360.99**	**9,027.37**

1. Leak rate from manufacturer.
2. GHG Calculated in accordance with Equations W-35 and W-36 in Subpart W of 40 CFR 98.
3. HAP/VOC Calculation: VOC emissions (tpy) = Volume vented (scf/yr) / 379 (scf/lbmol gas) x MW of gas (lb/lbmol) x wt% VOC/HAP x (1 ton/2000lb)

VOC and HAP Vented Blowdown Emissions

Blowdown Emissions Sources	Vented Gas Volume Per Blowdown Event (scf)	Number of Blowdown Events per year	Total Volume NG Emitted (scf/yr)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	Potential CH_4 Emissions[1] (tpy)	Potential CO_2 Emissions[1] (tpy)	Potential CO_2e Emissions (tpy)
Station ESD	250,000	1	250,000	0.04	<0.01	5.05	0.04	126
C2100 Blowdown	15,000	4	60,000	0.01	<0.01	1.21	0.01	30
C2200 Blowdown	15,000	4	60,000	0.01	<0.01	1.21	0.01	30
C2100 Cold Startup	14,688	4	58,752	0.01	<0.01	1.19	0.01	30
C2200 Cold Startup	14,688	4	58,752	0.01	<0.01	1.19	0.01	30
Existing Pig Receiver	1,820	52	94,640	0.02	<0.01	1.91	0.01	48
Pig Receiver	1,200	1	1,200	<0.01	<0.01	0.02	<0.01	1
Pig Launcher	1,000	1	1,000	<0.01	<0.01	0.02	<0.01	1
Main Gas Filter Blowdown	4,666	3	13,997	<0.01	<0.01	0.28	<0.01	7
Total				**0.10**	**0.01**	**12.09**	**0.08**	**302.26**

1. HAP/VOC Calculation: VOC emissions (tpy) = Volume vented (scf/yr) / 379 (scf/lbmol gas) x MW of gas (lb/lbmol) x wt% VOC/HAP x (1 ton/2000lb)
2. GHG Calculated in accordance with Equations W-35 and W-36 in Subpart W of 40 CFR 98.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 8. Reboiler Emissions Calculations

Reboiler Information:

Source ID:	Reboiler
Number of Units:	1

Reboiler Information:

Fuel Type:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,037
Heat Input (MMBtu/hr)	3.08
Potential Fuel Consumption (MMBtu/yr):	26,955
Max. Fuel Consumption (MMscf/hr):	0.0030
Max. Fuel Consumption (MMscf/yr):	26.0
Max. Annual Hours of Operation (hr/yr):	8,760

Reboiler Emissions:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	100	lb/MMScf	0.30	1.30	AP-42, Table 1.4-1 (Jul-1998)
VOC	5.5	lb/MMScf	0.02	0.07	AP-42, Table 1.4-2 (Jul-1998)
CO	84	lb/MMScf	0.25	1.09	AP-42, Table 1.4-1 (Jul-1998)
SO_X	0.6	lb/MMScf	<0.01	0.01	AP-42, Table 1.4-2 (Jul-1998)
PM_{10}	7.6	lb/MMScf	0.02	0.10	AP-42, Table 1.4-2 (Jul-1998)
$PM_{2.5}$	7.6	lb/MMScf	0.02	0.10	AP-42, Table 1.4-2 (Jul-1998)
Formaldehyde (HCHO)	0.08	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
GHG (CO_2e)	See Table Below		360	1,578	40 CFR 98, Tables C-1 & C-2
Other (Total HAP)	See Table Below		0.01	0.02	AP-42, Tables 1.4-3 & 1.4-4 (Jul-1998)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this source type.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 8. Reboiler Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	53.06	kg/MMBtu	360.00	1,577	40 CFR 98, Tables C-1 & C-2
CH_4	0.001	kg/MMBtu	0.01	0.03	40 CFR 98, Tables C-1 & C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
GHG (CO_2e)			**360**	**1,578**	
Organic HAPs:					
2-Methylnaphthalene	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
3-Methylchloranthrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthylene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Anthracene	2.40E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benz(a)anthracene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzene	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(a)pyrene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Chrysene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dichlorobenzene	1.20E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluoranthene	3.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluorene	2.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
n-Hexane	1.80E+00	lb/MMscf	0.01	0.02	AP-42, Table 1.4-3 (Jul-1998)
Indeno(1,2,3-c,d)pyrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Naphthalene	6.10E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Phenanthrene	1.70E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Pyrene	5.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Toluene	3.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Metal HAPs:					
Arsenic	2.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Beryllium	4.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cadmium	1.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Chromium	1.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cobalt	8.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Lead	5.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
Manganese	3.80E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Mercury	2.60E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Nickel	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 8. Reboiler Emissions Calculations

Selenium	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Total HAP			**0.005**	**0.02**	

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Statior**
Project Description: **Resource Report 9**

TABLE 9. Dehydrator Emissions Calculations

Dehydrator Information:

Rating (MMscfd)	150
Temperature (F)	80
Pressure (psig)	1,200
Glycol Pump Rate (gpm)	27.6
Flash Tank Temperature (F)	100
Flash Tank Pressure (psig)	60
Max. Annual Hours of Operation (hr/yr):	8,760

Dehydrator Emissions:

Pollutant	Potential Emissions	
	lbs/hr	tpy
VOC	0.31	1.36
HAP	0.26	1.15
n-hexane	<0.01	0.02
Toluene	0.26	1.13
Methane	1.16	5.06
CO_2	6.04	26.46
GHG (CO_2e)	35	153

Notes:
1. Emissions calculated using GRI-GLYCalc version 4.0

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 10. Combustor Emissions Calculations

Source ID:	Combustor
Number of Units:	1

Combustor Information:

Fuel Type:	Process Gas
Higher Heating Value (HHV) (Btu/scf):	1,037
Heat Input (MMBtu/hr)	12.09
Potential Fuel Consumption (MMBtu/yr):	105,908
Max. Fuel Consumption (MMscf/hr):	0.0117
Max. Fuel Consumption (MMscf/yr):	102.1
Max. Annual Hours of Operation (hr/yr):	8,760

Combustor Emissions:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	0.098	lb/MMBtu	1.19	5.19	AP-42, Table 1.4-1 (Jul-1998)
VOC	0.005	lb/MMBtu	0.07	0.29	AP-42, Table 1.4-2 (Jul-1998)
CO	0.082	lb/MMBtu	1.00	4.36	AP-42, Table 1.4-1 (Jul-1998)
SO_X	0.001	lb/MMBtu	0.01	0.03	AP-42, Table 1.4-2 (Jul-1998)
PM_{10}	0.007	lb/MMBtu	0.09	0.39	AP-42, Table 1.4-2 (Jul-1998)
$PM_{2.5}$	0.007	lb/MMBtu	0.09	0.39	AP-42, Table 1.4-2 (Jul-1998)
GHG (CO_2e)	See Table Below		1,416	6,202	40 CFR 98, Tables C-1 & C-2

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	53.06	kg/MMBtu	1414.50	6,195	40 CFR 98, Table C-1
CH_4	0.001	kg/MMBtu	0.03	0.12	40 CFR 98, Table C-2
N_2O	0.0001	kg/MMBtu	<0.01	0.01	40 CFR 98, Table C-2
GHG (CO_2e)			**1,416**	**6,202**	

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 11. Generator Emissions Calculations

Source ID:	Generator
Number of Units:	1

Generator Information:

Fuel Type:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,037
Engine Rating (bhp)	304
Brake Specific Fuel Consumption (Btu/bhp-hr)	8,626
Heat Input (MMBtu/hr)	2.62
Potential Fuel Consumption (MMBtu/yr):	22,971
Max. Fuel Consumption (MMscf/hr):	0.0025
Max. Fuel Consumption (MMscf/yr):	22.1
Max. Annual Hours of Operation (hr/yr):	8,760

Generator Emissions:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	0.13	g/bhp-hr	0.09	0.38	Manufacturer
VOC	0.53	g/bhp-hr	0.36	1.56	Manufacturer
CO	0.53	g/bhp-hr	0.36	1.56	Manufacturer
SO_X	5.88E-04	lb/MMBtu	<0.01	0.01	AP-42, Table 3.2-2 (Jul-2000)
PM_{10}	9.99E-03	lb/MMBtu	0.03	0.11	AP-42, Table 3.2-2 (Jul-2000)
$PM_{2.5}$	9.99E-03	lb/MMBtu	0.03	0.11	AP-42, Table 3.2-2 (Jul-2000)
GHG (CO_2e)	See Table Below		307	1,345	40 CFR 98, Tables C-1 & C-2
Other (Total HAP)	See Table Below		0.19	0.83	AP-42, Table 3.2-2 (Jul-2000)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this source type.

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 11. Generator Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Potential Emissions		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	53.06	kg/MMBtu	306.80	1,344	40 CFR 98, Table C-1
CH_4	0.001	kg/MMBtu	0.01	0.03	40 CFR 98, Table C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Table C-2
HAPs:					
1,1,2,2-Tetrachloroethane	4.00E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
1,1,2-Trichloroethane	3.18E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
1,1-Dichloroethane	2.36E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
1,2-Dichloroethane	2.36E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
1,2-Dichloropropane	2.69E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
1,3-Butadiene	2.67E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
1,3-Dichloropropene	2.64E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
2-Methylnaphthalene	3.32E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
2,2,4-Trimethylpentane	2.50E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Acenaphthene	1.25E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Acenaphthylene	5.53E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Acetaldehyde	8.36E-03	lb/MMBtu	0.02	0.10	AP-42, Table 3.2-2 (Jul-2000)
Acrolein	5.14E-03	lb/MMBtu	0.01	0.06	AP-42, Table 3.2-2 (Jul-2000)
Benzene	4.40E-04	lb/MMBtu	<0.01	0.01	AP-42, Table 3.2-2 (Jul-2000)
Benzo(b)fluoranthene	1.66E-07	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Benzo(e)pyrene	4.15E-07	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Benzo(g,h,i)perylene	4.14E-07	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Biphenyl	2.12E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Carbon Tetrachloride	3.67E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Chlorobenzene	3.04E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Chloroethane	1.87E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Chloroform	2.85E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Chrysene	6.93E-07	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Ethylbenzene	3.97E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Ethylene Dibromide	4.43E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Fluoranthene	1.11E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Fluorene	5.67E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Formaldehyde	5.28E-02	lb/MMBtu	0.14	0.61	AP-42, Table 3.2-2 (Jul-2000)
Methanol	2.50E-03	lb/MMBtu	0.01	0.03	AP-42, Table 3.2-2 (Jul-2000)
Methylene Chloride	2.00E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
n-Hexane	1.11E-03	lb/MMBtu	<0.01	0.01	AP-42, Table 3.2-2 (Jul-2000)
Naphthalene	7.44E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
PAH	2.69E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Phenanthrene	1.04E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Phenol	2.40E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Pyrene	1.36E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
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TABLE 11. Generator Emissions Calculations

Styrene	2.36E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Tetrachloroethane	2.48E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Toluene	4.08E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Vinyl Chloride	1.49E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Xylene	1.84E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.2-2 (Jul-2000)
Total HAP			**0.190**	**0.83**	

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 12. Site-Specific Gas Analysis

Sample Location: Braden Run
Sample Date: 6/13/2016
HHV (Btu/scf): 1,037
MW (lb/lbmol): 16.76

Constituent	Natural Gas Stream Speciation (Vol. %)	Natural Gas Stream Speciation (Wt. %)
N2	**0.2840**	0.475
METHANE	**95.4480**	91.364
CO2	**0.2450**	0.643
ETHANE	**3.7570**	6.742
PROPANE	**0.2100**	0.553
I-BUTANE	**0.0130**	0.045
N-BUTANE	**0.0220**	0.076
I-PENTANE	**0.0040**	0.017
N-PENTANE	**0.0050**	0.022
I-HEXANES	**0.0040**	0.021
N-HEXANE	**0.0040**	0.021
BENZENE	0.0000	0.000
CYCLOHEXANE	0.0000	0.000
HEPTANES	0.0000	0.000
TOLUENE	**0.0040**	0.022
2,2,4 Trimethylpentane	0.0000	0.000
N-OCTANE	0.0000	0.000
E-BENZENE	0.0000	0.000
m,o,&p-XYLENE	0.0000	0.000
I-NONANES	0.0000	0.000
N-NONANE	0.0000	0.000
I-DECANES	0.0000	0.000
N-DECANE	0.0000	0.000
I-UNDECANES +	0.0000	0.000
Totals	100.000	100.000

TOC (Total)	99.47	98.88
VOC (Total)	0.27	0.78
HAP (Total)	0.01	0.04

Company Name: **Equitrans, LP**
Facility Name: **Cygrymus Compressor Station**
Project Description: **Resource Report 9**

TABLE 13. Atmospheric Emissions from Each Source at the Facility

Source	Status	Pollutants																							
		VOC		NO_X		CO		HCHO		Total HAPs		PM_{10}		$PM_{2.5}$		SO_X		CO_2		CH_4		N_2O		CO_2e	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Turbine 1	New	0.21	1.04	2.99	13.09	0.61	3.13	0.05	0.23	0.08	0.36	0.92	4.03	0.92	4.03	0.31	1.37	10774	47193	1.39	6.60	0.02	0.09	#####	#####
Turbine 2	New	0.21	1.04	2.99	13.09	0.61	3.13	0.05	0.23	0.08	0.36	0.92	4.03	0.92	4.03	0.31	1.37	10774	47193	1.39	6.60	0.02	0.09	#####	#####
Microturbine 1	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01	266.28	1166.29
Microturbine 2	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01	266.28	1166.29
Microturbine 3	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01	266.28	1166.29
Microturbine 4	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01	266.28	1166.29
Microturbine 5	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01	266.28	1166.29
Fuel Gas Heater 1	New	0.01	0.03	0.11	0.49	0.09	0.41	<0.01	<0.01	<0.01	0.01	0.01	0.04	0.01	0.04	<0.01	<0.01	135	589	<0.01	0.01	<0.01	<0.01	134.69	589.92
Fuel Gas Heater 2	New	<0.01	0.01	0.04	0.16	0.03	0.13	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	44	195	<0.01	<0.01	<0.01	<0.01	44.50	194.93
Produced Fluids Tank (T01)	Existing	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	<0.01	0.01	0.02	0.08	--	--	0.47	2.08
Produced Fluids Tank (T02)	New	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	<0.01	0.01	0.02	0.08	--	--	0.47	2.08
Misc Storage Tanks (T003-T007)	Existing	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	0.00	0.00
Dehydrator	Existing	0.31	1.36	--	--	--	--	--	--	0.26	1.15	--	--	--	--	--	--	6	26	1.16	5.06	--	--	34.93	152.99
Reboiler	Existing	0.02	0.07	0.30	1.30	0.25	1.09	<0.01	<0.01	0.01	0.02	0.02	0.10	0.02	0.10	<0.01	0.01	360	1577	0.01	0.03	<0.01	<0.01	360.37	1578.43
Flare	Existing	0.07	0.29	1.19	5.19	1.00	4.36	--	--	--	--	0.09	0.39	0.09	0.39	0.01	0.03	1414	6195	0.03	0.12	<0.01	0.01	1415.96	6201.90
Generator	Existing	0.36	1.56	0.09	0.38	0.36	1.56	0.14	0.61	0.19	0.83	0.03	0.11	0.03	0.11	<0.01	0.01	307	1344	0.01	0.03	<0.01	<0.01	307.12	1345.18
Compressors	New	0.70	3.07	--	--	--	--	--	--	0.04	0.17	--	--	--	--	--	--	0.58	2.54	82.42	360.99	--	--	2061.04	9027.37
Blowdowns	Modified	0.02	0.09	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	0.02	0.07	2.31	10.13	--	--	57.84	253.34
Pigging	Modified	<0.01	0.02	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	<0.01	0.01	0.45	1.96	--	--	11.17	48.92
Fugitive Leaks	Modified	0.07	0.31	--	--	--	--	---	---	<0.01	0.02	--	--	--	--	--	--	0.01	0.06	2.10	9.19	--	--	52.46	229.78
Liquid Loading	Modified	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	<0.01	<0.01	--	--		
Facility-Wide		**2.07**	**9.30**	**8.09**	**35.46**	**4.05**	**18.62**	**0.25**	**1.11**	**0.68**	**2.98**	**2.07**	**9.05**	**2.07**	**9.05**	**0.68**	**2.96**	**25144**	**110141**	**91.32**	**401.00**	**0.05**	**0.21**	**27442**	**120228**

Notes:
1. PM_{10} and $PM_{2.5}$ emissions are filterable + condensable.

Bryan Research & Engineering, LLC

ProMax® 5.0

Simulation Report

Client Name: Cygyrmus Station
Location: Storage Tank Calculations
Job:

ProMax Filename: Cygrymus Tank Emissions
ProMax Version: 5.0.21256.0
Property Stencil Name: Tank-1
Property Stencil Flowsheet: Flowsheet1

Emission Summary [Total]					
Component Subset	**Tank Losses**	Flashing Losses	Working Losses	Breathing Losses	**Loading Losses**
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	**[ton/yr]**
VOCs [C3+]	**0.007**	0.007	0.000	0.000	**0.000**
HAPs	**0.006**	0.006	0.000	0.000	**0.000**
BTEX	**0.006**	0.006	0.000	0.000	**0.000**
Methane	**0.165**	0.165	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

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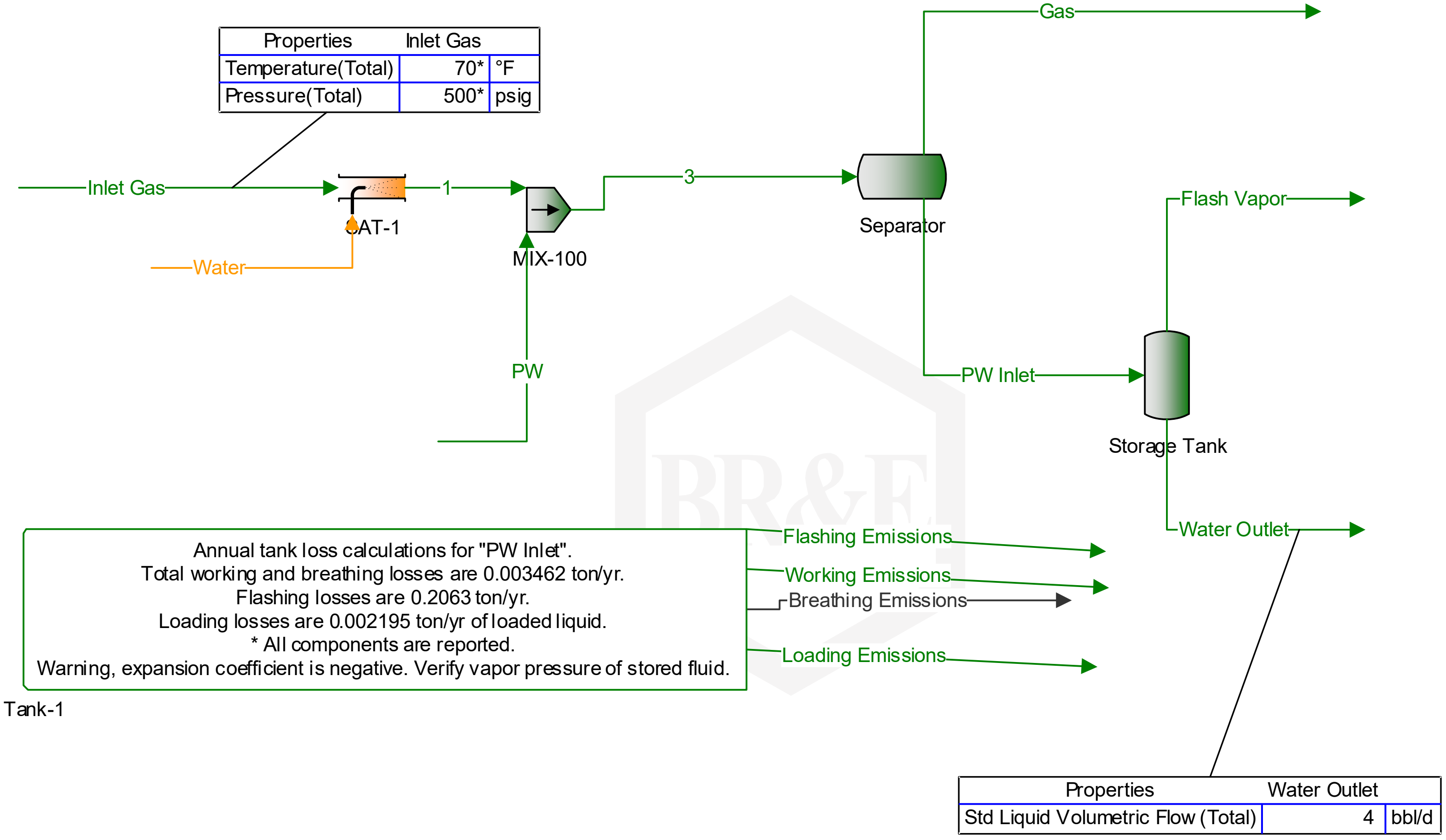
http://www.bre.com/

Report Navigator can be activated via the ProMax Navigator Toolbar.

Flowsheet1

Storage Tank Emissions



Inlet Stream Summary				
Stream Name		Inlet Gas	PW	Water
Stream Flowsheet		Flowsheet1	Flowsheet1	Flowsheet1
Temperature	°F	70.000	70.000	428.205
Pressure	psig	500.000	500.000	500.000
Standard Vapor Volumetric Flow	MSCFD	500000.000	27.413	681.877
Standard Liquid Volumetric Flow	bbl/d	205851.916	3.717	275.863
Vapor Fraction	(%)	100.000	0.000	42.256
Component		[Mol%]	[Mol%]	[Mol%]
Carbon Dioxide		0.245	0.000	0.000
Nitrogen		0.284	0.000	0.000
Oxygen		0.000	0.000	0.000
Methane		95.448	0.000	0.000
Ethane		3.757	0.000	0.000
Propane		0.210	0.000	0.000
Isobutane		0.013	0.000	0.000
n-Butane		0.022	0.000	0.000
i-Pentane		0.004	0.000	0.000
n-Pentane		0.005	0.000	0.000
Cyclopentane		0.000	0.000	0.000
n-Hexane		0.004	0.000	0.000
Cyclohexane		0.004	0.000	0.000
Heptane		0.000	0.000	0.000
Methylcyclohexane		0.000	0.000	0.000
2,2,4-Trimethylpentane		0.000	0.000	0.000
Benzene		0.000	0.000	15.000
Toluene		0.004	0.000	5.000
Ethylbenzene		0.000	0.000	5.000
m-Xylene		0.000	0.000	15.000
Octane		0.000	0.000	0.000
Water		0.000	100.000	60.000

Flowsheet Information			
Tank Losses Stencil Name		Tank-1	
Tank Losses Stencil Reference Stream		PW Inlet	
Tank Name		Storage Tank	
Tank Inlet Stream		PW Inlet	

Tank Characteristics			
Tank Type		Vertical Cylinder	
Time Frame		Year	
Material Category		Light Organics	
Number of Tanks		2.000	
Shell Height	[ft]	15.000	
Diameter [ft]	[ft]	10.000	
Maximum Liquid Height	[%] | [ft]	90.000	13.500
Average Liquid Height	[%] | [ft]	50.000	7.500
Minimum Liquid Height	[%] | [ft]	10.000	1.500
Sum of Increases in Liquid Level	[ft/yr]	-	
Tank Volume	[gal] | [bbl]	8812.779	209.828
Insulation		Uninsulated	
Bolted or Riveted Construction		FALSE	
Vapor Balance Tank		FALSE	
Paint Characteristics			
Shell Color		Dark Green	
Shell Paint Condition		Average	
Roof Color		Dark Green	
Roof Paint Condition		Average	
Roof Characteristics			
Type		Cone	
Diameter	[ft]	-	
Slope	[ft/ft]	0.063	
Breather Vent Settings			
Breather Vacuum Pressure	[psig]	-0.300	
Breather Vent Pressure	[psig]	0.700	

Loading Loss Parameters		
Cargo Carrier		Tank Truck or Rail Tank Car
Land Based Mode of Operation		Submerged Loading: Dedicated Normal Service
Marine Based Mode of Operation		-
Overall Reduction Efficiency	[%]	0.000

Meteorological Data			
Location		Pittsburgh, PA	
Average Atmospheric Pressure	[psia]	14.100	
Maximum Average Temperature	[°F]	60.400	
Minimum Average Temperature	[°F]	42.800	
Solar Insolation	[BTU/ft^2*day]	1170.000	
Average Wind Speed	[mph]	7.800	
Tank Conditions			
Flashing Temperature	[°F]	65.347	
Maximum Liquid Surface Temperature	[°F]	65.347	
Average Liquid Surface Temperature	[°F]	57.523	
Set Bulk Temperature to Stream Temperature?		FALSE	
Bulk Liquid Temperature	[°F]	54.759	
Net Throughput	[bbl/day] | [bbl/yr]	3.998	1459.391
Net Throughput Per Tank	[bbl/day] | [bbl/yr]	1.999	729.695
Annual Turnovers Per Tank		4.347	
Residual Liquid	[bbl/day]		
Residual Liquid Per Tank	[bbl/day]	0.000	
Raoult's Law Used for Vapor Pressure Calc?		TRUE	
Vapor Pressure @ Minimum Liquid Surface Temperature	[psia]	0.201	
Vapor Pressure @ Maximum Liquid Surface Temperature	[psia]	0.337	
True Vapor Pressure @ Average Liquid Surface Temperature	[psia]	0.261	

Emission Summary [Total]					
Component Subset	**Tank Losses**	Flashing Losses	Working Losses	Breathing Losses	**Loading Losses**
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	**[ton/yr]**
VOCs [C3+]	**0.007**	0.007	0.000	0.000	**0.000**
HAPs	**0.006**	0.006	0.000	0.000	**0.000**
BTEX	**0.006**	0.006	0.000	0.000	**0.000**
Methane	**0.165**	0.165	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

Emission Summary [Per Tank]					
Component Subset	**Tank Losses**	Flashing Losses	Working Losses	Breathing Losses	**Loading Losses**
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	**[ton/yr]**
VOCs [C3+]	**0.004**	0.004	0.000	0.000	**0.000**
HAPs	**0.003**	0.003	0.000	0.000	**0.000**
BTEX	**0.003**	0.003	0.000	0.000	**0.000**
Methane	**0.082**	0.082	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

Stream Properties						
	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
Molecular Weight [lb/lbmol]	18.017	18.007	18.998	18.998	18.998	-
Net Ideal Gas Heating Value [BTU/scf]	-	916.960	56.999	56.999	56.999	-
Specific Gravity	0.998	-	-	-	-	-
Reid Vapor Pressure [psi]	1.149	-	-	-	-	-
API Gravity	10.074	-	-	-	-	-
Standard Vapor Volumetric Flow [scf/d]	-	23.820	0.379	0.000	0.240	-
Standard Liquid Volumetric Flow [bbl/d]	4.010	-	-	-	-	-

Stream Mass Flow [Total]							
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual	Total Emissions
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]
Carbon Dioxide	0.023	0.014	0.000	0.000	0.000	-	0.014
Nitrogen	0.000	0.000	0.000	0.000	0.000	-	0.000
Oxygen	0.000	0.000	0.000	0.000	0.000	-	0.000
Methane	0.170	0.165	0.000	0.000	0.000	-	0.165
Ethane	0.016	0.015	0.000	0.000	0.000	-	0.015
Propane	0.001	0.001	0.000	0.000	0.000	-	0.001
Isobutane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Butane	0.000	0.000	0.000	0.000	0.000	-	0.000
i-Pentane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Pentane	0.000	0.000	0.000	0.000	0.000	-	0.000
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Hexane	0.000	0.000	0.000	0.000	0.000	-	0.000
Cyclohexane	0.000	0.000	0.000	0.000	0.000	-	0.000
Heptane	0.000	0.000	0.000	0.000	0.000	-	0.000
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-	0.000
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-	0.000
Benzene	0.014	0.002	0.000	0.000	0.000	-	0.002
Toluene	0.006	0.001	0.000	0.000	0.000	-	0.001
Ethylbenzene	0.003	0.001	0.000	0.000	0.000	-	0.001
m-Xylene	0.006	0.002	0.000	0.000	0.000	-	0.002
Octane	0.000	0.000	0.000	0.000	0.000	-	0.000
Water	255.569	0.005	0.003	0.000	0.002	-	0.008

Stream Compostion						
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
	[Mol%]	[Mol%]	[Mol%]	[Mol%]	[Mol%]	[Mol%]
Carbon Dioxide	0.004	2.770	4.056	4.056	4.056	-
Nitrogen	0.000	0.145	0.003	0.003	0.003	-
Oxygen	0.000	0.000	0.000	0.000	0.000	-
Methane	0.075	89.636	5.696	5.696	5.696	-
Ethane	0.004	4.466	0.307	0.307	0.307	-
Propane	0.000	0.156	0.002	0.002	0.002	-
Isobutane	0.000	0.006	0.000	0.000	0.000	-
n-Butane	0.000	0.013	0.000	0.000	0.000	-
i-Pentane	0.000	0.001	0.000	0.000	0.000	-
n-Pentane	0.000	0.001	0.000	0.000	0.000	-
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-
n-Hexane	0.000	0.000	0.000	0.000	0.000	-
Cyclohexane	0.000	0.006	0.000	0.000	0.000	-
Heptane	0.000	0.000	0.000	0.000	0.000	-
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-
Benzene	0.001	0.264	0.004	0.004	0.004	-
Toluene	0.000	0.116	0.000	0.000	0.000	-
Ethylbenzene	0.000	0.057	0.000	0.000	0.000	-
m-Xylene	0.000	0.156	0.000	0.000	0.000	-
Octane	0.000	0.000	0.000	0.000	0.000	-
Water	99.915	2.206	89.930	89.930	89.930	-
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
	[Mass%]	[Mass%]	[Mass%]	[Mass%]	[Mass%]	[Mass%]
Carbon Dioxide	0.009	6.769	9.397	9.397	9.397	-
Nitrogen	0.000	0.226	0.005	0.005	0.005	-
Oxygen	0.000	0.000	0.000	0.000	0.000	-
Methane	0.066	79.858	4.810	4.810	4.810	-
Ethane	0.006	7.458	0.486	0.486	0.486	-
Propane	0.000	0.382	0.004	0.004	0.004	-
Isobutane	0.000	0.020	0.000	0.000	0.000	-
n-Butane	0.000	0.042	0.000	0.000	0.000	-
i-Pentane	0.000	0.006	0.000	0.000	0.000	-
n-Pentane	0.000	0.003	0.000	0.000	0.000	-
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-
n-Hexane	0.000	0.002	0.000	0.000	0.000	-
Cyclohexane	0.000	0.030	0.000	0.000	0.000	-
Heptane	0.000	0.000	0.000	0.000	0.000	-
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-
Benzene	0.005	1.144	0.018	0.018	0.018	-
Toluene	0.002	0.593	0.002	0.002	0.002	-
Ethylbenzene	0.001	0.339	0.000	0.000	0.000	-
m-Xylene	0.002	0.923	0.000	0.000	0.000	-
Octane	0.000	0.000	0.000	0.000	0.000	-
Water	99.906	2.207	85.277	85.277	85.277	-

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 1a. Turbine Emissions Calculations

Turbine Information:

Source ID:	C-2100, C-2200
Manufacturer:	Solar
Model No.:	T-70
Fuel Used:	Natural Gas
Fuel Lower Heating Value (Btu/scf):	1000.2
Fuel Higher Heating Value (Btu/scf):	1112.6
Rated Horsepower (bhp):	11,250
Maximum Fuel Consumption at 100% Load (scf/hr):	83,223
Heat Input (MMBtu/hr) - LHV	83.24
Heat Input (MMBtu/hr) - HHV	92.40
Control Device:	None

Operational Details:

Potential Annual Hours of Operation (hr/yr):	8,760
Potential Fuel Consumption (MMscf/yr):	729.04
Potential Startup/Shutdown Events (per year):	12

Manufacturer Specific Pollutant Emission Factors:

Pollutant	Uncontrolled Emission Factors	Controlled Emission Factors	Units	Emission Factor Source
NO_X		0.060	lb/MMBtu (LHV)	Manufacturer
CO	0.061	0.012	lb/MMBtu (LHV)	Manufacturer
SO_2		0.003	lb/MMBtu (HHV)	Manufacturer
PM_{10}		0.018	lb/MMBtu (HHV)	Manufacturer
$PM_{2.5}$		0.018	lb/MMBtu (HHV)	Manufacturer
VOC	0.007	0.004	lb/MMBtu (LHV)	20% of UHC per Manufacturer
Formaldehyde	0.003	0.001	lb/MMBtu (HHV)	Manufacturer
CO_2		117.00	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-1
CH_4		0.028	lb/MMBtu (LHV)	80% of UHC per Manufacturer
N_2O		2.2E-04	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-2

*Emission factors from AP-42 and Subpart C are based on HHV. Emission factor basis notes which heat input value is used for calculations.

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 1a. Turbine Emissions Calculations

Pollutant Emission Rates:

Pollutant	Potential Emissions (lb/hr)[1]	Potential Emissions (tpy)[2]
NO_X	4.99	21.89
CO	1.02	5.45
SO_2	0.31	1.38
PM_{10}	1.66	7.28
$PM_{2.5}$	1.66	7.28
VOC	0.35	1.54
Formaldehyde	0.05	0.23
CO_2	10,810	47,355
CH_4	2.33	10.25
N_2O	0.02	0.09
GHG (CO_2e)	10,874	47,638

Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)

Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 1a. Turbine Emissions Calculations

Hazardous Air Pollutant (HAP) Emission Rates:

Pollutant	Emission Factor (lb/MMBtu)[3]	Potential Emissions (lb/hr)[1]	(tpy)[2]
HAPs:			
Acetaldehyde	4.00E-05	3.70E-03	1.62E-02
Acrolein	6.40E-06	5.91E-04	2.59E-03
Benzene	1.20E-05	1.11E-03	4.86E-03
1,3-Butadiene	4.30E-07	3.97E-05	1.74E-04
Propylene Oxide	2.90E-05	2.68E-03	1.17E-02
Ethylbenzene	3.20E-05	2.96E-03	1.30E-02
Toluene	1.30E-04	1.20E-02	5.26E-02
Xylene	6.40E-05	5.91E-03	2.59E-02
Polycyclic Organic Matter:			
Naphthalene	1.30E-06	1.20E-04	5.26E-04
PAH	2.20E-06	2.03E-04	8.90E-04
Total HAP (Including HCHO)		**0.08**	**0.36**

Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)
Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable
Emission factors from AP-42 Section 3.1, Table 3.1-3 "Emission Factors for HAPs from Natural Gas Fired Stationary Gas Turbines", April 2000. Factors are based on HHV. Therefore, they were converted to LHV by multiplying by (HHV/LHV).

Startup/Shutdown Combustion Emission Factors:

Pollutant	Startup Emissions[1] (lbs/event)	Shutdown Emissions[1] (lbs/event)	Emission Factor Source
NO_X	0.8	1.1	Manufacturer
CO	73.1	93.4	Manufacturer
VOC	0.8	1.06	20% of UHC per Manufacturer
CH_4	3.4	4.24	80% of UHC per Manufacturer
CO_2	519	575	Manufacturer

Each startup and shutdown event is estimated to last approximately 10 minutes, per manufacturer.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 1b. Turbine Emissions Calculations

Turbine Information:

Source ID:	C-2300
Manufacturer:	Solar
Model No.:	T-130
Fuel Used:	Natural Gas
Fuel Lower Heating Value (Btu/scf):	1000.2
Fuel Higher Heating Value (Btu/scf):	1112.6
Rated Horsepower (bhp):	23,497
Maximum Fuel Consumption at 100% Load (scf/hr):	165,207
Heat Input (MMBtu/hr) - LHV	165.24
Heat Input (MMBtu/hr) - HHV	183.42
Control Device:	None

Operational Details:

Potential Annual Hours of Operation (hr/yr):	8,760
Potential Fuel Consumption (MMscf/yr):	1,447.21
Potential Startup/Shutdown Events (per year):	12

Manufacturer Specific Pollutant Emission Factors:

Pollutant	Uncontrolled Emission Factors	Controlled Emission Factors	Units	Emission Factor Source
NO_X		0.036	lb/MMBtu (LHV)	Manufacturer
CO	0.037	0.007	lb/MMBtu (LHV)	Manufacturer
SO_2		0.003	lb/MMBtu (HHV)	Manufacturer
PM_{10}		0.010	lb/MMBtu (HHV)	Manufacturer
$PM_{2.5}$		0.010	lb/MMBtu (HHV)	Manufacturer
VOC	0.004	0.003	lb/MMBtu (LHV)	20% of UHC per Manufacturer
Formaldehyde	0.003	0.001	lb/MMBtu (HHV)	Manufacturer
CO_2		117.00	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-1
CH_4		0.017	lb/MMBtu (LHV)	80% of UHC per Manufacturer
N_2O		2.2E-04	lb/MMBtu (HHV)	40 CFR 98, Subpart C, Table C-2

*Emission factors from AP-42 and Subpart C are based on HHV. Emission factor basis notes which heat input value is used for calculations.

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 1b. Turbine Emissions Calculations

Pollutant Emission Rates:

Pollutant	Potential Emissions (lb/hr)[1]	(tpy)[2]
NO_X	5.95	26.07
CO	1.22	5.57
SO_2	0.62	2.73
PM_{10}	1.83	8.03
$PM_{2.5}$	1.83	8.03
VOC	0.42	1.87
Formaldehyde	0.11	0.46
CO_2	21,459	94,001
CH_4	2.78	12.35
N_2O	0.04	0.18
GHG (CO_2e)	21,541	94,363

Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)

Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable

Company Name: **Equitrans, LP**
Facility Name: **Corona Compressor Station**
Project Description: **Resource Report 9**

TABLE 1b. Turbine Emissions Calculations

Hazardous Air Pollutant (HAP) Emission Rates:

Pollutant	Emission Factor (lb/MMBtu)[3]	Potential Emissions (lb/hr)[1]	(tpy)[2]
HAPs:			
Acetaldehyde	4.00E-05	7.34E-03	3.21E-02
Acrolein	6.40E-06	1.17E-03	5.14E-03
Benzene	1.20E-05	2.20E-03	9.64E-03
1,3-Butadiene	4.30E-07	7.89E-05	3.45E-04
Propylene Oxide	2.90E-05	5.32E-03	2.33E-02
Ethylbenzene	3.20E-05	5.87E-03	2.57E-02
Toluene	1.30E-04	2.38E-02	1.04E-01
Xylene	6.40E-05	1.17E-02	5.14E-02
Polycyclic Organic Matter:			
Naphthalene	1.30E-06	2.38E-04	1.04E-03
PAH	2.20E-06	4.04E-04	1.77E-03
Total HAP (Including HCHO)		**0.16**	**0.72**

Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr) × Emission Factor (lb/MMBtu)

Emission Rate (tpy) = Emission Rate (lb/hr) × Hours of Operation (hr/yr) / 2000 (tons/lb) + SU/SD emissions, as applicable

Emission factors from AP-42 Section 3.1, Table 3.1-3 "Emission Factors for HAPs from Natural Gas Fired Stationary Gas Turbines", April 2000. Factors are based on HHV.

Startup/Shutdown Combustion Emission Factors:

Pollutant	Startup Emissions[1] (lbs/event)	Shutdown Emissions[1] (lbs/event)	Emission Factor Source
NO_X	1.0	1	Manufacturer
CO	16.0	19	Manufacturer
VOC	4.0	4	Manufacturer
CH_4	14.4	17.6	80% of UHC per Manufacturer
CO_2	767	869	Manufacturer

Each startup and shutdown event is estimated to last approximately 10 minutes, per manufacturer.

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 2. Microturbine Emissions Calculations

Microturbine Unit Information:

Source ID:	G-9401 - G-9405
Manufacturer:	Capstone
Model No.:	C200
Number of Units:	5

Microturbine Fuel Information:

	Per Unit	As Combined
Fuel Type:	Natural Gas	Natural Gas
Rated Electrical Power Output (kW):	200	1,000
Rated Electrical Power Output (MW):	0.2	1
Rated Horsepower (bhp):	268.2	1,341
Heat Input (MMBtu/hr)	2.28	11.4
Maximum Fuel Consumption at 100% Loac	2,049	10,246
Maximum Fuel Consumption at 100% Loac	17.95	89.76
Potential Fuel Consumption (MMBtu/yr):	19,973	99,864
Max. Annual Hours of Operation (hr/yr):	8,760	8,760

Microturbine Emissions Data:

Pollutant	Emission Factors	Units	Maximum Potential Emissions Per Unit		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	0.40	lb/MWhe	0.08	0.35	Manufacturer's Specifications
VOC	0.10	lb/MWhe	0.02	0.09	Manufacturer's Specifications
CO	1.10	lb/MWhe	0.22	0.96	Manufacturer's Specifications
SO_X	0.003	lb/MMBtu	0.01	0.03	AP-42, Table 3.1-2a (Apr-2000)
PM_{10}	0.007	lb/MMBtu	0.02	0.07	AP-42, Table 3.1-2a (Apr-2000)
$PM_{2.5}$	0.007	lb/MMBtu	0.02	0.07	AP-42, Table 3.1-2a (Apr-2000)
GHG (CO_2e)	See Table Below		266	1,166	Manufacturer's Specifications / 40 CFR 98, Table C-2
Other (Total HAP)	See Table Below		<0.01	0.01	AP-42, Table 3.1-3 (Apr-2000)

Notes:

1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this engine type, including HCHC

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 2. Microturbine Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Maximum Potential Emissions Per Unit		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	1,330	lb/MWhe	266	1,165	Manufacturer's Specifications
CH_4	0.001	kg/MMBtu	0.01	0.02	40 CFR 98, Tables C-1 & C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
GHG (CO_2e)			**266**	**1,166**	
HAPs:					
1,3-Butadiene	4.3E-07	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Acetaldehyde	4.0E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Acrolein	6.4E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Benzene	1.2E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Ethylbenzene	3.2E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Formaldehyde	7.1E-04	lb/MMBtu	<0.01	0.01	AP-42, Table 3.1-3 (Apr-2000)
Naphthalene	1.3E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
PAH	2.2E-06	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Propylene oxide	2.9E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Toluene	1.3E-04	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Xylene	6.4E-05	lb/MMBtu	<0.01	<0.01	AP-42, Table 3.1-3 (Apr-2000)
Total HAP			**0.002**	**0.010**	

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 3. Fuel Gas Heater Emissions Calculations

Fuel Gas Heater Information:

Source ID:	H-9300, H-9400
Number of Units:	2

Fuel Gas Heater Information:

Fuel Type:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,113
Heat Input (MMBtu/hr)	1.15
Potential Fuel Consumption (MMBtu/yr):	10,074
Max. Fuel Consumption (MMscf/hr):	0.0010
Max. Fuel Consumption (MMscf/yr):	9.1
Max. Annual Hours of Operation (hr/yr):	8,760

Fuel Gas Heater Information:

Pollutant	Emission Factor	Units	Maximum Potential Emissions Per Unit		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
NO_X	100	lb/MMScf	0.10	0.45	AP-42, Table 1.4-1 (Jul-1998)
VOC	5.5	lb/MMScf	0.01	0.02	AP-42, Table 1.4-2 (Jul-1998)
CO	84	lb/MMScf	0.09	0.38	AP-42, Table 1.4-1 (Jul-1998)
SO_X	0.6	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
PM_{10}	7.6	lb/MMScf	0.01	0.03	AP-42, Table 1.4-2 (Jul-1998)
$PM_{2.5}$	7.6	lb/MMScf	0.01	0.03	AP-42, Table 1.4-2 (Jul-1998)
Formaldehyde (HCHO)	0.08	lb/MMScf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
GHG (CO_2e)	See Table Below		135	590	40 CFR 98, Tables C-1 & C-2
Other (Total HAP)	See Table Below		<0.01	0.01	AP-42, Tables 1.4-3 & 1.4-4 (Jul-1998)

Notes:
1. PM_{10} and $PM_{2.5}$ are total values (filterable + condensable).
2. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).
3. Total HAP is the summation of all hazardous air pollutants for which there is a published emission factor for this source type.

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 3. Fuel Gas Heater Emissions Calculations

Greenhouse Gas (GHG) & Hazardous Air Pollutant (HAP) Emissions Calculations:

Pollutant	Emission Factor	Units	Maximum Potential Emissions Per Unit		Estimation Basis / Emission Factor Source
			lbs/hr	tpy	
GHGs:					
CO_2	53.06	kg/MMBtu	134.55	589	40 CFR 98, Tables C-1 & C-2
CH_4	0.001	kg/MMBtu	<0.01	0.01	40 CFR 98, Tables C-1 & C-2
N_2O	0.0001	kg/MMBtu	<0.01	<0.01	40 CFR 98, Tables C-1 & C-2
GHG (CO_2e)			**135**	**590**	
Organic HAPs:					
2-Methylnaphthalene	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
3-Methylchloranthrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Acenapthylene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Anthracene	2.40E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benz(a)anthracene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzene	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(a)pyrene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Chrysene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Dichlorobenzene	1.20E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluoranthene	3.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Fluorene	2.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
n-Hexane	1.80E+00	lb/MMscf	<0.01	0.01	AP-42, Table 1.4-3 (Jul-1998)
Indeno(1,2,3-c,d)pyrene	1.80E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Naphthalene	6.10E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Phenanthrene	1.70E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Pyrene	5.00E-06	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Toluene	3.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-3 (Jul-1998)
Metal HAPs:					
Arsenic	2.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Beryllium	4.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cadmium	1.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Chromium	1.40E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Cobalt	8.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Lead	5.00E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-2 (Jul-1998)
Manganese	3.80E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Mercury	2.60E-04	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Nickel	2.10E-03	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Selenium	2.40E-05	lb/MMscf	<0.01	<0.01	AP-42, Table 1.4-4 (Jul-1998)
Total HAP			**0.002**	**0.01**	

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 4. Storage Tank Emissions Calculations - Produced Fluids Tank

Storage Tank Information:

Source ID:	T001
Tank Capacity (gallons):	8,820
Tank Contents:	Produced Fluids
Annual Throughput (gallons/year):	105,840
Daily Throughput (bbl/day)	7
Percent Condensate	1%
Condensate Throughput (bbl/day)	0.1
Control Type:	None
Control Efficiency:	N/A
Max. Annual Hours of Operation (hr/yr):	8,760

Tank Emissions Data:

Pollutant	**Uncontrolled Emissions**		**Controlled Emissions**		**Emissions Estimation Method**
	lbs/hr	**tpy**	**lbs/hr**	**tpy**	
VOC	<0.01	0.01	<0.01	0.01	BRE ProMax
HAPs	<0.01	0.01	<0.01	0.01	BRE ProMax
CH4	0.07	0.30	0.07	0.30	BRE ProMax
CO2	<0.01	0.02	<0.01	0.02	BRE ProMax
GHG (CO2e)	1.71	7.49	1.71	7.49	BRE ProMax

Loading Emissions Data:

Pollutant	**Uncontrolled Emissions**		**Controlled Emissions**		**Emissions Estimation Method**
	lbs/hr	**tpy**	**lbs/hr**	**tpy**	
VOC	<0.01	<0.01	<0.01	<0.01	BRE ProMax
HAPs	<0.01	<0.01	<0.01	<0.01	BRE ProMax
CH4	<0.01	<0.01	<0.01	<0.01	BRE ProMax
CO2	<0.01	<0.01	<0.01	<0.01	BRE ProMax
GHG (CO_2e)	<0.01	<0.01	<0.01	<0.01	BRE ProMax

Notes:
1. BRE ProMax software estimates working, breathing, and flashing losses and reports as one total.

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 5. Miscellaneous Storage Tank Emissions Calculations

Storage Tank Information:

Source ID:	T002	T003	T004	T005	T006
Tank Capacity (gallons):	4,200	2,100	2,100	2,100	2,100
Tank Contents:	Used Oil	Engine Oil	Engine Oil	MEG	MEG
Annual Throughput (gallons/year):	2,100	2,100	2,100	2,100	2,100
Control Type:	None	None	None	None	None
Control Efficiency:	N/A	N/A	N/A	N/A	N/A
Max. Annual Hours of Operation (hr/yr):	8,760	8,760	8760	8,760	8,760

Emissions Data:

Pollutant	**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**		**Total Emissions (Working + Breathing)**	
	lbs/hr	**tpy**	**lbs/hr**	**tpy**	**lbs/hr**	**tpy**	**lbs/hr**	**tpy**	**lbs/hr**	**tpy**
VOC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
HAPs	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:
1. EPA TANKS software run for engine/compressor oil and used oil tanks are using properties of distillate fuel oil #2.
2. EPA TANKS software run for TEG and Used MEG are using properties of propylene glycol.
3. These tanks do not contain hydrocarbons that would be expected to be flashed off at tank operating conditions.

Tank Emissions Data:

Pollutant	**Total Emissions**		**Emissions Estimation Method**
	lbs/hr	**tpy**	
VOC	<0.01	<0.01	EPA Tanks 4.0.9d
HAPs	<0.01	<0.01	EPA Tanks 4.0.9d

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 6. Fugitive and Blowdown Emissions Calculations

Fugitive Component Information:

Component Type	Estimated Component Count	Gas Leak Emission Factor	Average Gas Leak Rate	Max Gas Leak Rate	Potential VOC Emissions	Potential HAP Emissions
		(lb/hr/component)	(lb/hr)	(tpy)	(tpy)	(tpy)
Connectors	1,380	4.4E-04	0.61	2.93	0.03	<0.01
Flanges	1,380	8.6E-04	1.19	5.72	0.05	<0.01
Open-Ended Lines	12	4.4E-03	0.05	0.25	<0.01	<0.01
Pump Seals	3	5.3E-03	0.02	0.08	<0.01	<0.01
Valves	312	9.9E-03	3.10	14.91	0.13	<0.01
Other	15	1.9E-02	0.29	1.40	0.01	<0.01
Total			**5.25**	**25.29**	**0.22**	**<0.01**

Notes:
1. "Other" equipment type includes compressor seals, relief valves, etc. Default component counts from Subpart W, Table W-1B with a safety factor of 3
2. Emission factors from EPA's Protocol for Equipment Leak Emission Estimates, Table 2-4 (11/1995)
3. Conservatively assumed that maximum leak rate is 10% greater than measured average leak rate for the purposes of establishing PTE.
4. VOC and HAP emissions are based on fractions of these pollutants in the site-specific gas analysis.

GHG Fugitive Emissions from Component Leaks:

Component Type	Estimated Component Count	GHG Emission Factor		CH_4 Emissions	CO_2 Emissions	CO_2e Emissions
		scf/hr/component	Factor Source	(tpy)	(tpy)	(tpy)
Connectors	1,380	0.003	40 CFR 98, Table W-1A	0.66	<0.01	16.55
Flanges	1,380	0.003	40 CFR 98, Table W-1A	0.66	<0.01	16.55
Open-Ended Lines	12	0.061	40 CFR 98, Table W-1A	0.12	<0.01	2.93
Pump Seals	3	13.3	40 CFR 98, Table W-1A	6.38	0.032	159.52
Valves	312	0.03	40 CFR 98, Table W-1A	1.35	0.007	33.68
Other	15	0.04	40 CFR 98, Table W-1A	0.10	<0.01	2.40
Total				**9.26**	**0.05**	**231.63**

Notes:
1. CH_4 and CO_2 emissions are based on fractions of these pollutants in the site-specific gas analysis.
2. Emissions are calculated in accordance with Equations W-32a, W-35 and W-36 in Subpart W of 40 CFR 98.
3. GHG (CO_2e) is carbon dioxide equivalent, which is the summation of CO_2 (GWP = 1) + CH_4 (GWP = 25) + N_2O (GWP = 298).

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 6. Fugitive and Blowdown Emissions Calculations

Dry Seal Emissions

Unit	Number of Compressors	Leak Rate (scfm)	Total Volume NG Emitted (scf/yr)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	Potential CO_2 Emissions (tpy)	Potential CH_4 Emissions (tpy)	Potential CO_2e Emissions (tpy)
T-70	2	17	17,870,400	3.78	<0.01	1.66	326.18	8156.04
T-130	1	13	6,832,800	1.44	<0.01	0.63	124.71	3118.49
Total				**5.22**	**<0.01**	**2.29**	**450.89**	**11,274.53**

1. Leak rate from manufacturer.
2. GHG Calculated in accordance with Equations W-35 and W-36 in Subpart W of 40 CFR 98.
3. HAP/VOC Calculation: VOC emissions (tpy) = Volume vented (scf/yr) / 379 (scf/lbmol gas) x MW of gas (lb/lbmol) x wt% VOC/HAP x (1 ton/2000lb)

Vented Blowdown Emissions

Blowdown Emissions Sources	Vented Gas Volume Per Blowdown Event (scf)	Number of Blowdown Events per year	Total Volume NG Emitted (scf/yr)	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	Potential CH_4 Emissions[1] (tpy)	Potential CO_2 Emissions[1] (tpy)	Potential CO_2e Emissions (tpy)
Station ESD Vent	635,056	1	635,056	0.13	<0.01	11.59	0.06	290
Suction Filters	46,089	12	553,070	0.12	<0.01	10.09	0.05	252
Meters	12,765	1	12,765	<0.01	<0.01	0.23	<0.01	6
Pig Receiver	6,106	3	18,317	<0.01	<0.01	0.33	<0.01	8
Pig Receiver	7,913	3	23,739	0.01	<0.01	0.43	<0.01	11
Pig Launcher	10,445	3	31,334	0.01	<0.01	0.57	<0.01	14
Pig Launcher	13,536	3	40,609	0.01	<0.01	0.74	<0.01	19
T-70 Centrifugal Compressor	58,641	24	1,407,392	0.30	<0.01	25.69	0.13	642
T-130 Centrifugal Compressor	110,479	12	1,325,751	0.28	<0.01	24.20	0.12	605
Total				**0.86**	**<0.01**	**73.9**	**0.38**	**1,848**

1. HAP/VOC Calculation: VOC emissions (tpy) = Volume vented (scf/yr) / 379 (scf/lbmol gas) x MW of gas (lb/lbmol) x wt% VOC/HAP x (1 ton/2000lb)
2. GHG Calculated in accordance with Equations W-35 and W-36 in Subpart W of 40 CFR 98.

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 7. Site-Specific Gas Analysis

Sample Location: Mobley to H302
Sample Date: 7/25/2014
HHV (Btu/scf): 1,112.6
MW (lb/lbmol): 18.03

Constituent	Natural Gas Stream Speciation (Vol. %)	Natural Gas Stream Speciation (Wt. %)
N2	0.4130	0.641
METHANE	86.2420	76.699
CO2	0.1600	0.390
ETHANE	12.8240	21.381
PROPANE	0.3530	0.863
I-BUTANE	0.0040	0.013
N-BUTANE	0.0040	0.013
I-PENTANE	0.0000	0.000
N-PENTANE	0.0000	0.000
I-HEXANES	0.0000	0.000
N-HEXANE	0.0000	0.000
BENZENE	0.0000	0.000
CYCLOHEXANE	0.0000	0.000
HEPTANES	0.0000	0.000
TOLUENE	0.0000	0.000
2,2,4 Trimethylpentane	0.0000	0.000
N-OCTANE	0.0000	0.000
E-BENZENE	0.0000	0.000
m,o,&p-XYLENE	0.0000	0.000
I-NONANES	0.0000	0.000
N-NONANE	0.0000	0.000
I-DECANES	0.0000	0.000
N-DECANE	0.0000	0.000
I-UNDECANES +	0.0000	0.000
Totals	100.000	100.000

TOC (Total)	99.43	98.97
VOC (Total)	0.36	0.89
HAP (Total)	0.00	0.00

Company Name: **Equitrans, LP**
Facility Name: **Plasma Compressor Station**
Project Description: **Resource Report 9**

TABLE 8. Atmospheric Emissions from Each Source at the Facility

Source	Status	Pollutants																					
		VOC		NO_X		CO		HCHO		Total HAPs		PM_{10}		$PM_{2.5}$		SO_X		CO_2		CH_4		N_2O	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Turbine 1	Existing	0.35	1.54	4.99	21.89	1.02	5.45	0.05	0.23	0.08	0.36	1.66	7.28	1.66	7.28	0.31	1.38	10810	47355	2.33	10.25	0.02	0.09
Turbine 2	Existing	0.35	1.54	4.99	21.89	1.02	5.45	0.05	0.23	0.08	0.36	1.66	7.28	1.66	7.28	0.31	1.38	10810	47355	2.33	10.25	0.02	0.09
Turbine 3	New	0.42	1.87	5.95	26.07	1.22	5.57	0.11	0.46	0.16	0.72	1.83	8.03	1.83	8.03	0.62	2.73	21459	94001	2.78	12.35	0.04	0.18
Microturbine 1	Existing	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 2	Existing	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 3	Existing	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 4	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Microturbine 5	New	0.02	0.09	0.08	0.35	0.22	0.96	<0.01	0.01	<0.01	0.01	0.02	0.07	0.02	0.07	0.01	0.03	266	1165	0.01	0.02	<0.01	<0.01
Fuel Gas Heater 1	Existing	0.01	0.02	0.10	0.45	0.09	0.38	<0.01	<0.01	<0.01	0.01	0.01	0.03	0.01	0.03	<0.01	<0.01	135	589	<0.01	0.01	<0.01	<0.01
Fuel Gas Heater 2	New	0.01	0.02	0.10	0.45	0.09	0.38	<0.01	<0.01	<0.01	0.01	0.01	0.03	0.01	0.03	<0.01	<0.01	135	589	<0.01	0.01	<0.01	<0.01
Produced Fluids Tank (T001)	Existing	<0.01	0.01	--	--	--	--	--	--	<0.01	0.01	--	--	--	--	--	--	<0.01	0.02	0.07	0.30	--	--
Misc Storage Tanks (T002-T006)	Existing	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--
Blowdowns	Modified	0.20	0.86	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	0.09	0.38	16.87	73.89	--	--
Compressors	Modified	1.19	5.22	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	0.52	2.29	102.94	450.89	--	--
Fugitive Leaks	Modified	0.05	0.22	--	--	--	--	---	---	<0.01	<0.01	--	--	--	--	**--**	**--**	0.01	0.05	2.11	9.26	--	--
Liquid Loading	Modified	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	<0.01	<0.01	<0.01	<0.01	--	--
Facility-Wide		**2.67**	**11.76**	**16.54**	**72.50**	**4.53**	**22.04**	**0.22**	**0.97**	**0.35**	**1.52**	**5.25**	**23.00**	**5.25**	**23.00**	**1.29**	**5.66**	**44679**	**195718**	**129.46**	**567.33**	**0.08**	**0.37**

Notes:
1. PM_{10} and $PM_{2.5}$ emissions are filterable + condensable.

Bryan Research & Engineering, LLC

BR&E ProMax® 5.0

Simulation Report

Client Name: Plasma Station
Location: Storage Tank Calculations
Job:

ProMax Filename: Plasma Tank Emissions
ProMax Version: 5.0.21256.0
Property Stencil Name: Tank-1
Property Stencil Flowsheet: Flowsheet1

Emission Summary [Total]					
Component Subset	**Tank Losses [ton/yr]**	Flashing Losses [ton/yr]	Working Losses [ton/yr]	Breathing Losses [ton/yr]	**Loading Losses [ton/yr]**
VOCs [C3+]	**0.013**	0.013	0.000	0.000	**0.000**
HAPs	**0.011**	0.011	0.000	0.000	**0.000**
BTEX	**0.011**	0.011	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

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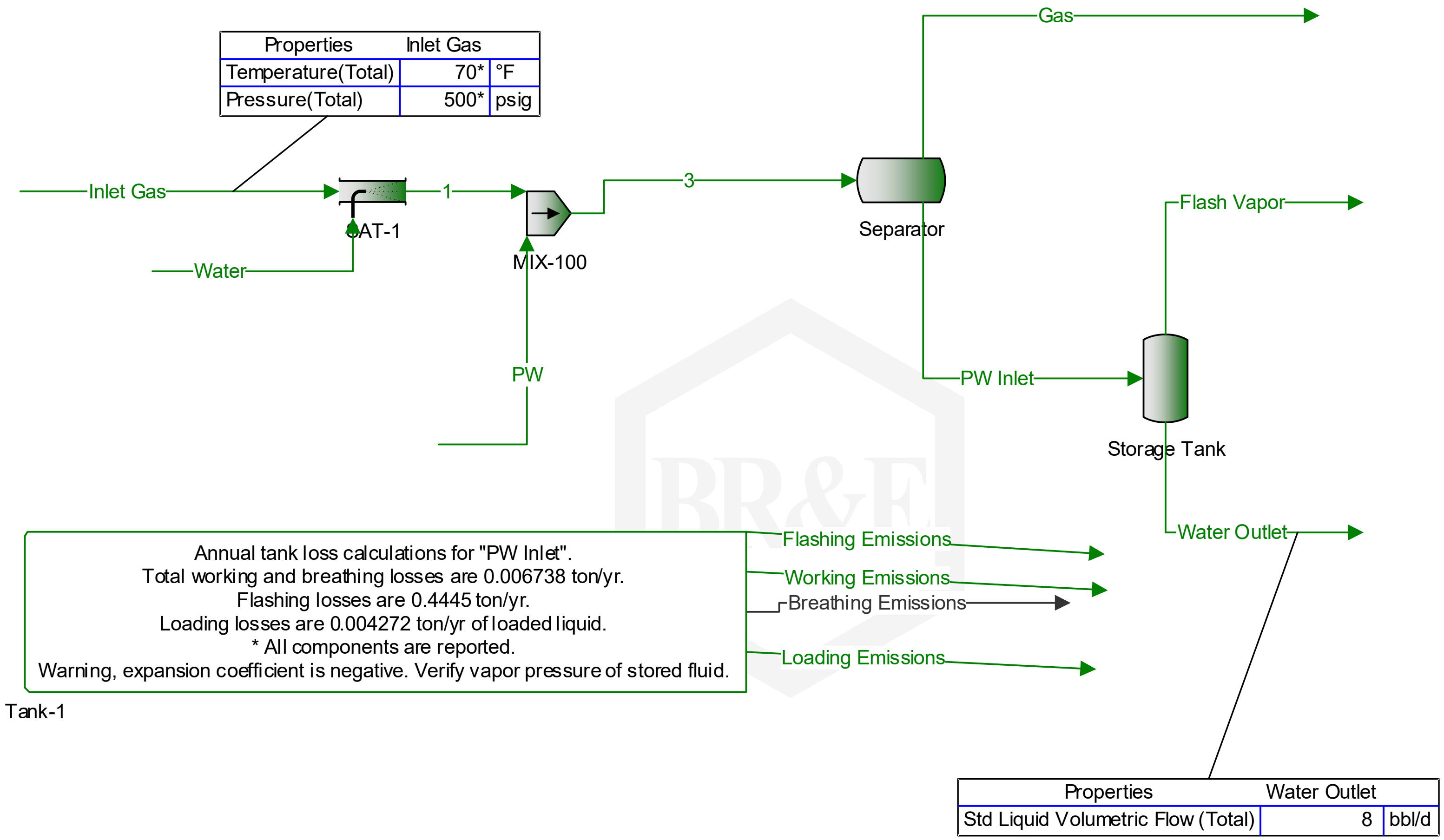
Report Navigator can be activated via the ProMax Navigator Toolbar.

Flowsheet1

Storage Tank Emissions



Inlet Stream Summary				
Stream Name		Inlet Gas	PW	Water
Stream Flowsheet		Flowsheet1	Flowsheet1	Flowsheet1
Temperature	°F	70.000	70.000	428.176
Pressure	psig	500.000	500.000	500.000
Standard Vapor Volumetric Flow	MSCFD	500000.000	56.499	678.539
Standard Liquid Volumetric Flow	bbl/d	216384.423	7.660	274.513
Vapor Fraction	(%)	100.000	0.000	41.610
Component		[Mol%]	[Mol%]	[Mol%]
Carbon Dioxide		0.160	0.000	0.000
Nitrogen		0.413	0.000	0.000
Oxygen		0.000	0.000	0.000
Methane		86.242	0.000	0.000
Ethane		12.824	0.000	0.000
Propane		0.353	0.000	0.000
Isobutane		0.004	0.000	0.000
n-Butane		0.004	0.000	0.000
i-Pentane		0.000	0.000	0.000
n-Pentane		0.000	0.000	0.000
Cyclopentane		0.000	0.000	0.000
n-Hexane		0.000	0.000	0.000
Cyclohexane		0.000	0.000	0.000
Heptane		0.000	0.000	0.000
Methylcyclohexane		0.000	0.000	0.000
2,2,4-Trimethylpentane		0.000	0.000	0.000
Benzene		0.000	0.000	15.000
Toluene		0.000	0.000	5.000
Ethylbenzene		0.000	0.000	5.000
m-Xylene		0.000	0.000	15.000
Octane		0.000	0.000	0.000
Water		0.000	100.000	60.000

Flowsheet Information			
Tank Losses Stencil Name		Tank-1	
Tank Losses Stencil Reference Stream		PW Inlet	
Tank Name		Storage Tank	
Tank Inlet Stream		PW Inlet	

Tank Characteristics			
Tank Type		Vertical Cylinder	
Time Frame		Year	
Material Category		Light Organics	
Number of Tanks		1.000	
Shell Height	[ft]	15.000	
Diameter [ft]	[ft]	10.000	
Maximum Liquid Height	[%] | [ft]	90.000	13.500
Average Liquid Height	[%] | [ft]	50.000	7.500
Minimum Liquid Height	[%] | [ft]	10.000	1.500
Sum of Increases in Liquid Level	[ft/yr]	-	
Tank Volume	[gal] | [bbl]	8812.779	209.828
Insulation		Uninsulated	
Bolted or Riveted Construction		FALSE	
Vapor Balance Tank		FALSE	
Paint Characteristics			
Shell Color		Dark Green	
Shell Paint Condition		Average	
Roof Color		Dark Green	
Roof Paint Condition		Average	
Roof Characteristics			
Type		Cone	
Diameter	[ft]	-	
Slope	[ft/ft]	0.063	
Breather Vent Settings			
Breather Vacuum Pressure	[psig]	-0.300	
Breather Vent Pressure	[psig]	0.700	

Loading Loss Parameters		
Cargo Carrier		Tank Truck or Rail Tank Car
Land Based Mode of Operation		Submerged Loading: Dedicated Normal Service
Marine Based Mode of Operation		-
Overall Reduction Efficiency	[%]	0.000

Meteorological Data			
Location		Pittsburgh, PA	
Average Atmospheric Pressure	[psia]	14.100	
Maximum Average Temperature	[°F]	60.400	
Minimum Average Temperature	[°F]	42.800	
Solar Insolation	[BTU/ft^2*day]	1170.000	
Average Wind Speed	[mph]	7.800	
Tank Conditions			
Flashing Temperature	[°F]	65.347	
Maximum Liquid Surface Temperature	[°F]	65.347	
Average Liquid Surface Temperature	[°F]	57.523	
Set Bulk Temperature to Stream Temperature?		FALSE	
Bulk Liquid Temperature	[°F]	54.759	
Net Throughput	[bbl/day] | [bbl/yr]	7.997	2918.789
Net Throughput Per Tank	[bbl/day] | [bbl/yr]	7.997	2918.789
Annual Turnovers Per Tank		8.693	
Residual Liquid	[bbl/day]		
Residual Liquid Per Tank	[bbl/day]	0.000	
Raoult's Law Used for Vapor Pressure Calc?		TRUE	
Vapor Pressure @ Minimum Liquid Surface Temperature	[psia]	0.198	
Vapor Pressure @ Maximum Liquid Surface Temperature	[psia]	0.333	
True Vapor Pressure @ Average Liquid Surface Temperature	[psia]	0.257	

Emission Summary [Total]					
Component Subset	**Tank Losses**	Flashing Losses	Working Losses	Breathing Losses	**Loading Losses**
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	**[ton/yr]**
VOCs [C3+]	**0.013**	0.013	0.000	0.000	**0.000**
HAPs	**0.011**	0.011	0.000	0.000	**0.000**
BTEX	**0.011**	0.011	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

Emission Summary [Per Tank]					
Component Subset	**Tank Losses**	Flashing Losses	Working Losses	Breathing Losses	**Loading Losses**
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	**[ton/yr]**
VOCs [C3+]	**0.013**	0.013	0.000	0.000	**0.000**
HAPs	**0.011**	0.011	0.000	0.000	**0.000**
BTEX	**0.011**	0.011	0.000	0.000	**0.000**
H2S	**0.000**	-	-	-	**-**

Stream Properties							
		Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
Molecular Weight	[lb/lbmol]	18.018	19.154	18.733	18.733	18.733	-
Net Ideal Gas Heating Value	[BTU/scf]	-	997.157	63.937	63.937	63.937	-
Specific Gravity		0.998	-	-	-	-	-
Reid Vapor Pressure	[psi]	1.124	-	-	-	-	-
API Gravity		10.077	-	-	-	-	-
Standard Vapor Volumetric Flow	[scf/d]	-	48.260	0.748	0.000	0.474	-
Standard Liquid Volumetric Flow	[bbl/d]	8.021	-	-	-	-	-

Stream Mass Flow [Total]							
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual	Total Emissions
	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]	[ton/yr]
Carbon Dioxide	0.030	0.018	0.000	0.000	0.000	-	0.019
Nitrogen	0.001	0.001	0.000	0.000	0.000	-	0.001
Oxygen	0.000	0.000	0.000	0.000	0.000	-	0.000
Methane	0.308	0.298	0.000	0.000	0.000	-	0.299
Ethane	0.109	0.104	0.000	0.000	0.000	-	0.104
Propane	0.003	0.003	0.000	0.000	0.000	-	0.003
Isobutane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Butane	0.000	0.000	0.000	0.000	0.000	-	0.000
i-Pentane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Pentane	0.000	0.000	0.000	0.000	0.000	-	0.000
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-	0.000
n-Hexane	0.000	0.000	0.000	0.000	0.000	-	0.000
Cyclohexane	0.000	0.000	0.000	0.000	0.000	-	0.000
Heptane	0.000	0.000	0.000	0.000	0.000	-	0.000
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-	0.000
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-	0.000
Benzene	0.027	0.005	0.000	0.000	0.000	-	0.005
Toluene	0.007	0.001	0.000	0.000	0.000	-	0.001
Ethylbenzene	0.006	0.001	0.000	0.000	0.000	-	0.001
m-Xylene	0.011	0.004	0.000	0.000	0.000	-	0.004
Octane	0.000	0.000	0.000	0.000	0.000	-	0.000
Water	511.146	0.009	0.006	0.000	0.004	-	0.015

Stream Compostion						
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
	[Mol%]	[Mol%]	[Mol%]	[Mol%]	[Mol%]	[Mol%]
Carbon Dioxide	0.002	1.791	2.658	2.658	2.658	-
Nitrogen	0.000	0.210	0.005	0.005	0.005	-
Oxygen	0.000	0.000	0.000	0.000	0.000	-
Methane	0.068	80.154	5.162	5.162	5.162	-
Ethane	0.013	14.869	1.035	1.035	1.035	-
Propane	0.000	0.252	0.003	0.003	0.003	-
Isobutane	0.000	0.002	0.000	0.000	0.000	-
n-Butane	0.000	0.002	0.000	0.000	0.000	-
i-Pentane	0.000	0.000	0.000	0.000	0.000	-
n-Pentane	0.000	0.000	0.000	0.000	0.000	-
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-
n-Hexane	0.000	0.000	0.000	0.000	0.000	-
Cyclohexane	0.000	0.000	0.000	0.000	0.000	-
Heptane	0.000	0.000	0.000	0.000	0.000	-
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-
Benzene	0.001	0.250	0.004	0.004	0.004	-
Toluene	0.000	0.068	0.000	0.000	0.000	-
Ethylbenzene	0.000	0.053	0.000	0.000	0.000	-
m-Xylene	0.000	0.144	0.000	0.000	0.000	-
Octane	0.000	0.000	0.000	0.000	0.000	-
Water	99.915	2.205	91.133	91.133	91.133	-
Component	Tank Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual
	[Mass%]	[Mass%]	[Mass%]	[Mass%]	[Mass%]	[Mass%]
Carbon Dioxide	0.006	4.115	6.244	6.244	6.244	-
Nitrogen	0.000	0.308	0.007	0.007	0.007	-
Oxygen	0.000	0.000	0.000	0.000	0.000	-
Methane	0.060	67.134	4.420	4.420	4.420	-
Ethane	0.021	23.342	1.662	1.662	1.662	-
Propane	0.001	0.581	0.007	0.007	0.007	-
Isobutane	0.000	0.006	0.000	0.000	0.000	-
n-Butane	0.000	0.007	0.000	0.000	0.000	-
i-Pentane	0.000	0.000	0.000	0.000	0.000	-
n-Pentane	0.000	0.000	0.000	0.000	0.000	-
Cyclopentane	0.000	0.000	0.000	0.000	0.000	-
n-Hexane	0.000	0.000	0.000	0.000	0.000	-
Cyclohexane	0.000	0.000	0.000	0.000	0.000	-
Heptane	0.000	0.000	0.000	0.000	0.000	-
Methylcyclohexane	0.000	0.000	0.000	0.000	0.000	-
2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000	0.000	-
Benzene	0.005	1.018	0.018	0.018	0.018	-
Toluene	0.001	0.327	0.001	0.001	0.001	-
Ethylbenzene	0.001	0.294	0.000	0.000	0.000	-
m-Xylene	0.002	0.796	0.000	0.000	0.000	-
Octane	0.000	0.000	0.000	0.000	0.000	-
Water	99.902	2.074	87.641	87.641	87.641	-

Company Name: **Equitrans, LP**
Facility Name: **Open Burning Emissions for Wetzel County, WV**
Project Description: **Resource Report 9**

TABLE 1a. Open Burning Emissions Calculations

Estimated Acres to be Burned	8.46
Density of forest[1]	150 metric tons per hectare
Metric ton	1.10 short ton
Hectare	2.47 acres

1. "The Relative Density of Forests in the United States," Christopher W. Woodall, Charles H. Perry, Patrick D. Miles; Forest Ecology and Management 226 (2006) 368–372. Used highest end of range from Figure 1.

	Emission Factor[1,2,3] (lb/ton)							
Fuel Type	PM	PM_{10}	$PM_{2.5}$	NO_X	CO	CO_2	CH_4	NMHC
Logging slash (piled)	12.0	8.0	8.0	4	74.0	3207.3	3.6	11.6
Woody debris (piled)	36.4	36.4	23.4	4	185.4	3143.4	21.7	15.2
Coniferous slash (piled)	20.4	20.4	10.8	4	153.2	3271.2	11.4	8

1. Emission Inventory Improvement Program, Volume III: Chapter 16, "Open Burning", Table 16.4-2. Revised Final January 2001. Assumed PM_{10} is equal to PM where PM_{10} was not specified.
2. Average of woody debris and coniferous slash factors were used for logging slash CO_2 and NMHC emissions.
3. NO_X emissions from U.S. EPA AP-42. Section 2.5 "Open Burning," Table 2.5-5 (10/92), footnote n. Assumed same emission factor for all source types.

			Emissions (tpy)								
Area	Fuel Type	Amount Burned (tons)[1]	PM	PM_{10}	$PM_{2.5}$	NO_X	CO	CO_2	CH_4	NMHC	CO_2e
Wetzel County	Logging slash (piled)	188.76	1.13	0.76	0.76	0.38	6.98	302.71	0.34	1.09	311
	Woody debris (piled)	188.76	3.44	3.44	2.21	0.38	17.50	296.68	2.05	1.43	348
	Coniferous slash (piled)	188.76	1.93	1.93	1.02	0.38	14.46	308.74	1.08	0.76	336
	Total	**566.29**	**6.49**	**6.12**	**3.98**	**1.13**	**38.94**	**908.13**	**3.47**	**3.28**	**995**

1. Assumes tonnage evenly divided among the three categories.

Company Name: **Equitrans, LP**
Facility Name: **Open Burning Emissions for Greene County, PA**
Project Description: **Resource Report 9**

TABLE 1b. Open Burning Emissions Calculations

Estimated Acres to be Burned	0.14
Density of forest[1]	150 metric tons per hectare
Metric ton	1.10 short ton
Hectare	2.47 acres

1. "The Relative Density of Forests in the United States," Christopher W. Woodall, Charles H. Perry, Patrick D. Miles; Forest Ecology and Management 226 (2006) 368–372. Used highest end of range from Figure 1.

	Emission Factor[1,2,3] (lb/ton)							
Fuel Type	PM	PM_{10}	$PM_{2.5}$	NO_X	CO	CO_2	CH_4	NMHC
Logging slash (piled)	12.0	8.0	8.0	4	74.0	3207.3	3.6	11.6
Woody debris (piled)	36.4	36.4	23.4	4	185.4	3143.4	21.7	15.2
Coniferous slash (piled)	20.4	20.4	10.8	4	153.2	3271.2	11.4	8

1. Emission Inventory Improvement Program, Volume III: Chapter 16, "Open Burning", Table 16.4-2. Revised Final January 2001. Assumed PM_{10} is equal to PM where PM_{10} was not specified.
2. Average of woody debris and coniferous slash factors were used for logging slash CO_2 and NMHC emissions.
3. NO_X emissions from U.S. EPA AP-42. Section 2.5 "Open Burning," Table 2.5-5 (10/92), footnote n. Assumed same emission factor for all source types.

			Emissions (tpy)								
Area	Fuel Type	Amount Burned (tons)[1]	PM	PM_{10}	$PM_{2.5}$	NO_X	CO	CO_2	CH_4	NMHC	CO_2e
Wetzel County	Logging slash (piled)	3.21	0.02	0.01	0.01	0.01	0.12	5.15	0.01	0.02	5
	Woody debris (piled)	3.21	0.06	0.06	0.04	0.01	0.30	5.05	0.03	0.02	6
	Coniferous slash (piled)	3.21	0.03	0.03	0.02	0.01	0.25	5.25	0.02	0.01	6
	Total	**9.64**	**0.11**	**0.10**	**0.07**	**0.02**	**0.66**	**15.45**	**0.06**	**0.06**	**17**

1. Assumes tonnage evenly divided among the three categories.

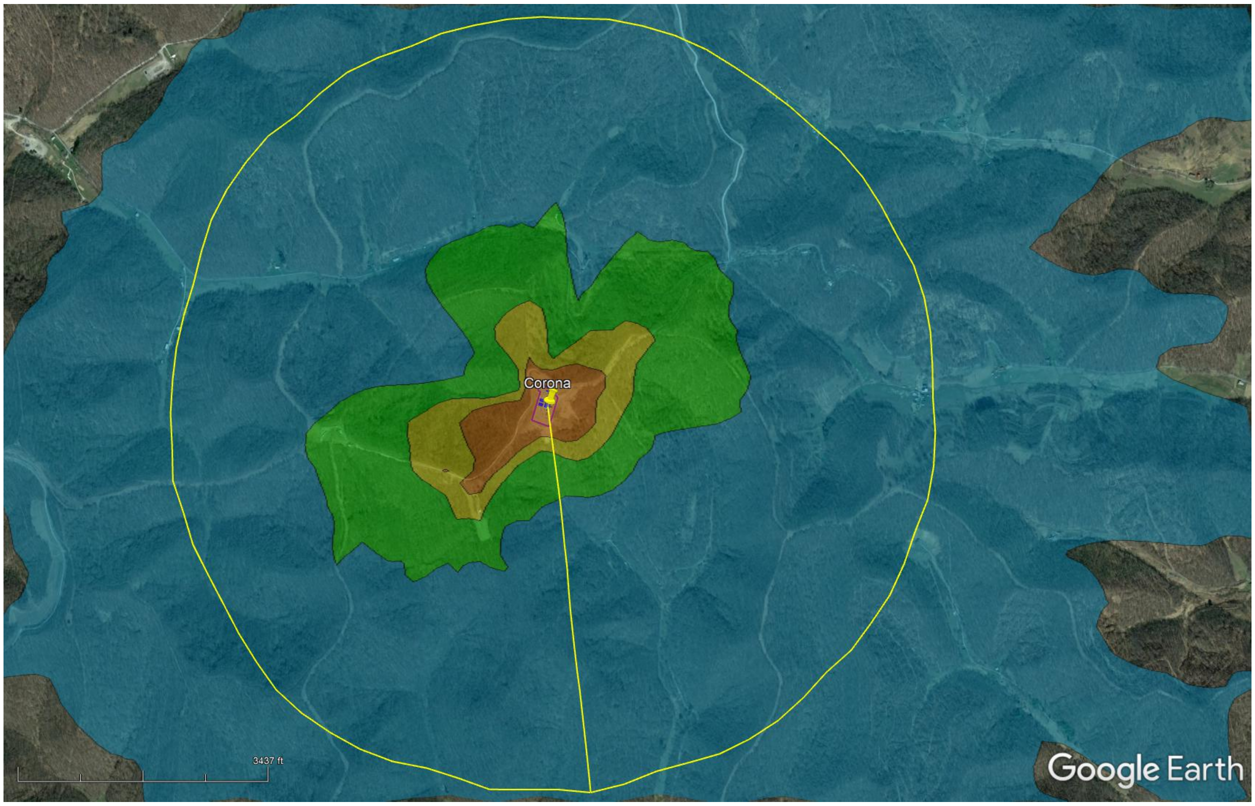
APPENDIX 9-C

Modeling Files

(Critical Energy Infrastructure Information – Filed Under Separate Cover)

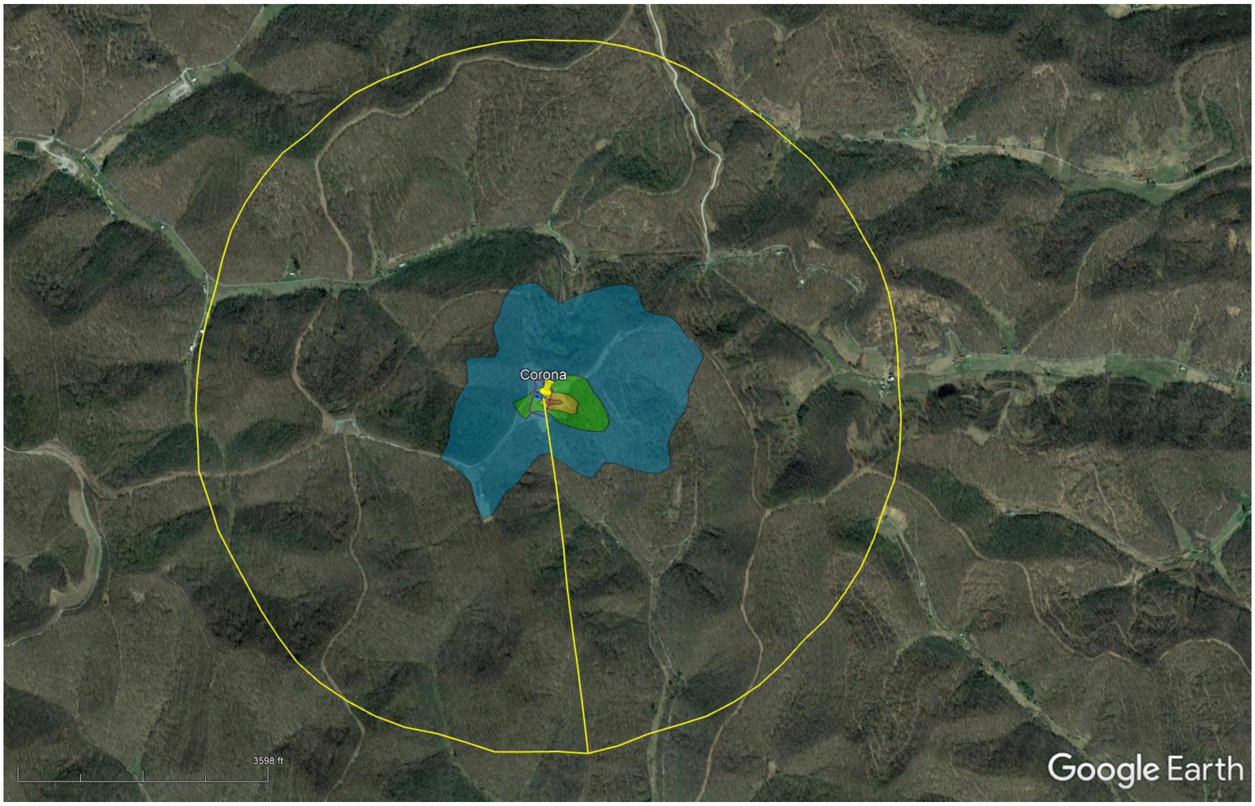
APPENDIX 9-D
Isopleth Maps

Corona CS Project Emissions Modeled Predicted 1-Hr Average NO_2 Concentrations



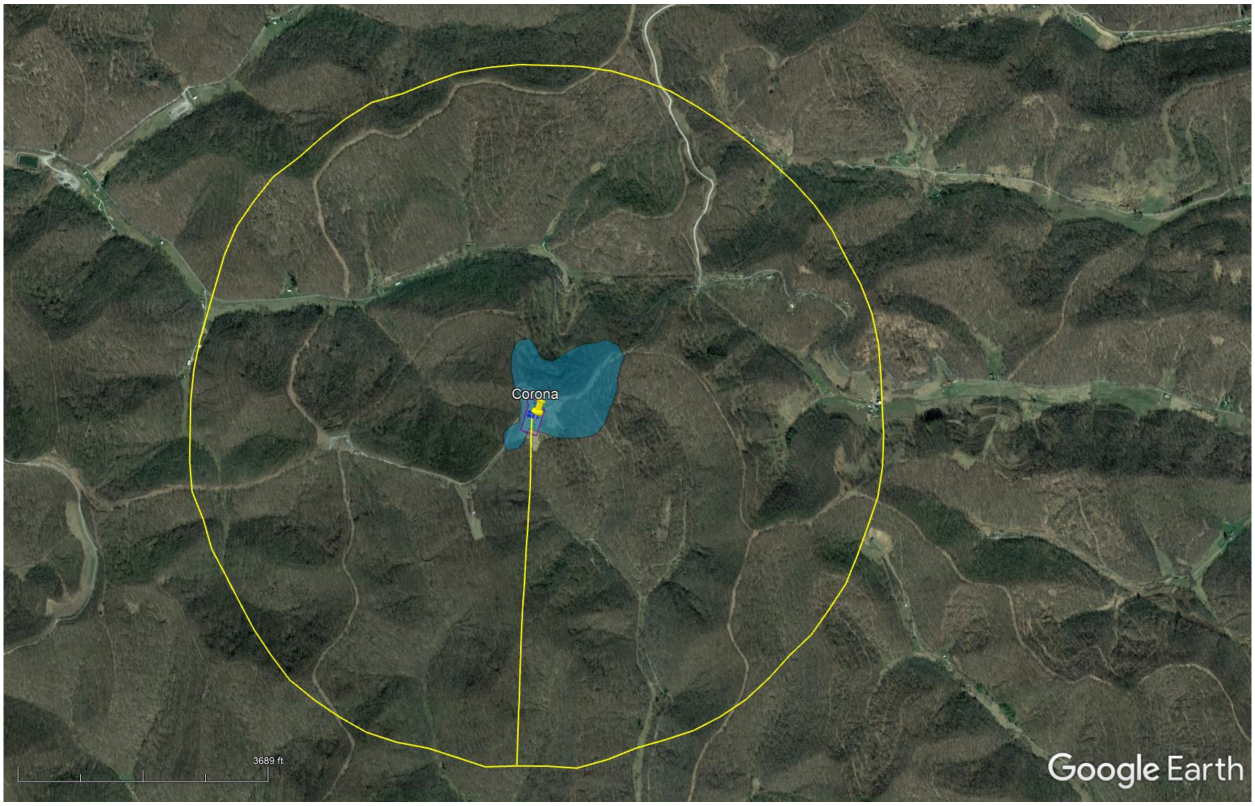
*Blue contour – 0.75 µg/m3 (10% of SIL)
*Green Contour – 2.5 µg/m3 (33% of SIL)
*Yellow Contour – 5.0 µg/m3 (67% of SIL)
*Orange Contour – 7.5 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at a distance of 0.5 miles or less.

Corona CS Project Emissions Modeled Predicted 24-Hr Average $PM_{2.5}$ Concentrations



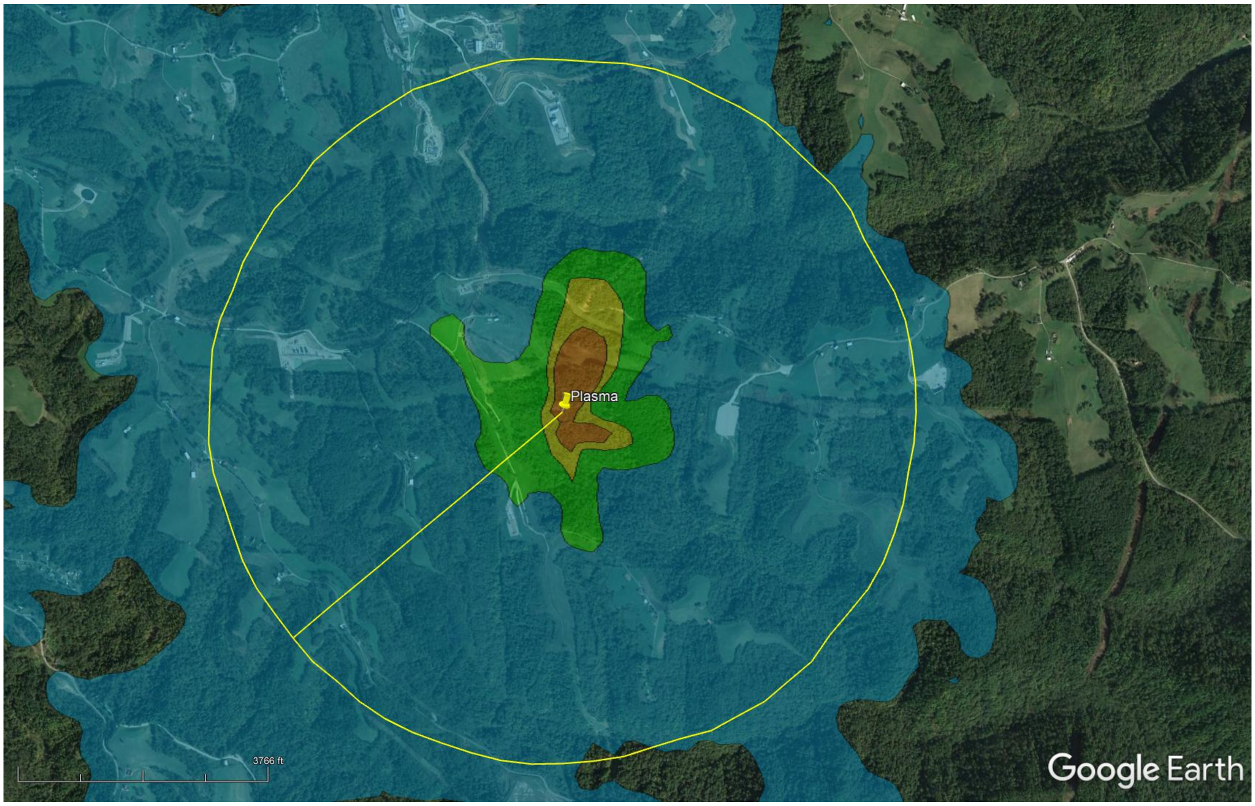
*Blue contour – 0.12 µg/m3 (10% of SIL)
*Green Contour – 0.4 µg/m3 (33% of SIL)
*Yellow Contour – 0.8 µg/m3 (67% of SIL)
*Orange Contour – 1.2 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at a distance of 0.1 miles or less.

Corona CS Project Emissions Modeled Predicted Annual Average $PM_{2.5}$ Concentrations



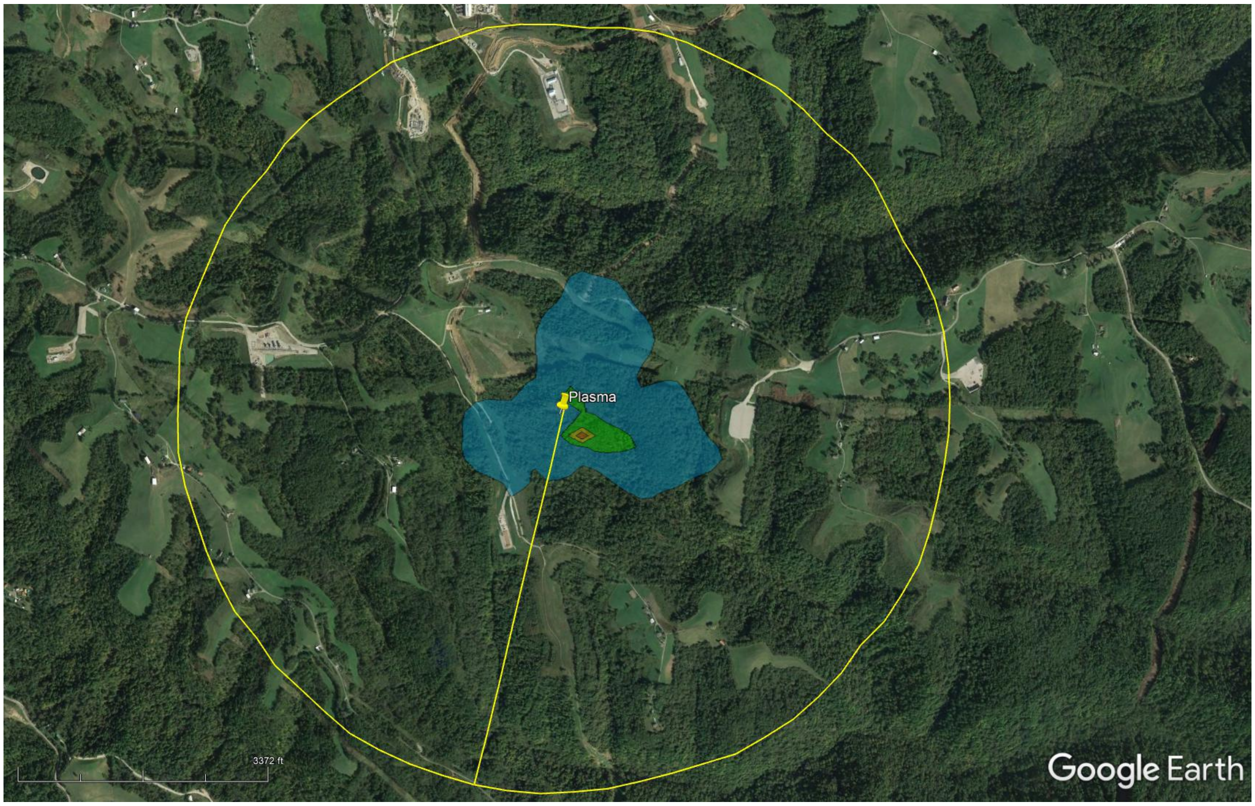
*Blue contour – 0.03 µg/m3 (10% of SIL)
*Green Contour – 0.1 µg/m3 (33% of SIL)
*Yellow Contour – 0.2 µg/m3 (67% of SIL)
*Orange Contour – 0.3 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at the fenceline and beyond.

Plasma CS Project Emissions Modeled Predicted 1-Hr Average NO_2 Concentrations



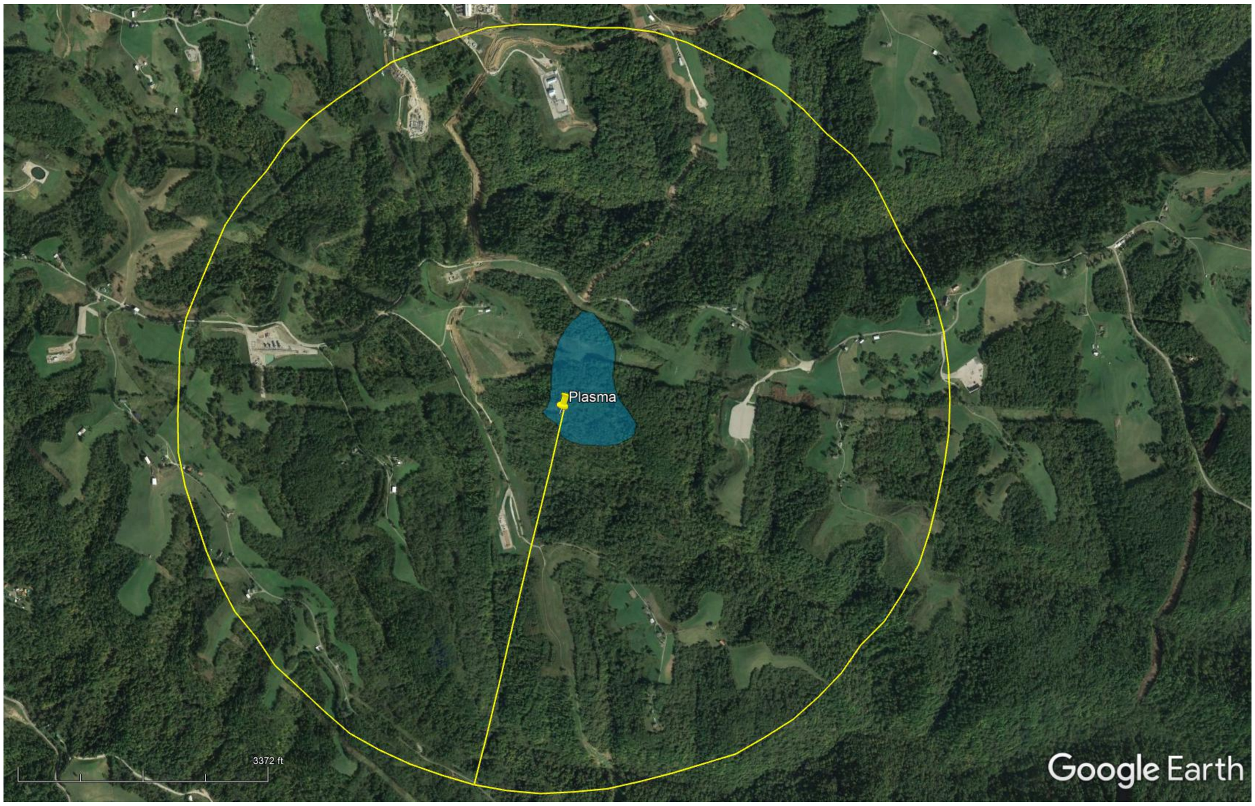
*Blue contour – 0.75 µg/m3 (10% of SIL)
*Green Contour – 2.5 µg/m3 (33% of SIL)
*Yellow Contour – 5.0 µg/m3 (67% of SIL)
*Orange Contour – 7.5 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at a distance of 0.3 miles or less.

Plasma CS Project Emissions Modeled Predicted 24-Hr Average $PM_{2.5}$ Concentrations



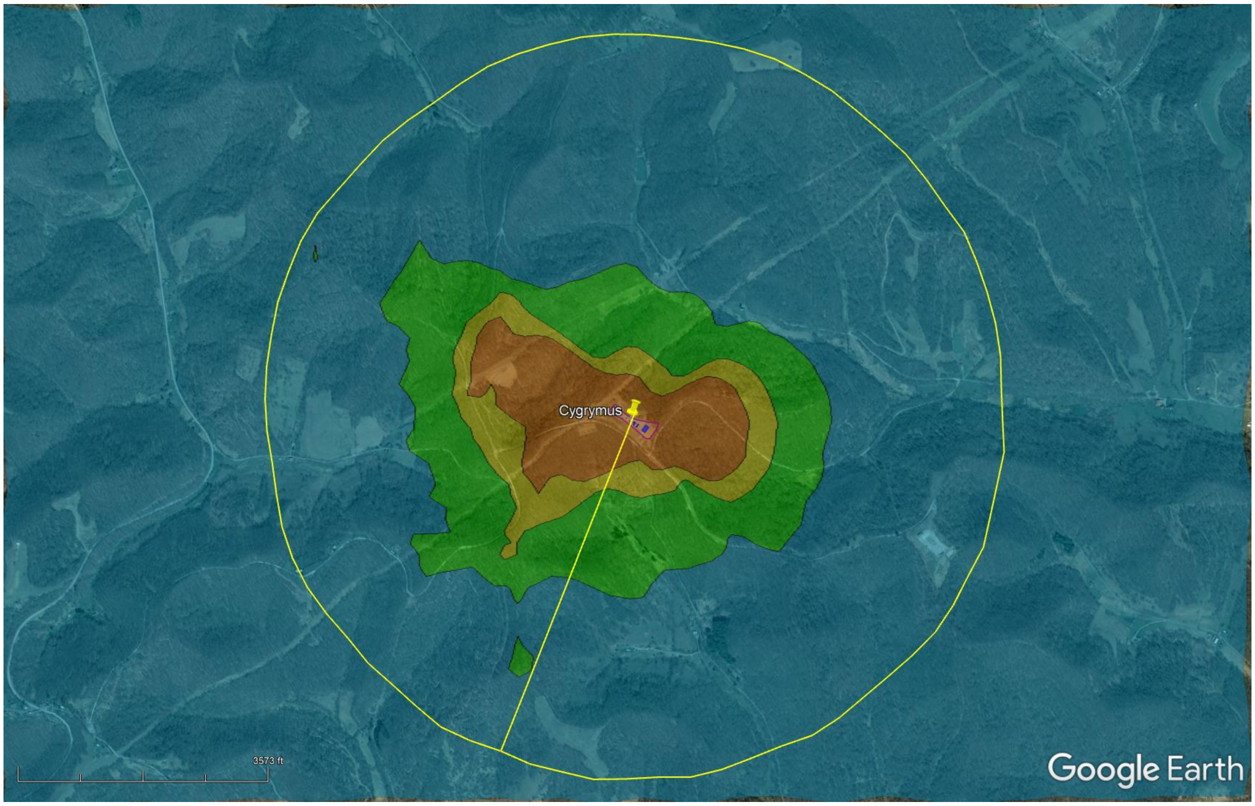
*Blue contour – 0.12 µg/m3 (10% of SIL)
*Green Contour – 0.4 µg/m3 (33% of SIL)
*Yellow Contour – 0.8 µg/m3 (67% of SIL)
*Orange Contour – 1.2 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at a distance of 0.1 miles or less.

Plasma CS Project Emissions Modeled Predicted Annual Average $PM_{2.5}$ Concentrations



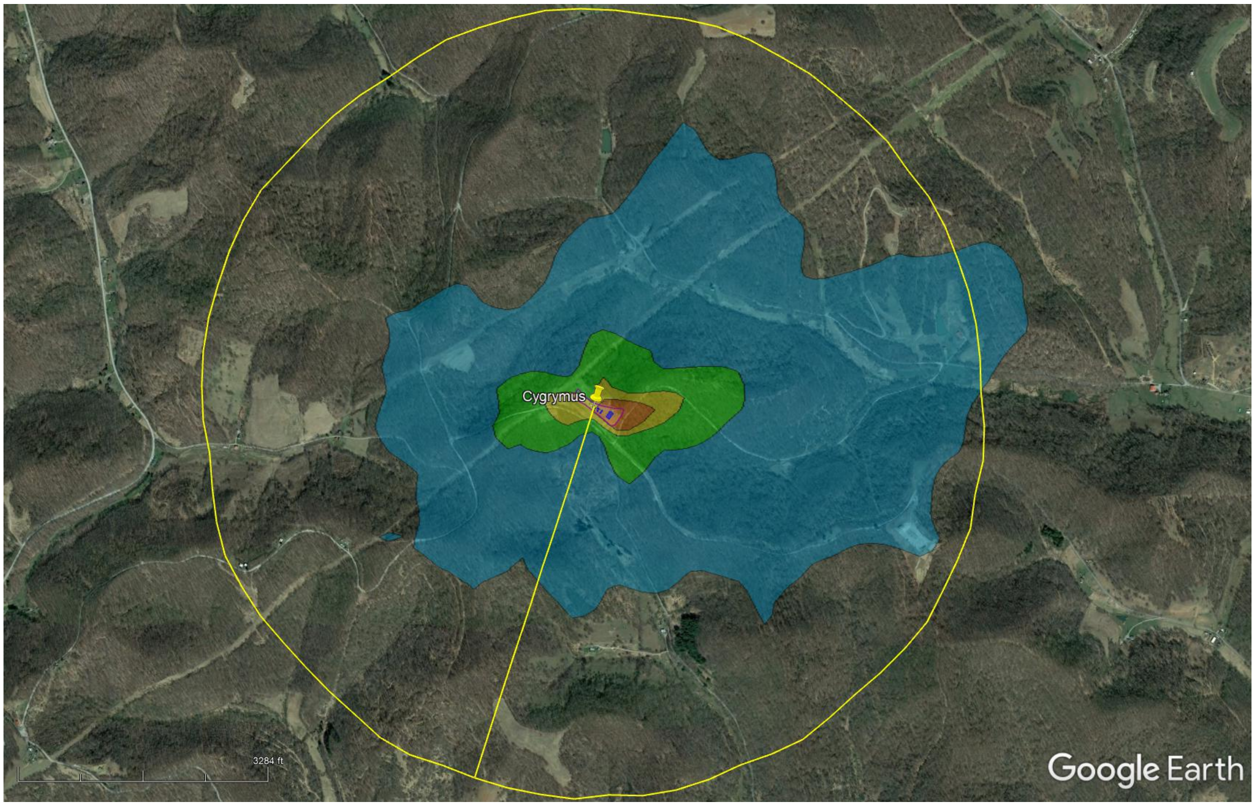
*Blue contour – 0.03 µg/m3 (10% of SIL)
*Green Contour – 0.1 µg/m3 (33% of SIL)
*Yellow Contour – 0.2 µg/m3 (67% of SIL)
*Orange Contour – 0.3 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at the fenceline and beyond.

Cygrymus CS Project Emissions Modeled Predicted 1-Hr Average NO_2 Concentrations



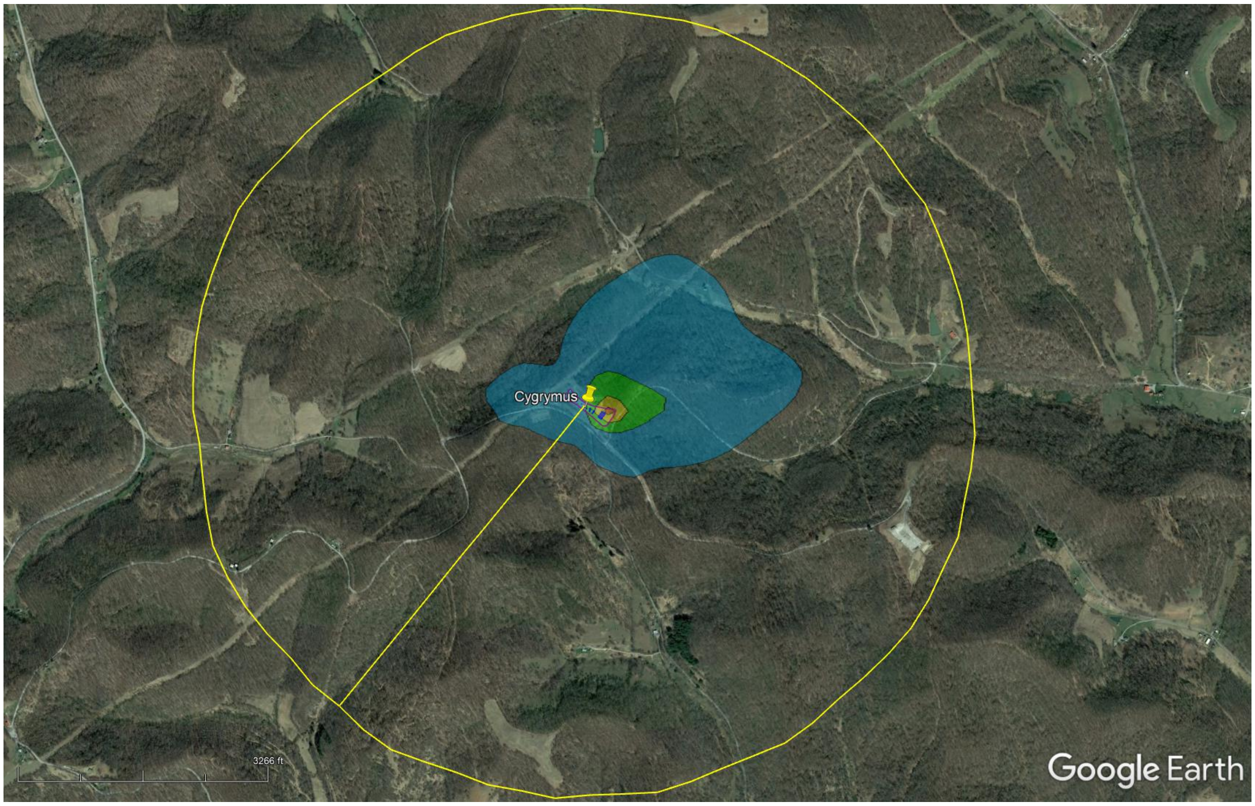
*Blue contour – 0.75 µg/m3 (10% of SIL)
*Green Contour – 2.5 µg/m3 (33% of SIL)
*Yellow Contour – 5.0 µg/m3 (67% of SIL)
*Orange Contour – 7.5 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at a distance of 0.5 miles or less.

Cygrymus CS Project Emissions Modeled Predicted 24-Hr Average $PM_{2.5}$ Concentrations



*Blue contour – 0.12 µg/m3 (10% of SIL)
*Green Contour – 0.4 µg/m3 (33% of SIL)
*Yellow Contour – 0.8 µg/m3 (67% of SIL)
*Orange Contour – 1.2 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at a distance of 0.2 miles or less.

Cygrymus CS Project Emissions Modeled Predicted Annual Average $PM_{2.5}$ Concentrations



*Blue contour – 0.03 µg/m3 (10% of SIL)
*Green Contour – 0.1 µg/m3 (33% of SIL)
*Yellow Contour – 0.2 µg/m3 (67% of SIL)
*Orange Contour – 0.3 µg/m3 (100% of SIL)
**The circle denotes areas within 1 mile of site. The model concentrations from the proposed project sources are below the level that EPA has determined will not cause or contribute to ambient air quality exceedances (i.e., less than SILs) at a distance of 0.1 miles or less.

APPENDIX 9-E
Noise Study Reports

CORONA COMPRESSOR STATION

Pre-Construction Sound Level Study

Prepared for: Equitrans Midstream

SLR Ref: 135.02234.00018

November 18, 2021

Pre-Construction Sound Level Study

Prepared for:

Equitrans Midstream

2200 Energy Drive
Canonsburg, PA 15317

This document has been prepared by SLR International Corporation. The material and data in this report were prepared under the supervision and direction of the undersigned.

U.S. Acoustical Services Manager

Daniel P. Hanley
Project Consultant

Steve Gronsky, E.I.T.
Project Engineer

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ACRONYMS

dB	Decibel
dBA	A-weighted Decibel
EDT	Eastern Daylight Time
FERC	Federal Energy Regulatory Commission
Hz	Hertz
IL	Insertion loss
ISO	International Organization for Standardization
lb/cf	Pounds per cubic foot
lb/sf	Pounds per square foot
L_{dn}	24-hour average day-night sound level
L_{eq}	Equivalent continuous sound level
L_w	Sound power level
L_p	Sound pressure level
SLM	Sound level meter
TL	Transmission loss

SUMMARY

SLR International Corporation (SLR) has prepared a noise study at the request of Equitrans Midstream, for the proposed expansion of the existing Corona Compressor Station near Coburn in Wetzel County, West Virginia. This report presents the results from SLR's sound level survey of the existing ambient conditions and sound modeling of the expanded station.

An operational sound survey for the station was conducted by SLR on September 15th through the 16th, 2021. Sound levels were measured at the four closest noise sensitive areas (NSAs) surrounding the station site. One measurement location encapsulated two NSAs. The existing turbine-compressor unit was operational during the survey, running under typical load conditions. However, the existing equipment at the station is very quiet and not audible at any of the NSA measurement locations.

The measured sound levels at the NSAs ranged from 40.5 to 65.8 dBA L_{dn}. The operating station was practically inaudible at the NSA measurement locations, so the ambient sound levels are controlled by other environmental noise sources, such as vehicular traffic. **Table A**, below, summarizes the calculated future sound levels at the NSAs. The table shows the current day-night ambient sound levels with the Corona Station operating, as well as the contribution from the future expanded station equipment (existing + future). The future station equipment was assumed to have the noise mitigation described in this report installed.

Table A: Compressor Station Sound Level Predictions

NSA	Distance from Comp. Bldg to NSA, feet	Direction	Measured Existing Ambient, Day-Night Average[a]	Estimated Contribution of Station Equipment					Combined, All Sources Including Ambient	Increase Above Existing Ambient
				Current Station Equipment[b]	Future Expansion Equipment[c]		Combined Existing and Future Expansion	Predicted Increase Over Existing Contribution		
			dBA L_{dn}	L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{dn} dBA	ΔL_{dn} dBA	dBA L_{dn}	dBA L_{dn}
1	1,875	N	57.0	32.0	25.2	31.6	**34.8**	2.8	57.0	0.0
2	2,070	SSE	40.5	34.1	25.9	32.3	**36.3**	2.2	41.1	0.6
3	2,630	N	57.0	27.5	21.0	27.4	**30.5**	3.0	57.0	0.0
4	3,135	NW	63.8	27.8	19.7	26.1	**30.0**	2.2	63.8	0.0
5	3,075	NE	65.8	32.4	25.4	31.8	**35.1**	2.7	65.8	0.0

a. Post-processed to remove noise from rain and insects; the existing compressor station equipment is practically inaudible at the NSAs, so these levels are controlled by traffic, leaf rustle, and other environmental noises.
b. Per noise modeling results, L_{dn} was calculated by adding 6.4 dB to the L_{eq}
c. L_{dn} was calculated by adding 6.4 dB to the L_{eq}

Table A shows that calculated A-weighted sound levels from the expanded station result in very minor increases at the NSAs (0 dBA to 0.6 dBA L_{dn}). Ambient A-weighted sound levels in the area are primarily controlled by non-station sound (natural sounds, local road traffic, etc.). Ambient levels at NSA 2 were lower due to the relative absence of roadway noise. A-weighted sound from the compressor station is relatively minor when compared to other ambient sounds, due to the existing and future equipment noise mitigation controls.

1 INTRODUCTION

SLR International Corporation (SLR) has prepared a pre-construction noise study at the request of Equitrans Midstream, for an expansion of the existing Corona Compressor Station near Coburn, in Wetzel County, West Virginia. The proposed station expansion comprises the addition of a second Solar Mars 100 turbine/compressor unit rated at 16,399 horsepower (hp) at 0° F. This report presents the results of the pre-construction noise survey conducted by SLR. The report also describes requirements for the expansion equipment sound power levels and noise control treatments necessary to meet the FERC sound level limit of 55 dBA day-night average (L_{dn}) at nearby noise-sensitive areas. Noise mitigation treatments will also limit station sound level increases to no more than 3 dBA above existing conditions.

2 ENVIRONMENTAL SOUND LEVEL CRITERIA

The environmental sound level contributions from the proposed equipment at this compressor station are subject to the FERC noise regulation governing interstate gas transmission compressor stations. The FERC noise regulation is receptor based, and limits compressor station noise contributions to no more than 55 dBA L_{dn} or, equivalently, no more than a continuous 48.6 dBA at the surrounding noise-sensitive areas (NSAs). NSAs are typically residences, schools, churches, or hospitals. There are no other known state, county, or local regulations that would apply to this compressor station site.

3 DESCRIPTION OF SITE AND STATION

3.1 DESCRIPTION OF SITE

The station site is located off Richwood Run Road about three and a half miles south of Coburn, West Virginia. The area surrounding the station consists primarily of rolling hills covered with dense forests and agricultural fields.

3.2 DESCRIPTION OF STATION EQUIPMENT

The existing station consists of a single Solar Mars 100 turbine-driven centrifugal compressor in an acoustically-insulated compressor building. The proposed station expansion will consist of the addition of a Solar Mars 100 unit in an expanded acoustically-insulated compressor building. Like the existing unit, the expansion unit will have a 16,399 hp turbine driving a centrifugal compressor. All power ratings are at 0° F ambient air temperature. Associated equipment (located outdoors) is as follows:

- Gas aftercoolers
- Turbine lube oil coolers
- Turbine inlet and exhaust openings
- Station suction and discharge piping and suction separators
- Fuel gas skid

- Capstone generator
- Control valves

4 SOUND LEVEL SURVEY

4.1 CLOSEST NOISE SENSITIVE AREAS

Five NSAs were identified by SLR using aerial imagery. They consist of the five closest residences relative to the station site. The NSAs are summarized in **Table 4-1**. The distance and direction from the site to the NSAs are shown. Distances reference the center of the site location provided by Equitrans Midstream. The NSAs and measurement locations are shown in **Figure 1**.

Table 4-1: Summary of Noise Sensitive Areas

NSA	Description	Approximate Distance from Station to NSA, feet	Direction to NSA
1	Residence	1,875	North
2	Residence	2,070	SSE
3	Residence	2,630	North
4	Residence	3,135	Northwest
5	Residence	3,075	Northeast

4.2 ENVIRONMENTAL SOUND LEVEL MEASUREMENTS

The ambient sound level survey was performed between September 15th and 16th, 2021 by Steve Gronsky and Damien Bell of SLR. Sound level measurements were monitored near each NSA. Measurements were approximately 24-hours in duration. **Figure 1**, attached, shows the NSAs and measurement locations. The measurements are summarized in **Table 4-2**. Measurement Location 1/3 was very close to NSAs 1 and 3, so ML 1/3 represents both NSAs.

Table 4-2: Summary of Sound Level Measurements

NSA	Measurement Location	Measurement Duration (HH:MM)	Source Observations
1	ML 1/3	24:03	Local traffic on nearby road, birds, insects, rain
2	ML 2	23:15	Local traffic, birds, insects, rain
3	ML 1/3	24:03	Local traffic on nearby road, birds, insects, rain
4	ML 4	23:51	Natural sounds (forested location), compressor station barely audible, rain
5	ML 5	18:32	Local traffic, daytime construction equipment, birds, insects, rain

4.3 MEASUREMENT EQUIPMENT

Sound level equipment used during the site survey included the following instruments:

- Larson Davis Model 831 Sound Level Meter, real time analyzer; Type 1; S/N: 11310
- Brüel and Kjær Model 2250 and 2270 Sound Level Meters, Type 1; S/N: 3000936, 2630388, 2704733, 2505915, 2590438
- Brüel and Kjær Type 4231 Calibrator; s/n 3001195

Windscreens were used on the measurement microphones. The sound level meters were field-calibrated before and after measurements. All sound meters have current laboratory certification, available upon request.

4.4 WEATHER CONDITIONS

Weather conditions were appropriate for a sound level survey as summarized in **Table 4-3**. There were periods of mist and/or rain during some portions of the monitoring period. However, there were enough periods without precipitation to quantify the existing station contribution and the overall ambient sound levels.

Table 4-3: Summary of Weather Conditions During Survey

Dates	September 15 – 16, 2021
Temperature	66°F – 79°F
Relative Humidity	78 – 100%
Wind Direction	S to E
Wind Speed	0 – 9 mph
Sky Conditions	Fair to Mostly Cloudy
Ground Conditions	Damp

4.5 MEASUREMENT METHODOLOGY

Sound levels were measured using the slow meter response and A-weighting. In addition to broadband A-weighted (dBA) levels, linear (dB) 1/3 and 1/1-octave band levels were also measured. The survey began at approximately 9:00 am on September 15, 2021 and ended at approximately 9:30 am on September 16, 2021.

4.6 MEASUREMENT RESULTS

The sound level measurement results are summarized in **Table 4-4**. The measured sound levels for daytime (L_d), nighttime (L_n), and the equivalent day-night sound level (L_{dn}) are shown. Daytime is considered to be the period from 7:00 am to 10:00 pm, and nighttime is from 10:00 pm to 7:00 am. The day-night average (L_{dn}) is a 24-hour sound level average that includes a 10-dBA penalty added to levels measured at night. The data in the **Table 4-4** were post-processed to remove the high-frequency contribution from insect noise and exclude periods of heavy rain. Levels at NSA 2 were considerably lower than the other locations, due to that location being far from any roadways.

Table 4-4: Summary of Sound Level Measurements

NSA	Measurement Location	Measured Levels Period Average, dBA		
		Day	Night	Day-Night
		L_d	L_n	L_{dn}
1	ML 1/3	52.6	50.1	57.0
2	ML 2	41.9	26.0	40.5
3	ML 1/3	52.6	50.1	57.0
4	ML 4	57.4	57.3	63.8
5	ML 5	55.4	59.8	65.8

Level versus time graphs of the measurement results for the four monitoring locations are shown in **Appendix A**. Each graph is the result of a single set of measurements at a single position. The graph shows the ten-second L_{eq}, represented by a solid blue line, and the L_{90}, represented by the red line. Sound levels at ML 1/3, ML 4, and ML 5 were influenced by vehicular traffic on N Fork Road (15/17). Location ML 2 is over 0.5 mile from any main roads, so ambient sound levels there were lower. Location ML 1/3 is a single location that represents conditions at NSA 1 and NSA 3.

5 PROPOSED EQUIPMENT NOISE IMPACT EVALUATION

5.1 SIGNIFICANT SOUND SOURCES

The following sound sources are considered significant:

- 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 inlet air system, including the inlet opening and noise radiated from the silencer/ductwork shell and any duct joints.
- Turbine/Compressor casing noise that radiates to the exterior of the building and through building ventilation openings.
- Noise from the lube oil cooler and gas aftercooler,
- Noise radiated by aboveground station piping.

5.2 NOISE MODEL DEVELOPMENT

A three-dimensional computer noise model was constructed to analyze the noise contributions expected from the future compressor station configuration (existing + new equipment). The model was developed using CadnaA, version 2021 MR 2 (build: 187.5163), a commercial noise modeling package developed by DataKustik GmbH. The software considers 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.

5.2.1 DATA AND ASSUMPTIONS

Table 5-1 presents the sound power levels used as input to the sound model. Existing Unit #1 and future Unit #2 The future compressor building dimensions were used in the noise model. The existing equipment was arranged as per the current site, with the unit suction and discharge piping on the northwest side; the turbine inlet on the southeast side; and the existing turbine exhaust and lube oil cooler on the south side of the compressor building. The future turbine exhaust and outdoor equipment were modeled per the plot plan provided to SLR. The turbine exhausts were modeled at a height of 45.5 feet above grade. The ventilation opening size and distribution was based on the current compressor building, as observed during the site visit. The expanded compressor building will include a total of four wall intakes (two existing fans and two new fans for Phase 2). Each opening was sized 60 inches square. The modeling also includes the throat ridge ventilator.

Table 5-1: Sound Pressure Levels (L_p) and Sound Power Levels (L_w) for Station Equipment [4]

Source	Linear L_p or L_w at Octave Center Frequency									Total
	31.5	63	125	250	500	1k	2k	4k	8k	dBA
Engine Intake, Mars 100, Unsilenced L_w[1]	113	119	125	126	127	129	132	161	153	162
Engine Exhaust, Mars 100, Unsilenced, L_w[1]	123	127	125	128	132	127	119	109	99	132
Unlagged Suction Piping, Per Meter, L_w[2]	96	98	97	92	93	98	113	102	92	114
Sound Level in Compressor Building at Inner Wall Surface, L_p[2]	86	86	97	100	99	98	100	108	98	110
Fuel Gas Skid, L_w[2]	-	-	-	-	91	96	104	103	99	108
Unlagged Discharge Piping, Per Meter, L_w[2]	90	86	86	92	97	90	102	94	83	104
42” Building Wall Panel Fan, L_w[2]	97	97	101	97	96	96	93	88	81	100
Exhaust Breakout, L_w[2]	95	97	94	94	88	86	95	94	83	99
Intake Breakout, L_w[2]	105	93	91	96	86	84	86	93	79	96
Capstone C1000 Generator, L_w[3]	92	90	97	90	88	90	84	87	87	95
Lube Oil Cooler, L_w[1]	95	102	96	92	87	84	80	76	71	90
Anti-surge Valve, L_w[2]	-	-	-	-	74	80	87	82	77	90
Sound Power Level of Gas Cooler Fans, Per Fan, L_w[3]	91	91	90	97	82	80	74	68	62	85

[1] From Solar Noise Book – 2015
[2] From SLR Data Library from similar projects
[3] From Vendor datasheet
[4] Sound level specifications and noise mitigation for the existing Mars 100 unit (Unit #1) and the proposed new Mars 100 unit (Unit #2) are equivalent.

5.2.2 NOISE MODEL RESULTS – TYPICAL OPERATION SCENARIO WITH MITIGATION

Table 5-2 shows a summary of the predicted future sound level contribution of the Station equipment (existing and future station equipment) at each NSA. The table also shows the overall NSA sound levels, including the future station and ambient environmental sources. This table indicates that with the proposed noise control treatments discussed below, the compressor station noise contributions at all of the nearest NSAs are below the FERC criterion of 55 dBA L_{dn}. The FERC sound level limits apply only to the sound level contribution of the compressor station equipment, and do not include the influence of the existing ambient sound levels. The highest station contribution is 36.3 dBA L_{dn} at NSA 2, which is well below the FERC limit of 55 dBA L_{dn}. A noise contour map of the station including the expansion equipment is shown as **Figure 2**.

Table 5-2: Compressor Station Sound Level Predictions

NSA	Distance from Comp. Bldg to NSA, feet	Direction	Measured Existing Ambient, Day-Night Average[a]	Estimated Contribution of Station Equipment					Combined, All Sources Including Ambient	Increase Above Existing Ambient
				Current Station Equipment[b]	Future Expansion Equipment[c]		Combined Existing and Future Expansion	Predicted Increase Over Existing Contribution		
			dBA L_{dn}	L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{dn} dBA	ΔL_{dn} dBA	dBA L_{dn}	dBA L_{dn}
1	1,875	N	57.0	32.0	25.2	31.6	**34.8**	2.8	57.0	0.0
2	2,070	SSE	40.5	34.1	25.9	32.3	**36.3**	2.2	41.1	0.6
3	2,630	N	57.0	27.5	21.0	27.4	**30.5**	3.0	57.0	0.0
4	3,135	NW	63.8	27.8	19.7	26.1	**30.0**	2.2	63.8	0.0
5	3,075	NE	65.8	32.4	25.4	31.8	**35.1**	2.7	65.8	0.0

a. Post-processed to remove noise from rain and insects; the existing compressor station equipment is practically inaudible at the NSAs, these levels are controlled by traffic, leaf rustle, and other environmental noises.

b. Per noise modeling results.

c. L_{dn} was calculated by adding 6.4 dB to the L_{eq}

5.2.3 NOISE MODEL RESULTS – UNIT BLOWDOWN SCENARIO

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

A compressor blowdown scenario was modeled using a single blowdown silencer specified to limit the blowdown sound levels to a maximum of **85 dBA at 3 feet**. **Table 5-3** shows the predicted short-term sound pressure levels at the NSAs during a blowdown event. The unit blowdown event sound levels are compared to the nighttime average levels at each NSA, to show the potential short-term sound level impact of the Station. The predicted blowdown sound levels are quite low, with the highest predicted sound level of 16.9 dBA L_{eq} at NSA 2.

Table 5-3: Station Unit Blowdown Sound Level Predictions

NSA	Distance from Compressor Building to NSA	Direction	Measured Existing Ambient, Night Average[a]	Estimated Contribution of Unit Blowdown	Combined Blowdown and Ambient	Short-Term Sound Level Increase During Blowdown
	(feet)		L_n dBA	L_{eq} dBA	L_n dBA	ΔL_{eq} dBA
1	1,875	North	50.1	10.6	50.1	0.0
2	2,070	SSE	26.0	16.9	26.5	0.5
3	2,630	North	50.1	6.2	50.1	0.0
4	3,135	Northwest	57.3	13.4	57.3	0.0
5	3,075	Northeast	59.8	8.1	59.8	0.0

a. Post-processed the sound level data to remove environmental noise sources such as rain and insects

5.2.4 NOISE MODEL RESULTS – EMERGENCY SHUTDOWN SCENARIO

The station has an emergency shutdown (ESD) system that automatically halts operation of the station in the event of an irregularity. This results in a full station blowdown 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 one time per year. The station ESD system was modeled with an estimated sound level due to the blowdown of **95 dBA at 50 feet**.

Table 5-4 shows the predicted short-term sound levels at the NSAs due to an ESD blowdown. The station ESD blowdown event sound levels are compared to the nighttime average levels at each NSA, to show the potential short-term nighttime sound level impact of the Station. The highest predicted ESD sound level is 51.4 L_{eq} dBA at NSA 2. This is a reasonable sound level for an event that will only occur in emergency situations, or during testing periods that are scheduled ahead of time and with limited frequency. An ESD blowdown event has a duration of less than ten minutes.

Table 5-4: Station ESD Blowdown Sound Level Predictions

NSA	Distance from Compressor Building to NSA	Direction	Measured Existing Ambient, Night Average[a]	Estimated Contribution of ESD Blowdown	Combined ESD Blowdown and Ambient	Short-Term Sound Level Increase During ESD Blowdown
	(feet)		L_n dBA	L_{eq} dBA	L_n dBA	ΔL_{eq} dBA
1	1,875	North	50.1	45.1	51.3	1.2
2	2,070	SSE	26.0	51.4	51.4	25.4
3	2,630	North	50.1	40.7	50.6	0.5
4	3,135	Northwest	57.3	47.9	57.8	0.5
5	3,075	Northeast	59.8	42.6	59.9	0.1

a. Post-processed the sound level data to remove environmental noise sources such as rain and insects

5.2.5 NOISE MODEL RESULTS – CONSTRUCTION

Only standard equipment will be used during construction, with no dynamic compaction or pile driving expected. Most construction will take place during daytime working hours of 7:00 a.m. until 7:00 p.m. Construction sound calculations were performed with the CadnaA propagation model, which accounts for local topography. Equipment usage factors were used per the Federal Highway Administration's Roadway Construction Noise Model version 1.1 (FHWA, 2006). Usage factor is the percentage of time a given piece of equipment typically operates during a given hour. The following equipment were included in the construction evaluation for the station (quantities in parentheses):

- Diesel Area Light Plant (8)
- Diesel Generators (2)
- Diesel Welders (2)
- Diesel Air Compressors (2)
- Aerial Platform Lift (2)
- Pneumatic noise, Purge, Blow Down (1)
- Skid Steer (1)
- Excavator (1)
- Dozer (1) **– No Nighttime Operation**
- Telehandler (1)
- Crane (1) **– No Nighttime Operation**
- Trucks (4)
- Air Hammer (1) **– No Nighttime Operation**
- Electric hand tools (2)
- Air Mover (1)
- Nitrogen Purge (1)

Calculated construction sound levels at the NSAs are 33 to 40 dBA L_{eq}, which is below the FERC limit of 48.6 dBA L_{eq}. By comparison, measured ambient levels at NSAs 1, 3, 4, and 5 ranged from 50 dBA to 60 dBA L_{eq}. At those locations, sound from construction activity is not expected to be more than 0 to 1 dBA above daytime or nighttime ambient L_{eq} levels.

Nighttime work may occur during the Project, involving occasional use of the construction equipment shown above. Due to the very low nighttime ambient levels at NSA 2 (26 dBA Leq), nighttime construction may be audible there at times. Sound levels may occasionally approach 40 dBA (L_{eq}) at NSA 2, which is almost 15 dBA above the measured nighttime ambient L_{eq}.

A temporary 10 to 15 dBA increase in the ambient sound level is likely to be noticeable, depending on the time of night or the sensitivity of the residents. Construction-related annoyance complaints will be addressed should they arise, and modifications to the construction schedule can be made if necessary.

6 NOISE CONTROL TREATMENTS

A summary of the modeled performance of one possible set of noise control treatments is shown in **Table 6-1**, below. The noise mitigation described applies to the expansion equipment only. The following subsections describe the treatments. The noise mitigation measures shown are based on the most current station design and represent one potential set of possible mitigation measures. There are many different combinations of noise control mitigation measures that will provide similar noise control. As the station design is finalized the noise mitigation treatments may be modified to account for other design changes, but the final noise control design will maintain compliance with the FERC sound level requirements.

Table 6-1: Required Noise Control Treatments

Required Dynamic Insertion Loss (DIL) or Transmission Loss (TL)										
Source	Treatment Description	Required Treatment Performance								
		31.5	63	125	250	500	1k	2k	4k	8k
Turbine Inlet	Solar Silencer, DIL	2	4	7	16	40	50	51	55	55
Turbine Inlet	Pulse Updraft Filter, DIL	2	4	8	9	13	26	27	27	33
Compressor Building	STC-39 Wall and Roof System, TL	10	16	17	24	44	49	55	55	58
Personnel Door	STC-32 Standard Personnel Door, TL	9	17	23	27	32	32	31	41	41
Equipment Door	STC-21 Insulated Roll-up Door, TL	2	7	12	17	18	19	22	30	35
Building Ventilation	3ft Silencers and Lined Hoods, DIL	2	6	10	15	25	30	30	25	15
Ridge Vent	Acoustic Baffle, DIL	-	-	-	4	6	9	9	14	9
Exhaust	Mars Exhaust Silencer, DIL	12	17	29	38	49	48	41	30	16
Piping or Inlet Ductwork, if necessary	Type ISO B2 Lagging, TL	-	-	-	-	6	15	24	33	42

6.1 COMPRESSOR BUILDING WALLS AND ROOF

The compressor building expansion shall achieve, at minimum, the sound transmission class rating (STC) and sound transmission loss performance shown in **Table 6-1**. It is recommended that the compressor building manufacturer supply laboratory test results for their proposed wall system, showing a transmission loss equal to or greater than the required performance in each octave band. The compressor building should have no windows, skylights, or translucent panels.

The interior surface of the compressor building walls should be acoustically absorptive, having a noise reduction coefficient (NRC) of at least NRC 0.8. The inside of the compressor building can be lined with perforated metal of at least 23 percent open area for insulation protection, if so desired. The building should be well sealed with no cracks or gaps. All piping penetrations through the building walls should be well insulated, flashed, and caulked.

6.2 COMPRESSOR BUILDING DOORS

The expanded compressor building section will have an additional 14-foot by 14-foot steel roll-up equipment door. Standard insulated over-head door will be sufficient for the equipment doors. The performance shown in **Table 6-1** is the required transmission loss performance of the roll-up door.

The personnel doors should achieve the STC rating per **Table 6-1,** or better. These are industrial metal doors with good perimeter seals. Small glass windows in the personnel doors are acceptable as long as the door STC rating is achieved.

6.3 COMPRESSOR VENTILATION

All building ventilation openings should include standard acoustical louvers or silencers, such that the total sound pressure level contribution of each opening does not exceed **70 dBA at 12 feet** from the opening. This sound level target for each ventilation opening includes the sound level contribution of both the mechanical equipment inside the building (turbines, etc.) along with the sound levels due to the ventilation fans. The unsilenced building ventilation fan should not exceed a level of **80 dBA at 3 feet**. The sound pressure level calculated for the interior of the building due to the turbine and compressor equipment is shown in **Table 5-1**. The ventilation system supplier should submit the sound power level of the proposed building ventilation fans during the bidding process for review.

The approximate ventilation silencer performance is shown in **Table 6-1**. The final performance requirements of these silencers will depend on the size, number, and type of ventilation fans used in the design. The sound pressure level target should be the primary design criterion, as it can be field-tested after installation.

Any expansion to the throat ridge ventilator should have acoustic insulation applied to the damper and an acoustic baffle suspended beneath it, along the center of the building.

6.4 TURBINE EXHAUSTS

For the operation of dual-shaft SoLoNox turbines, Solar notes that sound levels during partial-load operation can be higher than sound levels during full-load operation. In an analysis of manufacturer data for these turbines, increases of up to 6 dB at 1 kHz have been noted by Solar for Mars 100 exhausts and increases of up to 6 dB at 4 kHz for Mars 100 inlets. Silencer specification and bidding should be developed with such potential variability in mind, in order to satisfy the noise targets for all steady-state operational conditions.

6.4.1 SILENCER PERFORMANCE

The turbine will include an exhaust silencer system that results in the sound pressure level spectrum shown in **Table 6-1** at a distance of 200-feet. Because of the complexities involved with the field verification of silencer insertion loss, the vendor should bid to meet a sound pressure level target of **45 dBA at 200 feet** from the exhaust opening, measured horizontally from the edge of the stack top with the turbine in <u>any</u> steady-state operational condition, including partial load and full load.

6.4.2 EXHAUST DUCT AND SHELL NOISE

In large turbine-powered installations it is common for a significant amount of sound energy to radiate from the exhaust system ductwork, expansion joints, and exhaust silencer shell. This sound energy is often termed "shell-radiated" noise. Shell-radiated noise is not necessarily calculated by exhaust system manufacturers, but it can be a dominant noise source for NSAs close to the station. The modeled breakout noise sound power levels are shown in **Table 5-1**. These levels were based on measurements taken of the existing exhaust stack at the Corona station.

6.5 TURBINE INLET

The proposed expansion unit will include the standard Solar intake silencer and pulse-updraft filter. The insertion losses of each of these two elements are shown in **Table 6-1**.

6.5.1 INLET BREAKOUT

Sound radiating from the inlet ductwork on the turbine side of the inlet silencer can be a significant noise source. If possible, the inlet silencer should be located inside of the compressor building. If the inlet silencer is not located inside a compressor building, then the inlet ductwork between the silencer and the building wall should be acoustically lagged with the ISO Type B2 lagging listed in **Table 6-1**.

6.6 LUBE OIL COOLER

The sound power level of the lube oil cooler should not exceed the sound power levels given in **Table 5-1**. This is the total sound power level for the entire cooler (i.e. not just a single fan). The sound power level in **Table 5-1** is equivalent to the Solar 90 dBA lube oil cooler.

6.7 GAS AFTERCOOLER FANS

Table 5-1 shows the total radiated sound power level for the gas aftercooler fans at the station. The total sound power level including the sum of the sound power of each fan, along with any radiated sound due to the motors and drive assemblies for the future cooler, should not exceed **65 dBA at 16 feet** from the cooler. This was modeled using the sound power level spectrum supplied by the equipment manufacturer, and it was then adjusted based on the number of fans in each cooler bay.

6.8 STATION PIPING

Noise from centrifugal compressors will cause significant noise radiation from connected piping. To the extent practical, all suction and discharge piping should be run underground. All outdoor aboveground piping between the compressor and the separators on the suction side, and the compressor and the gas cooler on the discharge side, may be acoustically lagged if necessary. All piping was left untreated in the model.

The computer noise model also includes an anti-surge valve. Should the valve be louder than expected after construction, lagging could also be applied to this source.

6.8.1 ACOUSTICAL PIPE LAGGING

If acoustical lagging is used, it should conform to the performance specifications shown in **Table 6-1** for Type B2 lagging. This is generally equivalent to (listed from pipe surface outwards):

- 4 inches of 6 to 8 lb/cf mineral wool or fiberglass pipe insulation,
- a layer of 1 lb/sf mass-loaded vinyl,
- and a layer of 0.016" aluminum jacketing or silicon-coated fiberglass cloth.

Other lagging systems are available that will offer similar acoustical performance, so the lagging system performance shown in Table 6-1 should be used as the performance goal rather than the listed material requirements.

6.8.2 PIPING ISOLATION

To limit noise radiation from structural supports, the compressor piping should be isolated from pipe supports and other structural contacts using at least 1/4-inch neoprene bearing pads. The stiffness of the neoprene should be chosen so that the static deflection of the pads under the piping loads is about 1/16 inch. Secondary steel elements such as cable trays, pipe racks, walkways, and conduit supports should not be connected to the pipe supports and/or piping.

7 SUMMARY

Equitrans Midstream is proposing to expand the Corona Compressor Station, adding to the existing compressor station near Coburn, in Wetzel County, West Virginia. Measurements at the closest NSAs surrounding the station site show that current ambient sound levels range from L_{dn} 40.5 to 65.8 dBA. These levels were measured while the existing station equipment was operating under typical conditions. Because the sound survey occurred during September, high-frequency insect noise (a seasonal condition) was mathematically removed from the logged data.

A noise model has been developed of the existing and expansion station equipment. With the noise control treatments outlined in this report, modeling predicts that the combined future station sound level contribution at the NSAs will range from L_{dn} 26.1 to 32.3 dBA. The sound level contributions from the future station are expected to be in compliance with the FERC sound level limit of 55 dBA L_{dn}.

LIMITATIONS

The services described in this work product were performed in accordance with generally accepted professional consulting principles and practices. No other representations or warranties, expressed or implied, are made. These services were performed consistent with our agreement with our client. This work product is intended solely for the use and information of our client unless otherwise noted. Any reliance on this work product by a third party is at such party's sole risk.

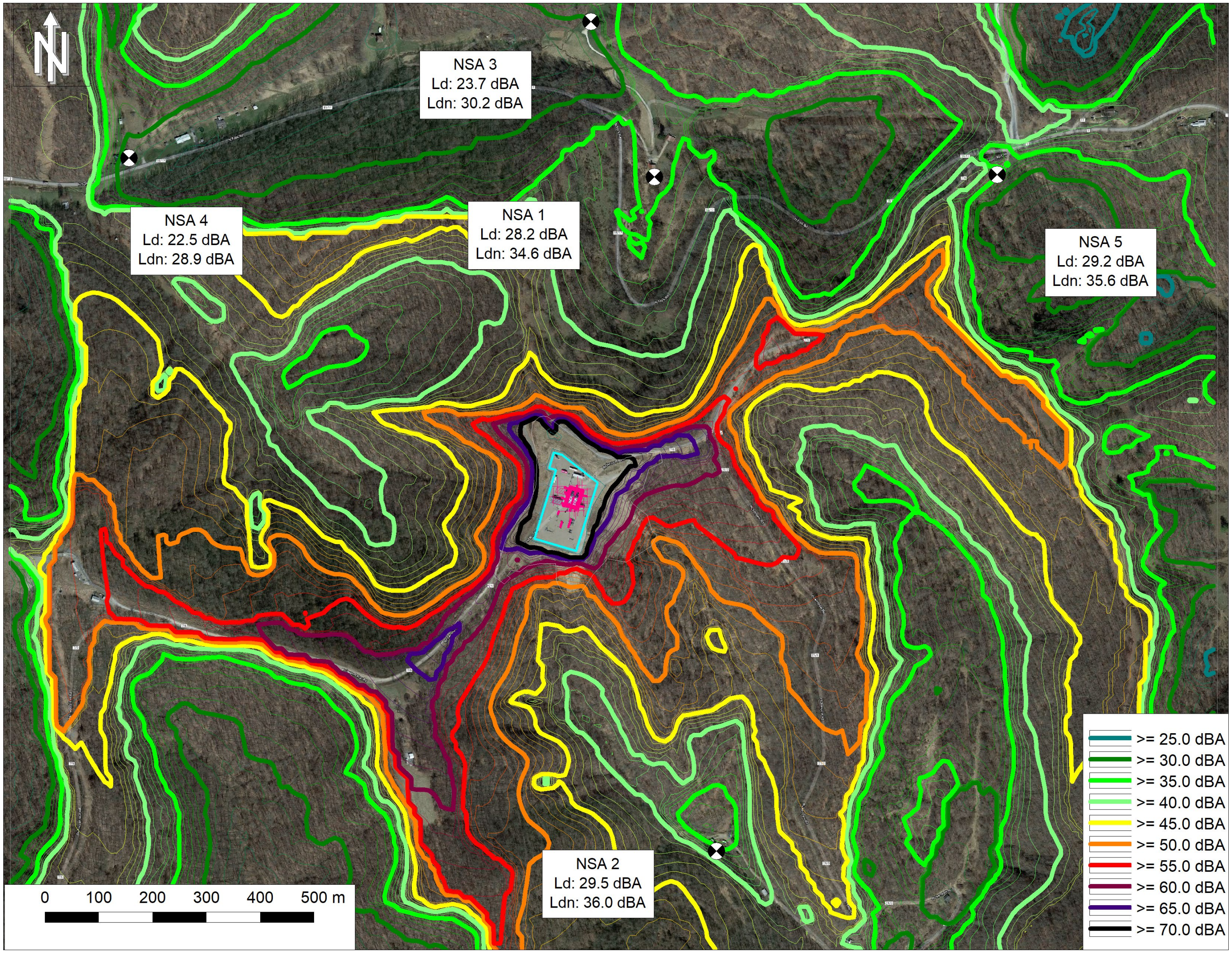
Opinions and recommendations contained in this work product are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, positions, time frames, and project parameters indicated. The data reported and the findings, observations, and conclusions expressed are limited by the scope of work. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this work product.

This work product presents professional opinions and findings of a scientific and technical nature. The work product shall not be construed to offer legal opinion or representations as to the requirements of, nor the compliance with, environmental laws rules, regulations, or policies of federal, state or local governmental agencies.

FIGURES

Figure 1: Map of NSA and Sound Level Measurement Locations

Figure 2: Predicted Sound Levels for Existing and Proposed Expansion Equipment – dBA L_{dn}



APPENDIX A

LEVEL VERSUS TIME GRAPHS OF AMBIENT SOUND LEVELS

Pre-Construction Sound Level Study

Equitrans Midstream
2200 Energy Drive
Canonsburg, PA 15317

November 18, 2021

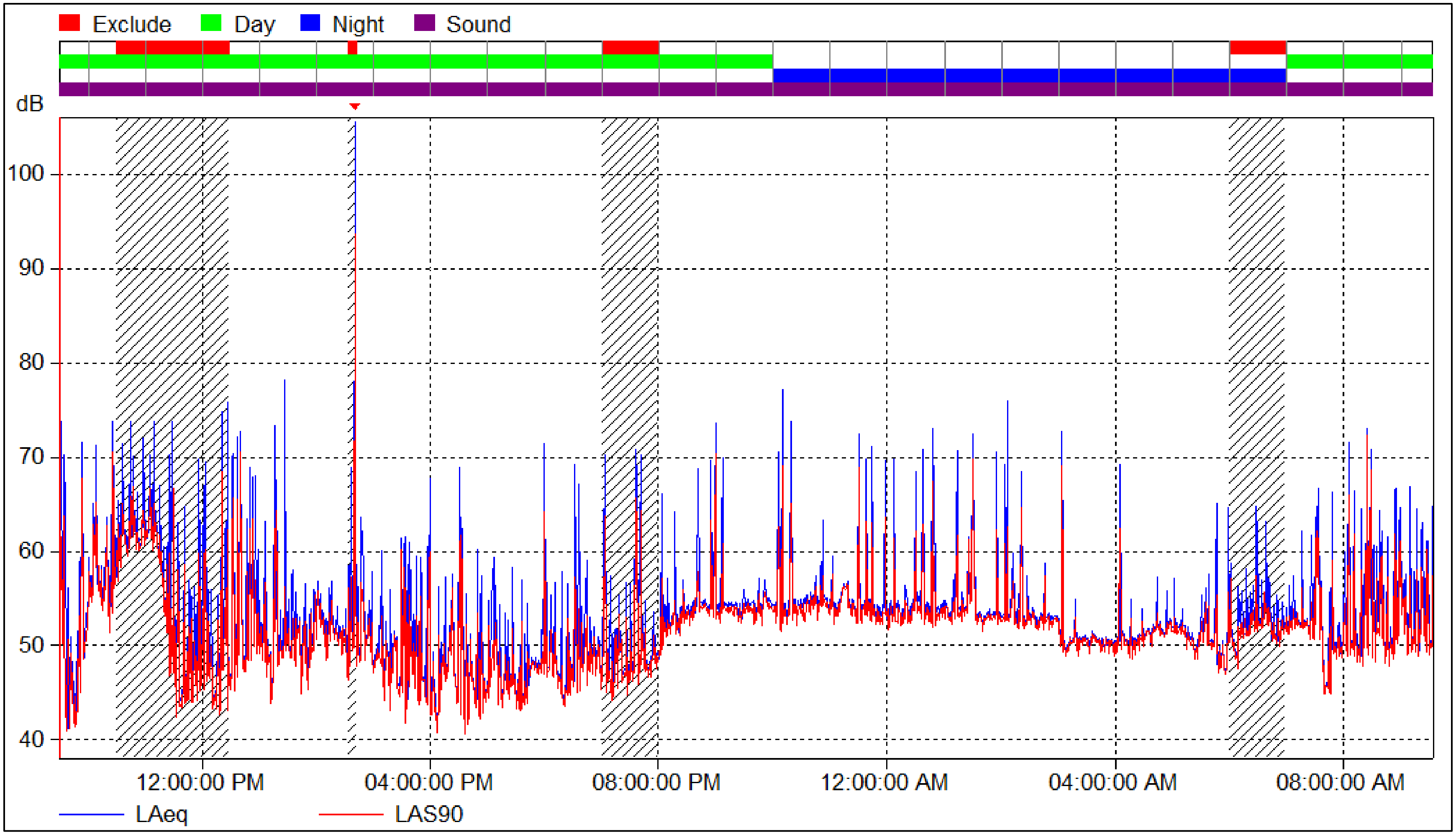


Figure 3: ML 1 & 3 Time History Plot – dBA – September 15-16, 2021

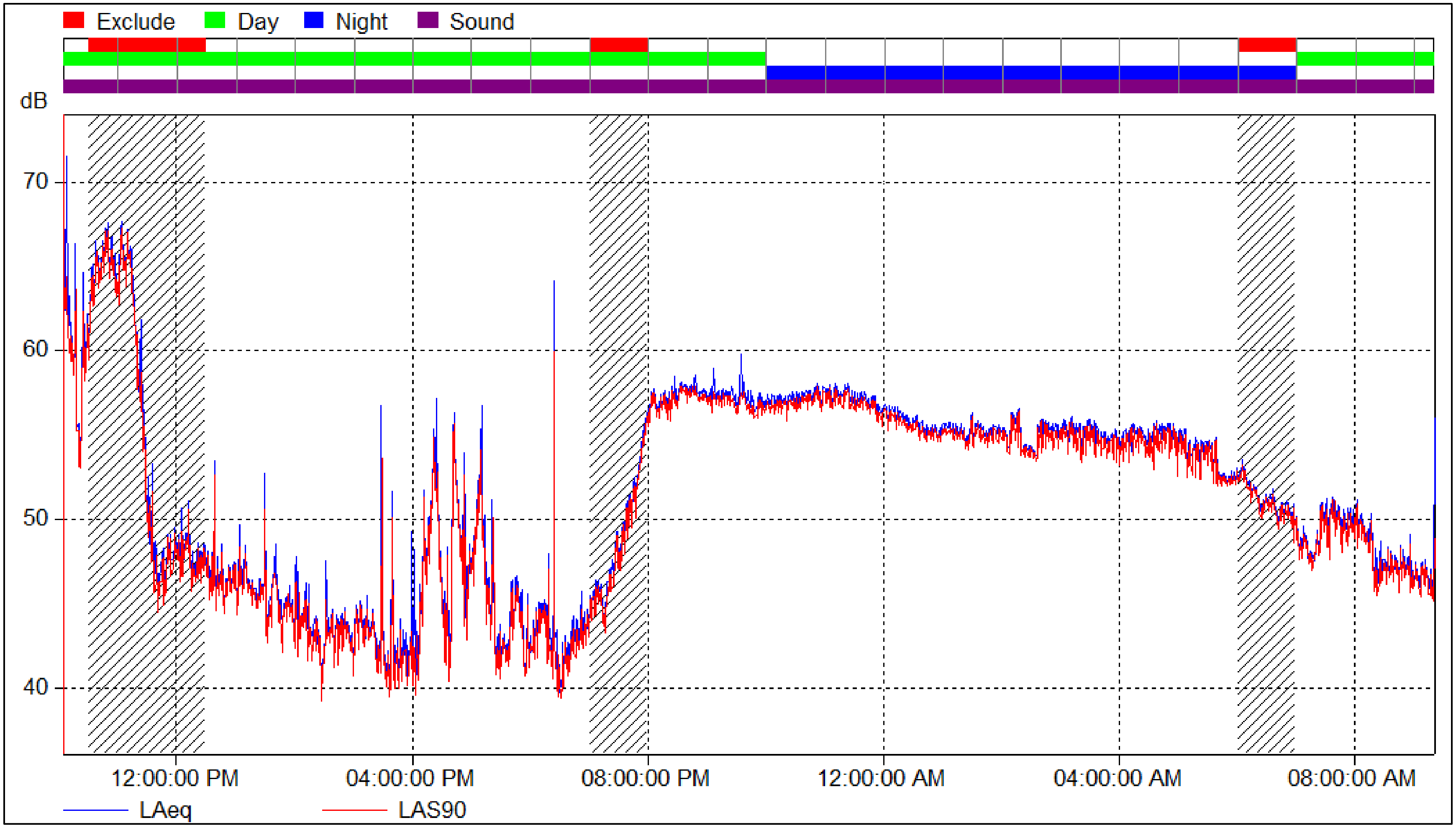


Figure 4: ML 2 Time History Plot – dBA – September 15-16, 2021

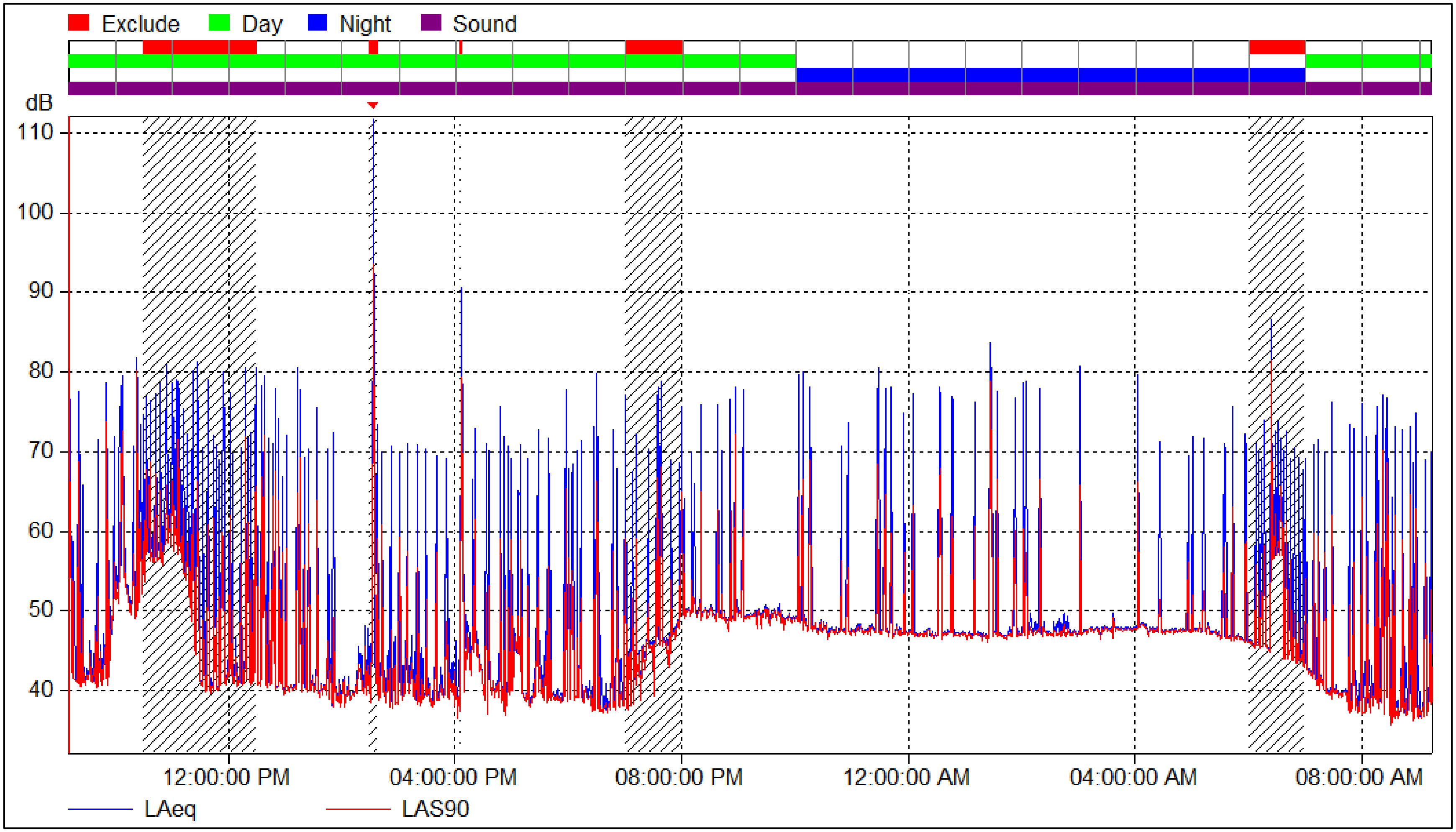


Figure 5: ML 4 Time History Plot – dBA – September 15-16, 2021

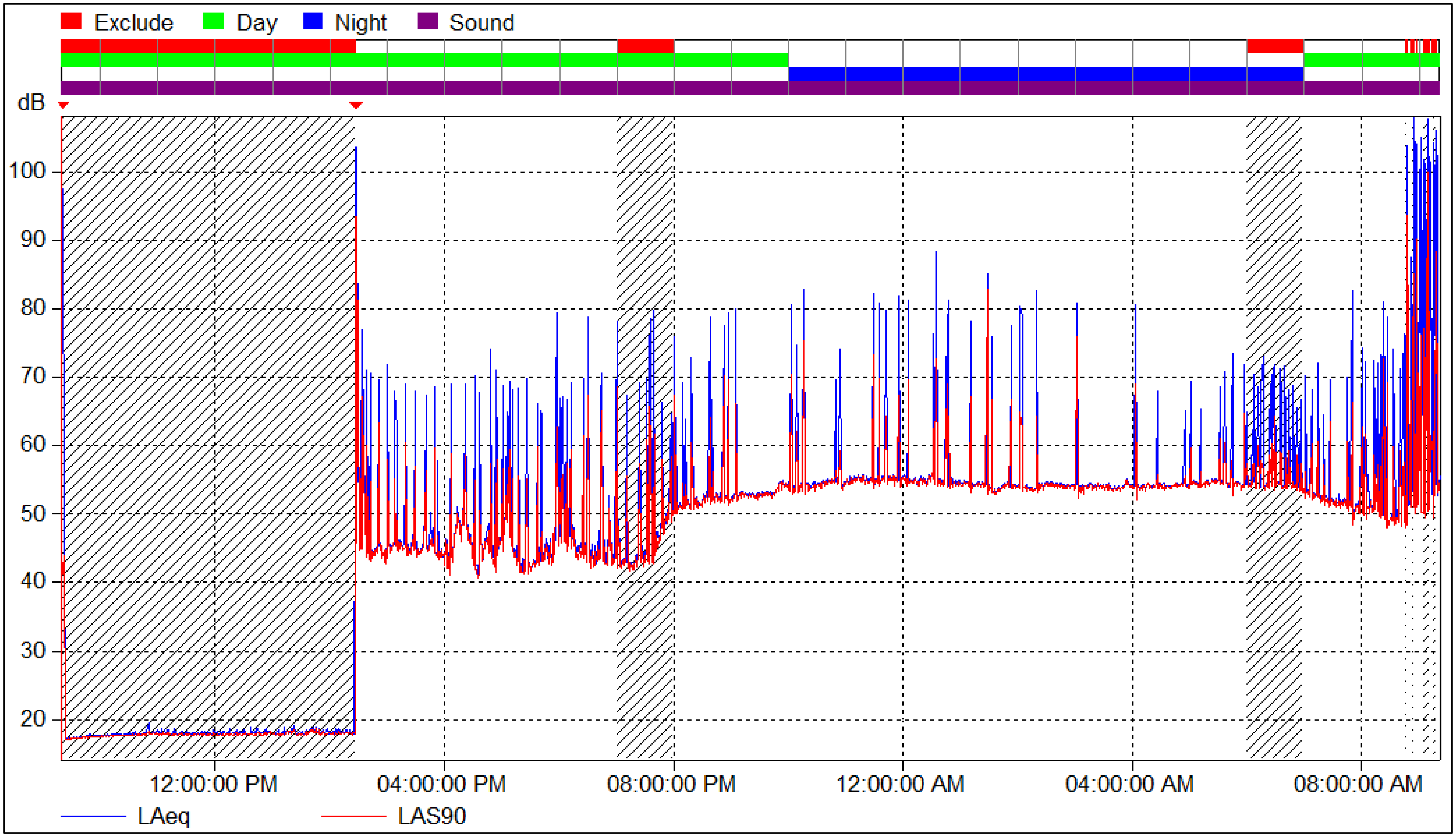


Figure 6: ML 5 Time History Plot – dBA – September 15-16, 2021

CYGRYMUS COMPRESSOR STATION

Pre-Construction Sound Level Study

Prepared for: Equitrans Midstream

SLR Ref: 135.02234.00017

November 5, 2021

Pre-Construction Sound Level Study

Prepared for:

Equitrans Midstream

2200 Energy Drive
Canonsburg, PA 15317

This document has been prepared by SLR International Corporation. The material and data in this report were prepared under the supervision and direction of the undersigned.

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Daniel P. Hanley
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ACRONYMS

dB	Decibel
dBA	A-weighted Decibel
EDT	Eastern Daylight Time
FERC	Federal Energy Regulatory Commission
Hz	Hertz
IL	Insertion loss
ISO	International Organization for Standardization
lb/cf	Pounds per cubic foot
lb/sf	Pounds per square foot
L_{dn}	24-hour average day-night sound level
L_{eq}	Equivalent continuous sound level
L_w	Sound power level
L_p	Sound pressure level
SLM	Sound level meter
TL	Transmission loss

SUMMARY

SLR International Corporation (SLR) has prepared a noise study at the request of Equitrans Midstream, for the proposed Cygrymus Compressor Station near New Freeport in Greene County, Pennsylvania. The project is a greenfield compressor station. SLR has developed a noise model to estimate sound levels due to the station at the nearest noise sensitive areas (NSAs). This report presents the results from SLR's sound level survey of the existing ambient conditions, the noise model development, the recommendations for equipment sound power levels, and the recommended noise control treatments for the planned station equipment.

A noise model was developed for the station using manufacturer sound level data. The noise model was used to predict the station sound level contribution at the NSAs and to develop recommended noise control treatments for the station equipment.

An operational sound survey for the station was conducted by SLR on September 9th through the 10th, 2021. The station current has a gathering compressor unit that is not FERC regulated and that will be replaced by the Taurus 70 turbine compressor units. The existing dehy and thermal oxidizer will remain operational and were included in the model. Sound levels were measured at the four closest noise sensitive areas (NSAs) surrounding the station site. Insect noise was a significant contributor to the measured sound levels, as is typical with summer-time sound monitoring. Because insect noise is not present during colder times of the year, the data were post processed to remove the high frequency noise contribution from insects. The measured, post-processed sound levels at the NSAs ranged from 50.8 to 53.8 dBA L_{dn} (Day-Night Level). **Table A**, below, summarizes the calculated future sound levels at the NSAs.

Table A: Compressor Station Sound Level Predictions

NSA	Distance from Compressor Building to NSA, feet	Direction	Measured Existing Ambient, Day-Night Average[a,b]	Estimated Contribution of Station Equipment, dBA		Combined, All Sources Including Ambient, dBA	Increase Above Existing Condition, dBA
			dBA L_{dn}	L_{eq} dBA	L_{dn} dBA	dBA L_{dn}	dBA L_{dn}
1	1,945	S	50.8	37.1	**43.5**	51.6	0.7
2	2,295	NE	53.8	35.9	**42.3**	54.1	0.3
3	2,975	N	50.9	37.7	**44.1**	51.7	0.8
4	3,420	W	50.9	26.1	**32.5**	50.9	0.1

a. Post-processed to remove influence from insect noise
b. Ambient measurements include existing equipment

Table A shows a noise model prediction for the station contribution of 32.5 dBA to 44.1 dBA L_{dn}, which are well below the Federal Energy Regulatory (FERC) limit of 55 dBA L_{dn}. The predicted sound level increases due to the station range from 0.1 dBA to 0.8 dBA L_{dn} above existing levels.

1 INTRODUCTION

SLR International Corporation (SLR) has prepared a pre-construction noise study at the request of Equitrans Midstream, for an expansion of the existing Cygrymus Compressor Station near New Freeport in Greene County, Pennsylvania. The proposed station comprises of two Solar Taurus 70 turbine/compressor unit rated at 10,804 horsepower (hp) each at 0°F. This report presents the results of the pre-construction noise survey conducted by SLR. The report also describes requirements for the expansion equipment sound power levels and noise control treatments necessary to meet the FERC sound level limit of 55 dBA day-night average (L_{dn}) at nearby noise-sensitive areas.

2 ENVIRONMENTAL SOUND LEVEL CRITERIA

The environmental sound level contributions from the proposed equipment at this compressor station are subject to the FERC noise regulation governing interstate gas transmission compressor stations. The FERC noise regulation is receptor based, and limits compressor station noise contributions to no more than 55 dBA L_{dn} or, equivalently, no more than a continuous 48.6 dBA at the surrounding noise-sensitive areas (NSAs). NSAs are typically residences, schools, churches, or hospitals. There are no other known state, county, or local regulations that would apply to this compressor station site.

3 DESCRIPTION OF SITE AND PROPOSED STATION

3.1 DESCRIPTION OF SITE

The station site is located off 6 Run Road approximately two miles southeast of New Freeport, Pennsylvania. The area surrounding the proposed station is rural and sparsely populated, consisting primarily of deciduous forests and cleared fields.

3.2 DESCRIPTION OF STATION EQUIPMENT

Currently, a reciprocating compressor unit is located at the station. It will be removed and replaced with the expansion equipment. The existing dehy and thermal oxidizer units will remain operational and are included in the model. The proposed station will consist of two Solar Taurus 70 turbine driving centrifugal compressors and located in an additional acoustically insulated compressor building. Associated equipment (located outdoors) is as follows:

- Gas aftercoolers
- Turbine lube oil coolers
- Turbine inlet and exhaust openings
- Station suction and discharge piping and suction separators
- Fuel gas skid
- Capstone generator

4 SOUND LEVEL SURVEY

4.1 CLOSEST NOISE SENSITIVE AREAS

Four NSAs were identified by SLR using aerial imagery. They consist of the four closest residences relative to the station site. The NSAs are summarized in **Table 4-1**. The distances and direction from the site to the NSAs are shown. Distances reference the center of the site location provided by Equitrans Midstream. The NSAs and measurement locations are shown in **Figure 1**.

Table 4-1: Summary of Noise Sensitive Areas

NSA	Description	Approximate Distance from Station to NSA, feet	Direction to NSA
1	Residence	1,945	South
2	Residence	2,295	Northeast
3	Residence	2,975	North
4	Residence	3,420	West

4.2 ENVIRONMENTAL SOUND LEVEL MEASUREMENTS

The ambient sound level survey was performed between September 9th and 10th, 2021 by Steve Gronsky of SLR. Sound level measurements were continuously monitored near each NSA for approximately 24 hours. The measurement locations are summarized in **Table 4-2**.

Table 4-2: Summary of Sound Level Measurements

NSA	Measurement Location	Measurement Duration (HH:MM)	Source Observations
1	ML 1	26:15	Birds, insects, station audible
2	ML 2	26:06	Birds, insects, station audible
3	ML 3	26:11	Birds, insects, station not audible
4	ML 4	26:15	Birds, insects, station not audible

4.3 MEASUREMENT EQUIPMENT

Sound level equipment used during the site survey included the following instruments:

- Larson Davis Model 831 Sound Level Meter, real time analyzer; Type 1; S/N: 11310
- Brüel and Kjær Model 2250 and 2270 Sound Level Meters, Type 1; S/N: 3000936, 2630388, 2704733, 2505915, 2590438
- Brüel and Kjær Type 4231 Calibrator; s/n 3001195

Windscreens were used on the measurement microphones. The sound level meters were field-calibrated before and after measurements. All sound meters have current laboratory certification, available upon request.

4.4 WEATHER CONDITIONS

Weather conditions were appropriate for a sound level survey as summarized in **Table 4-3**. There were periods of mist and/or rain during some portions of the monitoring period. However, there were enough periods without precipitation to quantify the existing station contribution and the overall ambient sound levels.

Table 4-3: Summary of Weather Conditions During Survey

Dates	September 9 – 10, 2021
Temperature	52°F – 70°F
Relative Humidity	61 – 100%
Wind Direction	CALM to W
Wind Speed	0 – 8 mph
Sky Conditions	Fair to Mostly Cloudy
Ground Conditions	Damp

4.5 MEASUREMENT METHODOLOGY

Sound levels were measured using the slow meter response and A-weighting. In addition to broadband A-weighted (dBA) levels, linear (dB) 1/3 and 1/1-octave band levels were also measured. The survey began at approximately 1:00 pm on September 9, 2021 and ended at approximately 3:00 pm on September 10, 2021.

4.6 MEASUREMENT RESULTS

The sound level measurement results are summarized in **Table 4-4**. The measured sound levels for daytime (L_d), nighttime (L_n), and the equivalent day-night sound level (L_{dn}) are shown. Daytime is considered to be the period from 7:00 am to 10:00 pm, and nighttime is from 10:00 pm to 7:00 am. The L_{dn} is a 24-hour sound level average that includes a 10-dBA penalty added to levels measured at night.

Due to high a high influence from insect noise, the data were post-processed to remove the high-frequency influence from the insects. The data presented is representative of those corrections.

Table 4-4: Summary of Sound Level Measurements

NSA	Measurement Location	Measured Levels Period Average, dBA[a]		
		Day L_d	Night L_n	Day-Night L_{dn}
1	ML 1	47.6	43.6	50.8
2	ML 2	55.4	37.5	53.8
3	ML 3	52.7	32.9	50.9
4	ML 4	47.3	32.9	50.9

a. Ambient measurements include existing equipment

Level versus time graphs of the measurement results for the four monitoring locations are shown in **Appendix A**. Each graph is the result of a single set of measurements at a single position. The graph shows the ten-second L_{eq}, represented by a solid blue line, and the L_{90}, represented by the red line.

5 PROPOSED EQUIPMENT NOISE IMPACT EVALUATION

5.1 SIGNIFICANT SOUND SOURCES

The following sound sources are considered significant:

- 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 inlet air system, including the inlet opening and noise radiated from the silencer/ductwork shell and any duct joints
- Turbine/Compressor casing noise that radiates to the exterior of the building and through building ventilation openings
- Noise from the lube oil / auxiliary cooler and gas aftercooler
- Noise radiated by aboveground station piping

5.2 NOISE MODEL DEVELOPMENT

A three-dimensional sound propagation model was constructed to analyze the contributions expected from the future compressor station configuration. The model was developed using CadnaA, version 2021 MR 2 (build: 187.5163), a commercial modeling package developed by DataKustik GmbH. The software considers spreading losses, ground and atmospheric effects, shielding from barriers and buildings, reflections from surfaces and other sound propagation properties. The modeling also accounts for the very topography surrounding the station. Local topography was imported into the 3D model space from a GIS database. The CadnaA software is based on published engineering standards. The ISO 9613 standard was used for air absorption and other noise propagation calculations.

5.2.1 DATA AND ASSUMPTIONS

The future compressor building dimensions were used in the noise model. The future turbine exhaust and outdoor equipment were modeled per the plot plan provided to SLR. The turbine exhausts were modeled at a height of 45.5 feet above grade. The ventilation opening size and distribution was based on the similar compressor buildings. The compressor building includes four wall intakes, each sized at about 60 inches square, with a rooftop throat ridge ventilator.

Table 5-1: 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
Engine Intake, Taurus 70, Unsilenced, L_w[1]	111	117	123	125	125	127	130	159	151	160
Engine Exhaust, Taurus 70, Unsilenced, L_w[1]	123	126	123	127	129	125	119	112	100	130
Unlagged Suction Piping, Per Meter, L_w[2]	94	96	95	90	91	96	111	100	90	113
Unlagged Discharge Piping, Per Meter, L_w[2]	88	84	84	90	95	88	100	92	81	103
Capstone C1000 Generator, L_p[3]	88	84	84	90	95	88	100	92	81	103
Sound Level in Compressor Building at Inner Wall Surface, L_p[2]	78	78	89	92	91	90	92	100	90	102
42" Building Wall Panel Fan, L_w[2]	97	97	101	97	96	96	93	88	81	100
Exhaust Breakout, L_w[2]	93	95	92	92	86	84	93	92	81	98
Intake Breakout, L_w[2]	103	91	89	94	84	82	84	91	77	95
Lube Oil Cooler, L_w[1]	95	102	96	92	87	84	80	76	71	90
Anti-surge Valve, L_w[2]	-	-	-	-	74	80	87	82	77	90
Sound Power Level of Gas Cooler Fans, Per Fan, L_w[2]	91	91	90	87	82	80	74	68	62	85

[1] From Solar Noise Book - 2015
[2] From SLR Data Library from similar projects
[3] From Vendor datasheet

5.2.2 NOISE MODEL RESULTS – TYPICAL OPERATION SCENARIO WITH MITIGATION

Table 5-2 shows a summary of the predicted future sound level contribution of the station equipment (existing and future station equipment) at each NSA. The table also shows the overall NSA sound levels, including the future station and ambient environmental sources. This table indicates that with the proposed noise control treatments discussed in Section 6, the compressor station noise contributions at all of the nearest NSAs will be below the FERC criterion of 55 dBA L_{dn}. The FERC sound level limits apply only to the sound level contribution of the compressor station equipment, and do not include the influence of the existing ambient sound levels. The highest station contribution is 44.1 dBA L_{dn} at NSA 3, which is well below the FERC limit of 55 dBA L_{dn}. **Figure 2** shows the A-weighted sound propagation contours for the station.

Table 5-2: Compressor Station Sound Level Predictions

NSA	Distance from Compressor Building to NSA, feet	Direction	Measured Existing Ambient, Day-Night Average[a,b]	Estimated Contribution of Station Equipment, dBA		Combined, All Sources Including Ambient, dBA	Increase Above Existing Condition, dBA
			L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{dn} dBA	L_{dn} dBA
1	1,945	S	50.8	37.1	**43.5**	51.6	0.7
2	2,295	NE	53.8	35.9	**42.3**	54.1	0.3
3	2,975	N	50.9	37.7	**44.1**	51.7	0.8
4	3,420	W	50.9	26.1	**32.5**	50.9	0.1

a. Post-processed to remove influence from insect noise
b. Ambient measurements include existing equipment

5.2.3 NOISE MODEL RESULTS – UNIT BLOWDOWN SCENARIO

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

A unit blowdown scenario was modeled using a single blowdown silencer specified to limit the blowdown sound levels to a maximum of **85 dBA at 3 feet**. **Table 5-3** shows the predicted short-term sound pressure levels at the NSAs during a blowdown event. The unit blowdown event sound levels are compared to the nighttime average levels at each NSA, to show the potential short-term sound level impact of the station. The predicted blowdown sound levels are quite low relative to ambient conditions, with the highest predicted sound level of 22.6 dBA L_{eq} at NSA 3.

Table 5-3: Station Unit Blowdown Sound Level Predictions

NSA	Distance from Compressor Building to NSA	Direction	Measured Existing Ambient, Night Average[a,b]	Estimated Contribution of Unit Blowdown	Combined Blowdown and Ambient	Short-Term Sound Level Increase During Blowdown
	(feet)		L_n dBA	L_{eq} dBA	L_n dBA	ΔL_{eq} dBA
1	1,945	S	43.6	20.6	43.6	0.0
2	2,295	NE	37.5	17.7	37.5	0.0
3	2,975	N	32.9	22.6	33.3	0.4
4	3,420	W	32.9	3.7	32.9	0.0

a. Post-processed to remove influence from insect noise
b. Ambient measurements include existing equipment

5.2.4 NOISE MODEL RESULTS – EMERGENCY SHUTDOWN SCENARIO

The station has an emergency shutdown (ESD) system that automatically halts operation of the station in the event of an irregularity. This results in a full station blowdown 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 every few years. The station ESD system was modeled with a maximum sound level due to the blowdown of **95 dBA at 50 feet**.

Table 5-4 shows the predicted short-term sound levels at the NSAs due to an ESD blowdown. The station ESD blowdown event sound levels are compared to the nighttime average levels at each NSA, to show the potential short-term nighttime sound level impact of the Station. The highest predicted ESD sound level is 47.1 L_{eq} dBA at NSA 3. This is a reasonable sound level for an event that will only occur in emergency situations or during testing periods that are scheduled in advance and with limited frequency and duration.

Table 5-4: Station ESD Blowdown Sound Level Predictions

NSA	Distance from Compressor Building to NSA	Direction	Measured Existing Ambient, Night Average[a,b]	Estimated Contribution of ESD Blowdown	Combined ESD Blowdown and Ambient	Short-Term Sound Level Increase During ESD Blowdown
	(feet)		L_n dBA	L_{eq} dBA	L_n dBA	ΔL_{eq} dBA
1	1,945	S	43.6	45.1	47.4	3.8
2	2,295	NE	37.5	42.2	43.5	6.0
3	2,975	N	32.9	47.1	47.3	14.4
4	3,420	W	32.9	28.2	34.1	1.3

a. Post-processed to remove influence from insect noise
b. Ambient measurements include existing equipment

5.2.5 NOISE MODEL RESULTS – CONSTRUCTION

Only standard equipment will be used during construction, with no dynamic compaction or pile driving expected. Most construction will take place during daytime working hours of 7:00 a.m. until 7:00 p.m. Construction sound calculations were performed using the CadnaA propagation model, which accounts for local topography. Equipment usage factors were used per the Federal Highway Administration's Roadway Construction Noise Model version 1.1 (FHWA, 2006). Usage factor is the percentage of time a given piece of equipment typically operates during a given hour. The following equipment items were included in the construction evaluation for the station (quantities in parentheses):

- Diesel Area Light Plant (8)
- Diesel Generators (2)
- Diesel Welders (2)
- Diesel Air Compressors (2)
- Man Lift (2)
- Pneumatic noise, Purge, Blow Down (1)

- Skid Steer (1)
- Excavator (1)
- Dozer (1) **– No Nighttime Operation**
- Telehandler (1)
- Crane (1) **– No Nighttime Operation**
- Trucks (4)
- Air Hammer (1) **– No Nighttime Operation**
- Electric hand tools (2)
- Air Mover (1)
- Nitrogen Purge (1)

Calculated construction sound levels at the NSAs are 33 to 48 dBA L_{eq} during the day, which is below the FERC limit of 48.6 dBA L_{eq} (or 55 dBA L_{dn}). By comparison, measured daytime levels at the NSAs ranged from 48 dBA to 55 dBA L_{eq}.

Nighttime work may occur during the Project, involving occasional use of the construction equipment shown above. Sound from construction activity may occasionally exceed measured ambient nighttime levels by 3 to 8 dBA at NSAs 1, 2, and 4. At NSA 3, there may be brief periods when nighttime sound levels approach 45-47 dBA. Due to the low nighttime ambient level (32.9 dBA L_n) at NSA 3, construction sound levels may exceed the measured ambient by as much as 12 dBA at times.

A temporary 10 to 12 dBA increase in the ambient sound level is likely to be noticeable, depending on the time of night or the sensitivity of the residents. Construction-related annoyance complaints will be addressed should they arise, and modifications to the construction schedule can be made if necessary.

6 NOISE CONTROL TREATMENTS

A summary of the modeled performance of one possible set of noise control treatments is shown in **Table 6-1**, below. The following subsections describe the treatments.

The noise mitigation measures shown are based on the most current station design and represent one potential set of possible mitigation measures. There are many different combinations of noise control mitigation measures that could provide similar noise control. As the station design and noise mitigation treatments are finalized, the specific performance values in **Table 6-1** may change somewhat, but the overall design will always maintain compliance with the FERC sound level requirements.

Table 6-1: Required Noise Control Treatments

Required Dynamic Insertion Loss (DIL) or Transmission Loss (TL)										
Source	Treatment Description	Required Treatment Performance								
		31.5	63	125	250	500	1k	2k	4k	8k
Turbine Inlet	Pulse Updraft Filter, DIL	2	4	8	9	13	26	27	27	33
Turbine Inlet	Solar Silencer, DIL	-	-	3	7	22	42	47	53	49
Compressor Building	STC-39 Wall and Roof System, TL	10	16	17	24	44	49	55	55	58
Equipment Door	STC-21 Insulated Roll-up Door, TL	2	7	12	17	18	19	22	30	35
Building Ventilation	3ft Silencers and Lined Hoods, DIL	2	6	10	15	25	30	30	25	15
Ridge Vent	Acoustic Baffle, DIL	4	1	10	7	11	12	15	14	17
Exhaust	Taurus Exhaust Silencer, DIL	12	17	28	37	48	47	40	35	16
Piping or Inlet Ductwork, if necessary	ISO Type B2 Lagging, TL	-	-	-	-	6	15	24	33	42

6.1 COMPRESSOR BUILDING WALLS AND ROOF

The compressor building should have an STC-39 wall and roof system with the transmission loss performance shown in **Table 6-1**. It is recommended that the compressor building manufacturer supply laboratory test results for their proposed wall system that show a transmission loss equal to or greater than the required performance in each octave band. The compressor building should have no windows, skylights, or translucent panels. The same wall system should be used for the expansion as currently exists in the compressor building.

The interior surface of the compressor building walls should be acoustically absorptive, having a noise reduction coefficient (NRC) of at least 0.8. The inside of the compressor building can be lined with perforated metal of at least 23 percent open area for insulation protection, if so desired. The building should be well sealed with no cracks or gaps. All piping penetrations through the building walls should be well insulated, flashed, and caulked.

6.2 COMPRESSOR BUILDING DOORS

The compressor building will have a 14-foot by 14-foot steel roll-up equipment door. Standard insulated over-head door will be sufficient for the equipment doors. The performance shown in **Table 6-1** is the required transmission loss performance for an STC-21 roll-up door.

The personnel doors should be STC-21 or better industrial metal doors with good perimeter seals. Small glass windows in the personnel doors are acceptable as long as the door STC rating is achieved.

6.3 COMPRESSOR VENTILATION

All building ventilation openings should include standard acoustical louvers or silencers, such that the total sound pressure level contribution of each opening does not exceed **70 dBA at 12 feet** from the opening. The unsilenced building ventilator (fan) should not exceed a level of **80 dBA at 3 feet**. The sound pressure level calculated for the interior of the building due to the turbine and compressor equipment is shown in **Table 5-1**. The sound level target for each ventilation opening includes the sound level contribution of both the mechanical equipment inside the building along with the sound levels due to the ventilation fans. The ventilation system supplier should submit the sound power level of the proposed building ventilation fans during the bidding process for review.

The approximate ventilation silencer performance is shown in **Table 6-1**. The final performance requirements of these silencers will depend on the size, number, and type of ventilation fans used in the design. The sound pressure level target should be the primary design criterion, as it can be field-tested after installation.

Any expansion to the throat ridge ventilator should have acoustic insulation applied to the damper and an acoustic baffle suspended beneath it, along the center of the building.

6.4 TURBINE EXHAUSTS

For the operation of dual-shaft SoLoNox turbines, Solar notes that sound levels during partial-load operation can be higher than sound levels during full-load operation. In an analysis of manufacturer data for these turbines, increases of up to 6 dB at 1 kHz have been noted by Solar for Taurus 70 exhausts and increases of up to 6 dB at 4 kHz for Taurus 70 inlets. Silencer specification and bidding should be developed with such potential variability in mind, in order to satisfy the noise targets for all steady-state operational conditions.

6.4.1 SILENCER PERFORMANCE

The turbine will include an exhaust silencer system with the dynamic insertion loss values (in decibels) shown in **Table 6-1**. Because of the complexities involved with the field verification of silencer insertion loss, the vendor should bid to meet a sound pressure level target of **45 dBA at 200 feet** from the exhaust opening, measured horizontally from the edge of the stack top with the turbine in any steady-state operational condition, including partial load and full load.

6.4.2 EXHAUST DUCT AND SHELL NOISE

In large turbine-powered installations it is common for a significant amount of sound energy to radiate from the exhaust system ductwork, expansion joints, and exhaust silencer shell. This sound energy is often termed “shell-radiated” noise. Shell-radiated noise is not necessarily calculated by exhaust system manufacturers, but it can be a dominant noise source for NSAs close to the station. The exhaust breakout modeling is based on measurements taken at a compressor station with a similar turbine. The modeled shell-radiated sound power levels are shown in **Table 5-1**.

6.5 TURBINE INLET

The proposed expansion unit will include the standard Solar intake silencer and pulse-updraft filter. The total insertion loss of these two elements is shown in **Table 6-1**.

6.5.1 INLET BREAKOUT

Sound radiating from the inlet ductwork on the turbine side of the inlet silencer can be a significant noise source. If possible, the inlet silencer should be located inside of the compressor building. If the inlet silencer is not located inside a compressor building, then the inlet ductwork between the silencer and the building wall should be acoustically lagged with the ISO Type B2 lagging listed in **Table 6-1**.

6.6 LUBE OIL COOLER

The sound power level of the lube oil cooler should not exceed the sound power levels given in **Table 5-1**. This is the total sound power level for the entire cooler (i.e. not just a single fan). The sound power level in **Table 5-1** is equivalent to the Solar 90 dBA lube oil cooler.

6.7 GAS AFTERCOOLER FANS

Table 5-1 shows the total radiated sound power level for the gas aftercooler fans at the station. The total sound power level includes all fans, along with any radiated sound due to the motors and drive assemblies. The sound pressure level emitted by the cooler should not exceed **65 dBA at 16 feet** from the cooler. This was modeled using the sound power level spectrum supplied by the equipment manufacturer, adjusted based on the number of fans in each cooler bay.

6.8 STATION PIPING

Noise from the compressors will cause significant noise radiation from connected piping. To the extent practical, all suction and discharge piping should be run underground. All outdoor aboveground piping between the compressor and the separators on the suction side, and the compressor and the gas cooler on the discharge side, may be acoustically lagged if necessary.

The computer noise model also includes an anti-surge valve. Should the valve be louder than expected after construction, lagging could also be applied to this source.

6.8.1 ACOUSTICAL PIPE LAGGING

If acoustical lagging is used, it should conform to the performance specifications shown in **Table 6-1** for ISO Type B2 lagging. This is generally equivalent to (listed from pipe surface outwards):

- 4 inches of 6 to 8 lb/cf mineral wool or fiberglass pipe insulation,
- a layer of 1 lb/sf mass-loaded vinyl,
- and a layer of 0.016" aluminum jacketing or silicon-coated fiberglass cloth.

Other lagging systems are available that will offer similar acoustical performance, so the lagging system performance shown in **Table 6-1** should be used as the performance goal rather than the listed material requirements.

6.8.2 PIPING ISOLATION

To limit noise radiation from structural supports, the compressor piping should be isolated from pipe supports and other structural contacts using at least 1/4 inch neoprene bearing pads. The stiffness of the neoprene should be chosen so that the static deflection of the pads under the piping loads is about 1/16 inch. Secondary steel elements such as cable trays, pipe racks, walkways, and conduit supports should not be connected to the pipe supports and/or piping.

7 SUMMARY

Equitrans Midstream is proposing to construct the Cygrymus Compressor Station near New Freeport, in Greene County, Pennsylvania. Measurements near the closest NSAs to the proposed station site show that the current ambient sound levels range from 50.8 to 53.8 dBA L_{dn}. A noise model has been developed of the future station equipment. With the noise control treatments outlined in this report, modeling predicts that the future station sound level contribution at the NSAs will range from 32.5 to 44.1 dBA L_{dn}. The sound level contributions from the future station are expected to be in compliance with the FERC 55 dBA L_{dn} criterion at all NSAs with the noise control treatments outlined in this report.

LIMITATIONS

The services described in this work product were performed in accordance with generally accepted professional consulting principles and practices. No other representations or warranties, expressed or implied, are made. These services were performed consistent with our agreement with our client. This work product is intended solely for the use and information of our client unless otherwise noted. Any reliance on this work product by a third party is at such party's sole risk.

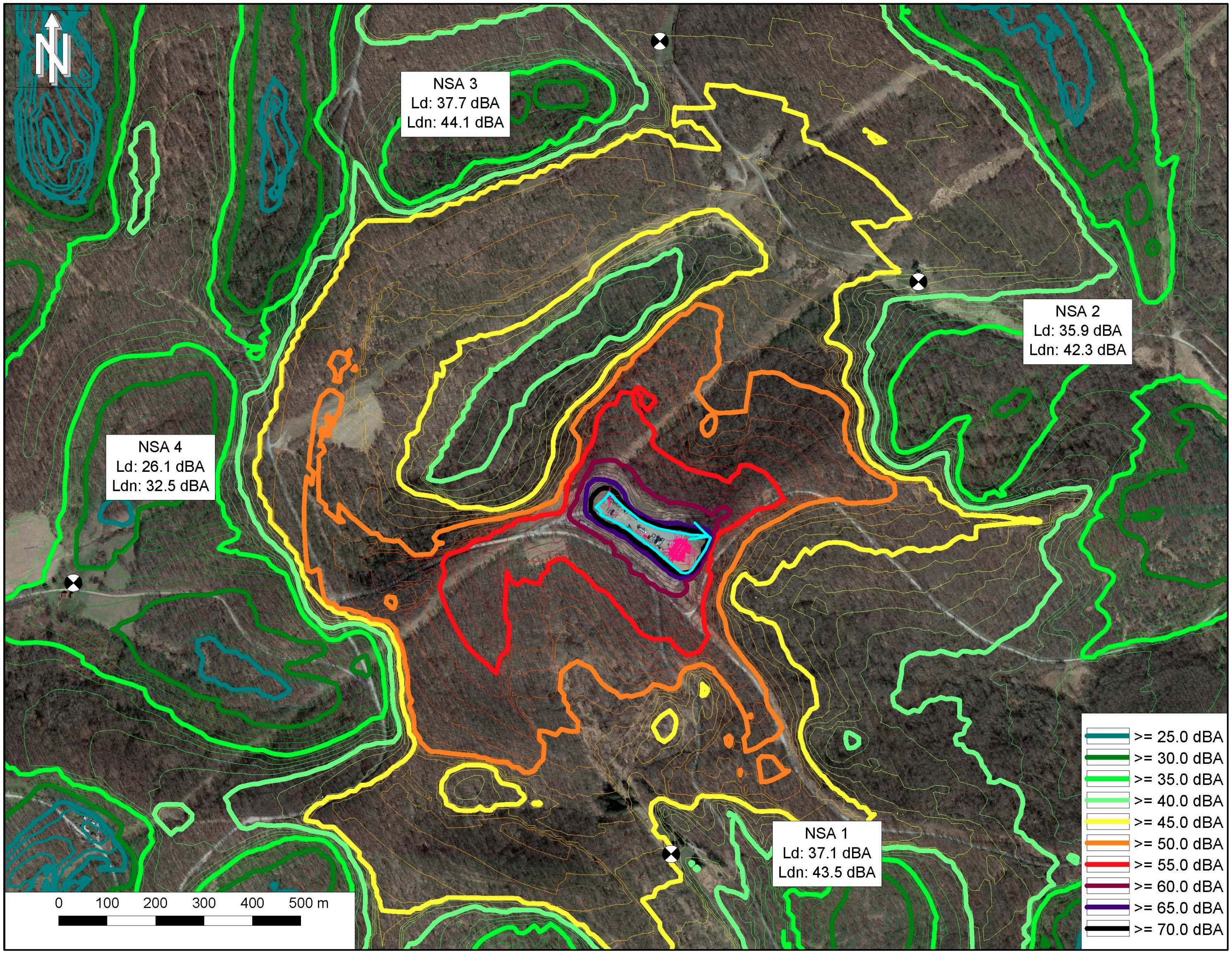
Opinions and recommendations contained in this work product are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, positions, time frames, and project parameters indicated. The data reported and the findings, observations, and conclusions expressed are limited by the scope of work. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this work product.

This work product presents professional opinions and findings of a scientific and technical nature. The work product shall not be construed to offer legal opinion or representations as to the requirements of, nor the compliance with, environmental laws rules, regulations, or policies of federal, state or local governmental agencies.

FIGURES

Figure 1: Map of NSA and Sound Level Measurement Locations

Figure 2: Predicted Sound Level – Existing and Proposed Expansion Equipment – dBA L_{dn}



APPENDIX A

LEVEL VERSUS TIME GRAPHS OF AMBIENT SOUND LEVELS

Pre-Construction Sound Level Study – Rev 1

Equitrans Midstream
2200 Energy Drive
Canonsburg, PA 15317

November 5, 2021

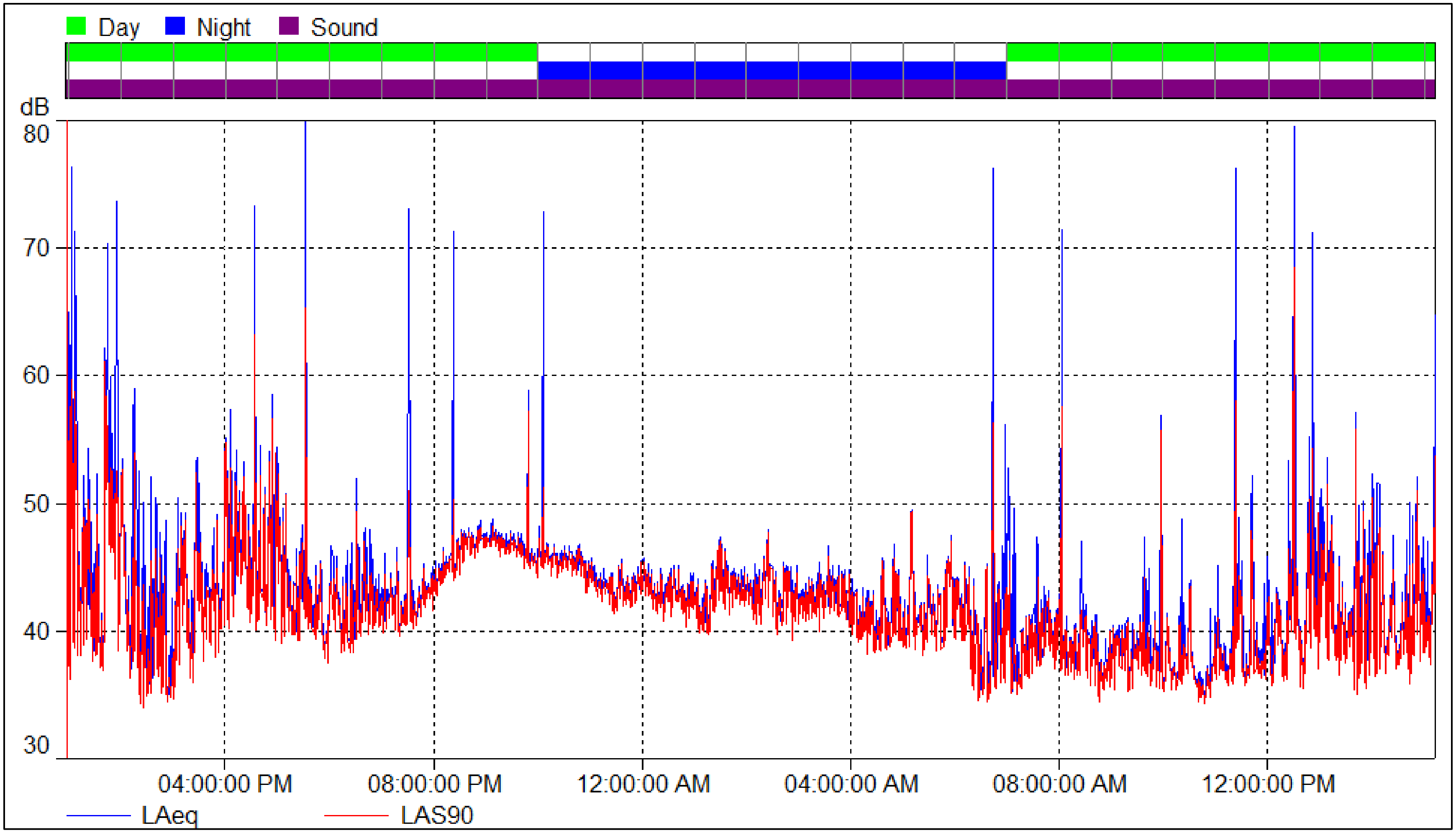


Figure 3: ML 1 Time History Plot – dBA – September 9-10, 2021

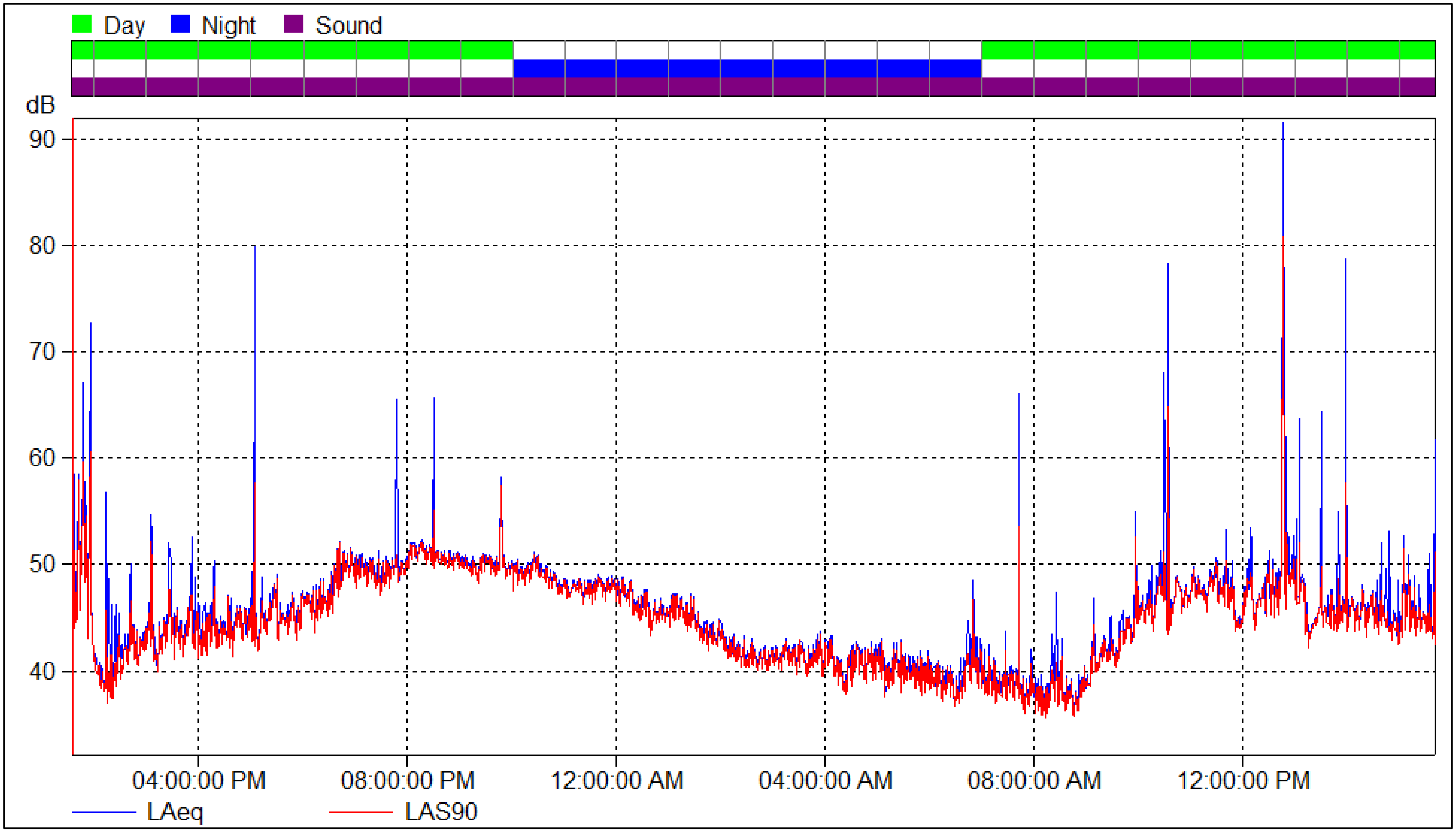


Figure 4: ML 2 Time History Plot – dBA – September 9-10, 2021

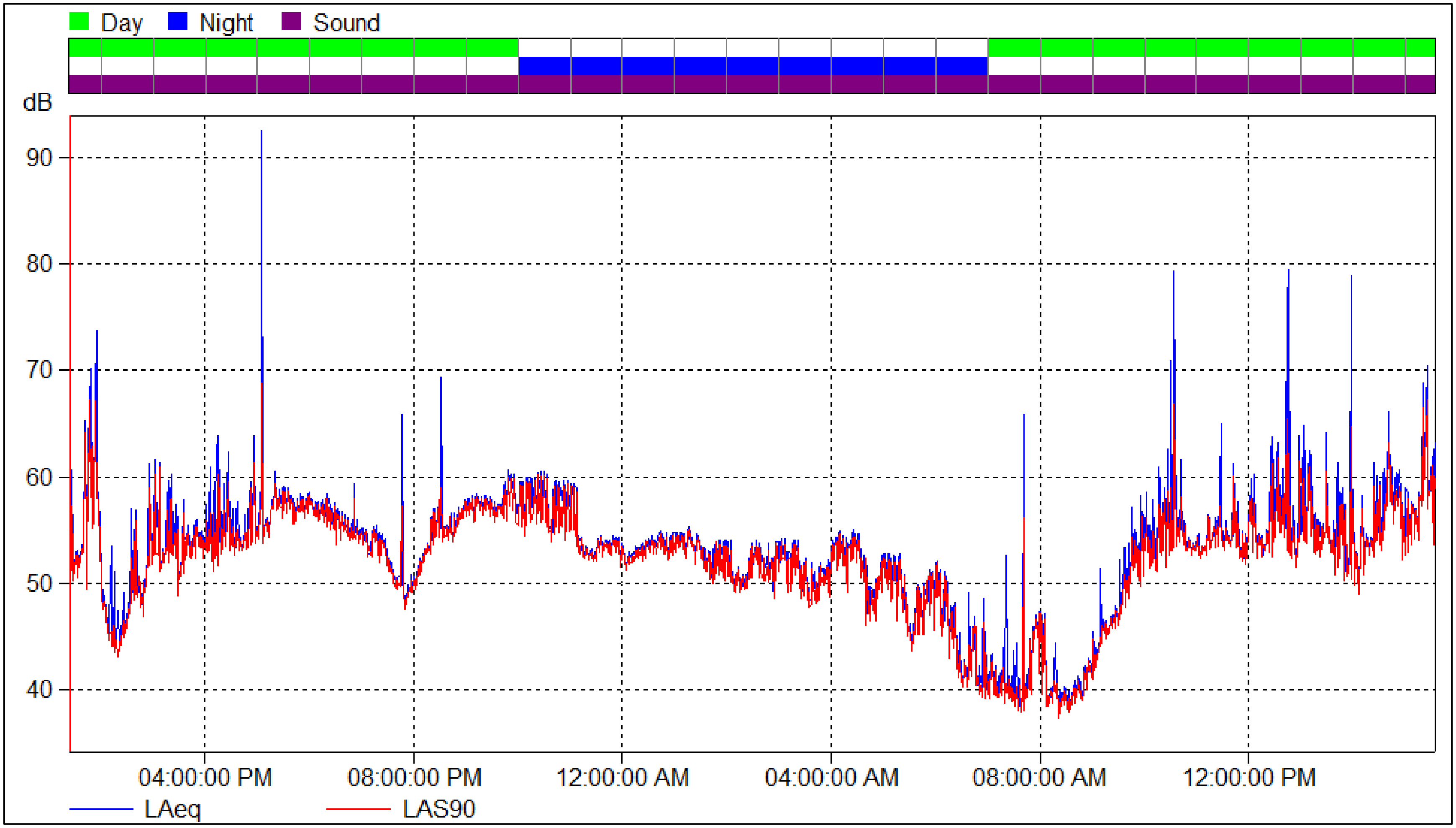


Figure 5: ML 3 Time History Plot – dBA – September 9-10, 2021

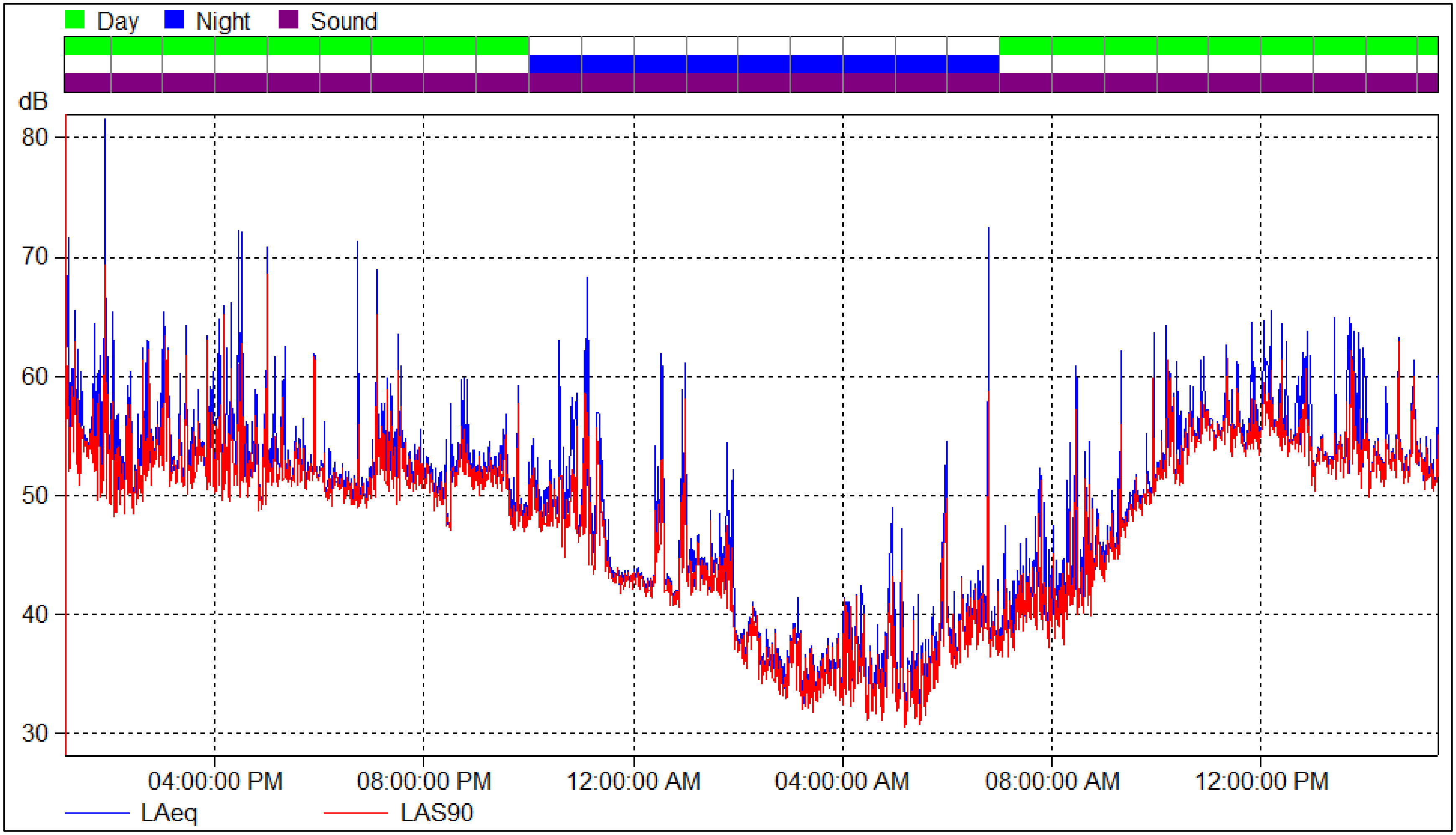


Figure 6: ML 4 Time History Plot – dBA – September 9-10, 2021

PLASMA COMPRESSOR STATION

Pre-Construction Sound Level Study

Prepared for: Equitrans Midstream

SLR Ref: 127.02234.00021

November 5, 2021

Pre-Construction Sound Level Study

Prepared for:

Equitrans Midstream

2200 Energy Drive
Canonsburg, PA 15317

This document has been prepared by SLR International Corporation. The material and data in this report were prepared under the supervision and direction of the undersigned.

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Project Consultant

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Project Engineer

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ACRONYMS

dB	Decibel
dBA	A-weighted Decibel
EDT	Eastern Daylight Time
FERC	Federal Energy Regulatory Commission
Hz	Hertz
IL	Insertion loss
ISO	International Organization for Standardization
lb/cf	Pounds per cubic foot
lb/sf	Pounds per square foot
L_{dn}	24-hour average day-night sound level
L_{eq}	Equivalent continuous sound level
L_w	Sound power level
L_p	Sound pressure level
SLM	Sound level meter
TL	Transmission loss

SUMMARY

SLR International Corporation (SLR) has prepared a noise study at the request of Equitrans Midstream, for the proposed expansion of the existing Plasma Compressor Station near Clarington in Monroe County, Ohio. This report presents the results from SLR's sound level survey of the existing ambient conditions and sound modeling of the expanded station.

An operational sound survey for the station was conducted by SLR on September 16th through the 17th, 2021. **Table A**, below, summarizes the findings. Sound levels were measured at the five closest noise sensitive areas (NSAs) surrounding the station site. The table shows the current day-night ambient sound levels (L_{dn}) with the Plasma Station operating. The existing turbine-compressor units were operational during the survey, running under typical load conditions. The ambient data collected were heavily influenced by periods of insect noise, which is typical of summer-time sound monitoring. After post-processing the data to remove the influence of insect noise, the measured sound levels at the NSAs ranged from 38.9 to 49.0 dBA L_{dn} (actual measured L_{dn} values were higher). The operating station was barely audible at the NSA measurement locations, so the ambient sound levels shown are also indicative of other environmental noise sources (non-insect) and other nearby compressor stations. The table then shows the calculated contributions from the future expanded station equipment (existing equipment + future). The noise mitigation described in this report was assumed to be installed on the future station equipment.

Table A: Compressor Station Sound Level Predictions

NSA	Distance from Comp. Bldg to NSA, feet	Direction	Measured Existing Ambient, Day-Night Average[a]	Estimated Contribution of Station Equipment					Combined, All Sources Including Ambient[c]	Potential Increase Above Existing Ambient
				Current Station Equipment[b]	Future Expansion Equipment[b]		Combined Existing and Future Expansion	Predicted Increase Over Existing Contribution		
			L_{dn} dBA	L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{dn} dBA	ΔL_{dn} dBA	L_{dn} dBA	L_{dn} dBA
1	1,980	NW	45.1	44.2	33.5	39.9	45.6	1.4	46.2	1.1
2	2,320	W	38.9	35.6	29.1	35.5	38.6	3.0	40.5	1.6
3	3,100	ENE	41.2	30.4	24.0	30.4	33.4	3.0	41.5	0.3
4	3,140	SSE	40.3	38.2	27.5	33.9	39.6	1.4	41.2	0.9
5	2,000	NE	49.0	44.4	34.6	41.0	46.0	1.6	49.6	0.6

a. Post-processed to remove environmental noise from insects (1,600 hz and above); ambient levels at the NSAs are controlled by traffic, leaf rustle, and other environmental noises;
b. Per noise modeling; Ldn was calculated by adding 6.4 dBA to the Leq
c. Measured Ambient + Future Expansion Contribution

Table A shows that calculated sound levels attributable to the future station increase ambient levels by 0.3 to 1.6 dBA L_{dn} at the NSAs. In that ambient A-weighted sound levels are also influenced by non-station sound (natural sounds, other nearby compressor stations, local road traffic, etc.), the A-weighted contribution from the future Plasma compressor station is expected to be similar to ambient conditions at most locations.

1 INTRODUCTION

SLR International Corporation (SLR) has prepared a pre-construction noise study at the request of Equitrans Midstream, for an expansion of the existing Plasma Compressor Station near Clarington, in Monroe County, Ohio. The proposed station expansion includes the addition of a Solar Titan 130 turbine/compressor unit rated at 23,497 horsepower (hp at 0 deg F). This report presents the results of the pre-construction noise survey conducted by SLR. The report also describes noise control treatments and required equipment sound power levels necessary to meet the FERC sound level limit of 55 dBA day-night average (L_{dn}) at nearby noise-sensitive areas. The noise mitigation also limits station sound level increases to no more than one to three dBA (L_{dn})

2 ENVIRONMENTAL SOUND LEVEL CRITERIA

The environmental sound level contributions from equipment at Plasma station are subject to the Federal Energy Regulatory Commission (FERC) noise regulation, which governs interstate gas transmission compressor stations. The FERC noise regulation is receptor based, and limits compressor station noise contributions to no more than 55 dBA L_{dn} or, equivalently, no more than a continuous 48.6 dBA at the surrounding noise-sensitive areas (NSAs). NSAs are typically residences, schools, churches, or hospitals. There are no other known state, county, or local regulations that would apply to this compressor station site.

3 DESCRIPTION OF SITE AND PROPOSED STATION

3.1 DESCRIPTION OF SITE

The station site is located off Steiger Ridge Road approximately three and a half miles north of Clarington, Ohio. The area surrounding the proposed station is rural and sparsely populated, consisting primarily of deciduous forests and cleared fields.

3.2 DESCRIPTION OF STATION EQUIPMENT

The existing station consists of a two Solar Taurus 70 turbine driven centrifugal compressor in an acoustically insulated compressor building. The proposed station expansion will consist of the addition of a Solar Titan 130 unit in an additional acoustically insulated compressor building. The two existing units are 11,250 hp turbines driving centrifugal compressors, and the additional unit will have a 23,497 hp turbine driving a centrifugal compressor. All power ratings are at 0 degrees Fahrenheit. Associated equipment (located outdoors) is as follows:

- Gas aftercoolers
- Turbine lube oil coolers
- Turbine inlet and exhaust openings
- Station suction and discharge piping and suction separators

- Fuel gas skid
- Capstone generator
- Control valves

4 SOUND LEVEL SURVEY

4.1 CLOSEST NOISE SENSITIVE AREAS

Five NSAs were identified by SLR using aerial imagery. They consist of the five closest residences relative to the station site. The NSAs are summarized in **Table 4-1**. The distance and direction from the site to the NSAs are shown. Distances reference the center of the site location provided by Equitrans Midstream. The NSAs and measurement locations are shown in **Figure 1**.

Table 4-1: Summary of Noise Sensitive Areas

NSA	Description	Approximate Distance from Station to NSA, feet	Direction to NSA
1	Residence	1,980	NW
2	Residence	2,320	West
3	Residence	3,100	ENE
4	Residence	3,140	SSE
5	Residence	2,000	NE

4.2 ENVIRONMENTAL SOUND LEVEL MEASUREMENTS

The ambient sound level survey was performed between September 16th and 17th, 2021 by Steve Gronsky and Damien Bell of SLR. Sound level measurements were monitored near each NSA. Measurements were approximately 24-hours in duration. **Figure 1**, attached, shows the NSAs and measurement locations. The measurements are summarized in **Table 4-2**.

Table 4-2: Summary of Sound Level Measurements

NSA	Measurement Location	Measurement Duration (HH:MM)	Source Observations
1	ML 1	25:09	Birds, insects, Plasma CS audible
2	ML 2	24:37	Birds, insects, Zink CS audible, corona noise from power lines, Plasma CS is not audible
3	ML 3	23:38	Birds, insects, corona noise from power lines, Plasma CS audible, traffic
4	ML 4	25:14	Birds, insects, Switz 27 CS audible, Plasma CS not audible
5	ML 5	24:42	Birds, insects, traffic, nearby CS audible, Plasma CS is not audible

4.3 MEASUREMENT EQUIPMENT

Sound level equipment used during the site survey included the following instruments:

- Larson Davis Model 831 Sound Level Meter, real time analyzer; Type 1; S/N: 11310
- Brüel and Kjær Model 2250 and 2270 Sound Level Meters, Type 1; S/N: 3000936, 2630388, 2704733, 2505915, 2590438, 2590439
- Brüel and Kjær Type 4231 Calibrator; s/n 3001195

Windscreens were used on the measurement microphones. The sound level meters were field-calibrated before and after measurements. All sound meters have current laboratory certification, available upon request.

4.4 WEATHER CONDITIONS

Weather conditions were appropriate for a sound level survey as summarized in **Table 4-3**. The overall weather conditions were good for a sound level survey.

Table 4-3: Summary of Weather Conditions During Survey

Dates	September 16 – 17, 2021
Temperature	64°F – 80°F
Relative Humidity	58 – 100%
Wind Direction	CALM to ENE
Wind Speed	0 – 6 mph
Sky Conditions	Fair to Mostly Cloudy
Ground Conditions	Damp to Dry

4.5 MEASUREMENT METHODOLOGY

Sound levels were measured using the slow meter response and A-weighting. In addition to broadband A-weighted (dBA) levels, linear (dB) 1/3 and 1/1-octave band levels were also measured. The survey began at approximately 12:00 pm on September 16, 2021 and ended at approximately 1:00 pm on September 17, 2021.

4.6 MEASUREMENT RESULTS

The sound level measurement results are summarized in **Table 4-4**. The measured sound levels for daytime (L_d), nighttime (L_n), and the equivalent day-night sound level (L_{dn}) are shown. Daytime is considered to be the period from 7:00 am to 10:00 pm, and nighttime is from 10:00 pm to 7:00 am. The L_{dn} is a 24-hour sound level average that includes a 10-dBA penalty added to levels measured at night. The data in the **Table 4-4** were post-processed to remove the high-frequency contribution from insect noise, which is a seasonal phenomenon.

Table 4-4: Summary of Sound Level Measurements

NSA	Measurement Location	Measured Levels Period Average, dBA		
		Day L_d	Night L_n	Day-Night L_{dn}
1	ML 1	38.8	38.7	45.1
2	ML 2	36.1	31.4	38.9
3	ML 3	35.8	34.8	41.2
4	ML 4	35.3	33.6	40.3
5	ML 5	47.7	40.5	49.0

Level versus time graphs of the measurement results for the five monitoring locations are shown in **Appendix A**. Each graph is the result of a single set of measurements at a single position. The graph shows the ten-second L_{eq}, represented by a solid blue line, and the L_{90}, represented by the red line.

5 PROPOSED EQUIPMENT NOISE IMPACT EVALUATION

5.1 SIGNIFICANT SOUND SOURCES

The following sound sources are considered significant:

- 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 inlet air system, including the inlet opening and noise radiated from the silencer/ductwork shell and any duct joints.
- Turbine/Compressor casing noise that radiates to the exterior of the building and through building ventilation openings.
- Noise from the lube oil / auxiliary cooler and gas aftercooler,
- Noise radiated by aboveground station piping.

5.2 NOISE MODEL DEVELOPMENT

A three-dimensional computer noise model was constructed to analyze the noise contributions expected from the future compressor station configuration (existing + new equipment). The model was developed using CadnaA, version 2021 MR 2 (build: 187.5163), a commercial noise modeling package developed by DataKustik GmbH. The software considers 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.

5.2.1 DATA AND ASSUMPTIONS

The future compressor building dimensions were used in the noise model. The existing equipment was arranged as per the current site, with the unit suction and discharge piping on the northeast side; the turbine inlet on the southwest side; and the existing turbine exhaust and lube oil cooler on the northwest and southeast sides of the compressor building. The future turbine exhaust and outdoor equipment were modeled per the plot plan provided to SLR. The turbine exhausts were modeled at a height of 45.5 feet above grade. The ventilation opening size and distribution was based on the current compressor building, as observed during the site visit. Modeling for the Phase 2 compressor building includes two wall intakes, each sized at about 60 inches square, and a throat ridge ventilator. **Table 5-1** shows the inputs to the modeling for the existing equipment and future equipment. The existing Unit 1 and 2 equipment sound power levels shown were calculated based upon diagnostic sound measurements performed by SLR. The Unit 1 and 2 source levels are indicative of the noise mitigation that was part of the station design, so they include special silencers (intake, exhaust), pipe lagging, and low-noise equipment packages.

Table 5-1: 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
Existing Unit 1 and Unit 2 Equipment										
Discharge Piping, L_w	61	73	77	84	92	95	102	101	90	105
Gas Aftercooler (per cooler), L_w	66	72	76	83	88	91	92	92	82	97
Building Exhaust (Ridge Vents), L_w	41	58	70	83	83	85	85	94	79	95
Capstone C1000 Generator, L_w[3]	92	90	97	90	88	90	84	87	87	95
Taurus 70 Exhaust Exit (per unit), L_w	70	89	84	80	85	80	81	78	65	92
Station Piping, L_w	52	69	67	67	74	77	85	83	80	89
Fuel Gas Skid, L_w	49	63	63	66	69	75	77	84	84	88
Suction Piping, L_w	48	53	59	65	77	77	86	74	78	88
Lube Oil Cooler (per cooler), L_w	52	72	79	80	80	81	78	74	66	87
Building Ventilation Intake Openings, L_w	51	60	73	77	71	68	71	83	82	87
Building Walls, Roof, and Doors, L_w	57	69	80	84	72	73	71	76	63	87
Taurus 70 Air Intake (per unit), L_w	56	71	70	71	74	69	70	72	56	80
Future Unit 3 Titan 130 Equipment										
Engine Intake, Titan 130, Unsilenced, L_w[1]	114	120	126	127	128	130	133	163	155	164
Engine Exhaust, Titan 130, Unsilenced, L_w[1]	124	128	126	129	133	128	120	110	100	133
Unlagged Suction Piping, Per Meter, L_w[2]	94	96	95	90	91	96	111	100	90	113
Fuel Gas Skid, L_w[2]	-	-	-	-	91	96	104	103	99	108
Sound Level in Compressor Building at Inner Wall Surface, L_p[2]	81	85	91	88	88	89	94	101	93	104
Unlagged Discharge Piping, Per Meter, L_w[2]	88	84	84	90	95	88	100	92	81	103
Building Wall Panel Fan, L_w[2]	97	97	101	97	96	96	93	88	81	100
Exhaust Breakout, L_w[2]	110	111	102	96	92	85	87	84	78	95
Lube Oil Cooler, L_w[1]	95	102	96	92	87	84	80	76	71	90
Anti-surge valve, L_w[2]	-	-	-	-	74	80	87	82	77	90

Source	Linear L_p or L_w at Octave Center Frequency									Total
	31.5	63	125	250	500	1k	2k	4k	8k	dBA
Sound Power Level of Gas Cooler Fans, Per Fan, L_w[3]	91	91	90	87	82	80	74	68	62	85
Intake Breakout, L_w[2]	79	88	83	85	68	61	63	64	55	78

[1]From Solar Noise Book – 2015
[2] From SLR Data Library from similar projects
[3] From Vendor datasheet

5.2.2 NOISE MODEL RESULTS – TYPICAL OPERATION SCENARIO WITH MITIGATION

Table 5-2 shows a summary of the predicted future sound level contribution of the station equipment (existing and future station equipment) at each NSA. The table also shows the overall NSA sound levels, including the future station and ambient environmental sources. This table indicates that with the proposed noise control treatments discussed below, the compressor station noise contributions at all of the nearest NSAs will be below the FERC criterion of 55 dBA L_{dn}. The FERC sound level limits apply only to the sound level contribution of the compressor station equipment, and do not include the influence of the existing ambient sound levels. The highest station contribution is 46.0 dBA L_{dn} at NSA 5, which is well below the FERC limit of 55 dBA L_{dn}. The predicted increases above the current station contribution are 1.4-3.0 dBA L_{dn}. Potential increases above the existing ambient are 0.3 dBA to 1.6 dBA L_{dn}.

Table 5-2: Compressor Station Sound Level Predictions

NSA	Distance from Comp. Bldg to NSA, feet	Direction	Measured Existing Ambient, Day-Night Average[a]	Estimated Contribution of Station Equipment					Combined, All Sources Including Ambient[c]	Potential Increase Above Existing Ambient
				Current Station Equipment[b]	Future Expansion Equipment[b]		Combined Existing and Future Expansion	Predicted Increase Over Existing Contribution		
			L_{dn} dBA	L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{dn} dBA	ΔL_{dn} dBA	L_{dn} dBA	L_{dn} dBA
1	1,980	NW	45.1	44.2	33.5	39.9	45.6	1.4	46.2	1.1
2	2,320	W	38.9	35.6	29.1	35.5	38.6	3.0	40.5	1.6
3	3,100	ENE	41.2	30.4	24.0	30.4	33.4	3.0	41.5	0.3
4	3,140	SSE	40.3	38.2	27.5	33.9	39.6	1.4	41.2	0.9
5	2,000	NE	49.0	44.4	34.6	41.0	46.0	1.6	49.6	0.6

a. Post-processed to remove environmental noise from insects (1,600 hz and above); ambient levels at the NSAs are controlled by traffic, leaf rustle, and other environmental noises;
b. Per noise modeling; Ldn was calculated by adding 6.4 dBA to the Leq
c. Measured Ambient + Future Expansion Contribution

5.2.3 NOISE MODEL RESULTS – UNIT BLOWDOWN SCENARIO

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

A compressor blowdown scenario was modeled using a single blowdown silencer specified to limit the blowdown sound levels to a maximum of **85 dBA at 3 feet**. **Table 5-3** shows the predicted short-term sound pressure levels at the NSAs during a blowdown event. The unit blowdown event sound levels are compared to the nighttime average levels at each NSA to show the potential short-term sound level impact of the station. The predicted blowdown sound levels are quite low, with the highest predicted sound level of 26.5 dBA L_{eq} at NSA 5.

Table 5-3: Station Unit Blowdown Sound Level Predictions

NSA	Distance from Compressor Building to NSA (feet)	Direction	Measured Existing Ambient, Night Average[a] L_n dBA	Estimated Contribution of Unit Blowdown L_{eq} dBA	Combined Blowdown and Ambient L_n dBA	Short-Term Sound Level Increase During Blowdown ΔL_{eq} dBA
1	1,980	NW	38.7	26.1	38.9	0.2
2	2,320	W	31.4	20.0	31.7	0.3
3	3,100	ENE	34.8	14.6	34.8	0.0
4	3,140	SSE	33.6	22.7	34.0	0.3
5	2,000	NE	40.5	26.5	40.7	0.2

a. Post-processed the sound data to remove contribution from seasonal insect noise

5.2.4 NOISE MODEL RESULTS – EMERGENCY SHUTDOWN SCENARIO

The station has an emergency shutdown (ESD) system that automatically halts operation of the station in the event of an irregularity. This results in a full station blowdown 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 one time per year. The station ESD system was modeled with a maximum sound level due to the blowdown of **95 dBA at 50 feet**.

Table 5-4 shows the predicted short-term sound levels at the NSAs due to an ESD blowdown. The station ESD blowdown event sound levels are compared to the nighttime average levels at each NSA to show the potential short-term nighttime sound level impact of the station. The predicted sound levels are all at or below 51 dBA, with the highest predicted sound level of 51.0 L_{eq} dBA at NSA 5. This is a reasonable sound level for an event that will only occur in emergency situations or during testing periods that are scheduled ahead of time and with limited frequency and duration. ESD blowdown duration is typically less than ten minutes in duration.

Table 5-4: Station ESD Blowdown Sound Level Predictions

NSA	Distance from Compressor Building to NSA	Direction	Measured Existing Ambient, Night Average[a]	Estimated Contribution of ESD Blowdown	Combined ESD Blowdown and Ambient	Short-Term Sound Level Increase During ESD Blowdown
	(feet)		L_n dBA	L_{eq} dBA	L_n dBA	ΔL_{eq} dBA
1	1,980	NW	38.7	50.6	50.9	12.2
2	2,320	W	31.4	44.5	44.7	13.3
3	3,100	ENE	34.8	39.1	40.5	5.7
4	3,140	SSE	33.6	47.2	47.4	13.8
5	2,000	NE	40.5	51.0	51.4	10.9

5.2.5 NOISE MODEL RESULTS – CONSTRUCTION

Only standard equipment will be used during construction, with no dynamic compaction or pile driving expected. Most construction will take place during daytime working hours of 7:00 a.m. until 7:00 p.m. Construction sound calculations were performed with the CadnaA propagation model, which accounts for local topography. Equipment usage factors were used per the Federal Highway Administration's Roadway Construction Noise Model version 1.1 (FHWA, 2006). Usage factor is the percentage of time a given piece of equipment typically operates during a given hour. The following equipment were included in the construction evaluation for the station (quantities in parentheses):

- Diesel Area Light Plant (8)
- Diesel Generators (2)
- Diesel Welders (2)
- Diesel Air Compressors (2)
- Man Lift (2)
- Pneumatic noise, Purge, Blow Down (1) **– No Nighttime Operation**
- Skid Steer (1) **– No Nighttime Operation**
- Excavator (1) **– No Nighttime Operation**
- Dozer (1) **– No Nighttime Operation**
- Telehandler (1) **– No Nighttime Operation**
- Crane (1) **– No Nighttime Operation**
- Trucks (4) **– No Nighttime Operation**
- Air Hammer (1) **– No Nighttime Operation**
- Electric hand tools (2) **– No Nighttime Operation**
- Air Mover (1) **– No Nighttime Operation**
- Nitrogen Purge (1) **– No Nighttime Operation**

Calculated construction sound levels at the NSAs are 47-55 dBA L_{eq}. If major construction activity is limited to daytime hours, then there is no specific sound level limit for construction activities. Sound levels during construction may occasional exceed the ambient daytime sound levels by 10 to 15 dBA L_{eq} or more during some hours of the day, such as when an air hammer is in use. A temporary 10 to 15 dBA increase in the ambient sound level could be noticeable, depending on the sensitivity of the residents. Construction-related annoyance complaints will be addressed should they arise, and modifications to the construction schedule can be made if necessary.

Nighttime work may occur during the last weeks of the Project, but night work at Plasma station will only involve limited activities that do not require significant noise-emitting equipment. For example, if nighttime activities are limited to the operation of light farms or occasional use of platform lifts, calculated sound levels exceed nighttime ambient levels by 2-5 dBA and would be barely noticeable to most people.

Nighttime activities such as manual work, non-destructive testing, inspections, etc. would not result in noticeable increases in the ambient levels.

6 NOISE CONTROL TREATMENTS

A summary of the modeled performance of one possible set of noise control treatments is shown in **Table 6-1**, below. The following subsections describe the treatments. The noise mitigation shown applies to future expansion equipment only.

The noise mitigation measures shown are based on the most current station design and represent one potential set of possible mitigation measures. There are many different combinations of noise control mitigation measures that will provide similar noise control. As the station design, including noise mitigation treatments, is finalized, the mitigation design will be modified to account for these design changes while maintaining compliance with the FERC sound level requirements.

Table 6-1: Required Noise Control Treatments

Required Dynamic Insertion Loss (DIL) or Transmission Loss (TL)										
Source	Treatment Description	Required Treatment Performance								
		31.5	63	125	250	500	1k	2k	4k	8k
T130 Turbine Intake	Solar Silencer, DIL	2	4	14	21	30	43	52	60	55
T130 Turbine Intake	Pulse Updraft Filter, DIL	2	4	8	9	13	26	27	27	33
T130 Compressor Building	STC-39 Wall and Roof System, TL	10	16	17	24	44	49	55	55	58
Equipment Door	STC-32 Personnel Door, TL	9	17	23	27	32	32	31	41	41
Personnel Door	STC-21 Insulated Roll-up Door, TL	2	7	12	17	18	19	22	30	35
Building Ventilation	3ft Silencers and Lined Hoods, DIL	2	6	10	15	25	30	30	25	15
Ridge Vent	Acoustic Baffle, DIL	-	-	-	4	6	9	9	14	9
T130 Exhaust	Custom Titan 130 Exhaust Silencer, DIL	3	18	24	40	46	42	39	38	34
T130 Piping or Inlet Ductwork, if necessary	Type ISO C2 Lagging, IL	-	-	-	4	14	24	34	38	42

6.1 COMPRESSOR BUILDING WALLS AND ROOF

The Titan 130 compressor building wall and roof system should have a sound transmission class rating (STC) and transmission loss performance shown in **Table 6-1**. It is recommended that the compressor building manufacturer supply laboratory test results for their proposed wall system that show a transmission loss equal to or greater than the required performance in each octave band. The compressor building should have no windows, skylights, or translucent panels. The same wall system should be used for the expansion as currently exists in the compressor building.

The interior surface of the compressor building walls should be acoustically absorptive, having a noise reduction coefficient (NRC) of at least NRC 0.8. The inside of the compressor building can be lined with perforated metal of at least 23 percent open area for insulation protection, if so desired. The building should be well sealed with no cracks or gaps. All piping penetrations through the building walls should be well insulated, flashed, and caulked.

6.2 COMPRESSOR BUILDING DOORS

The expanded compressor building will have an additional 14-foot by 14-foot steel roll-up equipment door. Standard insulated over-head door will be sufficient for the equipment doors. The performance shown in **Table 6-1** is the required transmission loss performance of the roll-up door.

The personnel doors should achieve the sound transmission loss and STC rating shown in **Table 6-1** (or better). These are industrial metal doors with good perimeter seals. Small glass windows in the personnel doors are acceptable as long as the door STC rating is achieved.

6.3 COMPRESSOR VENTILATION

All building ventilation openings should include standard acoustical louvers or silencers, such that the total sound pressure level contribution of each opening does not exceed **70 dBA at 12 feet** from the opening. The unsilenced building ventilator should not exceed a level of **80 dBA at 3 feet**. The sound pressure level calculated for the interior of the building due to the turbine and compressor equipment is shown in **Table 5-1**. The sound level target for each ventilation opening includes the sound level contribution of both the mechanical equipment inside the building along with the sound levels due to the ventilation fans. The ventilation system supplier should submit the sound power level of the proposed building ventilation fans during the bidding process for review.

The approximate ventilation silencer performance is shown in **Table 6-1**. The final performance requirements of these silencers will depend on the size, number, and type of ventilation fans used in the design. The sound pressure level target should be the primary design criterion, as it can be field-tested after installation.

Any expansion to the throat ridge ventilator should have acoustic insulation applied to the damper and an acoustic baffle suspended beneath it, along the center of the building.

6.4 TURBINE EXHAUSTS

For the operation of dual-shaft SoLoNox turbines, Solar notes that sound levels during partial-load operation can be higher than sound levels during full-load operation. In an analysis of manufacturer data for these turbines, increases of up to 6 dB at 1 kHz have been noted by Solar for Titan 130 exhausts and increases of up to 6 dB at 4 kHz for Titan 130 inlets. Silencer specification and bidding should be developed with such potential variability in mind in order to satisfy the noise targets for all steady-state operational conditions.

6.4.1 SILENCER PERFORMANCE

The turbine will include an exhaust silencer system achieving the dynamic insertion loss (DIL, in decibels) shown in **Table 6-1**. Because of the complexities involved with the field verification of silencer insertion loss, the vendor should bid to meet a sound pressure level target of **45 dBA at 200 feet** from the exhaust opening, measured horizontally from the edge of the stack top with the turbine in any steady-state operational condition, including partial load and full load.

6.4.2 EXHAUST DUCT AND SHELL NOISE

In large turbine-powered installations it is common for a significant amount of sound energy to radiate from the exhaust system ductwork, expansion joints, and exhaust silencer shell. This sound energy is often termed "shell-radiated" noise. Shell-radiated noise is not necessarily calculated by exhaust system manufacturers, but it can be a dominant noise source for NSAs close to the station. The exhaust breakout was modeled based on measurements taken at the existing Plasma station.

The modeled breakout noise sound power levels are shown in **Table 5-1**: Sound Pressure Levels (L_p) and Sound Power Levels (L_w) for Station Equipment. These levels were based on measurements taken of the existing exhaust stack at the Plasma station.

6.5 TURBINE INLET

The proposed expansion unit will include the standard Solar intake silencer and pulse-updraft filter. The insertion losses of each of these elements are shown in **Table 6-1**.

6.5.1 INLET BREAKOUT

Sound radiating from the inlet ductwork on the turbine side of the inlet silencer can be a significant noise source. If possible, the inlet silencer should be located inside of the compressor building. If the inlet silencer is not located inside a compressor building, then the inlet ductwork between the silencer and the building wall should be acoustically lagged with the ISO Type B2 lagging listed in **Table 6-1**.

6.6 LUBE OIL COOLER

The sound power level of the lube oil cooler should not exceed the sound power levels given in **Table 5-1**. This is the total sound power level for the entire cooler (i.e. not just a single fan). The sound power level in **Table 5-1** is representative of a custom-rated lube oil cooler.

6.7 GAS AFTERCOOLER FANS

Table 5-1 shows the total radiated sound power level for the gas aftercooler fans at the station. The total sound power level including the sum of the sound power of each fan, along with any radiated sound due to the motors and drive assemblies for the future cooler should not exceed **65 dBA at 16 feet** from the cooler. This was modeled using the sound power level spectrum supplied by the equipment manufacturer adjusted based on the number of fans in each cooler bay.

6.8 STATION PIPING

Noise from centrifugal compressors will cause significant noise radiation from connected piping. To the extent practical, all suction and discharge piping should be run underground. All outdoor aboveground piping between the compressor and the separators on the suction side, and the compressor and the gas cooler on the discharge side, may be acoustically lagged if necessary.

The computer noise model also includes an anti-surge valve. Should the valve be louder than expected after construction, lagging could also be applied to this source.

6.8.1 ACOUSTICAL PIPE LAGGING

If acoustical lagging is used, it should conform to the performance specifications shown in **Table 6-1** for ISO Type C2 lagging. This is generally equivalent to (listed from pipe surface outwards):

- 4 inches of 6 to 8 lb/cf mineral wool or fiberglass pipe insulation,
- a layer of 2 lb/sf mass-loaded vinyl,
- and a layer of 0.016” aluminum jacketing or silicon-coated fiberglass cloth.

Other lagging systems are available that will offer similar acoustical performance, so the lagging system performance shown in **Table 6-1** should be used as the performance goal rather than the listed material requirements.

6.8.2 PIPING ISOLATION

To limit noise radiation from structural supports, the compressor piping should be isolated from pipe supports and other structural contacts using at least 1/4-inch neoprene bearing pads. The stiffness of the neoprene should be chosen so that the static deflection of the pads under the piping loads is about 1/16 inch. Secondary steel elements such as cable trays, pipe racks, walkways, and conduit supports should not be connected to the pipe supports and/or piping.

7 SUMMARY

Equitrans Midstream is proposing to expand the Plasma Compressor Station, adding to the existing compressor station near Clarington, in Monroe County, Ohio Coburn. Measurements near the closest NSAs to the proposed station site show that the current ambient sound levels range from 38.9 to 49.0 dBA L_{dn}, which includes corrections made to remove the influence of seasonal insect noise. A sound propagation model has been developed of the existing and expansion station equipment. With the noise control treatments outlined in this report, modeling predicts that the future station sound level contribution at the NSAs will range from 34.0 dBA to 46.4 dBA L_{dn}. The sound level contributions from the future station are expected to be in compliance with the FERC sound level limit of 55 dBA L_{dn}.

LIMITATIONS

The services described in this work product were performed in accordance with generally accepted professional consulting principles and practices. No other representations or warranties, expressed or implied, are made. These services were performed consistent with our agreement with our client. This work product is intended solely for the use and information of our client unless otherwise noted. Any reliance on this work product by a third party is at such party's sole risk.

Opinions and recommendations contained in this work product are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, positions, time frames, and project parameters indicated. The data reported and the findings, observations, and conclusions expressed are limited by the scope of work. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this work product.

This work product presents professional opinions and findings of a scientific and technical nature. The work product shall not be construed to offer legal opinion or representations as to the requirements of, nor the compliance with, environmental laws rules, regulations, or policies of federal, state or local governmental agencies.

FIGURES

Figure 1: Map of NSA and Sound Level Measurement Locations

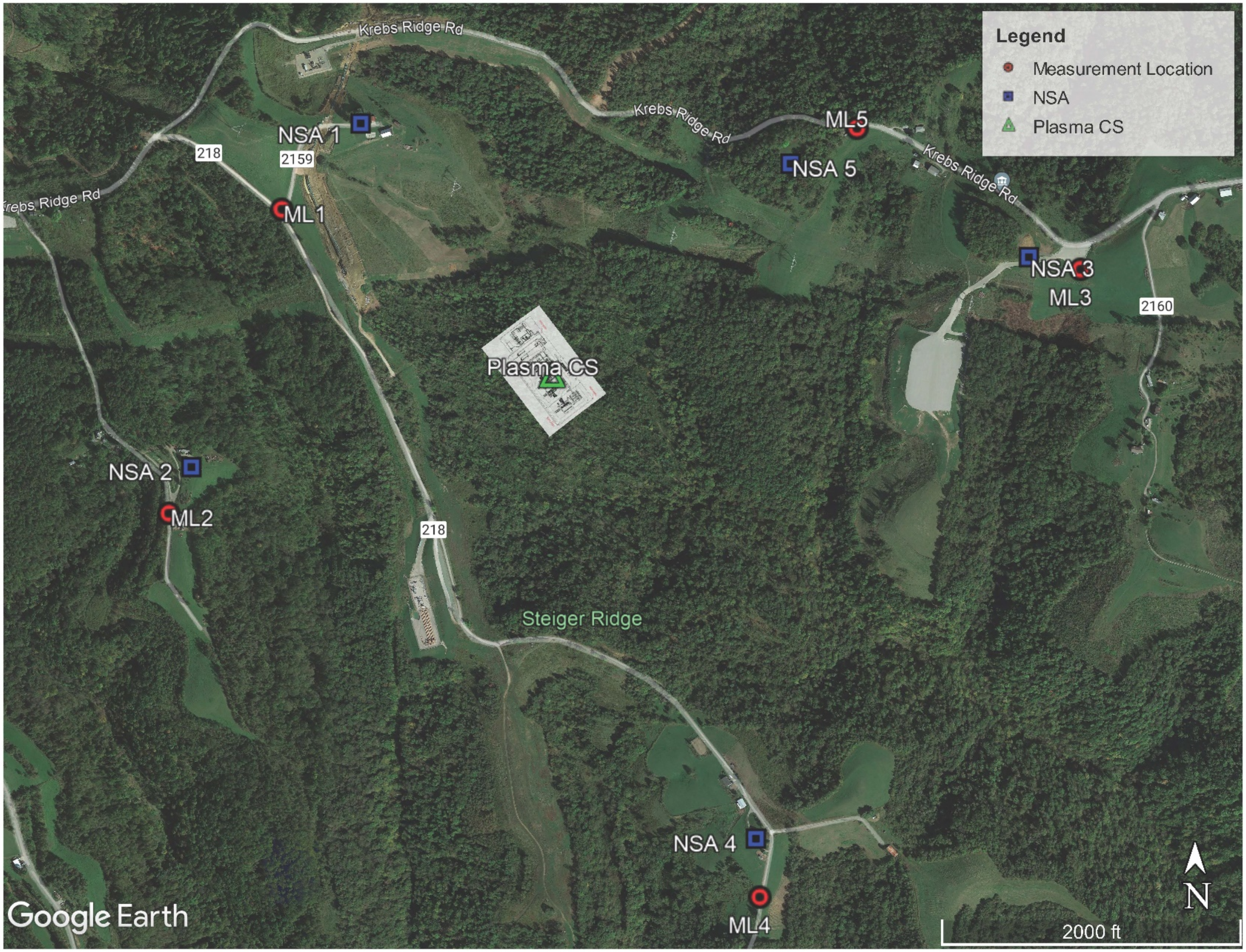
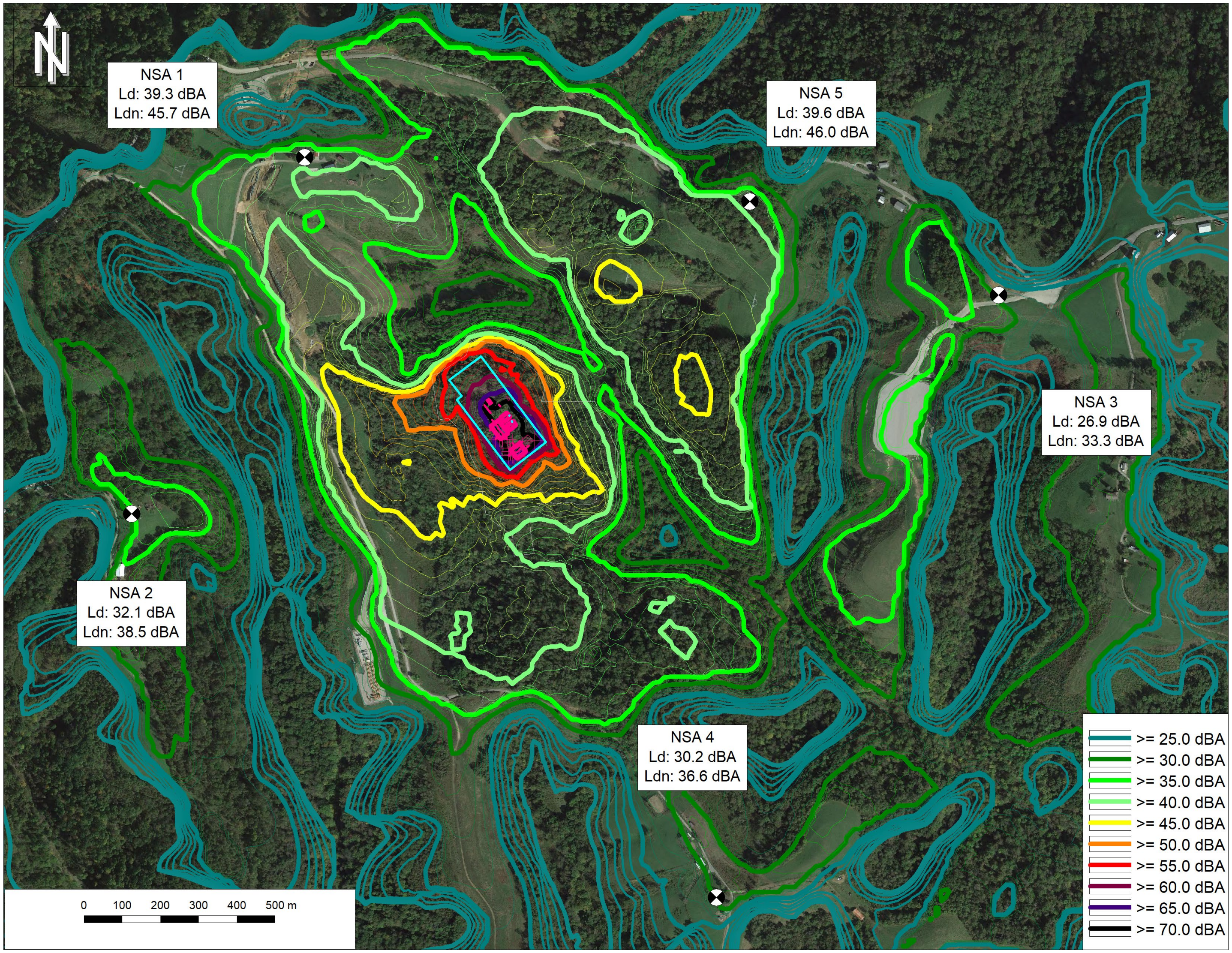


Figure 2: Predicted Sound Levels for Existing and Future Expansion Equipment – dBA L_{dn}



APPENDIX A

LEVEL VERSUS TIME GRAPHS OF AMBIENT SOUND LEVELS

Pre-Construction Sound Level Study

Equitrans Midstream
2200 Energy Drive
Canonsburg, PA 15317

November 5, 2021

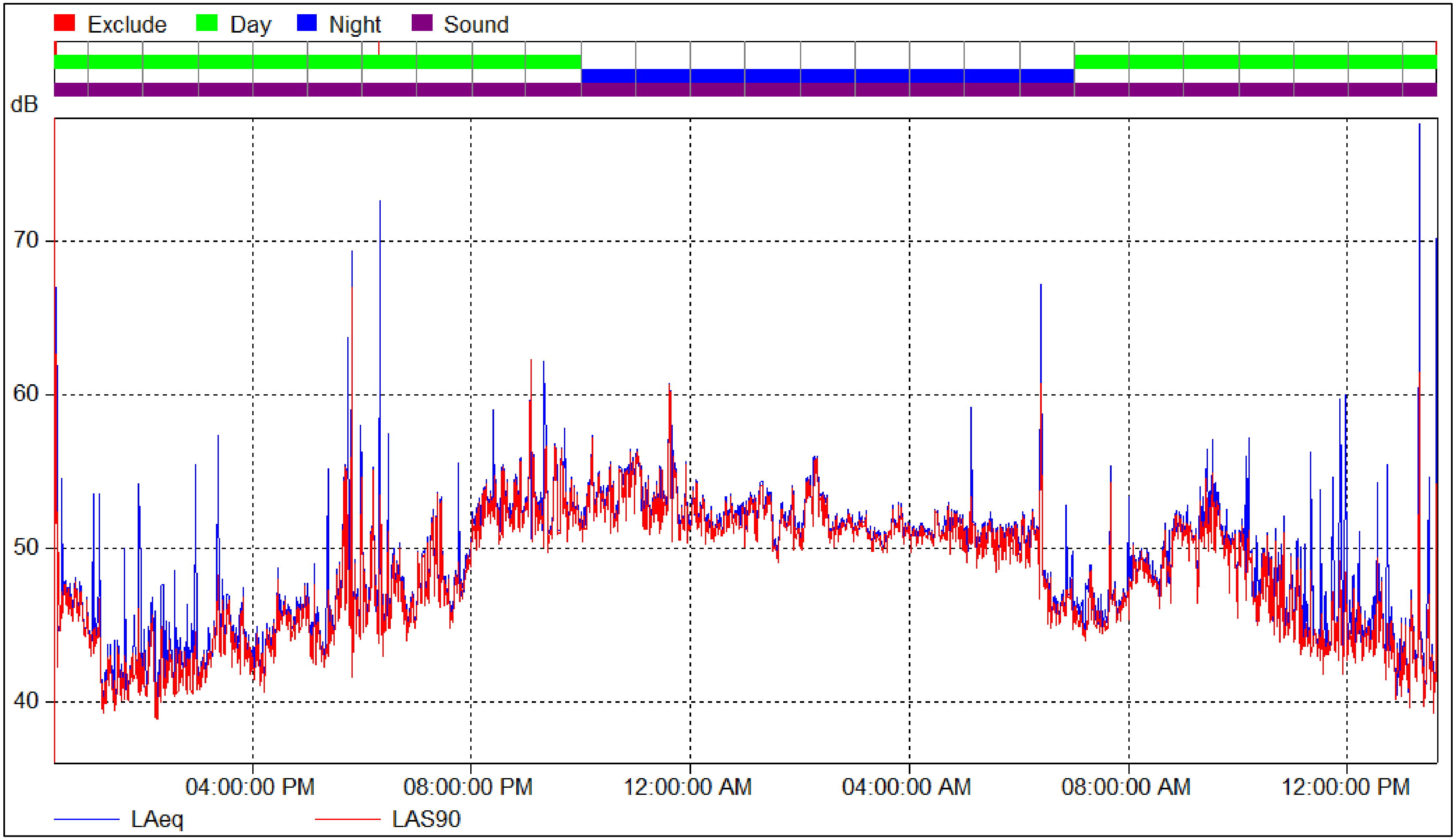


Figure 3: ML 1 Time History Plot – dBA – September 16-17, 2021

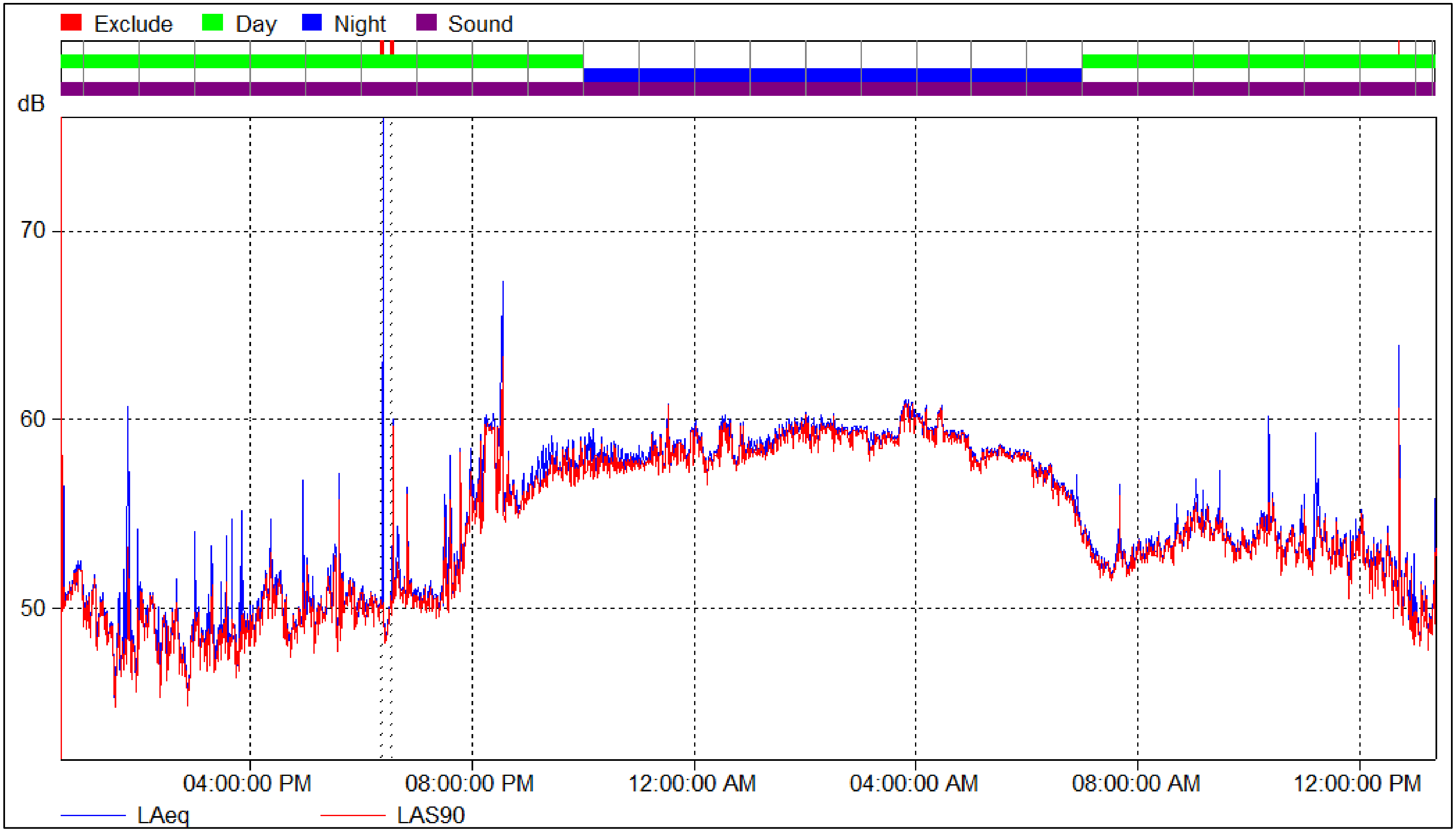


Figure 4: ML 2 Time History Plot – dBA – September 16-17, 2021

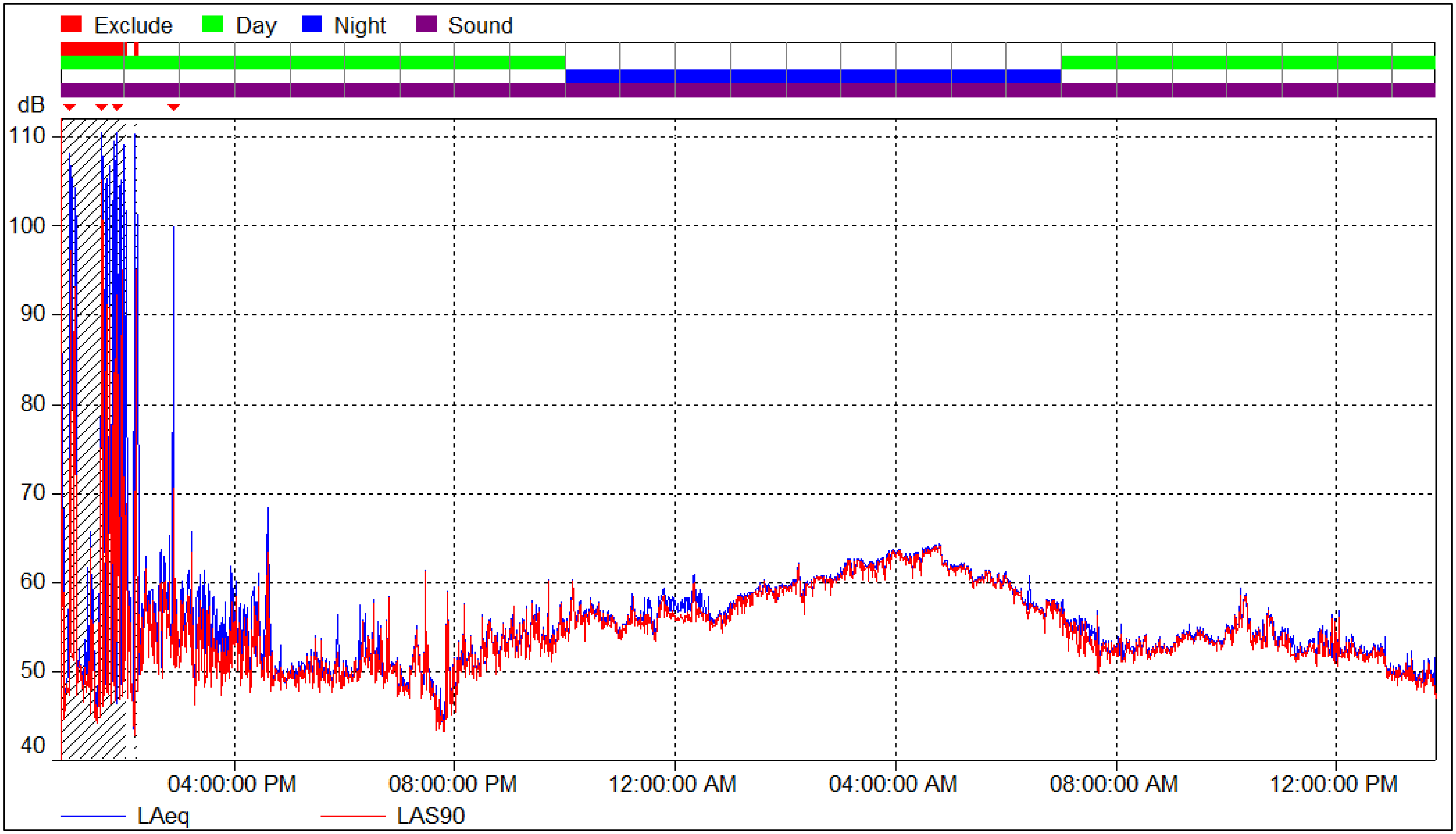


Figure 5: ML 3 Time History Plot – dBA – September 16-17, 2021

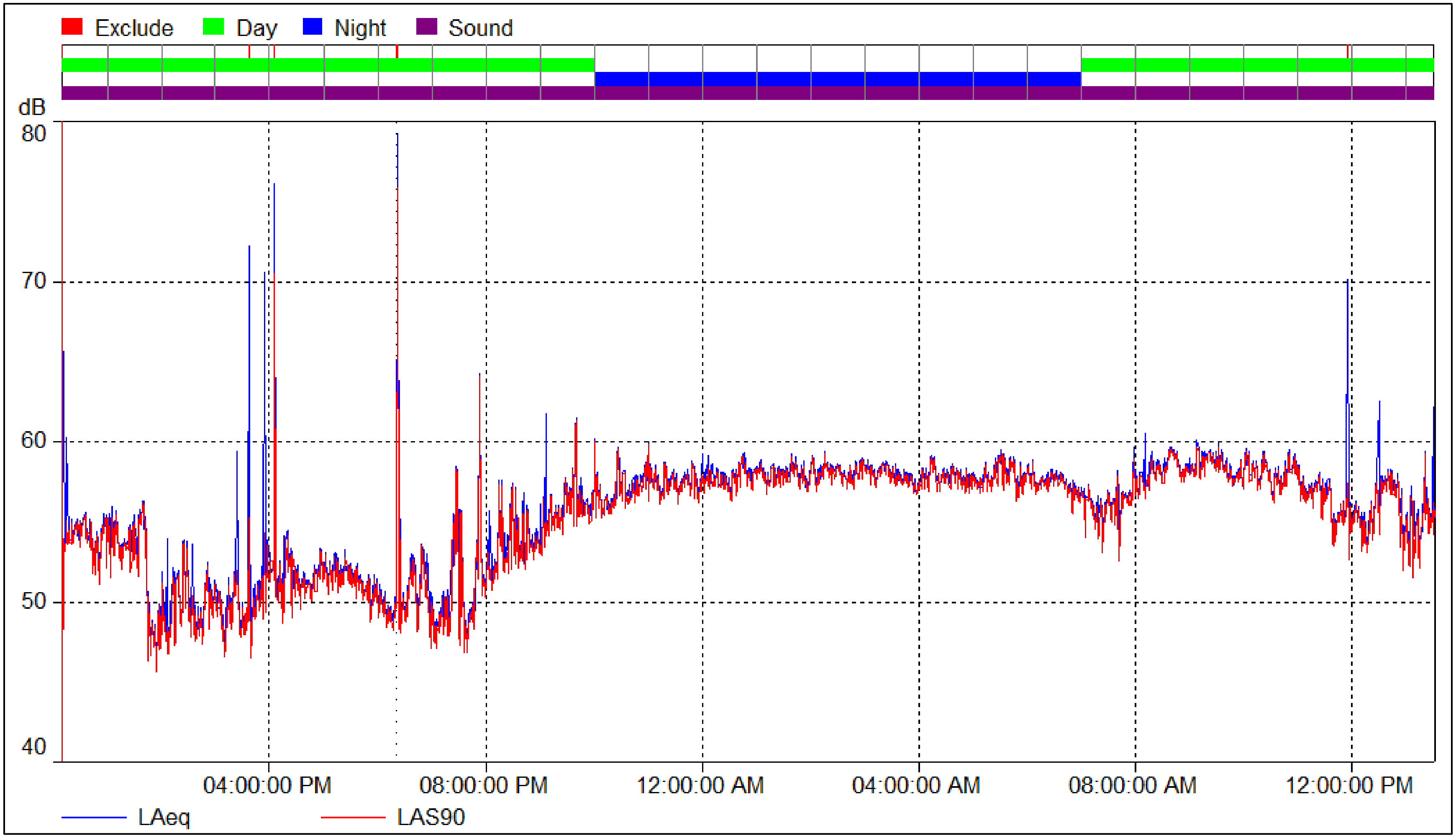


Figure 6: ML 4 Time History Plot – dBA – September 16-17, 2021

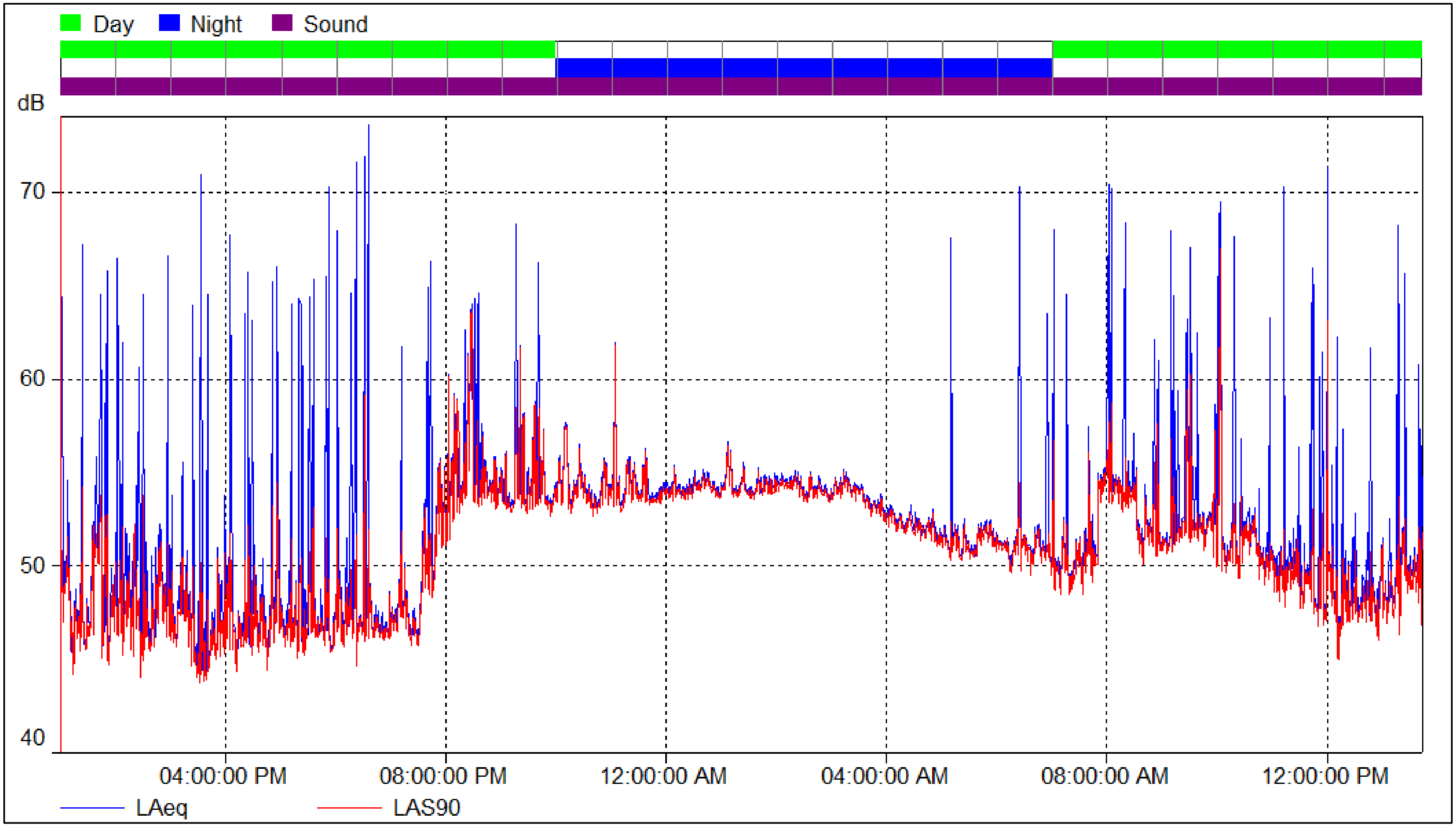


Figure 7: ML 5 Time History Plot – dBA – September 16-17, 2021