Sabine Pass Liquefaction Expansion, LLC

Sabine Pass Liquefaction, LLC

Sabine Pass LNG, L.P.

Liquefaction Expansion Project

Cheniere Creole Trail Pipeline, L.P.

CCTPL Expansion Project

Resource Report 9 — Air and Noise Quality

PF13-8-000

July 2013

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ACRONYMS AND ABBREVIATIONS

49 U.S.C.	Title 49 of the United States Code
$\mu g/m^3$	micrograms per cubic meter
AQCR	air quality control region
AQCR 106	Southern Louisiana - Southeast Texas Interstate AQCR
ANR	ANR Pipeline Company
BACT	Best Available Control Technology
Bcf/d	billion cubic feet per day
BD	blow down
CAA	Clean Air Act
CCTPL	Cheniere Creole Trail Pipeline, L.P.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGT	Columbia Gulf Transmission Company
CH_4	methane
CI	compression ignition
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalentdB decibel
dBA	A-weighting frequency scale in decibels
F	degrees Fahrenheit
FERC or Commission	Federal Energy Regulatory Commission
GE	General Electric
GHG	greenhouse gas
GJ/hr	gigajoules per hour
g/hp-hr	grams per horsepower hour
g/VMT	grams per vehicle mile traveled
HAP	hazardous air pollutant
HDD	horizontal directional drill
hp	horsepower
ICE	internal combustion engines
LAC	Louisiana Administrative Code
L_{Aeq}	A-weighted L_{eq} in decibels
LAAQS	Louisiana Ambient Air Quality Standards
lb/MMBtu	pound per million British thermal units
L_d	day sound level in decibels
L_{dn}	day-night sound level in decibels
L_{eq}	equivalent sound level in decibels
LDEQ	Louisiana Department of Environmental Quality
L_n	night sound level in decibels
LNG	liquefied natural gas

MACT	Maximum Achievable Control Technology
m^3	cubic meters
MOVES	USEPA Mobile Vehicle Emissions Simulator
MMBtu/hr	million British thermal units per hour
M&R	metering and regulating
MSS	maintenance, start-up, and shutdown
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NCDC	National Climatic Data Center
NFPA	National Fire Protection Association
NNSR	Nonattainment New Source Review
NO_2	nitrogen dioxide
N_2O	nitrous dioxide
NO_x	nitrogen oxides
NSA	Noise Sensitive Areas
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	ozone
Pb	lead
PHMSA	Pipeline and Hazardous Materials Safety Administration
Plan	FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan*
PM	particulate matter
PM_{10}	particulate matter with a nominal aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with a nominal aerodynamic diameter of 2.5 microns or less
PPEC	Pine Prairie Energy Center
ppm	parts per million
ppmvd @ 15% O_2	parts per million by volume corrected to 15% oxygen at dry conditions
Project	Liquefaction Expansion Project and CCTPL Expansion Project,
PSD	Prevention of Significant Deterioration
psia	pounds per square inch absolute
RICE	reciprocating internal combustion engine
RMP	risk management plan
Sabine Pass	Sabine Pass Liquefaction Expansion, LLC; Sabine Pass Liquefaction, LLC, and Sabine Pass LNG, L.P.
SAC	Single Annular Combustor
SER	significant emission rate
SIP	State Implementation Plan
SPLNG Terminal	Sabine Pass LNG Terminal
SO_2	Sulfur dioxide

T	Trace
TAP	Toxic Air Pollutant
TGT	Texas Gas Transmission, LLC
Title V	40 CFR Part 70 operating permit program
tpy	tons per year
U.S.	United States
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compounds
WRAP	Western Regional Air Partnership

RESOURCE REPORT 9 – AIR AND NOISE QUALITY	
Filing Requirement	**Location in Environmental Report**
Describe existing air quality, including background levels of nitrogen dioxide and other criteria pollutants which may be emitted above EPA-identified significance levels. (18 CFR § 380.12(k)(1))	Section 9.2.2
Quantitatively describe existing noise levels at noise-sensitive areas, such as schools, hospitals, or residences and include any areas covered by relevant state or local noise ordinances. (18 CFR § 380.12 (k)(2)). (i) Report existing noise levels as the Leq (day), Leq (night), and Ldn and include the basis for the data or estimates. (ii) For existing compressor stations, include the results of a sound level survey at the site property line and nearby noise-sensitive areas while the compressors are operated at full load. (iii)..For proposed new compressor station sites, measure or estimate the existing ambient sound environment based on current land uses. (iv) Include a plot plan that identifies the locations and duration of noise measurements, the time of day, weather conditions, wind speed and direction, engine load, and other noise sources present during each measurement.	Section 9.3
Estimated the impact of the project on air quality, including how existing regulatory standards would be met. (18 CFR § 380.12(k)(3)) (i) Provide the emission rate of nitrogen oxides from existing and proposed facilities, expressed in pounds per hour and tons per year for maximum operating conditions, include supporting calculations, emission factors, fuel consumption rates, and annual hours of operation. (ii) For major sources of air emissions (as defined by the Environmental Protection Agency), provide copies of applications for permits to construct (and operate, if applicable) or for applicability determinations under regulations for the prevention of significant air quality deterioration and subsequent determinations.	Section 9.2.4
Provide a quantitative estimate of the impact of the project on noise levels at noise-sensitive areas, such as schools, hospitals, or residences. (18 CFR § 380.12(k)(4)) (i) Include step-by-step supporting calculations or identify the computer program used to model the noise levels, the input and raw output data and all assumptions made when running the model, far-field sound level data for maximum facility operation, and the source of the data. (ii) Include sound pressure levels for unmuffled engine inlets and exhausts, engine casings, and cooling equipment; dynamic insertion loss for all mufflers; sound transmission loss for all compressor building components, including walls, roof, doors, windows and ventilation openings; sound attenuation from the station to nearby noise-sensitive areas, the manufacturer's name, the model number, the performance rating; and a description of each noise source and noise control component to be employed at the proposed compressor station. For proposed compressors the initial filing must include at least the proposed horsepower, type of compression, and energy source for the compressor.	Section 9.3

RESOURCE REPORT 9 – AIR AND NOISE QUALITY	
Filing Requirement	**Location in Environmental Report**
(iii) Far-field sound level data measured from similar units in service elsewhere, when available, may be substituted for manufacturer's far-field sound level data. (iv) If specific noise control equipment has not been chosen, include a schedule for submitting the data prior to certification. (v) The estimate must demonstrate that the project will comply with applicable noise regulations and show how the facility will meet the following requirements: (A) The noise attributable to any new compressor station, compression added to an existing station, or any modification, upgrade or update of an existing station, must not exceed a day-night sound level Ldn of 55 dBA at any pre-existing noise-sensitive area (such as schools, hospitals, or residences). (B) New compressor stations or modifications of existing stations shall not result in a perceptible increase in vibration at any noise sensitive area.	Section 9.3
Describe measures and manufacturer's specifications for equipment proposed to mitigate impact to air and noise quality, including emission control systems, installation of filters, mufflers, or insulation of piping and buildings, and orientation of equipment away from noise-sensitive areas. (18 CFR § 380.12(k)(5))	Sections 9.2 and 9.3

9.0 AIR AND NOISE QUALITY

9.1 INTRODUCTION

Sabine Pass Liquefaction Expansion, LLC, Sabine Pass Liquefaction, LLC and Sabine Pass LNG, L.P. (collectively referred to as "Sabine Pass") proposes to expand the existing Sabine Pass liquefied natural gas ("LNG") Terminal ("SPLNG Terminal") in Cameron Parish, Louisiana. The Liquefaction Expansion Project will primarily consist of the addition of two liquefaction trains (Trains 5 and 6). Trains 5 and 6 comprise Stage 3 of the Sabine Pass Liquefaction Project, of which Stages 1 and 2 (Trains 1 through 4) are currently under construction at the SPLNG Terminal.

To deliver pipeline gas to Trains 5 and 6, Cheniere Creole Trail Pipeline, L.P. ("CCTPL") proposes to expand and extend the existing CCTPL pipeline system in Cameron, Calcasieu, Beauregard, Allen, and Evangeline Parishes, Louisiana. The CCTPL Expansion Project will involve the addition of approximately 103.9 miles of pipeline, including two loops (Loop 1 and Loop 2), an Extension, and four laterals with interconnections to ANR Pipeline Company ("ANR"), Columbia Gulf Transmission Company ("CGT"), Pine Prairie Energy Center ("PPEC"), and Texas Gas Transmission, LLC ("TGT"). In addition, CCTPL will install a new compressor station (known as the Mamou Compressor Station) to provide an additional 1.5 billion cubic feet per day of capacity to the SPLNG Terminal, and four metering and regulating ("M&R") stations for the interconnections with ANR, CGT, PPEC, and TGT.

This Resource Report 9 describes the ambient air and noise conditions for the Liquefaction Expansion Project and CCTPL Expansion Project (collectively referred to as the "Project"), and provides an assessment of construction and operation impacts, primarily as they relate to the addition of liquefaction Trains 5 and 6 at the SPLNG Terminal, and CCTPL's new Mamou Compressor Station and pipelines. It also desribes the existing noise envionment and provides an assessment of impacts on Noise Sensitive Areas ("NSA") (e.g., schools, hospitals, or residences).

9.2 AIR QUALITY

9.2.1 Stationary Air Emission Sources

9.2.1.1 SPLNG Terminal Trains 1 through 4

There are no new stationary emission sources proposed for the SPLNG Terminal Trains 1 through 4. Sabine Pass proposes to modify operations of Trains 1 through 4. More specifically, Sabine Pass proposes to:

- Update emissions from the twenty four Single Annular Combustor ("SAC") LM2500 natural gas-fueled refrigeration compressor turbines to reflect the final detailed design operating parameters; and
- Update flare emissions to reflect recently identified vent streams that will be routed to the wet/dry flares during routine, start-up, shutdown, and maintenance operations.

9.2.1.2 SPLNG Terminal Trains 5 and 6

New stationary air emission sources associated with the proposed SPLNG Terminal Trains 5 and 6 include the following:

- Twelve (12) General Electric ("GE") LM2500 natural gas-fueled refrigeration compressor turbines, each with a capacity of 43,013 horsepower ("hp").
- Two (2) GE LM2500 natural gas-fueled power generation combustion turbines, each with a capacity of 43,013 hp.
- Two diesel-fueled emergency generators, model and manufacturer to be determined, each with a rating of 2,220 hp.
- One (1) natural gas-fueled wet flare with four pilots, model and manufacturer to be determined, each with a heat input capacity of 0.065 MMBtu/hr.
- One (1) natural gas-fueled dry flare with four pilots, model and manufacturer to be determined, each with a heat input capacity of 0.065 MMBtu/hr.
- Two acid gas vent thermal oxidizer, model and manufacturer to be determined, each with a heat input capacity of 23.08 MMBtu/hr.

Table 9.2-1 is a complete list of the current and proposed compressor units at the SPLNG Terminal.

9.2.1.3 CCTPL Pipeline Expansion

No new stationary air emission sources are associated with the proposed CCTPL Pipeline Expansion or the four associated M&R stations. Small quantities of fugitive volatile organic compounds ("VOC") emissions from valve or fitting leaks may occur.

9.2.1.4 Mamou Compressor Station

New stationary air emission sources associated with the proposed Mamou Compressor Station include the following:

- Three (3) natural gas-fueled compressor combustion turbines, Taurus 70-1080S, manufactured by Solar, each with a capacity of 10,836 hp.
- One (1) natural gas-fueled compressor combustion turbine, Titan 130-20502S, manufactured by Solar, with a capacity of 20,617 hp.
- Two (2) natural gas-fueled emergency generators, each with a rating of 543 hp.
- One (1) 4,300-gallon vertical fixed-roof condensate storage tank.
- Fugitive equipment leak emissions.
- Maintenance, Start-up, and Shutdown ("MSS") activities.

Table 9.2-2 summarizes the Mamou Compressor Station compressor units.

TABLE 9.2-1
SPLNG Terminal Compressor Horsepower Summary

Unit	Manufacturer	Model	Energy Source	Rated Output (Horsepower)			
				Current	Proposed Retirement	Proposed Addition	Proposed Total
1	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
2	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
3	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
4	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
5	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
6	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
7	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
8	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
9	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
10	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
11	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
12	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
13	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
14	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
15	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
16	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
17	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
18	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
19	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
20	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
21	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
22	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
23	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
24	General Electric	LM2500	Natural Gas	43,013	--	--	43,013
25	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
26	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
27	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
28	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
29	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
30	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
31	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
32	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
33	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
34	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
35	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
36	General Electric	LM2500	Natural Gas	--	--	43,013	43,013
Total				**1,032,312**	**--**	**516,156**	**1,548,468**

TABLE 9.2-2

Mamou Compressor Station Compressor Horsepower Summary

Unit	Manufacturer	Model	Energy Source	Rated Output (Horsepower)			
				Current	Proposed Retirement	Proposed Addition	Proposed Total
Turbine A	Solar	Taurus 70-1080S	Natural Gas	--	--	10,836	10,836
Turbine B	Solar	Taurus 70-1080S	Natural Gas	--	--	10,836	10,836
Turbine C	Solar	Taurus 70-1080S	Natural Gas	--	--	10,836	10,836
Turbine D	Solar	Titan 130-20502S	Natural Gas	--	--	20,617	20,617
Total				**--**	**--**	**53,125**	**53,125**

9.2.2 Existing Conditions

9.2.2.1 Climate

SPLNG Terminal Trains 5 and 6

The SPLNG Terminal is located in Cameron Parish, Louisiana. The climate type is humid sub-tropical, characterized by summers which are hot and humid, winters which are short and mild, and no dry season. The regional climate can be represented by National Climatic Data Center ("NCDC") data for Port Arthur, Texas. Table 9.2-3 provides climate data for Port Arthur.

TABLE 9.2-3
Regional Climate Data for Port Arthur, Texas

Parameter	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Normal Daily Minimum Temperature (F)	30	43.2	46.5	52.2	59	67	72.7	74.2	74	69.7	60.5	51.8	44.8	59.6
Normal Daily Maximum Temperature (F)	30	62.1	65.3	71.8	78.1	84.8	89.6	91.7	92.2	88.2	80.6	71.7	63.7	78.3
Normal Daily Mean Temperature (F)	30	52.7	55.9	62	68.6	75.9	81.2	83	83.1	79	70.6	61.7	54.3	69
Normal Heating Degree Days	30	393	270	148	39	1	0	0	0	1	33	161	355	1,401
Normal Cooling Degree Days	30	11	15	55	146	339	484	556	561	419	205	64	22	2,877
Average Percentage of Possible Sunshine	26	42	52	52	52	64	69	65	63	62	67	57	47	58
Mean Number of Days with ≥ 0.01 inch Precipitation	59	9	8	7	6	6	8	11	11	9	6	7	9	97
Normal Precipitation (inches)	30	5.26	3.58	3.53	3.21	5.23	7.09	5.95	5.38	5.97	5.58	4.40	5.29	60.5

TABLE 9.2-3
Regional Climate Data for Port Arthur, Texas

Parameter	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Total Snowfall (including ice pellets) (inches)	43	0.1	0.2	0	T	T	0	T	0	0	0	T	0	0.3

Source: Data reported for Port Arthur, Texas in Comparative Climatic Data for the United States Through 2012, National Climatic Data Center

F = degrees Fahrenheit

T = Trace

Mamou Compressor Station

The Mamou Compressor Station is located in Evangeline Parish, Louisiana. The climate type is humid sub-tropical, characterized by summers which are hot and humid, winters which are short and mild, and no dry season. The regional climate has been represented by using the NCDC data for Lake Charles, Louisiana. Table 9.2-4 provides climate data for Lake Charles.

TABLE 9.2-4
Regional Climate Data for Lake Charles, Louisiana

Parameter	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Normal Daily Minimum Temperature (F)	30	42.3	45.5	51.3	58.2	66.6	72.7	74.6	74.1	69.1	59.4	50.7	44.1	59.1
Normal Daily Maximum Temperature (F)	30	61.4	64.6	71.4	77.9	84.6	89.3	91.1	91.9	88.2	80.8	71.6	63.5	78.1
Normal Daily Mean Temperature (F)	30	51.8	55	61.4	68.1	75.6	81	82.9	83	78.6	70.1	61.1	53.8	68.6
Normal Heating Degree Days	30	417	291	162	45	1	0	0	0	1	35	171	367	1,491
Normal Cooling Degree Days	30	10	13	49	136	330	480	553	558	411	193	56	20	2,809
Average Percentage of Possible Sunshine	19	62	66	74	71	72	78	83	81	78	75	67	59	72
Mean Number of Days with ≥ 0.01 inch Precipitation	51	9	8	7	6	7	9	11	10	8	6	7	9	97
Normal Precipitation (inches)	30	5.23	3.46	3.66	3.33	5.2	6.85	5.63	4.86	5.26	4.9	4.43	4.68	57.4
Average Total Snowfall (including ice pellets) (inches)	36	0.2	0.1	T	T	T	0.0	T	0.0	0.0	0.0	T	T	0.3

Source: Data reported for Lake Charles, Louisiana in Comparative Climatic Data for the United States Through 2012, National Climatic Data Center

F = degrees Fahrenheit. T = Trace

9.2.2.2 National and State Ambient Air Quality Standards

The United States ("U.S.") Environmental Protection Agency ("USEPA") has promulgated National Ambient Air Quality Standards ("NAAQS") to protect human health and welfare. The NAAQS include primary standards, which are designed to protect human health, including the health of sensitive subpopulations such as children and those with chronic respiratory problems, and secondary standards, which are designed to protect public welfare, including economic interests, visibility, vegetation, animal species, and other concerns. NAAQS currently apply to the following criteria pollutants:

- Particulate matter ("PM") with a nominal aerodynamic diameter of 10 microns or less ("PM_{10}");
- PM with a nominal aerodynamic diameter of 2.5 microns or less ("$PM_{2.5}$");
- Nitrogen dioxide ("NO_2");
- Sulfur dioxide ("SO_2");
- Carbon monoxide ("CO");
- Ozone ("O_3"); and
- Lead ("Pb").

Each NAAQS is expressed in terms of a concentration level and an associated averaging period. The current NAAQS for these criteria pollutants are summarized in Table 9.2-5. The NAAQS apply in all Project areas. Notes to Table 9.2-5 list the form of the statistic used to assess compliance with each NAAQS.

TABLE 9.2-5
National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Form
		(ppm)	(ug/m^3)	(ppm)	(µg/m^3)	
Respirable Particulate (PM_{10})	24-hour	---	150	---	150	Not to be exceeded more than once per year on average over 3 years
Fine Particulate ($PM_{2.5}$)	24-hour	---	35	---	35	98th percentile, averaged over 3 years
	Annual	---	12	---	15	Annual mean, averaged over 3 years
Nitrogen Dioxide (NO_2)	1-hour	0.100	188	---	---	98th percentile, averaged over 3 years
	Annual	0.053	100	0.053	100	Annual Mean
Sulfur Dioxide (SO_2)	1-hour	0.075	196	---	---	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	3-hour	---	---	0.5	1,300	Not to be exceeded more than once per year
Carbon Monoxide (CO)	8-hour	9	10,300	---	---	Not to be exceeded more than once per year
	1-hour	35	40,000	---	---	Not to be exceeded more than once per year

TABLE 9.2-5
National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Form
		(ppm)	(ug/m^3)	(ppm)	(µg/m^3)	
Ozone (O_3)	1-hour	0.12	236	0.12	236	Not to be exceeded more than once per year
	8-hour (2008)	0.075	147	0.075	147	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
	8-hour (1997)	0.08	157	0.08	157	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Lead (Pb)	3-month rolling	---	0.15	---	0.15	Not to be exceeded

ppm = parts per million
µg/m^3 = micrograms per cubic meter.
Source: http://www.epa.gov/air/criteria.html accessed 05/30/13

States may adopt standards that are more stringent than the NAAQS. The Louisiana Department of Environmental Quality ("LDEQ") has adopted the Louisiana Ambient Air Quality Standards ("LAAQS"), which are found Title 33, Part III, Chapter 7, Section 711 of the Louisiana Administrative Code ("LAC") and summarized in Table 9.2-6. Notes to Table 9.2-6 list the form of the statistic used to assess compliance with each LAAQS.

TABLE 9.2-6
Louisiana Ambient Air Quality Standards

Pollutant	Averaging Period	LAAQS	
		Primary	Secondary
PM_{10}	24-hour [2]	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual [1]	15.0 µg/m^3	15.0 µg/m^3
	24-hour	35 µg/m^3	35 µg/m^3
NO_2	Annual [1]	100 µg/m^3 (0.05 ppm)	100 µg/m^3 (0.05 ppm)
SO_2	Annual [1]	0.03 ppm (80 µg/m^3)	--
	24-hour [2]	365 µg/m^3 (0.14 ppm)	--
	3-hour [2]	--	1,300 µg/m^3 (0.5 ppm)
CO	8-hour [2]	10,000 µg/m^3 (9 ppm)	10,000 µg/m^3 (9 ppm)
	1-hour [2]	40,000 µg/m^3 (35 ppm)	40,000 µg/m^3 (35 ppm)
O_3	8-hour [3]	0.08 ppm	0.08 ppm
Pb	Calendar quarter [1]	1.5 µg/m^3	1.5 µg/m^3

Form of Statistic:
1. Arithmetic mean.
2. Not to be exceeded more than once per year.
3. Compliance based on 3-year average of the annual fourth highest daily maximum 8-hour average ozone concentration at a monitor.

ppm = parts per million by volume.
µg/m^3 = micrograms per cubic meter.
From Louisiana Administrative Code 33:III.711.A & B, compiled June 2013.

9.2.2.3 Existing Ambient Air Quality

Pollutant concentration data characteristic of air quality in the Project areas were obtained from the USEPA AIRDATA database. Ambient air quality monitoring data for 2010 through 2012 (except as noted) are summarized in Tables 9.2-7 and 9.2-8 for the monitors that are nearest or most representative of the SPLNG Terminal Trains 5 and 6 area and the Mamou Compressor Station area, respectively. For each pollutant and averaging period shown in Tables 9.2-7 and 9.2-8, the rank generally corresponds to the form of the statistic. In the case of Pb, three-month rolling average data are not available at nearby monitoring locations, and annual arithmetic mean data are reported.

While the concentrations in Tables 9.2-7 and 9.2-8 are the best available data, they are not necessarily representative of present actual air quality in the immediate vicinity of the each of the Project areas. Sabine Pass collected background data for NO_x in 2012 and may use data different than shown in Tables 9.2-7 and 9.2-8 for the LDEQ air permit application.

TABLE 9.2-7
Existing Ambient Air Quality Estimated for the SPLNG Terminal Area

Pollutant	Monitoring Station ID	Miles from SPLNG Terminal	Averaging Time	Years	Concentrations		Rank
					(ppm)	(µg/m^3)	
CO	48-245-1035	43	8-hour	2010-2012	0.567	649	Second high
			1-hour		0.824	944	Second high
Pb	48-201-1039	78	3-month rolling	2012	---	0.0026	Annual average
NO_2	48-245-1035	43	1-hour	2010-2012	0.029	54.5	98th percentile
			Annual		0.0119	22.5	Annual Mean
O_3	48-245-0101	24	8-hour	2010-2012	0.080	158	Fourth high
			1-hour		0.112	220	Second high
$PM_{2.5}$	22-019-0009	62	Annual	2011-2012	---	8.7	Annual mean
			24-hour		---	19.2	98th percentile
PM_{10}	48-167-0004	63	24-hour	2010-2012	---	46.5	Second high
SO_2	22-019-0008	37	1-hour	2010-2012	0.038	98.4	99th percentile
			3-hour		0.040	104.4	Second high
			24-hour		0.017	45.5	Second high

Monitoring Station Key
48-245-1035: 135 Hare Road, Nederland, TX
48-201-1039: 4514 1/2 Durant St, Deer Park, TX
48-245-0101: 5200 Mechanic, Port Arthur, TX
22-019-0009: 2284 Paul Bellow Road, Vinton, LA
48-167-0004: 2516 Texas Avenue, Texas City, TX
22-019-0008: 2646 John Stine Road, Westlake, LA

ppm = parts per million
µg/m^3 = micrograms per cubic meter.

TABLE 9.2-8
Existing Ambient Air Quality Estimated for the Mamou Compressor Station

Pollutant	Monitoring Station ID	Miles from Mamou CS	Averaging Time	Years	Concentrations		Rank
					(ppm)	($\mu g/m^3$)	
CO	22-033-0009	77	8-hour	2010-2012	1.867	2,138	Second high
			1-hour		2.187	2,504	Second high
Pb	22-033-0014	71	3-month rolling	2010-2012	---	0.0036	Annual average
NO_2	22-019-0008	59	1-hour	2010-2012	0.032	60.4	98th percentile
			Annual		0.0144	27.1	Annual Mean
O_3	22-055-0007	41	8-hour	2010-2012	0.072	142	Fourth high
			1-hour		0.085	167	Second high
$PM_{2.5}$	22-055-0007	41	Annual	2011-2012	---	11.8	Annual mean
			24-hour		---	20.6	98th percentile
PM_{10}	22-055-0007	41	24-hour	2010-2012	---	64.2	Second high
SO_2	22-019-0008	59	1-hour	2010-2012	0.038	98.4	99th percentile
			3-hour		0.040	104.4	Second high
			24-hour		0.017	45.5	Second high

Monitoring Station Key
22-033-0009: 1061-A Leesville Ave, Baton Rouge, LA
22-033-0014: 1400 West Irene Road, Zachary, LA
22-019-0008: 2646 John Stine Road, Westlake, LA
22-055-0007: 646 Cajundome, Lafayette, LA

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

9.2.2.4 Attainment Status

An air quality control region ("AQCR"), as defined in Section 107 of the Clean Air Act ("CAA"), is a federally-designated area in which NAAQS must be met. An implementation plan is developed for each AQCR describing how ambient air quality standards will be achieved and maintained.

USEPA designates the attainment status of an area on a pollutant-specific basis based on whether an area meets the NAAQS. Areas that meet the NAAQS are termed "attainment areas." Areas that do not meet the NAAQS are termed "nonattainment areas." Areas for which insufficient data are available to determine attainment status are termed "unclassifiable areas." Areas formerly designated as nonattainment areas that subsequently reached attainment are termed "maintenance areas."

The attainment status designations appear in Title 40 of the Code of Federal Regulations ("CFR") Part 81. The attainment status of the area in which a source is located, and the source's potential air emissions or

air emissions increases, determine the permitting process for that source. The Project is located in Allen, Beauregard, Calcasieu, Cameron, and Evangeline Parishes within the Southern Louisiana - Southeast Texas Interstate AQCR ("AQCR 106"). Table 9.2-9 summarizes the attainment status of these parishes in AQCR 106.

TABLE 9.2-9
Attainment Status of Project Area

Pollutant	Designation Date	Status / Designation	Comment
PM_{10}	11/15/1990	Unclassifiable	
24-hour $PM_{2.5}$	12/13/2009	Unclassifiable / Attainment	
Annual $PM_{2.5}$	04/05/2005	Unclassifiable / Attainment	
NO_2	NA	Cannot be classified or better than national standards	1
SO_2	NA	Better than national standards	1
CO	11/15/1990	Unclassifiable / Attainment	
1-hour O_3	10/18/2000	Attainment	2
8-hour O_3	06/15/2004	Unclassifiable / Attainment	
Pb	01/06/1992	Not Designated	

Comments
1. No designation date.
2. The 1-hour ozone standard was revoked effective June 15, 2005 for all areas in Louisiana. Beauregard Parish is a maintenance area for the 1-hour NAAQS for the purposes of 40 CFR 51 Subpart X (Provisions for Implementation of 8-hour Ozone NAAQS).

9.2.3 Air Quality Permitting Requirements

LDEQ is the lead air permitting agency for the Project. LDEQ's air permitting requirements are codified in LAC Title 33, Part III. Facilities can trigger additional review by the USEPA if emissions of one or more regulated air pollutant exceed the applicable Prevention of Significant Deterioration ("PSD") or Nonattainment New Source Review ("NNSR") major source thresholds. PSD applies to a major source located in an attainment area, and NNSR applies to a major source located in a nonattainment area. A facility can undergo both types of review, depending on the potential emissions of each pollutant and the air quality attainment status.

A 40 CFR Part 70 operating permit program (known as "Title V") consolidates all applicable air quality requirements for a facility into a single document.

9.2.3.1 Prevention of Significant Deterioration

PSD regulations apply to new major stationary sources and major modifications. A major stationary source is a source that emits or has the potential to emit over 250 tons per year ("tpy") (or 100 tpy if the

source belongs to one of the 28 listed source categories) of at least one criteria pollutant. Neither LNG terminals nor natural gas compressor stations are one of the 28 listed categories. Therefore, the 250 tpy major source threshold applies to the SPLNG Terminal and the Mamou Compressor Station. A new source is also subject to PSD if its potential or actual greenhouse gas ("GHG") emissions equal or exceed 100,000 tpy on a carbon dioxide equivalent ("CO_2e") basis, and the applicable major source threshold on a mass-basis. GHGs include carbon dioxide ("CO_2"), methane ("CH_4"), nitrous oxide ("N_2O"), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

A major modification is a physical change or a change in the method of operation of a major stationary source that would result in a significant emissions increase of a regulated New Source Review ("NSR") pollutant and a significant net emissions increase of that pollutant from the major stationary source. An emission increase is considered significant for a regulated pollutant if it exceeds the applicable Significant Emission Rate ("SER"). For a new source, if the potential emissions of any regulated pollutant exceed the applicable major source threshold, any other pollutant whose potential emissions exceed its SER threshold is also subject to PSD review.

SPLNG Terminal

Table 9.2-10 summarizes the potential emissions from the existing SPLNG Terminal, nitrogen oxides ("NO_x") emissions increase from Trains 1 through 4 equipment (i.e., refrigeration compressor combustion turbines and flares), and potential emissions increase from the Trains 5 and 6. It also summarizes the applicable PSD, SER, and Title V major source thresholds. The existing SPLNG Terminal is a PSD major source for NO_x, CO, PM_{10}, $PM_{2.5}$, and GHG. The NO_x, CO, VOC, PM_{10}, $PM_{2.5}$, and GHG emissions increases due to the addition of Trains 5 and 6, and other modifications to the SPLNG Terminal exceed the applicable SER threshold, and therefore are also subject to PSD review. Note that the SPLNG Terminal has no existing or planned Pb emissions sources.

TABLE 9.2-10
SPLNG Terminal Potential Emissions and PSD and Title V Thresholds

Source	Potential Emissions (tpy)									
	NO_x	CO	VOC[1]	PM_{10}	$PM_{2.5}$	SO_2	Total HAPS	Single HAP	GHG as CO_2e	GHG Mass Basis
Existing SPLNG Terminal Potential Emissions	3,302.79	5,487.91	119.8	254.18	254.13	17.29	39.82	26	5,734,190	--
Existing Trains 1-4 Emissions Increases[3]	666.86	548.72	94.84	0.2	0.2	0.7	1.08	0.7	139,634	--
SPLNG Terminal Trains 5 and 6 Potential Emissions	1,820.83	2,800.6	90.4	117.8	117.8	6.20	19.14	13.17	2,543,099	--
Estimated Total	5,790.5	8,837.2	305.0	372.2	372.2	24.2	60.0	39.9	8,416,923	--

TABLE 9.2-10
SPLNG Terminal Potential Emissions and PSD and Title V Thresholds

Source	Potential Emissions (tpy)									
	NO_x	CO	VOC[1]	PM_{10}	$PM_{2.5}$	SO_2	Total HAPS	Single HAP	GHG as CO_2e	GHG Mass Basis
PSD Major Source Threshold	250	250	250	250	250	250	NA	NA	100,000	250
PSD SER Threshold	40	100	40	15	10[4]	40	NA	NA	75,000	NA
Title V Major Source Threshold	100	100	100	100	100	100	25	10	100,000	100

1 Volatile organic compounds
2 Includes fugitive emissions from tanks, valves, pumps, flanges, etc. Fugitive emissions are not counted for PSD applicability because LNG terminals are not one of 28 named source categories, but are counted for Title V applicability.
3 Includes NO_X emissions increase related to increasing limit from 20 to 25 ppm on existing Trains 1-4 turbines. Also includes flaring emissions from continuous purges and flaring during periodic maintenance, start-up/shutdown, and turnaround activities related to Trains 1 through 4.
4 Also, 40 tpy SO_2, or 40 tpy NO_x (unless demonstrated not to be a $PM_{2.5}$ precursor)

The PSD air permit application submitted to the LDEQ will include the following:

- A control technology analysis to show that the SPLNG Terminal Trains 5 and 6 will employ Best Available Control Technology ("BACT") for NO_x, CO, VOC, GHG, PM_{10}, and $PM_{2.5}$ emissions.
- An air quality analysis showing that proposed emissions will not significantly cause or contribute to a violation of any NAAQS or PSD increment.
- An additional impacts analysis that assesses the impacts of air, ground and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source or modification under review, and from associated growth.

Mamou Compressor Station

PSD review also considers the potential impacts on Class I areas located within 300 kilometers of a proposed major source or major modification. The closest Class I area to the Mamou Compressor Station is the Breton National Wildlife Refuge, located approximately 450 kilometers from the SPLNG Terminal. Therefore, an analysis of Class I area impacts is not necessary.

Table 9.2-11 summarizes the potential emissions from the Mamou Compressor Station, along with the applicable PSD thresholds. The Mamou Compressor Station's potential GHG emissions exceed 250 tpy on a mass basis and 100,000 tpy on a CO_2e basis, and the CO emissions exceed 250 tpy. Therefore, the Mamou Compressor Station is a PSD major source for CO and GHGs. Note that the Mamou Compressor Station has no Pb emissions.

TABLE 9.2-11
Mamou Compressor Station Potential Emissions and PSD and Title V Thresholds

Source	Potential Emissions (tpy)									
	NO_x	CO	VOC[1,2]	PM_{10}	$PM_{2.5}$	SO_2	Total HAPS	Single HAP	GHG as CO_2e	GHG Mass Basis
Total Facility Emissions	170.5	251.9	17.69	35.10	35.10	22.9	6.95	5.24	199,984	197,000
PSD Major Source Threshold	250	250	250	250	250	250	NA	NA	100,000	250
PSD SER Threshold	40	100	40	15	10[3]	40	NA	NA	75,000	NA
Title V Major Source Threshold	100	100	100	100	100	100	25	10	100,000	100

1. Volatile organic compounds
2. Includes fugitive emissions from tanks, valves, pumps, flanges, etc. Fugitive emissions are not counted for PSD applicability because compressor stations are not one of 28 named source categories, but are counted for Title V applicability. Also includes MSS and Louisiana GCXVII activities.
3. Also, 40 tpy SO_2, or 40 tpy NO_x (unless demonstrated not to be a $PM_{2.5}$ precursor)

The PSD air permit application submitted to the LDEQ will include:

- The control technology analysis to show that the Mamou Compressor Station will employ BACT for NO_x, CO, $PM_{10,}$ $PM_{2.5}$, and GHG emissions.
- Air Quality Analysis showing that proposed emissions will not cause or contribute to a violation of any NAAQS or PSD increment.
- Additional impacts analysis that assesses the impacts of air, ground and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source or modification under review, and from associated growth.

PSD review also considers the potential impacts on Class I areas located within 300 kilometers of a proposed major source or major modification. The closest Class I area to the Mamou Compressor Station is the Breton National Wildlife Refuge, located approximately 340 kilometers from the proposed Mamou Compressor Station site. Therefore an analysis of Class I area impacts is not necessary.

9.2.3.2 Nonattainment New Source Review

Since the Project is not located in a nonattainment area for any regulated pollutants, NNSR does not apply.

9.2.3.3 Title V Operating Permit

Title V requires that a major stationary source of air emissions apply for an operating permit within one year of its initial operation. The USEPA has delegated the authority to issue the Title V permits to the

LDEQ in accordance with LAC 33.III.507. A Title V permit is required if a source has potential or actual emissions equal to or exceeding 100 tpy for any criteria pollutant, 10 tpy for a single hazardous air pollutant ("HAP"), or 25 tpy for total HAPs. Additionally, stationary sources that have potential or actual GHG emissions equal to or greater than 100,000 tpy CO_2e will be subject to Title V permitting.

SPLNG Terminal

Table 9.2-10 summarizes the potential emissions from the existing SPLNG Terminal, potential emissions resulting from proposed operating modifications at the existing SPLNG Terminal, and SPLNG Terminal Trains 5 and 6, along with the applicable Title V thresholds. The SPLNG Terminal is a Title V major source. The PSD permit application will serve as the permit application to modify the current Title V Operating permit**.**

Mamou Compressor Station

Table 9.2-11 summarizes the potential emissions from the Mamou Compressor Station, along with the applicable Title V thresholds, and shows that a Title V operating permit will be required. The Mamou Compressor Station will be a Title V major source. The PSD permit application will serve as the permit application to obtain the initial Title V Operating permit**.**

9.2.3.4 New Source Performance Standards

SPLNG Terminal

The following NSPS requirements have been identified as potentially applicable to the specified sources at the SPLNG Terminal:

40 CFR 60 Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels for Which Construction, Reconstruction, or Modification Commenced after July 23, 1984
Subpart Kb lists applies to storage vessels with a capacity greater than or equal to 75 cubic meters ("m^3") that is used to store VOCs. Construction of SPLNG Terminal Trains 5 and 6 will not involve any additional storage vessels with a capacity greater than 75 m^3. Therefore, Subpart Kb does not apply.

40 CFR 60 Subpart GG - Standards of Performance for Stationary Gas Turbines
Subpart GG applies to all stationary gas turbines with a heat input at peak load equal or greater than 10.7 gigajoules per hour ("GJ/hr") (10 MMBtu/hr) which commence construction, modification, or reconstruction after October 3, 1997. Therefore, Subpart GG could potentially be applicable. However, 40 CFR §60.4305(b) states that stationary gas turbines regulated under Subpart KKKK are exempt from the requirements of Subpart GG. The combustion turbines associated with SPLNG Terminal Trains 5 and 6 are subject to Subpart KKKK (discussed below) and are therefore exempt from regulation under Subpart GG.

40 CFR 60 Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

Subpart IIII applies to owners and operators of certain stationary compression ignition ("CI") internal combustion engines ("ICE"). The SPLNG Terminal Trains 5 and 6 will include two standby generator diesel engines. The standby generator diesel engines will be subject to Subpart IIII and must meet the applicable emission standards in effect for the model year and type of engine installed. Sabine Pass will comply with the emission and monitoring limitations of Subpart IIII by installing manufacturer-certified engines and maintaining those engines according to the manufacturer's specifications. Additionally, Subpart IIII limits operation of emergency stationary ICE for the purpose of maintenance checks and readiness testing to 100 hours per year unless operation beyond 100 hours per year is required by other federal, state, or local standards.

40 CFR 60 Subpart KKKK, Standards of Performance for Stationary Combustion Turbines

Subpart KKKK applies to owners and operators of stationary combustion turbines with a heat input at peak load equal to or greater than 10.7 GJ/hr (10 MMBtu/hr) per hour which commence construction, modification, or reconstruction after February 18, 2005. The 12 refrigeration compressor combustion turbines and the two natural gas-fired generator combustion turbines associated with SPLNG Terminal Trains 5 and 6 will be subject to the regulations of Subpart KKKK. Subpart KKKK regulates emissions of NO_x and SO_2.

A new combustion turbine with heat input at peak load greater than 50 MMBtu/hr and less than or equal to 850 MMBtu/hr must satisfy a NO_x emission rate limit of 25 parts per million by volume corrected to 15% oxygen at dry conditions (ppmvd @ 15% O_2). Based on the size of the combustion turbines, NO_x emissions must be maintained at less than or equal to 25 ppmvd @ 15% O_2. Compliance with the NO_x emission rate will be demonstrated by a continuous monitoring system.

Additionally, Subpart KKKK requires that the combustion turbines not burn any fuel which contains total potential sulfur emissions of greater than 0.060 pound per million British thermal units ("lb/MMBtu") of SO_2. The combustion turbines will only combust pipeline quality natural gas which meets the requirements of Subpart KKKK.

Mamou Compressor Station

40 CFR 60 Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels for Which construction, Reconstruction, or Modification Commenced after July 23, 1984

Subpart Kb applies to storage vessels with a capacity greater than or equal to 75 m^3 used to store volatile organic liquids for which construction, reconstruction, or modification is commenced after July 23, 1984. The condensate tank is exempt from this subpart because the storage capacity is only 15.9 m^3.

40 CFR 60 Subpart GG - Standards of Performance for Stationary Gas Turbines

Subpart GG applies to stationary gas turbines with a heat input at peak load equal or greater than 10.7 GJ/hr (10 MMBtu/hr) which commences construction, modification, or reconstruction after October 3, 1997. Stationary gas turbines regulated under 40 CFR 60 Subpart KKKK are exempt from the

requirements of Subpart GG. The Mamou Compressor Station's combustion turbines are subject to Subpart KKKK (discussed below) and are therefore exempt from regulation under Subpart GG.

40 CFR 60 Subpart JJJJ - Standards of Performance for Stationary Spark Ignition ("SI") Internal Combustion Engines ("ICE")

Subpart JJJJ applies to owners and operators of certain SI ICE. The Mamou Compressor Station will include two standby natural gas-fueled SI ICE generators. The standby natural gas-fueled SI ICE generators will be subject to Subpart JJJJ and must meet the applicable emission standards for the model year and type of engine installed. Sabine Pass must also comply with the monitoring requirements of 40 CFR 60.4237 and compliance requirements of 40 CFR 60.4243(d). Sabine Pass will comply with emission ring limitations of Subpart JJJJ by installing manufacturer-certified engines and maintaining those engines according to the manufacturer's specifications. Additionally, Subpart JJJJ limits operation of emergency stationary SI ICE for the purpose of maintenance checks and readiness testing to 100 hours per year unless operation beyond 100 hours per year is required by other federal, state, or local standards.

40 CFR 60 Subpart KKKK - Standards of Performance for Stationary Combustion Turbines

Subpart KKKK applies to owners and operators of stationary combustion turbines with a heat input at peak load equal to or greater than 10.7 GJ/hr which commenced construction, modification, or reconstruction after February 18, 2005. A new combustion turbine with heat input at peak load greater than 50 MMBtu/hr and less than or equal to 850 MMBtu/hr must satisfy a NO_x emission rate limit of 25 ppmvd @ 15% O_2. The Mamou Compressor Station's combustion turbines will meet this limit.

Subpart KKKK requires that the combustion turbines burn fuel which contains total potential sulfur emissions less than or equal to 0.060 lb of SO_2 per MMBtu of heat input. The Mamou Compressor Station's combustion turbines will only combust pipeline quality natural gas which meets this limit.

9.2.3.5 National Emission Standards for Hazardous Air Pollutants

National Emission Standards for Hazardous Air Pollutants ("NESHAP") are set by the USEPA and contained in 40 CFR Parts 61 and 63. NESHAP establish technology-based Maximum Achievable Control Technology ("MACT") emissions standards for specified source categories. Sources with potential emissions equal to or greater than 10 tpy of any single HAP or 25 tpy total HAPs are major HAP sources. Sources with potential emissions less than the major source thresholds are area sources of HAPs. NESHAP requirements are incorporated by reference in LAC 33:III.5116 and 33:III.5122.

SPLNG Terminal

The SPLNG Terminal is a major source of HAPs. Four NESHAPs are potentially applicable to the SPLNG Terminal.

40 CFR 63 Subpart Y - National Emission Standards for Marine Tank Vessel Loading Operations

Subpart Y applies to marine vessel loading operations at facilities that are major sources of HAPs. This regulation is potentially applicable to the SPLNG Terminal. However, this subpart does not apply to

emissions resulting from marine tank vessel loading operations of commodities with vapor pressures less than 10.3 kilopascals (1.5 pounds per square inch absolute ("psia")) at standard conditions (40 CFR §63.560(d)(1)), therefore, Subpart Y does not apply to SPLNG Terminal Trains 5 and 6.

40 CFR 63 Subpart EEEE – National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline)

Subpart EEEE applies to organic liquids distribution facilities that are major sources of HAPs. This subpart is applicable to the existing condensate liquid storage tanks, truck loading operations, pipelines and components that are in service of the condensate liquid. SPLNG Terminal complies with the emission limits, operating limits and work practice standards of the subpart for the liquid storage tanks and truck loading operations.

40 CFR 63 Subpart YYYY - National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines

Subpart YYYY applies to owners and operators of certain stationary combustion turbines located at a major source of HAP emissions. The SPLNG Terminal is a major source of HAPs. However, 40 CFR 63.6095(d) stays the standards for new or reconstructed stationary lean premix gas-fired combustion turbines (such as the SPLNG Terminal LM 2500 turbines) and diffusion flame gas-fired stationary combustion. Sabine Pass will comply with the initial notification requirements, but need not comply with any other requirement of Subpart YYYY until USEPA takes final action to require compliance and publishes a document in the Federal Register.

40 CFR 63 Subpart ZZZZ - National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines ("RICE")

Subpart ZZZZ applies to RICE located at major and area sources of HAP. The two standby generator diesel engines would potentially be subject to this Subpart. However, these engines qualify as new stationary RICE with a rating of more than 500 hp subject to 40 CFR 60 Subpart IIII. Per 40 CFR 63.6590(c)(7), since these engines will be subject to the requirements of 40 CFR 60 Subpart IIII, they are not subject to any additional standards under 40 CFR 63 Subpart ZZZZ.

Mamou Compressor Station

The Mamou Compressor Station is an area source of HAPs. NESHAP requirements are incorporated by reference in LAC 33:III.5116 and 33:III.5122. Three NESHAPs are potentially applicable to the Mamou Compressor Station.

40 CFR 63 Subpart HHH, NESHAP from Natural Gas Transmission and Storage Facilities

Subpart HHH applies to owners and operators of natural gas transmission facilities that are a major source of HAPs. The Mamou compressor station will not be a major source of HAP emissions. Therefore, none of the requirements of Subpart HHH apply to the Mamou Compressor Station.

40 CFR 63 Subpart YYYY - National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines

Subpart YYYY applies to owners and operators of certain stationary combustion turbines located at major sources of HAP emissions. The Mamou Compressor Station will not be a major source of HAPs, and not subject to this subpart.

40 CFR 63 Subpart ZZZZ - National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

Subpart ZZZZ applies to RICE located at major and area sources of HAP. The two standby generator engines would potentially be subject to this Subpart, however, these engines qualify as new stationary RICE with a rating of more than 500 hp subject to 40 CFR 60 Subpart JJJJ. Per 40 CFR 63.6590(c)(7), since these engines will be subject to the requirements of 40 CFR 60 Subpart JJJJ, the proposed engines are not subject to any additional standards under 40 CFR 63 Subpart ZZZZ.

9.2.3.6 Greenhouse Gas Reporting

Federal GHG reporting requirements are codified at 40 CFR Part 98. Subpart W of 40 CFR Part 98 requires petroleum and natural gas facilities with annual GHG emissions equal to or greater than 25,000 metric tons of CO_2e to report GHG from various processes within the facility. Sabine Pass will report the SPLNG Terminal's and the Mamou Compressor Station's GHG emissions as required.

9.2.3.7 Chemical Accident Prevention Provisions

40 CFR Part 68 is a federal regulation designed to prevent the accidental release of hazardous substances and minimize the impacts if releases occur. The regulation contains a list of substances and threshold quantities. If a facility stores, handles, or processes a listed substance in an amount equal to or greater than its threshold quantity, the facility must prepare and submit a risk management plan ("RMP"). If a facility does not have a listed substance onsite, or the quantity of a listed substance is below the applicability threshold, the facility is not required to prepare an RMP. However, it must still comply with requirements of the general duty clause if it has any regulated substance or other extremely hazardous substance onsite. The general duty clause is as follows:

> "The owners and operators of stationary sources producing, processing, handling and storing such substances have a general duty … to identify hazards which may result from such releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur."

Regulations for the Louisiana RMP program are codified in LAC 33:III.5901.

SPLNG Terminal

Methane, ethylene, and propane will be stored or handled in quantities greater than the applicability threshold. These constituents are used as refrigerants in the process for liquefying the natural gas. The SPLNG Terminal and its use of these refrigerants are regulated under 49 CFR Part 193, 33 CFR Part 127 and National Fire Protection Association ("NFPA") 59A. These regulations effectively duplicate the requirements in 40 CFR Part 68, including hazard analysis, equipment spacing, siting requirements, training, spill and leak control, and implementation of emergency response plans. No other regulated substances would be handled or stored in quantities greater than the applicability threshold.

A liquefied natural gas pipeline facility (i.e., a gas pipeline facility used for transporting or storing LNG, or for LNG conversion, in interstate or foreign commerce) is not required to have a risk management plan if it is regulated by the U.S. Department of Transportation ("USDOT") or an equivalent state natural gas program certified by USDOT in accordance with Title 49 of the United States Code ("49 U.S.C.") Section 60105 or is subject to 49 CFR Part 193.

The Sabine Pass LNG Terminal is regulated under 49 CFR Part 193, and is not required to have a RMP under 40 CFR Part 98. It will meet the general duty provision of 40 CFR Part 98 by complying with USDOT regulations under 49 CFR Part 193, 33 CFR Part 127, and NFPA 59A.

CCTPL Pipeline Expansion

With the exception of natural gas constituents, no regulated substance would be handled or stored in quantities greater than the applicable threshold quantity. Furthermore, a natural gas pipeline is not required to have an RMP if it is regulated by the USDOT or an equivalent state natural gas program certified by USDOT in accordance with 49 U.S.C. Section 60105. The CCTPL pipeline expansion is regulated by the USDOT Pipeline and Hazardous Materials Safety Administration ("PHMSA"). Consequently, an RMP is not required. CCTPL will comply with the general duty clause as it pertains to the CCTPL pipeline expansion.

Mamou Compressor Station

With the exception of natural gas constituents, no regulated substance would be handled or stored in quantities greater than the applicable threshold quantity. A gas pipeline facility (including a pipeline, right-of-way, facility, building, or equipment used in transporting gas or treating gas during its transportation) is not required to have an RMP if it is regulated by the USDOT or an equivalent state natural gas program certified by USDOT in accordance with 49 U.S.C. Section 60105. The Mamou Compressor Station is regulated by the USDOT PHMSA. Consequently, an RMP is not required. CCTPL will comply with the general duty clause as it pertains to the Mamou Compressor Station.

9.2.3.8 General Conformity

Section 176(c) of the CAA prohibits federal agencies from taking actions in nonattainment or maintenance areas which do not conform to the State Implementation Plan ("SIP") for the attainment and

maintenance of the NAAQS. The purposes of conformity are to (1) ensure federal activities do not interfere with the budgets in the SIPs, (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the NAAQS. General Conformity applies only in areas that are designated as NAAQS nonattainment areas or maintenance areas. A conformity review is required only for those pollutants designated as nonattainment or maintenance pollutants. General conformity analysis must consider both direct and indirect emissions. Direct emissions are those that occur as a direct result of the action, and occur at the same time and place as the action. Indirect emissions are those that occur at a later time or distance from the place where the action takes place, but may be reasonably anticipated as a consequence of the proposed action.

Some emissions are excluded from conformity determination, such as those already subject to federal nonattainment new source review, those covered by Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") or compliance with other environmental laws, actions not reasonable foreseeable, and those for which the Agency has no continuing program responsibility.

SPLNG Terminal

SPLNG Terminal Trains 5 and 6 will be located in Cameron Parish, which is an attainment area or the equivalent for all criteria pollutants. Barges transporting construction materials and equipment to the site may emit NO_x and VOC as they travel through the Houston-Galveston-Brazoria or Beaumont-Port Arthur, ozone nonattainment areas. However, these emission will be less than the *de minimis* rates specified in 40 CFR 89.153(b)(1). Consequently, General Conformity does not apply to construction of SPLNG Terminal Trains 5 and 6.

CCTPL Pipeline Expansion

The CCTPL pipeline expansion will be located in Allen, Beauregard, Calcasieu, Cameron, and Evangeline Parishes. With the exception of Beauregard Parish, which is a maintenance area for the 1-hour NAAQS for the purposes of 40 CFR 51 Subpart X (Provisions for Implementation of 8-hour Ozone NAAQS), all of these Parishes are maintenance areas or the equivalent for all criteria pollutants. The NO_x and VOC emission that occur in Beauregard Parish due to the CCTPL pipeline expansion are well below the *de minimis* rate of 100 tpy specified in 40 CFR 89.153(b)(2). Consequently, General Conformity does not apply to construction of the CCTPL pipeline expansion.

Mamou Compressor Station

The Mamou Compressor Station will be located in Evangeline Parish, which is an attainment area or the equivalent for all criteria pollutants. Consequently, General Conformity does not apply to construction of the Mamou Compressor Station.

9.2.3.9 Louisiana Air Quality Regulations

SPLNG Terminal

LAC 33:III Chapter 9 - General Regulations

This section contains general requirements applicable to SPLNG Terminal. Sabine Pass will submit an air emissions inventory as required by LAC 33:III.919. Unauthorized discharges will be reported in accordance with LAC 33:III.927 and LAC 33:I Chapter 39.

LAC 33:III Chapter 11 - Control of Air Pollution from Smoke

Chapter 11 establishes opacity limits for combustion units and prohibits open burning and the impairment of visibility on public roads (LAC 33:III.1103). Sabine Pass will comply with the provisions for impairment of visibility on public roads. However, per LAC 33:III.1107, combustion units that combust only natural gas are not subject to the opacity standards of LAC:III.1101. With the exception of two diesel-fueled emergency generators, all combustion sources at SPLNG Terminal Trains 5 and 6 will combust natural gas only and are therefore not subject to the opacity standard. The emergency generators will operate infrequently, and will not emit smoke which passes onto or across a public road and creates or intensifies a traffic hazard by impairment of visibility.

LAC 33:III Chapter 13 - Emission Standards for Particulate Matter

Chapter 13 applies to any operation, process, or activity from which PM is emitted, and requires that all reasonable precautions be taken to minimize PM emissions from fugitive sources. Additionally, fuel burning equipment is limited to 0.6 lb/MMBtu of PM emissions. Sabine Pass will comply with these requirements.

LAC 33:III Chapter 15 - Emission Standards for Sulfur Dioxide

Chapter 15 pertains to new or existing sulfuric acid production plants, new or existing sulfur recovery plants, and all other single point sources that emit or have the potential SO_2 emission equal to or greater than 5 tpy. SPLNG does not operate a sulfur recovery plant and all other single point sources are less than 5 tpy each. Therefore, SPLNG is not subject to Chapter 15.

LAC 33:III.2103 - Storage of Volatile Organic Compounds

The existing condensate tanks are exempt from the requirements of this section because it has a storage capacity less than 420,000 gallons and stores only condensate (LAC 33:III.2103.G.1).

LAC 33:III.2104 - Crude Oil and Condensate

The SPLNG Terminal is exempt from the requirements of this section because it is a natural gas transmission facility and its potential flash gas emissions are less than 100 tpy.

LAC 33:III.2107 - Volatile Organic Compounds - Loading

The SPLNG Terminal is exempt from the requirements of this section because loading operations will involve condensate only. (LAC 33:III.2107.F).

LAC 33:III.2111 - Pumps and Compressors

This section requires that pumps and compressors handling VOCs with a true vapor pressure greater than 1.5 psia at handling conditions to be equipped with mechanical seals or other equivalent equipment approved by the administrative authority. Sabine Pass will comply with this regulation as it applies to pumps and compressors at the SPLNG Terminal.

LAC 33:III.2113 - Housekeeping

Best practices housekeeping and maintenance procedures will be followed to minimize the quantity of organic compound emissions.

LAC 33:III Chapter 29 - Odor Regulations

Sabine Pass will operate the SPLNG Terminal such that off-site odors do not cause a nuisance.

LAC 33:III Chapter 51 - Comprehensive Toxic Air Pollutant ("TAP") Emission Control Program

This Chapter 51 applies to major sources of TAPs. The condensate tanks and truck loading operations are subject to 40 CFR 63 Subpart EEEE (see Section 9.2.3.5). Per LAC 33:III.5101.D, this chapter does not apply to the condensate tanks and truck loading operations as they are subject to a MACT standard. The other components and emissions at the SPLNG Terminal are subject to the chapter. SPLNG Terminal will comply with the required emission and operation limits, and will submit the required reports.

CCTPL Pipeline Expansion

LAC 33:III Chapter 9 - General Regulations

This section contains general requirements applicable to the CCTPL pipeline expansion. Unauthorized discharges will be reported in accordance with LAC 33:III.927 and LAC 33:I Chapter 39.

LAC 33:III.2113 - Housekeeping

Best practices housekeeping and maintenance procedures will be followed to minimize the quantity of organic compound emissions.

LAC 33:III.2121 - Fugitive Emission Control

The Mamou Compressor Station is not one of the affected industries listed in LAC 33:III.2121.A. Therefore, this regulation does not apply.

LAC 33:III Chapter 29 - Odor Regulations

Sabine Pass will operate the Mamou Compressor Station such that off-site odors do not cause a nuisance.

Mamou Compressor Station

LAC 33:III Chapter 9 - General Regulations

This section contains general requirements applicable to the Mamou Compressor Station. CCTPL will submit an air emissions inventory as required by LAC 33:III.919. Unauthorized discharges will be reported in accordance with LAC 33:III.927 and LAC 33:I Chapter 39.

LAC 33:III Chapter 11 - Control of Air Pollution from Smoke

Chapter 11 establishes opacity limits for combustion units and prohibits open burning and the impairment of visibility on public roads (LAC 33:III.1103). CCTPL will comply with the provisions for impairment of visibility on public roads. However, per LAC 33:III.1107, combustion units that combust only natural gas are not subject to the opacity standards of LAC:III.1101. All combustion sources at the Mamou Compressor Station will combust natural gas only and are therefore not subject to the opacity standard.

LAC 33:III Chapter 13 - Emission Standards for Particulate Matter

Chapter 13 applies to any operation, process, or activity from which PM is emitted, and requires that all reasonable precautions be taken to minimize PM emissions from fugitive sources. Additionally, fuel burning equipment is limited to 0.6 lb/MMBtu of PM emissions. CCTPL will comply with these requirements.

LAC 33:III Chapter 15 - Emission Standards for Sulfur Dioxide

Chapter 15 pertains to new or existing sulfuric acid production plants, new or existing sulfur recovery plants, and all other single point sources that emit or have the potential SO_2 emission equal to or greater than 5 tpy. With the exception of Turbine D, the potential SO_2 emissions of all the Mamou Compressor Station's sources are less than 5 tpy each. Turbine D is required to meet an SO_2 emissions limitation of 2,000 ppm, or any applicable NESHAP or NSPS that is more stringent. Various methods are listed to demonstrate compliance. Turbine D will satisfy the more stringent SO_2 emission limitation of 40 CFR 60 Subpart KKKK (discussed in Section 9.2.2.4).

LAC 33:III.2103 - Storage of Volatile Organic Compounds

The Mamou Compressor Station's condensate tank is exempt from the requirements of this section because it has a storage capacity less than 420,000 gallons and stores only condensate (LAC 33:III.2103.G.1).

LAC 33:III.2104 - Crude Oil and Condensate

The Mamou Compressor Station is exempt from the requirements of this section because it is a natural gas transmission facility and its potential flash gas emissions are less than 100 tpy.

LAC 33:III.2107 - Volatile Organic Compounds - Loading

The Mamou Compressor Station is exempt from the requirements of this section because its loading operations will involve condensate only. (LAC 33:III.2107.F)

LAC 33:III.2111 - Pumps and Compressors

This section requires that pumps and compressors handling VOCs with a true vapor pressure greater than 1.5 psia at handling conditions to be equipped with mechanical seals or other equivalent equipment approved by the administrative authority. CCTPL will comply with this regulation as it applies to pumps and compressors at the Mamou Compressor Station.

LAC 33:III.2113 - Housekeeping

Best practices housekeeping and maintenance procedures will be followed to minimize the quantity of organic compound emissions.

LAC 33:III.2121 - Fugitive Emission Control

The Mamou Compressor Station is not one of the affected industries listed in LAC 33:III.2121.A. Therefore, this regulation does not apply.

LAC 33:III Chapter 29 - Odor Regulations

CCTPL will operate the Mamou Compressor Station such that off-site odors do not cause a nuisance.

LAC 33:III Chapter 51 - Comprehensive Toxic Air Pollutant Emission Control Program

Chapter 51 does not apply to the Mamou Compressor Station because it is not a major source of TAP emissions.

9.2.4 Air Quality Impacts

9.2.4.1 Construction

Air quality impacts associated with construction of the Project will include engine emissions from construction equipment, engine emissions from workers commuting to the construction site, engine emissions from vehicles delivering and removing materials, and fugitive dust generated by construction activities or resulting from wind erosion of disturbed areas. In addition, emissions will result from open burning in certain upland forest areas during construction of the CCTPL pipeline expansion. Detailed emission calculations are provided in Appendix 9A.

Emission estimates for construction equipment engines are based on the equipment that is expected to be used (number, type, capacity, and level of activity).

Emission factors in grams per horsepower hour ("g/hp-hr") for NO_x, CO, PM, SO_2, VOC[1], and CO_2 for nonroad equipment engines were obtained using the most recent version of the USEPA's NONROAD model (NONROAD2008a). NONROAD was run to obtain annual average emission factors for 2015 through 2019. Emission factors in grams per gallon of fuel for CH_4 and N_2O were obtained from the "2013 Climate Registry Default Emission Factors", and apportioned based on CO_2 emissions.

Emissions factors in grams per vehicle mile traveled ("g/VMT") for on-road vehicles were obtained from the USEPA Mobile Vehicle Emissions Simulator ("MOVES") version MOVES2010b. Emission factors were obtained for NO_x, CO, PM_{10}, $PM_{2.5}$[2], SO_2, VOC, and CO_2, and CO_2e for road types in Louisiana for 2015 through 2019.

[1] NONROAD does not provide emissions factors for VOC. The emission factor for total hydrocarbons is used as a conservative estimate of VOC.
[2] $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions.

Fugitive dust emissions were estimated using the methodology described in Section 3.4 of the Western Regional Air Partnership ("WRAP") Fugitive Dust Handbook[3]. Use of this methodology is conservative, as the climates typical of many Western states are more arid than in the Project area.

SPLNG Terminal

Table 9.2-12 summarizes the construction emissions for Trains 5 and 6. Emissions from construction are not expected to cause, or significantly contribute, to a violation of any applicable ambient air quality standard. The emissions will be limited to the immediate vicinity of the SPLNG Terminal area and will be short-term.

TABLE 9.2-12
SPLNG Terminal Trains 5 and 6 Estimated Construction Emissions (tons)

Source	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
2015										
Non-Road Engines	18.82	42.69	0.10	4.06	2.84	2.84	10,955	0.64	0.28	11,159
On-Road Vehicle Engines	3.62	1.87	0.01	0.20	0.06	0.06	802	----	----	803
Barge Tugs	8.24	43.04	4.35	0.90	1.02	1.02	2,308	0.07	0.30	2,335
Fugitive Dust	----	----	----	----	104.21	10.42	----	----	----	----
2015 Total	30.68	87.60	4.46	5.16	108.13	14.34	14,065	0.71	0.58	14,297
2016										
Non-Road Engines	163.12	67.58	0.18	9.69	4.86	4.86	15,709	0.93	0.40	16,005
On-Road Vehicle Engines	13.63	7.02	0.04	0.74	0.24	0.23	3,278	----	----	3,282
Barge Tugs	19.25	100.50	10.15	2.11	2.38	2.38	5,389	0.16	0.70	5,452
Fugitive Dust	----	----	----	----	104.21	10.42	----	----	----	----
2016 Total	196.00	175.10	10.37	12.54	111.69	17.89	24,376	1.08	1.10	24,739
2017										
Non-Road Engines	301.59	93.84	0.20	14.88	6.71	6.71	20,289	1.18	0.52	20,666
On-Road Vehicle Engines	14.02	8.65	0.04	0.84	0.31	0.30	3,949	----	----	3,954
Barge Tugs	0.50	2.63	0.27	0.06	0.06	0.06	142	0.004	0.02	143
Fugitive Dust	----	----	----	----	104.21	10.42	----	----	----	----
2017 Total	316.11	105.12	0.51	15.77	111.30	17.50	24,379	1.19	0.53	24,763
2018										
Non-Road Engines	296.15	84.23	0.16	14.29	6.29	6.29	19,677	1.13	0.50	20,038
On-Road Vehicle Engines	21.32	7.18	0.05	0.92	0.23	0.22	4,320	----	----	4,326
Barge Tugs	----	----	----	----	----	----	----	----	----	----
Fugitive Dust	----	----	----	----	104.21	10.42	----	----	----	----
2018 Total	317.47	91.40	0.21	15.22	110.73	16.93	23,997	1.13	0.50	24,364

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

TABLE 9.2-12
SPLNG Terminal Trains 5 and 6 Estimated Construction Emissions (tons)

Source	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
2019										
Non-Road Engines	75.16	18.97	0.03	3.56	1.48	1.48	5,327	0.30	0.13	5,423
On-Road Vehicle Engines	11.83	2.14	0.03	0.39	0.05	0.05	1,884	----	----	1,887
Barge Tugs	----	----	----	----	----	----	----	----	----	----
Fugitive Dust	----	----	----	----	104.21	10.42	----	----	----	----
2019 Total	86.99	21.12	0.06	3.95	105.74	11.95	7,210	0.30	0.13	7,310

Although most of the emissions summarized in Table 9.2-12 occur in attainment areas, a small fraction of these result from tugs pushing barges which transport construction materials and equipment through the Houston-Galveston-Brazoria or Beaumont-Port Arthur ozone nonattainment areas. Table 9.2-13 summarizes the emissions by attainment and non-attainment areas. As can be seen, the emissions of ozone precursors (NO_x and VOC) in nonattainment areas are much less than the *de minimis* thresholds for general conformity listed in 40 CFR 93.153(b).

TABLE 9.2-13
Criteria Pollutant and Greenhouse Gas Emissions (tons) from Material and Equipment Delivery Barges

Year	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Houston-Galveston-Brazoria 1-Hour Ozone Severe-17 and 8-Hour Ozone Severe-15 Nonattainment [1]							
2015	0.04	0.23	0.02	0.005	0.005	0.005	12
2016	0.22	1.13	0.11	0.024	0.027	0.027	61
2017	0.22	1.13	0.11	0.024	0.027	0.027	61
2018	----	----	----	----	----	----	----
2019	----	----	----	----	----	----	----
Beaumont-Port Arthur 1-Hour Ozone Serious Nonattainment Nonattainment[2]							
2015	0.02	0.13	0.013	0.003	0.003	0.003	7
2016	0.12	0.63	0.063	0.013	0.015	0.015	33
2017	0.12	0.63	0.063	0.013	0.015	0.015	33
2018	----	----	----	----	----	----	----
2019	----	----	----	----	----	----	----
Louisiana Unclassifiable or Attainment Areas[3]							
2015	8.18	42.69	4.31	0.90	1.01	1.01	2,289
2016	18.91	98.74	9.98	2.07	2.34	2.34	5,295
2017	0.17	0.87	0.09	0.02	0.02	0.02	47
2018	----	----	----	----	----	----	----
2019	----	----	----	----	----	----	----

TABLE 9.2-13
Criteria Pollutant and Greenhouse Gas Emissions (tons) from Material and Equipment Delivery Barges

Year	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Totals all Gulf Ports							
2015	8.24	43.04	4.35	0.90	1.02	1.02	2,308
2016	19.25	100.50	10.15	2.11	2.38	2.38	5,389
2017	0.50	2.63	0.27	0.06	0.06	0.06	142
2018	----	----	----	----	----	----	----
2019	----	----	----	----	----	----	----

1 Includes barges originating at the Port of Houston.
2 Includes all barges for some duration, depending on originating port.
3 Includes barges from Louisiana ports (Port of Westlake/Lake Charles and Port of New Orleans).

CCTPL Pipeline Expansion

Table 9.2-14 summarizes the construction emissions. Emissions from construction are not expected to cause, or significantly contribute, to a violation of any applicable ambient air quality standard. The emissions will be limited to the immediate vicinity of the CCTPL Pipeline Expansion area and will be short-term.

TABLE 9.2-14
CCTPL Pipeline Expansion Estimated Construction Emissions (tons)

Source	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
2015										
Non-Road Engines	4.64	10.43	0.01	1.06	0.79	0.79	3,965	0.10	0.23	4,001
On-Road Vehicle Engines	2.78	2.33	0.01	0.30	0.10	0.10	811	----	----	812
Fugitive Dust	----	----	----	----	61.87	7.12	----	----	----	----
Open Burning	71.06	2.02	----	12.20	8.67	8.67	1,603	0.09	0.02	1,611
2015 Total	78.48	14.78	0.02	13.56	71.43	16.68	6,379	0.19	0.25	6,425
2016										
Non-Road Engines	13.50	32.24	0.04	3.34	2.24	2.24	11,163	0.28	0.63	11,265
On-Road Vehicle Engines	15.11	9.57	0.04	1.39	0.41	0.40	3,868	----	----	3,874
Fugitive Dust	----	----	----	----	185.60	21.36	----	----	----	----
Open Burning	213.19	6.05	----	36.59	26.01	26.01	4,809	0.27	0.06	4,833
2016 Total	241.80	47.85	0.08	41.31	214.26	50.00	19,840	0.56	0.69	19,972

Mamou Compressor Station

Table 9.2-15 summarizes the construction emissions. Emissions from construction are not expected to cause, or significantly contribute, to a violation of any applicable ambient air quality standard. The emissions will be limited to the immediate vicinity of the Mamou Compressor Station area and will be short-term.

TABLE 9.2-15
Mamou Compressor Station Estimated Construction Emissions (tons)

Source	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
2015										
Non-Road Engines	0.95	2.16	<0.01	0.19	0.16	0.16	438	0.01	0.02	442
On-Road Vehicle Engines	0.60	0.52	<0.01	0.05	0.02	0.02	189	----	----	190
Fugitive Dust	----	----	----	----	4.40	0.44	----	----	----	----
2015 Total	1.55	2.69	<0.01	0.24	4.58	0.62	627	0.01	0.02	632
2016										
Non-Road Engines	9.90	3.57	0.01	0.51	0.20	0.20	775	0.02	0.04	782
On-Road Vehicle Engines	0.56	0.46	<0.01	0.04	0.02	0.02	188	----	----	188
Fugitive Dust	----	----	----	----	6.30	0.73	----	----	----	----
2016 Total	10.46	4.03	0.01	0.56	6.52	0.94	964	0.02	0.04	971

Air Impacts Mitigation Measures

The construction equipment will be operated on an as-needed basis, primarily during daylight hours. Reasonable measures will be taken to limit emissions of fugitive dust. Sabine Pass will maintain all construction equipment in accordance with manufacturers' recommendations and minimize engine idling time. CCTPL will employ proven construction practices, such as water sprays, to control fugitive dust emissions during construction. Additionally, all areas disturbed by construction will be stabilized in accordance with the Federal Energy Regulatory Commission ("FERC or Commission") *Upland Erosion Control, Revegetation, and Maintenance Plan,* May 2013 ("Plan"). Due to these factors, the intermittent and short-term characteristic of the emissions, construction is not expected to cause, or significantly contribute, to a violation of any applicable ambient air quality standard or degradation of air quality.

9.2.4.2 Operations

SPLNG Terminal Trains 1 through 4 Emissions Estimates

Table 9.2-16 provides updated emission estimates for the flares. It also provides the estimated increase which result from increasing the compressor turbines emissions from 20 to 25 ppmvd @ 15% O_2. Detailed emission calculations are provided in Appendix 9B.

TABLE 9.2-16
SPLNG Terminal Trains 1-4 Increases in Potential to Emit (tpy)

Emissions Unit	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	Total HAP	Single HAP[1]	GHG as CO_2e
Wet Gas Flare No. 1	32.00	274.36	47.42	<0.1	<0.1	0.35	0.54	0.35	69,817
Dry Gas Flare No. 1									
Wet Gas Flare No. 2	32.00	274.36	47.42	<0.1	<0.1	0.35	0.54	0.35	69,817
Dry Gas Flare No. 2									

TABLE 9.2-16
SPLNG Terminal Trains 1-4 Increases in Potential to Emit (tpy)

Emissions Unit	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	Total HAP	Single HAP[1]	GHG as CO_2e
Compressor Turbines Nos. 1- 24 (20 – 25 ppm NO_x)	602.86	---	---	---	---	---	---	---	---
Total	**666.86**	**548.72**	**94.84**	**0.2**	**0.2**	**0.7**	**1.08**	**0.7**	**139,634**

SPLNG Terminal Trains 5 and 6 Emissions Estimates

Emissions will result from the operation of stationary equipment. There will be no additional LNG carrier calls associated with operation of SPLNG Terminal Trains 5 and 6, and hence no additional ship or tug emissions.

Detailed emission calculations are provided in Appendix 9B. Table 9.2-17 summarizes the potential annual air emissions of criteria pollutants, GHG, total HAP, and the single HAP with the highest potential to emit. Table 9.2-17 includes the equipment listed in Section 9.2.1, as well as fugitive emissions.

TABLE 9.2-17
SPLNG Terminal Trains 5 and 6 Potential to Emit (tpy)

Emissions Unit or Type	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	Total HAP	Single HAP[1]	GHG as CO_2e
Thermal Oxidizer 5	9.38	37.4	0.56	0.76	0.76	2.95	0.20	0.18	197,823
Thermal Oxidizer 6	9.38	37.4	0.56	0.76	0.76	2.95	0.20	0.18	197,823
Wet Gas Flare No. 3 Dry Gas Flare No. 3	32.00	274.36	47.42	<0.1	<0.1	0.28	0.54	0.35	69,816
Compressor Turbine 25	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 26	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 27	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 28	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 29	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 30	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 31	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 32	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 33	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 34	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 35	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Compressor Turbine 36	125.6	191	2.63	8.28	8.28	---	1.30	0.89	146,744
Generator Turbine 7	125.6	76.5	2.63	8.28	8.28	---	1.30	0.89	146,744
Generator Turbine 8	125.6	76.5	2.63	8.28	8.28	---	1.30	0.89	146,744
Standby Generator 7	5.84	3.2	0.36	0.18	0.18	0.01	<0.01	<0.01	231

TABLE 9.2-17
SPLNG Terminal Trains 5 and 6 Potential to Emit (tpy)

Emissions Unit or Type	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	Total HAP	Single HAP[1]	GHG as CO_2e
Standby Generator 8	5.84	3.2	0.36	0.18	0.18	0.01	<0.01	<0.01	231
Fugitive	----	----	4.33	----	---	----	---	----	22,575
Total	**1,820.8**	**2,800.6**	**90.4**	**117.8**	**117.8**	**6.2**	**19.1**	**13.2**	**2,542,915**

FERC staff requested that Sabine Pass conduct NAAQS modeling to include marine vessel emissions for activities within the US Coast Guard (USGC) security zone. The proposed modeling protocol to include emission from LNGCs and support vessels is included as Appendix 9C.

CCTPL Pipeline Expansion Emissions Estimates

Other than small quantities of fugitive VOC emissions from valve or fitting leaks, no air emissions will occur as a result of CCTPL Pipeline Expansion operation.

Mamou Compressor Station Emissions Estimates

Detailed emission calculations are provided in Appendix 9B. Table 9.2-18 summarizes the potential annual air emissions of criteria pollutants, GHG, total HAP, and the single HAP with the highest potential to emit. Table 9.2-18 includes the equipment listed in Section 9.2.1, fugitive emissions, MSS emissions, unit and station blow down ("BD") emissions, and truck loading emissions.

TABLE 9.2-18
Mamou Compressor Station Potential to Emit (tpy)

Emissions Unit or Type	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	Total HAP	Single HAP[1]	GHG as CO_2e
Turbine A	34.82	42.90	2.40	7.24	7.24	4.72	1.22	1.05	40,352
Turbine B	34.82	42.90	2.40	7.24	7.24	4.72	1.22	1.05	40,352
Turbine C	34.82	42.90	2.40	7.24	7.24	4.72	1.22	1.05	40,352
Turbine D	64.30	78.24	4.43	13.37	13.37	8.71	2.19	1.99	74,494
Generator A[2]	0.60	0.39	0.11	<0.01	<0.01	0.01	0.05	0.05	109
Generator B[2]	0.60	0.39	0.11	<0.01	<0.01	0.01	0.05	0.05	109
Tank[3]	----	----	0.26	----	----	----	----	----	----
Fugitive[4]	----	----	0.25	----	----	----	0.06	----	----
MSS[5]	0.50	44.20	0.51	----	----	----	----	----	286
Unit BD[6]	----	----	2.21	----	----	----	0.44	----	1,838
Station BD[7]	----	----	2.52	----	----	----	0.50	----	2,092
Truck loading	----	----	0.09	----	----	----	----	----	----
Total	**170.5**	**251.9**	**17.7**	**35.1**	**35.1**	**22.9**	**6.95**	**5.24**	**199,984**

TABLE 9.2-18
Mamou Compressor Station Potential to Emit (tpy)

Emissions Unit or Type	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	Total HAP	Single HAP[1]	GHG as CO_2e
1. Formaldehyde									
2. Emergency generators									
3. 100 barrel condensate tank									
4. Fugitive emissions from valves, pumps, flanges, etc.									
5. Maintenance, startup, and shutdown emissions									
6. 12 BD events per compressor unit per year									
7. 4 Station BD events (suction and discharge) per year									
8. Condensate loading									

Air Impacts Mitigation Measures

The Project will use new, state-of-the-art equipment to minimize emissions. SPLNG Terminal Trains 5 and 6 and the Mamou Compressor Station will employ BACT for NO_x, CO, PM_{10}, $PM_{2.5}$, and GHG emissions. In additions, SPLNG Terminal Trains 5 and 6 will employ BACT for VOC.

The two emergency diesel engines will fire only ultra-low sulfur diesel. The remaining combustion equipment will fire clean-burning natural gas. The reciprocating internal combustion engines and combustion turbines will utilize computer controls for air, fuel, and timing.

Anticipated Air Quality Impacts

As part of the air permitting process, air quality analyses will be performed to show that proposed emissions will not significantly cause or contribute to a violation of any NAAQS or PSD increment. Also as part of the air permitting process, analyses will be performed to assess the impacts of air, ground and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source or modification under review, and from associated growth.

9.3 NOISE

Construction of the Project facilities will involve general construction equipment and noise will occur during the installation of the Project components. Operation of liquefaction Trains 5 and 6 at the SPLNG Terminal and the new Mamou Compressor Station may result in long-term increases in noise levels in the vicinity of each facility.

The unit of noise measurement is the decibel ("dB"), which measures the energy of the noise. Because the human ear is not uniformly sensitive to all noise frequencies, the "A" weighting frequency scale ("dBA") was devised to correspond with the ear's sensitivity. The L_{dn} is a 24-hour average equivalent sound level ("L_{eq}") of the measured daytime ("L_d") dB and measured nighttime ("L_n") dB with 10 dB added to the sound levels occurring during the nighttime hours of 10 p.m. to 7 a.m. to compensate for enhanced receptor sensitivity during the nighttime. Rather than being a true measure of the sound level, the L_{dn} represents a skewed average that correlates generally with the results of studies relating

environmental sound levels to physiological reaction and effects. For a source that operates at a continuous sound level over a 24-hour period, the L_{dn} is approximately 6.4 dBA above the measured L_{eq}. Consequently, an L_{dn} of 55 dBA corresponds to a steady state A-weighted L_{eq} ("L_{Aeq}") of 48.6 dBA.

FERC guidelines require that the sound attributable to a new aboveground facility (not the total sound level in the area) not exceed an L_{dn} of 55 dBA at any nearby NSA (e.g., residences, schools, hospitals, etc.) unless such NSAs are established after facility construction. No state or local noise regulations or ordinances were identified that are applicable to the SPLNG Terminal or Mamou Compressor Station.

The following sections summarize noise analyses conducted to date.

9.3.1 Construction Noise

Construction noise is highly variable, as the types of equipment in use at a construction site change with the construction phase and the type of activities. Generally, construction activities will occur during daylight (e.g., 7 a.m. to 7 p.m.) hours and will include the following major phases: site preparation, excavation, installation of pipeline and/or aboveground facilities, and site cleanup and restoration. The construction equipment that will be utilized will differ from phase to phase, but will include dozers, cranes, cement mixers, dump trucks, and loaders. Noise generated during construction is primarily from diesel engines which power the equipment. Exhaust noise usually is the predominant source of diesel engine noise. Equipment used is not generally operated continuously, nor is the equipment always operated simultaneously. Typically, the highest site average sound levels (89 dBA at 50 feet) are associated with excavation and finishing activities.

Noise actually transmitted from the construction site will be attenuated by a variety of mechanisms. The most significant of these is the diversion of the sound waves with distance (attenuation by divergence). In general, this mechanism will result in a 6 dBA decrease in the sound level with every doubling of distance from the source. Additional reductions in noise are achieved through absorption by the atmosphere.

Noise from construction activities may be noticeable at nearby residences. However, the construction noise levels provided above are those which would be experienced by people outdoors. A building (residence) provides significant attenuation for those who are indoors and sound levels can be expected to be up to 27 dBA lower indoors with the windows closed. Even in homes with the windows open, indoor sound levels can be reduced by up to 17 dBA (USEPA, 1978).

The short-term nature and small expected magnitude of the potential construction noise impacts do not warrant any mitigation measures. The continuous manner in which construction work must be done makes complete control of construction noise infeasible. Measures to mitigate construction noise will include compliance with federal regulations limiting noise from trucks, and ensuring that equipment and sound muffling devices provided by the manufacturer are kept in good working condition. In addition, construction activity will generally not occur during the nighttime hours when people are sleeping.

9.3.1.1 SPLNG Terminal

The nearest NSAs to the SPLNG Terminal are located across the Sabine Pass Channel in Texas and include a marina (4,900 feet) and the Sabine Pass Battleground State Park (4,750 feet). There are no residences within 0.5 mile.

Construction at the SPLNG Terminal will include pile driving that will result in greater noise level impacts. Pre-cast concrete piles will be utilized and installed using a combination of boring and impact pile driving. The sound power level of a typical pre-cast pile driver installing piles at approximately 50 blows per minute was calculated from sound level measurements of pile driving at a similar LNG project. The calculated sound power level was 123 dBA per pile driver operation. Assuming two simultaneous pile driving operations at the closest edge of the Trains 5 and 6 construction area, the predicted sound level due to pile driving operations is about 38 dBA at the nearest NSA. The temporary pile driving noise impact is anticipated to be minimal, even if it occurs at night. Further, the nearest NSAs do not have overnight sleeping facilities.

9.3.1.2 CCTPL Pipelines

CCTPL will use a horizontal direction drill ("HDD") construction technique to install the pipeline at twelve locations along the pipeline route. HDD utilizes a number of pieces of equipment that include power generation, drill pile storage, control rooms, an excavator, and storage trailers. Of these sources, the diesel engine power generation units are the most significant noise generating sources. Noise level data measured at a typical HDD site, where a 600 horsepower drive drill engine is in use, indicate that at the HDD entry site, the HDD generates a sound level, with equipment at full load, of approximately 85 dBA at 50 feet. Noise levels on the HDD exit site, where fewer equipment are in use, are approximately 79 dBA at 50 feet.

Table 9.3-1 identifies the nearest NSA within 0.5 mile of the entry and exit locations for each HDD. No HDDs are planned on Loop 1, or the ANR and TGT Laterals. Assuming that HDDs are conducted during the daytime only using standard drilling equipment, noise levels at residences located at a conservative distance of 1,200 feet from the entry/exit sites will not experience noise levels above the 55 dBA threshold. CCTPL will conduct noise analyses for those residences that are located less than 1,200 feet from the HDD entry/exit sites and will provide those analyses in September 2013.

TABLE 9.3-1
Nearest NSAs Within 0.5 Mile of CCTPL HDD Entry and Exit Locations

Facility / Feature	Entry and Exit Site			
	Approx. MP	NSA (Distance (ft) / Direction)	Approx. MP	NSA (Distance (ft) / Direction)
Loop 2				
Houston River Canal	71.0	1,772 / NE[1]	71.3	670 / E[1]
Houston River	73.4	460 / W	73.9	2,249 / SW

TABLE 9.3-1
Nearest NSAs Within 0.5 Mile of CCTPL HDD Entry and Exit Locations

Facility / Feature	Entry and Exit Site			
	Approx. MP	NSA (Distance (ft) / Direction)	Approx. MP	NSA (Distance (ft) / Direction)
U.S. 27/Bankens Road/Railroad	76.3	94 / N	76.5	933 / W
Little River	77.3	1,448 / S[1]	77.7	2,226 / SW[1]
West Fork Calcasieu River	81.0	523 / S	81.6	None
Indian Bayou/Camp Edgewood Road	86.8	1,407 / E[1]	87.0	309 / S
Marsh Bayou	90.2	302 / W[1]	90.5	1,990 / SW[1]
Extension				
Whiskey Chitto Creek	109	924 / E	109.6	None
Calcasieu River	112.2	1,856 / N	112.7	None
Caney Creek	130.2	2,695 / N[1]	130.5	2,310 / N[1]

TABLE 9.3-1
Nearest NSAs Within 0.5 Mile of CCTPL HDD Entry and Exit Locations

Facility / Feature	Entry and Exit Site			
	Approx. MP	NSA (Distance (ft) / Direction)	Approx. MP	NSA (Distance (ft) / Direction)
CGT Lateral				
WCGTLTA016 Wetland	10.8	929 / S[1]	11.1	1,530 / SW[1]
PPEC Lateral				
East Fork Bayou Nezpique	1.6	2,179 / SE	2.2	None

1 Same residence at both locations.

9.3.2 Operational Noise

9.3.2.1 SPLNG Terminal

The major noise generating sources at the SPLNG Terminal include:

- Two ConocoPhillips Optimized Cascade LNG Trains, each consisting of:
  - Six LM2500+G4 gas turbine-driven refrigerant compressors;
  - Gas treatment facilities;
  - Waste heat recovery systems;
  - Induced draft air coolers;
  - Associated Piping;
- Two LM2500+ gas turbine generators;
- Recycle boil-off gas (BOG) compressors;
- Instrument air compressor packages; and
- Liquefaction Flares.

Existing Noise Levels

The SPLNG Terminal in Cameron Parish, Louisiana is bounded by the Sabine Pass Channel on the west and south and open land (primarily wetlands) to the north, and east. The nearest NSAs to the site are a marina and the Sabine Pass Battleground State Park, both located across the Sabine River in Texas. These NSAs, which were identified during licensing of the original Sabine Pass LNG receiving terminal in 2005, do not have overnight sleeping facilities and are shown on Figure 1 in Appendix 9D.

Ambient noise monitoring was conducted during June 17-18, 2013 at these NSA locations in order to quantify the existing noise levels. Measurements were limited to daytime only at NSA 1 (the marina), and were judged to be representative of noise conditions at both NSA sites. No construction or operational noise was audible during the measurement period. Meteorological conditions during the daytime measurements included clear to partly cloudy skies, south-southwest winds of 7 to 15 miles per

hour and a temperature of 82 degrees F. Table 9.3-2 lists the NSAs, their distance and direction to the site, the measured short-term ambient noise levels, and the calculated L_{dn} levels.

TABLE 9.3-2
SPLNG Terminal NSA Locations and Measured Ambient Noise Levels (dBA)

NSA	Distance (ft) / Direction	Daytime L_{eq}[1]	L_{dn}[2]
1 – Marina	4,900	47.1	53.5
2 – Sabine Pass Battleground State Park	4,750	47.1	53.5

[1] Only daytime noise levels were measured at NSA 1, and assumed to exist for NSA 2.
[2] L_{dn} based on assuming L_{day} and L_{night} are the same.

Noise Mitigation Measures

Noise mitigation measures were incorporated in the modeling analysis for the SPLNG Terminal and included:

- Acoustically treated buildings for the BOG compressors;
- Liquefaction train combustion turbine exhaust stack silencers;
- Power generator combustion turbine exhaust stack silencers;
- Pipe lagging around above-ground pipes; and
- Low noise gas coolers and lube oil coolers.

It may be possible to achieve compliance through use of alternative noise control measures other than those used in the analyses, provided that the final design achieves the same level of compliance.

Predicted Noise Levels During Operation

Manufacturer's data (as available) and measurements of similar units at other LNG facilities were used to develop noise model input data for the SPLNG Terminal. The results of the noise modeling analysis are provided in Table 9.3-3 and indicate that the calculated levels at the nearest NSAs are all below the L_{dn} of 55 dBA. The highest calculated L_{dn} is 54.7 dBA at NSA (Marina), located about 4,900 feet southwest of the approximate center of the SPLNG Terminal site. The expected increases in noise levels at the two NSAs range from 3.4 dBA to 3.7 dBA.

TABLE 9.3-3
SPLNG Terminal Operational Noise Impact at the Nearest NSAs (dBA)

NSA	Distance (ft) / Direction	L_{dn} for Station Only [1] (dBA)	Existing L_{dn} without Station (dBA)	Combined L_{dn} (Station plus Existing) (dBA)	Expected Increase (dBA)
1 – Marina	4,900 / SW	54.7	53.5	57.2	3.7
2 - Sabine Pass Battleground State Park	4,750 / SW	54.2	53.5	56.9	3.4

1 Includes existing LNG vaporization equipment and the approved liquefaction Trains 1 through 4, and equipment.

Within 60 days of placing the SPLNG Terminal into service, a post-construction sound survey will be performed to ensure that the sound level attributable to the station, at full load operation, does not exceed the criterion of 55 dBA L_{dn} at the nearby NSAs. The results of the post-construction sound survey will be filed with the FERC.

9.3.2.2 Mamou Compressor Station

The preliminary design includes four Dresser Rand compressors driven by Solar Taurus 70 and Solar Titan 130 combustion turbines. Three of the compressors/turbines will be located within one building, and the fourth compressor/turbine in a separate building. Listed below is the major equipment proposed for the station:

- Three (3) Dresser Rand C40-5M compressors;
- One (1) Dresser Rand C51-4 compressor;
- Three (3) Solar Taurus 70 combustion turbines;
- One (1) Solar Titan 130 combustion turbines;
- Four (4) Lube Oil Cooler fan bays (8 fans in total); and
- Eight (8) Gas Cooler fan bays (21 fans in total).

Measurements of existing noise levels were made at nearby NSAs to each Project site to provide a comparison of calculated future noise levels. Calculated Project noise levels were also evaluated against the FERC noise criterion.

Existing Noise Levels

The Mamou Compressor Station site in Evangeline Parish is surrounded by undeveloped, agricultural land, and low density residential use. Nearby NSAs to the Mamou Compressor Station site (all residences) were identified through the use of topographic maps and site reconnaissance. The NSAs are listed in Table 9.3-4 and their location in relation to the Mamou Compressor Station is shown in Figure 2 in Appendix 9D.

TABLE 9.3-4
Mamou Compressor Station NSA Locations and Measured Ambient Noise Levels (dBA)

NSA	Distance (ft) / Direction	Daytime L_{eq}	Nighttime L_{eq} with insects	L_{dn} with Insects	Nighttime L_{eq} without insects	L_{dn} Without Insects
1 – 1298 Lariat Lane	1,800 / N	37.4	56.1	61.9	43.4	49.3
2 – 1926 Rocky Lane	2,000 / SE	38.8	53.7	59.5	51.3	57.1
3 – 1176 Joe Lane	3,200 / W	40.5	53.0	58.5	35.4	43.0

Ambient noise monitoring was conducted in the vicinity of the Mamou Compressor Station site on June 12 and 13, 2013. Short-term (10 minutes per location) noise level measurements were conducted at the nearest NSAs during the daytime hours and late at night to calculate existing L_{dn} levels. Noise levels typically are lowest during the late night hours, when human activity and traffic are at a minimum.

The primary sources of noise in the area included occasional cars on local roads, as well as natural sounds such as insects, birds and farm animals. Insect noise was more pronounced at night, resulting in higher ambient sound levels during the nighttime hours at all locations. Meteorological conditions during the daytime measurement program included partly cloudy skies, winds of 10 mph or less and temperatures ranging from 85 degrees Fahrenheit to 92 degrees Fahrenheit. At night, skies were clear and winds were near calm. The temperature was approximately 80 degrees Fahrenheit.

The measured nighttime noise levels were further analyzed to estimate the amount of insect noise present. Insect noise is typically present in the higher frequency ranges, generally 4,000 to 8,000 hertz. When the one-third octave data are plotted, insect noise is revealed as spikes at these frequencies. In most outdoor environments without insect sound, the one-third octave data will show higher sound levels in the lower frequencies and the sound level will gradually taper off into the higher frequencies. It is therefore possible to remove the insect sound by eliminating the spikes at the higher frequencies such that the plot gradually tapers off instead of spiking, then recombining the data into a single dBA level. This methodology was used to remove insect noise from the measured levels.

Ambient L_{dn} levels from the short term measurements ranged from 58.8 dBA to 61.9 dBA with insect noise, but were found to be lower at 43.0 dBA to 57.1 dBA with insect noise removed. Table 9.3-4 provides the measured short-term ambient noise levels with and without insect noise, and the calculated L_{dn} levels at the nearest NSAs.

Noise Mitigation Measures

Noise mitigation measures were incorporated in the modeling analysis for the Mamou Compressor Station and included:

- Acoustically treated compressor building;
- Exhaust stack silencers;

- Engine combustion air intake silencers;
- Pipe lagging around above-ground pipes; and
- Low noise gas coolers and lube oil coolers.

It may be possible to achieve compliance through use of alternative noise control measures other than those used in the analyses, provided that the final design achieves the same level of compliance.

Predicted Noise Levels During Operation

Noise will generally be produced on a continuous basis at the Mamou Compressor Station by the turbines/compressors and associated auxiliary equipment. CCTPL will enclose the turbines and compressors in acoustically designed buildings and silencers will be fitted to the turbine air intakes and exhausts, which will extend outside the buildings.

Estimated noise level data for the Solar turbines and lube oil coolers were obtained from Solar. Data for the compressors, gas coolers, and above ground piping were estimated from similar projects. The results of the noise modeling analysis for noise impacts with and without insect noise are provided in Tables 9.3-5 and 9.3-6, respectively. The analysis indicates that the calculated levels at the NSAs are all below the L_{dn} of 55 dBA with the highest calculated L_{dn} of 52.8 dBA at the nearest NSA (NSA 1). The expected increases in noise levels at the NSAs around the Mamou Compressor Station site range from 0.2 dBA to 0.7 dBA with existing insect noise and 1.1 dBA to 5.1 dBA with insect noise removed.

TABLE 9.3-5
Mamou Compressor Station Operational Noise Impact Results With Insect Noise in Ambient (dBA)

NSA	Distance (ft) / Direction	L_{dn} for Station Only (dBA)	Existing L_{dn} without Station (dBA)	Combined L_{dn} (with Station) (dBA)	Expected Increase (dBA)
1 – 1298 Lariat Lane	1,800 / N	52.8	61.9	62.4	0.5
2 – 1926 Rocky Lane	2,000 / SE	51.7	59.5	60.2	0.7
3 – 1176 Joe Lane	3,200 / W	46.2	58.8	59.0	0.2
All distances calculated from the center of the site.					

TABLE 9.3-6
Mamou Compressor Station Operational Noise Impact Results Without Insect Noise in Ambient (dBA)

NSA	Distance (ft) / Direction	L_{dn} for Station Only (dBA)	Existing L_{dn} without Station (dBA)	Combined L_{dn} (with Station) (dBA)	Expected Increase (dBA)
1 – 1298 Lariat Lane	1,800 / N	52.8	49.3	54.4	5.1
2 – 1926 Rocky Lane	2,000 / SEt	51.7	57.1	58.2	1.1
3 – 1176 Joe Lane	3,200 / W	46.2	43.0	47.9	4.9
All distances calculated from the center of the site.					

Within 60 days of placing the SPLNG Terminal and the Mamou Compressor Station into service, a post-construction sound survey will be performed to ensure that the sound level attributable to the station, at full load operation, does not exceed the criterion of 55 dBA L_{dn} at the nearby NSAs. The results of the post-construction sound survey will be filed with the FERC.

9.3.2.3 CCTPL Pipelines

There are no anticipated operational noise effects associated with the operation of the pipeline.

9.4 REFERENCES

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APPENDIX 9A

Construction Emissions Calculations

Table 9.A.1.1 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
CLASS 06 PERSONNEL CARRIERS																
All terrain vehicle	Diesel	2270001060	22	21%	7.66	6.41	4.7E-03	1.89	1.09	225	40	0.35	0.29	2.1E-04	0.09	0.05
CLASS 11 EARTHMOVING																
Dozer	Diesel	2270002069	159	59%	0.87	2.02	3.1E-03	0.18	0.21	-	40	-	-	-	-	-
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	0.74	3.58	3.2E-03	0.18	0.11	-	40	-	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	250	59%	0.55	1.66	3.0E-03	0.16	0.10	-	40	-	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	0.89	2.22	3.1E-03	0.16	0.13	-	40	-	-	-	-	-
Motor graders	Diesel	2270002048	183	59%	0.62	1.82	3.0E-03	0.17	0.12	-	40	-	-	-	-	-
Loader backhoe	Diesel	2270002066	101	21%	2.60	4.37	3.9E-03	0.66	0.50	-	40	-	-	-	-	-
Loader tool carrier	Diesel	2270002066	134	21%	2.60	4.37	3.9E-03	0.66	0.50	-	40	-	-	-	-	-
Skidsteer loader	Diesel	2270002072	68	21%	5.94	5.51	4.5E-03	1.16	0.90	-	40	-	-	-	-	-
Rubber tire loader	Diesel	2270002060	249	59%	0.72	2.17	3.1E-03	0.19	0.14	-	40	-	-	-	-	-
Tractor	Diesel	2270005015	115	59%	1.34	3.40	3.3E-03	0.29	0.28	-	40	-	-	-	-	-
CLASS 12 PIPELAYING / TRENCHING EQUIPMENT																
Trencher	Diesel	2270002030	51	59%	2.69	3.89	3.7E-03	0.31	0.33	-	40	-	-	-	-	-
CLASS 13 COMPACTION																
Soil compactor	Diesel	2270002009	339	43%	2.52	4.73	4.0E-03	0.53	0.37	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	2.52	4.73	4.0E-03	0.53	0.37	-	40	-	-	-	-	-
CLASS 14 CRANES																
Crane crawler	Diesel	2270002045	285	43%	0.49	2.27	3.1E-03	0.19	0.10	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	300	43%	0.82	3.21	3.2E-03	0.19	0.12	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	340	43%	0.82	3.21	3.2E-03	0.19	0.12	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	600	43%	1.09	3.22	3.2E-03	0.18	0.13	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	500	43%	0.82	3.21	3.2E-03	0.19	0.12	-	40	-	-	-	-	-
Crane carrydeck	Diesel	2270003010	200	21%	3.13	5.31	4.0E-03	0.82	0.54	-	40	-	-	-	-	-
Crane carrydeck	Diesel	2270003010	300	21%	3.13	5.31	4.0E-03	0.82	0.54	-	40	-	-	-	-	-
RT crane - 35 ton	Diesel	2270002045	140	43%	0.65	2.48	3.2E-03	0.21	0.16	4	40	0.01	0.03	3.4E-05	2.2E-03	1.7E-03
RT crane - 50 ton	Diesel	2270002045	180	43%	0.49	2.27	3.1E-03	0.19	0.10	-	40	-	-	-	-	-
RT crane - 66 ton	Diesel	2270002045	220	43%	0.49	2.27	3.1E-03	0.19	0.10	4	40	0.01	0.04	5.2E-05	3.1E-03	1.6E-03
RT crane - 75 ton	Diesel	2270002045	220	43%	0.49	2.27	3.1E-03	0.19	0.10	-	40	-	-	-	-	-
RT crane - 80 ton	Diesel	2270002045	260	43%	0.49	2.27	3.1E-03	0.19	0.10	-	40	-	-	-	-	-

Table 9.A.1.1 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO[2]	NO_x[2]	SO_2[2]	VOC[2]	PM_{10}/ $PM_{2.5}$[2,3]	weeks	hrs/week	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
RT crane - 110 ton	Diesel	2270002045	300	43%	0.82	3.21	3.2E-03	0.19	0.12	-	40	-	-	-	-	-
CLASS 15 FORKLIFT																
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	0.50	1.28	2.9E-03	0.15	0.11	4	40	0.01	0.02	4.5E-05	2.3E-03	1.8E-03
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	9.04	1.44	0.01	0.28	0.06	4	40	0.05	0.01	5.7E-05	1.5E-03	3.0E-04
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	1.04	2.62	3.3E-03	0.23	0.23	4	40	0.01	0.03	3.4E-05	2.4E-03	2.4E-03
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	0.50	1.28	2.9E-03	0.15	0.11	4	40	0.01	0.02	3.6E-05	1.9E-03	1.4E-03
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	0.50	1.28	2.9E-03	0.15	0.11	-	40	-	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	0.50	1.28	2.9E-03	0.15	0.11	4	40	0.01	0.01	3.0E-05	1.5E-03	1.2E-03
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	0.50	1.28	2.9E-03	0.15	0.11	-	40	-	-	-	-	-
CLASS 16 CONCRETE / AGGREGATE																
Concrete pump	Diesel	2270002042	350	43%	1.31	4.48	3.3E-03	0.30	0.18	-	40	-	-	-	-	-
CLASS 17 AIR COMPRESSORS																
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.86	3.32	3.6E-03	0.30	0.29	-	40	-	-	-	-	-
Air compressor 250 cfm	Diesel	2270006015	80	43%	1.86	3.32	3.6E-03	0.30	0.29	-	40	-	-	-	-	-
Air compressor 375 cfm	Diesel	2270006015	115	43%	0.72	2.88	3.2E-03	0.23	0.17	-	40	-	-	-	-	-
Air compressor 600 cfm	Diesel	2270006015	250	43%	0.57	2.68	3.2E-03	0.21	0.11	-	40	-	-	-	-	-
Air compressor 750 cfm	Diesel	2270006015	275	43%	0.57	2.68	3.2E-03	0.21	0.11	-	40	-	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	310	43%	1.01	3.61	3.3E-03	0.23	0.15	-	40	-	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	-	-	40	-	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	1.01	3.61	3.3E-03	0.23	0.15	-	40	-	-	-	-	-
CLASS 25 CABLE LAYING / PULLING EQUIPMENT																
Cable winch	Diesel	2270002081	26	59%	1.19	4.02	3.5E-03	0.23	0.19	-	40	-	-	-	-	-
CLASS 52 WELDING EQUIPMENT																
Welder 400A trailer mount	Diesel	2270006025	32	21%	4.62	5.12	4.4E-03	1.08	0.72	-	40	-	-	-	-	-
Welder 500A trailer mount	Diesel	2270006025	40	21%	4.62	5.12	4.4E-03	1.08	0.72	-	40	-	-	-	-	-
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	6.08	5.68	4.7E-03	1.38	0.84	-	40	-	-	-	-	-
CLASS 53 GENERATION EQUIPMENT																
Generator set 150 kW	Diesel	2270006005	221	43%	1.18	4.21	3.3E-03	0.34	0.22	4	40	0.02	0.07	5.6E-05	0.01	3.7E-03
Generator set 800 kW	Diesel	2270006005	1,125	0%	-	-	-	-	-	4	40	-	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1,425	0%	-	-	-	-	-	9	40	-	-	-	-	-
Light plant	Diesel	2270002027	14	43%	2.46	4.64	4.0E-03	0.50	0.36	9	40	0.01	0.01	9.5E-06	1.2E-03	8.5E-04

Table 9.A.1.1 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
CLASS 54 MANLIFTS / SCISSORLIFTS																
Manlift - 40 ft	Diesel	2270003010	28	21%	6.32	5.59	4.5E-03	1.64	0.91	-	40	-	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	5.38	5.68	4.5E-03	1.08	0.77	-	40	-	-	-	-	-
Manlift - 80 ft	Diesel	2270003010	65	21%	5.38	5.68	4.5E-03	1.08	0.77	-	40	-	-	-	-	-
Manlift - 125 ft	Diesel	2270003010	75	21%	5.94	5.38	4.4E-03	1.12	0.86	-	40	-	-	-	-	-
Scissor lift - 60 ft	Diesel	2270003010	31	21%	6.32	5.59	4.5E-03	1.64	0.91	-	40	-	-	-	-	-
CLASS 55,56 SMALL CAPITAL EQUIPMENT																
Compactor - 29" manual	Diesel	2270002003	15	59%	2.40	4.46	4.0E-03	0.45	0.35	-	40	-	-	-	-	-
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	289.04	2.03	0.02	5.15	0.11	-	40	-	-	-	-	-
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	2.50	4.52	3.7E-03	0.50	0.45	-	40	-	-	-	-	-
Water pump trash 316 gpm	Diesel	2270006010	7	43%	4.51	5.08	4.0E-03	0.70	0.50	-	40	-	-	-	-	-
Water pump trash 611 gpm	Diesel	2270006010	15	43%	2.65	4.90	4.0E-03	0.58	0.39	-	40	-	-	-	-	-
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.64	4.54	3.7E-03	0.38	0.31	-	40	-	-	-	-	-
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	4.51	5.08	4.0E-03	0.70	0.50	-	40	-	-	-	-	-
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	289.04	2.03	0.02	5.15	0.11	-	40	-	-	-	-	-
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	2.65	4.90	4.0E-03	0.58	0.39	-	40	-	-	-	-	-
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	2.65	4.90	4.0E-03	0.58	0.39	-	40	-	-	-	-	-
Compactor - 16" in manual	Diesel	2270002003	5	59%	2.40	4.46	4.0E-03	0.45	0.35	-	40	-	-	-	-	-
Compactor - 26" in manual	Diesel	2270002003	9	59%	2.40	4.46	4.0E-03	0.45	0.35	-	40	-	-	-	-	-
Tamper rammer	Diesel	2270002003	9	59%	2.40	4.46	4.0E-03	0.45	0.35	-	40	-	-	-	-	-
Mortar mixer	Diesel	2270002042	5	43%	4.73	6.17	4.0E-03	0.88	0.66	-	40	-	-	-	-	-
Concrete mixer	Gas	2265002042	5	59%	221.18	2.35	0.02	8.86	0.34	-	40	-	-	-	-	-
Generator set 6 kW	Gas	2265006005	9	68%	291.40	2.23	0.02	5.39	0.11	9	40	0.71	0.01	4.6E-05	0.01	2.7E-04
Generator set 10 kW	Gas	2265006005	15	68%	291.40	2.23	0.02	5.39	0.11	9	40	1.18	0.01	7.7E-05	0.02	4.6E-04
Concrete trowel 36"	Gas	2265002021	5	59%	212.62	2.12	0.02	6.43	0.32	-	40	-	-	-	-	-
SOIL STABLIZATION & SITE PREP																
CAT D6M dozer	Diesel	2270002069	140	59%	0.87	2.02	3.1E-03	0.18	0.21	43	40	0.14	0.32	4.9E-04	0.03	0.03
Soil compactor	Diesel	2270002009	153	43%	2.52	4.73	4.0E-03	0.53	0.37	43	40	0.31	0.59	5.0E-04	0.07	0.05
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.55	1.66	3.0E-03	0.16	0.10	1,040	40	3.54	10.57	0.02	1.04	0.67
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.50	1.28	2.9E-03	0.15	0.11	87	40	0.12	0.32	7.1E-04	0.04	0.03
Generator set 150 kW	Diesel	2270006005	221	43%	1.18	4.21	3.3E-03	0.34	0.22	87	40	0.43	1.54	1.2E-03	0.12	0.08

Table 9.A.1.1 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.64	4.54	3.7E-03	0.38	0.31	87	40	0.09	0.26	2.1E-04	0.02	0.02
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.64	1.63	3.0E-03	0.15	0.10	433	40	3.06	7.83	0.01	0.71	0.49
Light plant	Diesel	2270002027	15	43%	2.46	4.64	4.0E-03	0.50	0.36	867	40	0.61	1.15	9.8E-04	0.12	0.09
Water truck	Diesel	2270002051	427	59%	0.64	1.63	3.0E-03	0.15	0.10	43	40	0.30	0.78	1.4E-03	0.07	0.05
Excavator CAT 345B	Diesel	2270002036	345	59%	0.89	2.22	3.1E-03	0.16	0.13	208	40	1.65	4.14	0.01	0.30	0.24
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.55	1.66	3.0E-03	0.16	0.10	52	40	0.18	0.53	9.5E-04	0.05	0.03
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.64	1.63	3.0E-03	0.15	0.10	208	40	1.47	3.76	0.01	0.34	0.23
CAT D6M dozer	Diesel	2270002069	140	59%	0.87	2.02	3.1E-03	0.18	0.21	156	40	0.49	1.15	1.8E-03	0.11	0.12
Motor graders	Diesel	2270002048	185	59%	0.62	1.82	3.0E-03	0.17	0.12	104	40	0.31	0.91	1.5E-03	0.08	0.06
Soil compactor	Diesel	2270002009	228	43%	2.52	4.73	4.0E-03	0.53	0.37	26	40	0.28	0.53	4.5E-04	0.06	0.04
Soil compactor	Diesel	2270002009	153	43%	2.52	4.73	4.0E-03	0.53	0.37	52	40	0.38	0.71	6.0E-04	0.08	0.06
Loader tool carrier	Diesel	2270001060	125	21%	3.49	5.01	4.0E-03	0.84	0.56	26	40	0.10	0.15	1.2E-04	0.03	0.02
PILE DRIVING																
American 9310	Diesel	2270001060	285	21%	3.07	4.76	3.9E-03	0.76	0.48	82	40	0.66	1.03	8.5E-04	0.17	0.10
American 9260	Diesel	2270001060	275	21%	3.07	4.76	3.9E-03	0.76	0.48	104	40	0.81	1.26	1.0E-03	0.20	0.13
Pile hammer	Diesel	2270001060	60	21%	5.76	5.37	4.5E-03	1.10	0.80	82	40	0.26	0.24	2.0E-04	0.05	0.04
Manlift - 60 ft	Diesel	2270003010	65	21%	5.38	5.68	4.5E-03	1.08	0.77	61	40	0.20	0.21	1.6E-04	0.04	0.03
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.50	1.28	2.9E-03	0.15	0.11	61	40	0.09	0.22	5.0E-04	0.03	0.02
Welder	Diesel	2270001060	50	21%	5.76	5.37	4.5E-03	1.10	0.80	82	40	0.22	0.20	1.7E-04	0.04	0.03
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.86	3.32	3.6E-03	0.30	0.29	82	40	0.23	0.41	4.5E-04	0.04	0.04
MISCELLANEOUS																
Tugs Twin Screw[4,5]	Diesel		350	31%	2.01	13.41	0.17	0.36	0.35	52	40	0.50	3.34	0.04	0.09	0.09
Total												**18.8**	**42.7**	**0.10**	**4.1**	**2.8**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2015, Cameron Parish, LA, except as noted
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.

Table 9.A.1.2 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 06 PERSONNEL CARRIERS														
All terrain vehicle	Diesel	2270001060	22	21%	690	0.039	0.018	696	225	40	32	1.8E-03	8.1E-04	32
CLASS 11 EARTHMOVING														
Dozer	Diesel	2270002069	159	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	596	0.034	0.015	601	0	40	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	250	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	0	40	-	-	-	-
Motor graders	Diesel	2270002048	183	59%	536	0.030	0.014	541	0	40	-	-	-	-
Loader backhoe	Diesel	2270002066	101	21%	624	0.035	0.016	630	0	40	-	-	-	-
Loader tool carrier	Diesel	2270002066	134	21%	624	0.035	0.016	630	0	40	-	-	-	-
Skidsteer loader	Diesel	2270002072	68	21%	692	0.039	0.018	699	0	40	-	-	-	-
Rubber tire loader	Diesel	2270002060	249	59%	536	0.030	0.014	541	0	40	-	-	-	-
Tractor	Diesel	2270005015	115	59%	536	0.030	0.014	541	0	40	-	-	-	-
CLASS 12 PIPELAYING / TRENCHING EQUI														
Trencher	Diesel	2270002030	51	59%	595	0.034	0.015	601	0	40	-	-	-	-
CLASS 13 COMPACTION														
Soil compactor	Diesel	2270002009	339	43%	589	0.033	0.015	594	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	0	40	-	-	-	-
CLASS 14 CRANES														
Crane crawler	Diesel	2270002045	285	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	300	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	340	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	600	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	500	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane carrydeck	Diesel	2270003010	200	21%	624	0.035	0.016	630	0	40	-	-	-	-
Crane carrydeck	Diesel	2270003010	300	21%	624	0.035	0.016	630	0	40	-	-	-	-
RT crane - 35 ton	Diesel	2270002045	140	43%	530	0.030	0.014	535	4	40	6	3.2E-04	1.4E-04	6
RT crane - 50 ton	Diesel	2270002045	180	43%	530	0.030	0.014	535	0	40	-	-	-	-
RT crane - 66 ton	Diesel	2270002045	220	43%	530	0.030	0.014	535	4	40	9	5.0E-04	2.3E-04	9
RT crane - 75 ton	Diesel	2270002045	220	43%	530	0.030	0.014	535	0	40	-	-	-	-
RT crane - 80 ton	Diesel	2270002045	260	43%	530	0.030	0.014	535	0	40	-	-	-	-

Table 9.A.1.2 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
RT crane - 110 ton	Diesel	2270002045	300	43%	530	0.030	0.014	535	0	40	-	-	-	-
CLASS 15 FORKLIFT														
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	4	40	8	4.8E-04	2.1E-04	9
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	555	0.032	0.013	560	4	40	3	1.7E-04	6.7E-05	3
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	536	0.030	0.014	541	4	40	6	3.2E-04	1.4E-04	6
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	536	0.030	0.014	541	4	40	7	3.8E-04	1.7E-04	7
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	0	40	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	4	40	6	3.2E-04	1.4E-04	6
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	0	40	-	-	-	-
CLASS 16 CONCRETE / AGGREGATE														
Concrete pump	Diesel	2270002042	350	43%	530	0.030	0.013	535	0	40	-	-	-	-
CLASS 17 AIR COMPRESSORS														
Air compressor 185 cfm	Diesel	2270006015	80	43%	589	0.033	0.015	595	0	40	-	-	-	-
Air compressor 250 cfm	Diesel	2270006015	80	43%	589	0.033	0.015	595	0	40	-	-	-	-
Air compressor 375 cfm	Diesel	2270006015	115	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 600 cfm	Diesel	2270006015	250	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 750 cfm	Diesel	2270006015	275	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	310	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	0	40	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	530	0.030	0.014	535	0	40	-	-	-	-
CLASS 25 CABLE LAYING / PULLING EQUIP														
Cable winch	Diesel	2270002081	26	59%	595	0.034	0.015	601	0	40	-	-	-	-
CLASS 52 WELDING EQUIPMENT														
Welder 400A trailer mount	Diesel	2270006025	32	21%	693	0.039	0.018	699	0	40	-	-	-	-
Welder 500A trailer mount	Diesel	2270006025	40	21%	693	0.039	0.018	699	0	40	-	-	-	-
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	692	0.039	0.018	698	0	40	-	-	-	-
CLASS 53 GENERATION EQUIPMENT														
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	4	40	9	5.0E-04	2.3E-04	9
Generator set 800 kW	Diesel	2270006005	1125	0%	-	-	-	-	4	40	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1425	0%	-	-	-	-	9	40	-	-	-	-
Light plant	Diesel	2270002027	14	43%	589	0.033	0.015	594	9	40	1	8.0E-05	3.6E-05	1

Table 9.A.1.2 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 54 MANLIFTS / SCISSORLIFTS														
Manlift - 40 ft	Diesel	2270003010	28	21%	691	0.039	0.018	697	0	40	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	0	40	-	-	-	-
Manlift - 80 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	0	40	-	-	-	-
Manlift - 125 ft	Diesel	2270003010	75	21%	692	0.039	0.018	699	0	40	-	-	-	-
Scissor lift - 60 ft	Diesel	2270003010	31	21%	691	0.039	0.018	697	0	40	-	-	-	-
CLASS 55,56 SMALL CAPITAL EQUIPMENT														
Compactor - 29'' manual	Diesel	2270002003	15	59%	595	0.034	0.015	600	0	40	-	-	-	-
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	1,046	0.060	0.024	1,055	0	40	-	-	-	-
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	589	0.033	0.015	594	0	40	-	-	-	-
Water pump trash 316 gpm	Diesel	2270006010	6.5	43%	588	0.033	0.015	593	0	40	-	-	-	-
Water pump trash 611 gpm	Diesel	2270006010	15	43%	589	0.033	0.015	594	0	40	-	-	-	-
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	0	40	-	-	-	-
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	588	0.033	0.015	593	0	40	-	-	-	-
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	1,046	0.059	0.027	1,056	0	40	-	-	-	-
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	589	0.033	0.015	594	0	40	-	-	-	-
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	589	0.033	0.015	594	0	40	-	-	-	-
Compactor - 16" in manual	Diesel	2270002003	5	59%	595	0.034	0.015	600	0	40	-	-	-	-
Compactor - 26" in manual	Diesel	2270002003	9	59%	595	0.034	0.015	600	0	40	-	-	-	-
Tamper rammer	Diesel	2270002003	9	59%	595	0.034	0.015	600	0	40	-	-	-	-
Mortar mixer	Diesel	2270002042	5	43%	588	0.033	0.015	593	0	40	-	-	-	-
Concrete mixer	Gas	2265002042	5	59%	1,220	0.069	0.028	1,230	0	40	-	-	-	-
Generator set 6 kW	Gas	2265006005	9	68%	1,046	0.060	0.024	1,055	9	40	3	1.4E-04	5.8E-05	3
Generator set 10 kW	Gas	2265006005	15	68%	1,046	0.060	0.024	1,055	9	40	4	2.4E-04	9.6E-05	4
Concrete trowel 36"	Gas	2265002021	5	59%	1,229	0.070	0.028	1,239	0	40	-	-	-	-
SOIL STABLIZATION & SITE PREP														
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	43	40	84	4.8E-03	2.1E-03	86
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	43	40	73	4.2E-03	1.9E-03	75
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	1040	40	3,424	0.19	0.09	3,487
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	87	40	134	0.01	3.4E-03	136
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	87	40	193	0.01	4.9E-03	197

Table 9.A.1.2 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	87	40	34	1.9E-03	8.7E-04	35
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	433	40	2,580	0.15	0.07	2,627
Light plant	Diesel	2270002027	15	43%	589	0.033	0.015	594	867	40	145	0.01	3.7E-03	148
Water truck	Diesel	2270002051	427	59%	536	0.030	0.014	541	43	40	256	0.01	0.01	261
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	208	40	1,001	0.06	0.03	1,019
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	52	40	171	0.01	4.4E-03	174
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	208	40	1,239	0.07	0.03	1,262
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	156	40	305	0.02	0.01	310
Motor graders	Diesel	2270002048	185	59%	536	0.030	0.014	541	104	40	268	0.02	0.01	273
Soil compactor	Diesel	2270002009	228	43%	589	0.033	0.015	594	26	40	66	3.8E-03	1.7E-03	67
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	52	40	89	0.01	2.3E-03	90
Loader tool carrier	Diesel	2270001060	125	21%	624	0.035	0.016	630	26	40	19	1.1E-03	4.8E-04	19
PILE DRIVING														
American 9310	Diesel	2270001060	285	21%	624	0.035	0.016	630	82	40	135	0.01	3.4E-03	138
American 9260	Diesel	2270001060	275	21%	624	0.035	0.016	630	104	40	165	0.01	4.2E-03	168
Pile hammer	Diesel	2270001060	60	21%	692	0.039	0.018	699	82	40	32	1.8E-03	8.0E-04	32
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	61	40	25	1.4E-03	6.5E-04	26
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	61	40	94	0.01	2.4E-03	95
Welder	Diesel	2270001060	50	21%	692	0.039	0.018	699	82	40	26	1.5E-03	6.7E-04	27
Air compressor 185 cfm	Diesel	2270006015	80	43%	589	0.033	0.015	595	82	40	73	4.2E-03	1.9E-03	75
MISCELLANEOUS														
Tugs Twin Screw[4,5]	Diesel		350	31%	925	0.121	0.027	936	52	40	230	0.03	0.01	240
Total											**10,955**	**0.64**	**0.28**	**11,159**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2015, Cameron Parish, LA, except as noted
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.
5. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
6. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.

Table 9.A.1.3 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO[2]	NO_x[2]	SO_2[2]	VOC[2]	PM_{10}/ $PM_{2.5}$[2,3]	weeks	hrs/week	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
CLASS 06 PERSONNEL CARRIERS																
All terrain vehicle	Diesel	2270001060	22	21%	7.26	6.24	4.7E-03	1.77	1.03	1,105	40	1.63	1.41	1.0E-03	0.40	0.23
CLASS 11 EARTHMOVING																
Dozer	Diesel	2270002069	159	59%	0.74	1.70	3.0E-03	0.17	0.18	56	40	0.17	0.39	7.0E-04	0.04	0.04
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	0.47	3.26	3.0E-03	0.15	0.06	104	40	0.03	0.24	2.2E-04	0.01	4.3E-03
Excavator CAT 330BL	Diesel	2270002036	250	59%	0.44	1.34	2.9E-03	0.15	0.08	95	40	0.27	0.83	1.8E-03	0.09	0.05
Excavator CAT 345B	Diesel	2270002036	345	59%	0.77	1.90	3.1E-03	0.15	0.12	43	40	0.30	0.73	1.2E-03	0.06	0.04
Motor graders	Diesel	2270002048	183	59%	0.51	1.52	2.9E-03	0.16	0.10	43	40	0.10	0.31	6.0E-04	0.03	0.02
Loader backhoe	Diesel	2270002066	101	21%	2.33	3.99	3.9E-03	0.61	0.46	113	40	0.25	0.42	4.1E-04	0.06	0.05
Loader tool carrier	Diesel	2270002066	134	21%	2.33	3.99	3.9E-03	0.61	0.46	104	40	0.30	0.52	5.0E-04	0.08	0.06
Skidsteer loader	Diesel	2270002072	68	21%	5.58	5.33	4.4E-03	1.08	0.84	104	40	0.37	0.35	2.9E-04	0.07	0.05
Rubber tire loader	Diesel	2270002060	249	59%	0.63	1.86	3.0E-03	0.18	0.12	104	40	0.42	1.25	2.1E-03	0.12	0.08
Tractor	Diesel	2270005015	115	59%	1.22	3.08	3.3E-03	0.27	0.25	117	40	0.43	1.08	1.1E-03	0.09	0.09
CLASS 12 PIPELAYING / TRENCHING EQUIPMENT																
Trencher	Diesel	2270002030	51	59%	2.44	3.75	3.7E-03	0.29	0.29	35	40	0.11	0.17	1.7E-04	0.01	0.01
CLASS 13 COMPACTION																
Soil compactor	Diesel	2270002009	339	43%	2.48	4.66	4.0E-03	0.51	0.36	69	40	1.10	2.07	1.8E-03	0.23	0.16
Soil compactor	Diesel	2270002009	153	43%	2.48	4.66	4.0E-03	0.51	0.36	69	40	0.50	0.93	7.9E-04	0.10	0.07
CLASS 14 CRANES																
Crane crawler	Diesel	2270002045	285	43%	0.43	1.95	3.0E-03	0.17	0.09	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	300	43%	0.74	2.89	3.2E-03	0.18	0.11	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	340	43%	0.74	2.89	3.2E-03	0.18	0.11	43	40	0.21	0.80	8.8E-04	0.05	0.03
Crane crawler	Diesel	2270002045	600	43%	1.00	2.90	3.2E-03	0.18	0.12	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	500	43%	0.74	2.89	3.2E-03	0.18	0.11	-	40	-	-	-	-	-
Crane carrydeck	Diesel	2270003010	200	21%	2.90	4.95	3.9E-03	0.76	0.50	9	40	0.05	0.08	6.5E-05	0.01	0.01
Crane carrydeck	Diesel	2270003010	300	21%	2.90	4.95	3.9E-03	0.76	0.50	9	40	0.07	0.12	9.8E-05	0.02	0.01
RT crane - 35 ton	Diesel	2270002045	140	43%	0.57	2.14	3.1E-03	0.19	0.14	221	40	0.34	1.25	1.8E-03	0.11	0.08
RT crane - 50 ton	Diesel	2270002045	180	43%	0.43	1.95	3.0E-03	0.17	0.09	225	40	0.33	1.49	2.3E-03	0.13	0.07
RT crane - 66 ton	Diesel	2270002045	220	43%	0.43	1.95	3.0E-03	0.17	0.09	230	40	0.41	1.87	2.9E-03	0.17	0.08
RT crane - 75 ton	Diesel	2270002045	220	43%	0.43	1.95	3.0E-03	0.17	0.09	-	40	-	-	-	-	-
RT crane - 80 ton	Diesel	2270002045	260	43%	0.43	1.95	3.0E-03	0.17	0.09	4	40	0.01	0.04	6.0E-05	3.5E-03	1.7E-03

Table 9.A.1.3 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
RT crane - 110 ton	Diesel	2270002045	300	43%	0.74	2.89	3.2E-03	0.18	0.11	9	40	0.04	0.15	1.6E-04	0.01	0.01
CLASS 15 FORKLIFT																
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	0.30	0.90	2.7E-03	0.14	0.06	169	40	0.20	0.59	1.8E-03	0.09	0.04
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	7.74	1.27	0.01	0.24	0.06	82	40	0.84	0.14	1.2E-03	0.03	0.01
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	0.93	2.30	3.2E-03	0.21	0.21	100	40	0.24	0.60	8.3E-04	0.05	0.05
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	0.30	0.90	2.7E-03	0.14	0.06	69	40	0.06	0.19	5.8E-04	0.03	0.01
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	0.30	0.90	2.7E-03	0.14	0.06	43	40	0.05	0.15	4.5E-04	0.02	0.01
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	0.30	0.90	2.7E-03	0.14	0.06	212	40	0.17	0.49	1.5E-03	0.08	0.03
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	0.30	0.90	2.7E-03	0.14	0.06	191	40	0.15	0.45	1.3E-03	0.07	0.03
CLASS 16 CONCRETE / AGGREGATE																
Concrete pump	Diesel	2270002042	350	43%	1.21	4.17	3.3E-03	0.28	0.17	52	40	0.42	1.44	1.1E-03	0.10	0.06
CLASS 17 AIR COMPRESSORS																
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.69	2.95	3.5E-03	0.27	0.26	182	40	0.47	0.81	9.7E-04	0.07	0.07
Air compressor 250 cfm	Diesel	2270006015	80	43%	1.69	2.95	3.5E-03	0.27	0.26	-	40	-	-	-	-	-
Air compressor 375 cfm	Diesel	2270006015	115	43%	0.65	2.53	3.2E-03	0.22	0.15	-	40	-	-	-	-	-
Air compressor 600 cfm	Diesel	2270006015	250	43%	0.50	2.34	3.1E-03	0.20	0.10	-	40	-	-	-	-	-
Air compressor 750 cfm	Diesel	2270006015	275	43%	0.50	2.34	3.1E-03	0.20	0.10	-	40	-	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	310	43%	0.92	3.30	3.2E-03	0.21	0.14	-	40	-	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	-	-	40	-	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	0.92	3.30	3.2E-03	0.21	0.14	-	40	-	-	-	-	-
CLASS 25 CABLE LAYING / PULLING EQUIPMENT																
Cable winch	Diesel	2270002081	26	59%	0.98	3.81	3.4E-03	0.21	0.15	-	40	-	-	-	-	-
CLASS 52 WELDING EQUIPMENT																
Welder 400A trailer mount	Diesel	2270006025	32	21%	4.09	4.92	4.3E-03	0.93	0.65	381	40	0.46	0.55	4.9E-04	0.11	0.07
Welder 500A trailer mount	Diesel	2270006025	40	21%	4.09	4.92	4.3E-03	0.93	0.65	191	40	0.29	0.35	3.1E-04	0.07	0.05
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	5.60	5.50	4.7E-03	1.25	0.77	87	40	0.06	0.06	4.9E-05	0.01	0.01
CLASS 53 GENERATION EQUIPMENT																
Generator set 150 kW	Diesel	2270006005	221	43%	1.08	3.93	3.3E-03	0.32	0.21	91	40	0.41	1.50	1.2E-03	0.12	0.08
Generator set 800 kW	Diesel	2270006005	1,125	0%	-	-	-	-	-	130	40	-	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1,425	0%	-	-	-	-	-	104	40	-	-	-	-	-
Light plant	Diesel	2270002027	14	43%	2.42	4.59	4.0E-03	0.49	0.35	875	40	0.56	1.07	9.2E-04	0.11	0.08

Table 9.A.1.3 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO[2]	NO_x[2]	SO_2[2]	VOC[2]	PM_{10}/ $PM_{2.5}$[2,3]	weeks	hrs/week	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
CLASS 54 MANLIFTS / SCISSORLIFTS																
Manlift - 40 ft	Diesel	2270003010	28	21%	5.87	5.42	4.4E-03	1.52	0.85	165	40	0.25	0.23	1.9E-04	0.06	0.04
Manlift - 60 ft	Diesel	2270003010	65	21%	5.07	5.47	4.4E-03	1.00	0.72	139	40	0.42	0.46	3.7E-04	0.08	0.06
Manlift - 80 ft	Diesel	2270003010	65	21%	5.07	5.47	4.4E-03	1.00	0.72	191	40	0.58	0.63	5.1E-04	0.12	0.08
Manlift - 125 ft	Diesel	2270003010	75	21%	5.61	5.04	4.3E-03	1.04	0.80	17	40	0.07	0.06	5.1E-05	0.01	0.01
Scissor lift - 60 ft	Diesel	2270003010	31	21%	5.87	5.42	4.4E-03	1.52	0.85	74	40	0.12	0.12	9.3E-05	0.03	0.02
CLASS 55,56 SMALL CAPITAL EQUIPMENT																
Compactor - 29" manual	Diesel	2270002003	15	59%	2.38	4.46	4.0E-03	0.45	0.36	173	40	0.16	0.30	2.7E-04	0.03	0.02
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	287.26	1.90	0.02	4.98	0.11	173	40	24.21	0.16	1.6E-03	0.42	0.01
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	2.36	4.25	3.7E-03	0.47	0.43	208	40	0.74	1.34	1.2E-03	0.15	0.13
Water pump trash 316 gpm	Diesel	2270006010	7	43%	4.49	4.94	4.0E-03	0.67	0.48	312	40	0.17	0.19	1.5E-04	0.03	0.02
Water pump trash 611 gpm	Diesel	2270006010	15	43%	2.59	4.81	4.0E-03	0.55	0.38	156	40	0.11	0.21	1.8E-04	0.02	0.02
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.47	4.38	3.6E-03	0.34	0.28	312	40	0.31	0.91	7.5E-04	0.07	0.06
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	4.49	4.94	4.0E-03	0.67	0.48	208	40	0.09	0.10	7.8E-05	0.01	0.01
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	287.26	1.90	0.02	4.98	0.11	95	40	11.25	0.07	7.5E-04	0.19	4.5E-03
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	2.59	4.81	4.0E-03	0.55	0.38	312	40	0.24	0.46	3.8E-04	0.05	0.04
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	2.59	4.81	4.0E-03	0.55	0.38	312	40	0.35	0.65	5.4E-04	0.08	0.05
Compactor - 16" in manual	Diesel	2270002003	5	59%	2.38	4.46	4.0E-03	0.45	0.36	173	40	0.05	0.10	9.0E-05	0.01	0.01
Compactor - 26" in manual	Diesel	2270002003	9	59%	2.38	4.46	4.0E-03	0.45	0.36	173	40	0.10	0.18	1.6E-04	0.02	0.01
Tamper rammer	Diesel	2270002003	9	59%	2.38	4.46	4.0E-03	0.45	0.36	139	40	0.08	0.15	1.3E-04	0.01	0.01
Mortar mixer	Diesel	2270002042	5	43%	4.69	5.96	4.0E-03	0.85	0.63	121	40	0.05	0.07	4.5E-05	0.01	0.01
Concrete mixer	Gas	2265002042	5	59%	214.92	2.18	0.02	7.23	0.32	173	40	4.84	0.05	5.0E-04	0.16	0.01
Generator set 6 kW	Gas	2265006005	9	68%	288.22	2.00	0.02	5.07	0.11	355	40	27.61	0.19	1.8E-03	0.49	0.01
Generator set 10 kW	Gas	2265006005	15	68%	288.22	2.00	0.02	5.07	0.11	477	40	61.83	0.43	4.1E-03	1.09	0.02
Concrete trowel 36"	Gas	2265002021	5	59%	212.29	2.11	0.02	6.33	0.32	113	40	3.12	0.03	3.3E-04	0.09	4.8E-03
SOIL STABLIZATION & SITE PREP																
CAT D6M dozer	Diesel	2270002069	140	59%	0.74	1.70	3.0E-03	0.17	0.18	17	40	0.05	0.11	1.9E-04	0.01	0.01
Soil compactor	Diesel	2270002009	153	43%	2.48	4.66	4.0E-03	0.51	0.36	17	40	0.12	0.23	2.0E-04	0.03	0.02
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.44	1.34	2.9E-03	0.15	0.08	416	40	1.11	3.43	0.01	0.39	0.20
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.30	0.90	2.7E-03	0.14	0.06	35	40	0.03	0.09	2.7E-04	0.01	0.01
Generator set 150 kW	Diesel	2270006005	221	43%	1.08	3.93	3.3E-03	0.32	0.21	35	40	0.16	0.58	4.8E-04	0.05	0.03

Table 9.A.1.3 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.47	4.38	3.6E-03	0.34	0.28	35	40	0.03	0.10	8.4E-05	0.01	0.01
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.50	1.33	2.9E-03	0.14	0.08	173	40	0.96	2.56	0.01	0.28	0.15
Light plant	Diesel	2270002027	15	43%	2.42	4.59	4.0E-03	0.49	0.35	347	40	0.24	0.45	3.9E-04	0.05	0.03
Water truck	Diesel	2270002051	427	59%	0.50	1.33	2.9E-03	0.14	0.08	17	40	0.09	0.25	5.4E-04	0.03	0.01
Excavator CAT 345B	Diesel	2270002036	345	59%	0.77	1.90	3.1E-03	0.15	0.12	277	40	1.91	4.72	0.01	0.38	0.29
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.44	1.34	2.9E-03	0.15	0.08	69	40	0.18	0.57	1.2E-03	0.06	0.03
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.50	1.33	2.9E-03	0.14	0.08	277	40	1.54	4.09	0.01	0.44	0.24
CAT D6M dozer	Diesel	2270002069	140	59%	0.74	1.70	3.0E-03	0.17	0.18	208	40	0.56	1.29	2.3E-03	0.13	0.13
Motor graders	Diesel	2270002048	185	59%	0.51	1.52	2.9E-03	0.16	0.10	139	40	0.34	1.02	2.0E-03	0.11	0.06
Soil compactor	Diesel	2270002009	228	43%	2.48	4.66	4.0E-03	0.51	0.36	35	40	0.37	0.71	6.0E-04	0.08	0.05
Soil compactor	Diesel	2270002009	153	43%	2.48	4.66	4.0E-03	0.51	0.36	69	40	0.50	0.93	7.9E-04	0.10	0.07
Loader tool carrier	Diesel	2270001060	125	21%	3.22	4.68	3.9E-03	0.78	0.52	35	40	0.13	0.19	1.6E-04	0.03	0.02
PILE DRIVING																
American 9310	Diesel	2270001060	285	21%	2.81	4.44	3.9E-03	0.71	0.44	191	40	1.42	2.24	1.9E-03	0.36	0.22
American 9260	Diesel	2270001060	275	21%	2.81	4.44	3.9E-03	0.71	0.44	234	40	1.67	2.65	2.3E-03	0.42	0.26
Pile hammer	Diesel	2270001060	60	21%	5.40	5.20	4.4E-03	1.03	0.75	191	40	0.57	0.55	4.7E-04	0.11	0.08
Manlift - 60 ft	Diesel	2270003010	65	21%	5.07	5.47	4.4E-03	1.00	0.72	147	40	0.45	0.48	3.9E-04	0.09	0.06
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.30	0.90	2.7E-03	0.14	0.06	147	40	0.13	0.38	1.1E-03	0.06	0.02
Welder	Diesel	2270001060	50	21%	5.40	5.20	4.4E-03	1.03	0.75	191	40	0.48	0.46	3.9E-04	0.09	0.07
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.69	2.95	3.5E-03	0.27	0.26	191	40	0.49	0.85	1.0E-03	0.08	0.07
MISCELLANEOUS																
Tugs Twin Screw[4,5]	Diesel		350	31%	2.01	13.41	0.17	0.36	0.35	104	40	1.00	6.67	0.09	0.18	0.17
Total												**163.1**	**67.6**	**0.18**	**9.7**	**4.9**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2016, Cameron Parish, LA, except as noted
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.

Table 9.A.1.4 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 06 PERSONNEL CARRIERS														
All terrain vehicle	Diesel	2270001060	22	21%	690	0.039	0.018	697	1105	40	155	0.01	4.0E-03	158
CLASS 11 EARTHMOVING														
Dozer	Diesel	2270002069	159	59%	536	0.030	0.014	541	56	40	124	0.01	3.2E-03	126
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	596	0.034	0.015	601	104	40	44	2.5E-03	1.1E-03	44
Excavator CAT 330BL	Diesel	2270002036	250	59%	536	0.030	0.014	541	95	40	331	0.02	0.01	337
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	43	40	207	0.01	0.01	211
Motor graders	Diesel	2270002048	183	59%	536	0.030	0.014	541	43	40	110	0.01	2.8E-03	112
Loader backhoe	Diesel	2270002066	101	21%	625	0.035	0.016	630	113	40	66	3.7E-03	1.7E-03	67
Loader tool carrier	Diesel	2270002066	134	21%	625	0.035	0.016	630	104	40	81	4.6E-03	2.1E-03	82
Skidsteer loader	Diesel	2270002072	68	21%	693	0.039	0.018	699	104	40	45	2.6E-03	1.2E-03	46
Rubber tire loader	Diesel	2270002060	249	59%	536	0.030	0.014	541	104	40	361	0.02	0.01	368
Tractor	Diesel	2270005015	115	59%	536	0.030	0.014	541	117	40	188	0.01	4.8E-03	191
CLASS 12 PIPELAYING / TRENCHING EQUI														
Trencher	Diesel	2270002030	51	59%	595	0.034	0.015	601	35	40	28	1.6E-03	7.0E-04	28
CLASS 13 COMPACTION														
Soil compactor	Diesel	2270002009	339	43%	589	0.033	0.015	594	69	40	261	0.01	0.01	266
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	69	40	118	0.01	3.0E-03	120
CLASS 14 CRANES														
Crane crawler	Diesel	2270002045	285	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	300	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	340	43%	530	0.030	0.014	535	43	40	147	0.01	3.7E-03	150
Crane crawler	Diesel	2270002045	600	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	500	43%	530	0.030	0.014	535	0	40	-	-	-	-
Crane carrydeck	Diesel	2270003010	200	21%	624	0.035	0.016	630	9	40	10	5.9E-04	2.6E-04	11
Crane carrydeck	Diesel	2270003010	300	21%	624	0.035	0.016	630	9	40	16	8.9E-04	4.0E-04	16
RT crane - 35 ton	Diesel	2270002045	140	43%	530	0.030	0.014	535	221	40	311	0.02	0.01	317
RT crane - 50 ton	Diesel	2270002045	180	43%	530	0.030	0.014	535	225	40	407	0.02	0.01	415
RT crane - 66 ton	Diesel	2270002045	220	43%	530	0.030	0.014	535	230	40	509	0.03	0.01	518
RT crane - 75 ton	Diesel	2270002045	220	43%	530	0.030	0.014	535	0	40	-	-	-	-
RT crane - 80 ton	Diesel	2270002045	260	43%	530	0.030	0.014	535	4	40	10	5.9E-04	2.7E-04	11

Table 9.A.1.4 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
RT crane - 110 ton	Diesel	2270002045	300	43%	530	0.030	0.014	535	9	40	27	1.5E-03	6.9E-04	28
CLASS 15 FORKLIFT														
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	169	40	354	0.02	0.01	360
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	554	0.032	0.013	558	82	40	60	3.4E-03	1.4E-03	61
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	536	0.030	0.014	541	100	40	139	0.01	3.6E-03	142
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	536	0.030	0.014	541	69	40	116	0.01	2.9E-03	118
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	43	40	90	0.01	2.3E-03	92
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	212	40	296	0.02	0.01	301
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	191	40	267	0.02	0.01	271
CLASS 16 CONCRETE / AGGREGATE														
Concrete pump	Diesel	2270002042	350	43%	530	0.030	0.014	535	52	40	183	0.01	4.7E-03	186
CLASS 17 AIR COMPRESSORS														
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	182	40	163	0.01	4.1E-03	166
Air compressor 250 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	0	40	-	-	-	-
Air compressor 375 cfm	Diesel	2270006015	115	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 600 cfm	Diesel	2270006015	250	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 750 cfm	Diesel	2270006015	275	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	310	43%	530	0.030	0.014	535	0	40	-	-	-	-
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	0	40	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	530	0.030	0.014	535	0	40	-	-	-	-
CLASS 25 CABLE LAYING / PULLING EQUIP														
Cable winch	Diesel	2270002081	26	59%	595	0.034	0.015	601	0	40	-	-	-	-
CLASS 52 WELDING EQUIPMENT														
Welder 400A trailer mount	Diesel	2270006025	32	21%	693	0.039	0.018	699	381	40	78	4.4E-03	2.0E-03	80
Welder 500A trailer mount	Diesel	2270006025	40	21%	693	0.039	0.018	699	191	40	49	2.8E-03	1.2E-03	50
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	692	0.039	0.018	698	87	40	7	4.1E-04	1.8E-04	7
CLASS 53 GENERATION EQUIPMENT														
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	91	40	202	0.01	0.01	206
Generator set 800 kW	Diesel	2270006005	1125	0%	-	-	-	-	130	40	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1425	0%	-	-	-	-	104	40	-	-	-	-
Light plant	Diesel	2270002027	14	43%	589	0.033	0.015	594	875	40	137	0.01	3.5E-03	139

Table 9.A.1.4 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 54 MANLIFTS / SCISSORLIFTS														
Manlift - 40 ft	Diesel	2270003010	28	21%	691	0.039	0.018	697	165	40	30	1.7E-03	7.5E-04	30
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	139	40	58	3.3E-03	1.5E-03	59
Manlift - 80 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	191	40	80	4.5E-03	2.0E-03	81
Manlift - 125 ft	Diesel	2270003010	75	21%	693	0.039	0.018	699	17	40	8	4.6E-04	2.1E-04	8
Scissor lift - 60 ft	Diesel	2270003010	31	21%	691	0.039	0.018	697	74	40	15	8.3E-04	3.7E-04	15
CLASS 55,56 SMALL CAPITAL EQUIPMENT														
Compactor - 29'' manual	Diesel	2270002003	15	59%	595	0.034	0.015	600	173	40	40	2.3E-03	1.0E-03	41
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	1,046	0.060	0.024	1,055	173	40	88	0.01	2.0E-03	90
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	589	0.033	0.015	594	208	40	186	0.01	4.7E-03	189
Water pump trash 316 gpm	Diesel	2270006010	6.5	43%	588	0.033	0.015	594	312	40	23	1.3E-03	5.8E-04	23
Water pump trash 611 gpm	Diesel	2270006010	15	43%	589	0.033	0.015	594	156	40	26	1.5E-03	6.6E-04	27
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	312	40	122	0.01	3.1E-03	124
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	588	0.033	0.015	594	208	40	12	6.6E-04	3.0E-04	12
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	1,046	0.059	0.027	1,056	95	40	41	2.3E-03	1.0E-03	42
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	589	0.033	0.015	594	312	40	56	3.2E-03	1.4E-03	57
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	589	0.033	0.015	594	312	40	80	4.5E-03	2.0E-03	82
Compactor - 16" in manual	Diesel	2270002003	5	59%	595	0.034	0.015	600	173	40	13	7.6E-04	3.4E-04	14
Compactor - 26" in manual	Diesel	2270002003	9	59%	595	0.034	0.015	600	173	40	24	1.4E-03	6.1E-04	25
Tamper rammer	Diesel	2270002003	9	59%	595	0.034	0.015	600	139	40	19	1.1E-03	4.9E-04	20
Mortar mixer	Diesel	2270002042	5	43%	588	0.033	0.015	593	121	40	7	3.8E-04	1.7E-04	7
Concrete mixer	Gas	2265002042	5	59%	1,226	0.070	0.028	1,236	173	40	28	1.6E-03	6.3E-04	28
Generator set 6 kW	Gas	2265006005	9	68%	1,046	0.060	0.024	1,055	355	40	100	0.01	2.3E-03	102
Generator set 10 kW	Gas	2265006005	15	68%	1,046	0.060	0.024	1,055	477	40	225	0.01	0.01	229
Concrete trowel 36"	Gas	2265002021	5	59%	1,229	0.070	0.028	1,239	113	40	18	1.0E-03	4.1E-04	18
SOIL STABLIZATION & SITE PREP														
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	17	40	33	1.9E-03	8.5E-04	34
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	17	40	29	1.6E-03	7.4E-04	30
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	416	40	1,370	0.08	0.03	1,395
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	35	40	54	3.1E-03	1.4E-03	55
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	35	40	78	4.4E-03	2.0E-03	79

Table 9.A.1.4 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	35	40	14	7.8E-04	3.5E-04	14
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	173	40	1,031	0.06	0.03	1,049
Light plant	Diesel	2270002027	15	43%	589	0.033	0.015	594	347	40	58	3.3E-03	1.5E-03	59
Water truck	Diesel	2270002051	427	59%	536	0.030	0.014	541	17	40	101	0.01	2.6E-03	103
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	277	40	1,333	0.08	0.03	1,358
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	69	40	227	0.01	0.01	231
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	277	40	1,650	0.09	0.04	1,680
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	208	40	406	0.02	0.01	414
Motor graders	Diesel	2270002048	185	59%	536	0.030	0.014	541	139	40	359	0.02	0.01	365
Soil compactor	Diesel	2270002009	228	43%	589	0.033	0.015	594	35	40	89	0.01	2.3E-03	91
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	69	40	118	0.01	3.0E-03	120
Loader tool carrier	Diesel	2270001060	125	21%	624	0.035	0.016	630	35	40	25	1.4E-03	6.4E-04	26
PILE DRIVING														
American 9310	Diesel	2270001060	285	21%	624	0.035	0.016	630	191	40	315	0.02	0.01	320
American 9260	Diesel	2270001060	275	21%	624	0.035	0.016	630	234	40	372	0.02	0.01	379
Pile hammer	Diesel	2270001060	60	21%	693	0.039	0.018	699	191	40	74	4.2E-03	1.9E-03	75
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	147	40	61	3.5E-03	1.6E-03	62
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	147	40	226	0.01	0.01	230
Welder	Diesel	2270001060	50	21%	693	0.039	0.018	699	191	40	61	3.5E-03	1.6E-03	62
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	191	40	171	0.01	4.3E-03	174
MISCELLANEOUS														
Tugs Twin Screw[4,5]	Diesel		350	31%	925	0.121	0.027	936	104	40	460	0.06	0.01	479
Total											**15,709**	**0.93**	**0.40**	**16,005**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2016, Cameron Parish, LA, except as noted
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.
5. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
6. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.

Table 9.A.1.5 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
CLASS 06 PERSONNEL CARRIERS																
All terrain vehicle	Diesel	2270001060	22	21%	6.87	6.09	4.7E-03	1.66	0.98	1,564	40	2.19	1.94	1.5E-03	0.53	0.31
CLASS 11 EARTHMOVING																
Dozer	Diesel	2270002069	159	59%	0.61	1.41	2.9E-03	0.16	0.14	104	40	0.26	0.61	1.3E-03	0.07	0.06
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	0.35	3.13	3.0E-03	0.14	0.04	208	40	0.05	0.46	4.3E-04	0.02	0.01
Excavator CAT 330BL	Diesel	2270002036	250	59%	0.32	1.07	2.8E-03	0.15	0.05	156	40	0.33	1.09	2.8E-03	0.15	0.06
Excavator CAT 345B	Diesel	2270002036	345	59%	0.66	1.63	3.0E-03	0.15	0.10	52	40	0.31	0.76	1.4E-03	0.07	0.05
Motor graders	Diesel	2270002048	183	59%	0.41	1.25	2.8E-03	0.15	0.07	104	40	0.20	0.62	1.4E-03	0.08	0.04
Loader backhoe	Diesel	2270002066	101	21%	2.13	3.66	3.8E-03	0.56	0.43	208	40	0.42	0.71	7.4E-04	0.11	0.08
Loader tool carrier	Diesel	2270002066	134	21%	2.13	3.66	3.8E-03	0.56	0.43	208	40	0.55	0.94	9.8E-04	0.14	0.11
Skidsteer loader	Diesel	2270002072	68	21%	5.24	5.15	4.4E-03	1.00	0.78	208	40	0.69	0.67	5.7E-04	0.13	0.10
Rubber tire loader	Diesel	2270002060	249	59%	0.54	1.60	3.0E-03	0.17	0.10	208	40	0.73	2.16	4.0E-03	0.22	0.14
Tractor	Diesel	2270005015	115	59%	1.11	2.79	3.2E-03	0.25	0.23	208	40	0.69	1.73	2.0E-03	0.16	0.14
CLASS 12 PIPELAYING / TRENCHING EQUIPMENT																
Trencher	Diesel	2270002030	51	59%	2.20	3.61	3.6E-03	0.26	0.25	35	40	0.10	0.17	1.7E-04	0.01	0.01
CLASS 13 COMPACTION																
Soil compactor	Diesel	2270002009	339	43%	2.44	4.61	4.0E-03	0.49	0.36	104	40	1.63	3.08	2.7E-03	0.33	0.24
Soil compactor	Diesel	2270002009	153	43%	2.44	4.61	4.0E-03	0.49	0.36	104	40	0.74	1.39	1.2E-03	0.15	0.11
CLASS 14 CRANES																
Crane crawler	Diesel	2270002045	285	43%	0.37	1.67	3.0E-03	0.17	0.07	69	40	0.14	0.62	1.1E-03	0.06	0.03
Crane crawler	Diesel	2270002045	300	43%	0.67	2.58	3.1E-03	0.18	0.10	69	40	0.26	1.01	1.2E-03	0.07	0.04
Crane crawler	Diesel	2270002045	340	43%	0.67	2.58	3.1E-03	0.18	0.10	312	40	1.34	5.20	0.01	0.35	0.20
Crane crawler	Diesel	2270002045	600	43%	0.92	2.60	3.1E-03	0.17	0.11	43	40	0.45	1.27	1.5E-03	0.08	0.05
Crane crawler	Diesel	2270002045	500	43%	0.67	2.58	3.1E-03	0.18	0.10	87	40	0.55	2.13	2.6E-03	0.15	0.08
Crane carrydeck	Diesel	2270003010	200	21%	2.68	4.60	3.9E-03	0.71	0.47	165	40	0.82	1.41	1.2E-03	0.22	0.14
Crane carrydeck	Diesel	2270003010	300	21%	2.68	4.60	3.9E-03	0.71	0.47	165	40	1.23	2.11	1.8E-03	0.33	0.22
RT crane - 35 ton	Diesel	2270002045	140	43%	0.50	1.82	3.0E-03	0.18	0.12	390	40	0.52	1.88	3.1E-03	0.18	0.13
RT crane - 50 ton	Diesel	2270002045	180	43%	0.37	1.67	3.0E-03	0.17	0.07	572	40	0.72	3.26	0.01	0.32	0.14
RT crane - 66 ton	Diesel	2270002045	220	43%	0.37	1.67	3.0E-03	0.17	0.07	572	40	0.88	3.99	0.01	0.40	0.18
RT crane - 75 ton	Diesel	2270002045	220	43%	0.37	1.67	3.0E-03	0.17	0.07	329	40	0.51	2.29	4.1E-03	0.23	0.10
RT crane - 80 ton	Diesel	2270002045	260	43%	0.37	1.67	3.0E-03	0.17	0.07	100	40	0.18	0.82	1.5E-03	0.08	0.04

Table 9.A.1.5 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
RT crane - 110 ton	Diesel	2270002045	300	43%	0.67	2.58	3.1E-03	0.18	0.10	52	40	0.20	0.76	9.2E-04	0.05	0.03
CLASS 15 FORKLIFT																
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	0.23	0.65	2.7E-03	0.14	0.04	312	40	0.28	0.79	3.2E-03	0.17	0.04
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	6.80	1.14	0.01	0.20	0.06	104	40	0.94	0.16	1.5E-03	0.03	0.01
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	0.82	1.99	3.1E-03	0.19	0.19	156	40	0.33	0.81	1.3E-03	0.08	0.08
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	0.23	0.65	2.7E-03	0.14	0.04	104	40	0.07	0.21	8.6E-04	0.04	0.01
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	0.23	0.65	2.7E-03	0.14	0.04	104	40	0.09	0.26	1.1E-03	0.06	0.01
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	0.23	0.65	2.7E-03	0.14	0.04	312	40	0.18	0.52	2.2E-03	0.11	0.03
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	0.23	0.65	2.7E-03	0.14	0.04	416	40	0.25	0.70	2.9E-03	0.15	0.04
CLASS 16 CONCRETE / AGGREGATE																
Concrete pump	Diesel	2270002042	350	43%	1.11	3.88	3.2E-03	0.26	0.15	152	40	1.12	3.91	3.3E-03	0.26	0.16
CLASS 17 AIR COMPRESSORS																
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.53	2.60	3.4E-03	0.25	0.22	407	40	0.95	1.61	2.1E-03	0.15	0.14
Air compressor 250 cfm	Diesel	2270006015	80	43%	1.53	2.60	3.4E-03	0.25	0.22	312	40	0.72	1.23	1.6E-03	0.12	0.11
Air compressor 375 cfm	Diesel	2270006015	115	43%	0.58	2.23	3.1E-03	0.20	0.14	312	40	0.40	1.52	2.1E-03	0.14	0.09
Air compressor 600 cfm	Diesel	2270006015	250	43%	0.45	2.05	3.0E-03	0.19	0.09	104	40	0.22	1.01	1.5E-03	0.09	0.04
Air compressor 750 cfm	Diesel	2270006015	275	43%	0.45	2.05	3.0E-03	0.19	0.09	104	40	0.24	1.11	1.6E-03	0.10	0.05
Air compressor 900 cfm	Diesel	2270006015	310	43%	0.83	3.02	3.2E-03	0.20	0.13	104	40	0.51	1.85	1.9E-03	0.12	0.08
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	-	52	40	-	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	0.83	3.02	3.2E-03	0.20	0.13	69	40	0.55	1.98	2.1E-03	0.13	0.08
CLASS 25 CABLE LAYING / PULLING EQUIPMENT																
Cable winch	Diesel	2270002081	26	59%	0.80	3.61	3.3E-03	0.19	0.12	234	40	0.13	0.57	5.2E-04	0.03	0.02
CLASS 52 WELDING EQUIPMENT																
Welder 400A trailer mount	Diesel	2270006025	32	21%	3.59	4.72	4.3E-03	0.80	0.57	2,288	40	2.43	3.20	2.9E-03	0.54	0.39
Welder 500A trailer mount	Diesel	2270006025	40	21%	3.59	4.72	4.3E-03	0.80	0.57	1,144	40	1.52	2.00	1.8E-03	0.34	0.24
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	5.15	5.33	4.7E-03	1.12	0.71	52	40	0.03	0.03	2.9E-05	0.01	4.4E-03
CLASS 53 GENERATION EQUIPMENT																
Generator set 150 kW	Diesel	2270006005	221	43%	0.98	3.65	3.2E-03	0.30	0.19	104	40	0.43	1.59	1.4E-03	0.13	0.08
Generator set 800 kW	Diesel	2270006005	1,125	0%	-	-	-	-	-	156	40	-	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1,425	0%	-	-	-	-	-	104	40	-	-	-	-	-
Light plant	Diesel	2270002027	14	43%	2.40	4.55	4.0E-03	0.47	0.35	2,513	40	1.60	3.03	2.6E-03	0.32	0.23

Table 9.A.1.5 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO[2]	NO_x[2]	SO_2[2]	VOC[2]	PM_{10}/ $PM_{2.5}$[2,3]	weeks	hrs/week	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
CLASS 54 MANLIFTS / SCISSORLIFTS																
Manlift - 40 ft	Diesel	2270003010	28	21%	5.44	5.26	4.3E-03	1.39	0.79	849	40	1.20	1.16	9.6E-04	0.31	0.17
Manlift - 60 ft	Diesel	2270003010	65	21%	4.77	5.27	4.4E-03	0.93	0.67	685	40	1.97	2.17	1.8E-03	0.38	0.28
Manlift - 80 ft	Diesel	2270003010	65	21%	4.77	5.27	4.4E-03	0.93	0.67	1,014	40	2.91	3.22	2.7E-03	0.57	0.41
Manlift - 125 ft	Diesel	2270003010	75	21%	5.30	4.72	4.3E-03	0.97	0.75	243	40	0.89	0.80	7.2E-04	0.16	0.13
Scissor lift - 60 ft	Diesel	2270003010	31	21%	5.44	5.26	4.3E-03	1.39	0.79	273	40	0.43	0.41	3.4E-04	0.11	0.06
CLASS 55,56 SMALL CAPITAL EQUIPMENT																
Compactor - 29" manual	Diesel	2270002003	15	59%	2.37	4.46	4.0E-03	0.45	0.36	416	40	0.38	0.72	6.5E-04	0.07	0.06
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	286.01	1.81	0.02	4.85	0.11	312	40	43.48	0.28	2.9E-03	0.74	0.02
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	2.21	3.98	3.6E-03	0.44	0.40	416	40	1.40	2.51	2.3E-03	0.28	0.25
Water pump trash 316 gpm	Diesel	2270006010	7	43%	4.47	4.82	4.0E-03	0.65	0.46	416	40	0.23	0.25	2.0E-04	0.03	0.02
Water pump trash 611 gpm	Diesel	2270006010	15	43%	2.54	4.74	4.0E-03	0.53	0.37	208	40	0.15	0.28	2.3E-04	0.03	0.02
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.32	4.23	3.6E-03	0.31	0.25	416	40	0.36	1.17	9.8E-04	0.09	0.07
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	4.47	4.82	4.0E-03	0.65	0.46	416	40	0.18	0.19	1.6E-04	0.03	0.02
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	286.01	1.81	0.02	4.85	0.11	104	40	12.26	0.08	8.2E-04	0.21	4.9E-03
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	2.54	4.74	4.0E-03	0.53	0.37	416	40	0.32	0.60	5.0E-04	0.07	0.05
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	2.54	4.74	4.0E-03	0.53	0.37	416	40	0.46	0.86	7.2E-04	0.10	0.07
Compactor - 16" in manual	Diesel	2270002003	5	59%	2.37	4.46	4.0E-03	0.45	0.36	416	40	0.13	0.24	2.2E-04	0.02	0.02
Compactor - 26" in manual	Diesel	2270002003	9	59%	2.37	4.46	4.0E-03	0.45	0.36	416	40	0.23	0.43	3.9E-04	0.04	0.03
Tamper rammer	Diesel	2270002003	9	59%	2.37	4.46	4.0E-03	0.45	0.36	208	40	0.12	0.22	2.0E-04	0.02	0.02
Mortar mixer	Diesel	2270002042	5	43%	4.65	5.76	4.0E-03	0.81	0.60	208	40	0.09	0.11	7.8E-05	0.02	0.01
Concrete mixer	Gas	2265002042	5	59%	212.79	2.12	0.02	6.62	0.31	208	40	5.76	0.06	6.1E-04	0.18	0.01
Generator set 6 kW	Gas	2265006005	9	68%	286.71	1.89	0.02	4.92	0.11	416	40	32.18	0.21	2.1E-03	0.55	0.01
Generator set 10 kW	Gas	2265006005	15	68%	286.71	1.89	0.02	4.92	0.11	1,248	40	160.92	1.06	0.01	2.76	0.06
Concrete trowel 36"	Gas	2265002021	5	59%	212.19	2.11	0.02	6.30	0.32	182	40	5.02	0.05	5.3E-04	0.15	0.01
SOIL STABLIZATION & SITE PREP																
CAT D6M dozer	Diesel	2270002069	140	59%	0.61	1.41	2.9E-03	0.16	0.14	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	2.44	4.61	4.0E-03	0.49	0.36	-	40	-	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.32	1.07	2.8E-03	0.15	0.05	-	40	-	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.23	0.65	2.7E-03	0.14	0.04	-	40	-	-	-	-	-
Generator set 150 kW	Diesel	2270006005	221	43%	0.98	3.65	3.2E-03	0.30	0.19	-	40	-	-	-	-	-

Table 9.A.1.5 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	PM_{10}/ $PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.32	4.23	3.6E-03	0.31	0.25	-	40	-	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.37	1.06	2.8E-03	0.14	0.05	-	40	-	-	-	-	-
Light plant	Diesel	2270002027	15	43%	2.40	4.55	4.0E-03	0.47	0.35	-	40	-	-	-	-	-
Water truck	Diesel	2270002051	427	59%	0.37	1.06	2.8E-03	0.14	0.05	-	40	-	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	0.66	1.63	3.0E-03	0.15	0.10	-	40	-	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.32	1.07	2.8E-03	0.15	0.05	-	40	-	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.37	1.06	2.8E-03	0.14	0.05	-	40	-	-	-	-	-
CAT D6M dozer	Diesel	2270002069	140	59%	0.61	1.41	2.9E-03	0.16	0.14	-	40	-	-	-	-	-
Motor graders	Diesel	2270002048	185	59%	0.41	1.25	2.8E-03	0.15	0.07	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	228	43%	2.44	4.61	4.0E-03	0.49	0.36	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	2.44	4.61	4.0E-03	0.49	0.36	-	40	-	-	-	-	-
Loader tool carrier	Diesel	2270001060	125	21%	2.96	4.37	3.9E-03	0.73	0.49	-	40	-	-	-	-	-
PILE DRIVING																
American 9310	Diesel	2270001060	285	21%	2.56	4.14	3.8E-03	0.66	0.41	-	40	-	-	-	-	-
American 9260	Diesel	2270001060	275	21%	2.56	4.14	3.8E-03	0.66	0.41	-	40	-	-	-	-	-
Pile hammer	Diesel	2270001060	60	21%	5.06	5.03	4.4E-03	0.95	0.69	-	40	-	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	4.77	5.27	4.4E-03	0.93	0.67	-	40	-	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.23	0.65	2.7E-03	0.14	0.04	-	40	-	-	-	-	-
Welder	Diesel	2270001060	50	21%	5.06	5.03	4.4E-03	0.95	0.69	-	40	-	-	-	-	-
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.53	2.60	3.4E-03	0.25	0.22	-	40	-	-	-	-	-
MISCELLANEOUS																
Tugs Twin Screw[4,5]	Diesel		350	31%	2.01	13.41	0.17	0.36	0.35	87	40	0.84	5.58	0.07	0.15	0.15
Total												**301.6**	**93.8**	**0.20**	**14.9**	**6.7**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2017, Cameron Parish, LA, except as noted
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.

Table 9.A.1.6 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 06 PERSONNEL CARRIERS														
All terrain vehicle	Diesel	2270001060	22	21%	691	0.039	0.018	697	1564	40	220	0.01	0.01	224
CLASS 11 EARTHMOVING														
Dozer	Diesel	2270002069	159	59%	536	0.030	0.014	541	104	40	231	0.01	0.01	235
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	596	0.034	0.015	601	208	40	87	4.9E-03	2.2E-03	89
Excavator CAT 330BL	Diesel	2270002036	250	59%	536	0.030	0.014	541	156	40	544	0.03	0.01	554
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	52	40	250	0.01	0.01	255
Motor graders	Diesel	2270002048	183	59%	536	0.030	0.014	541	104	40	266	0.02	0.01	270
Loader backhoe	Diesel	2270002066	101	21%	625	0.035	0.016	630	208	40	122	0.01	3.1E-03	124
Loader tool carrier	Diesel	2270002066	134	21%	625	0.035	0.016	630	208	40	161	0.01	4.1E-03	164
Skidsteer loader	Diesel	2270002072	68	21%	693	0.039	0.018	699	208	40	91	0.01	2.3E-03	92
Rubber tire loader	Diesel	2270002060	249	59%	536	0.030	0.014	541	208	40	723	0.04	0.02	736
Tractor	Diesel	2270005015	115	59%	536	0.030	0.014	541	208	40	334	0.02	0.01	340
CLASS 12 PIPELAYING / TRENCHING EQUI														
Trencher	Diesel	2270002030	51	59%	595	0.034	0.015	601	35	40	28	1.6E-03	7.0E-04	28
CLASS 13 COMPACTION														
Soil compactor	Diesel	2270002009	339	43%	589	0.033	0.015	594	104	40	394	0.02	0.01	401
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	104	40	178	0.01	4.5E-03	181
CLASS 14 CRANES														
Crane crawler	Diesel	2270002045	285	43%	531	0.030	0.014	535	69	40	198	0.01	0.01	201
Crane crawler	Diesel	2270002045	300	43%	530	0.030	0.014	535	69	40	208	0.01	0.01	212
Crane crawler	Diesel	2270002045	340	43%	530	0.030	0.014	535	312	40	1,067	0.06	0.03	1,086
Crane crawler	Diesel	2270002045	600	43%	530	0.030	0.014	535	43	40	259	0.01	0.01	264
Crane crawler	Diesel	2270002045	500	43%	530	0.030	0.014	535	87	40	438	0.02	0.01	445
Crane carrydeck	Diesel	2270003010	200	21%	624	0.035	0.016	630	165	40	191	0.01	4.9E-03	194
Crane carrydeck	Diesel	2270003010	300	21%	624	0.035	0.016	630	165	40	286	0.02	0.01	291
RT crane - 35 ton	Diesel	2270002045	140	43%	530	0.030	0.014	535	390	40	549	0.03	0.01	559
RT crane - 50 ton	Diesel	2270002045	180	43%	531	0.030	0.014	535	572	40	1,036	0.06	0.03	1,054
RT crane - 66 ton	Diesel	2270002045	220	43%	531	0.030	0.014	535	572	40	1,266	0.07	0.03	1,289
RT crane - 75 ton	Diesel	2270002045	220	43%	531	0.030	0.014	535	329	40	728	0.04	0.02	741
RT crane - 80 ton	Diesel	2270002045	260	43%	531	0.030	0.014	535	100	40	262	0.01	0.01	266

Table 9.A.1.6 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
RT crane - 110 ton	Diesel	2270002045	300	43%	530	0.030	0.014	535	52	40	157	0.01	4.0E-03	160
CLASS 15 FORKLIFT														
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	312	40	653	0.04	0.02	665
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	553	0.031	0.013	557	104	40	76	4.3E-03	1.7E-03	77
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	536	0.030	0.014	541	156	40	218	0.01	0.01	222
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	536	0.030	0.014	541	104	40	174	0.01	4.4E-03	177
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	104	40	218	0.01	0.01	222
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	312	40	435	0.02	0.01	443
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	416	40	580	0.03	0.01	591
CLASS 16 CONCRETE / AGGREGATE														
Concrete pump	Diesel	2270002042	350	43%	530	0.030	0.014	535	152	40	535	0.03	0.01	545
CLASS 17 AIR COMPRESSORS														
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	407	40	364	0.02	0.01	371
Air compressor 250 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	312	40	279	0.02	0.01	284
Air compressor 375 cfm	Diesel	2270006015	115	43%	530	0.030	0.014	535	312	40	361	0.02	0.01	367
Air compressor 600 cfm	Diesel	2270006015	250	43%	530	0.030	0.014	535	104	40	261	0.01	0.01	266
Air compressor 750 cfm	Diesel	2270006015	275	43%	530	0.030	0.014	535	104	40	288	0.02	0.01	293
Air compressor 900 cfm	Diesel	2270006015	310	43%	530	0.030	0.014	535	104	40	324	0.02	0.01	330
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	52	40	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	530	0.030	0.014	535	69	40	347	0.02	0.01	353
CLASS 25 CABLE LAYING / PULLING EQUIP														
Cable winch	Diesel	2270002081	26	59%	596	0.034	0.015	601	234	40	94	0.01	2.4E-03	96
CLASS 52 WELDING EQUIPMENT														
Welder 400A trailer mount	Diesel	2270006025	32	21%	693	0.039	0.018	700	2288	40	470	0.03	0.01	479
Welder 500A trailer mount	Diesel	2270006025	40	21%	693	0.039	0.018	700	1144	40	294	0.02	0.01	299
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	692	0.039	0.018	699	52	40	4	2.5E-04	1.1E-04	4
CLASS 53 GENERATION EQUIPMENT														
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	104	40	231	0.01	0.01	235
Generator set 800 kW	Diesel	2270006005	1125	0%	-	-	-	-	156	40	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1425	0%	-	-	-	-	104	40	-	-	-	-
Light plant	Diesel	2270002027	14	43%	589	0.033	0.015	594	2513	40	393	0.02	0.01	400

Table 9.A.1.6 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 54 MANLIFTS / SCISSORLIFTS														
Manlift - 40 ft	Diesel	2270003010	28	21%	692	0.039	0.018	698	849	40	152	0.01	3.9E-03	155
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	685	40	286	0.02	0.01	291
Manlift - 80 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	1014	40	423	0.02	0.01	431
Manlift - 125 ft	Diesel	2270003010	75	21%	693	0.039	0.018	699	243	40	117	0.01	3.0E-03	119
Scissor lift - 60 ft	Diesel	2270003010	31	21%	692	0.039	0.018	698	273	40	54	3.1E-03	1.4E-03	55
CLASS 55,56 SMALL CAPITAL EQUIPMENT														
Compactor - 29'' manual	Diesel	2270002003	15	59%	595	0.034	0.015	600	416	40	97	0.01	2.5E-03	98
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	1,047	0.060	0.024	1,055	312	40	159	0.01	3.6E-03	162
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	589	0.033	0.015	594	416	40	372	0.02	0.01	378
Water pump trash 316 gpm	Diesel	2270006010	6.5	43%	588	0.033	0.015	594	416	40	30	1.7E-03	7.7E-04	31
Water pump trash 611 gpm	Diesel	2270006010	15	43%	589	0.033	0.015	594	208	40	35	2.0E-03	8.9E-04	35
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	416	40	163	0.01	4.1E-03	166
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	588	0.033	0.015	594	416	40	23	1.3E-03	5.9E-04	24
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	1,047	0.059	0.027	1,056	104	40	45	2.5E-03	1.1E-03	46
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	589	0.033	0.015	594	416	40	74	4.2E-03	1.9E-03	76
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	589	0.033	0.015	594	416	40	107	0.01	2.7E-03	109
Compactor - 16" in manual	Diesel	2270002003	5	59%	595	0.034	0.015	600	416	40	32	1.8E-03	8.2E-04	33
Compactor - 26" in manual	Diesel	2270002003	9	59%	595	0.034	0.015	600	416	40	58	3.3E-03	1.5E-03	59
Tamper rammer	Diesel	2270002003	9	59%	595	0.034	0.015	600	208	40	29	1.6E-03	7.4E-04	29
Mortar mixer	Diesel	2270002042	5	43%	588	0.033	0.015	593	208	40	12	6.6E-04	3.0E-04	12
Concrete mixer	Gas	2265002042	5	59%	1,228	0.070	0.028	1,238	208	40	33	1.9E-03	7.6E-04	34
Generator set 6 kW	Gas	2265006005	9	68%	1,047	0.060	0.024	1,055	416	40	117	0.01	2.7E-03	120
Generator set 10 kW	Gas	2265006005	15	68%	1,047	0.060	0.024	1,055	1248	40	587	0.03	0.01	598
Concrete trowel 36"	Gas	2265002021	5	59%	1,229	0.070	0.028	1,239	182	40	29	1.7E-03	6.6E-04	30
SOIL STABLIZATION & SITE PREP														
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	0	40	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	0	40	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	0	40	-	-	-	-
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	0	40	-	-	-	-

Table 9.A.1.6 - Liquefaction and CCTPL Expansion Project
2017 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6 (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	0	40	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
Light plant	Diesel	2270002027	15	43%	589	0.033	0.015	594	0	40	-	-	-	-
Water truck	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	0	40	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	0	40	-	-	-	-
Motor graders	Diesel	2270002048	185	59%	536	0.030	0.014	541	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	228	43%	589	0.033	0.015	594	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	0	40	-	-	-	-
Loader tool carrier	Diesel	2270001060	125	21%	624	0.035	0.016	630	0	40	-	-	-	-
PILE DRIVING														
American 9310	Diesel	2270001060	285	21%	624	0.035	0.016	630	0	40	-	-	-	-
American 9260	Diesel	2270001060	275	21%	624	0.035	0.016	630	0	40	-	-	-	-
Pile hammer	Diesel	2270001060	60	21%	693	0.039	0.018	699	0	40	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	699	0	40	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	0	40	-	-	-	-
Welder	Diesel	2270001060	50	21%	693	0.039	0.018	699	0	40	-	-	-	-
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	0	40	-	-	-	-
MISCELLANEOUS														
Tugs Twin Screw[4,5]	Diesel		350	31%	925	0.121	0.027	936	87	40	385	0.05	0.01	401
Total											**20,289**	**1.18**	**0.52**	**20,666**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2017, Cameron Parish, LA, except as noted
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.
5. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
6. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.

Table 9.A.1.7 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
CLASS 06 PERSONNEL CARRIERS																
All terrain vehicle	Diesel	2270001060	22	21%	6.49	5.94	4.7E-03	1.55	0.92	1,504	40	1.99	1.82	1.4E-03	0.47	0.28
CLASS 11 EARTHMOVING																
Dozer	Diesel	2270002069	159	59%	0.49	1.16	2.9E-03	0.15	0.11	91	40	0.19	0.43	1.1E-03	0.06	0.04
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	0.30	3.07	2.9E-03	0.14	0.03	182	40	0.04	0.39	3.7E-04	0.02	3.8E-03
Excavator CAT 330BL	Diesel	2270002036	250	59%	0.23	0.83	2.7E-03	0.14	0.03	113	40	0.17	0.61	2.0E-03	0.10	0.03
Excavator CAT 345B	Diesel	2270002036	345	59%	0.56	1.40	2.9E-03	0.15	0.08	4	40	0.02	0.05	1.0E-04	0.01	3.0E-03
Motor graders	Diesel	2270002048	183	59%	0.31	1.01	2.8E-03	0.15	0.05	91	40	0.13	0.44	1.2E-03	0.06	0.02
Loader backhoe	Diesel	2270002066	101	21%	1.96	3.34	3.7E-03	0.52	0.40	208	40	0.38	0.65	7.3E-04	0.10	0.08
Loader tool carrier	Diesel	2270002066	134	21%	1.96	3.34	3.7E-03	0.52	0.40	208	40	0.51	0.86	9.7E-04	0.13	0.10
Skidsteer loader	Diesel	2270002072	68	21%	4.90	4.98	4.3E-03	0.93	0.72	208	40	0.64	0.65	5.6E-04	0.12	0.09
Rubber tire loader	Diesel	2270002060	249	59%	0.46	1.36	2.9E-03	0.16	0.09	208	40	0.62	1.83	3.9E-03	0.21	0.11
Tractor	Diesel	2270005015	115	59%	1.01	2.50	3.2E-03	0.23	0.21	208	40	0.63	1.56	2.0E-03	0.15	0.13
CLASS 12 PIPELAYING / TRENCHING EQUIPMENT																
Trencher	Diesel	2270002030	51	59%	1.96	3.50	3.5E-03	0.24	0.22	-	40	-	-	-	-	-
CLASS 13 COMPACTION																
Soil compactor	Diesel	2270002009	339	43%	2.41	4.56	4.0E-03	0.48	0.35	91	40	1.41	2.67	2.3E-03	0.28	0.21
Soil compactor	Diesel	2270002009	153	43%	2.41	4.56	4.0E-03	0.48	0.35	91	40	0.64	1.20	1.0E-03	0.13	0.09
CLASS 14 CRANES																
Crane crawler	Diesel	2270002045	285	43%	0.32	1.43	2.9E-03	0.16	0.06	91	40	0.16	0.70	1.4E-03	0.08	0.03
Crane crawler	Diesel	2270002045	300	43%	0.60	2.31	3.1E-03	0.17	0.09	91	40	0.31	1.20	1.6E-03	0.09	0.05
Crane crawler	Diesel	2270002045	340	43%	0.60	2.31	3.1E-03	0.17	0.09	295	40	1.15	4.40	0.01	0.32	0.17
Crane crawler	Diesel	2270002045	600	43%	0.84	2.31	3.1E-03	0.17	0.09	87	40	0.83	2.29	3.0E-03	0.16	0.09
Crane crawler	Diesel	2270002045	500	43%	0.60	2.31	3.1E-03	0.17	0.09	87	40	0.50	1.91	2.5E-03	0.14	0.07
Crane carrydeck	Diesel	2270003010	200	21%	2.46	4.27	3.8E-03	0.66	0.44	173	40	0.79	1.37	1.2E-03	0.21	0.14
Crane carrydeck	Diesel	2270003010	300	21%	2.46	4.27	3.8E-03	0.66	0.44	173	40	1.18	2.05	1.8E-03	0.32	0.21
RT crane - 35 ton	Diesel	2270002045	140	43%	0.44	1.55	3.0E-03	0.17	0.11	347	40	0.40	1.43	2.7E-03	0.15	0.10
RT crane - 50 ton	Diesel	2270002045	180	43%	0.32	1.43	2.9E-03	0.16	0.06	451	40	0.49	2.20	4.4E-03	0.24	0.10
RT crane - 66 ton	Diesel	2270002045	220	43%	0.32	1.43	2.9E-03	0.16	0.06	451	40	0.60	2.69	0.01	0.30	0.12
RT crane - 75 ton	Diesel	2270002045	220	43%	0.32	1.43	2.9E-03	0.16	0.06	260	40	0.34	1.55	3.1E-03	0.17	0.07
RT crane - 80 ton	Diesel	2270002045	260	43%	0.32	1.43	2.9E-03	0.16	0.06	82	40	0.13	0.58	1.2E-03	0.06	0.03

Table 9.A.1.7 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO[2]	NO_x[2]	SO_2[2]	VOC[2]	PM_{10}/ $PM_{2.5}$[2,3]	weeks	hrs/week	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
RT crane - 110 ton	Diesel	2270002045	300	43%	0.60	2.31	3.1E-03	0.17	0.09	52	40	0.18	0.68	9.1E-04	0.05	0.03
CLASS 15 FORKLIFT																
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	0.18	0.45	2.6E-03	0.13	0.02	312	40	0.23	0.55	3.2E-03	0.16	0.03
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	6.10	1.05	0.01	0.18	0.06	104	40	0.84	0.14	1.5E-03	0.02	0.01
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	0.72	1.72	3.0E-03	0.18	0.17	156	40	0.29	0.70	1.2E-03	0.07	0.07
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	0.18	0.45	2.6E-03	0.13	0.02	104	40	0.06	0.15	8.5E-04	0.04	0.01
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	0.18	0.45	2.6E-03	0.13	0.02	104	40	0.08	0.18	1.1E-03	0.05	0.01
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	0.18	0.45	2.6E-03	0.13	0.02	312	40	0.15	0.36	2.1E-03	0.11	0.02
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	0.18	0.45	2.6E-03	0.13	0.02	416	40	0.20	0.48	2.8E-03	0.15	0.02
CLASS 16 CONCRETE / AGGREGATE																
Concrete pump	Diesel	2270002042	350	43%	1.02	3.59	3.2E-03	0.24	0.14	104	40	0.70	2.48	2.2E-03	0.17	0.10
CLASS 17 AIR COMPRESSORS																
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.38	2.28	3.4E-03	0.23	0.20	416	40	0.87	1.44	2.1E-03	0.14	0.13
Air compressor 250 cfm	Diesel	2270006015	80	43%	1.38	2.28	3.4E-03	0.23	0.20	312	40	0.65	1.08	1.6E-03	0.11	0.09
Air compressor 375 cfm	Diesel	2270006015	115	43%	0.52	1.95	3.0E-03	0.19	0.12	312	40	0.35	1.32	2.1E-03	0.13	0.08
Air compressor 600 cfm	Diesel	2270006015	250	43%	0.40	1.78	3.0E-03	0.17	0.08	104	40	0.19	0.88	1.5E-03	0.09	0.04
Air compressor 750 cfm	Diesel	2270006015	275	43%	0.40	1.78	3.0E-03	0.17	0.08	104	40	0.21	0.97	1.6E-03	0.09	0.04
Air compressor 900 cfm	Diesel	2270006015	310	43%	0.76	2.76	3.1E-03	0.19	0.12	104	40	0.46	1.69	1.9E-03	0.12	0.07
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	-	52	40	-	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	0.76	2.76	3.1E-03	0.19	0.12	104	40	0.75	2.72	3.1E-03	0.19	0.11
CLASS 25 CABLE LAYING / PULLING EQUIPMENT																
Cable winch	Diesel	2270002081	26	59%	0.62	3.43	3.1E-03	0.17	0.09	312	40	0.13	0.72	6.6E-04	0.04	0.02
CLASS 52 WELDING EQUIPMENT																
Welder 400A trailer mount	Diesel	2270006025	32	21%	3.21	4.56	4.2E-03	0.71	0.52	2,912	40	2.77	3.93	3.6E-03	0.61	0.44
Welder 500A trailer mount	Diesel	2270006025	40	21%	3.21	4.56	4.2E-03	0.71	0.52	1,456	40	1.73	2.46	2.3E-03	0.38	0.28
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	4.73	5.17	4.7E-03	1.01	0.64	-	40	-	-	-	-	-
CLASS 53 GENERATION EQUIPMENT																
Generator set 150 kW	Diesel	2270006005	221	43%	0.89	3.39	3.2E-03	0.29	0.17	104	40	0.39	1.48	1.4E-03	0.12	0.08
Generator set 800 kW	Diesel	2270006005	1,125	0%	-	-	-	-	-	204	40	-	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1,425	0%	-	-	-	-	-	104	40	-	-	-	-	-
Light plant	Diesel	2270002027	14	43%	2.38	4.52	4.0E-03	0.46	0.35	3,120	40	1.97	3.74	3.3E-03	0.38	0.29

Table 9.A.1.7 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
CLASS 54 MANLIFTS / SCISSORLIFTS																
Manlift - 40 ft	Diesel	2270003010	28	21%	5.02	5.10	4.3E-03	1.27	0.73	1,040	40	1.35	1.37	1.2E-03	0.34	0.20
Manlift - 60 ft	Diesel	2270003010	65	21%	4.48	5.08	4.3E-03	0.87	0.62	832	40	2.24	2.54	2.2E-03	0.43	0.31
Manlift - 80 ft	Diesel	2270003010	65	21%	4.48	5.08	4.3E-03	0.87	0.62	1,248	40	3.36	3.82	3.2E-03	0.65	0.47
Manlift - 125 ft	Diesel	2270003010	75	21%	4.99	4.41	4.2E-03	0.90	0.70	277	40	0.96	0.85	8.1E-04	0.17	0.13
Scissor lift - 60 ft	Diesel	2270003010	31	21%	5.02	5.10	4.3E-03	1.27	0.73	312	40	0.45	0.46	3.8E-04	0.11	0.07
CLASS 55,56 SMALL CAPITAL EQUIPMENT																
Compactor - 29" manual	Diesel	2270002003	15	59%	2.37	4.46	4.0E-03	0.45	0.36	416	40	0.38	0.72	6.5E-04	0.07	0.06
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	285.33	1.77	0.02	4.77	0.11	312	40	43.37	0.27	2.9E-03	0.73	0.02
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	2.08	3.73	3.6E-03	0.42	0.37	416	40	1.31	2.35	2.3E-03	0.26	0.23
Water pump trash 316 gpm	Diesel	2270006010	7	43%	4.46	4.71	4.0E-03	0.63	0.44	416	40	0.23	0.24	2.0E-04	0.03	0.02
Water pump trash 611 gpm	Diesel	2270006010	15	43%	2.49	4.68	4.0E-03	0.52	0.37	208	40	0.15	0.28	2.3E-04	0.03	0.02
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.18	4.09	3.5E-03	0.28	0.22	416	40	0.33	1.13	9.6E-04	0.08	0.06
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	4.46	4.71	4.0E-03	0.63	0.44	416	40	0.18	0.19	1.6E-04	0.02	0.02
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	285.33	1.77	0.02	4.77	0.11	104	40	12.23	0.08	8.2E-04	0.20	4.9E-03
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	2.49	4.68	4.0E-03	0.52	0.37	416	40	0.31	0.59	5.0E-04	0.07	0.05
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	2.49	4.68	4.0E-03	0.52	0.37	416	40	0.45	0.85	7.2E-04	0.09	0.07
Compactor - 16" in manual	Diesel	2270002003	5	59%	2.37	4.46	4.0E-03	0.45	0.36	416	40	0.13	0.24	2.2E-04	0.02	0.02
Compactor - 26" in manual	Diesel	2270002003	9	59%	2.37	4.46	4.0E-03	0.45	0.36	416	40	0.23	0.43	3.9E-04	0.04	0.03
Tamper rammer	Diesel	2270002003	9	59%	2.37	4.46	4.0E-03	0.45	0.36	208	40	0.12	0.22	2.0E-04	0.02	0.02
Mortar mixer	Diesel	2270002042	5	43%	4.62	5.58	4.0E-03	0.78	0.57	199	40	0.09	0.11	7.5E-05	0.01	0.01
Concrete mixer	Gas	2265002042	5	59%	211.48	2.08	0.02	6.23	0.30	199	40	5.47	0.05	5.8E-04	0.16	0.01
Generator set 6 kW	Gas	2265006005	9	68%	285.60	1.81	0.02	4.80	0.11	416	40	32.06	0.20	2.1E-03	0.54	0.01
Generator set 10 kW	Gas	2265006005	15	68%	285.60	1.81	0.02	4.80	0.11	1,248	40	160.30	1.02	0.01	2.70	0.06
Concrete trowel 36"	Gas	2265002021	5	59%	212.19	2.11	0.02	6.30	0.32	95	40	2.62	0.03	2.8E-04	0.08	4.0E-03
SOIL STABLIZATION & SITE PREP																
CAT D6M dozer	Diesel	2270002069	140	59%	0.49	1.16	2.9E-03	0.15	0.11	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	2.41	4.56	4.0E-03	0.48	0.35	-	40	-	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.23	0.83	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.18	0.45	2.6E-03	0.13	0.02	-	40	-	-	-	-	-
Generator set 150 kW	Diesel	2270006005	221	43%	0.89	3.39	3.2E-03	0.29	0.17	-	40	-	-	-	-	-

Table 9.A.1.7 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.18	4.09	3.5E-03	0.28	0.22	-	40	-	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.27	0.82	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
Light plant	Diesel	2270002027	15	43%	2.38	4.52	4.0E-03	0.46	0.35	-	40	-	-	-	-	-
Water truck	Diesel	2270002051	427	59%	0.27	0.82	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	0.56	1.40	2.9E-03	0.15	0.08	-	40	-	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.23	0.83	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.27	0.82	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
CAT D6M dozer	Diesel	2270002069	140	59%	0.49	1.16	2.9E-03	0.15	0.11	-	40	-	-	-	-	-
Motor graders	Diesel	2270002048	185	59%	0.31	1.01	2.8E-03	0.15	0.05	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	228	43%	2.41	4.56	4.0E-03	0.48	0.35	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	2.41	4.56	4.0E-03	0.48	0.35	-	40	-	-	-	-	-
Loader tool carrier	Diesel	2270001060	125	21%	2.71	4.07	3.8E-03	0.68	0.45	-	40	-	-	-	-	-
PILE DRIVING																
American 9310	Diesel	2270001060	285	21%	2.33	3.84	3.8E-03	0.61	0.37	-	40	-	-	-	-	-
American 9260	Diesel	2270001060	275	21%	2.33	3.84	3.8E-03	0.61	0.37	-	40	-	-	-	-	-
Pile hammer	Diesel	2270001060	60	21%	4.74	4.87	4.3E-03	0.88	0.64	-	40	-	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	4.48	5.08	4.3E-03	0.87	0.62	-	40	-	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.18	0.45	2.6E-03	0.13	0.02	-	40	-	-	-	-	-
Welder	Diesel	2270001060	50	21%	4.74	4.87	4.3E-03	0.88	0.64	-	40	-	-	-	-	-
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.38	2.28	3.4E-03	0.23	0.20	-	40	-	-	-	-	-
MISCELLANEOUS																
Tugs Twin Screw[4,5]	Diesel		350	31%	2.01	13.41	0.17	0.36	0.35	39	40	0.38	2.50	0.03	0.07	0.07
Total												**296.2**	**84.2**	**0.16**	**14.3**	**6.3**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2018, Cameron Parish, LA, except as noted
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.

Table 9.A.1.8 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 06 PERSONNEL CARRIERS														
All terrain vehicle	Diesel	2270001060	22	21%	691	0.039	0.018	697	1504	40	212	0.01	0.01	216
CLASS 11 EARTHMOVING														
Dozer	Diesel	2270002069	159	59%	536	0.030	0.014	541	91	40	202	0.01	0.01	206
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	596	0.034	0.015	601	182	40	76	4.3E-03	1.9E-03	78
Excavator CAT 330BL	Diesel	2270002036	250	59%	536	0.030	0.014	541	113	40	394	0.02	0.01	401
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	4	40	19	1.1E-03	4.9E-04	20
Motor graders	Diesel	2270002048	183	59%	536	0.030	0.014	541	91	40	232	0.01	0.01	237
Loader backhoe	Diesel	2270002066	101	21%	625	0.035	0.016	631	208	40	122	0.01	3.1E-03	124
Loader tool carrier	Diesel	2270002066	134	21%	625	0.035	0.016	631	208	40	161	0.01	4.1E-03	164
Skidsteer loader	Diesel	2270002072	68	21%	693	0.039	0.018	699	208	40	91	0.01	2.3E-03	92
Rubber tire loader	Diesel	2270002060	249	59%	536	0.030	0.014	541	208	40	723	0.04	0.02	736
Tractor	Diesel	2270005015	115	59%	536	0.030	0.014	541	208	40	334	0.02	0.01	340
CLASS 12 PIPELAYING / TRENCHING EQUI														
Trencher	Diesel	2270002030	51	59%	595	0.034	0.015	601	0	40	-	-	-	-
CLASS 13 COMPACTION														
Soil compactor	Diesel	2270002009	339	43%	589	0.033	0.015	594	91	40	344	0.02	0.01	351
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	91	40	155	0.01	4.0E-03	158
CLASS 14 CRANES														
Crane crawler	Diesel	2270002045	285	43%	531	0.030	0.014	535	91	40	261	0.01	0.01	266
Crane crawler	Diesel	2270002045	300	43%	530	0.030	0.014	535	91	40	275	0.02	0.01	280
Crane crawler	Diesel	2270002045	340	43%	530	0.030	0.014	535	295	40	1,009	0.06	0.03	1,027
Crane crawler	Diesel	2270002045	600	43%	531	0.030	0.014	535	87	40	525	0.03	0.01	535
Crane crawler	Diesel	2270002045	500	43%	530	0.030	0.014	535	87	40	438	0.02	0.01	445
Crane carrydeck	Diesel	2270003010	200	21%	624	0.035	0.016	630	173	40	200	0.01	0.01	204
Crane carrydeck	Diesel	2270003010	300	21%	624	0.035	0.016	630	173	40	300	0.02	0.01	306
RT crane - 35 ton	Diesel	2270002045	140	43%	531	0.030	0.014	535	347	40	489	0.03	0.01	497
RT crane - 50 ton	Diesel	2270002045	180	43%	531	0.030	0.014	535	451	40	817	0.05	0.02	831
RT crane - 66 ton	Diesel	2270002045	220	43%	531	0.030	0.014	535	451	40	998	0.06	0.03	1,016
RT crane - 75 ton	Diesel	2270002045	220	43%	531	0.030	0.014	535	260	40	575	0.03	0.01	586
RT crane - 80 ton	Diesel	2270002045	260	43%	531	0.030	0.014	535	82	40	214	0.01	0.01	218

Table 9.A.1.8 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
RT crane - 110 ton	Diesel	2270002045	300	43%	530	0.030	0.014	535	52	40	157	0.01	4.0E-03	160
CLASS 15 FORKLIFT														
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	312	40	653	0.04	0.02	665
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	552	0.031	0.013	556	104	40	76	4.3E-03	1.7E-03	77
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	536	0.030	0.014	541	156	40	218	0.01	0.01	222
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	536	0.030	0.014	541	104	40	174	0.01	4.4E-03	177
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	104	40	218	0.01	0.01	222
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	312	40	435	0.02	0.01	443
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	416	40	580	0.03	0.01	591
CLASS 16 CONCRETE / AGGREGATE														
Concrete pump	Diesel	2270002042	350	43%	530	0.030	0.014	535	104	40	366	0.02	0.01	373
CLASS 17 AIR COMPRESSORS														
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	416	40	372	0.02	0.01	379
Air compressor 250 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	312	40	279	0.02	0.01	284
Air compressor 375 cfm	Diesel	2270006015	115	43%	530	0.030	0.014	535	312	40	361	0.02	0.01	367
Air compressor 600 cfm	Diesel	2270006015	250	43%	530	0.030	0.014	535	104	40	262	0.01	0.01	266
Air compressor 750 cfm	Diesel	2270006015	275	43%	530	0.030	0.014	535	104	40	288	0.02	0.01	293
Air compressor 900 cfm	Diesel	2270006015	310	43%	530	0.030	0.014	535	104	40	324	0.02	0.01	330
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	52	40	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	530	0.030	0.014	535	104	40	523	0.03	0.01	532
CLASS 25 CABLE LAYING / PULLING EQUIP														
Cable winch	Diesel	2270002081	26	59%	596	0.034	0.015	601	312	40	126	0.01	3.2E-03	128
CLASS 52 WELDING EQUIPMENT														
Welder 400A trailer mount	Diesel	2270006025	32	21%	694	0.039	0.018	700	2912	40	599	0.03	0.02	609
Welder 500A trailer mount	Diesel	2270006025	40	21%	694	0.039	0.018	700	1456	40	374	0.02	0.01	381
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	693	0.039	0.018	699	0	40	-	-	-	-
CLASS 53 GENERATION EQUIPMENT														
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	104	40	231	0.01	0.01	235
Generator set 800 kW	Diesel	2270006005	1125	0%	-	-	-	-	204	40	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1425	0%	-	-	-	-	104	40	-	-	-	-
Light plant	Diesel	2270002027	14	43%	589	0.033	0.015	594	3120	40	488	0.03	0.01	497

Table 9.A.1.8 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 54 MANLIFTS / SCISSORLIFTS														
Manlift - 40 ft	Diesel	2270003010	28	21%	692	0.039	0.018	698	1040	40	187	0.01	4.8E-03	190
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	700	832	40	347	0.02	0.01	353
Manlift - 80 ft	Diesel	2270003010	65	21%	693	0.039	0.018	700	1248	40	521	0.03	0.01	530
Manlift - 125 ft	Diesel	2270003010	75	21%	693	0.039	0.018	699	277	40	133	0.01	3.4E-03	136
Scissor lift - 60 ft	Diesel	2270003010	31	21%	692	0.039	0.018	698	312	40	62	3.5E-03	1.6E-03	63
CLASS 55,56 SMALL CAPITAL EQUIPMENT														
Compactor - 29'' manual	Diesel	2270002003	15	59%	595	0.034	0.015	600	416	40	97	0.01	2.5E-03	98
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	1,047	0.060	0.024	1,055	312	40	159	0.01	3.6E-03	162
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	589	0.033	0.015	594	416	40	372	0.02	0.01	378
Water pump trash 316 gpm	Diesel	2270006010	6.5	43%	588	0.033	0.015	594	416	40	30	1.7E-03	7.7E-04	31
Water pump trash 611 gpm	Diesel	2270006010	15	43%	589	0.033	0.015	594	208	40	35	2.0E-03	8.9E-04	35
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	416	40	163	0.01	4.1E-03	166
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	588	0.033	0.015	594	416	40	23	1.3E-03	5.9E-04	24
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	1,047	0.059	0.027	1,056	104	40	45	2.5E-03	1.1E-03	46
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	589	0.033	0.015	594	416	40	74	4.2E-03	1.9E-03	76
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	589	0.033	0.015	594	416	40	107	0.01	2.7E-03	109
Compactor - 16" in manual	Diesel	2270002003	5	59%	595	0.034	0.015	600	416	40	32	1.8E-03	8.2E-04	33
Compactor - 26" in manual	Diesel	2270002003	9	59%	595	0.034	0.015	600	416	40	58	3.3E-03	1.5E-03	59
Tamper rammer	Diesel	2270002003	9	59%	595	0.034	0.015	600	208	40	29	1.6E-03	7.4E-04	29
Mortar mixer	Diesel	2270002042	5	43%	588	0.033	0.015	593	199	40	11	6.3E-04	2.8E-04	11
Concrete mixer	Gas	2265002042	5	59%	1,229	0.070	0.028	1,240	199	40	32	1.8E-03	7.2E-04	32
Generator set 6 kW	Gas	2265006005	9	68%	1,047	0.060	0.024	1,055	416	40	118	0.01	2.7E-03	120
Generator set 10 kW	Gas	2265006005	15	68%	1,047	0.060	0.024	1,055	1248	40	588	0.03	0.01	598
Concrete trowel 36"	Gas	2265002021	5	59%	1,229	0.070	0.028	1,239	95	40	15	8.6E-04	3.5E-04	15
SOIL STABLIZATION & SITE PREP														
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	0	40	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	0	40	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	0	40	-	-	-	-
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.013	535	0	40	-	-	-	-

Table 9.A.1.8 - Liquefaction and CCTPL Expansion Project
2018 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	589	0.033	0.015	595	0	40	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
Light plant	Diesel	2270002027	15	43%	589	0.033	0.015	594	0	40	-	-	-	-
Water truck	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	0	40	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	0	40	-	-	-	-
Motor graders	Diesel	2270002048	185	59%	536	0.030	0.014	541	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	228	43%	589	0.033	0.015	594	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	0	40	-	-	-	-
Loader tool carrier	Diesel	2270001060	125	21%	624	0.035	0.016	630	0	40	-	-	-	-
PILE DRIVING														
American 9310	Diesel	2270001060	285	21%	625	0.035	0.016	630	0	40	-	-	-	-
American 9260	Diesel	2270001060	275	21%	625	0.035	0.016	630	0	40	-	-	-	-
Pile hammer	Diesel	2270001060	60	21%	693	0.039	0.018	699	0	40	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	700	0	40	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	0	40	-	-	-	-
Welder	Diesel	2270001060	50	21%	693	0.039	0.018	699	0	40	-	-	-	-
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	0	40	-	-	-	-
MISCELLANEOUS														
Tugs Twin Screw[4,5]	Diesel		350	31%	925	0.121	0.027	936	39	40	173	0.02	0.01	180
Total											**19,677**	**1.13**	**0.50**	**20,038**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2018, Cameron Parish, LA, except as noted
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.
5. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
6. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.

Table 9.A.1.9 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
CLASS 06 PERSONNEL CARRIERS																
All terrain vehicle	Diesel	2270001060	22	21%	6.12	5.79	4.7E-03	1.44	0.87	542	40	0.68	0.64	5.1E-04	0.16	0.10
CLASS 11 EARTHMOVING																
Dozer	Diesel	2270002069	159	59%	0.38	0.92	2.8E-03	0.15	0.08	26	40	0.04	0.10	3.0E-04	0.02	0.01
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	0.27	3.03	2.9E-03	0.13	0.02	35	40	0.01	0.07	7.1E-05	3.3E-03	6.1E-04
Excavator CAT 330BL	Diesel	2270002036	250	59%	0.19	0.67	2.7E-03	0.14	0.03	26	40	0.03	0.11	4.5E-04	0.02	4.5E-03
Excavator CAT 345B	Diesel	2270002036	345	59%	0.47	1.19	2.8E-03	0.14	0.07	-	40	-	-	-	-	-
Motor graders	Diesel	2270002048	183	59%	0.23	0.80	2.7E-03	0.14	0.03	26	40	0.03	0.10	3.3E-04	0.02	4.2E-03
Loader backhoe	Diesel	2270002066	101	21%	1.80	3.05	3.7E-03	0.48	0.36	78	40	0.13	0.22	2.7E-04	0.03	0.03
Loader tool carrier	Diesel	2270002066	134	21%	1.80	3.05	3.7E-03	0.48	0.36	78	40	0.17	0.29	3.6E-04	0.05	0.04
Skidsteer loader	Diesel	2270002072	68	21%	4.58	4.81	4.2E-03	0.85	0.67	78	40	0.22	0.24	2.1E-04	0.04	0.03
Rubber tire loader	Diesel	2270002060	249	59%	0.38	1.14	2.8E-03	0.15	0.07	78	40	0.19	0.58	1.4E-03	0.08	0.03
Tractor	Diesel	2270005015	115	59%	0.91	2.23	3.1E-03	0.22	0.19	78	40	0.21	0.52	7.3E-04	0.05	0.04
CLASS 12 PIPELAYING / TRENCHING EQUIPMENT																
Trencher	Diesel	2270002030	51	59%	1.74	3.39	3.4E-03	0.22	0.19	-	40	-	-	-	-	-
CLASS 13 COMPACTION																
Soil compactor	Diesel	2270002009	339	43%	2.39	4.53	4.0E-03	0.47	0.35	4	40	0.06	0.12	1.0E-04	0.01	0.01
Soil compactor	Diesel	2270002009	153	43%	2.39	4.53	4.0E-03	0.47	0.35	4	40	0.03	0.05	4.6E-05	0.01	4.1E-03
CLASS 14 CRANES																
Crane crawler	Diesel	2270002045	285	43%	0.26	1.21	2.8E-03	0.15	0.05	26	40	0.04	0.17	3.9E-04	0.02	0.01
Crane crawler	Diesel	2270002045	300	43%	0.54	2.06	3.0E-03	0.16	0.08	26	40	0.08	0.30	4.5E-04	0.02	0.01
Crane crawler	Diesel	2270002045	340	43%	0.54	2.06	3.0E-03	0.16	0.08	52	40	0.18	0.69	1.0E-03	0.05	0.03
Crane crawler	Diesel	2270002045	600	43%	0.77	2.06	3.0E-03	0.16	0.09	-	40	-	-	-	-	-
Crane crawler	Diesel	2270002045	500	43%	0.54	2.06	3.0E-03	0.16	0.08	-	40	-	-	-	-	-
Crane carrydeck	Diesel	2270003010	200	21%	2.26	3.95	3.8E-03	0.62	0.41	-	40	-	-	-	-	-
Crane carrydeck	Diesel	2270003010	300	21%	2.26	3.95	3.8E-03	0.62	0.41	-	40	-	-	-	-	-
RT crane - 35 ton	Diesel	2270002045	140	43%	0.37	1.32	2.9E-03	0.16	0.09	113	40	0.11	0.40	8.6E-04	0.05	0.03
RT crane - 50 ton	Diesel	2270002045	180	43%	0.26	1.21	2.8E-03	0.15	0.05	87	40	0.08	0.36	8.3E-04	0.05	0.02
RT crane - 66 ton	Diesel	2270002045	220	43%	0.26	1.21	2.8E-03	0.15	0.05	113	40	0.12	0.57	1.3E-03	0.07	0.02
RT crane - 75 ton	Diesel	2270002045	220	43%	0.26	1.21	2.8E-03	0.15	0.05	26	40	0.03	0.13	3.0E-04	0.02	0.01
RT crane - 80 ton	Diesel	2270002045	260	43%	0.26	1.21	2.8E-03	0.15	0.05	22	40	0.03	0.13	3.0E-04	0.02	0.01

Table 9.A.1.9 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO[2]	NO_x[2]	SO_2[2]	VOC[2]	PM_{10}/ $PM_{2.5}$[2,3]	weeks	hrs/week	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
RT crane - 110 ton	Diesel	2270002045	300	43%	0.54	2.06	3.0E-03	0.16	0.08	22	40	0.07	0.26	3.8E-04	0.02	0.01
CLASS 15 FORKLIFT																
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	0.16	0.37	2.6E-03	0.13	0.02	152	40	0.09	0.22	1.5E-03	0.08	0.01
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	5.59	0.99	0.01	0.16	0.06	65	40	0.48	0.08	9.2E-04	0.01	5.0E-03
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	0.63	1.48	3.0E-03	0.17	0.14	91	40	0.15	0.35	7.0E-04	0.04	0.03
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	0.16	0.37	2.6E-03	0.13	0.02	39	40	0.02	0.04	3.2E-04	0.02	1.9E-03
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	0.16	0.37	2.6E-03	0.13	0.02	69	40	0.04	0.10	7.0E-04	0.04	4.2E-03
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	0.16	0.37	2.6E-03	0.13	0.02	113	40	0.05	0.11	7.6E-04	0.04	4.6E-03
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	0.16	0.37	2.6E-03	0.13	0.02	139	40	0.06	0.13	9.4E-04	0.05	0.01
CLASS 16 CONCRETE / AGGREGATE																
Concrete pump	Diesel	2270002042	350	43%	0.93	3.32	3.2E-03	0.23	0.13	17	40	0.10	0.37	3.6E-04	0.03	0.01
CLASS 17 AIR COMPRESSORS																
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.23	1.99	3.3E-03	0.21	0.17	156	40	0.29	0.47	7.8E-04	0.05	0.04
Air compressor 250 cfm	Diesel	2270006015	80	43%	1.23	1.99	3.3E-03	0.21	0.17	139	40	0.26	0.42	7.0E-04	0.04	0.04
Air compressor 375 cfm	Diesel	2270006015	115	43%	0.46	1.68	3.0E-03	0.18	0.11	121	40	0.12	0.44	7.8E-04	0.05	0.03
Air compressor 600 cfm	Diesel	2270006015	250	43%	0.35	1.54	2.9E-03	0.16	0.07	35	40	0.06	0.26	4.8E-04	0.03	0.01
Air compressor 750 cfm	Diesel	2270006015	275	43%	0.35	1.54	2.9E-03	0.16	0.07	35	40	0.06	0.28	5.3E-04	0.03	0.01
Air compressor 900 cfm	Diesel	2270006015	310	43%	0.69	2.50	3.1E-03	0.18	0.10	52	40	0.21	0.77	9.4E-04	0.06	0.03
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	-	17	40	-	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	0.69	2.50	3.1E-03	0.18	0.10	17	40	0.11	0.40	5.0E-04	0.03	0.02
CLASS 25 CABLE LAYING / PULLING EQUIPMENT																
Cable winch	Diesel	2270002081	26	59%	0.47	3.26	3.0E-03	0.15	0.06	91	40	0.03	0.20	1.9E-04	0.01	3.8E-03
CLASS 52 WELDING EQUIPMENT																
Welder 400A trailer mount	Diesel	2270006025	32	21%	2.88	4.41	4.1E-03	0.63	0.46	693	40	0.59	0.90	8.5E-04	0.13	0.09
Welder 500A trailer mount	Diesel	2270006025	40	21%	2.88	4.41	4.1E-03	0.63	0.46	312	40	0.33	0.51	4.8E-04	0.07	0.05
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	4.41	5.06	4.7E-03	0.93	0.60	-	40	-	-	-	-	-
CLASS 53 GENERATION EQUIPMENT																
Generator set 150 kW	Diesel	2270006005	221	43%	0.81	3.13	3.1E-03	0.27	0.16	61	40	0.21	0.80	8.0E-04	0.07	0.04
Generator set 800 kW	Diesel	2270006005	1,125	0%	-	-	-	-	-	121	40	-	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1,425	0%	-	-	-	-	-	82	40	-	-	-	-	-
Light plant	Diesel	2270002027	14	43%	2.36	4.50	4.0E-03	0.46	0.35	832	40	0.52	0.99	8.8E-04	0.10	0.08

Table 9.A.1.9 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
CLASS 54 MANLIFTS / SCISSORLIFTS																
Manlift - 40 ft	Diesel	2270003010	28	21%	4.61	4.94	4.2E-03	1.16	0.68	329	40	0.39	0.42	3.6E-04	0.10	0.06
Manlift - 60 ft	Diesel	2270003010	65	21%	4.19	4.90	4.2E-03	0.80	0.57	269	40	0.68	0.79	6.9E-04	0.13	0.09
Manlift - 80 ft	Diesel	2270003010	65	21%	4.19	4.90	4.2E-03	0.80	0.57	390	40	0.98	1.15	1.0E-03	0.19	0.13
Manlift - 125 ft	Diesel	2270003010	75	21%	4.69	4.11	4.2E-03	0.83	0.64	52	40	0.17	0.15	1.5E-04	0.03	0.02
Scissor lift - 60 ft	Diesel	2270003010	31	21%	4.61	4.94	4.2E-03	1.16	0.68	117	40	0.15	0.17	1.4E-04	0.04	0.02
CLASS 55,56 SMALL CAPITAL EQUIPMENT																
Compactor - 29" manual	Diesel	2270002003	15	59%	2.37	4.46	4.0E-03	0.45	0.36	87	40	0.08	0.15	1.4E-04	0.02	0.01
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	284.98	1.74	0.02	4.73	0.11	104	40	14.44	0.09	9.7E-04	0.24	0.01
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	1.95	3.48	3.5E-03	0.39	0.34	104	40	0.31	0.55	5.6E-04	0.06	0.05
Water pump trash 316 gpm	Diesel	2270006010	7	43%	4.46	4.61	4.0E-03	0.61	0.42	139	40	0.08	0.08	6.8E-05	0.01	0.01
Water pump trash 611 gpm	Diesel	2270006010	15	43%	2.46	4.63	4.0E-03	0.50	0.36	69	40	0.05	0.09	7.8E-05	0.01	0.01
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.05	3.96	3.4E-03	0.26	0.19	139	40	0.10	0.37	3.1E-04	0.02	0.02
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	4.46	4.61	4.0E-03	0.61	0.42	104	40	0.04	0.05	3.9E-05	0.01	4.2E-03
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	284.98	1.74	0.02	4.73	0.11	35	40	4.11	0.03	2.8E-04	0.07	1.7E-03
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	2.46	4.63	4.0E-03	0.50	0.36	139	40	0.10	0.20	1.7E-04	0.02	0.02
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	2.46	4.63	4.0E-03	0.50	0.36	139	40	0.15	0.28	2.4E-04	0.03	0.02
Compactor - 16" in manual	Diesel	2270002003	5	59%	2.37	4.46	4.0E-03	0.45	0.36	87	40	0.03	0.05	4.5E-05	0.01	4.1E-03
Compactor - 26" in manual	Diesel	2270002003	9	59%	2.37	4.46	4.0E-03	0.45	0.36	87	40	0.05	0.09	8.2E-05	0.01	0.01
Tamper rammer	Diesel	2270002003	9	59%	2.37	4.46	4.0E-03	0.45	0.36	52	40	0.03	0.05	4.9E-05	0.01	4.4E-03
Mortar mixer	Diesel	2270002042	5	43%	4.58	5.40	4.0E-03	0.75	0.54	39	40	0.02	0.02	1.5E-05	2.8E-03	2.0E-03
Concrete mixer	Gas	2265002042	5	59%	210.93	2.06	0.02	6.05	0.30	39	40	1.07	0.01	1.1E-04	0.03	1.5E-03
Generator set 6 kW	Gas	2265006005	9	68%	284.91	1.76	0.02	4.73	0.11	104	40	8.00	0.05	5.4E-04	0.13	3.2E-03
Generator set 10 kW	Gas	2265006005	15	68%	284.91	1.76	0.02	4.73	0.11	295	40	37.80	0.23	2.5E-03	0.63	0.01
Concrete trowel 36"	Gas	2265002021	5	59%	212.19	2.11	0.02	6.30	0.32	-	40	-	-	-	-	-
SOIL STABLIZATION & SITE PREP																
CAT D6M dozer	Diesel	2270002069	140	59%	0.38	0.92	2.8E-03	0.15	0.08	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	2.39	4.53	4.0E-03	0.47	0.35	-	40	-	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.19	0.67	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.16	0.37	2.6E-03	0.13	0.02	-	40	-	-	-	-	-
Generator set 150 kW	Diesel	2270006005	221	43%	0.81	3.13	3.1E-03	0.27	0.16	-	40	-	-	-	-	-

Table 9.A.1.9 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration		Pollutant Emissions (tons)				
					CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	hrs/week	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	1.05	3.96	3.4E-03	0.26	0.19	-	40	-	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.22	0.66	2.7E-03	0.13	0.03	-	40	-	-	-	-	-
Light plant	Diesel	2270002027	15	43%	2.36	4.50	4.0E-03	0.46	0.35	-	40	-	-	-	-	-
Water truck	Diesel	2270002051	427	59%	0.22	0.66	2.7E-03	0.13	0.03	-	40	-	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	0.47	1.19	2.8E-03	0.14	0.07	-	40	-	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	0.19	0.67	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	0.22	0.66	2.7E-03	0.13	0.03	-	40	-	-	-	-	-
CAT D6M dozer	Diesel	2270002069	140	59%	0.38	0.92	2.8E-03	0.15	0.08	-	40	-	-	-	-	-
Motor graders	Diesel	2270002048	185	59%	0.23	0.80	2.7E-03	0.14	0.03	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	228	43%	2.39	4.53	4.0E-03	0.47	0.35	-	40	-	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	2.39	4.53	4.0E-03	0.47	0.35	-	40	-	-	-	-	-
Loader tool carrier	Diesel	2270001060	125	21%	2.48	3.77	3.8E-03	0.63	0.42	-	40	-	-	-	-	-
PILE DRIVING																
American 9310	Diesel	2270001060	285	21%	2.11	3.56	3.7E-03	0.56	0.34	-	40	-	-	-	-	-
American 9260	Diesel	2270001060	275	21%	2.11	3.56	3.7E-03	0.56	0.34	-	40	-	-	-	-	-
Pile hammer	Diesel	2270001060	60	21%	4.42	4.72	4.2E-03	0.81	0.59	-	40	-	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	4.19	4.90	4.2E-03	0.80	0.57	-	40	-	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	0.16	0.37	2.6E-03	0.13	0.02	-	40	-	-	-	-	-
Welder	Diesel	2270001060	50	21%	4.42	4.72	4.2E-03	0.81	0.59	-	40	-	-	-	-	-
Air compressor 185 cfm	Diesel	2270006015	80	43%	1.23	1.99	3.3E-03	0.21	0.17	-	40	-	-	-	-	-
MISCELLANEOUS																
Tugs Twin Screw[4,5]	Diesel		350	31%	2.01	13.41	0.17	0.36	0.35	-	40	-	-	-	-	-
Total												**75.2**	**19.0**	**3.3E-02**	**3.6**	**1.5**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2019, Cameron Parish, LA, except as noted
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories ICF International, April 2009.

Table 9.A.1.10 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 06 PERSONNEL CARRIERS														
All terrain vehicle	Diesel	2270001060	22	21%	691	0.039	0.018	698	542	40	76	4.3E-03	1.9E-03	78
CLASS 11 EARTHMOVING														
Dozer	Diesel	2270002069	159	59%	536	0.030	0.014	541	26	40	58	3.3E-03	1.5E-03	59
Excavator CAT 303.5CR	Diesel	2270002036	27	59%	596	0.034	0.015	601	35	40	15	8.3E-04	3.7E-04	15
Excavator CAT 330BL	Diesel	2270002036	250	59%	536	0.030	0.014	541	26	40	91	0.01	2.3E-03	92
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	0	40	-	-	-	-
Motor graders	Diesel	2270002048	183	59%	536	0.030	0.014	541	26	40	66	3.8E-03	1.7E-03	68
Loader backhoe	Diesel	2270002066	101	21%	625	0.036	0.016	631	78	40	46	2.6E-03	1.2E-03	46
Loader tool carrier	Diesel	2270002066	134	21%	625	0.036	0.016	631	78	40	60	3.4E-03	1.5E-03	62
Skidsteer loader	Diesel	2270002072	68	21%	693	0.039	0.018	700	78	40	34	1.9E-03	8.7E-04	35
Rubber tire loader	Diesel	2270002060	249	59%	536	0.030	0.014	541	78	40	271	0.02	0.01	276
Tractor	Diesel	2270005015	115	59%	536	0.030	0.014	541	78	40	125	0.01	3.2E-03	127
CLASS 12 PIPELAYING / TRENCHING EQUI														
Trencher	Diesel	2270002030	51	59%	595	0.034	0.015	601	0	40	-	-	-	-
CLASS 13 COMPACTION														
Soil compactor	Diesel	2270002009	339	43%	589	0.033	0.015	594	4	40	15	8.6E-04	3.9E-04	15
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	4	40	7	3.9E-04	1.7E-04	7
CLASS 14 CRANES														
Crane crawler	Diesel	2270002045	285	43%	531	0.030	0.014	535	26	40	75	4.2E-03	1.9E-03	76
Crane crawler	Diesel	2270002045	300	43%	531	0.030	0.014	535	26	40	78	4.5E-03	2.0E-03	80
Crane crawler	Diesel	2270002045	340	43%	531	0.030	0.014	535	52	40	178	0.01	4.5E-03	181
Crane crawler	Diesel	2270002045	600	43%	531	0.030	0.014	535	0	40	-	-	-	-
Crane crawler	Diesel	2270002045	500	43%	531	0.030	0.014	535	0	40	-	-	-	-
Crane carrydeck	Diesel	2270003010	200	21%	625	0.035	0.016	630	0	40	-	-	-	-
Crane carrydeck	Diesel	2270003010	300	21%	625	0.035	0.016	630	0	40	-	-	-	-
RT crane - 35 ton	Diesel	2270002045	140	43%	531	0.030	0.014	535	113	40	159	0.01	4.1E-03	162
RT crane - 50 ton	Diesel	2270002045	180	43%	531	0.030	0.014	535	87	40	158	0.01	4.0E-03	160
RT crane - 66 ton	Diesel	2270002045	220	43%	531	0.030	0.014	535	113	40	250	0.01	0.01	255
RT crane - 75 ton	Diesel	2270002045	220	43%	531	0.030	0.014	535	26	40	58	3.3E-03	1.5E-03	59
RT crane - 80 ton	Diesel	2270002045	260	43%	531	0.030	0.014	535	22	40	58	3.3E-03	1.5E-03	59

Table 9.A.1.10 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
RT crane - 110 ton	Diesel	2270002045	300	43%	531	0.030	0.014	535	22	40	66	3.8E-03	1.7E-03	68
CLASS 15 FORKLIFT														
Forklift, yard 36,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	152	40	318	0.02	0.01	324
Forklift, wharehouse 6,000 lb	LPG	2267003020	100	30%	551	0.031	0.013	556	65	40	47	2.7E-03	1.1E-03	48
Forklift, RT 6,000 lb	Diesel	2270002057	100	59%	536	0.030	0.014	541	91	40	127	0.01	3.2E-03	129
Forklift, yard 11,000 lb	Diesel	2270003020	120	59%	536	0.030	0.014	541	39	40	65	3.7E-03	1.7E-03	66
Forklift, yard 20,000 lb	Diesel	2270003020	150	59%	536	0.030	0.014	541	69	40	144	0.01	3.7E-03	147
Forklift, tele-boom 8,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	113	40	158	0.01	4.0E-03	161
Forklift, tele-boom 9,000 lb	Diesel	2270003020	100	59%	536	0.030	0.014	541	139	40	194	0.01	4.9E-03	197
CLASS 16 CONCRETE / AGGREGATE														
Concrete pump	Diesel	2270002042	350	43%	530	0.030	0.014	535	17	40	60	3.4E-03	1.5E-03	61
CLASS 17 AIR COMPRESSORS														
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	156	40	140	0.01	3.6E-03	142
Air compressor 250 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	139	40	124	0.01	3.2E-03	127
Air compressor 375 cfm	Diesel	2270006015	115	43%	530	0.030	0.014	535	121	40	140	0.01	3.6E-03	142
Air compressor 600 cfm	Diesel	2270006015	250	43%	531	0.030	0.014	535	35	40	88	5.0E-03	2.2E-03	90
Air compressor 750 cfm	Diesel	2270006015	275	43%	531	0.030	0.014	535	35	40	97	0.01	2.5E-03	99
Air compressor 900 cfm	Diesel	2270006015	310	43%	530	0.030	0.014	535	52	40	162	0.01	4.1E-03	165
Air compressor 900 cfm	Diesel	2270006015	700	0%	-	-	-	-	17	40	-	-	-	-
Air compressor 1500 cfm	Diesel	2270006015	500	43%	530	0.030	0.014	535	17	40	85	4.9E-03	2.2E-03	87
CLASS 25 CABLE LAYING / PULLING EQUIP														
Cable winch	Diesel	2270002081	26	59%	596	0.034	0.015	601	91	40	37	2.1E-03	9.3E-04	37
CLASS 52 WELDING EQUIPMENT														
Welder 400A trailer mount	Diesel	2270006025	32	21%	694	0.039	0.018	700	693	40	143	0.01	3.6E-03	145
Welder 500A trailer mount	Diesel	2270006025	40	21%	694	0.039	0.018	700	312	40	80	4.6E-03	2.0E-03	82
Welder fusion Tracstart 28	Diesel	2270006025	13	21%	693	0.039	0.018	699	0	40	-	-	-	-
CLASS 53 GENERATION EQUIPMENT														
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.014	535	61	40	136	0.01	3.5E-03	138
Generator set 800 kW	Diesel	2270006005	1125	0%	-	-	-	-	121	40	-	-	-	-
Generator set 1000 kW	Diesel	2270006005	1425	0%	-	-	-	-	82	40	-	-	-	-
Light plant	Diesel	2270002027	14	43%	589	0.033	0.015	594	832	40	130	0.01	3.3E-03	132

Table 9.A.1.10 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
CLASS 54 MANLIFTS / SCISSORLIFTS														
Manlift - 40 ft	Diesel	2270003010	28	21%	692	0.039	0.018	699	329	40	59	3.4E-03	1.5E-03	60
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	700	269	40	112	0.01	2.9E-03	114
Manlift - 80 ft	Diesel	2270003010	65	21%	693	0.039	0.018	700	390	40	163	0.01	4.1E-03	166
Manlift - 125 ft	Diesel	2270003010	75	21%	693	0.039	0.018	700	52	40	25	1.4E-03	6.4E-04	25
Scissor lift - 60 ft	Diesel	2270003010	31	21%	692	0.039	0.018	699	117	40	23	1.3E-03	5.9E-04	24
CLASS 55,56 SMALL CAPITAL EQUIPMENT														
Compactor - 29'' manual	Diesel	2270002003	15	59%	595	0.034	0.015	600	87	40	20	1.1E-03	5.1E-04	21
Pressure washer 3500 psi 4 gpm	Gas	2265006030	13	85%	1,047	0.060	0.024	1,055	104	40	53	3.0E-03	1.2E-03	54
Water pump centrifugal 1600 gpm	Diesel	2270006010	80	43%	589	0.033	0.015	594	104	40	93	0.01	2.4E-03	95
Water pump trash 316 gpm	Diesel	2270006010	6.5	43%	588	0.033	0.015	594	139	40	10	5.7E-04	2.6E-04	10
Water pump trash 611 gpm	Diesel	2270006010	15	43%	589	0.033	0.015	594	69	40	12	6.6E-04	2.9E-04	12
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	590	0.033	0.015	595	139	40	54	3.1E-03	1.4E-03	55
Water pump centrifugal 10,000 gph	Diesel	2270006010	5	43%	588	0.033	0.015	594	104	40	6	3.3E-04	1.5E-04	6
Pressure washer 3000 psi 3.5 gpm	Gas	2265006030	11	85%	1,047	0.059	0.027	1,056	35	40	15	8.6E-04	3.8E-04	15
Water pump submersible 420 gpm	Diesel	2270006010	16	43%	589	0.033	0.015	594	139	40	25	1.4E-03	6.3E-04	25
Water pump submersible 800 gpm	Diesel	2270006010	23	43%	589	0.033	0.015	594	139	40	36	2.0E-03	9.1E-04	36
Compactor - 16" in manual	Diesel	2270002003	5	59%	595	0.034	0.015	600	87	40	7	3.8E-04	1.7E-04	7
Compactor - 26" in manual	Diesel	2270002003	9	59%	595	0.034	0.015	600	87	40	12	6.9E-04	3.1E-04	12
Tamper rammer	Diesel	2270002003	9	59%	595	0.034	0.015	600	52	40	7	4.1E-04	1.8E-04	7
Mortar mixer	Diesel	2270002042	5	43%	588	0.033	0.015	593	39	40	2	1.2E-04	5.5E-05	2
Concrete mixer	Gas	2265002042	5	59%	1,230	0.070	0.028	1,240	39	40	6	3.6E-04	1.4E-04	6
Generator set 6 kW	Gas	2265006005	9	68%	1,047	0.060	0.024	1,055	104	40	29	1.7E-03	6.7E-04	30
Generator set 10 kW	Gas	2265006005	15	68%	1,047	0.060	0.024	1,055	295	40	139	0.01	3.2E-03	141
Concrete trowel 36"	Gas	2265002021	5	59%	1,229	0.070	0.028	1,239	0	40	-	-	-	-
SOIL STABLIZATION & SITE PREP														
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	0	40	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	0	40	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	0	40	-	-	-	-
Generator set 150 kW	Diesel	2270006005	221	43%	530	0.030	0.014	535	0	40	-	-	-	-

Table 9.A.1.10 - Liquefaction and CCTPL Expansion Project
2019 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - SPLNG Terminal Trains 5 & 6
(Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration		Pollutant Emissions (tons)			
					CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	hours/day	CO_2	N_2O	CH_4	CO_2e
Water pump trash 1083 gpm	Diesel	2270006010	35	43%	590	0.033	0.015	595	0	40	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
Light plant	Diesel	2270002027	15	43%	589	0.033	0.015	594	0	40	-	-	-	-
Water truck	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 345B	Diesel	2270002036	345	59%	536	0.030	0.014	541	0	40	-	-	-	-
Excavator CAT 330BL	Diesel	2270002036	236	59%	536	0.030	0.014	541	0	40	-	-	-	-
Articulated truck, CAT D400	Diesel	2270002051	427	59%	536	0.030	0.014	541	0	40	-	-	-	-
CAT D6M dozer	Diesel	2270002069	140	59%	536	0.030	0.014	541	0	40	-	-	-	-
Motor graders	Diesel	2270002048	185	59%	536	0.030	0.014	541	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	228	43%	589	0.033	0.015	594	0	40	-	-	-	-
Soil compactor	Diesel	2270002009	153	43%	589	0.033	0.015	594	0	40	-	-	-	-
Loader tool carrier	Diesel	2270001060	125	21%	625	0.035	0.016	630	0	40	-	-	-	-
PILE DRIVING														
American 9310	Diesel	2270001060	285	21%	625	0.035	0.016	630	0	40	-	-	-	-
American 9260	Diesel	2270001060	275	21%	625	0.035	0.016	630	0	40	-	-	-	-
Pile hammer	Diesel	2270001060	60	21%	693	0.039	0.018	700	0	40	-	-	-	-
Manlift - 60 ft	Diesel	2270003010	65	21%	693	0.039	0.018	700	0	40	-	-	-	-
Forklift, tele-boom 8,000 lb	Diesel	2270003020	110	59%	536	0.030	0.014	541	0	40	-	-	-	-
Welder	Diesel	2270001060	50	21%	693	0.039	0.018	700	0	40	-	-	-	-
Air compressor 185 cfm	Diesel	2270006015	80	43%	590	0.033	0.015	595	0	40	-	-	-	-
MISCELLANEOUS														
Tugs Twin Screw[4,5]	Diesel		350	31%	925	0.121	0.027	936	0	40	-	-	-	-
Total											**5,327**	**0.30**	**0.13**	**5,423**

1. User's Guide for the Final NONROAD2005, except as noted Model, EPA420-R-05-013, US EPA, December 2005, except as noted
2. EPA NONROAD2008 run for calendar year 2019, Cameron Parish, LA, except as noted
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.
5. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
6. Tier 0 emission factors from Tables 3-8 and 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.

Table 9.A.1.11 - Liquefaction and CCTPL Expansion Project
On-Road On-Site Construction VehicleTailpipe Emission Factors - SPLNG Terminal Trains 5 & 6

Vehicle	Emission Factor (g/VMT)[1]								Onsite Travel (mile/ vehicle-day)	Vehicle-months	Vehicle Usage (vehicle-days/year)
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e			
2015											
Diesel Heavy Trucks	1.59	6.13	0.014	0.333	0.246	0.239	1,897	1,898	50	-	-
Diesel Buses	2.25	6.13	0.009	0.420	0.283	0.274	1,211	1,212	50	-	-
Diesel Light Trucks	1.54	2.10	0.005	0.302	0.109	0.105	631	631	50		-
Gasoline Passenger Cars	1.91	0.22	0.005	0.053	0.004	0.004	313	314	50		-
Gasoline Passenger Trucks	4.36	0.69	0.007	0.185	0.007	0.007	430	432	50	128	2,781
2016											
Diesel Heavy Trucks	1.39	5.35	0.014	0.294	0.210	0.204	1,897	1,898	50	222	4,836
Diesel Buses	2.00	5.41	0.009	0.378	0.247	0.239	1,211	1,212	50	13	283
Diesel Light Trucks	1.43	1.92	0.005	0.270	0.096	0.093	628	629	50		-
Gasoline Passenger Cars	1.79	0.18	0.005	0.045	0.004	0.004	307	307	50		-
Gasoline Passenger Trucks	4.10	0.63	0.007	0.164	0.007	0.006	421	422	50	68	1,481
2017											
Diesel Heavy Trucks	1.21	4.65	0.014	0.261	0.178	0.173	1,897	1,898	50	391	8,495
Diesel Buses	1.77	4.76	0.009	0.337	0.213	0.207	1,211	1,212	50	24	521
Diesel Light Trucks	1.33	1.76	0.005	0.240	0.085	0.082	625	626	50		-
Gasoline Passenger Cars	1.70	0.16	0.005	0.039	0.004	0.003	301	301	50		-
Gasoline Passenger Trucks	3.92	0.58	0.006	0.147	0.007	0.006	413	414	50	239	5,193
2018											
Diesel Heavy Trucks	1.06	4.04	0.014	0.230	0.150	0.145	1,897	1,898	50	373	8,104
Diesel Buses	1.55	4.19	0.009	0.299	0.181	0.176	1,211	1,212	50	24	521
Diesel Light Trucks	1.24	1.61	0.005	0.213	0.075	0.073	622	623	50		-
Gasoline Passenger Cars	1.64	0.13	0.005	0.034	0.004	0.003	295	296	50		-
Gasoline Passenger Trucks	3.75	0.53	0.006	0.133	0.007	0.006	405	406	50	496	10,776
Total											
2019											
Diesel Heavy Trucks	0.92	3.53	0.013	0.204	0.127	0.124	1,897	1,898	50	144	3,129
Diesel Buses	1.36	3.68	0.009	0.266	0.158	0.154	1,211	1,212	50	11	239
Diesel Light Trucks	1.17	1.47	0.005	0.189	0.066	0.064	620	620	50		-
Gasoline Passenger Cars	1.59	0.12	0.004	0.031	0.004	0.003	290	290	50		-
Gasoline Passenger Trucks	3.60	0.49	0.006	0.121	0.007	0.006	397	398	50	460	9,994

1. EPA MOVES2010b

Table 9.A.1.12 - Liquefaction and CCTPL Expansion Project
On-Road On-Site Construction VehicleTailpipe Emissions - SPLNG Terminal Trains 5 & 6

Vehicle	Vehicle Miles Traveled (VMT)	Emissions (ton/yr)							
		CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e
2015									
Diesel Heavy Trucks	-	-	-	-	-	-	-	-	-
Diesel Buses	-	-	-	-	-	-	-	-	-
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	-	-	-	-	-	-	-	-	-
Gasoline Passenger Trucks	139,050	0.67	0.11	1.0E-03	0.03	1.1E-03	1.0E-03	66	66
Total		**0.67**	**0.11**	**1.0E-03**	**0.03**	**1.1E-03**	**1.0E-03**	**66**	**66**
2016									
Diesel Heavy Trucks	241,800	0.37	1.43	3.7E-03	0.08	0.06	0.05	506	506
Diesel Buses	14,150	0.03	0.08	1.4E-04	0.01	3.8E-03	3.7E-03	19	19
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	-	-	-	-	-	-	-	-	-
Gasoline Passenger Trucks	74,050	0.33	0.05	5.3E-04	0.01	5.7E-04	5.3E-04	34	34
Total		**0.74**	**1.56**	**4.3E-03**	**0.10**	**0.06**	**0.06**	**559**	**559**
2017									
Diesel Heavy Trucks	424,750	0.57	2.18	0.01	0.12	0.08	0.08	888	889
Diesel Buses	26,050	0.05	0.14	2.5E-04	0.01	0.01	0.01	35	35
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	-	-	-	-	-	-	-	-	-
Gasoline Passenger Trucks	259,650	1.12	0.17	1.8E-03	0.04	2.0E-03	1.8E-03	118	118
Total		**1.74**	**2.48**	**0.01**	**0.17**	**0.09**	**0.09**	**1,041**	**1,042**
2018									
Diesel Heavy Trucks	405,200	0.47	1.81	0.01	0.10	0.07	0.06	847	848
Diesel Buses	26,050	0.04	0.12	2.5E-04	0.01	0.01	0.01	35	35
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	-	-	-	-	-	-	-	-	-
Gasoline Passenger Trucks	538,800	2.23	0.32	3.7E-03	0.08	4.0E-03	3.7E-03	240	241
Total		**2.75**	**2.24**	**0.01**	**0.19**	**0.08**	**0.07**	**1,122**	**1,124**
2019									
Diesel Heavy Trucks	156,450	0.16	0.61	2.3E-03	0.04	0.02	0.02	327	327
Diesel Buses	11,950	0.02	0.05	1.1E-04	3.5E-03	2.1E-03	2.0E-03	16	16
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	-	-	-	-	-	-	-	-	-
Gasoline Passenger Trucks	499,700	1.99	0.27	3.4E-03	0.07	3.7E-03	3.4E-03	219	219
Total		**2.16**	**0.93**	**0.01**	**0.11**	**0.03**	**0.03**	**562**	**563**

Table 9.A.1.13 - Liquefaction and CCTPL Expansion Project
On-Road Material Delivery, and Worker Commuting Emission Factors - SPLNG Terminal Trains 5 & 6

Vehicle	Emission Factor (g/VMT)[1]								Trip Distance (2-way) (miles)	Vehicle-months	Vehicle Usage (vehicle-days/year)
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e			
2015											
Diesel Heavy Trucks	1.59	6.13	0.014	0.333	0.246	0.239	1,897	1,898	100	94	2,042
Diesel Buses	2.25	6.13	0.009	0.420	0.283	0.274	1,211	1,212	50	1	22
Diesel Light Trucks	1.54	2.10	0.005	0.302	0.109	0.105	631	631	50		-
Gasoline Passenger Cars	1.91	0.22	0.005	0.053	0.004	0.004	313	314	50	345	7,499
Gasoline Passenger Trucks	4.36	0.69	0.007	0.185	0.007	0.007	430	432	50	345	7,499
2016											
Diesel Heavy Trucks	1.39	5.35	0.014	0.294	0.210	0.204	1,897	1,898	100	240	5,214
Diesel Buses	2.00	5.41	0.009	0.378	0.247	0.239	1,211	1,212	50	116	2,520
Diesel Light Trucks	1.43	1.92	0.005	0.270	0.096	0.093	628	629	50		-
Gasoline Passenger Cars	1.79	0.18	0.005	0.045	0.004	0.004	307	307	50	1,675	36,390
Gasoline Passenger Trucks	4.10	0.63	0.007	0.164	0.007	0.006	421	422	50	1,675	36,390
2017											
Diesel Heavy Trucks	1.21	4.65	0.014	0.261	0.178	0.173	1,897	1,898	100	193	4,193
Diesel Buses	1.77	4.76	0.009	0.337	0.213	0.207	1,211	1,212	50	460	9,994
Diesel Light Trucks	1.33	1.76	0.005	0.240	0.085	0.082	625	626	50		-
Gasoline Passenger Cars	1.70	0.16	0.005	0.039	0.004	0.003	301	301	50	1,596	34,683
Gasoline Passenger Trucks	3.92	0.58	0.006	0.147	0.007	0.006	413	414	50	1,596	34,683
2018											
Diesel Heavy Trucks	1.06	4.04	0.014	0.230	0.150	0.145	1,897	1,898	100	65	1,412
Diesel Buses	1.55	4.19	0.009	0.299	0.181	0.176	1,211	1,212	50	424	9,212
Diesel Light Trucks	1.24	1.61	0.005	0.213	0.075	0.073	622	623	50		-
Gasoline Passenger Cars	1.64	0.13	0.005	0.034	0.004	0.003	295	296	50	2,729	59,295
Gasoline Passenger Trucks	3.75	0.53	0.006	0.133	0.007	0.006	405	406	50	2,729	59,295
2019											
Diesel Heavy Trucks	0.92	3.53	0.013	0.204	0.127	0.124	1,897	1,898	100	10	217
Diesel Buses	1.36	3.68	0.009	0.266	0.158	0.154	1,211	1,212	50	-	-
Diesel Light Trucks	1.17	1.47	0.005	0.189	0.066	0.064	620	620	50		-
Gasoline Passenger Cars	1.59	0.12	0.004	0.031	0.004	0.003	290	290	50	1,551	33,697
Gasoline Passenger Trucks	3.60	0.49	0.006	0.121	0.007	0.006	397	398	50	1,551	33,697

1. EPA MOVES2010b

Table 9.A.1.14 - Liquefaction and CCTPL Expansion Project
On-Road Material Delivery, and Worker Commuting Emissions - SPLNG Terminal Trains 5 & 6

Vehicle	Vehicle Miles Traveled (VMT)	Emissions (ton/yr)							
		CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e
2015									
Diesel Heavy Trucks	204,200	0.36	1.38	3.1E-03	0.07	0.06	0.05	427	427
Diesel Buses	1,100	2.7E-03	0.01	1.1E-05	5.1E-04	3.4E-04	3.3E-04	1	1
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	374,950	0.79	0.09	2.0E-03	0.02	1.7E-03	1.5E-03	130	130
Gasoline Passenger Trucks	374,950	1.80	0.29	2.8E-03	0.08	3.0E-03	2.7E-03	178	178
Total		**2.95**	**1.77**	**0.01**	**0.17**	**0.06**	**0.06**	**736**	**737**
2016									
Diesel Heavy Trucks	521,400	0.80	3.07	0.01	0.17	0.12	0.12	1,090	1,091
Diesel Buses	126,000	0.28	0.75	1.2E-03	0.05	0.03	0.03	168	168
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	1,819,500	3.59	0.37	0.01	0.09	0.01	0.01	616	616
Gasoline Passenger Trucks	1,819,500	8.23	1.26	0.01	0.33	0.01	0.01	845	847
Total		**12.89**	**5.46**	**0.03**	**0.64**	**0.18**	**0.17**	**2,719**	**2,723**
2017									
Diesel Heavy Trucks	419,300	0.56	2.15	0.01	0.12	0.08	0.08	877	877
Diesel Buses	499,700	0.97	2.62	4.9E-03	0.19	0.12	0.11	667	668
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	1,734,150	3.25	0.30	0.01	0.07	0.01	0.01	575	576
Gasoline Passenger Trucks	1,734,150	7.49	1.11	0.01	0.28	0.01	0.01	789	791
Total		**12.28**	**6.17**	**0.03**	**0.66**	**0.22**	**0.21**	**2,908**	**2,912**
2018									
Diesel Heavy Trucks	141,200	0.16	0.63	2.1E-03	0.04	0.02	0.02	295	295
Diesel Buses	460,600	0.79	2.13	4.4E-03	0.15	0.09	0.09	615	615
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	2,964,750	5.35	0.44	0.01	0.11	0.01	0.01	965	966
Gasoline Passenger Trucks	2,964,750	12.27	1.74	0.02	0.43	0.02	0.02	1,323	1,326
Total		**18.57**	**4.93**	**0.04**	**0.73**	**0.15**	**0.14**	**3,198**	**3,203**
2019									
Diesel Heavy Trucks	21,700	0.02	0.08	3.2E-04	4.9E-03	3.0E-03	3.0E-03	45	45
Diesel Buses	-	-	-	-	-	-	-	-	-
Diesel Light Trucks	-	-	-	-	-	-	-	-	-
Gasoline Passenger Cars	1,684,850	2.95	0.22	0.01	0.06	0.01	0.01	539	540
Gasoline Passenger Trucks	1,684,850	6.69	0.91	0.01	0.22	0.01	0.01	738	739
Total		**9.67**	**1.21**	**0.02**	**0.29**	**0.02**	**0.02**	**1,322**	**1,324**

Table 9.A.1.15 - Liquefaction and CCTPL Expansion Project
Tug Transport Emissions - New Orleans to Sabine Pass LNG - SPLNG Terminal Trains 5 & 6

	Emission Factors (g/kw-hr)[1]								
	NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2	N_2O	CH_4
Main Engine	13	0.27	2.5	0.3	0.3	1.3	690	0.02	0.09
Auxiliary Engines	10	0.27	1.7	0.4	0.4	1.3	690	0.02	0.09

Assist Tug Engine Data[2]	
Main Engine Power (kW)	1540
Main Engines per Vessel	2
Auxiliary Engine Power (kW)	100
Auxiliary Engines per Vessel	1.9

Year	Calls	Comments
2015	46	Pile deliveries
2016	106	Pile deliveries
2017	-	
2018	-	
2019	-	
Total	152	

Travel Segment	Distances (nautical miles)			
	Severe Non-attainment	Serious Non-attainment	Attainment	Total
New Orleans to Sabine Pass[3]				254.0
Reduced Speed Zone[4]				
New Orleans	-	-	104.2	104.2
Port Arthur	-	-	-	-
Intracostal Waterway			149.8	149.8
Total RSZ	-	-	254.0	254.0
Cruise Zone Distance	-	-	-	-

Houston-Galveston-Brazoria 1-Hour Ozone Standard Severe 17 Nonattainment / 8-Hour Ozone Standard Severe 15 Nonattainment (40 CFR 81.344)

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	0.00	0.00	0.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	-	-	-	-	-	-	-	-	-
Maneuver (g/call)	-	-	-	-	-	-	-	-	-
Hotel (g/call)	-	-	-	-	-	-	-	-	-
Total (g/call)	-	-	-	-	-	-	-	-	-
Total (tons/call)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Year	Annual Emissions (tons)								
	CO	NO_x	VOC	SO_2	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-

Beaumont - Port Arthur, TX 1-Hour Ozone Standard Serious Nonattainment (40 CFR 81.344)

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	0.00	0.00	0.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	-	-	-	-	-	-	-	-	-
Maneuver (g/call)	-	-	-	-	-	-	-	-	-
Hotel (g/call)	-	-	-	-	-	-	-	-	-
Total (g/call)	-	-	-	-	-	-	-	-	-
Total (tons/call)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Table 9.A.1.15 - Liquefaction and CCTPL Expansion Project
Tug Transport Emissions - New Orleans to Sabine Pass LNG - SPLNG Terminal Trains 5 & 6
(Continued)

Year	Annual Emissions (tons)								
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-

1-Hour Ozone Standard Attainment or Unclassifiable / 8-Hour Ozone Standard Attainment or Unclassifiable

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	42.33	2.00	12.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	157,152	819,711	82,623	17,160	19,284	19,284	43,853,559	1,271	5,720
Maneuver (g/call)	2,439	12,881	1,339	278	326	326	710,887	21	93
Hotel (g/call)	853	5,016	652	135	201	201	346,104	10	45
Total (g/call)	160,444	837,608	84,614	17,574	19,811	19,811	44,910,550	1,302	5,858
Total (tons/call)	0.177	0.923	0.093	0.019	0.022	0.022	49.51	1.4E-03	6.5E-03

Year	Annual Emissions (tons)								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	8.14	42.47	4.29	0.89	1.00	1.00	2,277	0.066	0.297
2016	18.75	97.87	9.89	2.05	2.31	2.31	5,248	0.152	0.684
2017	-	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	26.88	140.34	14.18	2.94	3.32	3.32	7,525	0.218	0.982

1. Tier 0 emission factors from Table 3-8 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
2. Tug engine data is taken from Table 3-10 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
3. From Distances Between United States Ports (12th Edition) , NOAA, 2012. Port Arthur used as location of Sabine Pass.
4. From Table 2-18 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
   The barges do not enter open ocean
5. See Section 2-7.3 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
   Calculated using Propeller Law:
   $LF = (AS/MS)^3$
   Where;
   LF = Load Factor
   AS = Actual Speed (knots)
   MS = Maximum Speed (knots)
6. From Table 2-7 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
7. Emission rates were calculated using the following equation:
   $E\ (g/call) = P_{Main} * LF_{Main} * A * EF_{Main} + P_{Aux} * LF_{Aux} * A * EF_{Aux}$
   Where
   P = Engine Power Rating (kW)
   LF = Load Factor
   A = Activity (hours)
   EF = Emission Factor

Table 9.A.1.16 - Liquefaction and CCTPL Expansion Project
Tug Transport Emissions - Houston to Sabine Pass LNG - SPLNG Terminal Trains 5 & 6

	Emission Factors (g/kw-hr)[1]								
	NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2	N_2O	CH_4
Main Engine	13	0.27	2.5	0.3	0.3	1.3	690	0.02	0.09
Auxiliary Engines	10	0.27	1.7	0.4	0.4	1.3	690	0.02	0.09

Assist Tug Engine Data[2]	
Main Engine Power (kW)	1540
Main Engines per Vessel	2
Auxiliary Engine Power (kW)	100
Auxiliary Engines per Vessel	1.9

Year	Calls	Comments
2015	1	Equipment / Materials
2016	5	Equipment / Materials
2017	5	Equipment / Materials
2018	-	
2019	-	
Total	11	

Travel Segment	Distances (nautical miles)			
	Severe Non-attainment	Serious Non-attainment	Attainment	Total
Houston to Sabine Pass[3]				97.0
Reduced Speed Zone[4]				
Houston	49.6	-	-	49.6
Port Arthur	-	-	-	-
Intracostal Waterway	12.2	35.2	-	47.4
Total RSZ	61.8	35.2	-	97.0
Cruise Zone Distance	-	-	-	-

Houston-Galveston-Brazoria 1-Hour Ozone Standard Severe 17 Nonattainment / 8-Hour Ozone Standard Severe 15 Nonattainment (40 CFR 81.344)

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	10.30	1.00	0.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	38,236	199,442	20,103	4,175	4,692	4,692	10,669,882	309	1,392
Maneuver (g/call)	1,219	6,440	670	139	163	163	355,444	10	46
Hotel (g/call)	-	-	-	-	-	-	-	-	-
Total (g/call)	39,456	205,882	20,772	4,314	4,855	4,855	11,025,325	320	1,438
Total (tons/call)	4.3E-02	2.3E-01	2.3E-02	4.8E-03	5.4E-03	5.4E-03	1.2E+01	3.5E-04	1.6E-03

Year	Annual Emissions (tons)								
	CO	NO_x	VOC	SO_2	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	0.04	0.23	0.00	0.02	0.01	0.01	12.15	0.000	0.002
2016	0.22	1.13	0.02	0.11	0.03	0.03	60.77	0.002	0.008
2017	0.22	1.13	0.02	0.11	0.03	0.03	60.77	0.002	0.008
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	0.48	2.50	0.05	0.25	0.06	0.06	133.69	0.004	0.017

Beaumont - Port Arthur, TX 1-Hour Ozone Standard Serious Nonattainment (40 CFR 81.344)

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	5.87	0.00	0.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	21,779	113,598	11,450	2,378	2,672	2,672	6,077,344	176	793
Maneuver (g/call)	-	-	-	-	-	-	-	-	-
Hotel (g/call)	-	-	-	-	-	-	-	-	-
Total (g/call)	21,779	113,598	11,450	2,378	2,672	2,672	6,077,344	176	793
Total (tons/call)	2.4E-02	1.3E-01	1.3E-02	2.6E-03	2.9E-03	2.9E-03	6.7E+00	1.9E-04	8.7E-04

Table 9.A.1.16 - Liquefaction and CCTPL Expansion Project
Tug Transport Emissions - Houston to Sabine Pass LNG - SPLNG Terminal Trains 5 & 6
(Continued)

Year	Annual Emissions (tons)								
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	0.02	0.13	0.01	0.00	0.00	0.00	6.70	0.000	0.001
2016	0.12	0.63	0.06	0.01	0.01	0.01	33.50	0.001	0.004
2017	0.12	0.63	0.06	0.01	0.01	0.01	33.50	0.001	0.004
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	0.26	1.38	0.14	0.03	0.03	0.03	73.69	0.002	0.010

1-Hour Ozone Standard Attainment or Unclassifiable / 8-Hour Ozone Standard Attainment or Unclassifiable

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	0.00	1.00	12.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	-	-	-	-	-	-	-	-	-
Maneuver (g/call)	1,219	6,440	670	139	163	163	355,444	10	46
Hotel (g/call)	853	5,016	652	135	201	201	346,104	10	45
Total (g/call)	2,072	11,456	1,322	275	364	364	701,548	20	92
Total (tons/call)	0.002	0.013	0.001	0.000	0.000	0.000	0.77	2.2E-04	1.0E-04

Year	Annual Emissions (tons)								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	0.00	0.01	0.00	0.00	0.00	0.00	1	0.000	0.000
2016	0.01	0.06	0.01	0.00	0.00	0.00	4	0.000	0.001
2017	0.01	0.06	0.01	0.00	0.00	0.00	4	0.000	0.001
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	0.03	0.14	0.02	0.00	0.00	0.00	9	0.000	0.001

1. Tier 0 emission factors from Table 3-8 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
2. Tug engine data is taken from Table 3-10 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
3. From Distances Between United States Ports (12th Edition) , NOAA, 2012. Port Arthur used as location of Sabine Pass.
4. From Table 2-18 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
   The barges do not enter open ocean
5. See Section 2-7.3 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
   Calculated using Propeller Law:
   $LF = (AS/MS)^3$
   Where;
   LF = Load Factor
   AS = Actual Speed (knots)
   MS = Maximum Speed (knots)
6. From Table 2-7 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
7. Emission rates were calculated using the following equation:
   $E\ (g/call) = P_{Main} * LF_{Main} * A * EF_{Main} + P_{Aux} * LF_{Aux} * A * EF_{Aux}$
   Where
   P = Engine Power Rating (kW)
   LF = Load Factor
   A = Activity (hours)
   EF = Emission Factor

Table 9.A.1.17 - Liquefaction and CCTPL Expansion Project
Tug Transport Emissions - Lake Charles to Sabine Pass LNG - SPLNG Terminal Trains 5 & 6

	Emission Factors (g/kw-hr)[1]								
	NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2	N_2O	CH_4
Main Engine	13	0.27	2.5	0.3	0.3	1.3	690	0.02	0.09
Auxiliary Engines	10	0.27	1.7	0.4	0.4	1.3	690	0.02	0.09

Assist Tug Engine Data[2]	
Main Engine Power (kW)	1540
Main Engines per Vessel	2
Auxiliary Engine Power (kW)	100
Auxiliary Engines per Vessel	1.9

Year	Calls	Comments
2015	1	Equipment / Materials
2016	4	Equipment / Materials
2017	4	Equipment / Materials
2018	-	
2019	-	
Total	9	

Travel Segment	Distances (nautical miles)			
	Severe Non-attainment	Serious Non-attainment	Attainment	Total
Lake Charles to Sabine Pass[3]				51.0
Reduced Speed Zone[4]				
Port Arthur	-	-	-	-
Lake Charles	-	-	38.0	38.0
Intracostal Waterway			13.0	13.0
Total RSZ	-	-	51.0	51.0
Cruise Zone Distance	-	-	-	-

Houston-Galveston-Brazoria 1-Hour Ozone Standard Severe 17 Nonattainment / 8-Hour Ozone Standard Severe 15 Nonattainment (40 CFR 81.344)

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	0.00	0.00	0.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	-	-	-	-	-	-	-	-	-
Maneuver (g/call)	-	-	-	-	-	-	-	-	-
Hotel (g/call)	-	-	-	-	-	-	-	-	-
Total (g/call)	-	-	-	-	-	-	-	-	-
Total (tons/call)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Year	Annual Emissions (tons)								
	CO	NO_x	VOC	SO_2	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-

Beaumont - Port Arthur, TX 1-Hour Ozone Standard Serious Nonattainment (40 CFR 81.344)

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	0.00	0.00	0.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	-	-	-	-	-	-	-	-	-
Maneuver (g/call)	-	-	-	-	-	-	-	-	-
Hotel (g/call)	-	-	-	-	-	-	-	-	-
Total (g/call)	-	-	-	-	-	-	-	-	-
Total (tons/call)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Table 9.A.1.17 - Liquefaction and CCTPL Expansion Project
Tug Transport Emissions - Lake Charles to Sabine Pass LNG - SPLNG Terminal Trains 5 & 6
(Continued)

Year	Annual Emissions (tons)								
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-

1-Hour Ozone Standard Attainment or Unclassifiable / 8-Hour Ozone Standard Attainment or Unclassifiable

Mode	Cruise	RSZ	Maneuver	Hotel
Time (per call)	0.00	8.50	2.00	12.00
Speed (knots)	14.5	12.0	8.0	0.0
Load Factors				
Main Engine[5]	0.83	0.47	0.14	0.00
Auxiliary Engine[6]	0.17	0.27	0.45	0.22

Mode	Emission Rates[7]								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
Cruise (g/call)	-	-	-	-	-	-	-	-	-
RSZ (g/call)	31,554	164,588	16,590	3,446	3,872	3,872	8,805,242	255	1,149
Maneuver (g/call)	2,439	12,881	1,339	278	326	326	710,887	21	93
Hotel (g/call)	853	5,016	652	135	201	201	346,104	10	45
Total (g/call)	34,846	182,484	18,581	3,859	4,399	4,399	9,862,233	286	1,286
Total (tons/call)	0.038	0.201	0.020	0.004	0.005	0.005	10.87	3.2E-04	1.4E-03

Year	Annual Emissions (tons)								
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4
2015	0.04	0.20	0.02	0.00	0.00	0.00	11	0.000	0.001
2016	0.15	0.80	0.08	0.02	0.02	0.02	43	0.001	0.006
2017	0.15	0.80	0.08	0.02	0.02	0.02	43	0.001	0.006
2018	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-
Total	0.35	1.81	0.18	0.04	0.04	0.04	98	0.003	0.013

1. Tier 0 emission factors from Table 3-8 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
2. Tug engine data is taken from Table 3-10 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
3. From Distances Between United States Ports (12th Edition) , NOAA, 2012. Port Arthur used as location of Sabine Pass.
4. From Table 2-18 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
   The barges do not enter open ocean
5. See Section 2-7.3 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
   Calculated using Propeller Law:
   $LF = (AS/MS)^3$
   Where;
   LF = Load Factor
   AS = Actual Speed (knots)
   MS = Maximum Speed (knots)
6. From Table 2-7 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories , ICF International, April 2009.
7. Emission rates were calculated using the following equation:
   $E\ (g/call) = P_{Main} * LF_{Main} * A * EF_{Main} + P_{Aux} * LF_{Aux} * A * EF_{Aux}$
   Where
   P = Engine Power Rating (kW)
   LF = Load Factor
   A = Activity (hours)
   EF = Emission Factor

Table 9.A.1.18 - Liquefaction and CCTPL Expansion Project
Tug Transport Emissions - Total All Ports to Sabine Pass LNG - SPLNG Terminal Trains 5 & 6

Houston-Galveston-Brazoria, TX 1-Hour Ozone Standard Severe 17 Nonattainment / 8-Hour Ozone Standard Severe 15 Nonattainment (40 CFR 81.344)										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	0.04	0.23	0.02	4.8E-03	0.01	0.01	12	3.5E-04	1.6E-03	12
2016	0.22	1.13	0.11	0.02	0.03	0.03	61	1.8E-03	0.01	61
2017	0.22	1.13	0.11	0.02	0.03	0.03	61	1.8E-03	0.01	61
2018	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-
Total	0.48	2.50	0.25	0.05	0.06	0.06	134	3.9E-03	0.02	135
Beaumont - Port Arthur, TX 1-Hour Ozone Standard Serious Nonattainment (40 CFR 81.344)										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	0.02	0.13	0.01	2.6E-03	2.9E-03	2.9E-03	7	1.9E-04	8.7E-04	7
2016	0.12	0.63	0.06	0.01	0.01	0.01	33	9.7E-04	4.4E-03	34
2017	0.12	0.63	0.06	0.01	0.01	0.01	33	9.7E-04	4.4E-03	34
2018	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-
Total	0.26	1.38	0.14	0.03	0.03	0.03	74	2.1E-03	0.01	75
1-Hour Ozone Standard Attainment or Unclassifiable / 8-Hour Ozone Standard Attainment or Unclassifiable										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	8.18	42.69	4.31	0.90	1.01	1.01	2,289	0.07	0.30	2,316
2016	18.91	98.74	9.98	2.07	2.34	2.34	5,295	0.15	0.69	5,357
2017	0.17	0.87	0.09	0.02	0.02	0.02	47	1.4E-03	0.01	48
2018	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-
Total	27.25	142.29	14.38	2.99	3.37	3.37	7,631	0.22	1.00	7,721
Total Attainment and Non-attainment Areas										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	8.24	43.04	4.35	0.90	1.02	1.02	2,308	0.07	0.30	2,335
2016	19.25	100.50	10.15	2.11	2.38	2.38	5,389	0.16	0.70	5,452
2017	0.50	2.63	0.27	0.06	0.06	0.06	142	4.1E-03	0.02	143
2018	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-
Total	28.00	146.17	14.77	3.07	3.46	3.46	7,839	0.23	1.02	7,930

Table 9.A.1.19 - Liquefaction and CCTPL Expansion Project
Fugitive Dust - SPLNG Terminal Trains 5 & 6

Year	Construction Area (acres)		Emission Factor (ton/acre-month)		Duration (months)	Uncontrolled Emissions (tons)		Controlled Emissions[3] (tons)	
	Laydown Areas	Trains 5 & 6 Facilities	PM_{10}[1]	$PM_{2.5}$[2]		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
2015	103.9	54.0	1.1E-01	1.1E-02	12	208.4	20.84	104.2	10.42
2016	103.9	54.0	1.1E-01	1.1E-02	12	208.4	20.84	104.2	10.42
2017	103.9	54.0	1.1E-01	1.1E-02	12	208.4	20.84	104.2	10.42
2018	103.9	54.0	1.1E-01	1.1E-02	12	208.4	20.84	104.2	10.42
2019	103.9	54.0	1.1E-01	1.1E-02	12	208.4	20.84	104.2	10.42

1. WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 3-2, level 1, average conditions.
2. $PM_{2.5}/PM_{10}$ = 0.10 (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1)
3. Assume 50% control from water and other approved dust suppressants. (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1)

Table 9.A.1.20 - Liquefaction and CCTPL Expansion Project
Construction Emissions Totals - SPLNG Terminal Trains 5 & 6

Nonroad Tailpipe Emissions										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	18.82	42.69	0.10	4.06	2.84	2.84	10,955	0.64	0.28	11,159
2016	163.12	67.58	0.18	9.69	4.86	4.86	15,709	0.93	0.40	16,005
2017	301.59	93.84	0.20	14.88	6.71	6.71	20,289	1.18	0.52	20,666
2018	296.15	84.23	0.16	14.29	6.29	6.29	19,677	1.13	0.50	20,038
2019	75.16	18.97	0.03	3.56	1.48	1.48	5,327	0.30	0.13	5,423
Total	854.84	307.31	0.68	46.47	22.17	22.17	71,957	4.18	1.83	73,291

On-Road Tailpipe Emissions										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	3.62	1.87	0.009	0.20	0.06	0.06	802			803
2016	13.63	7.02	0.036	0.74	0.24	0.23	3,278			3,282
2017	14.02	8.65	0.041	0.84	0.31	0.30	3,949			3,954
2018	21.32	7.18	0.052	0.92	0.23	0.22	4,320			4,326
2019	11.83	2.14	0.026	0.39	0.05	0.05	1,884			1,887
Total	64.42	26.87	0.164	3.09	0.89	0.85	14,232	-	-	14,252

Tugs - Total Attainment and Non-attainment Areas										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	8.24	43.04	4.35	0.90	1.02	1.02	2,308	0.07	0.30	2,335
2016	19.25	100.50	10.15	2.11	2.38	2.38	5,389	0.16	0.70	5,452
2017	0.50	2.63	0.27	0.06	0.06	0.06	142	0.00	0.02	143
2018	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-
Total	28.00	146.17	14.77	3.07	3.46	3.46	7,839	0.227	1.022	7,930

Table 9.A.1.20 - Liquefaction and CCTPL Expansion Project Construction Emissions Totals - SPLNG Terminal Trains 5 & 6 (Continued)

Fugitive Dust										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	-	-	-	-	104.21	10.42	-	-	-	-
2016	-	-	-	-	104.21	10.42	-	-	-	-
2017	-	-	-	-	104.21	10.42	-	-	-	-
2018	-	-	-	-	104.21	10.42	-	-	-	-
2019	-	-	-	-	104.21	10.42	-	-	-	-
Total	-	-	-	-	521.07	52.11	-	-	-	-

Totals										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	30.68	87.60	4.46	5.16	108.13	14.34	14,065	0.71	0.58	14,297
2016	196.00	175.10	10.37	12.54	111.69	17.89	24,376	1.08	1.10	24,739
2017	316.11	105.12	0.51	15.77	111.30	17.50	24,379	1.19	0.53	24,763
2018	317.47	91.40	0.21	15.22	110.73	16.93	23,997	1.13	0.50	24,364
2019	86.99	21.12	0.06	3.95	105.74	11.95	7,210	0.30	0.13	7,310
Total	947.26	480.34	15.61	52.63	547.59	78.59	94,028	4.41	2.85	95,473

Table 9.A.2.1 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - CCTPL Pipeline Expansion

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration			Pollutant Emissions (tons)				
						CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	days/ week	hours/ day	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
Lowboy Truck	Diesel	2270002051	400	9	59%	0.64	1.63	3.0E-03	0.15	0.10	13	6	5	0.58	1.49	2.7E-03	0.13	0.09
Flatbed Truck	Diesel	2270002051	125	16	59%	0.52	1.32	2.9E-03	0.15	0.12	13	6	5	0.26	0.67	1.5E-03	0.08	0.06
Dozer	Diesel	2270002069	250	12	59%	0.63	1.85	3.0E-03	0.17	0.12	13	6	5	0.48	1.41	2.3E-03	0.13	0.09
Backhoe/Excavator	Diesel	2270002066	300	12	21%	2.12	4.10	3.9E-03	0.58	0.40	13	6	5	0.69	1.33	1.3E-03	0.19	0.13
Backhoe	Diesel	2270002066	80	6	21%	5.70	4.65	4.4E-03	0.92	0.84	13	6	5	0.25	0.20	1.9E-04	0.04	0.04
Side booms	Diesel	2270002069	260	8	59%	0.63	1.85	3.0E-03	0.17	0.12	13	6	5	0.33	0.98	1.6E-03	0.09	0.06
Crane	Diesel	2270002045	250	3	43%	0.49	2.27	3.1E-03	0.19	0.10	13	6	5	0.07	0.31	4.3E-04	0.03	0.01
Crane	Diesel	2270002045	680	3	43%	1.09	3.22	3.2E-03	0.18	0.14	13	6	5	0.41	1.21	1.2E-03	0.07	0.05
Loaders/Graders/Special	Diesel	2270002048	250	2	59%	0.62	1.82	3.0E-03	0.17	0.12	13	6	5	0.08	0.23	3.8E-04	0.02	0.02
Farm Tractors	Diesel	2270002066	175	1	21%	2.12	4.10	3.9E-03	0.58	0.40	13	6	5	0.03	0.06	6.1E-05	0.01	0.01
Forklift / manlift	Diesel	2270002057	60	3	59%	2.54	3.73	3.7E-03	0.28	0.30	13	6	5	0.12	0.17	1.7E-04	0.01	0.01
Bending Machine	Diesel	2270002081	85	1	59%	2.86	3.24	3.6E-03	0.31	0.40	13	6	5	0.06	0.07	7.9E-05	0.01	0.01
Road Boring machine	Diesel	2270002033	90	1	43%	2.47	4.62	3.7E-03	0.49	0.46	13	6	5	0.04	0.08	6.2E-05	0.01	0.01
Fill / Test pumps	Diesel	2270006010	40	2	43%	1.64	4.54	3.7E-03	0.38	0.32	4	6	5	0.01	0.02	1.7E-05	1.7E-03	1.4E-03
185 acfm compressor	Diesel	2270006015	60	2	43%	2.03	3.98	3.7E-03	0.30	0.28	13	6	5	0.05	0.09	8.2E-05	0.01	0.01
375 acfm compressor	Diesel	2270006015	100	2	43%	0.72	2.88	3.2E-03	0.23	0.18	13	6	5	0.03	0.11	1.2E-04	0.01	0.01
1200 acfm compressor	Diesel	2270006015	350	2	43%	1.01	3.61	3.3E-03	0.23	0.16	13	6	5	0.13	0.47	4.2E-04	0.03	0.02
Welding machine	Diesel	2270006025	40	16	21%	4.62	5.12	4.4E-03	1.08	0.73	13	6	5	0.27	0.30	2.5E-04	0.06	0.04
Generator	Diesel	2270006005	50	14	43%	2.58	4.93	3.8E-03	0.50	0.44	13	6	5	0.33	0.64	4.9E-04	0.07	0.06
Misc saws, trowel machine, compactor plate, etc.	Diesel	2270002008	50	6	43%	4.48	4.88	4.0E-03	0.66	0.49	13	6	5	0.25	0.27	2.2E-04	0.04	0.03
6" Water Pump	Diesel	2270006010	60	6	43%	2.61	4.94	3.8E-03	0.51	0.45	13	6	5	0.17	0.33	2.5E-04	0.03	0.03
3" Water Pump	Diesel	2270006010	40	6	43%	1.64	4.54	3.7E-03	0.38	0.32	0	6	5	-	-	0.0E+00	-	-
Total														**4.6**	**10.4**	**1.4E-02**	**1.06**	**0.79**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2015, all Parishes in Louisiana
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.

Table 9.A.2.2 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - CCTPL Pipeline Expansion

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration			Pollutant Emissions (tons)			
						CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	days/ week	hours/ day	CO_2	N_2O	CH_4	CO_2e
Lowboy Truck	Diesel	2270002051	400	9	59%	536	0.030	0.014	541	13	5	10	816	0.02	0.05	824
Flatbed Truck	Diesel	2270002051	125	16	59%	536	0.030	0.014	541	13	5	10	453	0.01	0.03	458
Dozer	Diesel	2270002069	250	12	59%	536	0.030	0.014	541	13	5	10	680	0.02	0.04	686
Backhoe/Excavator	Diesel	2270002066	300	12	21%	625	0.035	0.016	630	13	5	10	338	0.01	0.02	341
Backhoe	Diesel	2270002066	80	6	21%	693	0.039	0.018	699	13	5	10	50	1.3E-03	2.8E-03	51
Side booms	Diesel	2270002069	260	8	59%	536	0.030	0.014	541	13	5	10	472	0.01	0.03	476
Crane	Diesel	2270002045	250	3	43%	530	0.030	0.014	535	13	5	10	123	3.1E-03	0.01	124
Crane	Diesel	2270002045	680	3	43%	530	0.030	0.014	535	13	5	10	333	0.01	0.02	336
Loaders/Graders/Special	Diesel	2270002048	250	2	59%	536	0.030	0.014	541	13	5	10	113	2.9E-03	0.01	114
Farm Tractors	Diesel	2270002066	175	1	21%	625	0.035	0.016	630	13	5	10	16	4.2E-04	9.3E-04	17
Forklift / manlift	Diesel	2270002057	60	3	59%	595	0.034	0.015	601	13	5	10	45	1.2E-03	2.6E-03	46
Bending Machine	Diesel	2270002081	85	1	59%	595	0.034	0.015	601	13	5	10	21	5.4E-04	1.2E-03	22
Road Boring machine	Diesel	2270002033	90	1	43%	589	0.033	0.015	594	13	5	10	16	4.2E-04	9.3E-04	16
Fill / Test pumps	Diesel	2270006010	40	2	43%	589	0.033	0.015	595	4	5	10	4	1.1E-04	2.5E-04	5
185 acfm compressor	Diesel	2270006015	60	2	43%	589	0.033	0.015	595	13	5	10	22	5.5E-04	1.2E-03	22
375 acfm compressor	Diesel	2270006015	100	2	43%	530	0.030	0.014	535	13	5	10	33	8.3E-04	1.9E-03	33
1200 acfm compressor	Diesel	2270006015	350	2	43%	530	0.030	0.014	535	13	5	10	114	2.9E-03	0.01	115
Welding machine	Diesel	2270006025	40	16	21%	693	0.039	0.018	699	13	5	10	67	1.7E-03	3.8E-03	67
Generator	Diesel	2270006005	50	14	43%	589	0.033	0.015	594	13	5	10	127	3.2E-03	0.01	128
Misc saws, trowel machine, compactor plate, etc.	Diesel	2270002008	50	6	43%	588	0.033	0.015	594	13	5	10	54	1.4E-03	3.1E-03	55
6" Water Pump	Diesel	2270006010	60	6	43%	589	0.033	0.015	594	13	5	10	65	1.7E-03	3.7E-03	66
3" Water Pump	Diesel	2270006010	40	6	43%	589	0.033	0.015	595	0	5	10	-	-	-	-
Total													**3,965**	**1.0E-01**	**2.3E-01**	**4,001**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2015, all Parishes in Louisiana
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.

Table 9.A.2.3 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - CCTPL Pipeline Expansion

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration			Pollutant Emissions (tons)				
						CO[2]	NO_x[2]	SO_2[2]	VOC[2]	PM_{10}/ $PM_{2.5}$[2,3]	weeks	days/ week	hours/ day	CO	NO_x	SO_2	VOC	PM_{10}/ $PM_{2.5}$
Lowboy Truck	Diesel	2270002051	400	12	59%	0.50	1.33	2.9E-03	0.14	0.08	26	6	5	1.22	3.24	0.01	0.35	0.19
Flatbed Truck	Diesel	2270002051	125	23	59%	0.32	0.93	2.7E-03	0.14	0.06	26	6	5	0.47	1.36	4.0E-03	0.20	0.09
Dozer	Diesel	2270002069	250	18	59%	0.52	1.55	2.9E-03	0.16	0.10	24	6	5	1.10	3.27	0.01	0.34	0.21
Backhoe/Excavator	Diesel	2270002066	300	23	21%	1.93	3.76	3.8E-03	0.54	0.37	24	6	5	2.22	4.33	4.4E-03	0.62	0.42
Backhoe	Diesel	2270002066	80	8	21%	5.29	4.28	4.3E-03	0.84	0.77	26	6	5	0.61	0.50	5.0E-04	0.10	0.09
Side booms	Diesel	2270002069	260	10	59%	0.52	1.55	2.9E-03	0.16	0.10	22	6	5	0.58	1.73	3.3E-03	0.18	0.11
Crane	Diesel	2270002045	250	2	43%	0.43	1.95	3.0E-03	0.17	0.09	26	6	5	0.08	0.36	5.6E-04	0.03	0.02
Crane	Diesel	2270002045	680	3	43%	1.00	2.90	3.2E-03	0.18	0.13	26	6	5	0.76	2.19	2.4E-03	0.13	0.09
Loaders/Graders/Special	Diesel	2270002048	250	2	59%	0.51	1.52	2.9E-03	0.16	0.10	22	6	5	0.11	0.33	6.3E-04	0.03	0.02
Farm Tractors	Diesel	2270002066	175	4	21%	1.93	3.76	3.8E-03	0.54	0.37	26	6	5	0.24	0.48	4.8E-04	0.07	0.05
Forklift / manlift	Diesel	2270002057	60	3	59%	2.26	3.59	3.6E-03	0.26	0.26	26	6	5	0.21	0.33	3.3E-04	0.02	0.02
Bending Machine	Diesel	2270002081	85	1	59%	2.60	2.89	3.6E-03	0.28	0.35	26	6	5	0.11	0.12	1.5E-04	0.01	0.02
Road Boring machine	Diesel	2270002033	90	2	43%	2.32	4.32	3.7E-03	0.46	0.43	26	6	5	0.15	0.29	2.5E-04	0.03	0.03
Fill / Test pumps	Diesel	2270006010	40	4	43%	1.47	4.38	3.6E-03	0.34	0.29	13	6	5	0.04	0.13	1.1E-04	0.01	0.01
185 acfm compressor	Diesel	2270006015	60	2	43%	1.86	3.82	3.6E-03	0.28	0.25	26	6	5	0.08	0.17	1.6E-04	0.01	0.01
375 acfm compressor	Diesel	2270006015	100	2	43%	0.65	2.53	3.2E-03	0.22	0.16	26	6	5	0.05	0.19	2.3E-04	0.02	0.01
1200 acfm compressor	Diesel	2270006015	350	2	43%	0.92	3.30	3.2E-03	0.21	0.15	26	6	5	0.24	0.86	8.3E-04	0.05	0.04
Welding machine	Diesel	2270006025	40	26	21%	4.09	4.92	4.3E-03	0.93	0.66	26	6	5	0.77	0.92	8.1E-04	0.18	0.12
Generator	Diesel	2270006005	50	20	43%	2.43	4.78	3.7E-03	0.47	0.41	26	6	5	0.90	1.77	1.4E-03	0.18	0.15
Misc saws, trowel machine, compactor plate, etc.	Diesel	2270002008	50	10	43%	4.47	4.75	4.0E-03	0.64	0.46	26	6	5	0.83	0.88	7.3E-04	0.12	0.09
6" Water Pump	Diesel	2270006010	60	10	43%	2.46	4.79	3.7E-03	0.48	0.42	22	6	5	0.46	0.90	7.0E-04	0.09	0.08
3" Water Pump	Diesel	2270006010	40	10	43%	1.47	4.38	3.6E-03	0.34	0.29	22	6	5	0.18	0.55	4.5E-04	0.043	0.036
HDD Rig	Diesel	2270002033	800	2	43%	1.50	5.59	3.3E-03	0.39	0.24	17	6	10	1.16	4.32	2.5E-03	0.305	0.187
Mud pump	Diesel	2270006010	400	4	43%	1.20	3.92	3.3E-03	0.28	0.18	17	6	10	0.93	3.04	2.5E-03	0.214	0.142
Total														**13.5**	**32.2**	**4.1E-02**	**3.34**	**2.24**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2016, all Parishes in Louisiana
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.

Table 9.A.2.4 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - CCTPL Pipeline Expansion

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration			Pollutant Emissions (tons)			
						CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	days/ week	hours/ day	CO_2	N_2O	CH_4	CO_2e
Lowboy Truck	Diesel	2270002051	400	12	59%	536	0.030	0.014	541	26	5	10	2,177	0.06	0.12	2,197
Flatbed Truck	Diesel	2270002051	125	23	59%	536	0.030	0.014	541	26	5	10	1,304	0.03	0.07	1,316
Dozer	Diesel	2270002069	250	18	59%	536	0.030	0.014	541	24	5	10	1,884	0.05	0.11	1,901
Backhoe/Excavator	Diesel	2270002066	300	23	21%	625	0.035	0.016	631	24	5	10	1,198	0.03	0.07	1,208
Backhoe	Diesel	2270002066	80	8	21%	693	0.039	0.018	700	26	5	10	134	3.4E-03	0.01	135
Side booms	Diesel	2270002069	260	10	59%	536	0.030	0.014	541	22	5	10	998	0.03	0.06	1,007
Crane	Diesel	2270002045	250	2	43%	530	0.030	0.014	535	26	5	10	163	4.2E-03	0.01	165
Crane	Diesel	2270002045	680	3	43%	530	0.030	0.014	535	26	5	10	667	0.02	0.04	673
Loaders/Graders/Special	Diesel	2270002048	250	2	59%	536	0.030	0.014	541	22	5	10	192	4.9E-03	0.01	194
Farm Tractors	Diesel	2270002066	175	4	21%	625	0.035	0.016	631	26	5	10	132	3.4E-03	0.01	133
Forklift / manlift	Diesel	2270002057	60	3	59%	595	0.034	0.015	601	26	5	10	91	2.3E-03	0.01	91
Bending Machine	Diesel	2270002081	85	1	59%	595	0.034	0.015	601	26	5	10	43	1.1E-03	2.4E-03	43
Road Boring machine	Diesel	2270002033	90	2	43%	589	0.033	0.015	594	26	5	10	65	1.7E-03	3.7E-03	66
Fill / Test pumps	Diesel	2270006010	40	4	43%	589	0.033	0.015	595	13	5	10	29	7.4E-04	1.7E-03	29
185 acfm compressor	Diesel	2270006015	60	2	43%	589	0.033	0.015	595	26	5	10	44	1.1E-03	2.5E-03	44
375 acfm compressor	Diesel	2270006015	100	2	43%	530	0.030	0.014	535	26	5	10	65	1.7E-03	3.7E-03	66
1200 acfm compressor	Diesel	2270006015	350	2	43%	530	0.030	0.014	535	26	5	10	229	0.01	0.01	231
Welding machine	Diesel	2270006025	40	26	21%	693	0.039	0.018	699	26	5	10	217	0.01	0.01	219
Generator	Diesel	2270006005	50	20	43%	589	0.033	0.015	594	26	5	10	363	0.01	0.02	366
Misc saws, trowel machine, compactor plate, etc.	Diesel	2270002008	50	10	43%	588	0.033	0.015	594	26	5	10	181	4.6E-03	0.01	183
6" Water Pump	Diesel	2270006010	60	10	43%	589	0.033	0.015	594	22	5	10	184	4.7E-03	0.01	186
3" Water Pump	Diesel	2270006010	40	10	43%	589	0.033	0.015	595	22	5	10	123	3.1E-03	0.01	124
HDD Rig	Diesel	2270002033	800	2	43%	530	0.030	0.013	535	17	5	10	342	8.7E-03	1.9E-02	345
Mud pump	Diesel	2270006010	400	4	43%	530	0.030	0.014	535	17	5	10	342	8.7E-03	1.9E-02	345
Total													**11,163**	**2.8E-01**	**6.3E-01**	**11,265**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2016, all Parishes in Louisiana
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.

Table 9.A.2.5 - Liquefaction and CCTPL Expansion Project
On-Road Material Delivery, and Worker Commuting Emission Factors - CCTPL Pipeline Expansion

Vehicle	Emission Factor (g/VMT)[1]								Trip Distance (2-way) (miles)	Vehicle-months	Vehicle Usage (vehicle-days/yr)
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e			
2015											
Diesel Heavy Trucks	1.59	6.13	0.014	0.333	0.246	0.239	1,897	1,898	100	36	939
Diesel Buses	2.25	6.13	0.009	0.420	0.283	0.274	1,211	1,212	100	3	78
Diesel Light Trucks	1.54	2.10	0.005	0.302	0.109	0.105	631	631	100	18	469
Gasoline Passenger Cars	1.91	0.22	0.005	0.053	0.004	0.004	313	314	100	74	1,929
Gasoline Passenger Trucks	4.36	0.69	0.007	0.185	0.007	0.007	430	432	100	92	2,399
2016											
Diesel Heavy Trucks	1.39	5.35	0.014	0.294	0.210	0.204	1,897	1,898	160	60	1,304
Diesel Buses	2.00	5.41	0.009	0.378	0.247	0.239	1,211	1,212	160	5	109
Diesel Light Trucks	1.43	1.92	0.005	0.270	0.096	0.093	628	629	160	91	1,977
Gasoline Passenger Cars	1.79	0.18	0.005	0.045	0.004	0.004	307	307	160	363	7,887
Gasoline Passenger Trucks	4.10	0.63	0.007	0.164	0.007	0.006	421	422	160	454	9,864

1. EPA MOVES2010b

Table 9.A.2.6 - Liquefaction and CCTPL Expansion Project
On-Road Material Delivery, and Worker Commuting Emissions - CCTPL Pipeline Expansion

Vehicle	Vehicle Miles Traveled (VMT)	Emissions (ton/yr)							
		CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e
2015									
Diesel Heavy Trucks	93,900	0.16	0.63	1.4E-03	0.03	0.03	0.02	196	196
Diesel Buses	7,800	0.02	0.05	7.7E-05	3.6E-03	2.4E-03	2.4E-03	10	10
Diesel Light Trucks	46,900	0.08	0.11	2.5E-04	0.02	0.01	0.01	33	33
Gasoline Passenger Cars	192,900	0.41	0.05	1.0E-03	0.01	8.6E-04	7.9E-04	67	67
Gasoline Passenger Trucks	239,900	1.15	0.18	1.8E-03	0.05	1.9E-03	1.7E-03	114	114
Total		**1.82**	**1.03**	**4.6E-03**	**1.1E-01**	**3.6E-02**	**3.5E-02**	**420**	**420**
2016									
Diesel Heavy Trucks	208,640	0.32	1.23	3.2E-03	0.07	0.05	0.05	436	436
Diesel Buses	17,440	0.04	0.10	1.7E-04	0.01	4.7E-03	4.6E-03	23	23
Diesel Light Trucks	316,320	0.50	0.67	1.6E-03	0.09	0.03	0.03	219	219
Gasoline Passenger Cars	1,261,920	2.49	0.26	0.01	0.06	0.01	5.0E-03	427	427
Gasoline Passenger Trucks	1,578,240	7.14	1.10	0.01	0.28	0.01	0.01	733	735
Total		**10.48**	**3.36**	**2.3E-02**	**5.2E-01**	**1.0E-01**	**1.0E-01**	**1,838**	**1,841**

Table 9.A.2.7 - Liquefaction and CCTPL Expansion Project
On-Road On-Site Construction Vehicle Tailpipe Emission Factors - CCTPL Pipeline Expansion

Vehicle	Emission Factor (g/VMT)[1]								Onsite Travel (mile/ vehicle-day)	Vehicle-months	Vehicle Usage (vehicle-days/yr)
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e			
2015											
Diesel Heavy Trucks	1.59	6.13	0.014	0.333	0.246	0.239	1,897	1,898	-	-	-
Diesel Buses	2.25	6.13	0.009	0.420	0.283	0.274	1,211	1,212	-	-	-
Diesel Light Trucks	1.54	2.10	0.005	0.302	0.109	0.105	631	631	150	144	3,754
Gasoline Passenger Cars	1.91	0.22	0.005	0.053	0.004	0.004	313	314	-	-	-
Gasoline Passenger Trucks	4.36	0.69	0.007	0.185	0.007	0.007	430	432	-	-	-
2016											
Diesel Heavy Trucks	1.39	5.35	0.014	0.294	0.210	0.204	1,897	1,898	-	-	-
Diesel Buses	2.00	5.41	0.009	0.378	0.247	0.239	1,211	1,212	-	-	-
Diesel Light Trucks	1.43	1.92	0.005	0.270	0.096	0.093	628	629	150	750	19,554
Gasoline Passenger Cars	1.79	0.18	0.005	0.045	0.004	0.004	307	307	-	-	-
Gasoline Passenger Trucks	4.10	0.63	0.007	0.164	0.007	0.006	421	422	-	-	-

1. EPA MOVES2010b

Table 9.A.2.8 - Liquefaction and CCTPL Expansion Project
On-Road On-Site Construction Vehicle Tailpipe Emissions - CCTPL Pipeline Expansion

Vehicle	Vehicle Miles Traveled (VMT)	Emissions (ton/yr)							
		CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e
2015									
Diesel Heavy Trucks	-	-	-	-	-	-	-	-	-
Diesel Buses	-	-	-	-	-	-	-	-	-
Diesel Light Trucks	563,100	0.96	1.30	2.9E-03	0.19	0.07	0.07	391	392
Gasoline Passenger Cars	-	-	-	-	-	-	-	-	-
Gasoline Passenger Trucks	-	-	-	-	-	-	-	-	-
Total		**0.96**	**1.30**	**2.9E-03**	**1.9E-01**	**6.7E-02**	**6.5E-02**	**391**	**392**
2016									
Diesel Heavy Trucks	-	-	-	-	-	-	-	-	-
Diesel Buses	-	-	-	-	-	-	-	-	-
Diesel Light Trucks	2,933,100	4.62	6.21	0.02	0.87	0.31	0.30	2,030	2,032
Gasoline Passenger Cars	-	-	-	-	-	-	-	-	-
Gasoline Passenger Trucks	-	-	-	-	-	-	-	-	-
Total		**4.62**	**6.21**	**1.5E-02**	**8.7E-01**	**3.1E-01**	**3.0E-01**	**2,030**	**2,032**

Table 9.A.2.9 - Liquefaction and CCTPL Expansion Project
2015 Fugitive Dust - CCTPL Pipeline Expansion

Acres Disturbed	392.8
Dust Control Efficiency[1]	50%

Activity	Emission Factor (ton/acre-month)		Reference	Duration (months)[7,8]	Uncontrolled Emissions (tons)		Controlled Emissions (tons)	
	PM_{10}	$PM_{2.5}$			PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Construction	1.10E-01	1.10E-02	2, 3	2	86.42	8.64	43.21	4.32
Wind erosion	1.58E-02	2.38E-03	4, 5, 6	6	37.32	5.60	18.66	2.80
Total Emissions					123.73	14.24	61.87	7.12

1. Assume 50% control from water and other approved dust suppressants. (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1.
2. WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 3-2, level 1, average conditions
3. $PM_{2.5}/PM_{10}$ = 0.10 (WRAP Fugitive Dust Handbook, Section 3.4.1)
4. Wind erosion of exposed areas (seeded land, stripped or graded overburden) = 0.38 ton TSP/acre/yr (WRAP Fugitive Dust Handbook, Table 11-6)
5. PM_{10}/TSP = 0.5, $PM_{2.5}/PM_{10}$ = 0.15, (WRAP Fugitive Dust Handbook, Section 7-2)
6. Emission factor converted from ton/acre-year to ton/acre-month by dividing by 12
7. It is assumed that constructionof a given pipeline segment will entail 2 months of continuous activity.
8. It is assumed that, on average, it will require 6 months to fully revegetate disturbed areas.

Table 9.A.2.10 - Liquefaction and CCTPL Expansion Project
2016 Fugitive Dust - CCTPL Pipeline Expansion

Acres Disturbed	1,178
Dust Control Efficiency[1]	50%

Activity	Emission Factor (ton/acre-month)		Reference	Duration (months)[7,8]	Uncontrolled Emissions (tons)		Controlled Emissions (tons)	
	PM_{10}	$PM_{2.5}$			PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Construction	1.10E-01	1.10E-02	2, 3	2	259.25	25.93	129.63	12.96
Wind erosion	1.58E-02	2.38E-03	4, 5, 6	6	111.95	16.79	55.97	8.40
Total Emissions					371.20	42.72	185.60	21.36

1. Assume 50% control from water and other approved dust suppressants. (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1.
2. WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 3-2, level 1, average conditions
3. $PM_{2.5}/PM_{10}$ = 0.10 (WRAP Fugitive Dust Handbook, Section 3.4.1)
4. Wind erosion of exposed areas (seeded land, stripped or graded overburden) = 0.38 ton TSP/acre/yr (WRAP Fugitive Dust Handbook, Table 11-6)
5. PM_{10}/TSP = 0.5, $PM_{2.5}/PM_{10}$ = 0.15, (WRAP Fugitive Dust Handbook, Section 7-2)
6. Emission factor converted from ton/acre-year to ton/acre-month by dividing by 12
7. It is assumed that constructionof a given pipeline segment will entail 2 months of continuous activity.
8. It is assumed that, on average, it will require 6 months to fully revegetate disturbed areas.

Table 9.A.2.11 - Liquefaction and CCTPL Expansion Project
Open Burning - CCTPL Pipeline Expansion

Fuel Loading (tons/acre)	9.0(a)
Upland Forest Total (acres)	560
Percent Burned in 2015	20%
Percent Burned in 2016	60%

Pollutant	Emission Factor		Emission (tons)	
	(lb/ton)	(lb/acre)	2015	2016
CO	141.0(b)	1,269	71.06	213.19
NO_x	4.0(b)	36	2.02	6.05
VOC	24.2(b)	218	12.20	36.59
PM	17.2(b)	155	8.67	26.01
CO_2	3,180.5(c)	28,624	1,602.97	4,808.91
CH_4	0.18(d)	1.62	0.09	0.27
N_2O	0.04(d)	0.36	0.02	0.06
CO_2e	3,196.7(e)	28,770	1,611.12	4,833.37

References
(a) AP42 Table 13.1-1 (10/96) (Region 8: Southern)
(b) AP42 page 13.1-2, Southern Region
(c) 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Table 12.1.
(d) 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Table 12.4.
(e) The global warming potentials of CO_2, CH_4, and N_2O are 1, 21, and 310, respectively.

Table 9.A.2.12 - Liquefaction and CCTPL Expansion Project Construction Emissions Totals - CCTPL Pipeline Expansion

Nonroad Tailpipe Emissions: Pipeline Construction										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	4.64	10.43	1.4E-02	1.06	0.79	0.79	3,965	1.0E-01	0.23	4,001
2016	13.50	32.24	4.1E-02	3.34	2.24	2.24	11,163	2.8E-01	0.63	11,265
Total	18.14	42.67	0.05	4.40	3.03	3.03	15,129	0.39	0.86	15,266

On-Road Emissions: Pipeline Material Deliveries and Commuting										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	1.82	1.03	4.6E-03	0.11	0.04	0.04	420	-	-	420
2016	10.48	3.36	2.3E-02	0.52	0.10	0.10	1,838	-	-	1,841
Total	12.30	4.38	0.03	0.63	0.14	0.14	2,258	-	-	2,262

On-Road Emissions: Pipeline On-site Construction Vehicles										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	0.96	1.30	2.9E-03	0.19	0.07	0.07	391	-	-	392
2016	4.62	6.21	1.5E-02	0.87	0.31	0.30	2,030	-	-	2,032
Total	5.58	7.51	0.02	1.06	0.38	0.37	2,421	-	-	2,424

Fugitive Dust Emissions: Pipeline Construction										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	-	-	-	-	61.87	7.12	-	-	-	-
2016	-	-	-	-	185.60	21.36	-	-	-	-
Total	-	-	-	-	247.47	28.48	-	-	-	-

Total: Open Burning										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}[1]	$PM_{2.5}$[1]	CO_2	N_2O	CH_4	CO_2e
2015	71.06	2.02	-	12.20	8.67	8.67	1,603	0.09	0.02	1,611
2016	213.19	6.05	-	36.59	26.01	26.01	4,809	0.27	0.06	4,833
Total	284.26	8.06	-	48.79	34.68	34.68	6,412	0.36	0.08	6,444

1. Total PM is conservatively reported as PM_{10} and $PM_{2.5}$.

Table 9.A.2.12 - Liquefaction and CCTPL Expansion Project Construction Emissions Totals - CCTPL Pipeline Expansion (Continued)

Total: Pipeline Construction										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	78.48	14.78	0.02	13.56	71.43	16.68	6,379	0.19	0.25	6,425
2016	241.80	47.85	0.08	41.31	214.26	50.00	19,840	0.56	0.69	19,972
Total	314.70	55.12	0.08	53.81	285.31	66.31	23,799	0.75	0.94	23,972

Table 9.A.3.1 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - Mamou Compressor Station

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration			Pollutant Emissions (tons)				
						CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	days/ week	hours/day	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
D-6 Dozer	Diesel	2270002069	140	1	59%	0.87	2.02	3.1E-03	0.18	0.21	12	5	10	0.05	0.11	1.7E-04	0.01	0.01
D-8 Dozer	Diesel	2270002069	305	1	59%	1.00	2.53	3.2E-03	0.17	0.15	12	5	10	0.12	0.30	3.8E-04	0.02	0.02
Caterpillar 385C	Diesel	2270002036	520	1	59%	0.89	2.22	3.1E-03	0.16	0.14	12	5	10	0.18	0.45	6.4E-04	0.03	0.03
Weld Machine	Gas	2265006025	80	1	68%	31.28	2.26	0.04	0.91	0.07	0	5	10	-	-	-	-	-
Backhoe	Diesel	2270002036	125	2	59%	0.80	1.82	3.1E-03	0.17	0.19	12	5	10	0.08	0.18	3.0E-04	0.02	0.02
Air Compressor	Diesel	2270006015	50	2	43%	2.03	3.98	3.7E-03	0.30	0.28	12	5	10	0.06	0.11	1.1E-04	0.01	0.01
50 T Link Belt Crane	Diesel	2270002045	330	1	43%	0.82	3.21	3.2E-03	0.19	0.13	0	5	10	-	-	-	-	-
Crawler Crane	Diesel	2270002045	500	1	43%	0.82	3.21	3.2E-03	0.19	0.13	0	5	10	-	-	-	-	-
Generators	Diesel	2270006005	30	2	43%	1.92	4.73	3.7E-03	0.48	0.37	12	5	10	0.03	0.08	6.4E-05	0.01	0.01
Pumps	Diesel	2270006010	75	4	43%	2.50	4.52	3.7E-03	0.50	0.46	12	5	10	0.21	0.39	3.2E-04	0.04	0.04
Aerial Lifts	Gas	2265003010	80	1	46%	143.13	10.07	0.05	4.63	0.07	0	5	10	-	-	-	-	-
9000 # Fork Lifts	Diesel	2270003020	90	1	59%	1.36	1.52	3.2E-03	0.15	0.17	12	5	10	0.05	0.05	1.1E-04	0.01	0.01
Trenchers	Diesel	2270002030	185	1	59%	0.88	2.67	3.2E-03	0.22	0.17	8	5	10	0.04	0.13	1.5E-04	0.01	0.01
Graders	Diesel	2270002048	185	1	59%	0.62	1.82	3.0E-03	0.17	0.12	8	5	10	0.03	0.09	1.5E-04	0.01	0.01
Concrete Saws	Gas	2265002039	15	1	78%	291.25	1.91	0.06	5.49	0.14	0	5	10	-	-	-	-	-
Off Highway trucks	Diesel	2270002051	303	2	59%	0.64	1.63	3.0E-03	0.15	0.10	12	5	10	0.15	0.38	7.0E-04	0.03	0.02
Roller Compacter	Diesel	2270002015	50	1	59%	2.36	3.58	3.7E-03	0.25	0.27	0	5	10	-	-	-	-	-
Total														**0.95**	**2.16**	**2.9E-03**	**0.19**	**0.16**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2015, all Parishes in Louisiana
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.

Table 9.A.3.2 - Liquefaction and CCTPL Expansion Project
2015 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - Mamou Compressor Station

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration			Pollutant Emissions (tons)			
						CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	days/ week	hours/day	CO_2	N_2O	CH_4	CO_2e
D-6 Dozer	Diesel	2270002069	140	1	59%	536	0.030	0.014	541	12	5	10	29	7.5E-04	1.7E-03	30
D-8 Dozer	Diesel	2270002069	305	1	59%	536	0.030	0.014	541	12	5	10	64	1.6E-03	3.6E-03	64
Caterpillar 385C	Diesel	2270002036	520	1	59%	536	0.030	0.014	541	12	5	10	109	2.8E-03	0.01	110
Weld Machine	Gas	2265006025	80	1	68%	711	0.040	0.016	717	0	5	10	-	-	-	-
Backhoe	Diesel	2270002036	125	2	59%	536	0.030	0.014	541	12	5	10	52	1.3E-03	3.0E-03	53
Air Compressor	Diesel	2270006015	50	2	43%	589	0.033	0.015	595	12	5	10	17	4.3E-04	9.5E-04	17
50 T Link Belt Crane	Diesel	2270002045	330	1	43%	530	0.030	0.014	535	0	5	10	-	-	-	-
Crawler Crane	Diesel	2270002045	500	1	43%	530	0.030	0.014	535	0	5	10	-	-	-	-
Generators	Diesel	2270006005	30	2	43%	589	0.033	0.015	594	12	5	10	10	2.6E-04	5.7E-04	10
Pumps	Diesel	2270006010	75	4	43%	589	0.033	0.015	594	12	5	10	50	1.3E-03	2.9E-03	51
Aerial Lifts	Gas	2265003010	80	1	46%	823	0.047	0.019	830	0	5	10	-	-	-	-
9000 # Fork Lifts	Diesel	2270003020	90	1	59%	596	0.034	0.015	601	12	5	10	21	5.3E-04	1.2E-03	21
Trenchers	Diesel	2270002030	185	1	59%	536	0.030	0.014	541	8	5	10	26	6.6E-04	1.5E-03	26
Graders	Diesel	2270002048	185	1	59%	536	0.030	0.014	541	8	5	10	26	6.6E-04	1.5E-03	26
Concrete Saws	Gas	2265002039	15	1	78%	1,044	0.059	0.024	1,053	0	5	10	-	-	-	-
Off Highway trucks	Diesel	2270002051	303	1	59%	536	0.030	0.014	541	12	5	10	63	1.6E-03	3.6E-03	64
Roller Compacter	Diesel	2270002015	50	1	59%	595	0.034	0.015	601	0	5	10	-	-	-	-
Total													**438**	**0.01**	**0.02**	**442**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2015, all Parishes in Louisiana
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.

Table 9.A.3.3 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Criteria Pollutant Tailpipe Emissions - Mamou Compressor Station

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)					Equipment Operating Duration			Pollutant Emissions (tons)				
						CO^2	NO_x^2	SO_2^2	VOC^2	$PM_{10}/PM_{2.5}^{2,3}$	weeks	days/ week	hours/day	CO	NO_x	SO_2	VOC	$PM_{10}/PM_{2.5}$
D-6 Dozer	Diesel	2270002069	140	1	59%	0.74	1.70	3.0E-03	0.17	0.18	4	5	10	0.01	0.03	5.5E-05	3.1E-03	3.2E-03
D-8 Dozer	Diesel	2270002069	305	1	59%	0.89	2.22	3.1E-03	0.16	0.13	4	5	10	0.04	0.09	1.2E-04	0.01	0.01
Caterpillar 385C	Diesel	2270002036	520	1	59%	0.77	1.90	3.1E-03	0.15	0.12	18	5	10	0.23	0.58	9.3E-04	0.05	0.04
Weld Machine	Gas	2265006025	80	2	68%	26.25	1.95	0.04	0.76	0.07	18	5	10	2.83	0.21	4.4E-03	0.08	0.01
Backhoe	Diesel	2270002036	125	2	59%	0.65	1.49	3.0E-03	0.16	0.16	4	5	10	0.02	0.05	9.7E-05	0.01	0.01
Air Compressor	Diesel	2270006015	50	2	43%	1.86	3.82	3.6E-03	0.28	0.25	18	5	10	0.08	0.16	1.5E-04	0.01	0.01
50 T Link Belt Crane	Diesel	2270002045	330	1	43%	0.74	2.89	3.2E-03	0.18	0.12	18	5	10	0.10	0.41	4.5E-04	0.03	0.02
Crawler Crane	Diesel	2270002045	500	1	43%	0.74	2.89	3.2E-03	0.18	0.12	18	5	10	0.16	0.62	6.8E-04	0.04	0.03
Generators	Diesel	2270006005	30	2	43%	1.71	4.55	3.7E-03	0.42	0.33	18	5	10	0.04	0.12	9.4E-05	0.01	0.01
Pumps	Diesel	2270006010	75	4	43%	2.36	4.25	3.7E-03	0.47	0.43	18	5	10	0.30	0.54	4.7E-04	0.06	0.06
Aerial Lifts	Gas	2265003010	80	1	46%	141.04	9.87	0.05	4.55	0.07	18	5	10	5.15	0.36	1.7E-03	0.17	2.7E-03
9000 # Fork Lifts	Diesel	2270003020	90	1	59%	0.82	1.04	3.0E-03	0.14	0.08	18	5	10	0.04	0.05	1.6E-04	0.01	4.3E-03
Trenchers	Diesel	2270002030	185	1	59%	0.78	2.35	3.1E-03	0.21	0.15	4	5	10	0.02	0.06	7.6E-05	4.9E-03	3.7E-03
Graders	Diesel	2270002048	185	1	59%	0.51	1.52	2.9E-03	0.16	0.10	4	5	10	0.01	0.04	7.1E-05	3.9E-03	2.3E-03
Concrete Saws	Gas	2265002039	15	1	78%	290.90	1.89	0.06	5.45	0.14	4	5	10	0.75	4.9E-03	1.6E-04	0.01	3.5E-04
Off Highway trucks	Diesel	2270002051	303	1	59%	0.50	1.33	2.9E-03	0.14	0.08	18	5	10	0.09	0.24	5.1E-04	0.03	0.01
Roller Compacter	Diesel	2270002015	50	1	59%	2.07	3.44	3.6E-03	0.23	0.23	9	5	10	0.03	0.05	5.2E-05	3.3E-03	3.4E-03
Total														**9.90**	**3.57**	**0.01**	**0.51**	**0.20**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2016, all Parishes in Louisiana
3. $PM_{2.5}$ emissions are assumed to be equivalent to PM_{10} emissions for combustion sources.

Table 9.A.3.4 - Liquefaction and CCTPL Expansion Project
2016 Non-Road Construction Equipment Greenhouse Gas Tailpipe Emissions - Mamou Compressor Station

Equipment Type	Fuel	Source Category[1]	Engine Rating (hp)	No.	Load Factor	Pollutant Emission Factor (g/hp-hr)				Equipment Operating Duration			Pollutant Emissions (tons)			
						CO_2[2]	CH_4[3]	N_2O[3]	CO_2e[4]	weeks	days/ week	hours/day	CO_2	N_2O	CH_4	CO_2e
D-6 Dozer	Diesel	2270002069	140	1	59%	536	0.030	0.014	541	4	5	10	10	2.5E-04	5.5E-04	10
D-8 Dozer	Diesel	2270002069	305	1	59%	536	0.030	0.014	541	4	5	10	21	5.4E-04	1.2E-03	21
Caterpillar 385C	Diesel	2270002036	520	1	59%	536	0.030	0.014	541	18	5	10	163	4.2E-03	0.01	165
Weld Machine	Gas	2265006025	80	2	68%	708	0.040	0.018	715	18	5	10	76	1.9E-03	4.3E-03	77
Backhoe	Diesel	2270002036	125	2	59%	536	0.030	0.014	541	4	5	10	17	4.4E-04	9.9E-04	18
Air Compressor	Diesel	2270006015	50	2	43%	589	0.033	0.015	595	18	5	10	25	6.4E-04	1.4E-03	25
50 T Link Belt Crane	Diesel	2270002045	330	1	43%	530	0.030	0.014	535	18	5	10	75	1.9E-03	4.2E-03	75
Crawler Crane	Diesel	2270002045	500	1	43%	530	0.030	0.014	535	18	5	10	113	2.9E-03	0.01	114
Generators	Diesel	2270006005	30	2	43%	589	0.033	0.015	594	18	5	10	15	3.8E-04	8.6E-04	15
Pumps	Diesel	2270006010	75	4	43%	589	0.033	0.015	594	18	5	10	75	1.9E-03	4.3E-03	76
Aerial Lifts	Gas	2265003010	80	1	46%	819	0.047	0.021	827	18	5	10	30	7.6E-04	1.7E-03	30
9000 # Fork Lifts	Diesel	2270003020	90	1	59%	596	0.034	0.015	601	18	5	10	31	8.0E-04	1.8E-03	32
Trenchers	Diesel	2270002030	185	1	59%	536	0.030	0.014	541	4	5	10	13	3.3E-04	7.3E-04	13
Graders	Diesel	2270002048	185	1	59%	536	0.030	0.014	541	4	5	10	13	3.3E-04	7.3E-04	13
Concrete Saws	Gas	2265002039	15	1	78%	1,044	0.059	0.027	1,054	4	5	10	3	6.9E-05	1.5E-04	3
Off Highway trucks	Diesel	2270002051	303	1	59%	536	0.030	0.014	541	18	5	10	95	2.4E-03	0.01	96
Roller Compacter	Diesel	2270002015	50	1	59%	595	0.034	0.015	601	9	5	10	9	2.2E-04	4.9E-04	9
Total													**775**	**0.02**	**0.04**	**782**

1. User's Guide for the Final NONROAD2005 Model, EPA420-R-05-013, US EPA, December 2005
2. EPA NONROAD2008 run for calendar year 2016, all Parishes in Louisiana
3. 2013 Climate Registry Default Emission Factors, Released: April 2, 2013, Tables 13.1 and 13.7., ratioed based on CO_2 emission factor from NONROAD. http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/
4. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 21, and 310, respectively.

Table 9.A.3.5 - Liquefaction and CCTPL Expansion Project
On-Road Material Delivery, and Worker Commuting Emission Factors - Mamou Compressor Station

Vehicle	Emission Factor (g/VMT)[1]								Trip Distance (2-way) (miles)	Vehicle-months	Vehicle Usage (vehicle-days/yea
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e			
2015											
Diesel Heavy Trucks	1.59	6.13	0.014	0.333	0.246	0.239	1,897	1,898	150	16	348
Diesel Buses	2.25	6.13	0.009	0.420	0.283	0.274	1,211	1,212	75	4	87
Diesel Light Trucks	1.54	2.10	0.005	0.302	0.109	0.105	631	631	75	16	348
Gasoline Passenger Cars	1.91	0.22	0.005	0.053	0.004	0.004	313	314	75	40	869
Gasoline Passenger Trucks	4.36	0.69	0.007	0.185	0.007	0.007	430	432	75	40	869
2016											
Diesel Heavy Trucks	1.39	5.35	0.014	0.294	0.210	0.204	1,897	1,898	150	16	348
Diesel Buses	2.00	5.41	0.009	0.378	0.247	0.239	1,211	1,212	75	4	87
Diesel Light Trucks	1.43	1.92	0.005	0.270	0.096	0.093	628	629	75	16	348
Gasoline Passenger Cars	1.79	0.18	0.005	0.045	0.004	0.004	307	307	75	40	869
Gasoline Passenger Trucks	4.10	0.63	0.007	0.164	0.007	0.006	421	422	75	40	869

1. EPA MOVES2010b

Table 9.A.3.6 - Liquefaction and CCTPL Expansion Project
On-Road Material Delivery, and Worker Commuting Emissions - Mamou Compressor Station

Vehicle	Vehicle Miles Traveled (VMT)	Emissions (ton/yr)							
		CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CO_2e
2015									
Diesel Heavy Trucks	52,200	0.09	0.35	8.0E-04	0.02	0.01	0.01	109.1	109.2
Diesel Buses	6,525	0.02	0.04	6.5E-05	3.0E-03	2.0E-03	2.0E-03	8.7	8.7
Diesel Light Trucks	26,100	0.04	0.06	1.4E-04	0.01	3.1E-03	3.0E-03	18.1	18.2
Gasoline Passenger Cars	65,175	0.14	0.02	3.5E-04	3.8E-03	2.9E-04	2.7E-04	22.5	22.6
Gasoline Passenger Trucks	65,175	0.31	0.05	4.8E-04	0.01	5.2E-04	4.7E-04	30.9	31.0
Total		**0.60**	**0.52**	**1.8E-03**	**4.8E-02**	**2.0E-02**	**1.9E-02**	**189**	**190**
2016									
Diesel Heavy Trucks	52,200	0.08	0.31	7.9E-04	0.02	0.01	0.01	109.1	109.2
Diesel Buses	6,525	0.01	0.04	6.4E-05	2.7E-03	1.8E-03	1.7E-03	8.7	8.7
Diesel Light Trucks	26,100	0.04	0.06	1.3E-04	0.01	2.8E-03	2.7E-03	18.1	18.1
Gasoline Passenger Cars	65,175	0.13	0.01	3.4E-04	3.2E-03	2.8E-04	2.6E-04	22.0	22.1
Gasoline Passenger Trucks	65,175	0.29	0.05	4.7E-04	0.01	5.0E-04	4.6E-04	30.3	30.4
Total		**0.56**	**0.46**	**1.8E-03**	**4.2E-02**	**1.7E-02**	**1.7E-02**	**188**	**188**

Table 9.A.3.7 - Liquefaction and CCTPL Expansion Project
2015 Fugitive Dust - Mamou Compressor Station

Acres Disturbed 40.0
Dust Control Efficiency[1] 50%

Activity	Emission Factor (ton/acre-month)		Reference	Duration (months)[7]	Uncontrolled Emissions (tons)		Controlled Emissions (tons)	
	PM_{10}	$PM_{2.5}$			PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Construction	1.10E-01	1.10E-02	2, 3	2	8.80	0.88	4.40	0.44
Wind erosion	1.58E-02	2.38E-03	4, 5, 6	0	0.00	0.00	0.00	0.00
Total Emissions					8.80	0.88	4.40	0.44

1. Assume 50% control from water and other approved dust suppressants. (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1.
2. WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 3-2, level 1, average conditions
3. $PM_{2.5}/PM_{10}$ = 0.10 (WRAP Fugitive Dust Handbook, Section 3.4.1)
4. Wind erosion of exposed areas (seeded land, stripped or graded overburden) = 0.38 ton TSP/acre/yr (WRAP Fugitive Dust Handbook, Table 11-6)
5. PM_{10}/TSP = 0.5, $PM_{2.5}/PM_{10}$ = 0.15, (WRAP Fugitive Dust Handbook, Section 7-2)
6. Emission factor converted from ton/acre-year to ton/acre-month by dividing by 12
7. It is assumed that, on average, it will require 6 months to fully revegetate disturbed areas.

Table 9.A.3.8 - Liquefaction and CCTPL Expansion Project
2016 Fugitive Dust - Mamou Compressor Station

Acres Disturbed	40
Dust Control Efficiency[1]	50%

Activity	Emission Factor (ton/acre-month)		Reference	Duration (months)[7]	Uncontrolled Emissions (tons)		Controlled Emissions (tons)	
	PM_{10}	$PM_{2.5}$			PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Construction	1.10E-01	1.10E-02	2, 3	2	8.80	0.88	4.40	0.44
Wind erosion	1.58E-02	2.38E-03	4, 5, 6	6	3.80	0.57	1.90	0.29
Total Emissions					12.60	1.45	6.30	0.73

1. Assume 50% control from water and other approved dust suppressants. (WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Section 3.4.1.
2. WRAP Fugitive Dust Handbook, Countess Environmental, September 2006, Table 3-2, level 1, average conditions
3. $PM_{2.5}/PM_{10}$ = 0.10 (WRAP Fugitive Dust Handbook, Section 3.4.1)
4. Wind erosion of exposed areas (seeded land, stripped or graded overburden) = 0.38 ton TSP/acre/yr (WRAP Fugitive Dust Handbook, Table 11-6)
5. PM_{10}/TSP = 0.5, $PM_{2.5}/PM_{10}$ = 0.15, (WRAP Fugitive Dust Handbook, Section 7-2)
6. Emission factor converted from ton/acre-year to ton/acre-month by dividing by 12
7. It is assumed that, on average, it will require 6 months to fully revegetate disturbed areas.

Table 9.A.3.9 - Liquefaction and CCTPL Expansion Project
Construction Emissions Totals - Mamou Compressor Station

Nonroad Tailpipe Emissions - Mamou Compressor Station Construction										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	0.95	2.16	2.9E-03	0.19	0.16	0.16	438	1.1E-02	0.02	442
2016	9.90	3.57	1.0E-02	0.51	0.20	0.20	775	2.0E-02	0.04	782
Total	10.86	5.73	1.3E-02	0.70	0.36	0.36	1,213	0.03	0.07	1,224

On-Road Emissions - Mamou Compressor Station Material Deliveries and Commuting										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	0.60	0.52	1.8E-03	0.05	0.02	0.02	189	-	-	190
2016	0.56	0.46	1.8E-03	0.04	0.02	0.02	188	-	-	188
Total	1.16	0.98	3.6E-03	0.09	0.04	0.04	378	-	-	378

Fugitive Dust Emissions - Mamou Compressor Station Construction										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	-	-	-	-	4.40	0.44	-	-	-	-
2016	-	-	-	-	6.30	0.73	-	-	-	-
Total	-	-	-	-	10.70	1.17	-	-	-	-

Total - Mamou Compressor Station Construction										
Year	Annual Emissions (tons)									
	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_2e
2015	1.55	2.69	4.7E-03	0.24	4.58	0.62	627	1.1E-02	0.02	632
2016	10.46	4.03	1.2E-02	0.56	6.52	0.94	964	2.0E-02	0.04	971
Total	12.02	6.72	1.7E-02	0.79	11.10	1.57	1,591	0.03	0.07	1,603

APPENDIX 9B

Operating Emissions Calculations

Mamou Compressor Station
Evangeline Parish, Louisiana

EMERGENCY GENERATOR EMISSION CALCULATIONS

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Emergency Generator	N/A	G-0223

Operating Data[1]		
Manufacturer	Dresser Waukesha	
Model	VGF24GL/GLD	
Rating	543	hp
	6,846	Btu/hp-hr
	3.72	MMBtu/hr
Fuel Type	Natural Gas	
Hours of Operations	500	hrs/year

Pollutant	Emission Factor	Reference	Emission Rates		
			Avg (lb/hr)	Max (lb/hr)	Annual (tons/yr)
$PM_{10}/PM_{2.5}$	7.71E-05 lb/MMBtu	AP-42 Table 3.2-2	0.00	0.00	0.00
SO_2	1.33E-02 lb/MMBtu	Fuel Gas Composition (5 grains sulfur/100 SCF)	0.05	0.05	0.01
NO_X	2.00 g/bhp-hr	Manufacturer Spec.	2.39	2.39	0.60
CO	1.30 g/bhp-hr	Manufacturer Spec.	1.56	1.56	0.39
VOC Total	0.37 g/bhp-hr	Manufacturer Spec.	0.45	0.45	0.11
Formaldehyde	5.28E-02 lb/MMBtu	AP-42 Table 3.2-2	0.20	0.20	0.05
CO_2-e	53.02 kg/MMBtu	EPA Factor[2]	434.52	434.52	108.63

(1) Provided by Cheniere Energy, Inc.

(2) Table NN-1 to Subpart NN of Part 98 - Default Factors for Calculation Methodology 1 of this subpart (40 CFR 98, October 30, 2009)

(3) Emission rates calculated as follows:

Example 1: *Emiision rate (lb/hr) = Operating Rate (MMBtu/hr) X Emission Factor (lb/MMBtu)*

Example 2: *Emiision rate (lb/hr) = Operating Rate (bhp) X Emission Factor (g/bhp-hr) / (453.6 g/lb)*

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Emergency Generator	N/A	G-0224

Operating Data[1]		
Manufacturer	Dresser Waukesha	
Model	VGF24GL/GLD	
Rating	543	hp
	6,846	Btu/hp-hr
	3.72	MMBtu/hr
Fuel Type	Natural Gas	
Hours of Operations	500	hrs/year

Pollutant	Emission Factor	Reference	Emission Rates		
			Avg (lb/hr)	Max (lb/hr)	Annual (tons/yr)
$PM_{10}/PM_{2.5}$	7.71E-05 lb/MMBtu	AP-42 Table 3.2-2	0.00	0.00	0.00
SO_2	1.33E-02 lb/MMBtu	Fuel Gas Composition (5 grains sulfur/100 SCF)	0.05	0.05	0.01
NO_X	2.00 g/bhp-hr	Manufacturer Spec.	2.39	2.39	0.60
CO	1.30 g/bhp-hr	Manufacturer Spec.	1.56	1.56	0.39
VOC Total	0.37 g/bhp-hr	Manufacturer Spec.	0.45	0.45	0.11
Formaldehyde	5.28E-02 lb/MMBtu	AP-42 Table 3.2-2	0.20	0.20	0.05
CO_2-e	53.02 kg/MMBtu	EPA Factor[2]	434.52	434.52	108.63

(1) Provided by Cheniere Energy, Inc.

(2) Table NN-1 to Subpart NN of Part 98 - Default Factors for Calculation Methodology 1 of this subpart (40 CFR 98, October 30, 2009)

(3) Emission rates calculated as follows:

Example 1: *Emiision rate (lb/hr) = Operating Rate (MMBtu/hr) X Emission Factor (lb/MMBtu)*

Example 2: *Emiision rate (lb/hr) = Operating Rate (bhp) X Emission Factor (g/bhp-hr) / (453.6 g/lb)*

NATURAL GAS-FIRED TURBINE EMISSION CALCULATIONS

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Gas Turbine Driven Compressor Unit A - Taurus 70	N/A	Z-0101

Operating Data[1]		
Manufacturer	Solar	
Model	Taurus 70-1080S	
Rating	10,836	hp
	7,267	Btu/hp-hr
	78.74	MMBtu/hr
Fuel Type	Natural Gas	
Hours of Operations	8,760	hrs/year

Pollutant	Emission Factor	Reference	Emission Rates		
			Avg (lb/hr)	Max (lb/hr)	Annual (tons/yr)
$PM_{10}/PM_{2.5}$	0.02 lb/MMBtu	Manufacturer Spec.	1.65	1.65	7.24
SO_2	0.01 lb/MMBtu	Fuel Gas Composition (5 grains sulfur/100 SCF)	1.08	1.08	4.72
NO_X	0.33 g/bhp-hr	Manufacturer Spec.	7.95	7.95	34.82
CO	0.41 g/bhp-hr	Manufacturer Spec.	9.68	9.68	42.40
VOC Total	0.02 g/bhp-hr	Manufacturer Spec.	0.55	0.55	2.40
Formaldehyde	0.01 g/bhp-hr	Manufacturer Spec.	0.23	0.23	0.99
CO_2-e	53.02 kg/MMBtu	EPA Factor[2]	9,203.84	9,203.84	40,312.82

(1) Provided by Cheniere Energy, Inc.

(2) Table NN-1 to Subpart NN of Part 98 - Default Factors for Calculation Methodology 1 of this subpart (40 CFR 98, October 30, 2009)

(3) Emission rates calculated as follows:

Example 1: *Emiision rate (lb/hr) = Operating Rate (MMBtu/hr) X Emission Factor (lb/MMBtu)*

Example 2: *Emiision rate (lb/hr) = Operating Rate (bhp) X Emission Factor (g/bhp-hr) / (453.6 g/lb)*

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Gas Turbine Driven Compressor Unit B - Taurus 70	N/A	Z-0102

Operating Data[1]		
Manufacturer	Solar	
Model	Taurus 70-1080S	
Rating	10,836	hp
	7,267	Btu/hp-hr
	78.74	MMBtu/hr
Fuel Type	Natural Gas	
Hours of Operations	8,760	hrs/year

Pollutant	Emission Factor	Reference	Emission Rates		
			Avg (lb/hr)	Max (lb/hr)	Annual (tons/yr)
$PM_{10}/PM_{2.5}$	0.02 lb/MMBtu	Manufacturer Spec.	1.65	1.65	7.24
SO_2	0.01 lb/MMBtu	Fuel Gas Composition (5 grains sulfur/100 SCF)	1.08	1.08	4.72
NO_X	0.33 g/bhp-hr	Manufacturer Spec.	7.95	7.95	34.82
CO	0.41 g/bhp-hr	Manufacturer Spec.	9.68	9.68	42.40
VOC Total	0.02 g/bhp-hr	Manufacturer Spec.	0.55	0.55	2.40
Formaldehyde	0.01 g/bhp-hr	Manufacturer Spec.	0.23	0.23	0.99
CO_2-e	53.02 kg/MMBtu	EPA Factor[2]	9,203.84	9,203.84	40,312.82

(1) Provided by Cheniere Energy, Inc.

(2) Table NN-1 to Subpart NN of Part 98 - Default Factors for Calculation Methodology 1 of this subpart (40 CFR 98, October 30, 2009)

(3) Emission rates calculated as follows:

Example 1: *Emiision rate (lb/hr) = Operating Rate (MMBtu/hr) X Emission Factor (lb/MMBtu)*

Example 2: *Emiision rate (lb/hr) = Operating Rate (bhp) X Emission Factor (g/bhp-hr) / (453.6 g/lb)*

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Gas Turbine Driven Compressor Unit C - Taurus 70	N/A	Z-0103

Operating Data[1]		
Manufacturer	Solar	
Model	Taurus 70-1080S	
Rating	10,836	hp
	7,267	Btu/hp-hr
	78.74	MMBtu/hr
Fuel Type	Natural Gas	
Hours of Operations	8,760	hrs/year

Pollutant	Emission Factor	Reference	Emission Rates		
			Avg (lb/hr)	Max (lb/hr)	Annual (tons/yr)
$PM_{10}/PM_{2.5}$	0.02 lb/MMBtu	Manufacturer Spec.	1.65	1.65	7.24
SO_2	0.01 lb/MMBtu	Fuel Gas Composition (5 grains sulfur/100 SCF)	1.08	1.08	4.72
NO_X	0.33 g/bhp-hr	Manufacturer Spec.	7.95	7.95	34.82
CO	0.41 g/bhp-hr	Manufacturer Spec.	9.68	9.68	42.40
VOC Total	0.02 g/bhp-hr	Manufacturer Spec.	0.55	0.55	2.40
Formaldehyde	0.01 g/bhp-hr	Manufacturer Spec.	0.23	0.23	0.99
CO_2-e	53.02 kg/MMBtu	EPA Factor[2]	9,203.84	9,203.84	40,312.82

(1) Provided by Cheniere Energy, Inc.

(2) Table NN-1 to Subpart NN of Part 98 - Default Factors for Calculation Methodology 1 of this subpart (40 CFR 98, October 30, 2009)

(3) Emission rates calculated as follows:

Example 1: *Emiision rate (lb/hr) = Operating Rate (MMBtu/hr) X Emission Factor (lb/MMBtu)*

Example 2: *Emiision rate (lb/hr) = Operating Rate (bhp) X Emission Factor (g/bhp-hr) / (453.6 g/lb)*

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Gas Turbine Driven Compressor Unit D - Titan 130	N/A	Z-0104

Operating Data[1]		
Manufacturer	Solar	
Model	Titan 130-20502S	
Rating	20,617	hp
	7,050	Btu/hp-hr
	145.36	MMBtu/hr
Fuel Type	Natural Gas	
Hours of Operations	8,760	hrs/year

Pollutant	Emission Factor	Reference	Emission Rates		
			Avg (lb/hr)	Max (lb/hr)	Annual (tons/yr)
$PM_{10}/PM_{2.5}$	0.02 lb/MMBtu	Manufacturer Spec.	3.053	3.053	13.37
SO_2	0.01 lb/MMBtu	Fuel Gas Composition (5 grains sulfur/100 SCF)	1.989	1.989	8.71
NO_X	0.32 g/bhp-hr	Manufacturer Spec.	14.681	14.681	64.30
CO	0.39 g/bhp-hr	Manufacturer Spec.	17.863	17.863	78.24
VOC Total	0.02 g/bhp-hr	Manufacturer Spec.	1.011	1.011	4.43
Formaldehyde	0.01 g/bhp-hr	Manufacturer Spec.	0.418	0.418	1.83
CO_2-e	53.02 kg/MMBtu	EPA Factor[2]	16,990.986	16,990.986	74,420.52

(1) Provided by Cheniere Energy, Inc.

(2) Table NN-1 to Subpart NN of Part 98 - Default Factors for Calculation Methodology 1 of this subpart (40 CFR 98, October 30, 2009)

(3) Emission rates calculated as follows:

Example 1: *Emiision rate (lb/hr) = Operating Rate (MMBtu/hr) X Emission Factor (lb/MMBtu)*

Example 2: *Emiision rate (lb/hr) = Operating Rate (bhp) X Emission Factor (g/bhp-hr) / (453.6 g/lb)*

CONDENSATE TANK EMISSION CALCULATIONS

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

Identification		
User Identification:	TK-0101	
City:	Lake Charles	
State:	Louisiana	
Company:	Cheniere	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Condensate Storage Tank	
Tank Dimensions		
Shell Height (ft):		12.00
Diameter (ft):		8.00
Liquid Height (ft) :		11.50
Avg. Liquid Height (ft):		10.00
Volume (gallons):		4,324.15
Turnovers:		12.00
Net Throughput(gal/yr):		51,889.82
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	White/White	
Shell Condition	Good	
Roof Color/Shade:	White/White	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		1.00
Slope (ft/ft) (Cone Roof)		0.25
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Baton Rouge, Louisiana (Avg Atmospheric Pressure = 14.72 psia)

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

TK-101 - Vertical Fixed Roof Tank
Lake Charles, Louisiana

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 7)	All	69.60	64.20	74.99	67.70	4.2222	3.7936	4.6890	68.0000			92.00	Option 4: RVP=7, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TK-101 - Vertical Fixed Roof Tank
Lake Charles, Louisiana

Annual Emission Calcaulations	
Standing Losses (lb):	171.1491
Vapor Space Volume (cu ft):	117.2861
Vapor Density (lb/cu ft):	0.0506
Vapor Space Expansion Factor:	0.1204
Vented Vapor Saturation Factor:	0.6570
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	117.2861
Tank Diameter (ft):	8.0000
Vapor Space Outage (ft):	2.3333
Tank Shell Height (ft):	12.0000
Average Liquid Height (ft):	10.0000
Roof Outage (ft):	0.3333
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.3333
Roof Height (ft):	1.0000
Roof Slope (ft/ft):	0.2500
Shell Radius (ft):	4.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0506

Vapor Molecular Weight (lb/lb-mole):	68.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.2222
Daily Avg. Liquid Surface Temp. (deg. R):	529.2692
Daily Average Ambient Temp. (deg. F):	67.6833
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	527.3733
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,418.1969
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1204
Daily Vapor Temperature Range (deg. R):	21.5826
Daily Vapor Pressure Range (psia):	0.8955
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.2222
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	3.7936
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	4.6890
Daily Avg. Liquid Surface Temp. (deg R):	529.2692
Daily Min. Liquid Surface Temp. (deg R):	523.8735
Daily Max. Liquid Surface Temp. (deg R):	534.6648
Daily Ambient Temp. Range (deg. R):	20.6000
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.6570
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	4.2222
Vapor Space Outage (ft):	2.3333
Working Losses (lb):	354.7121
Vapor Molecular Weight (lb/lb-mole):	68.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.2222
Annual Net Throughput (gal/yr.):	51,889.8169
Annual Turnovers:	12.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	4,324.1514
Maximum Liquid Height (ft):	11.5000
Tank Diameter (ft):	8.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	525.8612

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

Emissions Report for: Annual

TK-101 - Vertical Fixed Roof Tank
Lake Charles, Louisiana

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 7)	354.71	171.15	525.86

FUGITIVE EMISSION CALCULATIONS

Component Name	Stream Type	Number of Components	Emission Factor	Uncontrolled Emissions Rates	
			lb/hr	lb/hr	Ton/year
Valves	Gas	100	9.92E-03	0.99	4.34
Pumps	Gas	0	5.29E-03	0.00	0.00
Flanges/Connectors	Gas	200	8.60E-04	0.17	0.75
Compressors	Gas	3	1.94E-02	0.06	0.25
Relief Valves	Gas	15	1.94E-02	0.29	1.27
Open-ended Lines	Gas	10	4.41E-03	0.04	0.19
Connectors	Gas	0	4.40E-04	0.00	0.00
Others	Gas	0	1.94E-02	0.00	0.00
Process Drains	Gas	10	1.94E-02	0.19	0.85
Valves	Water / Light Oil	20	2.16E-04	0.00	0.02
Pumps	Water / Light Oil	1	5.20E-05	0.00	0.00
Flanges/Connectors	Water / Light Oil	40	6.00E-06	0.00	0.00
Compressors	Water / Light Oil	0	3.09E-02	0.00	0.00
Relief Valves	Water / Light Oil	2	3.09E-02	0.06	0.27
Open-ended Lines	Water / Light Oil	10	5.50E-04	0.01	0.02
Connectors	Water / Light Oil	10	2.43E-04	0.00	0.01
Others	Water / Light Oil	0	3.09E-02	0.00	0.00
Process Drains	Water / Light Oil	10	3.09E-02	0.31	1.35
Valves	Light Oil	20	5.50E-03	0.11	0.48
Pumps	Light Oil	1	2.87E-02	0.03	0.13
Flanges/Connectors	Light Oil	40	2.43E-04	0.01	0.04
Compressors	Light Oil	0	1.65E-02	0.00	0.00
Relief Valves	Light Oil	2	1.65E-02	0.03	0.14
Open-ended Lines	Light Oil	10	3.09E-03	0.03	0.14
Connectors	Light Oil	10	4.63E-04	0.00	0.02
Others	Light Oil	0	1.65E-02	0.00	0.00
Process Drains	Light Oil	10	1.65E-02	0.17	0.72
		THC	96.92	2.44	10.68
		NMHCs	7.34	0.18	0.81
		NMNEHCs(VOCs)	2.22	0.06	0.25
		HEXANE	0.51	0.01	0.06

MAINTENANCE STARTUP AND SHUTDOWN EMISSION CALCULATIONS

Company	Facility	
Cheniere Energy, Inc.	[illegible] Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item	Emission Point ID No.
Maintenance Startup and Shutdown	N/A	MSS

Start up Emissions - 10 Minute Startup[1]													
Description	Events per Year	NO_X			CO			VOC			CO_2		
		Avg (lb/event)	Max (lb/hr)	TPY	Avg (lb/event)	Max (lb/hr)	TPY	Avg (lb/event)	Max (lb/hr)	TPY	Avg (lb/event)	Max (lb/hr)	TPY
Gas Turbine Driven Compressor Unit A - Taurus 70	100	0.80	4.80	0.04	73.10	438.60	3.66	0.84	5.04	0.04	519.00	3,114.00	25.95
Gas Turbine Driven Compressor Unit B - Taurus 70	100	0.80	4.80	0.04	73.10	438.60	3.66	0.84	5.04	0.04	519.00	3,114.00	25.95
Gas Turbine Driven Compressor Unit C - Taurus 70	100	0.80	4.80	0.04	73.10	438.60	3.66	0.84	5.04	0.04	519.00	3,114.00	25.95
Gas Turbine Driven Compressor Unit D - Titan 130	100	1.90	11.40	0.10	176.90	1,061.40	8.85	2.02	12.12	0.10	1,161.00	6,966.00	58.05
Total Startup Emissions				**0.22**			**19.81**			**0.23**			**135.90**

Shutdown Emissions - 10 Minute Shutdown[1]													
Description	Events per Year	NO_X			CO			VOC			CO_2		
		Avg (lb/event)	Max (lb/hr)	TPY	Avg (lb/event)	Max (lb/hr)	TPY	Avg (lb/event)	Max (lb/hr)	TPY	Avg (lb/event)	Max (lb/hr)	TPY
Gas Turbine Driven Compressor Unit A - Taurus 70	100	1.10	6.60	0.06	93.40	560.40	4.67	1.06	6.36	0.05	575.00	3,450.00	28.75
Gas Turbine Driven Compressor Unit B - Taurus 70	100	1.10	6.60	0.06	93.40	560.40	4.67	1.06	6.36	0.05	575.00	3,450.00	28.75
Gas Turbine Driven Compressor Unit C - Taurus 70	100	1.10	6.60	0.06	93.40	560.40	4.67	1.06	6.36	0.05	575.00	3,450.00	28.75
Gas Turbine Driven Compressor Unit D - Titan 130	100	2.40	14.40	0.12	207.60	1,245.60	10.38	2.38	14.28	0.12	1,272.00	7,632.00	63.60
Total Shutdown Emissions				**0.29**			**24.39**			**0.28**			**149.85**
Total MSS Emissions				**0.50**			**44.20**			**0.51**			**285.75**

(1) Emissions data and maintenance sheduling provided by Manufacturing Specifications.

BLOWN STACK EMISSION CALCULATIONS

BLOW DOWN SYSTEM CALCULATIONS

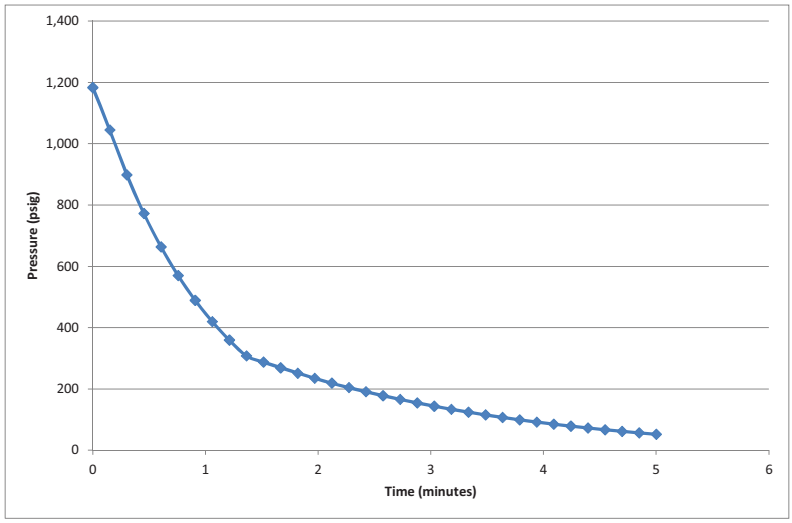
PIPE VOLUME CALCULATIONS

SECTION:	COMPRESSOR UNIT: Taurus 70 Units	BDV TAG:	

Section	Description	Line Number	NPS (in)	Piping Class	Sch / BWG	OD(in)	ID(in)	WT(in)	Length (ft)	Transv Sect Area (ft2)	Cylinder Volume (ft3)	Heads Volume (ft3)	Volume (ft3)	Normal Volume (ft3)	Press (psig)	Temp (°F)	Pseudo-reduced Press	Pseudo-reduced Temp	Z Factor	Moles (lbmol)	Temp x Moles
Comp Suction	Piping		20"	D	XS	20.000	19.000	0.500	100	1.969	196.895		197	10651	850	75	1.277	1.519	0.887	33	17879
Comp Discharge	Piping		16"	D	XS	16.000	15.000	0.500	200	1.227	245.437		245	18348	1370	160	2.044	1.761	0.907	56	34937
Cooler Inlet	Piping		12"	D	STD	12.750	12.000	0.375	20	0.785	15.708		16	1174	1370	160	2.044	1.761	0.907	4	2236
Cooler Inlet	Piping		12"	D	STD	12.750	12.000	0.375	20	0.785	15.708		16	1174	1370	160	2.044	1.761	0.907	4	2236
Cooler Outlet	Piping		12"	D	STD	12.750	12.000	0.375	20	0.785	15.708		16	1251	1365	120	2.037	1.647	0.875	4	2307
Cooler Outlet	Piping		12"	D	STD	12.750	12.000	0.375	20	0.785	15.708		16	1251	1365	120	2.037	1.647	0.875	4	2307
Cooler Discharge	Piping		16"	D	XS	16.000	15.000	0.500	50	1.227	61.359		61	4885	1365	120	2.037	1.647	0.875	16	9013
Compressor Bypass	Piping		12"	D	STD	12.750	12.000	0.375	125	0.785	98.175		98	7817	1365	120	2.037	1.647	0.875	25	14421
Compressor Bypass	Piping		12"	D	STD	12.750	12.000	0.375	125	0.785	98.175		98	5311	850	75	1.277	1.519	0.887	17	8915
Cooler	Tubing	Tubes	1"		14	1.000	0.834	0.083	9000	0.004	34.143		34	2552	1370	160	2.044	1.761	0.907	8	4860
Cooler	Tubing	Tubes	1"		14	1.000	0.834	0.083	9000	0.004	34.143		34	2552	1370	160	2.044	1.761	0.907	8	4860
													831	56967			**Total**			178	103972
																	T Average			°F	125.16
																	P Average			psig	1,183.53
																	Std Vol			SCF	67,413.40
																	Molecular Weight			lb/lbmol	17.03
																	Pseudo Critical Pressure			psia	677.4

BLOWDOWN CALCULATIONS

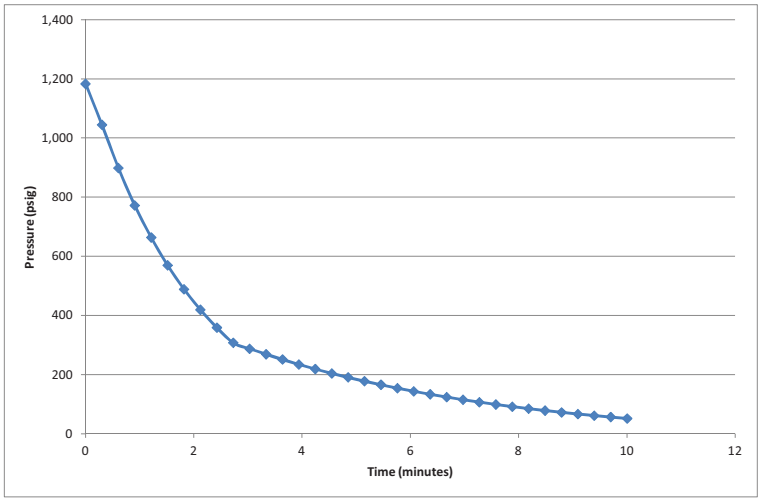
Reference Data		Initial	Change
Orifice Diameter, Inches		1.307	1.307
Choke Area	in2	1.341	
Inlet Pipe OD	in	6"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	6.065	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.215	
Settleout Z		0.914	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		42.147	
Time Increment, seconds		9.091	
Critical Ratio, Pcrt		0.043	
Expansion Factor, Fcr		1.357	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		831.159	
Mole to Blowdown, LB-Moles		177.637	
Settleout Pressure, psig		1,183.525	
Ave. Settleout Temp., deg R/deg F		585.305	°R / 125°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1183.53	1183.5	0.012	3605388	177.637	-	
0.15	9	1045.23	1045.2	0.014	3189275	153.647	24.0	24.0
0.30	18	898.83	898.8	0.016	2748767	132.425	21.2	45.2
0.45	27	772.65	772.7	0.019	2369102	114.134	18.3	63.5
0.61	36	663.90	663.9	0.022	2041878	98.370	15.8	79.3
0.76	45	570.17	570.2	0.025	1759850	84.783	13.6	92.9
0.91	55	489.39	489.4	0.029	1516776	73.072	11.7	104.6
1.06	64	419.76	419.8	0.034	1307277	62.979	10.1	114.7
1.21	73	359.76	359.8	0.039	1126713	54.281	8.7	123.4
1.36	82	308.03	308.0	0.046	435349	46.783	7.5	130.9
1.52	91	288.05	288.1	0.049	409000	43.886	2.9	133.8
1.67	100	269.28	269.3	0.052	384237	41.165	2.7	136.5
1.82	109	251.64	251.6	0.055	360963	38.608	2.6	139.0
1.97	118	235.07	235.1	0.059	339089	36.206	2.4	141.4
2.12	127	219.50	219.5	0.063	318529	33.950	2.3	143.7
2.27	136	204.88	204.9	0.067	299204	31.830	2.1	145.8
2.42	145	191.15	191.1	0.071	281039	29.839	2.0	147.8
2.58	155	178.25	178.2	0.076	263964	27.969	1.9	149.7
2.73	164	166.13	166.1	0.081	247912	26.213	1.8	151.4
2.88	173	154.75	154.7	0.087	232821	24.563	1.6	153.1
3.03	182	144.06	144.1	0.093	218633	23.014	1.5	154.6
3.18	191	134.03	134.0	0.099	205292	21.559	1.5	156.1
3.33	200	124.60	124.6	0.106	192748	20.193	1.4	157.4
3.48	209	115.75	115.8	0.113	180950	18.910	1.3	158.7
3.64	218	107.45	107.4	0.120	169854	17.706	1.2	159.9
3.79	227	99.65	99.7	0.129	159417	16.576	1.1	161.1
3.94	236	92.33	92.3	0.137	149597	15.515	1.1	162.1
4.09	245	85.47	85.5	0.147	140358	14.520	1.0	163.1
4.24	255	79.02	79.0	0.157	131662	13.586	0.9	164.1
4.39	264	72.98	73.0	0.168	123477	12.710	0.9	164.9
4.55	273	67.31	67.3	0.179	115771	11.888	0.8	165.7
4.70	282	62.00	62.0	0.192	108513	11.118	0.8	166.5
4.85	291	57.02	57.0	0.205	101676	10.396	0.7	167.2
5.00	300	52.35	52.3	0.219	95233	9.719	0.7	167.9

BLOWDOWN CALCULATIONS

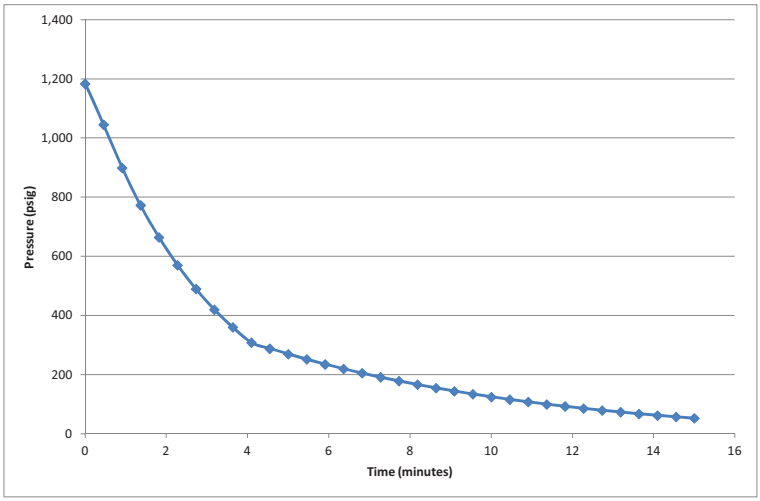
Reference Data		Initial	Change
Orifice Diameter, Inches		0.924	0.924
Choke Area	in2	0.671	
Inlet Pipe OD	in	6"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	6.065	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.152	
Settleout Z		0.914	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		42.147	
Time Increment, seconds		18.182	
Critical Ratio, Pcrt		0.043	
Expansion Factor, Fcr		1.357	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		831.159	
Mole to Blowdown, LB-Moles		177.637	
Settleout Pressure, psig		1,183.525	
Ave. Settleout Temp., deg R/deg F		585.305	°R / 125°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1183.53	1183.5	0.012	1803957	177.637	-	
0.30	18	1045.12	1045.1	0.014	1595580	153.630	24.0	24.0
0.61	36	898.63	898.6	0.016	1375041	132.395	21.2	45.2
0.91	55	772.39	772.4	0.019	1184985	114.096	18.3	63.5
1.21	**73**	**663.60**	**663.6**	**0.022**	**1021198**	**98.326**	**15.8**	**79.3**
1.52	91	569.85	569.8	0.025	880050	84.735	13.6	92.9
1.82	109	489.05	489.1	0.029	758411	73.023	11.7	104.6
2.12	127	419.42	419.4	0.034	653584	62.930	10.1	114.7
2.42	145	359.42	359.4	0.039	563247	54.232	8.7	123.4
2.73	164	307.71	307.7	0.046	217613	46.736	7.5	130.9
3.03	182	287.73	287.7	0.049	204433	43.840	2.9	133.8
3.33	200	268.96	269.0	0.052	192046	41.119	2.7	136.5
3.64	218	251.33	251.3	0.055	180405	38.564	2.6	139.1
3.94	236	234.77	234.8	0.059	169465	36.163	2.4	141.5
4.24	255	219.21	219.2	0.063	159183	33.907	2.3	143.7
4.55	273	204.60	204.6	0.067	149519	31.789	2.1	145.8
4.85	291	190.87	190.9	0.072	140435	29.799	2.0	147.8
5.15	309	177.98	178.0	0.076	131896	27.930	1.9	149.7
5.45	327	165.87	165.9	0.081	123870	26.175	1.8	151.5
5.76	345	154.50	154.5	0.087	116324	24.526	1.6	153.1
6.06	364	143.82	143.8	0.093	109230	22.978	1.5	154.7
6.36	382	133.79	133.8	0.099	102560	21.525	1.5	156.1
6.67	400	124.37	124.4	0.106	96288	20.160	1.4	157.5
6.97	418	115.53	115.5	0.113	90390	18.878	1.3	158.8
7.27	436	107.23	107.2	0.121	84843	17.675	1.2	160.0
7.58	455	99.44	99.4	0.129	79626	16.546	1.1	161.1
7.88	473	92.13	92.1	0.138	74717	15.487	1.1	162.2
8.18	491	85.27	85.3	0.147	70099	14.492	1.0	163.1
8.48	509	78.84	78.8	0.157	65753	13.559	0.9	164.1
8.79	527	72.80	72.8	0.168	61662	12.684	0.9	165.0
9.09	545	67.14	67.1	0.180	57810	11.864	0.8	165.8
9.39	564	61.83	61.8	0.192	54183	11.094	0.8	166.5
9.70	582	56.86	56.9	0.205	50766	10.373	0.7	167.3
10.00	600	52.20	52.2	0.220	47546	9.698	0.7	167.9

BLOWDOWN CALCULATIONS

Reference Data		Initial	Change
Orifice Diameter, Inches		0.754	0.754
Choke Area	in2	0.447	
Inlet Pipe OD	in	6"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	6.065	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.124	
Settleout Z		0.914	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		42.147	
Time Increment, seconds		27.273	
Critical Ratio, Pcrt		0.043	
Expansion Factor, Fcr		1.357	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		831.159	
Mole to Blowdown, LB-Moles		177.637	
Settleout Pressure, psig		1,183.525	
Ave. Settleout Temp., deg R/deg F		585.305	°R / 125°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1183.53	1183.5	0.012	1201799	177.637	-	
0.45	27	1045.23	1045.2	0.014	1063094	153.647	24.0	24.0
0.91	55	898.83	898.8	0.016	916257	132.425	21.2	45.2
1.36	82	772.65	772.7	0.019	789702	114.134	18.3	63.5
1.82	109	663.90	663.9	0.022	680627	98.369	15.8	79.3
2.27	136	570.17	570.2	0.025	586617	84.782	13.6	92.9
2.73	164	489.39	489.4	0.029	505592	73.072	11.7	104.6
3.18	191	419.76	419.8	0.034	435759	62.979	10.1	114.7
3.64	218	359.75	359.8	0.039	375571	54.280	8.7	123.4
4.09	245	308.03	308.0	0.046	145116	46.783	7.5	130.9
4.55	273	288.05	288.0	0.049	136333	43.886	2.9	133.8
5.00	300	269.27	269.3	0.052	128079	41.165	2.7	136.5
5.45	327	251.64	251.6	0.055	120321	38.608	2.6	139.0
5.91	355	235.07	235.1	0.059	113029	36.206	2.4	141.4
6.36	382	219.50	219.5	0.063	106176	33.950	2.3	143.7
6.82	409	204.88	204.9	0.067	99735	31.830	2.1	145.8
7.27	436	191.15	191.1	0.071	93680	29.839	2.0	147.8
7.73	464	178.25	178.2	0.076	87988	27.969	1.9	149.7
8.18	491	166.13	166.1	0.081	82637	26.213	1.8	151.4
8.64	518	154.75	154.7	0.087	77607	24.563	1.6	153.1
9.09	545	144.06	144.1	0.093	72877	23.014	1.5	154.6
9.55	573	134.02	134.0	0.099	68431	21.559	1.5	156.1
10.00	600	124.60	124.6	0.106	64249	20.193	1.4	157.4
10.45	627	115.75	115.8	0.113	60317	18.910	1.3	158.7
10.91	655	107.45	107.4	0.120	56618	17.706	1.2	159.9
11.36	682	99.65	99.6	0.129	53139	16.576	1.1	161.1
11.82	709	92.33	92.3	0.137	49866	15.515	1.1	162.1
12.27	736	85.47	85.5	0.147	46786	14.520	1.0	163.1
12.73	764	79.02	79.0	0.157	43887	13.586	0.9	164.1
13.18	791	72.98	73.0	0.168	41159	12.710	0.9	164.9
13.64	818	67.31	67.3	0.179	38590	11.888	0.8	165.7
14.09	845	62.00	62.0	0.192	36171	11.118	0.8	166.5
14.55	873	57.01	57.0	0.205	33892	10.396	0.7	167.2
15.00	900	52.35	52.3	0.219	31744	9.719	0.7	167.9

Case	Stack Diameter in	Height Above Ground ft	MW	Stack Gas Flow lb/hr	MMSCFD	SCFS	lbmol/hr	Stack Temperature °F	R	Temperature Correction Factor	Stack Pressure psig	psia	Pressure Correction Factor	Corrected Stack Flow ft3/sec	ft3/min	Stack Area ft2	Stack Velocity ft/s
Emergency	54	12	17.039	655,650	350	4,051	38,478	80	540	1.174	0	14.700	1.000	4,755	285,312	15.904	298.988
5 min	54	12	17.039	162,094	87	1,001	9,513	80	540	1.174	0	14.700	1.000	1,176	70,537	15.904	73.918
10 min	54	12	17.039	81,104	43	501	4,760	80	540	1.174	0	14.700	1.000	588	35,293	15.904	36.985
15 min	54	12	17.039	54,032	29	334	3,171	80	540	1.174	0	14.700	1.000	392	23,512	15.904	24.639

	MOLECULAR WEIGHT LB/LBMOL	MOL FRACTION	MASS FRACTION	GAS VOLUME LBMOL	GAS MASS LBM
METHANE	16.042	**0.951**	0.895	168.92	2,709.74
ETHANE	30.069	**0.029**	0.051	5.15	154.90
PROPANE	44.096	**0.004**	0.011	0.75	32.90
ISO-BUTANE	58.122	**0.001**	0.003	0.18	10.32
N-BUTANE	58.122	**0.001**	0.003	0.16	9.29
ISO-PENTANE	72.149	**0.000**	0.000	0.02	1.28
N-PENTANE	72.149	**0.000**	0.000	0.02	1.28
N-HEXANE	86.175	**0.001**	0.005	0.16	13.78
CYCLOHEXANE	84.159	**0.000**	0.000	0.00	0.00
N-HEPTANE	100.202	**0.000**	0.000	0.00	0.00
BENZENE	78.112	**0.000**	0.000	0.00	0.00
TOLUENE	92.138	**0.000**	0.000	0.00	0.00
ETHYLBENZENE	106.165	**0.000**	0.000	0.00	0.00
XYLENE	106.165	**0.000**	0.000	0.00	0.00
STYRENE	104.149	**0.000**	0.000	0.00	0.00
CARBON DIOXIDE	44.100	**0.010**	0.026	1.81	79.90
WATER	18.015	**0.000**	0.000	0.00	0.00
NITROGEN	28.014	**0.003**	0.004	0.48	13.44
TOTAL	17.04	1.000	1.000	178	3,027
THC		0.987	0.969	175	2,933
NMHC		0.036	0.074	6	224
NMNEHC (VOCs)		0.007	0.023	1	69
HEXANE		0.001	0.005	0	14

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Taurus 70 Unit Blowdown Stacks	N/A	NA

Emissions Per Event[1]			
Pollutant	5 min	10 min	15 min
	(lb/hr)	(lb/hr)	(lb/hr)
VOC	826.00	413.00	275.00
Hexane	165.00	83.00	55.00
CO_2	958.80	479.40	319.60
CH_4	32,516.88	16,258.44	10,838.96
CO_2-e	683,813.28	341,906.64	227,937.76

Emissions Per Year[1]			
Pollutant	3 Events	6 Events	12 Events
	TPY	TPY	TPY
VOC	0.10	0.21	0.41
Hexane	0.02	0.04	0.08
CO_2	0.12	0.24	0.48
CH_4	4.06	8.13	16.26
CO_2-e	85.48	170.95	341.91

(1) Emission calculation methodology provided by Engineering Firm with Site Specific Process Knowledge. Emission calculations based upon site specific fuel analysis.

BLOW DOWN SYSTEM CALCULATIONS

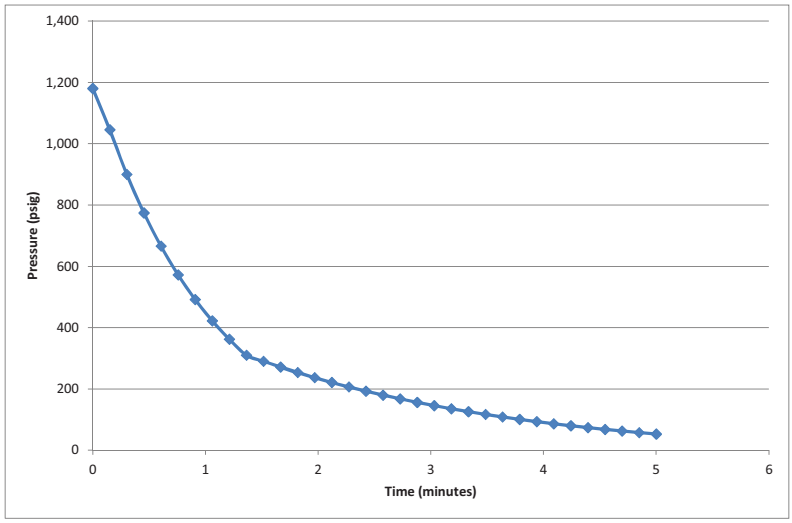
PIPE VOLUME CALCULATIONS

SECTION:	COMPRESSOR UNIT: Titan 130 Unit	BDV TAG:	

Section	Description	Line Number	NPS (in)	Piping Class	Sch / BWG	OD(in)	ID(in)	WT(in)	Length (ft)	Transv Sect Area (ft2)	Cylinder Volume (ft3)	Heads Volume (ft3)	Volume (ft3)	Normal Volume (ft3)	Press (psig)	Temp (°F)	Pseudo-reduced Press	Pseudo-reduced Temp	Z Factor	Moles (lbmol)	Temp x Moles
Comp Suction	Piping		30"	D	STD	30.000	29.250	0.375	100	4.666	466.637		467	25243	850	75	1.277	1.519	0.887	79	42374
Comp Discharge	Piping		24"	D	40	24.000	22.624	0.688	200	2.792	558.337		558	41738	1370	160	2.044	1.761	0.907	128	79477
Cooler Inlet	Piping		16"	D	XS	16.000	15.000	0.500	20	1.227	24.544		25	1835	1370	160	2.044	1.761	0.907	6	3494
Cooler Inlet	Piping		16"	D	XS	16.000	15.000	0.500	20	1.227	24.544		25	1835	1370	160	2.044	1.761	0.907	6	3494
Cooler Inlet	Piping		16"	D	XS	16.000	15.000	0.500	20	1.227	24.544		25	1835	1370	160	2.044	1.761	0.907	6	3494
Cooler Outlet	Piping		16"	D	XS	16.000	15.000	0.500	20	1.227	24.544		25	1954	1365	120	2.037	1.647	0.875	6	3605
Cooler Outlet	Piping		16"	D	XS	16.000	15.000	0.500	20	1.227	24.544		25	1954	1365	120	2.037	1.647	0.875	6	3605
Cooler Outlet	Piping		16"	D	XS	16.000	15.000	0.500	20	1.227	24.544		25	1954	1365	120	2.037	1.647	0.875	6	3605
Cooler Discharge	Piping		24"	D	40	24.000	22.624	0.688	50	2.792	139.584		140	11114	1365	120	2.037	1.647	0.875	35	20503
Compressor Bypass	Piping		20"	D	XS	20.000	19.000	0.500	125	1.969	246.119		246	19596	1365	120	2.037	1.647	0.875	62	36152
Compressor Bypass	Piping		20"	D	XS	20.000	19.000	0.500	125	1.969	246.119		246	13314	850	75	1.277	1.519	0.887	42	22349
Cooler	Tubing	Tubes	1 1/4"		14	1.250	1.084	0.083	9000	0.006	57.680		58	4312	1370	160	2.044	1.761	0.907	13	8211
Cooler	Tubing	Tubes	1 1/4"		14	1.250	1.084	0.083	9000	0.006	57.680		58	4312	1370	160	2.044	1.761	0.907	13	8211
Cooler	Tubing	Tubes	1 1/4"		14	1.250	1.084	0.083	9000	0.006	57.680		58	4312	1370	160	2.044	1.761	0.907	13	8211
													1977	135308			**Total**			422	246784
																	T Average			°F	124.62
																	P Average			psig	1,180.66
																	d Vol			SCF	160,157.15
																	Molecular Weight			lb/lbmol	17.03
																	Pseudo Critical Pressure			psia	677.4
																	Pseudo Critical Temperature			°R	352.

BLOWDOWN CALCULATIONS

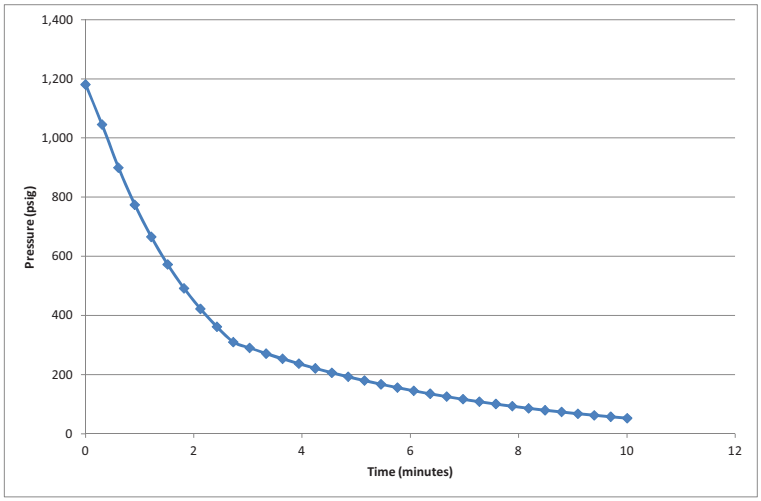
Reference Data		Initial	Change
Orifice Diameter, Inches		2.010	2.010
Choke Area	in2	3.172	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.252	
Settleout Z		0.915	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		41.852	
Time Increment, seconds		9.091	
Critical Ratio, Pcrt		0.043	
Expansion Factor, Fcr		1.355	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		1,977.099	
Mole to Blowdown, LB-Moles		422.021	
Settleout Pressure, psig		1,180.661	
Ave. Settleout Temp., deg R/deg F		584.767	°R / 125°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1180.66	1180.7	0.012	8501744	422.021	-	
0.15	9	1045.81	1045.8	0.014	7542649	365.450	56.6	56.6
0.30	18	900.16	900.2	0.016	6506759	315.260	50.2	106.8
0.45	27	774.52	774.5	0.019	5613136	271.963	43.3	150.1
0.61	36	666.13	666.1	0.022	4842242	234.612	37.4	187.4
0.76	45	572.63	572.6	0.025	4177220	202.391	32.2	219.6
0.91	55	491.96	492.0	0.029	3603530	174.595	27.8	247.4
1.06	64	422.38	422.4	0.034	3108630	150.617	24.0	271.4
1.21	73	362.35	362.4	0.039	2681698	129.931	20.7	292.1
1.36	82	310.57	310.6	0.045	1039668	112.087	17.8	309.9
1.52	91	290.49	290.5	0.048	976939	105.169	6.9	316.9
1.67	100	271.63	271.6	0.051	917973	98.668	6.5	323.4
1.82	109	253.90	253.9	0.055	862543	92.560	6.1	329.5
1.97	118	237.25	237.2	0.058	810436	86.820	5.7	335.2
2.12	127	221.60	221.6	0.062	761452	81.427	5.4	340.6
2.27	136	206.89	206.9	0.066	715401	76.361	5.1	345.7
2.42	145	193.08	193.1	0.071	672106	71.600	4.8	350.4
2.58	155	180.10	180.1	0.075	631400	67.128	4.5	354.9
2.73	164	167.91	167.9	0.081	593126	62.926	4.2	359.1
2.88	173	156.46	156.5	0.086	557138	58.980	3.9	363.0
3.03	182	145.70	145.7	0.092	523296	55.272	3.7	366.7
3.18	191	135.59	135.6	0.098	491470	51.790	3.5	370.2
3.33	200	126.10	126.1	0.104	461537	48.520	3.3	373.5
3.48	209	117.19	117.2	0.111	433382	45.449	3.1	376.6
3.64	218	108.82	108.8	0.119	406897	42.565	2.9	379.5
3.79	227	100.96	101.0	0.127	381979	39.857	2.7	382.2
3.94	236	93.59	93.6	0.136	358532	37.316	2.5	384.7
4.09	245	86.66	86.7	0.145	336467	34.930	2.4	387.1
4.24	255	80.17	80.2	0.155	315698	32.691	2.2	389.3
4.39	264	74.07	74.1	0.166	296145	30.590	2.1	391.4
4.55	273	68.35	68.4	0.177	277733	28.620	2.0	393.4
4.70	282	62.99	63.0	0.189	260391	26.772	1.8	395.2
4.85	291	57.96	58.0	0.202	244051	25.039	1.7	397.0
5.00	300	53.25	53.2	0.216	228652	23.415	1.6	398.6

BLOWDOWN CALCULATIONS

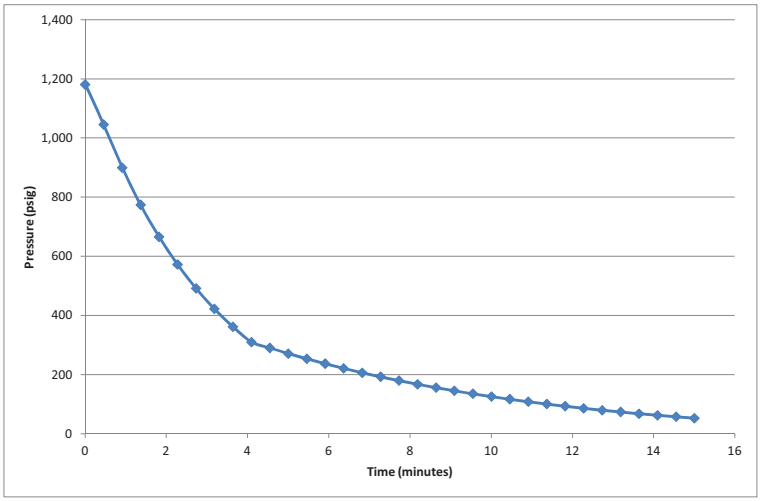
Reference Data		Initial	Change
Orifice Diameter, Inches		1.421	1.421
Choke Area	in2	1.586	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.178	
Settleout Z		0.915	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		41.852	
Time Increment, seconds		18.182	
Critical Ratio, Pcrt		0.043	
Expansion Factor, Fcr		1.355	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		1,977.099	
Mole to Blowdown, LB-Moles		422.021	
Settleout Pressure, psig		1,180.661	
Ave. Settleout Temp., deg R/deg F		584.767	°R / 125°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1180.66	1180.7	0.012	4250872	422.021	-	
0.30	18	1045.81	1045.8	0.014	3771324	365.450	56.6	56.6
0.61	36	900.16	900.2	0.016	3253380	315.260	50.2	106.8
0.91	55	774.52	774.5	0.019	2806568	271.963	43.3	150.1
1.21	**73**	**666.13**	**666.1**	**0.022**	**2421121**	**234.612**	**37.4**	**187.4**
1.52	91	572.63	572.6	0.025	2088610	202.391	32.2	219.6
1.82	109	491.96	492.0	0.029	1801765	174.595	27.8	247.4
2.12	127	422.38	422.4	0.034	1554315	150.617	24.0	271.4
2.42	145	362.35	362.4	0.039	1340849	129.931	20.7	292.1
2.73	164	310.57	310.6	0.045	519834	112.087	17.8	309.9
3.03	182	290.49	290.5	0.048	488469	105.169	6.9	316.9
3.33	200	271.63	271.6	0.051	458986	98.668	6.5	323.4
3.64	218	253.90	253.9	0.055	431272	92.560	6.1	329.5
3.94	236	237.25	237.2	0.058	405218	86.820	5.7	335.2
4.24	255	221.60	221.6	0.062	380726	81.427	5.4	340.6
4.55	273	206.89	206.9	0.066	357700	76.361	5.1	345.7
4.85	291	193.08	193.1	0.071	336053	71.600	4.8	350.4
5.15	309	180.10	180.1	0.075	315700	67.128	4.5	354.9
5.45	327	167.91	167.9	0.081	296563	62.926	4.2	359.1
5.76	345	156.46	156.5	0.086	278569	58.980	3.9	363.0
6.06	364	145.70	145.7	0.092	261648	55.272	3.7	366.7
6.36	382	135.59	135.6	0.098	245735	51.790	3.5	370.2
6.67	400	126.10	126.1	0.104	230768	48.520	3.3	373.5
6.97	418	117.19	117.2	0.111	216691	45.449	3.1	376.6
7.27	436	108.82	108.8	0.119	203448	42.565	2.9	379.5
7.58	455	100.96	101.0	0.127	190989	39.857	2.7	382.2
7.88	473	93.59	93.6	0.136	179266	37.316	2.5	384.7
8.18	491	86.66	86.7	0.145	168234	34.930	2.4	387.1
8.48	509	80.17	80.2	0.155	157849	32.691	2.2	389.3
8.79	527	74.07	74.1	0.166	148073	30.590	2.1	391.4
9.09	545	68.35	68.4	0.177	138867	28.620	2.0	393.4
9.39	564	62.99	63.0	0.189	130195	26.772	1.8	395.2
9.70	582	57.96	58.0	0.202	122026	25.039	1.7	397.0
10.00	600	53.25	53.2	0.216	114326	23.415	1.6	398.6

BLOWDOWN CALCULATIONS

Reference Data		Initial	Change
Orifice Diameter, Inches		1.160	1.160
Choke Area	in2	1.057	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.145	
Settleout Z		0.915	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		41.852	
Time Increment, seconds		27.273	
Critical Ratio, Pcrt		0.043	
Expansion Factor, Fcr		1.355	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		1,977.099	
Mole to Blowdown, LB-Moles		422.021	
Settleout Pressure, psig		1,180.661	
Ave. Settleout Temp., deg R/deg F		584.767	°R / 125°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1180.66	1180.7	0.012	2833915	422.021	-	
0.45	27	1045.81	1045.8	0.014	2514216	365.450	56.6	56.6
0.91	55	900.16	900.2	0.016	2168920	315.260	50.2	106.8
1.36	82	774.52	774.5	0.019	1871045	271.963	43.3	150.1
1.82	**109**	**666.13**	**666.1**	**0.022**	**1614081**	**234.612**	**37.4**	**187.4**
2.27	136	572.63	572.6	0.025	1392407	202.391	32.2	219.6
2.73	164	491.96	492.0	0.029	1201177	174.595	27.8	247.4
3.18	191	422.38	422.4	0.034	1036210	150.617	24.0	271.4
3.64	218	362.35	362.4	0.039	893899	129.931	20.7	292.1
4.09	245	310.57	310.6	0.045	346556	112.087	17.8	309.9
4.55	273	290.49	290.5	0.048	325646	105.169	6.9	316.9
5.00	300	271.63	271.6	0.051	305991	98.668	6.5	323.4
5.45	327	253.90	253.9	0.055	287514	92.560	6.1	329.5
5.91	355	237.25	237.2	0.058	270145	86.820	5.7	335.2
6.36	382	221.60	221.6	0.062	253817	81.427	5.4	340.6
6.82	409	206.89	206.9	0.066	238467	76.361	5.1	345.7
7.27	436	193.08	193.1	0.071	224035	71.600	4.8	350.4
7.73	464	180.10	180.1	0.075	210467	67.128	4.5	354.9
8.18	491	167.91	167.9	0.081	197709	62.926	4.2	359.1
8.64	518	156.46	156.5	0.086	185713	58.980	3.9	363.0
9.09	545	145.70	145.7	0.092	174432	55.272	3.7	366.7
9.55	573	135.59	135.6	0.098	163823	51.790	3.5	370.2
10.00	600	126.10	126.1	0.104	153846	48.520	3.3	373.5
10.45	627	117.19	117.2	0.111	144461	45.449	3.1	376.6
10.91	655	108.82	108.8	0.119	135632	42.565	2.9	379.5
11.36	682	100.96	101.0	0.127	127326	39.857	2.7	382.2
11.82	709	93.59	93.6	0.136	119511	37.316	2.5	384.7
12.27	736	86.66	86.7	0.145	112156	34.930	2.4	387.1
12.73	764	80.17	80.2	0.155	105233	32.691	2.2	389.3
13.18	791	74.07	74.1	0.166	98715	30.590	2.1	391.4
13.64	818	68.35	68.4	0.177	92578	28.620	2.0	393.4
14.09	845	62.99	63.0	0.189	86797	26.772	1.8	395.2
14.55	873	57.96	58.0	0.202	81350	25.039	1.7	397.0
15.00	900	53.25	53.2	0.216	76217	23.415	1.6	398.6

Case	Stack Diameter in	Height Above Ground ft	MW	Stack Gas Flow lb/hr	MMSCFD	SCFS	lbmol/hr	Stack Temperature °F	R	Temperature Correction Factor	Stack Pressure psig	psia	Pressure Correction Factor	Corrected Stack Flow ft3/sec	ft3/min	Stack Area ft2	Stack Velocity ft/s
Emergency	78	12	17.039	655,650	350	4,051	38,478	80	540	1.174	0	14.700	1.000	4,755	285,312	33.183	143.302
5 min	78	12	17.039	382,229	204	2,362	22,432	80	540	1.174	0	14.700	1.000	2,772	166,330	33.183	83.542
10 min	78	12	17.039	191,114	102	1,181	11,216	80	540	1.174	0	14.700	1.000	1,386	83,165	33.183	41.771
15 min	78	12	17.039	127,410	68	787	7,477	80	540	1.174	0	14.700	1.000	924	55,443	33.183	27.847

	MOLECULAR WEIGHT LB/LBMOL	MOL FRACTION	MASS FRACTION	GAS VOLUME LBMOL	GAS MASS LBM
METHANE	16.042	0.951	0.895	401.30	6,437.66
ETHANE	30.069	0.029	0.051	12.24	368.00
PROPANE	44.096	0.004	0.011	1.77	78.16
ISO-BUTANE	58.122	0.001	0.003	0.42	24.53
N-BUTANE	58.122	0.001	0.003	0.38	22.08
ISO-PENTANE	72.149	0.000	0.000	0.04	3.04
N-PENTANE	72.149	0.000	0.000	0.04	3.04
N-HEXANE	86.175	0.001	0.005	0.38	32.73
CYCLOHEXANE	84.159	0.000	0.000	0.00	0.00
N-HEPTANE	100.202	0.000	0.000	0.00	0.00
BENZENE	78.112	0.000	0.000	0.00	0.00
TOLUENE	92.138	0.000	0.000	0.00	0.00
ETHYLBENZENE	106.165	0.000	0.000	0.00	0.00
XYLENE	106.165	0.000	0.000	0.00	0.00
STYRENE	104.149	0.000	0.000	0.00	0.00
CARBON DIOXIDE	44.100	0.010	0.026	4.30	189.83
WATER	18.015	0.000	0.000	0.00	0.00
NITROGEN	28.014	0.003	0.004	1.14	31.92
TOTAL	17.04	1.000	1.000	422	7,191
THC		0.987	0.969	417	6,969
NMHC		0.036	0.074	15	532
NMNEHC (VOCs)		0.007	0.023	3	164
HEXANE		0.001	0.005	0	33

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Titan 130 Unit Blowdown Stack	N/A	NA

Emissions Per Event[1]			
Pollutant	5 min	10 min	15 min
	(lb/hr)	(lb/hr)	(lb/hr)
VOC	1,963.00	982.00	654.00
Hexane	393.00	196.00	131.00
CO_2	2,277.96	1,138.98	759.32
CH_4	77,251.92	38,625.96	25,750.64
CO_2-e	1,624,568.28	812,284.14	541,522.76

Emissions Per Year[1]			
Pollutant	3 Events	6 Events	12 Events
	TPY	TPY	TPY
VOC	0.25	0.49	0.98
Hexane	0.05	0.10	0.20
CO_2	0.28	0.57	1.14
CH_4	9.66	19.31	38.63
CO_2-e	203.07	406.14	812.28

(1) Emission calculation methodology provided by Engineering Firm with Site Specific Process Knowledge.
Emission calculations based upon site specific fuel analysis.

BLOW DOWN SYSTEM CALCULATIONS

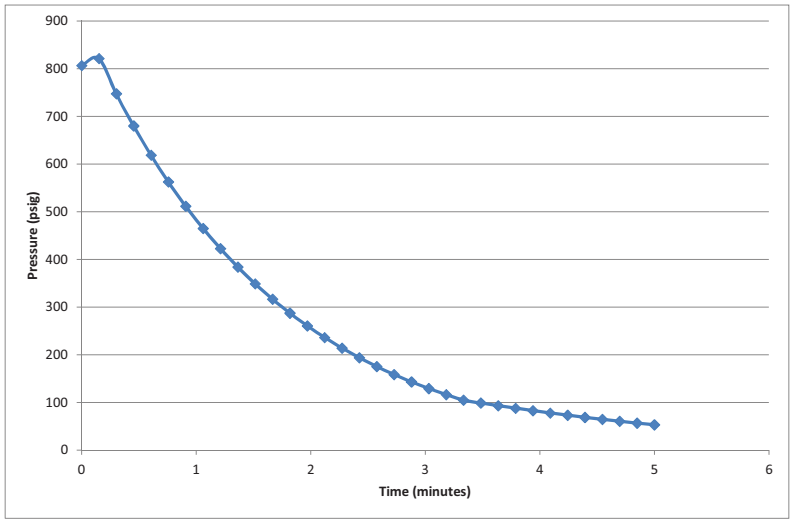
PIPE VOLUME CALCULATIONS

SECTION:	COMPRESSOR UNIT: Station Suction Blowdown	BDV TAG:	

Section	Description	Line Number	NPS (in)	Piping Class	Sch / BWG	OD(in)	ID(in)	WT(in)	Length (ft)	Transv Sect Area (ft2)	Cylinder Volume (ft3)	Heads Volume (ft3)	Volume (ft3)	Normal Volume (ft3)	Press (psig)	Temp (°F)	Pseudo-reduced Press	Pseudo-reduced Temp	Z Factor	Moles (lbmol)	Temp x Moles
Comp Suction Header	Piping		42"	D	STD	42.000	41.250	0.375	750	9.281	6960.438		6960	376536	850	75	1.277	1.519	0.887	1181	632056
Comp Suction	Piping		20"	D	XS	20.000	19.000	0.500	50	1.969	98.447		98	5326	850	75	1.277	1.519	0.887	17	8940
Comp Suction	Piping		20"	D	XS	20.000	19.000	0.500	50	1.969	98.447		98	5326	850	75	1.277	1.519	0.887	17	8940
Comp Suction	Piping		30"	D	STD	30.000	29.250	0.375	50	4.666	233.318		233	12622	850	75	1.277	1.519	0.887	40	21187
Comp Suction Header	Piping		36"	D	STD	36.000	35.250	0.375	350	6.777	2371.994		2372	113477	750	75	1.129	1.519	0.900	351	187749
Comp Suction Header	Piping		42"	D	STD	42.000	41.250	0.375	300	9.281	2784.175		2784	133196	750	75	1.129	1.519	0.900	412	220374
Comp Suction	Piping		20"	D	XS	20.000	19.000	0.500	50	1.969	98.447		98	4710	750	75	1.129	1.519	0.900	15	7792
Comp Suction	Piping		20"	D	XS	20.000	19.000	0.500	50	1.969	98.447		98	4710	750	75	1.129	1.519	0.900	15	7792
Comp Suction	Piping		30"	D	STD	30.000	29.250	0.375	50	4.666	233.318		233	11162	750	75	1.129	1.519	0.900	35	18468
													12977	667065			**Total**			2080	1113298
																	T Average			°F	75.00
																	P Average			psig	806.95
																	Std Vol			SCF	789,492.06
																	Molecular Weight			lb/lbmol	17.03
																	Pseudo Critical Pressure			psia	677.4
																	Pseudo Critical Temperature			°R	352.2

BLOWDOWN CALCULATIONS

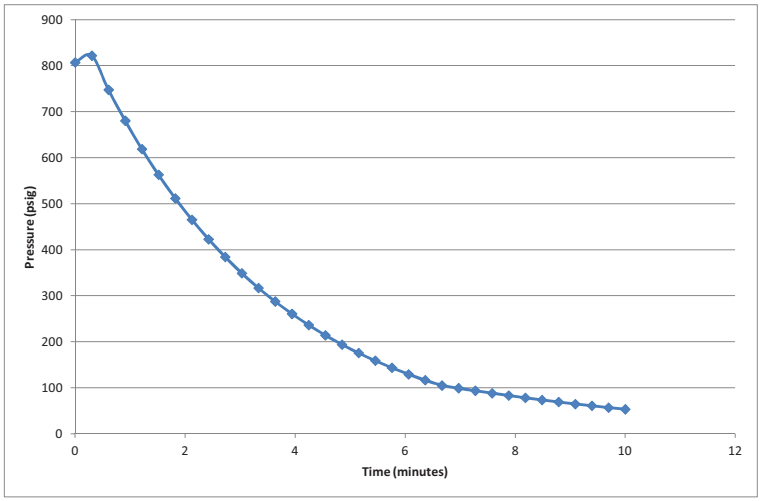
Reference Data		Initial	Change
Orifice Diameter, Inches		4.384	4.384
Choke Area	in2	15.096	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.549	
Settleout Z		0.988	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		12.860	
Time Increment, seconds		9.091	
Critical Ratio, Pcrt		0.123	
Expansion Factor, Fcr		1.164	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		12,977.034	
Mole to Blowdown, LB-Moles		2,080.348	
Settleout Pressure, psig		806.952	
Ave. Settleout Temp., deg R/deg F		535.150	°R / 75°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	806.95	807.0	0.018	24969639	2080.348	-	
0.15	9	821.58	821.6	0.018	25414076	1914.196	166.2	166.2
0.30	18	747.70	747.7	0.019	23168874	1745.087	169.1	335.3
0.45	27	680.34	680.3	0.021	21122025	1590.918	154.2	489.4
0.61	36	618.94	618.9	0.023	19256004	1450.368	140.5	630.0
0.76	45	562.96	563.0	0.025	17554837	1322.236	128.1	758.1
0.91	55	511.93	511.9	0.028	16003958	1205.423	116.8	874.9
1.06	64	465.40	465.4	0.031	14590092	1098.930	106.5	981.4
1.21	73	422.99	423.0	0.034	13301134	1001.846	97.1	1,078.5
1.36	82	384.32	384.3	0.037	12126048	913.338	88.5	1,167.0
1.52	91	349.07	349.1	0.040	11054775	832.649	80.7	1,247.7
1.67	100	316.93	316.9	0.044	10078143	759.089	73.6	1,321.3
1.82	109	287.63	287.6	0.049	9187792	692.027	67.1	1,388.3
1.97	118	260.92	260.9	0.053	8376098	630.890	61.1	1,449.5
2.12	127	236.57	236.6	0.059	7636113	575.154	55.7	1,505.2
2.27	136	214.38	214.4	0.064	6961503	524.343	50.8	1,556.0
2.42	145	194.14	194.1	0.070	6346490	478.020	46.3	1,602.3
2.58	155	175.69	175.7	0.077	5785811	435.789	42.2	1,644.6
2.73	164	158.87	158.9	0.085	5274665	397.289	38.5	1,683.1
2.88	173	143.53	143.5	0.093	4808676	362.191	35.1	1,718.2
3.03	182	129.56	129.6	0.102	4383854	330.193	32.0	1,750.2
3.18	191	116.81	116.8	0.112	3996563	301.022	29.2	1,779.3
3.33	200	105.19	105.2	0.123	2045066	274.429	26.6	1,805.9
3.48	209	99.25	99.2	0.129	1947474	260.820	13.6	1,819.5
3.64	218	93.59	93.6	0.136	1854368	247.862	13.0	1,832.5
3.79	227	88.20	88.2	0.143	1765532	235.522	12.3	1,844.8
3.94	236	83.06	83.1	0.150	1680762	223.774	11.7	1,856.6
4.09	245	78.18	78.2	0.158	1599863	212.590	11.2	1,867.8
4.24	255	73.53	73.5	0.167	1522649	201.944	10.6	1,878.4
4.39	264	69.10	69.1	0.175	1448942	191.813	10.1	1,888.5
4.55	273	64.89	64.9	0.185	1378571	182.171	9.6	1,898.2
4.70	282	60.88	60.9	0.194	1311375	172.998	9.2	1,907.4
4.85	291	57.07	57.1	0.205	1247198	164.272	8.7	1,916.1
5.00	300	53.44	53.4	0.216	1185894	155.973	8.3	1,924.4

BLOWDOWN CALCULATIONS

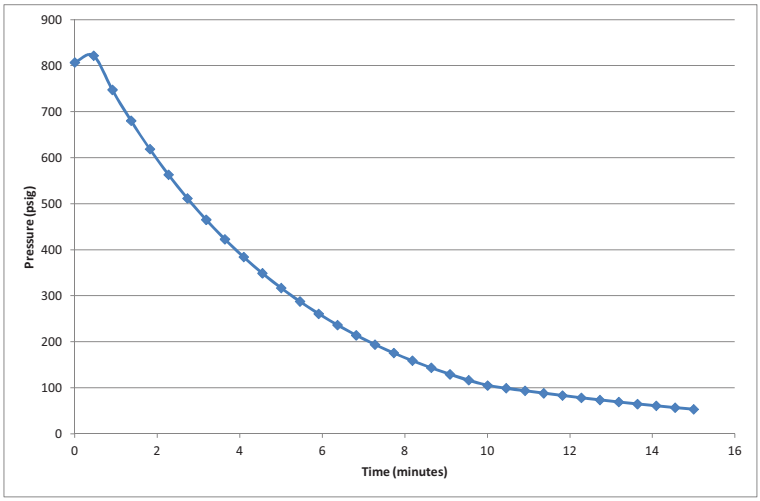
Reference Data		Initial	Change
Orifice Diameter, Inches		3.100	3.100
Choke Area	in2	7.548	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.388	
Settleout Z		0.988	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		12.860	
Time Increment, seconds		18.182	
Critical Ratio, Pcrt		0.123	
Expansion Factor, Fcr		1.164	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		12,977.034	
Mole to Blowdown, LB-Moles		2,080.348	
Settleout Pressure, psig		806.952	
Ave. Settleout Temp., deg R/deg F		535.150	°R / 75°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	806.95	807.0	0.018	12484820	2080.348	-	
0.30	18	821.58	821.6	0.018	12707038	1914.196	166.2	166.2
0.61	36	747.70	747.7	0.019	11584437	1745.087	169.1	335.3
0.91	55	680.34	680.3	0.021	10561013	1590.918	154.2	489.4
1.21	**73**	**618.94**	**618.9**	**0.023**	**9628002**	**1450.368**	**140.5**	**630.0**
1.52	91	562.96	563.0	0.025	8777418	1322.236	128.1	758.1
1.82	109	511.93	511.9	0.028	8001979	1205.423	116.8	874.9
2.12	127	465.40	465.4	0.031	7295046	1098.930	106.5	981.4
2.42	145	422.99	423.0	0.034	6650567	1001.846	97.1	1,078.5
2.73	164	384.32	384.3	0.037	6063024	913.338	88.5	1,167.0
3.03	182	349.07	349.1	0.040	5527387	832.649	80.7	1,247.7
3.33	200	316.93	316.9	0.044	5039071	759.089	73.6	1,321.3
3.64	218	287.63	287.6	0.049	4593896	692.027	67.1	1,388.3
3.94	236	260.92	260.9	0.053	4188049	630.890	61.1	1,449.5
4.24	255	236.57	236.6	0.059	3818057	575.154	55.7	1,505.2
4.55	273	214.38	214.4	0.064	3480751	524.343	50.8	1,556.0
4.85	291	194.14	194.1	0.070	3173245	478.020	46.3	1,602.3
5.15	309	175.69	175.7	0.077	2892905	435.789	42.2	1,644.6
5.45	327	158.87	158.9	0.085	2637332	397.289	38.5	1,683.1
5.76	345	143.53	143.5	0.093	2404338	362.191	35.1	1,718.2
6.06	364	129.56	129.6	0.102	2191927	330.193	32.0	1,750.2
6.36	382	116.81	116.8	0.112	1998282	301.022	29.2	1,779.3
6.67	400	105.19	105.2	0.123	1022533	274.429	26.6	1,805.9
6.97	418	99.25	99.2	0.129	973737	260.820	13.6	1,819.5
7.27	436	93.59	93.6	0.136	927184	247.862	13.0	1,832.5
7.58	455	88.20	88.2	0.143	882766	235.522	12.3	1,844.8
7.88	473	83.06	83.1	0.150	840381	223.774	11.7	1,856.6
8.18	491	78.18	78.2	0.158	799932	212.590	11.2	1,867.8
8.48	509	73.53	73.5	0.167	761325	201.944	10.6	1,878.4
8.79	527	69.10	69.1	0.175	724471	191.813	10.1	1,888.5
9.09	545	64.89	64.9	0.185	689285	182.171	9.6	1,898.2
9.39	564	60.88	60.9	0.194	655687	172.998	9.2	1,907.4
9.70	582	57.07	57.1	0.205	623599	164.272	8.7	1,916.1
10.00	600	53.44	53.4	0.216	592947	155.973	8.3	1,924.4

BLOWDOWN CALCULATIONS

Reference Data		Initial	Change
Orifice Diameter, Inches		2.531	2.531
Choke Area	in2	5.032	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.317	
Settleout Z		0.988	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		12.860	
Time Increment, seconds		27.273	
Critical Ratio, Pcrt		0.123	
Expansion Factor, Fcr		1.164	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		12,977.034	
Mole to Blowdown, LB-Moles		2,080.348	
Settleout Pressure, psig		806.952	
Ave. Settleout Temp., deg R/deg F		535.150	°R / 75°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	806.95	807.0	0.018	8323213	2080.348	-	
0.45	27	821.58	821.6	0.018	8471359	1914.196	166.2	166.2
0.91	55	747.70	747.7	0.019	7722958	1745.087	169.1	335.3
1.36	82	680.34	680.3	0.021	7040675	1590.918	154.2	489.4
1.82	**109**	**618.94**	**618.9**	**0.023**	**6418668**	**1450.368**	**140.5**	**630.0**
2.27	136	562.96	563.0	0.025	5851612	1322.236	128.1	758.1
2.73	164	511.93	511.9	0.028	5334653	1205.423	116.8	874.9
3.18	191	465.40	465.4	0.031	4863364	1098.930	106.5	981.4
3.64	218	422.99	423.0	0.034	4433711	1001.846	97.1	1,078.5
4.09	245	384.32	384.3	0.037	4042016	913.338	88.5	1,167.0
4.55	273	349.07	349.1	0.040	3684925	832.649	80.7	1,247.7
5.00	300	316.93	316.9	0.044	3359381	759.089	73.6	1,321.3
5.45	327	287.63	287.6	0.049	3062597	692.027	67.1	1,388.3
5.91	355	260.92	260.9	0.053	2792033	630.890	61.1	1,449.5
6.36	382	236.57	236.6	0.059	2545371	575.154	55.7	1,505.2
6.82	409	214.38	214.4	0.064	2320501	524.343	50.8	1,556.0
7.27	436	194.14	194.1	0.070	2115497	478.020	46.3	1,602.3
7.73	464	175.69	175.7	0.077	1928604	435.789	42.2	1,644.6
8.18	491	158.87	158.9	0.085	1758222	397.289	38.5	1,683.1
8.64	518	143.53	143.5	0.093	1602892	362.191	35.1	1,718.2
9.09	545	129.56	129.6	0.102	1461285	330.193	32.0	1,750.2
9.55	573	116.81	116.8	0.112	1332188	301.022	29.2	1,779.3
10.00	600	105.19	105.2	0.123	681689	274.429	26.6	1,805.9
10.45	627	99.25	99.2	0.129	649158	260.820	13.6	1,819.5
10.91	655	93.59	93.6	0.136	618123	247.862	13.0	1,832.5
11.36	682	88.20	88.2	0.143	588511	235.522	12.3	1,844.8
11.82	709	83.06	83.1	0.150	560254	223.774	11.7	1,856.6
12.27	736	78.18	78.2	0.158	533288	212.590	11.2	1,867.8
12.73	764	73.53	73.5	0.167	507550	201.944	10.6	1,878.4
13.18	791	69.10	69.1	0.175	482980	191.813	10.1	1,888.5
13.64	818	64.89	64.9	0.185	459524	182.171	9.6	1,898.2
14.09	845	60.88	60.9	0.194	437125	172.998	9.2	1,907.4
14.55	873	57.07	57.1	0.205	415733	164.272	8.7	1,916.1
15.00	900	53.44	53.4	0.216	395298	155.973	8.3	1,924.4

Case	Stack Diameter in	Height Above Ground ft	MW	Stack Gas Flow lb/hr	MMSCFD	SCFS	lbmol/hr	Stack Temperature °F	R	Temperature Correction Factor	Stack Pressure psig	psia	Pressure Correction Factor	Corrected Stack Flow ft3/sec	ft3/min	Stack Area ft2	Stack Velocity ft/s
Emergency	84	15	17.039	1,123,972	600	6,944	65,963	80	540	1.174	0	14.700	1.000	8,152	489,107	38.485	211.820
5 min	84	15	17.039	1,122,607	599	6,936	65,883	80	540	1.174	0	14.700	1.000	8,142	488,513	38.485	211.563
10 min	84	15	17.039	561,304	300	3,468	32,941	80	540	1.174	0	14.700	1.000	4,071	244,256	38.485	105.781
15 min	84	15	17.039	374,202	200	2,312	21,961	80	540	1.174	0	14.700	1.000	2,714	162,838	38.485	70.521

	MOLECULAR WEIGHT LB/LBMOL	MOL FRACTION	MASS FRACTION	GAS VOLUME LBMOL	GAS MASS LBM
METHANE	16.042	**0.951**	0.895	1,978.20	31,734.33
ETHANE	30.069	**0.029**	0.051	60.33	1,814.07
PROPANE	44.096	**0.004**	0.011	8.74	385.29
ISO-BUTANE	58.122	**0.001**	0.003	2.08	120.91
N-BUTANE	58.122	**0.001**	0.003	1.87	108.82
ISO-PENTANE	72.149	**0.000**	0.000	0.21	15.01
N-PENTANE	72.149	**0.000**	0.000	0.21	15.01
N-HEXANE	86.175	**0.001**	0.005	1.87	161.35
CYCLOHEXANE	84.159	**0.000**	0.000	0.00	0.00
N-HEPTANE	100.202	**0.000**	0.000	0.00	0.00
BENZENE	78.112	**0.000**	0.000	0.00	0.00
TOLUENE	92.138	**0.000**	0.000	0.00	0.00
ETHYLBENZENE	106.165	**0.000**	0.000	0.00	0.00
XYLENE	106.165	**0.000**	0.000	0.00	0.00
STYRENE	104.149	**0.000**	0.000	0.00	0.00
CARBON DIOXIDE	44.100	**0.010**	0.026	21.22	935.78
WATER	18.015	**0.000**	0.000	0.00	0.00
NITROGEN	28.014	**0.003**	0.004	5.62	157.35
TOTAL	17.04	1.000	1.000	2,080	35,448
THC		0.987	0.969	2,054	34,355
NMHC		0.036	0.074	75	2,620
NMNEHC (VOCs)		0.007	0.023	15	806
HEXANE		0.001	0.005	2	161

Company	Facility	
Cheniere Energy, Inc.	; Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Station Suction Blowdown Stack	N/A	NA

Emissions Per Event[1]			
Pollutant	5 min	10 min	15 min
	(lb/hr)	(lb/hr)	(lb/hr)
VOC	9,677.00	4,838.00	3,226.00
Hexane	1,936.00	968.00	645.00
CO_2	11,229.36	5,614.68	3,743.12
CH_4	380,811.96	190,405.98	126,937.32
CO_2-e	8,008,280.52	4,004,140.26	2,669,426.84

Emissions Per Year[1]			
Pollutant	2 Events	3 Events	4 Events
	TPY	TPY	TPY
VOC	0.81	1.21	1.61
Hexane	0.16	0.24	0.32
CO_2	0.94	1.40	1.87
CH_4	31.73	47.60	63.47
CO_2-e	667.36	1,001.04	1,334.71

(1) Emission calculation methodology provided by Engineering Firm with Site Specific Process Knowledge.
Emission calculations based upon site specific fuel analysis.

BLOW DOWN SYSTEM CALCULATIONS

PIPE VOLUME CALCULATIONS

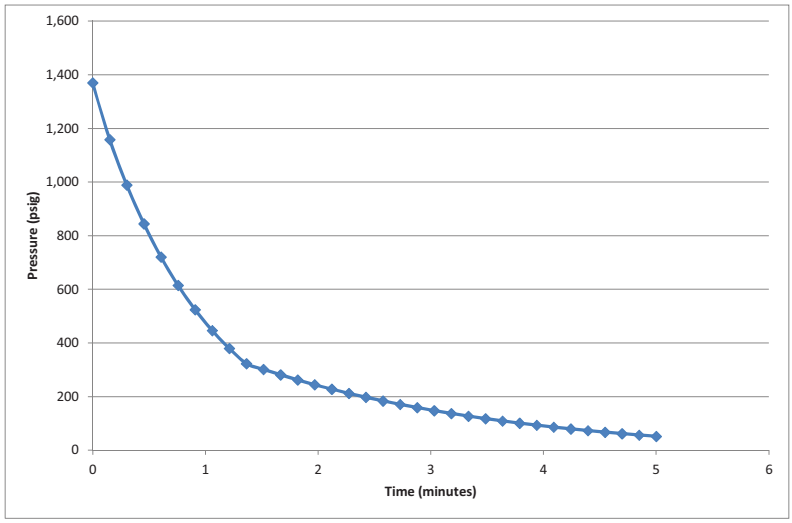
SECTION:	COMPRESSOR UNIT: Station Discharge Blowdown	BDV TAG:	

Section	Description	Line Number	NPS (in)	Piping Class	Sch / BWG	OD(in)	ID(in)	WT(in)	Length (ft)	Transv Sect Area (ft2)	Cylinder Volume (ft3)	Heads Volume (ft3)	Volume (ft3)	Normal Volume (ft3)	Press (psig)	Temp (°F)	Pseudo-reduced Press	Pseudo-reduced Temp	Z Factor	Moles (lbmol)	Temp x Moles
Comp Discharge Header	Piping		42"	D	STD	42.000	41.250	0.375	500	9.281	4640.292		4640	370801	1370	120	2.044	1.647	0.875	1180	684352
													4640	370801							

Total	1180	684352
T Average	°F	120.00
P Average	psig	1,370.00
Std Vol	SCF	447,662.98
Molecular Weight	lb/lbmol	17.03
Pseudo Critical Pressure	psia	677.4
Pseudo Critical Temperature	°R	352.2

BLOWDOWN CALCULATIONS

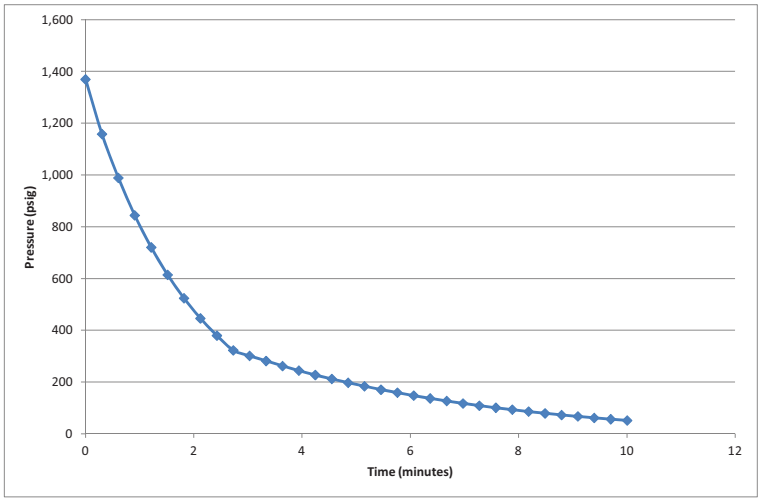
Reference Data		Initial	Change
Orifice Diameter, Inches		3.196	3.196
Choke Area	in2	8.024	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.400	
Settleout Z		0.868	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		44.350	
Time Increment, seconds		9.091	
Critical Ratio, Pcrt		0.041	
Expansion Factor, Fcr		1.397	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		4,640.292	
Mole to Blowdown, LB-Moles		1,179.613	
Settleout Pressure, psig		1,370.000	
Ave. Settleout Temp., deg R/deg F		580.150	°R / 120°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1370.00	1370.0	0.011	25779614	1179.613	-	
0.15	9	1158.00	1158.0	0.013	21832699	1008.071	171.5	171.5
0.30	18	989.00	989.0	0.015	18686279	862.793	145.3	316.8
0.45	27	844.35	844.3	0.017	15993305	738.451	124.3	441.2
0.61	36	720.55	720.5	0.020	13688429	632.029	106.4	547.6
0.76	45	614.59	614.6	0.023	11715720	540.944	91.1	638.7
0.91	55	523.90	523.9	0.027	10027308	462.986	78.0	716.6
1.06	64	446.28	446.3	0.032	8582222	396.263	66.7	783.3
1.21	73	379.84	379.8	0.037	7345395	339.155	57.1	840.5
1.36	82	322.98	323.0	0.044	2787195	290.278	48.9	889.3
1.52	91	301.41	301.4	0.047	2612999	271.732	18.5	907.9
1.67	100	281.18	281.2	0.050	2449632	254.344	17.4	925.3
1.82	109	262.22	262.2	0.053	2296419	238.044	16.3	941.6
1.97	118	244.44	244.4	0.057	2152723	222.763	15.3	956.8
2.12	127	227.78	227.8	0.061	2017950	208.439	14.3	971.2
2.27	136	212.16	212.2	0.065	1891540	195.011	13.4	984.6
2.42	145	197.52	197.5	0.069	1772970	182.424	12.6	997.2
2.58	155	183.79	183.8	0.074	1661749	170.627	11.8	1,009.0
2.73	164	170.93	170.9	0.079	1557414	159.569	11.1	1,020.0
2.88	173	158.87	158.9	0.085	1459535	149.206	10.4	1,030.4
3.03	182	147.57	147.6	0.091	1367705	139.494	9.7	1,040.1
3.18	191	136.99	137.0	0.097	1281543	130.393	9.1	1,049.2
3.33	200	127.07	127.1	0.104	1200693	121.866	8.5	1,057.7
3.48	209	117.77	117.8	0.111	1124820	113.876	8.0	1,065.7
3.64	218	109.07	109.1	0.119	1053608	106.391	7.5	1,073.2
3.79	227	100.91	100.9	0.127	986763	99.380	7.0	1,080.2
3.94	236	93.27	93.3	0.136	924007	92.814	6.6	1,086.8
4.09	245	86.12	86.1	0.146	865081	86.666	6.1	1,092.9
4.24	255	79.42	79.4	0.156	809741	80.909	5.8	1,098.7
4.39	264	73.15	73.2	0.167	757756	75.521	5.4	1,104.1
4.55	273	67.29	67.3	0.179	708911	70.479	5.0	1,109.1
4.70	282	61.80	61.8	0.192	663005	65.762	4.7	1,113.9
4.85	291	56.67	56.7	0.206	619845	61.350	4.4	1,118.3
5.00	300	51.87	51.9	0.221	579255	57.226	4.1	1,122.4

BLOWDOWN CALCULATIONS

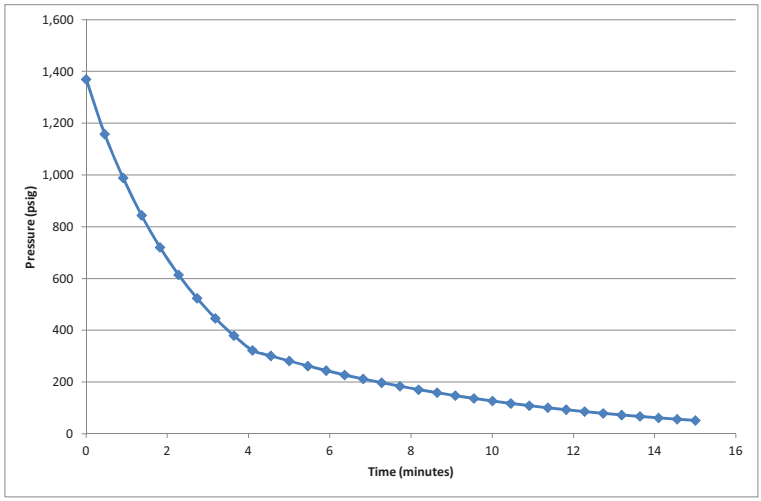
Reference Data		Initial	Change
Orifice Diameter, Inches		2.260	2.260
Choke Area	in2	4.012	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.283	
Settleout Z		0.868	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		44.350	
Time Increment, seconds		18.182	
Critical Ratio, Pcrt		0.041	
Expansion Factor, Fcr		1.397	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		4,640.292	
Mole to Blowdown, LB-Moles		1,179.613	
Settleout Pressure, psig		1,370.000	
Ave. Settleout Temp., deg R/deg F		580.150	°R / 120°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1370.00	1370.0	0.011	12889804	1179.613	-	
0.30	18	1158.00	1158.0	0.013	10916348	1008.071	171.5	171.5
0.61	36	989.00	989.0	0.015	9343138	862.793	145.3	316.8
0.91	55	844.35	844.3	0.017	7996651	738.451	124.3	441.2
1.21	73	720.55	720.5	0.020	6844214	632.030	106.4	547.6
1.52	91	614.59	614.6	0.023	5857860	540.945	91.1	638.7
1.82	109	523.90	523.9	0.027	5013654	462.986	78.0	716.6
2.12	127	446.28	446.3	0.032	4291111	396.263	66.7	783.3
2.42	145	379.84	379.8	0.037	3672698	339.156	57.1	840.5
2.73	164	322.98	323.0	0.044	1393598	290.278	48.9	889.3
3.03	182	301.41	301.4	0.047	1306500	271.732	18.5	907.9
3.33	200	281.18	281.2	0.050	1224816	254.344	17.4	925.3
3.64	218	262.22	262.2	0.053	1148210	238.044	16.3	941.6
3.94	236	244.44	244.4	0.057	1076362	222.763	15.3	956.8
4.24	255	227.78	227.8	0.061	1008975	208.439	14.3	971.2
4.55	273	212.16	212.2	0.065	945770	195.011	13.4	984.6
4.85	291	197.52	197.5	0.069	886485	182.425	12.6	997.2
5.15	309	183.79	183.8	0.074	830875	170.627	11.8	1,009.0
5.45	327	170.93	170.9	0.079	778707	159.569	11.1	1,020.0
5.76	345	158.87	158.9	0.085	729768	149.206	10.4	1,030.4
6.06	364	147.57	147.6	0.091	683853	139.494	9.7	1,040.1
6.36	382	136.99	137.0	0.097	640772	130.393	9.1	1,049.2
6.67	400	127.07	127.1	0.104	600347	121.866	8.5	1,057.7
6.97	418	117.77	117.8	0.111	562410	113.876	8.0	1,065.7
7.27	436	109.07	109.1	0.119	526804	106.391	7.5	1,073.2
7.58	455	100.91	100.9	0.127	493382	99.380	7.0	1,080.2
7.88	473	93.27	93.3	0.136	462004	92.814	6.6	1,086.8
8.18	491	86.12	86.1	0.146	432541	86.666	6.1	1,092.9
8.48	509	79.42	79.4	0.156	404871	80.909	5.8	1,098.7
8.79	527	73.15	73.2	0.167	378878	75.521	5.4	1,104.1
9.09	545	67.29	67.3	0.179	354456	70.479	5.0	1,109.1
9.39	564	61.80	61.8	0.192	331502	65.762	4.7	1,113.9
9.70	582	56.67	56.7	0.206	309923	61.350	4.4	1,118.3
10.00	600	51.87	51.9	0.221	289627	57.226	4.1	1,122.4

BLOWDOWN CALCULATIONS

Reference Data		Initial	Change
Orifice Diameter, Inches		1.845	1.845
Choke Area	in2	2.675	
Inlet Pipe OD	in	8"	
Inlet Pipe Class		D	
Schedule		40	
Inlet Pipe ID	in	7.981	
Pseudo Critical Pressure		675.500	
Pseudo Critical Temperature		347.900	
Beta Ratio, d2/d1		0.231	
Settleout Z		0.868	
Gas Molecular Weight		17.039	
Gas Gravity		0.588	
Cp/Cv Ratio		44.350	
Time Increment, seconds		27.273	
Critical Ratio, Pcrt		0.041	
Expansion Factor, Fcr		1.397	
Gravity Correction Factor		1.010	
Vent Header Back Pressure, psig		0.000	
Initial Blowdown Volume, ft3		4,640.292	
Mole to Blowdown, LB-Moles		1,179.613	
Settleout Pressure, psig		1,370.000	
Ave. Settleout Temp., deg R/deg F		580.150	°R / 120°F



Time, minutes	Time, seconds	Pi, psig	dP, psi	Po / Pi	Rate, scfh	Inventory Moles	Vented Moles	Total Vent
0.00	0	1370.00	1370.0	0.011	8593204	1179.613	-	
0.45	27	1158.00	1158.0	0.013	7277566	1008.071	171.5	171.5
0.91	55	989.00	989.0	0.015	6228759	862.793	145.3	316.8
1.36	82	844.35	844.3	0.017	5331101	738.451	124.3	441.2
1.82	**109**	**720.55**	**720.5**	**0.020**	**4562810**	**632.029**	**106.4**	**547.6**
2.27	136	614.59	614.6	0.023	3905240	540.944	91.1	638.7
2.73	164	523.90	523.9	0.027	3342436	462.986	78.0	716.6
3.18	191	446.28	446.3	0.032	2860741	396.263	66.7	783.3
3.64	218	379.84	379.8	0.037	2448465	339.155	57.1	840.5
4.09	245	322.98	323.0	0.044	929065	290.278	48.9	889.3
4.55	273	301.41	301.4	0.047	871000	271.732	18.5	907.9
5.00	300	281.18	281.2	0.050	816544	254.344	17.4	925.3
5.45	327	262.22	262.2	0.053	765473	238.044	16.3	941.6
5.91	355	244.44	244.4	0.057	717574	222.763	15.3	956.8
6.36	382	227.78	227.8	0.061	672650	208.439	14.3	971.2
6.82	409	212.16	212.2	0.065	630513	195.011	13.4	984.6
7.27	436	197.52	197.5	0.069	590990	182.424	12.6	997.2
7.73	464	183.79	183.8	0.074	553916	170.627	11.8	1,009.0
8.18	491	170.93	170.9	0.079	519138	159.569	11.1	1,020.0
8.64	518	158.87	158.9	0.085	486512	149.206	10.4	1,030.4
9.09	545	147.57	147.6	0.091	455902	139.494	9.7	1,040.1
9.55	573	136.99	137.0	0.097	427181	130.393	9.1	1,049.2
10.00	600	127.07	127.1	0.104	400231	121.866	8.5	1,057.7
10.45	627	117.77	117.8	0.111	374940	113.876	8.0	1,065.7
10.91	655	109.07	109.1	0.119	351203	106.391	7.5	1,073.2
11.36	682	100.91	100.9	0.127	328921	99.380	7.0	1,080.2
11.82	709	93.27	93.3	0.136	308002	92.814	6.6	1,086.8
12.27	736	86.12	86.1	0.146	288360	86.666	6.1	1,092.9
12.73	764	79.42	79.4	0.156	269914	80.909	5.8	1,098.7
13.18	791	73.15	73.2	0.167	252585	75.521	5.4	1,104.1
13.64	818	67.29	67.3	0.179	236304	70.479	5.0	1,109.1
14.09	845	61.80	61.8	0.192	221002	65.762	4.7	1,113.9
14.55	873	56.67	56.7	0.206	206615	61.350	4.4	1,118.3
15.00	900	51.87	51.9	0.221	193085	57.226	4.1	1,122.4

Case	Stack Diameter in	Height Above Ground ft	MW	Stack Gas Flow lb/hr	MMSCFD	SCFS	lbmol/hr	Stack Temperature °F	R	Temperature Correction Factor	Stack Pressure psig	psia	Pressure Correction Factor	Corrected Stack Flow ft3/sec	ft3/min	Stack Area ft2	Stack Velocity ft/s
Emergency	84	15	17.039	1,217,637	650	7,523	71,460	80	540	1.174	0	14.700	1.000	8,831	529,866	38.485	229.471
5 min	84	15	17.039	1,159,023	619	7,161	68,020	80	540	1.174	0	14.700	1.000	8,406	504,359	38.485	218.425
10 min	84	15	17.039	579,511	309	3,581	34,010	80	540	1.174	0	14.700	1.000	4,203	252,180	38.485	109.213
15 min	84	15	17.039	386,341	206	2,387	22,673	80	540	1.174	0	14.700	1.000	2,802	168,120	38.485	72.808

	MOLECULAR WEIGHT LB/LBMOL	MOL FRACTION	MASS FRACTION	GAS VOLUME LBMOL	GAS MASS LBM
METHANE	16.042	**0.951**	0.895	1,121.69	17,994.21
ETHANE	30.069	**0.029**	0.051	34.21	1,028.62
PROPANE	44.096	**0.004**	0.011	4.95	218.47
ISO-BUTANE	58.122	**0.001**	0.003	1.18	68.56
N-BUTANE	58.122	**0.001**	0.003	1.06	61.71
ISO-PENTANE	72.149	**0.000**	0.000	0.12	8.51
N-PENTANE	72.149	**0.000**	0.000	0.12	8.51
N-HEXANE	86.175	**0.001**	0.005	1.06	91.49
CYCLOHEXANE	84.159	**0.000**	0.000	0.00	0.00
N-HEPTANE	100.202	**0.000**	0.000	0.00	0.00
BENZENE	78.112	**0.000**	0.000	0.00	0.00
TOLUENE	92.138	**0.000**	0.000	0.00	0.00
ETHYLBENZENE	106.165	**0.000**	0.000	0.00	0.00
XYLENE	106.165	**0.000**	0.000	0.00	0.00
STYRENE	104.149	**0.000**	0.000	0.00	0.00
CARBON DIOXIDE	44.100	**0.010**	0.026	12.03	530.61
WATER	18.015	**0.000**	0.000	0.00	0.00
NITROGEN	28.014	**0.003**	0.004	3.18	89.22
TOTAL	17.04	1.000	1.000	1,180	20,100
THC		0.987	0.969	1,164	19,480
NMHC		0.036	0.074	43	1,486
NMNEHC (VOCs)		0.007	0.023	8	457
HEXANE		0.001	0.005	1	91

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Station Discharge Blowdown Stack	N/A	NA

Emissions Per Event[1]			
Pollutant	5 min	10 min	15 min
	(lb/hr)	(lb/hr)	(lb/hr)
VOC	5,487.00	2,743.00	1,829.00
Hexane	1,098.00	549.00	366.00
CO_2	6,367.32	3,183.66	2,122.44
CH_4	215,930.52	107,965.26	71,976.84
CO_2-e	4,540,908.24	2,270,454.12	1,513,636.08

Emissions Per Year[1]			
Pollutant	2 Events	3 Events	4 Events
	TPY	TPY	TPY
VOC	0.46	0.69	0.91
Hexane	0.09	0.14	0.18
CO_2	0.53	0.80	1.06
CH_4	17.99	26.99	35.99
CO_2-e	378.41	567.61	756.82

(1) Emission calculation methodology provided by Engineering Firm with Site Specific Process Knowledge. Emission calculations based upon site specific fuel analysis.

TRUCK LOADING EMISSION CALCULATIONS

Company	Facility	
Cheniere Energy, Inc.	Compressor Station	
Descriptive Name of Emission Point	TEMP Subject Item ID	Emission Point ID No.
Condensate Truck Loading	N/A	TRKLD

Parameter		Unit
Saturation Factor[1]	0.60	
Temperature of bulk liquid loaded[2]	527.37	R
True Vapor Pressure of liquid loaded[3]	3.50	PSI
Molecular Weight of Vapor[2]	68.00	
Loading Loss Factor = 12.46*S*VP*MW/T		
Loading Loss Factor	3.37	lb/1000 gal
Truck Max Loading Rate	8,400.00	gal/hr
Tank Throughput[2]	51,889.82	gal/yr
Max Loadout VOC Emissions	28.341	lb/hr
Total Loadout VOC Emissions	0.088	TPY

(1) Saturation factor from AP-42 Fifth Edition, Table 5.2-1

(2) Tanks 4.09d, metorological data used in Emission Calculations: Baton Rouge, LA.

(3) AP-42 Fifth Edition, Table 7.1-2. Properties of Selected Petroluem Liquids. Based upon RVP 7 at 70 ^{o}F.

Sabine Pass Liquefaction Project
Sabine Pass Liquefied Natural Gas Terminal Trains 1-4
Stationary Sources
Air Emission Calculations

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Refrigeration Compressor Turbines -
Criteria Pollutants

No. of Turbines =	24	
Average Operating Rate =	6,656	BTU/Hp-hr/compressor turbine
Annual Operating Time =	8,760	hrs/yr
Power of Compressor=	32,075	kW/ each compressor turbine
	43,013	HP / each compressor turbine

Pollutant	Emission Factor (ppmvd@ 15% O_2)		Ref	Emission Rates (lb/hr/turbine)		Emissions Increase			
						1 Turbine		24 Turbines	
	Original	Revised		Original	Revised	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)
NO_x	20	25	[1], [2]	22.94	28.68	5.74	25.12	137.64	602.86

[1] Vendor Guarantee

[2] NOx concentration increased from 20 ppm to 25 ppm. Based on an email from Ms. Catherine Rourke (Cheniere) to Mr. Jason Swofford (Trinity) on May 21, 2013.

Facility Name:	Sabine Pass Liquefaction, LLC			
AIR CONTAMINANT DATA				
1. Emission Point			**2. Component or Air Contaminant Name**	
(A) EPN	**(B) FIN**	**(C) NAME**		**(B) TPY**
WTDYFLR1	WTDYFLR1	Wet/Dry Gas Flare 1 (continuous)	NO_x	5.20
			CO	44.59
			VOC	26.11
			H2S	< 0.01
			SO_2	0.07
		Wet/Dry Gas Flare 1 (MSS)	NO_x	26.80
			CO	229.77
			VOC	21.32
			H2S	< 0.01
			SO_2	0.28
		Wet/Dry Gas Flare 1 (Total)	NO_x	32.00
			CO	274.36
			VOC	47.42
			H2S	< 0.01
			SO_2	0.35
WTDYFLR2	WTDYFLR2	Wet/Dry Gas Flare 2 (continuous)	NO_x	5.20
			CO	44.59
			VOC	26.11
			H2S	< 0.01
			SO_2	0.07
		Wet/Dry Gas Flare 2 (MSS)	NO_x	26.80
			CO	229.77
			VOC	21.32
			H2S	< 0.01
			SO_2	0.28
		Wet/Dry Gas Flare 2 (Total)	NO_x	32.00
			CO	274.36
			VOC	47.42
			H2S	< 0.01
			SO_2	0.35

EPN = Emission Point Number

FIN = Facility Identification Number

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	Wet/Dry Flare 2 (tpy)
SO_2	1.53E-02	1.53E-02	6.70E-02	6.70E-02
NO_x	1.67E-02	1.67E-02	7.30E-02	7.30E-02
CO	1.43E-01	1.43E-01	6.26E-01	6.26E-01
VOC	8.64E-04	8.64E-04	3.78E-03	3.78E-03

WET/DRY FLARE CONTINUOUS PURGE

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	Wet/Dry Flare 2 (tpy)
NO_x	1.33E+00	6.44E-01	5.13E+00	2.56E+00
CO	1.14E+01	5.52E+00	4.40E+01	2.20E+01
VOC	6.56E+00	3.28E+00	2.61E+01	1.31E+01

[A] The continuous purge from two trains is lined up to one flare, while the continiuous purge from the third train is lined up to the other flare. Since the flares are identical and co-located, the modeling demonstration arbitrarliy assigns the two-train purge to Wet/Dry Flare 1. However, either flare can receive continuous purges from two trains.

WET/DRY FLARE MAINTENANCE AND TURNAROUND

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	Wet/Dry Flare 2 (tpy)
NO_x	1.21E+02	1.21E+02	9.63E-01	4.82E-01
CO	1.04E+03	1.04E+03	8.26E+00	4.13E+00
VOC	9.49E+02	9.49E+02	6.90E+00	3.45E+00

WET/DRY FLARE MAJOR OVERHAUL

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	
NO_x	3.69E+02	3.69E+02	2.58E+01	
CO	3.16E+03	3.16E+03	2.22E+02	
VOC	1.05E+02	1.05E+02	1.44E+01	

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare

Pilot Gas Emissions

Number of Pilots =	4	[1]
Flare Pilot Heat Input =	0.065	MMBtu/hr [1]
Heating Value of Fuel =	850.24	Btu/scf
Pilot Gas Molar Flowrate =	0.20	lb-mol/hr
Annual Operating Time =	8,760	hr/yr [1]
VOC DRE (C1-C3 compounds)	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

Pilot Gas Composition [3]

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	5.32E+00	28.01		1.49	8.84E-02	0.00E+00	-	-
Hydrogen Sulfide	3.01E-04	34.08	29	0.0001	6.08E-06	1.76E-04	1.63E-06	3.72E-07
Water	6.67E-02	18.02		0.01	7.13E-04	0.00E+00	-	-
Carbon Dioxide	2.70E-01	44.01		0.12	7.04E-03	0.00E+00	9.42E-02	2.15E-02
Methane	9.37E+01	16.04	21,509	15.04	8.91E-01	1.92E+04	1.19E-01	2.72E-02
Ethane	4.75E-01	30.069	20,426	0.14	8.47E-03	1.73E+02	1.13E-03	2.59E-04
Propane	6.82E-02	44.096	19,919	0.03	1.78E-03	3.55E+01	2.39E-04	5.45E-05
Isobutane	1.83E-02	58.122	19,587	0.01	6.30E-04	1.23E+01	1.69E-04	3.85E-05
n-Butane	1.52E-02	58.122	19,648	0.01	5.24E-04	1.03E+01	1.40E-04	3.20E-05
Isopentane	6.64E-03	72.149	19,305	0.005	2.84E-04	5.48E+00	7.60E-05	1.73E-05
n-Pentane	3.32E-03	72.149	19,339	0.002	1.42E-04	2.74E+00	3.80E-05	8.67E-06
n-Hexane	7.73E-03	86.175	19,245	0.01	3.95E-04	7.60E+00	1.06E-04	2.41E-05
Benzene	1.96E-03	78.11	17,274	0.002	9.10E-05	1.57E+00	2.44E-05	5.56E-06
n-Heptane	4.55E-03	100.2	19,176	0.005	2.70E-04	5.19E+00	7.24E-05	1.65E-05
				16.87		**19,424**		

Pollutant	Emission Factor		Ref	Emission Rates (per Flare) Hourly (lb/hr)	Emission Rates (per Flare) Annual (tpy)
SO_2				1.53E-02	6.70E-02
NO_x	0.0641	lb/MMBtu	[2]	1.67E-02	7.30E-02
CO	0.5496	lb/MMBtu	[2]	1.43E-01	6.26E-01
VOC				8.64E-04	3.78E-03

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Continuous Purges

VOC (C1-C3) DRE	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

Continuous Purge to Flare 1

Propane Feed Gas Flowrate =	276	lb/hr
Ethylene Feed Gas Flowrate =	320	lb/hr
Methane Feed Gas Flowrate =	220	lb/hr
Regen Gas Flowrate =	84	lb/hr
Pipeline Gas Flowrate =	30	lb/hr
Purge hours =	8760	hr/yr (all except pipeline gas)
	12	hr/yr (pipeline gas)

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	2.70E+00	1.18E+01
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	1.88E-02	8.24E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	7.28E-02	3.19E-01
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	3.18E+00	1.39E+01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	1.84E-02	8.05E-02
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	1.13E+01	4.94E+01
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	2.09E+00	9.14E+00
				16.40		**20,407**		

Regen Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Methane	9.65E+01	16.04	21,509	15.48	0.9369	20,152	7.87E-01	3.45E+00
Ethane	3.00E+00	30.069	20,426	0.90	0.0546	1,115	4.59E-02	2.01E-01
Nitrogen	5.00E-01	28.01		0.14	0.0085	0	7.12E-01	3.12E+00
				16.52		**21,267**		

Pipeline Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	2.10E+00	28.01		0.59	0.0361	0	1.08E+00	6.50E-03
Methane	9.79E+01	16.04	21,509	15.70	0.9639	20,732	2.89E-01	1.74E-03
				16.29		**20,732**		

Total heating value for purges = 18.89 MMBtu/hr
160,001 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	1.21E+00	1.33E+00	5.13E+00
CO	0.5496	lb/MMBtu	[2], [6]	1.04E+01	1.14E+01	4.40E+01
VOC			[2], [6]	5.96E+00	6.56E+00	2.61E+01

Continuous Purge to Flare 2

Propane Feed Gas Flowrate = 138 lb/hr
Ethylene Feed Gas Flowrate = 160 lb/hr
Methane Feed Gas Flowrate = 110 lb/hr
Regen Gas Flowrate = 42 lb/hr
Pipeline Gas Flowrate = 0 lb/hr
Purge hours = 8760 hr/yr (all except pipeline gas)
12 hr/yr (pipeline gas)

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19520.33	1.35E+00	5.92E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139.28	9.41E-03	4.12E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258.17	3.64E-02	1.59E-01
				44.10		**19917.78**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.59E+00	6.97E+00
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	9.19E-03	4.02E-02
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	5.64E+00	2.47E+01
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	1.04E+00	4.57E+00
				16.40		**20,407**		

Regen Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Methane	9.65E+01	16.04	21,509	15.48	0.9369	20,152	3.94E-01	1.72E+00
Ethane	3.00E+00	30.069	20,426	0.90	0.0546	1,115	2.29E-02	1.00E-01
Nitrogen	5.00E-01	28.01		0.14	0.0085	0	3.56E-01	1.56E+00
				16.52		**21,267**		

Total heating value fo 9.13E+00 MMBtu/hr
8.00E+04 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	5.85E-01	6.44E-01	2.56E+00
CO	0.5496	lb/MMBtu	[2], [6]	5.02E+00	5.52E+00	2.20E+01
VOC			[2], [6]	2.98E+00	3.28E+00	1.31E+01

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Maintenance and Turnaround Emissions

VOC (C1-C3) DRE	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

LNG Train Planned Maintenance Emissions

Borescope Purges

Propane Purge Flowrate =	55,200	lb/purge/turbine
Ethylene Purge Flowrate =	16,400	lb/purge/turbine
Methane Purge Flowrate =	10,400	lb/purge/turbine
Borescope Purge per year =	2	/turbine
Turbines =	6	in each service (18 total)
Maximum turbine systems purged at a time =	2	in each service (6 total)
Hours per purge =	3	hr

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	3.61E+02	3.25E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	2.51E+00	2.26E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	9.70E+00	8.73E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.09E+02	9.78E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	6.28E-01	5.65E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	3.55E+02	3.20E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	6.58E+01	5.92E-01
				16.40		**20,407**		

Total heating value for purges =	1,096	MMBtu/hr
	19,732	MMBtu/yr

Pollutant	Emission Factor		Ref	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	7.03E+01	7.73E+01	6.32E-01
CO	0.5496	lb/MMBtu	[2], [6]	6.02E+02	6.63E+02	5.42E+00
VOC			[2], [6]	4.79E+02	5.27E+02	4.31E+00

Combustor Changeout/Hot Section Purge

Propane Purge Flowrate =	55,200	lb/purge/turbine
Ethylene Purge Flowrate =	16,400	lb/purge/turbine
Methane Purge Flowrate =	10,400	lb/purge/turbine
CC/HS Purge per year =	1	/turbine
Turbines =	6	in each service (18 total)
bine systems purged at a time =	2	in each service (6 total)
Hours per purge =	3	hr

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	3.61E+02	1.62E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	2.51E+00	1.13E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	9.70E+00	4.37E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.09E+02	4.89E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	6.28E-01	2.83E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0.00	3.55E+02	1.60E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20406.77	6.58E+01	2.96E-01
				16.40		**20406.77**		

Total heating value for purges = 1,096 MMBtu/hr
9,866 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	7.03E+01	7.73E+01	3.16E-01
CO	0.5496	lb/MMBtu	[2], [6]	6.02E+02	6.63E+02	2.71E+00
VOC			[2], [6]	4.79E+02	5.27E+02	2.16E+00

Combustor Changeout/Hot Section Startup

Propane Purge Flowrate =	100,803	lb/purge/turbine
Ethylene Purge Flowrate =	28,158	lb/purge/turbine
Methane Purge Flowrate =		lb/purge/turbine
CC/HS Startup per year =	1	/turbine
Turbines =	6	in each service (18 total)
Maximum turbine systems purged at a time =	2	in each service (6 total)
Hours per purge =	3	hr

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	6.59E+02	2.96E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	4.58E+00	2.06E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	1.77E+01	7.97E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.87E+02	8.40E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	1.08E+00	4.85E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	0.00E+00	0.00E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	0.00E+00	0.00E+00
				16.40		**20,407**		

Total heating value for purges = 1,719 MMBtu/hr
15,474 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	1.10E+02	1.21E+02	4.96E-01
CO	0.5496	lb/MMBtu	[2], [6]	9.45E+02	1.04E+03	4.25E+00
VOC			[2], [6]	8.63E+02	9.49E+02	3.88E+00

[1] Data provided by Cheniere.

[2] The emission factors and destruction efficiencies were obtained from TCEQ's "Air Permit Technical Guidance for Chemical Sources: Flares and Vapor Oxidizers; October 2000." Factors are for low Btu streams in non-steam assisted flares. The destruction efficiencies meet the TCEQ BACT guidance for Flares and Vapor Combustors, 8/1/2011.

[3] *LP1 Fuel Gas composition* from "*25744-100-M3-DK-00002.xls* ", provided by Jose Dumlao (Cheniere) to Melissa Ryan (Trinity) on 8/20/12, was used as the pilot gas composition.

[4] Net Heating Values (NHV) were obtained from "Yaws' Handbook of Thermodynamic and Physical Properties of Chemical Compounds".

[5] Feed Gas composition was obtained from "CCLNG-H&MB_for_Air_Permit.xlsx", provided by Cheniere .

[6] Maximum hourly emission rates are based on maximum expected variability during routine operations.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Major Overhaul Intermittent MSS Emissions

VOC (C1-C3) DRE	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

LNG Train Planned Maintenance Emissions

Feed Gas Flowrate =	254,760	lb/hr [1]
Annual Flowrate =	37,738,000	lb/2 trains[1]
Heating Value of Feed Gas =	20,530	Btu/lb
	907	Btu/scf

Feed Gas Composition [5]

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	4.90E-01	28.01		0.14	0.0081	0.00E+00	2.05E+03	-
Carbon Dioxide	1.30E+00	44.01		0.57	0.0336	0.00E+00	8.55E+03	6.34E+02
Methane	9.59E+01	16.04	21508.9	15.38	0.9028	1.94E+04	2.30E+03	1.70E+02
Ethane	1.89E+00	30.069	20425.8	0.57	0.0334	6.81E+02	8.50E+01	6.29E+00
Propane	2.50E-01	44.096	19918.7	0.11	0.0065	1.29E+02	1.65E+01	1.22E+00
Isobutane	6.00E-02	58.122	19586.8	0.15	0.0085	1.67E+02	4.35E+01	3.22E+00
n-Butane	5.00E-02	58.122	19647.5	0.03	0.0020	4.02E+01	1.04E+01	7.72E-01
Isopentane	2.00E-02	72.149	19305.4	0.04	0.0021	4.09E+01	1.08E+01	7.99E-01
n-Pentane	1.00E-02	72.149	19339.4	0.01	0.0008	1.64E+01	4.32E+00	3.20E-01
n-Hexane	2.00E-02	86.175	19245.1	0.01	0.0005	9.73E+00	2.58E+00	1.91E-01
Benzene	1.50E-03	78.11	17274.3	0.02	0.0009	1.58E+01	4.67E+00	3.46E-01
n-Heptane	1.00E-02	100.2	19176	0.01	0.0006	1.13E+01	3.00E+00	2.22E-01
Hydrogen Sulfide	4.00E-04	34.08	28.87	0.0001	0.00001	2.31E-04	4.08E-02	3.02E-03
Water	1.47E-02	18.02		0.003	0.0002	0.00E+00	7.93E-01	-
				17.04	1.00	**20,530**		

Major Overhaul Purge Depressurization

Propane Purge Flowrate =	62,100	lb/purge
Ethylene Purge Flowrate =	18,327	lb/purge
Methane Purge Flowrate =	11,060	lb/purge
Overhaul Purge per year =	2	
Duration of Depressurization Purge =	4	hr
Turbine Systems =	2	in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	3.04E+02	1.22E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	2.12E+00	8.47E-03
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	8.19E+00	3.27E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	9.11E+01	3.64E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	5.26E-01	2.10E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	2.83E+02	1.13E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	5.25E+01	2.10E-01
				16.40		**20,407**		

Total heating value for purge depres = 7.34E+03 MMBtu/yr

Major Overhaul Purge Fuel Gas

Propane Purge Flowrate = 31112 lb/purge
Ethylene Purge Flowrate = 14582 lb/purge
Methane Purge Flowrate = 0 lb/purge
Overhaul Purge per year = 2
Duration of Fuel Gas Purge = 3 hr
Turbine Systems = 2 in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	2.03E+02	6.10E-01
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	1.41E+00	4.24E-03
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	5.47E+00	1.64E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	28	0.9943	20,160	9.67E+01	2.90E-01
Methane	1.00E+00	16.04	21,509	0	0.0057	124	5.58E-01	1.67E-03
				28		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	0.00E+00	0.00E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	0.00E+00	0.00E+00
				16.40		**20,407**		

Total heating value for purge fuel gas= 3.66E+03 MMBtu/yr

Major Overhaul Startup Fuel Gas

Propane Purge Flowrate =	31112	lb/purge
Ethylene Purge Flowrate =	14582	lb/purge
Methane Purge Flowrate =	0	lb/purge
Overhaul Startup per year =	2	
Duration of Overhaul Startup Fuel Gas =	3	hr
Turbine Systems =	2	in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	2.03E+02	6.10E-01
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	1.41E+00	4.24E-03
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	5.47E+00	1.64E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	9.67E+01	2.90E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	5.58E-01	1.67E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	0.00E+00	0.00E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	0.00E+00	0.00E+00
				16.40		**20,407**		

Total heating value for startup fuel gas= 3.66E+03 MMBtu/yr

Major Overhaul Startup Refrigerant

Propane Purge Flowrate =	151,204	lb/purge
Ethylene Purge Flowrate =	42,237	lb/purge
Methane Purge Flowrate =	14,411	lb/purge
Overhaul Startup per year =	2	
Duration of Overhaul Startup Refrigerant =	4	hr
Turbine Systems =	2	in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	7.41E+02	2.96E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	5.16E+00	2.06E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	1.99E+01	7.97E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	2.10E+02	8.40E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	1.21E+00	4.85E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	3.69E+02	1.48E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	6.84E+01	2.73E-01
				16.40		**20,407**		

Total heating value for startup refrigerant= 1.66E+04 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
SO_2			[6]	3.83E+00	4.22E+00	2.84E-01
NO_x	0.0641	lb/MMBtu	[2], [6]	3.35E+02	3.69E+02	2.58E+01
CO	0.5496	lb/MMBtu	[2], [6]	2.87E+03	3.16E+03	2.22E+02
VOC			[2], [6]	9.57E+01	1.05E+02	1.44E+01
H2S			[2], [6]	4.08E-02	4.49E-02	3.02E-03

[1] Data provided by Cheniere.

[2] The emission factors and destruction efficiencies were obtained from TCEQ's "Air Permit Technical Guidance for Chemical Sources: Flares and Vapor

[3] *LP1 Fuel Gas composition* from "*25744-100-M3-DK-00002.xls* ", provided by Jose Dumlao (Cheniere) to Melissa Ryan (Trinity) on 8/20/12, was used as the pilot gas composition.

[4] Net Heating Values (NHV) were obtained from "Yaws' Handbook of Thermodynamic and Physical Properties of Chemical Compounds".

[5] Feed Gas composition was obtained from "CCLNG-H&MB_for_Air_Permit.xlsx", provided by Cheniere .

[6] Maximum hourly emission rates are based on maximum expected variability during routine operations.

Area Name:	Sabine Pass Liquefaction, LLC	Customer Reference No.: 604136374

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) MTCE/yr	(B) TPY
WTDYFLR1	WTDYFLR1	Wet/Dry Gas Flare 1 (continuous)	CO_2	10,590.18	11,670.38
			CH_4	11.52	12.70
			N_2O	0.02	0.02
		Wet/Dry Gas Flare 1 (MSS)	CO_2	49,230.44	54,251.94
			CH_4	155.31	171.15
			N_2O	0.08	0.09
		Wet/Dry Gas Flare 1 (Total)	CO_2	59,820.62	65,922.33
			CH_4	166.83	183.85
			N_2O	0.10	0.11
WTDYFLR2	WTDYFLR2	Wet/Dry Gas Flare 2 (continuous)	CO_2	10,590.18	11,670.38
			CH_4	11.52	12.70
			N_2O	0.02	0.02
		Wet/Dry Gas Flare 2 (MSS)	CO_2	49,230.44	54,251.94
			CH_4	155.31	171.15
			N_2O	0.08	0.09
		Wet/Dry Gas Flare 2 (Total)	CO_2	59,820.62	65,922.33
			CH_4	166.83	183.85
			N_2O	0.10	0.11

EPN = Emission Point Number

FIN = Facility Identification Number

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Summary of Updated GHG Emission Rates

WET/DRY FLARE PILOTS

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	Wet/Dry Flare 2 (tpy)
CO_2	3.33E+01	3.33E+01	1.46E+02	1.46E+02
CH_4	1.19E-01	1.19E-01	2.72E-02	2.72E-02
N_2O	5.73E-05	5.73E-05	1.86E-09	1.86E-09
CO_2e	3.58E+01	3.58E+01	1.46E+02	1.46E+02

BOG COMPRESSOR OVERHAUL

Pollutant	BOG Compressor (lb/hr)	BOG Compressor (tpy)
CO_2	--	--
CH_4	2.88E+02	7.54E-01
N_2O	--	--
CO_2e	6.05E+03	1.58E+01

WET/DRY FLARE CONTINUOUS FLOWS

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	Wet/Dry Flare 2 (tpy)
CO_2	2.71E+03	1.32E+03	1.15E+04	5.76E+03
CH_4	3.18E+00	1.45E+00	1.27E+01	6.33E+00
N_2O	4.16E-03	2.01E-03	1.76E-02	8.82E-03
CO_2e	2.78E+03	1.35E+03	1.18E+04	5.90E+03

FUGITIVES

Pollutant	Fugitives (lb/hr)	Fugitives (tpy)
CO_2	5.07E-02	2.22E-01
CH_4	9.89E+01	4.33E+02
N_2O	--	--
CO_2e	2.08E+03	9.09E+03

WET/DRY FLARE MAINTENANCE AND

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	Wet/Dry Flare 2 (tpy)
CO_2	2.60E+05	2.60E+05	1.49E+03	7.47E+02
CH_4	6.64E+01	6.64E+01	6.01E-01	3.00E-01
N_2O	3.79E-01	3.79E-01	3.31E-03	1.66E-03
CO_2e	2.60E+05	2.60E+05	1.51E+03	7.54E+02

WET/DRY FLARE MAJOR OVERHAUL

Pollutant	Hourly Emissions		Annual Emissions	
	Wet/Dry Flare 1 (lb/hr)	Wet/Dry Flare 2 (lb/hr)	Wet/Dry Flare 1 (tpy)	Wet/Dry Flare 2 (tpy)
CO_2	7.50E+05	7.50E+05	5.28E+04	0.00E+00
CH_4	2.53E+03	2.53E+03	1.71E+02	0.00E+00
N_2O	1.27E+00	1.27E+00	8.89E-02	0.00E+00
CO_2e	8.03E+05	8.03E+05	5.64E+04	0.00E+00

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Pilot Emissions

Pilot Gas Emissions

Number of Pilots =	4	[1]
Flare Pilot Heat Input =	0.065	MMBtu/hr [1]
Heating Value of Fuel =	850.24	Btu/scf
Pilot Gas Molar Flowrate =	0.20	lb-mol/hr
Annual Operating Time =	8,760	hr/yr [1]

Emissions From Pilot Gas Combustion

Pollutant	Emission Factor		References	Emission Rate	
				Average (lb/hr)	Annual (tpy)
CO_2			[2]	3.33E+01	1.46E+02
CH_4			[3]	1.19E-01	2.72E-02
N_2O	1.0E-04	kg/MMBtu	[4]	5.73E-05	1.86E-09
CO_2e	--	--	[5]	3.58E+01	1.46E+02

[1] Data provided by Cheniere.

[2] Based on mass balance of carbon in pilot gas.

[3] Emission rate estimated at a DRE of 99%

[4] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[5] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Continuous Flows

Continuous Flow to Flare 1

Continuous Flow Gas Heat Input = 18.89 MMBtu/hr
160,000.99 MMBtu/yr

Emissions From Continuous Flow Gas Combustion

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	2.71E+03	1.15E+04
CH_4			[2]	3.18E+00	1.27E+01
N_2O	1.0E-04	kg/MMBtu	[3]	4.16E-03	1.76E-02
CO_2e	--	--	[4]	2.78E+03	1.18E+04

Continuous Flow to Flare 2

Continuous Flow Gas Heat Input = 9.13 MMBtu/hr
79,996.76 MMBtu/yr

Emissions From Continuous Flow Gas Combustion

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	1.32E+03	5.76E+03
CH_4			[2]	1.45E+00	6.33E+00
N_2O	1.0E-04	kg/MMBtu	[3]	2.01E-03	8.82E-03
CO_2e	--	--	[4]	1.35E+03	5.90E+03

[1] Based on mass balance of carbon in purge gas.

[2] Emission rate estimated at a DRE of 99%

[3] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[4] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Maintenance and Turnaround Emissions

LNG Train Planned Maintenance Emissions

Borescope Purges

Purge Gas Heat Input = 1,096 MMBtu/hr
19,732 MMBtu/yr

Emissions From Borescope Purges

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	1.62E+05	9.75E+02
CH_4			[2]	6.64E+01	5.98E-01
N_2O	1.0E-04	kg/MMBtu	[3]	2.42E-01	2.18E-03
CO_2e	--	--	[4]	1.64E+05	9.88E+02

Combustor Changeout/Hot Section Purges

Purge Gas Heat Input = 1,096 MMBtu/hr
9,866 MMBtu/yr

Emissions From Combustor Changeout/Hot Section Purges

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	1.62E+05	4.87E+02
CH_4			[2]	6.64E+01	2.99E-01
N_2O	1.0E-04	kg/MMBtu	[3]	2.42E-01	1.09E-03
CO_2e	--	--	[4]	1.64E+05	4.94E+02

Combustor Changeout/Hot Section Startup

Purge Gas Heat Input = 1,719 MMBtu/hr
15,474 MMBtu/yr

Emissions From Combustor Changeout/Hot Section Startup

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	2.60E+05	7.80E+02
CH_4			[2]	1.08E+00	4.85E-03
N_2O	1.0E-04	kg/MMBtu	[3]	3.79E-01	1.71E-03
CO_2e	--	--	[4]	2.60E+05	7.81E+02

[1] Based on mass balance of carbon in purge gas.

[2] Emission rate estimated at a DRE of 99%

[3] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[4] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Major Overhaul Intermittent MSS Emissions

LNG Train Planned Maintenance Emissions

Purge of Feed Gas

Purge Gas Heat Input = 5,230 MMBtu/hr
774,774 MMBtu/yr

Emissions From Purge of Feed Gas

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	6.81E+05	5.05E+04
CH_4			[2]	2.30E+03	1.70E+02
N_2O	1.0E-04	kg/MMBtu	[3]	1.15E+00	8.54E-02
CO_2e	--	--	[4]	7.30E+05	5.41E+04

Major Overhaul Purge Depressurization

Purge Gas Heat Input = 917 MMBtu/hr
7,337 MMBtu/yr

Emissions From Major Overhaul Purge Depressurization

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	1.22E+05	4.88E+02
CH_4			[2]	5.30E+01	2.12E-01
N_2O	1.0E-04	kg/MMBtu	[3]	2.02E-01	8.09E-04
CO_2e	--	--	[4]	1.23E+05	4.93E+02

Major Overhaul Purge Fuel Gas

Purge Gas Heat Input = 610 MMBtu/hr
3,662 MMBtu/yr

Emissions From Major Overhaul Purge Fuel Gas

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	9.26E+04	2.78E+02
CH_4			[2]	5.58E-01	1.67E-03
N_2O	1.0E-04	kg/MMBtu	[3]	1.35E-01	4.04E-04
CO_2e	--	--	[4]	9.26E+04	2.78E+02

Major Overhaul Startup Fuel Gas

Purge Gas Heat Input = 610 MMBtu/hr
3,662 MMBtu/yr

Emissions From Major Overhaul Startup Fuel Gas

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	9.26E+04	2.78E+02
CH_4			[2]	5.58E-01	1.67E-03
N_2O	1.0E-04	kg/MMBtu	[3]	1.35E-01	4.04E-04
CO_2e	--	--	[4]	9.26E+04	2.78E+02

Major Overhaul Startup Refrigerant

Purge Gas Heat Input = 2,081 MMBtu/hr
16,650 MMBtu/yr

Emissions From Major Overhaul Startup Refrigerant

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	3.11E+05	1.25E+03
CH_4			[2]	6.96E+01	2.78E-01
N_2O	1.0E-04	kg/MMBtu	[3]	4.59E-01	1.84E-03
CO_2e	--	--	[4]	3.13E+05	1.25E+03

Emissions Summary from Major Overhaul

Pollutant	Emission Rate Hourly [5] (lb/hr)	Emission Rate Maximum [6] (lb/hr)	Emission Rate Annual (tpy)
CO_2	6.81E+05	7.50E+05	5.28E+04
CH_4	2.30E+03	2.53E+03	1.71E+02
N_2O	1.15E+00	1.27E+00	8.89E-02
CO_2e	7.30E+05	8.03E+05	5.64E+04

[1] Based on mass balance of carbon in purge gas.

[2] Emission rate estimated at a DRE of 99%

[3] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[4] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

[5] Purge flows will not occur in same hour as purge of feedgas. Hourly rates are maximum of all scenarios.

[6] Maximum hourly emission rates are based on maximum expected variability during routine operations.

Sabine Pass Liquefaction Project
Sabine Pass Liquefied Natural Gas Terminal Trains 5 and 6
Stationary Sources
Air Emission Calculations

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana
Table 1 - Acid Gas Thermal Oxidizer

Client Data:

Waste gas flow [1]:	43,467	lb/hr
Gas Temperature [1]:	122	°F
Required Destruction Efficiency [1]:	99.99%	

Calculated Output:

Waste Gas Stream Ave MW:	42.202	lb/lbmol
Waste Gas Stream Flow:	1,029.96	lbmol/hr

Waste Gas Composition

Composition	MW [4] lb/lbmol	Mol% [1] %	Flowrate [1] Lbs/hr	Component Molar Flow Inlet lbmol/hr	Component Molar Flow Exhaust [2,3] lbmol/hr	Component Mass Flow Exhaust lb/hr
H2	2.016	0.00000	0.0000	--	--	--
O2	32	0.00000	0.0000	--	--	--
N2	28.02	0.00000	0.0000	--	--	--
CO	28.01	0.00000	0.0000	--	--	--
CO2	44.01	92.98930	42150.9069	9.58E+2	9.65E+2	4.25E+4
C1	16.04	0.44666	73.8003	4.60E+0	4.60E-4	7.38E-3
C2	30.07	0.02233	6.9156	2.30E-1	2.30E-5	6.92E-4
C2=	28.05	0.00000	0.0000	--	--	--
ACETYLENE	26.04	0.00000	0.0000	--	--	--
C3	44.09	0.00388	1.7622	4.00E-2	4.00E-6	1.76E-4
C3=	42.08	0.00000	0.0000	--	--	--
N-C4	58.12	0.00097	0.5807	9.99E-3	9.99E-7	5.81E-5
I-C4	58.12	0.00097	0.5807	9.99E-3	9.99E-7	5.81E-5
C4=	56.1	0.00000	0.0000	--	--	--
N-C5	72.15	0.00049	0.3641	5.05E-3	5.05E-7	3.64E-5
I-C5	72.15	0.00049	0.3641	5.05E-3	5.05E-7	3.64E-5
Neo-C5	72.15	0.00000	0.0000	--	--	--
N-C6	86.17	0.00097	0.8609	9.99E-3	9.99E-7	8.61E-5
N-C7	100.2	0.00097	1.0011	9.99E-3	9.99E-7	1.00E-4
N-C8	114.22	0.00000	0.0000	--	--	--
BENZENE	78.11	0.02816	22.6555	2.90E-1	2.90E-5	2.27E-3
TOLUENE	92.13	0.00000	0.0000	--	--	--
XYLENE	106.16	0.00000	0.0000	--	--	--
METHANOL	32.04	0.00000	0.0000	--	--	--
NH3	17.03	0.00000	0.0000	--	--	--
SO2	64.06	0.00000	0.0000	--	1.03E-2	6.60E-1
H2S	34.08	0.00100	0.3510	1.03E-2	1.03E-6	3.51E-5
H2O	18.016	6.50379	1206.7869	6.70E+1	6.70E+1	1.21E+3
Cl2	70.91	0.00000	0.0000	--	--	--
HCl	36.47	0.00000	0.0000	--	--	--
Total VOC	**--**	**--**	**--**	**3.80E-1**	**3.80E-5**	**2.82E-3**
Total		**100.00**	**43,466.93**	**1,029.96**	**1,031.87**	**43,671.73**

[1] Data supplied by Bechtel on February 10, 2012.

[2] It is assumed that all of the controlled hydrocarbons are oxidized to CO_2.

[3] It is assumed that all of the controlled H_2S is oxidized to SO_2.

[4] Obtained from "Perry's Chemical Engineer's Handbook", Seventh Edition, 1997.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Table 2 - Criteria Pollutant Emissions from Thermal Oxidizer Fuel Gas Combustion

Thermal Oxidizer Heat Input =	23.08	MMBtu/hr [1]
Heating Value of Fuel =	1,013	Btu/scf [6]
Annual Operating Time=	8,760	hr/yr [1]

Pollutant	Emission Factor		References	Emission Rates		
				Average (lb/hr)	Maximum (lb/hr) [5]	Annual (tpy)
PM_{10}	7.6	lb/MMscf	[2]	1.73E-01	1.90E-01	0.75837
$PM_{2.5}$	7.6	lb/MMscf	[2]	1.73E-01	1.90E-01	0.75837
SO_2	0.6	lb/MMscf	[2]	1.37E-02	1.50E-02	0.05987
NO_x	94	lb/MMscf	[3]	2.14E+00	2.36E+00	9.37979
CO	0.37	lb/MMBtu	[4]	8.54E+00	9.39E+00	37.40043
Lead	0.0005	lb/MMscf	[2]	1.14E-05	1.25E-05	0.00005
VOC	5.5	lb/MMscf	[2]	1.25E-01	1.38E-01	0.54882

[1] Data supplied by Bechtel on February 10, 2012.
[2] U.S. EPA AP-42, Volume I, Chapter 1, External Combustion Sources, Section 1.4, Natural Gas Combustion, Table 1.4-2, Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion, p.1.4-6, July 1998.
[3] U.S. EPA AP-42, Volume I, Chapter 1, External Combustion Sources, Section 1.4, Natural Gas Combustion, Table 1.4-1, Emission Factors for Nitrogen Oxides (NOx) and Carbon Monoxide (CO) from Natural Gas Combustion, p.1.4-5, July 1998.
[4] U.S. EPA AP-42, Volume I, Chapter 13, Section 13.5, Industrial Flares, Table 13.5-1, Emission Factors for Flare Operations, p.13.5-4, July 1998.

[5] A contingency factor of ten percent is added to the average emission rate to estimate the maximum emission rate.
[6] Assumed to be equal to the heating value of the flare pilot fuel.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Table 3 - Hazardous Air Pollutant Emissions from Thermal Oxidizer Fuel Gas Combustion

Thermal Oxidizer Heat Input =	23.08	MMBtu/hr [1]
Heating Value of Fuel =	1,013	Btu/scf [6]
Annual Operating Time=	8,760	hr/yr [1]

Pollutant	Emission Factor		References	Emission Rates		
				Average (lb/hr)	Maximum (lb/hr) [4]	Annual (tpy)
Arsenic	2.00E-04	lb/MMscf	[5]	4.56E-06	5.01E-06	0.000020
Benzene	2.10E-03	lb/MMscf	[2]	4.78E-05	5.26E-05	0.000210
Beryllium	1.20E-05	lb/MMscf	[5]	2.73E-07	3.01E-07	0.000001
Cadmium	1.10E-03	lb/MMscf	[5]	2.51E-05	2.76E-05	0.000110
Chromium	1.40E-03	lb/MMscf	[5]	3.19E-05	3.51E-05	0.000140
Cobalt	8.40E-05	lb/MMscf	[5]	1.91E-06	2.11E-06	0.000008
Dichlorobenzene	1.20E-03	lb/MMscf	[2]	2.73E-05	3.01E-05	0.000120
Formaldehyde	7.50E-02	lb/MMscf	[2]	1.71E-03	1.88E-03	0.007484
Hexane	1.80E+00	lb/MMscf	[2]	4.10E-02	4.51E-02	0.179613
Manganese	3.80E-04	lb/MMscf	[5]	8.66E-06	9.52E-06	0.000038
Mercury	2.60E-04	lb/MMscf	[5]	5.92E-06	6.52E-06	0.000026
Naphthalene	6.10E-04	lb/MMscf	[2]	1.39E-05	1.53E-05	0.000061
Nickel	2.10E-03	lb/MMscf	[5]	4.78E-05	5.26E-05	0.000210
Selenium	2.40E-05	lb/MMscf	[5]	5.47E-07	6.01E-07	0.000002
Toluene	3.40E-03	lb/MMscf	[2]	7.75E-05	8.52E-05	0.000339
Total POM	8.82E-05	lb/MMscf	[2], [3]	2.01E-06	2.21E-06	8.80E-06

[1] Data supplied by Bechtel on February 10, 2012.
[2] U.S. EPA AP-42, Volume I, Chapter 1, External Combustion Sources, Section 1.4, Natural Gas Combustion, Table 1.4-3, Emission Factors for Speciated Organic Compounds from Natural Gas Combustion, p.1.4-7, July 1998.
[3] Polycyclic Organic Matter (POM)
[4] A contingency factor of ten percent is added to the average emission rate to estimate the maximum emission rate.
[5] U.S. EPA AP-42, Volume I, Chapter 1, External Combustion Sources, Section 1.4, Natural Gas Combustion, Table 1.4-4, Emission Factors for Metals from Natural Gas Combustion, p.1.4-9, July 1998.
[6] Assumed to be equal to the heating value of the flare pilot fuel.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Table 4 - Greenhouse Gas Emissions from Thermal Oxidizer Fuel Gas Combustion

Average Operating Rate = 23.08 MMBtu/hr [1]
Annual Operating Time = 8760 hrs/yr [1]

Pollutant	Emission Factor		References	Average (lb/hr)	Annual (tpy)
CO_2	53.02	kg/MMBtu	[2]	2.70E+03	1.18E+04
CH_4	1.0E-03	kg/MMBtu	[2]	5.09E-02	2.23E-01
N_2O	1.0E-04	kg/MMBtu	[2]	5.09E-03	2.23E-02
CO_2e	--	--	[3]	2.70E+03	1.18E+04

[1] Data supplied by Bechtel on February 10, 2012.
[2] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.
[3] CH_4, CO_2, and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potentials (GWP). The GWP of CH_4 is 21, of CO_2 is 1, and of N_2O is 310.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Table 5 - Overall Thermal Oxidzer Vent Emissions

Pollutant	Controlled Acid Gas vent with Thermal Oxidizer Emissions		
	Average lb/hr	**Maximum** lb/hr	**Annual** tpy
PM_{10}	1.73E-01	1.90E-01	0.75837
$PM_{2.5}$	1.73E-01	1.90E-01	0.75837
NO_X	2.14E+00	2.36E+00	9.37979
SO_2	6.73E-01	7.41E-01	2.94948
CO	8.54E+00	9.39E+00	37.40043
VOC	1.28E-01	1.41E-01	0.56116
H_2S	3.51E-05	3.86E-05	0.00015
Benzene	2.31E-03	2.54E-03	0.01013
Formaldehyde	1.71E-03	1.88E-03	0.00748
n-Hexane	4.11E-02	4.52E-02	0.17999
CO_2	4.52E+04	--	197810.75671
CH_4	5.83E-02	--	0.25521
N_2O	5.09E-03	--	0.02229
CO_2e	4.52E+04	--	197823.02553

Facility Name:	Sabine Pass Liquefaction, LLC			
AIR CONTAMINANT DATA				
1. Emission Point			2. Component or Air Contaminant Name	
(A) EPN	(B) FIN	(C) NAME		(B) TPY
WTDYFLR3	WTDYFLR3	Wet/Dry Gas Flare 3 (continuous)	NO_x	5.20
			CO	44.59
			VOC	26.11
			H2S	< 0.01
			SO_2	0.07
		Wet/Dry Gas Flare 3 (MSS)	NO_x	26.80
			CO	229.77
			VOC	21.32
			H2S	< 0.01
			SO_2	0.28
		Wet/Dry Gas Flare 3 (Total)	NO_x	32.00
			CO	274.36
			VOC	47.42
			H2S	< 0.01
			SO_2	0.35

EPN = Emission Point Number
FIN = Facility Identification Number

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Continuous Purges

Pollutant	Hourly Emissions	Annual Emissions
	Wet/Dry Flare 3 (lb/hr)	Wet/Dry Flare 3 (tpy)
SO_2	1.53E-02	6.70E-02
NO_x	1.67E-02	7.30E-02
CO	1.43E-01	6.26E-01
VOC	8.64E-04	3.78E-03

WET/DRY FLARE CONTINUOUS PURGE

Pollutant	Hourly Emissions	Annual Emissions
	Wet/Dry Flare 3 (lb/hr)	Wet/Dry Flare 3 (tpy)
NO_x	1.33E+00	5.13E+00
CO	1.14E+01	4.40E+01
VOC	6.56E+00	2.61E+01

WET/DRY FLARE MAINTENANCE AND TURNAROUND

Pollutant	Hourly Emissions	Annual Emissions
	Wet/Dry Flare 3 (lb/hr)	Wet/Dry Flare 3 (tpy)
NO_x	1.21E+02	9.63E-01
CO	1.04E+03	8.26E+00
VOC	9.49E+02	6.90E+00

WET/DRY FLARE MAJOR OVERHAUL

Pollutant	Hourly Emissions	Annual Emissions
	Wet/Dry Flare 3 (lb/hr)	Wet/Dry Flare 3 (tpy)
NO_x	3.69E+02	2.58E+01
CO	3.16E+03	2.22E+02
VOC	1.05E+02	1.44E+01

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare

Pilot Gas Emissions

Number of Pilots =	4	[1]
Flare Pilot Heat Input =	0.065	MMBtu/hr [1]
Heating Value of Fuel =	850.24	Btu/scf
Pilot Gas Molar Flowrate =	0.20	lb-mol/hr
Annual Operating Time =	8,760	hr/yr [1]
VOC DRE (C1-C3 compounds)	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

Pilot Gas Composition [3]

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	5.32E+00	28.01		1.49	8.84E-02	0.00E+00	-	-
Hydrogen Sulfide	3.01E-04	34.08	29	0.0001	6.08E-06	1.76E-04	1.63E-06	3.72E-07
Water	6.67E-02	18.02		0.01	7.13E-04	0.00E+00	-	-
Carbon Dioxide	2.70E-01	44.01		0.12	7.04E-03	0.00E+00	9.42E-02	2.15E-02
Methane	9.37E+01	16.04	21,509	15.04	8.91E-01	1.92E+04	1.19E-01	2.72E-02
Ethane	4.75E-01	30.069	20,426	0.14	8.47E-03	1.73E+02	1.13E-03	2.59E-04
Propane	6.82E-02	44.096	19,919	0.03	1.78E-03	3.55E+01	2.39E-04	5.45E-05
Isobutane	1.83E-02	58.122	19,587	0.01	6.30E-04	1.23E+01	1.69E-04	3.85E-05
n-Butane	1.52E-02	58.122	19,648	0.01	5.24E-04	1.03E+01	1.40E-04	3.20E-05
Isopentane	6.64E-03	72.149	19,305	0.005	2.84E-04	5.48E+00	7.60E-05	1.73E-05
n-Pentane	3.32E-03	72.149	19,339	0.002	1.42E-04	2.74E+00	3.80E-05	8.67E-06
n-Hexane	7.73E-03	86.175	19,245	0.01	3.95E-04	7.60E+00	1.06E-04	2.41E-05
Benzene	1.96E-03	78.11	17,274	0.002	9.10E-05	1.57E+00	2.44E-05	5.56E-06
n-Heptane	4.55E-03	100.2	19,176	0.005	2.70E-04	5.19E+00	7.24E-05	1.65E-05
				16.87		**19,424**		

Pollutant	Emission Factor		Ref	Emission Rates (per Flare) Hourly (lb/hr)	Emission Rates (per Flare) Annual (tpy)
SO_2				1.53E-02	6.70E-02
NO_x	0.0641	lb/MMBtu	[2]	1.67E-02	7.30E-02
CO	0.5496	lb/MMBtu	[2]	1.43E-01	6.26E-01
VOC				8.64E-04	3.78E-03

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Continuous Purges

VOC (C1-C3) DRE	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

Continuous Purge to Flare 3

Propane Feed Gas Flowrate =	276	lb/hr
Ethylene Feed Gas Flowrate =	320	lb/hr
Methane Feed Gas Flowrate =	220	lb/hr
Regen Gas Flowrate =	84	lb/hr
Pipeline Gas Flowrate =	30	lb/hr
Purge hours =	8760	hr/yr (all except pipeline gas)
	12	hr/yr (pipeline gas)

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	2.70E+00	1.18E+01
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	1.88E-02	8.24E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	7.28E-02	3.19E-01
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	3.18E+00	1.39E+01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	1.84E-02	8.05E-02
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	1.13E+01	4.94E+01
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	2.09E+00	9.14E+00
				16.40		**20,407**		

Regen Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Methane	9.65E+01	16.04	21,509	15.48	0.9369	20,152	7.87E-01	3.45E+00
Ethane	3.00E+00	30.069	20,426	0.90	0.0546	1,115	4.59E-02	2.01E-01
Nitrogen	5.00E-01	28.01		0.14	0.0085	0	7.12E-01	3.12E+00
				16.52		**21,267**		

Pipeline Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	2.10E+00	28.01		0.59	0.0361	0	1.08E+00	6.50E-03
Methane	9.79E+01	16.04	21,509	15.70	0.9639	20,732	2.89E-01	1.74E-03
				16.29		**20,732**		

Total heating value for purges = 18.89 MMBtu/hr
160,001 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	1.21E+00	1.33E+00	5.13E+00
CO	0.5496	lb/MMBtu	[2], [6]	1.04E+01	1.14E+01	4.40E+01
VOC			[2], [6]	5.96E+00	6.56E+00	2.61E+01

Continuous Purge to Flare 2

Propane Feed Gas Flowrate = 138 lb/hr
Ethylene Feed Gas Flowrate = 160 lb/hr
Methane Feed Gas Flowrate = 110 lb/hr
Regen Gas Flowrate = 42 lb/hr
Pipeline Gas Flowrate = 0 lb/hr
Purge hours = 8760 hr/yr (all except pipeline gas)
12 hr/yr (pipeline gas)

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19520.33	1.35E+00	5.92E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139.28	9.41E-03	4.12E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258.17	3.64E-02	1.59E-01
				44.10		**19917.78**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.59E+00	6.97E+00
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	9.19E-03	4.02E-02
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	5.64E+00	2.47E+01
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	1.04E+00	4.57E+00
				16.40		**20,407**		

Regen Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Methane	9.65E+01	16.04	21,509	15.48	0.9369	20,152	3.94E-01	1.72E+00
Ethane	3.00E+00	30.069	20,426	0.90	0.0546	1,115	2.29E-02	1.00E-01
Nitrogen	5.00E-01	28.01		0.14	0.0085	0	3.56E-01	1.56E+00
				16.52		**21,267**		

Total heating value fo 9.13E+00 MMBtu/hr
8.00E+04 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	5.85E-01	6.44E-01	2.56E+00
CO	0.5496	lb/MMBtu	[2], [6]	5.02E+00	5.52E+00	2.20E+01
VOC			[2], [6]	2.98E+00	3.28E+00	1.31E+01

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Maintenance and Turnaround Emissions

VOC (C1-C3) DRE	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

LNG Train Planned Maintenance Emissions

Borescope Purges

Propane Purge Flowrate =	55,200	lb/purge/turbine
Ethylene Purge Flowrate =	16,400	lb/purge/turbine
Methane Purge Flowrate =	10,400	lb/purge/turbine
Borescope Purge per year =	2	/turbine
Turbines =	6	in each service (18 total)
Maximum turbine systems purged at a time =	2	in each service (6 total)
Hours per purge =	3	hr

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	3.61E+02	3.25E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	2.51E+00	2.26E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	9.70E+00	8.73E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.09E+02	9.78E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	6.28E-01	5.65E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	3.55E+02	3.20E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	6.58E+01	5.92E-01
				16.40		**20,407**		

Total heating value for purges =	1,096	MMBtu/hr
	19,732	MMBtu/yr

Pollutant	Emission Factor		Ref	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	7.03E+01	7.73E+01	6.32E-01
CO	0.5496	lb/MMBtu	[2], [6]	6.02E+02	6.63E+02	5.42E+00
VOC			[2], [6]	4.79E+02	5.27E+02	4.31E+00

Combustor Changeout/Hot Section Purge

Propane Purge Flowrate =	55,200	lb/purge/turbine
Ethylene Purge Flowrate =	16,400	lb/purge/turbine
Methane Purge Flowrate =	10,400	lb/purge/turbine
CC/HS Purge per year =	1	/turbine
Turbines =	6	in each service (18 total)
bine systems purged at a time =	2	in each service (6 total)
Hours per purge =	3	hr

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	3.61E+02	1.62E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	2.51E+00	1.13E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	9.70E+00	4.37E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.09E+02	4.89E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	6.28E-01	2.83E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0.00	3.55E+02	1.60E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20406.77	6.58E+01	2.96E-01
				16.40		**20406.77**		

Total heating value for purges = 1,096 MMBtu/hr
9,866 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	7.03E+01	7.73E+01	3.16E-01
CO	0.5496	lb/MMBtu	[2], [6]	6.02E+02	6.63E+02	2.71E+00
VOC			[2], [6]	4.79E+02	5.27E+02	2.16E+00

Combustor Changeout/Hot Section Startup

Propane Purge Flowrate =	100,803	lb/purge/turbine
Ethylene Purge Flowrate =	28,158	lb/purge/turbine
Methane Purge Flowrate =		lb/purge/turbine
CC/HS Startup per year =	1	/turbine
Turbines =	6	in each service (18 total)
Maximum turbine systems purged at a time =	2	in each service (6 total)
Hours per purge =	3	hr

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	6.59E+02	2.96E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	4.58E+00	2.06E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	1.77E+01	7.97E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	1.87E+02	8.40E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	1.08E+00	4.85E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	0.00E+00	0.00E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	0.00E+00	0.00E+00
				16.40		**20,407**		

Total heating value for purges = 1,719 MMBtu/hr
15,474 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
NO_x	0.0641	lb/MMBtu	[2], [6]	1.10E+02	1.21E+02	4.96E-01
CO	0.5496	lb/MMBtu	[2], [6]	9.45E+02	1.04E+03	4.25E+00
VOC			[2], [6]	8.63E+02	9.49E+02	3.88E+00

[1] Data provided by Cheniere.

[2] The emission factors and destruction efficiencies were obtained from TCEQ's "Air Permit Technical Guidance for Chemical Sources: Flares and Vapor Oxidizers; October 2000." Factors are for low Btu streams in non-steam assisted flares. The destruction efficiencies meet the TCEQ BACT guidance for Flares and Vapor Combustors, 8/1/2011.

[3] *LP1 Fuel Gas composition* from "*25744-100-M3-DK-00002.xls* ", provided by Jose Dumlao (Cheniere) to Melissa Ryan (Trinity) on 8/20/12, was used as the pilot gas composition.

[4] Net Heating Values (NHV) were obtained from "Yaws' Handbook of Thermodynamic and Physical Properties of Chemical Compounds".

[5] Feed Gas composition was obtained from "CCLNG-H&MB_for_Air_Permit.xlsx", provided by Cheniere .

[6] Maximum hourly emission rates are based on maximum expected variability during routine operations.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Major Overhaul Intermittent MSS Emissions

VOC (C1-C3) DRE	99.00%	[2]
H2S and VOC (C4+) DRE	98.00%	[2]

LNG Train Planned Maintenance Emissions

Feed Gas Flowrate =	254,760	lb/hr [1]
Annual Flowrate =	37,738,000	lb/2 trains[1]
Heating Value of Feed Gas =	20,530	Btu/lb
	907	Btu/scf

Feed Gas Composition [5]

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	4.90E-01	28.01		0.14	0.0081	0.00E+00	2.05E+03	-
Carbon Dioxide	1.30E+00	44.01		0.57	0.0336	0.00E+00	8.55E+03	6.34E+02
Methane	9.59E+01	16.04	21508.9	15.38	0.9028	1.94E+04	2.30E+03	1.70E+02
Ethane	1.89E+00	30.069	20425.8	0.57	0.0334	6.81E+02	8.50E+01	6.29E+00
Propane	2.50E-01	44.096	19918.7	0.11	0.0065	1.29E+02	1.65E+01	1.22E+00
Isobutane	6.00E-02	58.122	19586.8	0.15	0.0085	1.67E+02	4.35E+01	3.22E+00
n-Butane	5.00E-02	58.122	19647.5	0.03	0.0020	4.02E+01	1.04E+01	7.72E-01
Isopentane	2.00E-02	72.149	19305.4	0.04	0.0021	4.09E+01	1.08E+01	7.99E-01
n-Pentane	1.00E-02	72.149	19339.4	0.01	0.0008	1.64E+01	4.32E+00	3.20E-01
n-Hexane	2.00E-02	86.175	19245.1	0.01	0.0005	9.73E+00	2.58E+00	1.91E-01
Benzene	1.50E-03	78.11	17274.3	0.02	0.0009	1.58E+01	4.67E+00	3.46E-01
n-Heptane	1.00E-02	100.2	19176	0.01	0.0006	1.13E+01	3.00E+00	2.22E-01
Hydrogen Sulfide	4.00E-04	34.08	28.87	0.0001	0.00001	2.31E-04	4.08E-02	3.02E-03
Water	1.47E-02	18.02		0.003	0.0002	0.00E+00	7.93E-01	-
				17.04	1.00	**20,530**		

Major Overhaul Purge Depressurization

Propane Purge Flowrate =	62,100	lb/purge
Ethylene Purge Flowrate =	18,327	lb/purge
Methane Purge Flowrate =	11,060	lb/purge
Overhaul Purge per year =	2	
Duration of Depressurization Purge =	4	hr
Turbine Systems =	2	in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	3.04E+02	1.22E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	2.12E+00	8.47E-03
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	8.19E+00	3.27E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	9.11E+01	3.64E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	5.26E-01	2.10E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	2.83E+02	1.13E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	5.25E+01	2.10E-01
				16.40		**20,407**		

Total heating value for purge depres = 7.34E+03 MMBtu/yr

Major Overhaul Purge Fuel Gas

Propane Purge Flowrate = 31112 lb/purge
Ethylene Purge Flowrate = 14582 lb/purge
Methane Purge Flowrate = 0 lb/purge
Overhaul Purge per year = 2
Duration of Fuel Gas Purge = 3 hr
Turbine Systems = 2 in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	2.03E+02	6.10E-01
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	1.41E+00	4.24E-03
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	5.47E+00	1.64E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	28	0.9943	20,160	9.67E+01	2.90E-01
Methane	1.00E+00	16.04	21,509	0	0.0057	124	5.58E-01	1.67E-03
				28		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	0.00E+00	0.00E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	0.00E+00	0.00E+00
				16.40		**20,407**		

Total heating value for purge fuel gas= 3.66E+03 MMBtu/yr

Major Overhaul Startup Fuel Gas

Propane Purge Flowrate =	31112	lb/purge
Ethylene Purge Flowrate =	14582	lb/purge
Methane Purge Flowrate =	0	lb/purge
Overhaul Startup per year =	2	
Duration of Overhaul Startup Fuel Gas =	3	hr
Turbine Systems =	2	in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	2.03E+02	6.10E-01
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	1.41E+00	4.24E-03
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	5.47E+00	1.64E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	9.67E+01	2.90E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	5.58E-01	1.67E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	0.00E+00	0.00E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	0.00E+00	0.00E+00
				16.40		**20,407**		

Total heating value for startup fuel gas= 3.66E+03 MMBtu/yr

Major Overhaul Startup Refrigerant

Propane Purge Flowrate =	151,204	lb/purge
Ethylene Purge Flowrate =	42,237	lb/purge
Methane Purge Flowrate =	14,411	lb/purge
Overhaul Startup per year =	2	
Duration of Overhaul Startup Refrigerant =	4	hr
Turbine Systems =	2	in each service (6 total)

Purge flowrates will not occur during same hours as Feed Gas Flowrate to flare calculated above. Hourly emissions from Feed Gas Flowrate are worst case. Only annual emissions are calculated for purge flowrates.

Propane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Propane	9.80E+01	44.096	19,919	43.21	0.9800	19,520	7.41E+02	2.96E+00
Ethane	1.00E+00	30.069	20,426	0.30	0.0068	139	5.16E+00	2.06E-02
i-Butane	1.00E+00	58.122	19,587	0.58	0.0132	258	1.99E+01	7.97E-02
				44.10		**19,918**		

Ethylene Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Ethylene	9.90E+01	28.054	20,277	27.77	0.9943	20,160	2.10E+02	8.40E-01
Methane	1.00E+00	16.04	21,509	0.16	0.0057	124	1.21E+00	4.85E-03
				27.93		**20,284**		

Methane Gas Composition

Constituents	Mol %	Molecular Weight (lb/lb-mol)	NHV [4] Btu/lb	Molar mass	Weight Fraction	Net Heat Release Btu/lb	Emission Rates Hourly (lb/hr)	Emission Rates Annual (tpy)
Nitrogen	3.00E+00	28.01		0.84	0.0512	0	3.69E+02	1.48E+00
Methane	9.70E+01	16.04	21,509	15.56	0.9488	20,407	6.84E+01	2.73E-01
				16.40		**20,407**		

Total heating value for startup refrigerant= 1.66E+04 MMBtu/yr

Pollutant	Emission Factor		References	Emission Rates Hourly (lb/hr)	Emission Rates Maximum (lb/hr)	Emission Rates Annual (tpy)
SO_2			[6]	3.83E+00	4.22E+00	2.84E-01
NO_x	0.0641	lb/MMBtu	[2], [6]	3.35E+02	3.69E+02	2.58E+01
CO	0.5496	lb/MMBtu	[2], [6]	2.87E+03	3.16E+03	2.22E+02
VOC			[2], [6]	9.57E+01	1.05E+02	1.44E+01
H2S			[2], [6]	4.08E-02	4.49E-02	3.02E-03

[1] Data provided by Cheniere.

[2] The emission factors and destruction efficiencies were obtained from TCEQ's "Air Permit Technical Guidance for Chemical Sources: Flares and Vapor

[3] *LP1 Fuel Gas composition* from "*25744-100-M3-DK-00002.xls* ", provided by Jose Dumlao (Cheniere) to Melissa Ryan (Trinity) on 8/20/12, was used as the pilot gas composition.

[4] Net Heating Values (NHV) were obtained from "Yaws' Handbook of Thermodynamic and Physical Properties of Chemical Compounds".

[5] Feed Gas composition was obtained from "CCLNG-H&MB_for_Air_Permit.xlsx", provided by Cheniere .

[6] Maximum hourly emission rates are based on maximum expected variability during routine operations.

Area Name:	Sabine Pass Liquefaction, LLC			Customer Reference No.: 604136374	
AIR CONTAMINANT DATA					
1. Emission Point			**2. Component or Air Contaminant Name**	**3. Air Contaminant Emission Rate**	
(A) EPN	**(B) FIN**	**(C) NAME**		**(A) MTCE/yr**	**(B) TPY**
WTDYFLR3	WTDYFLR3	Wet/Dry Gas Flare 3 (continuous)	CO_2	10,590.18	11,670.38
			CH_4	11.52	12.70
			N_2O	0.02	0.02
		Wet/Dry Gas Flare 3 (MSS)	CO_2	49,230.44	54,251.94
			CH_4	155.31	171.15
			N_2O	0.08	0.09
		Wet/Dry Gas Flare 3 (Total)	CO_2	59,820.62	65,922.33
			CH_4	166.83	183.85
			N_2O	0.10	0.11
			CO_2e	63,354.49	69,816.65

EPN = Emission Point Number

FIN = Facility Identification Number

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Summary of Updated GHG Emission Rates

WET/DRY FLARE PILOTS

Pollutant	Hourly Emissions Wet/Dry Flare 3 (lb/hr)	Annual Emissions Wet/Dry Flare 3 (tpy)
CO_2	3.33E+01	1.46E+02
CH_4	1.19E-01	2.72E-02
N_2O	5.73E-05	1.86E-09
CO_2e	3.58E+01	1.46E+02

WET/DRY FLARE CONTINUOUS FLOWS

Pollutant	Hourly Emissions Wet/Dry Flare 3 (lb/hr)	Annual Emissions Wet/Dry Flare 3 (tpy)
CO_2	2.71E+03	1.15E+04
CH_4	3.18E+00	1.27E+01
N_2O	4.16E-03	1.76E-02
CO_2e	2.78E+03	1.18E+04

WET/DRY FLARE

Pollutant	Hourly Emissions Wet/Dry Flare 3 (lb/hr)	Annual Emissions Wet/Dry Flare 3 (tpy)
CO_2	2.60E+05	1.49E+03
CH_4	6.64E+01	6.01E-01
N_2O	3.79E-01	3.31E-03
CO_2e	2.60E+05	1.51E+03

WET/DRY FLARE MAJOR

Pollutant	Hourly Emissions Wet/Dry Flare 3 (lb/hr)	Annual Emissions Wet/Dry Flare 3 (tpy)
CO_2	7.50E+05	5.28E+04
CH_4	2.53E+03	1.71E+02
N_2O	1.27E+00	8.89E-02
CO_2e	8.03E+05	5.64E+04

BOG COMPRESSOR OVERHAUL

Pollutant	BOG Compressor (lb/hr)	BOG Compressor (tpy)
CO_2	--	--
CH_4	2.88E+02	7.54E-01
N_2O	--	--
CO_2e	6.05E+03	1.58E+01

FUGITIVES

Pollutant	Fugitives (lb/hr)	Fugitives (tpy)
CO_2	5.07E-02	2.22E-01
CH_4	9.89E+01	4.33E+02
N_2O	--	--
CO_2e	2.08E+03	9.09E+03

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Pilot Emissions

Pilot Gas Emissions

Number of Pilots =	4	[1]
Flare Pilot Heat Input =	0.065	MMBtu/hr [1]
Heating Value of Fuel =	850.24	Btu/scf
Pilot Gas Molar Flowrate =	0.20	lb-mol/hr
Annual Operating Time =	8,760	hr/yr [1]

Emissions From Pilot Gas Combustion

Pollutant	Emission Factor		References	Emission Rate	
				Average (lb/hr)	Annual (tpy)
CO_2			[2]	3.33E+01	1.46E+02
CH_4			[3]	1.19E-01	2.72E-02
N_2O	1.0E-04	kg/MMBtu	[4]	5.73E-05	1.86E-09
CO_2e	--	--	[5]	3.58E+01	1.46E+02

[1] Data provided by Cheniere.

[2] Based on mass balance of carbon in pilot gas.

[3] Emission rate estimated at a DRE of 99%

[4] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[5] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Continuous Flows

Continuous Flow to Flare 3

Continuous Flow Gas Heat Input = 19 MMBtu/hr

160,001 MMBtu/yr

Emissions From Continuous Flow Gas Combustion

Pollutant	Emission Factor		References	Emission Rate	
				Average (lb/hr)	Annual (tpy)
CO_2			[1]	2.71E+03	1.15E+04
CH_4			[2]	3.18E+00	1.27E+01
N_2O	1.0E-04	kg/MMBtu	[3]	4.16E-03	1.76E-02
CO_2e	--	--	[4]	2.78E+03	1.18E+04

Continuous Flow to Flare 2

Continuous Flow Gas Heat Input = 9 MMBtu/hr

79,997 MMBtu/yr

Emissions From Continuous Flow Gas Combustion

Pollutant	Emission Factor		References	Emission Rate	
				Average (lb/hr)	Annual (tpy)
CO_2			[1]	1.32E+03	5.76E+03
CH_4			[2]	1.45E+00	6.33E+00
N_2O	1.0E-04	kg/MMBtu	[3]	2.01E-03	8.82E-03
CO_2e	--	--	[4]	1.35E+03	5.90E+03

[1] Based on mass balance of carbon in purge gas.

[2] Emission rate estimated at a DRE of 99%

[3] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[4] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Maintenance and Turnaround Emissions

LNG Train Planned Maintenance Emissions

Borescope Purges

Purge Gas Heat Input = 1,096 MMBtu/hr
19,732 MMBtu/yr

Emissions From Borescope Purges

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	1.62E+05	9.75E+02
CH_4			[2]	6.64E+01	5.98E-01
N_2O	1.0E-04	kg/MMBtu	[3]	2.42E-01	2.18E-03
CO_2e	--	--	[4]	1.64E+05	9.88E+02

Combustor Changeout/Hot Section Purges

Purge Gas Heat Input = 1,096 MMBtu/hr
9,866 MMBtu/yr

Emissions From Combustor Changeout/Hot Section Purges

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	1.62E+05	4.87E+02
CH_4			[2]	6.64E+01	2.99E-01
N_2O	1.0E-04	kg/MMBtu	[3]	2.42E-01	1.09E-03
CO_2e	--	--	[4]	1.64E+05	4.94E+02

Combustor Changeout/Hot Section Startup

Purge Gas Heat Input = 1,719 MMBtu/hr
15,474 MMBtu/yr

Emissions From Combustor Changeout/Hot Section Startup

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	2.60E+05	7.80E+02
CH_4			[2]	1.08E+00	4.85E-03
N_2O	1.0E-04	kg/MMBtu	[3]	3.79E-01	1.71E-03
CO_2e	--	--	[4]	2.60E+05	7.81E+02

[1] Based on mass balance of carbon in purge gas.

[2] Emission rate estimated at a DRE of 99%

[3] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[4] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

Sabine Pass Liquefaction, LLC
Sabine Pass Liquefaction Project
Wet/Dry Flare Major Overhaul Intermittent MSS Emissions

LNG Train Planned Maintenance Emissions

Purge of Feed Gas

Purge Gas Heat Input = 5,230 MMBtu/hr
774,774 MMBtu/yr

Emissions From Purge of Feed Gas

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	6.81E+05	5.05E+04
CH_4			[2]	2.30E+03	1.70E+02
N_2O	1.0E-04	kg/MMBtu	[3]	1.15E+00	8.54E-02
CO_2e	--	--	[4]	7.30E+05	5.41E+04

Major Overhaul Purge Depressurization

Purge Gas Heat Input = 917 MMBtu/hr
7,337 MMBtu/yr

Emissions From Major Overhaul Purge Depressurization

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	1.22E+05	4.88E+02
CH_4			[2]	5.30E+01	2.12E-01
N_2O	1.0E-04	kg/MMBtu	[3]	2.02E-01	8.09E-04
CO_2e	--	--	[4]	1.23E+05	4.93E+02

Major Overhaul Purge Fuel Gas

Purge Gas Heat Input = 610 MMBtu/hr
3,662 MMBtu/yr

Emissions From Major Overhaul Purge Fuel Gas

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	9.26E+04	2.78E+02
CH_4			[2]	5.58E-01	1.67E-03
N_2O	1.0E-04	kg/MMBtu	[3]	1.35E-01	4.04E-04
CO_2e	--	--	[4]	9.26E+04	2.78E+02

Major Overhaul Startup Fuel Gas

Purge Gas Heat Input = 610 MMBtu/hr
3,662 MMBtu/yr

Emissions From Major Overhaul Startup Fuel Gas

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	9.26E+04	2.78E+02
CH_4			[2]	5.58E-01	1.67E-03
N_2O	1.0E-04	kg/MMBtu	[3]	1.35E-01	4.04E-04
CO_2e	--	--	[4]	9.26E+04	2.78E+02

Major Overhaul Startup Refrigerant

Purge Gas Heat Input = 2,081 MMBtu/hr
16,650 MMBtu/yr

Emissions From Major Overhaul Startup Refrigerant

Pollutant	Emission Factor		References	Emission Rate Average (lb/hr)	Emission Rate Annual (tpy)
CO_2			[1]	3.11E+05	1.25E+03
CH_4			[2]	6.96E+01	2.78E-01
N_2O	1.0E-04	kg/MMBtu	[3]	4.59E-01	1.84E-03
CO_2e	--	--	[4]	3.13E+05	1.25E+03

Emissions Summary from Major Overhaul

Pollutant	Emission Rate Hourly [5] (lb/hr)	Emission Rate Maximum [6] (lb/hr)	Emission Rate Annual (tpy)
CO_2	6.81E+05	7.50E+05	5.28E+04
CH_4	2.30E+03	2.53E+03	1.71E+02
N_2O	1.15E+00	1.27E+00	8.89E-02
CO_2e	7.30E+05	8.03E+05	5.64E+04

[1] Based on mass balance of carbon in purge gas.

[2] Emission rate estimated at a DRE of 99%

[3] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.

[4] CH4, CO2, and N2O are included in the emissions of CO2 equivalent (CO2e), weighted according to their global warming potentials (GWP). The GWP of CH4 is 21, of CO2 is 1, and of N2O is 310.

[5] Purge flows will not occur in same hour as purge of feedgas. Hourly rates are maximum of all scenarios.

[6] Maximum hourly emission rates are based on maximum expected variability during routine operations.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Refrigeration Compressor Turbines -
Criteria Pollutants

No. of Turbines =	12	
Average Operating Rate =	6,656	BTU/Hp-hr/compressor turbine [4]
Annual Operating Time =	8,760	hrs/yr [4]
Power of Compressor=	32,075	kW/ each compressor turbine [4]
	43,013	HP / each compressor turbine [4]
% Sulfur in Fuel =	0	% [5]

Pollutant	Emission Factor		References	Emission Rates per Turbine		
				Average (lb/hr)	Maximum (lb/hr)	Annual (tpy)
PM_{10}	6.60E-03	lb/MMBtu	[1], [2]	1.89E+00	2.08E+00	8.28E+00
$PM_{2.5}$	6.60E-03	lb/MMBtu	[1], [2], [6]	1.89E+00	2.08E+00	8.28E+00
NO_x	25	ppm	[3], [7]	2.29E+01	2.87E+01	1.26E+02
CO	58.4	ppm	[3], [8]	4.36E+01	4.36E+01	1.91E+02
VOC	2.10E-03	lb/MMBtu	[1], [2]	6.01E-01	6.61E-01	2.63E+00

[1] U.S. EPA AP-42, Volume I, Chapter 3, Section 3.1, Stationary Gas Turbines, Table 3.1-2a, Emission Factors for Criteria Pollutants and Greenhouse Gases From Stationary Gas Turbines, p.3.1-11, July 1998.

[2] A contingency factor of 10% is added to the average emission rate to estimate the maximum emission rate.

[3] Vendor Guarantee

[4] Data supplied by Bechtel on September 24, 2010.

[5] Data supplied by Bechtel on August 1, 2010 for sulfur content of fuel.

[6] $PM_{2.5}$ emission factor is assumed to be equal to PM_{10} emission factor.

[7] NOx concentration increased from 20 ppm to 25 ppm. Based on an email from Ms. Catherine Rourke (Cheniere) to Mr. Jason Swofford (Trinity) on May 21, 2013.

[8] CO concentration increased from 25 ppm to 58.4 ppm. Obtained CO emission rate from "GE Industrial Aeroderivative Gas Turbines", LM2500 Industrial Applications Memo 2500-11-012A. Based upon Personal Communication, Email Communication between Ms. Cathy Rourke (Sabine Pass LNG) and Mr. Bill Bruscino

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Refrigeration Compressor Turbines -
Hazardous Air Pollutant Emissions

No. of Turbines =	12	
Average Operating Rate =	6,656	BTU/Hp-hr/compressor turbine [1]
Annual Operating Time =	8,760	hrs/yr [1]
Power of Compressor=	32,075	kW/ each compressor turbine [1]
	43,013	HP / each compressor turbine [1]

Pollutant	Emission Factor		References	Emission Rates per Turbine		
				Average (lb/hr)	Maximum (lb/hr) [3]	Annual (tpy)
1,3-Butadiene	4.30E-07	lb/MMBtu	[2]	1.23E-04	1.35E-04	5.4E-04
Acetaldehyde	4.00E-05	lb/MMBtu	[2]	1.15E-02	1.26E-02	5.0E-02
Acrolein	6.40E-06	lb/MMBtu	[2]	1.83E-03	2.02E-03	8.0E-03
Benzene	1.20E-05	lb/MMBtu	[2]	3.44E-03	3.78E-03	1.5E-02
Ethylbenzene	3.20E-05	lb/MMBtu	[2]	9.16E-03	1.01E-02	4.0E-02
Formaldehyde	7.10E-04	lb/MMBtu	[2]	2.03E-01	2.24E-01	8.9E-01
Naphthalene	1.30E-06	lb/MMBtu	[2]	3.72E-04	4.09E-04	1.6E-03
PAH	2.20E-06	lb/MMBtu	[2]	6.30E-04	6.93E-04	2.8E-03
Propylene Oxide	2.90E-05	lb/MMBtu	[2]	8.30E-03	9.13E-03	3.6E-02
Toluene	1.30E-04	lb/MMBtu	[2]	3.72E-02	4.09E-02	1.6E-01
Xylene (Mixed Isomers)	6.40E-05	lb/MMBtu	[2]	1.83E-02	2.02E-02	8.0E-02

[1] Data supplied by Bechtel on September 24, 2010.

[2] U.S. EPA AP-42, Volume I, Chapter 3, Section 3.1, Stationary Gas Turbines, Table 3.1-3, Emission Factors for Hazardous Air Pollutants From Natural Gas Fired Stationary Gas Turbines, p.3.1-13, July 1998.

[3] A contingency factor of ten percent is added to the average emission rate to estimate the maximum emission rate.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Refrigeration Compressor Turbines - Greenhouse Gases

No. of Turbines =	12	
Average Operating Rate =	6,656	BTU/Hp-hr/compressor turbine [1]
Annual Operating Time =	8,760	hrs/yr [1]
Power of Compressor=	32,075	kW/ each compressor turbine [1]
	43,013	HP / each compressor turbine [1]

Pollutant	Emission Factor		References	Emission Rates per Turbine	
				Average (lb/hr)	Annual (tpy)
CO_2	53.02	kg/MMBtu	[2]	3.35E+04	1.47E+05
CH_4	1.0E-03	kg/MMBtu	[2]	6.31E-01	2.77E+00
N_2O	1.0E-04	kg/MMBtu	[2]	6.31E-02	2.77E-01
CO_2e	--	--	[3]	3.35E+04	1.47E+05

[1] Data supplied by Bechtel on September 24, 2010.
[2] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.
[3] CH_4, CO_2, and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potentials (GWP). The GWP of CH_4 is 21, of CO_2 is 1, and of N_2O is 310.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Proposed Natural Gas-Fired Generator Turbines - Criteria Pollutants

No. of Turbines =	2	
Average Operating Rate =	6,656	Btu/Hp-hr/compressor turbine [4]
Annual Operating Time =	8,760	hrs/yr [4]
Power of Compressor=	32,075	kW/ each compressor turbine [4]
	43,013	HP / each compressor turbine [4]
% Sulfur in Fuel =	0	% [5]

Pollutant	Emission Factor		References	Emission Rates per Turbine		
				Average (lb/hr)	Maximum (lb/hr)	Annual (tpy)
PM_{10}	6.60E-03	lb/MMBtu	[1], [2]	1.89E+00	2.08E+00	8.28E+00
$PM_{2.5}$	6.60E-03	lb/MMBtu	[1], [2], [6]	1.89E+00	2.08E+00	8.28E+00
NO_x	25	ppm	[3]	2.87E+01	2.87E+01	1.26E+02
CO	25	ppm	[3]	1.75E+01	1.75E+01	7.65E+01
VOC	2.10E-03	lb/MMBtu	[1], [2]	6.01E-01	6.61E-01	2.63E+00

[1] U.S. EPA AP-42, Volume I, Chapter 3, Section 3.1, Stationary Gas Turbines, Table 3.1-2a, Emission Factors for Criteria Pollutants and Greenhouse Gases From Stationary Gas Turbines, p.3.1-11, July 1998.

[2] A contingency factor of ten percent is added to the average emission rate to estimate the maximum emission rate.

[3] Vendor Guarantee

[4] Data supplied by Bechtel on September 24, 2010.

[5] Data supplied by Bechtel on August 1, 2010 for sulfur content of fuel.

[6] $PM_{2.5}$ emission factor is assumed to be equal to PM_{10} emission factor.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Proposed Natural Gas-Fired Generator Turbines -
Hazardous Air Pollutant Emissions

No. of Turbines =	2	
Average Operating Rate =	6,656	BTU/Hp-hr/compressor turbine [1]
Annual Operating Time =	8,760	hrs/yr [1]
Power of Compressor=	32,075	kW/ each compressor turbine [1]
	43,013	HP / each compressor turbine [1]

Pollutant	Emission Factor		References	Emission Rates per Turbine		
				Average (lb/hr)	Maximum (lb/hr) [3]	Annual (tpy)
1,3-Butadiene	4.30E-07	lb/MMBtu	[2]	1.23E-04	1.35E-04	5.4E-04
Acetaldehyde	4.00E-05	lb/MMBtu	[2]	1.15E-02	1.26E-02	5.0E-02
Acrolein	6.40E-06	lb/MMBtu	[2]	1.83E-03	2.02E-03	8.0E-03
Benzene	1.20E-05	lb/MMBtu	[2]	3.44E-03	3.78E-03	1.5E-02
Ethylbenzene	3.20E-05	lb/MMBtu	[2]	9.16E-03	1.01E-02	4.0E-02
Formaldehyde	7.10E-04	lb/MMBtu	[2]	2.03E-01	2.24E-01	8.9E-01
Naphthalene	1.30E-06	lb/MMBtu	[2]	3.72E-04	4.09E-04	1.6E-03
PAH	2.20E-06	lb/MMBtu	[2]	6.30E-04	6.93E-04	2.8E-03
Propylene Oxide	2.90E-05	lb/MMBtu	[2]	8.30E-03	9.13E-03	3.6E-02
Toluene	1.30E-04	lb/MMBtu	[2]	3.72E-02	4.09E-02	1.6E-01
Xylene (Mixed Isomers)	6.40E-05	lb/MMBtu	[2]	1.83E-02	2.02E-02	8.0E-02

[1] Data supplied by Bechtel on September 24, 2010.

[2] U.S. EPA AP-42, Volume I, Chapter 3, Section 3.1, Stationary Gas Turbines, Table 3.1-3, Emission Factors for Hazardous Air Pollutants From Natural Gas Fired Stationary Gas Turbines, p.3.1-13, July 1998.

[3] A contingency factor of ten percent is added to the average emission rate to estimate the maximum emission rate.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Proposed Natural Gas-Fired Generator Turbines - Greenhouse Gases

No. of Turbines =	2	
Average Operating Rate =	6,656	BTU/Hp-hr/compressor turbine [1]
Annual Operating Time =	8,760	hrs/yr [1]
Power of Compressor=	32,075	kW/ each compressor turbine [1]
	43,013	HP / each compressor turbine [1]

Pollutant	Emission Factor		References	Emission Rates per Turbine	
				Average (lb/hr)	Annual (tpy)
CO_2	53.02	kg/MMBtu	[2]	3.35E+04	1.47E+05
CH_4	1.0E-03	kg/MMBtu	[2]	6.31E-01	2.77E+00
N_2O	1.0E-04	kg/MMBtu	[2]	6.31E-02	2.77E-01
CO_2e	--	--	[3]	3.35E+04	1.47E+05

[1] Data supplied by Bechtel on September 24, 2010.
[2] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for natural gas.
[3] CH_4, CO_2, and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potentials (GWP). The GWP of CH_4 is 21, of CO_2 is 1, and of N_2O is 310.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Standby Generator - Criteria Air Pollutants

Operating Time [1] =	500	hrs/yr
Generator Rating [1] =	1,655	KW each
Generator Rating [1] =	2,220	HP each
No of Generators [1] =	2	

Pollutant	Emission Factor		References	Emission Rate per Engine		
				Average (lb/hr)	Maximum (lb/hr) [5]	Annual (tpy)
PM_{10}	2.00E-01	g/kw-hr	[7]	7.30E-01	8.03E-01	1.82E-01
$PM_{2.5}$	2.00E-01	g/kw-hr	[4], [7]	7.30E-01	8.03E-01	1.82E-01
SO_2	1.21E-05	lb/hp-hr	[2], [3]	2.69E-02	2.96E-02	6.73E-03
NO_X	6.40E+00	g/kw-hr	[7]	2.34E+01	2.57E+01	5.84E+00
CO	3.50E+00	g/kw-hr	[7]	1.28E+01	1.41E+01	3.19E+00
VOC	6.42E-04	lb/hp-hr	[2],[6]	1.43E+00	1.57E+00	3.56E-01

Notes:
[1] Data supplied by Bechtel . Operating time was assumed to be 500 hrs/yr.
[2] AP-42, Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-1, Gaseous Emission factors for Large Uncontrolled Stationary Engines and All Stationary Dual-fuel Engines, October 1996.
[3] Emission factor based on maximum 15 ppm of Sulfur content as per 40 CFR 60.4207(b) and 40 CFR 80.510(b)(1)(i).
[4] $PM_{2.5}$ emission factor is limited by the PM_{10} emission standards as set in 40 CFR 89.112(a), Table 1 for Stationary Emergency CI Engines < 3,000 HP and a displacement of less than 10 liters per cylinder.
[5] A contingency factor of ten percent is added to the average emission rate to estimate the maximum emission rate.
[6] Per footnote f of AP-42 Chapter 3, Table 3.4-1, non methane VOC emission factor has been taken as 91% of TOC emission factor.
[7] Based on PM, NO_X, and CO emission standards set in 40 CFR 89.112(a), Table 1 for Stationary Emergency CI Engines $\leq$ 3,000 HP and a displacement of less than 10 liters per cylinder.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Standby Generator -
Hazardous Air Pollutants

Operating Time [1] =	500	hrs/yr
Generator Rating [1] =	1,655	KW each
Generator Rating [1] =	2,220	HP each
Design Rating [1] =	5.7	MMBtu/hr
No of Generators [1] =	2	

Pollutant	Emission Factor		References	Emission Rate per Turbine		
				Average (lb/hr)	Maximum (lb/hr) [4]	Annual (tpy)
Acetaldehyde	2.52E-05	lb/MMBtu	[2]	1.42E-04	1.57E-04	0.0000356
Acrolein	7.88E-06	lb/MMBtu	[2]	4.45E-05	4.90E-05	0.0000111
Benzene	7.76E-04	lb/MMBtu	[2]	4.38E-03	4.82E-03	0.0010961
Formaldehyde	7.89E-05	lb/MMBtu	[2]	4.46E-04	4.90E-04	0.0001114
Naphthalene	1.30E-04	lb/MMBtu	[3]	7.35E-04	8.08E-04	0.0001836
Toluene	2.81E-04	lb/MMBtu	[2]	1.59E-03	1.75E-03	0.0003969
Xylene	1.93E-04	lb/MMBtu	[2]	1.09E-03	1.20E-03	0.0002726

Notes:
[1] Data supplied by Bechtel on . Operating time was assumed to be 500 hrs/yr.
[2] AP-42, Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-3, SpeciatedOrganic Compound Emission factors For Large Uncontrolled Stationary Diesel Engines, October 1996.
[3] AP-42, Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, Table 3.4-4, PAH Emission factors For Large Uncontrolled Stationary Diesel Engines, October 1996..
[4] A contingency factor of ten percent is added to the average emission rate to estimate the maximum emission rate.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Standby Generator -
Greenhouse Gases

Generator Rating [1] =	1,655	KW each
Generator Rating [1] =	2,220	HP each
Design Operating Rate [1] =	5.7	MMBtu/hr
Annual Operating Time [1] =	500	hrs/yr
No of Generators [1] =	2	

Pollutant	Emission Factor		References	Emission Rate per Turbine: Average Emissions (lbs/hr)	Emission Rate per Turbine: Annual Emissions (tpy)
CO_2	73.96	kg/MMBtu	[2]	9.21E+02	2.30E+02
CH_4	3.0E-03	kg/MMBtu	[2]	3.74E-02	9.34E-03
N_2O	6.0E-04	kg/MMBtu	[2]	7.48E-03	1.87E-03
CO_2e	--	--	[3]	9.25E+02	2.31E+02

Notes:
[1] Data supplied by Bechtel on . Operating time was assumed to be 500 hrs/yr.
[2] Based on EPA default factors in U.S. EPA, 40 CFR 98 Subpart C, Tables C-1 and C-2 for diesel.
[3] CH_4, CO_2, and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potentials (GWP). The GWP of CH_4 is 21, of CO_2 is 1, and of N_2O is 310.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Fugitive Emissions -
Criteria Pollutants

Component Type[2]	Service[2]	Quantity[3] (per train)	Avg. Wt Fraction[2] (WTOC)	Emission Factor (kg/hr)/source[1]	Emission Factor (lb/hr)/source	Hours of Operation[2] (hrs/yr)
Connectors	Gas	506	1	2.00E-04	4.41E-04	8,760
Flanges	Gas	7,552	1	3.90E-04	8.60E-04	8,760
Pump Seals	Oil/Water	88	1	2.40E-05	5.29E-05	8,760
Valves	Gas	3,830	1	4.50E-03	9.92E-03	8,760
	Gas	1,365	1	4.50E-03	9.92E-03	52
	Oil	31	0.2	2.50E-03	5.51E-03	8,760
	Oil/Water	30	0.1	9.80E-05	2.16E-04	8,760
Other	Gas	180	1	8.80E-03	1.94E-02	8,760

Speciation Factors[2]

Substance	Gas	Light Oil	Oil/Water
VOC	0.01	0.296	0.296

Component Type	Service	VOC Emissions Average (lb/hr)	VOC Emissions Maximum (lb/hr)	VOC Emissions Annual (tpy)
Connectors	Gas	2.23E-03	2.23E-03	9.77E-03
Flanges	Gas	6.49E-02	6.49E-02	2.84E-01
Pump Seals	Oil/Water	1.38E-03	1.38E-03	6.04E-03
Valves	Gas	3.80E-01	3.80E-01	1.66E+00
	Gas	1.35E-01	1.35E-01	3.52E-03
	Oil	1.01E-02	1.01E-02	4.43E-02
	Oil/Water	1.92E-04	1.92E-04	8.40E-04
Other	Gas	3.49E-02	3.49E-02	1.53E-01
Total / Train		6.29E-01	6.29E-01	2.17E+00
Total 2 Trains		2.52E+00	2.52E+00	4.33E+00

[1] Emission factors based on U.S. EPA's "Protocol for Equipment Leak Emission Estimates", Table 2-4, Oil and Gas Production Operations Average Emission Factors, November 1995.

[2] Based on information provided by Bechtel on August 2, 2010. VOC speciation factor conservatively estimated as worst-case vapor stream.

[3] Based on information provided by Cathy Rourke (Cheniere) to Bill Bruscino (Trinity) on May 8, 2011.

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Fugitive Emissions - Greenhouse Gases

Density of Gas Fuel = 1.92E-02 kg/scf [2]
Fraction of Time Component Leaks = 0.04 (4%) of the year [6]

Component Type[2]	Service[2]	Quantity[7] (per train)	Avg. Wt Fraction[2] (WTOC)	Emission Factor (scf/hr)/source[1]	Emission Factor (lb/hr)/source	Hours of Operation[2] (hrs/yr)
Connectors	Gas	506	1	5.80	0.24	8,760
Flanges	Gas	7,552	1	5.80	0.24	8,760
Valves	Gas	3,830	1	6.52	0.27	8,760
	Gas	1,365	1	6.52	0.27	52
Other	Gas	180	1	11.44	0.48	8,760

Speciation Factors [3]

Substance	Gas
CO_2	0.013
CH_4	0.959

Component Type	Service	CO_2 Emissions Average (lb/hr) [4]	CO_2 Emissions Annual (tpy)
Connectors	Gas	6.61E-02	2.89E-01
Flanges	Gas	9.86E-01	4.32E+00
Valves	Gas	5.62E-01	2.46E+00
	Gas	2.00E-01	5.21E-03
Other	Gas	4.64E-02	2.03E-01
Total / Train		1.86E+00	7.28E+00
Total 2 Trains		7.45E+00	1.46E+01

Component Type	Service	CH_4 Emissions Average (lb/hr) [4]	CH_4 Emissions Annual (tpy)
Connectors	Gas	4.88E+00	2.14E+01
Flanges	Gas	7.28E+01	3.19E+02
Valves	Gas	4.15E+01	1.82E+02
	Gas	1.48E+01	3.84E-01
Other	Gas	3.42E+00	1.50E+01
Total / Train		1.37E+02	5.37E+02
Total 2 Trains		5.49E+02	1.07E+03

Sabine Pass Liquefaction Project
Johnsons Bayou, Cameron Parish, Louisiana

Fugitive Emissions -
Greenhouse Gases (continued)

Component Type	Service	CO_2e Emissions [5]	
		Average (lb/hr) [4]	Annual (tpy)
Connectors	Gas	1.02E+02	4.49E+02
Flanges	Gas	1.53E+03	6.70E+03
Valves	Gas	8.72E+02	3.82E+03
	Gas	3.11E+02	8.08E+00
Other	Gas	7.19E+01	3.15E+02
Total / Train		2.89E+03	1.13E+04
Total 2 Trains		5.77E+03	2.26E+04

[1] Emission factors based on U.S. EPA, 40 CFR Part 98, Mandatory Reporting of Greenhouse Gases Petroleum and Natural Gas Systems, Subpart W (final), Table W-2, November 2010.
[2] Based on information provided by Bechtel on August 2, 2010.
[3] Speciation Factors for gases conservatively assumed to be equal to Gas Analysis, Stream 1 data provided by Bechtel on September 24, 2010.
[4] Calculated using Equation W-30, U.S. EPA, 40 CFR Part 98, Mandatory Reporting of Greenhouse Gases Petroleum and Natural Gas Systems, Subpart W (final), November 2010.
[5] CH_4, CO_2, and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potentials (GWP). The GWP of CH_4 is 21, of CO_2 is 1, and of N_2O is 310.
[6] The fraction of time component leaks is conservatively assumed to be 15 days per year per LAC 33:III.2121.B.3 (4% of the year).
[7] Based on information provided by Cathy Rourke (Cheniere) to Bill Bruscino (Trinity) on May 8, 2011.

APPENDIX 9C

Air Quality Dispersion Modeling Protocol Including Marine Sources

DRAFT

AIR QUALITY DISPERSION MODELING PROTOCOL INCLUDING MARINE SOURCES

Sabine Pass Liquefaction Expansion, LLC

July 2013

As requested by the Federal Energy Regulatory Commission (FERC), Sabine Pass Liquefaction Expansion, LLC. (SPL) proposes to conduct an air quality dispersion analysis for the Sabine Pass LNG Terminal located in Cameron Parish, Louisiana. This model will include marine sources in addition to modeling performed for the Louisiana Department of Environmental Quality (LDEQ) for demonstration of compliance with the National Ambient Air Quality Standards (NAAQS).

SPL currently operates under Title V Permit No. 0560-00214-V4 issued on March 22, 2013 and Prevention of Significant Deterioration (PSD) Permit No. PSD-LA-703 (M-4) issued on March 22, 2013. SPL is proposing to add two additional trains at the Sabine Pass LNG site. The proposed expansion project will require the submittal of a modification to the existing PSD and Title V Permits to LDEQ.

SPL plans to for up to 400 LNG Carriers (LNGCs) per year to call on the facility. Each LNGC call will include 4 tug boats (dedicated to SLPNG) and a security vessel provided by USCG or Jefferson County Sheriff's Waterway Patrol unit, if so requested by USCG.

In accordance with Title 40 of the Code of Federal Regulations (CFR) Part 52.21, a demonstration of compliance with the NAAQS is required for the construction of any new major stationary source or any project at an existing major stationary source in an area designated as attainment or unclassifiable under the Clean Air Act (CAA).

The purpose of this modeling protocol is to provide the FERC with an opportunity to review and approve the proposed modeling methodology, modified to include marine vessels while inside the security zone. This protocol in general follows the current U.S. Environmental Protection Agency (U.S. EPA)[1] and the Louisiana Department of Environmental Quality (LDEQ)[2] modeling guidelines, with the exception of including marine (mobile) sources.

Section 1 describes the proposed modeling methodology, which includes a discussion of the PSD Screening Analysis and NAAQS Analysis. If a full impacts analysis is required, the air dispersion modeling results (i.e., modeling of the SPL sources plus the appropriate marine sources) for a single pollutant will be added to the corresponding background concentration for that pollutant and then compared to the appropriate NAAQS on a receptor grid surrounding the SPL facility according to and consistent with available U.S. EPA guidance. This methodology is explained in more detail in Section 1.

Section 2 describes the model selection and inputs, which includes a discussion of the dispersion model selection, meteorological data, land use, topography, Good Engineering Practice (GEP) Stack Height analysis, building wake effects, receptor grid, emission rates, and source parameters.

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[1] EPA's *Guideline on Air Quality Models (Revised)*, Federal Register Vol. 70, No. 216, pp. 68,218 – 68,261, November 9, 2005. Codified at 40 CFR Part 51, Appendix W and EPA's *New Source Review Workshop Manual (DRAFT)* (1990).

[2] *Air Quality Modeling Procedures*, Air Quality Assessment Division, LDEQ, August 2006.

1. AIR QUALITY DISPERSION MODELING METHODOLOGY

The purpose of the proposed air quality analysis is to demonstrate that emissions of NO_2, CO, PM_{10}, and $PM_{2.5}$ from the proposed project, including mobile sources, will not cause or significantly contribute to a modeled exceedance of the NAAQS. As discussed in detail in the following sections, the air dispersion modeling analysis will be conducted in accordance with the U.S. EPA's Guideline on Air Quality Models (the "*Guideline*"),[3] the LDEQ's Air Quality Modeling Procedures,[4] and other appropriate guidance such as the Draft New Source Review Workshop Manual[5] and recent U.S. EPA Modeling Clearinghouse "Clarification Memos."

1.1 METHODOLOGY

1.1.1 Special Considerations for $PM_{2.5}$

On May 16, 2008, U.S. EPA issued the final $PM_{2.5}$ New Source Review (NSR) Implementation Rule, which requires sources in delegated states, such as Louisiana, to conduct an ambient air quality analysis for $PM_{2.5}$ in accordance with 40 CFR §52.21(m).[6] In a March 23, 2010, U.S. EPA Memorandum,[7] EPA recommended that the highest average of the modeled annual averages of $PM_{2.5}$ concentrations based on 5 years of National Weather Service data or the highest modeled annual average of $PM_{2.5}$ concentration based on 1 year of site-specific meteorological data be compared to the annual SIL. Similarly, EPA recommended that the highest average of the maximum 24-hour averages of $PM_{2.5}$ concentrations based on 5 years of National Weather Service data or the highest modeled 24-hour average of $PM_{2.5}$ concentration based on 1 year of site-specific meteorological data be compared to the 24-hour SIL. SPL is proposing to use the annual and 24-hour options based on 5 years of National Weather Service data. Additionally, the impacts of $PM_{2.5}$ will be analyzed using the 8th highest modeled result per most recent U.S. EPA guidance.

1.1.2 Special Considerations for NO_2

In the "Models for Nitrogen Dioxide" section of the *Guideline* (Section 5.2.4), U.S. EPA recommends a tiered screening approach for estimating annual NO_2 impacts from point sources in PSD modeling analyses. Since the *Guideline* has not been revised to specifically address recommended modeling methodologies for the 1-hour NO_2 NAAQS analysis, the approaches identified for the annual standard will also be applied to the new 1-hour standard.

Under the initial and most conservative Tier 1 screening level, all NO_X emitted is modeled as NO_2, *i.e.*, total conversion of NO (the primary chemical form of NO_X) to NO_2 is assumed. If the impacts predicted using this approach result in exceedances of the NAAQS, a more refined technique could be used.

For the Tier 2 screening level, U.S. EPA recommends multiplying the Tier 1 results by an empirically derived national annual average default NO_2:NO_X ambient equilibrium ratio of 0.80. As an alternative to the default value, the reviewing agency may also establish a project-specific NO_2:NO_X ratio based on existing air quality

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[3] Federal Register Vol. 70, No. 216, pp. 68,218 – 68,261, November 9, 2005. Codified at 40 CFR Part 51, Appendix W.

[4] *Air Quality Modeling Procedures*, Air Quality Assessment Division, LDEQ, August 2006.

[5] EPA's *New Source Review Workshop Manual (DRAFT)* (1990).

[6] Federal Register, Vol. 73, p. 28,321.

[7] Based on U.S. EPA Memorandum from Stephen D. Page to Bill Harnett, et al. titled, "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS". March 23, 2010.

data collected at representative ambient monitoring stations. Should the impacts predicted using the Tier 2 approach still result in modeled exceedances of the NAAQS, the case-by-case Tier 3 approach could be relied upon to estimate 1-hour NO_2 impacts.

Since the impact of an individual NO_X source on ambient NO_2 depends on the chemical environment into which the source's plume is emitted, modeling techniques that account for this atmospheric chemistry such as the Ozone Limiting Method (OLM) or the Plume Volume Molar Ratio Method (PVMRM) can be considered under the most refined Tier 3 approach identified by U.S. EPA.

SPL proposes to use the Tier 2 screening level. If additional refinement is required, the Tier 3 screening level will be used and the details of in-stack ratio, final conversion, and ozone background will be supplied in the final report.

1.2 PSD SCREENING ANALYSIS

The screening analysis consists of three separate determinations that are listed as follows: the Significance Analysis, an AOI Analysis, and a Preconstruction Monitoring Analysis. The most recent U.S. EPA guidance will be used for all three determinations.

More specifically, the Significance Impact Analysis (SIA) determines whether 40 CFR 52.21 requires a full impact analysis (i.e., NAAQS modeling) for compliance. For each compound that requires PSD review, the air dispersion model incorporates all project sources, project-affected sources, and any emissions sources that have emissions increases or decreases within the project's contemporaneous period. The modeled emissions rate may reflect the net emissions change (increase or decrease) from the project, the net emissions change (increase or decrease) from the project's contemporaneous period, or both if applicable. The net emissions increase as determined for the PSD applicability analysis should be modeled for the SIA.[8]

The significance analysis compares the maximum concentration from the significance model to the appropriate significance level. If the maximum concentration for a pollutant is less than its respective significance level, the project's impact is not significant, and no further analysis is required. If the maximum concentration for a pollutant is greater than or equal to its respective significance level, the project's impact is potentially significant, and a full impact analysis is required.

1.3 NAAQS ANALYSIS

The National Ambient Air Quality Standards (NAAQS) are limits defined as the total allowable concentration of a pollutant in the atmosphere. For criteria pollutants with a significant off-property impact, the PSD analysis requires a NAAQS analysis. The NAAQS analysis demonstrates that the proposed project will not cause or contribute to a violation of federal ambient air concentration thresholds. The NAAQS uses the sum of the dispersion model and an ambient monitoring concentration to demonstrate compliance.

For each pollutant that requires a NAAQS analysis (i.e., pollutants that are shown in the significant impact analysis to be above their corresponding significant impact limits), the air dispersion model incorporates both facility-wide (both permitted and grandfathered sources) and marine off-property emissions sources at their post-project, potential emissions rate (PTE). For facility sources, the appropriate emissions rate depends upon the averaging period. For short-term averaging periods (1-hour, 8-hour, or 24-hour), the model

[8] Air Quality Modeling Procedures, Air Quality Assessment Division, LDEQ, August 2006, Section 2.1.1.

includes the maximum, hourly PTE. For annual averaging periods, the model includes the average annual PTE.

The expected, post-project ambient concentration will be compared to the NAAQS. Initially, the total modeled ambient concentration is the appropriate ground-level concentration from the NAAQS model added to the background concentration for the facility. Additional information on background concentration is presented in Section 2.4. For annual averaging periods, the maximum GLC will be used for the model concentration in the NAAQS analysis. For short-term averaging periods, the appropriate GLC depends upon the pollutant under review.

If the expected ambient concentration is less than the applicable NAAQS, the proposed project does not cause or contribute to an exceedance of the NAAQS and, therefore, no further analysis is required. If the expected ambient concentration is greater than or equal to the NAAQS, a culpability analysis will be performed to determine if the contribution from the significant impact analysis is significant at the same time and location of the modeled exceedance.

1.4 BACKGROUND CONCENTRATIONS

Per U.S. EPA guidance, a background concentration for each pollutant must be added to the modeled impacts – to estimate at a maximum, total predicted impact – prior to comparison with the NAAQS. The background concentration includes emissions from non-industrial emission sources (*e.g.*, vehicles, recreational watercraft, etc.), which are not included in the model. However, the background concentration may also include industrial emission sources already accounted for in the inventory. Therefore, adding the background concentration to the modeled concentrations should be conservative since impacts from the inventory sources are included in both the modeled concentration and the background concentration.

SPL proposes to use onsite monitoring data to determine the background concentrations for $PM_{2.5}$ and NO_X. SPL has already completed one year of NO_2 and $PM_{2.5}$ monitoring from December 2011 to November 2012 and has removed the monitoring site because a representative data set for the Sabine Pass LNG Terminal has been collected. Data were collected hourly over the sampling time period (approximately 8,000 data points). The data obtained from this pre-construction ambient monitoring will be used to establish $PM_{2.5}$ and NO_X background concentrations for the required NAAQS analyses.

SPL will use the NO_2 and $PM_{2.5}$ background concentrations as recorded from the onsite ambient monitors from December 2011 to November 2012. As per the "Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD),"

> *The current monitor location can represent the combined impact of proposed source and existing sources. If the proposed construction will be in an area of multisource emissions and flat terrain, then the proposed source or modification may propose to use existing data at nearby monitoring sites if either of the following criteria is met.*
>
> - *Existing monitor within 10 km of the points of proposed emissions, or*
> - *Existing monitor is within or not farther than 1 km away from either the areas of the maximum air pollutant concentration from existing sources or the areas of the combined maximum impact from existing and proposed sources.*
>
> *If the existing monitors meets either of the above two conditions then the data could be used together with model estimates to determine concentrations.*

For all pollutants less than full year will be accepted if the applicant can demonstrate (through historic data or modeling) that data is obtained during a time period when maximum air quality levels can be expected. Minimum 4 months of air quality data required.

The rationale for considering the use of existing data collected from monitors satisfying the above criteria is that modelers have reasonable degree of confidence in the modeling results within 10 km distance and maximum concentration from most sources are likely to occur within this distance.

SPL proposes to use data from a representative monitoring site for other pollutants. Table 1-1 lists the proposed ambient monitors as representative for the facility. To select the monitors, SPL considered the surrounding area, the availability of data, and the proximity to the Sabine Pass LNG Terminal.

Table 1-1. Proposed Monitors

Monitoring Site	Parameter Monitored	Monitor Location	Distance of Monitor from Facility (km)	Monitoring Data Meets EPA QA Criteria? (Yes/No)
Nederland High School C1035	CO	Nederland, Texas	28.87	Yes
Port Arthur West C28/A128/A228	SO_2	Port Arthur, Texas	19.67	Yes
Port Allen (PA)	PM_{10}	Port Allen, Louisiana	265.7	Yes

1.5 CULPABILITY ANALYSIS

A source is not considered to have caused or contributed to the violation if its own impact from the modeling significance analysis is not significant (i.e., is less than the SIL) at the violating receptor at the time of the predicted violation. If a culpability analysis is required for modeled exceedances, SPL will determine culpability.

If the maximum contribution from the significance analysis is less than the significance level at any receptor(s) and time(s) of the potential NAAQS exceedance(s), the proposed project will not cause or contribute to the potential NAAQS exceedance(s). If this is the case, no further analysis is required.

2. MODEL SELECTION AND INPUTS

This modeling protocol proposes certain dispersion models and input parameters for approval by LDEQ. Section 2.1 describes the potential computer models for the analysis. Section 2.2 describes the meteorological data. Section 2.3 describes the land use of the area surrounding the facility. Section 2.4 describes the topography of the area surrounding the facility. Section 2.5 describes the stack height analysis. Section 2.6 describes the building wake (downwash) analysis. Section 2.7 describes the receptor grids. Section 2.8 describes the proposed emission rates and averaging periods for the modeling analysis. Section 2.9 describes the default source parameters used in the analysis, if applicable.

2.1 DISPERSION MODEL SELECTION

The American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD) is the Guideline-recommended model for evaluating near-field impacts (i.e., source receptor distances of less than 50 km). The AERMOD modeling system is composed of three modular components: AERMAP, the terrain preprocessor; AERMET, the meteorological preprocessor; and AERMOD, the control module and modeling processor. Additionally, a fourth processor, the AERSURFACE tool, is used to estimate surface characteristics required for input to AERMET. The most recent versions of each processor will be used: for AERMOD, version 12345; for AERMET, version 12345; for AERMAP, version 11103; and for AERSURFACE, version 13016.

2.2 METEOROLOGICAL DATA

The EPA AERMOD program requires meteorological data preprocessed with the AERMET program. Three additional variables are considered when preprocessing the surface and meteorological data for a site. These variables are:

- Surface roughness;
- Albedo; and
- Bowen Ratio.

The EPA has developed a software program called AERSURFACE that can be used to determine realistic and reproducible surface characteristics values, including Albedo, Bowen Ratio, and Surface roughness parameters. AERSURFACE requires the input of land cover data from the United States Geological Survey (USGS) National Land Cover Data 1992 archives (NLCD92), which it uses to determine the values of surface characteristics based on the land cover type for the study area. AERSURFACE will be used to determine the surface characteristics values for the area surrounding the NWS station for input to AERMET. Modeling will be performed using preprocessed hourly surface data and upper air station data from the NWS Station at the Lake Charles Regional Airport (NWS Station 03937). That data will be processed in AERMET using the surface characteristics values generated by AERSURFACE. If the appropriate input data are available allowing the accurate use of AERMINUTE, AERMINUTE will be used. If more accurate results are expected using AERMET without AERMINUTE (e.g., if AERMINUTE input data do not meet availability or accuracy criteria), then only AERMET will be used.

2.3 LAND USE

SPL's Sabine Pass LNG Terminal is located in Cameron Parish, Louisiana. An Auer Land Use analysis[9] for a 3-kilometer radius surrounding the facility was performed in conjunction with the June 2012 and prior modeling analyses. Consistent with previous analyses, the land within a 3-kilometer radius of the facility is predominately rural. The results of the Land Use Analysis are presented below in Table 2-1.

Table 2-1. Land Use Analysis Results

Auer's Land Type	Classification	Percent
I1 – Heavy Industrial	Urban	4.67
I2 – Light Industrial	Urban	2.05
C1 - Commercial	Urban	0.59
R1 – Common Residential	Urban	0
A1 – Metropolitan Natural	Rural	0.76
A3 – Undeveloped Rural	Rural	69.13
A5 – Water Surfaces	Rural	22.79
Total Urban	**--**	**26.96**
Total Rural	**--**	**73.04**

2.4 TOPOGRAPHY

The terrain elevation for each modeled building, source, and receptor will be determined using USGS National Elevation Data set (NED). The terrain height for each modeled receptor will be calculated using AERMAP (version 11103), a terrain preprocessor developed specifically for the AERMOD model. AERMAP computes the terrain height and hill height scale from the digital terrain elevations surrounding the modeled receptors. AERMAP also computes the terrain height for modeled sources and buildings. AERMAP is used to search for the terrain height and location that has the greatest influence on dispersion for an individual receptor. Input to AERMAP consists of USGS Digital Elevation Model (DEM) data.

2.5 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT

A good engineering practice (GEP) stack height evaluation determines if avoidance of building wake effects allow a point source to be modeled at a height greater than 65 meters. The GEP formula stack height is expressed as the greater of 65 meters or GEP = H_b + 1.5L (where H_b is the building height, and L is the lesser of the building's height or maximum projected width). These procedures follow EPA Guidelines for Determination of Good Engineering Practice Stack Height.[10]

For stacks in the NAAQS Inventory that have a stack height greater than 65 meters, SPL will model these stack heights at 65 meters.

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[9] Auer, Jr., A.H., 1978. "Correlation of Land Use and Cover with Meteorological Anomalies." Journal of Applied Meteorology, 17:636-643.

[10] EPA, Guideline for Determination of Good Stack height (Technical Support Document for the Stack Height Regulations) (Revised), 1985.

2.6 BUILDING WAKE (DOWNWASH) EFFECTS

The emissions sources at the Sabine Pass LNG Terminal will be evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges may become caught in the turbulent wakes generated by these structures. AERMOD incorporates the Plume Rise Model Enhancements (PRIME) algorithms for estimating enhanced plume growth and restricted plume rise for plumes affected by building wakes.[11]

Direction-specific structure dimensions and the dominant downwash structure parameters used as input to AERMOD will be determined using the BREEZE® Building Profile Input Program – PRIME Model (BPIPPRM) software, developed by Trinity Consultants, Inc. The software incorporates the algorithms of the U.S. EPA's sanctioned BREEZE® BPIP PRIME (BPIPPRM), version 04274.[12]

The output from the BPIPPRM downwash analysis lists the names and dimensions of the structures generating wake effects and the locations and heights of the affected emissions sources (i.e., stacks). In addition, the output contains a summary of the dominant structure for each emissions source (considering all wind directions) and the actual structure height and projected widths for all wind directions. This information will be incorporated into the AERMOD data input files.

2.7 RECEPTOR GRID

The receptor grids used in the preliminary modeling analysis will follow available U.S. EPA guidance. For the modeling analysis, SPL is proposing to use a Cartesian receptor grid to locate off-property, ground-level concentrations. Note that the AOI will not extend greater than 50 kilometers from the facility due to accuracy constraints of the dispersion models. For NAAQS modeling, the results will be compared to the appropriate NAAQS on a receptor grid near the facility according to and consistent with available U.S. EPA guidance.

2.8 EMISSION RATES

The modeled emission rates for the Significance Modeling Analysis are the net emissions increase, as presented in the Netting Analysis of the permit application.

For the NAAQS analysis, the modeled emission rates are the potential emission rates (PTE). For short-term averaging periods, the modeled emission rates are the hourly maximum PTE. For the annual averaging period, the modeled emission rates are the average annual PTE.

SPL's insignificant and/or GCXVII activity emissions will be included in the modeling scenarios according to U.S. EPA guidance for the particular pollutant and averaging period.

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[11] L.L. Schulman, D.G. Strimaitis, and J.S. Scire, Development and Evaluation of the Prime Plume Rise and Building Downwash Model, *AWMA*, 50:378-390, 2000.

[12] U.S. Environmental Protection Agency, *User's Guide to the Building Profile Input Program*, Research Triangle Park, NC, EPA-454/R-93-038.

2.9 SOURCE PARAMETERS

Please note that SPL is still in the planning stages of this air quality analysis; therefore, source parameters have not been included in this protocol. The final modeling report will provide all modeled source parameters and emissions rates.

For missing or unavailable data, SPL will use the following source parameters as outlined in LDEQ's *AQMP* or provide documentation to the LDEQ for use of parameters from comparable equipment:

- Default height is 3.28 feet (1 meter);
- Default exit temperature is -459.67 °F (0 Kelvin);
- Default exit velocity is 0.00328 feet per second (0.001 meters per second); and
- Default diameter is 3.28 feet (1 meter, not applicable to flares).

For horizontal releases, if any, SPL will use the following source parameters as outlined in LDEQ's *AQMP* or provide documentation to the LDEQ for use of parameters from comparable equipment:

- Model height is lesser of actual or GEP stack height;
- Model temperature is actual stack temperature;
- Model velocity is 0.00328-feet-per-second (0.001-meters-per-second); and
- Model diameter is 3.28-feet (or 1-meter).

For downward releases, if any, SPL will conservatively assume that the stack parameters are the same as that for horizontal releases in order to avoid attributing momentum or buoyancy effects to the plume.

For stacks that are inclined at an angle of 45° from vertical, if any, the stack velocity is considered to be equal to the vertical velocity component. The vertical velocity component is calculated by multiplying the actual stack velocity by cosine of the offset angle (45°) from the vertical.

The stack parameters for stacks that are inclined at an angle of 45° will be the following:

- Model height is lesser of actual or GEP stack height;
- Model temperature is actual stack temperature;
- Model velocity is the vertical velocity component; and
- Model diameter is actual stack diameter.

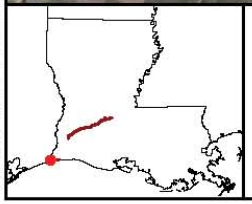
3. MODELING REPORT CONTENTS

A document that details the modeling methodology and summarizes the modeling results will be submitted to the FERC. The air dispersion modeling report will include the following information:

- Brief overview of the proposed project;
- Facility plot plan indicating sources, property line, clear scale, and true north;
- Emissions rate summary for all facility sources, with units consistent with modeling;
- Stack parameter summary for all facility sources, with units consistent with modeling;
- Approved modeling protocol;
- Technical basis for any nonstandard procedures;
- Summary of all model inputs (e.g., model used, met data, rural or urban dispersion coefficients, etc.); and
- Comparison of all modeling results to the applicable standards.

APPENDIX 9D

Noise Sensitive Areas



N

0 375 750 Feet

Distance to Nearest NSA

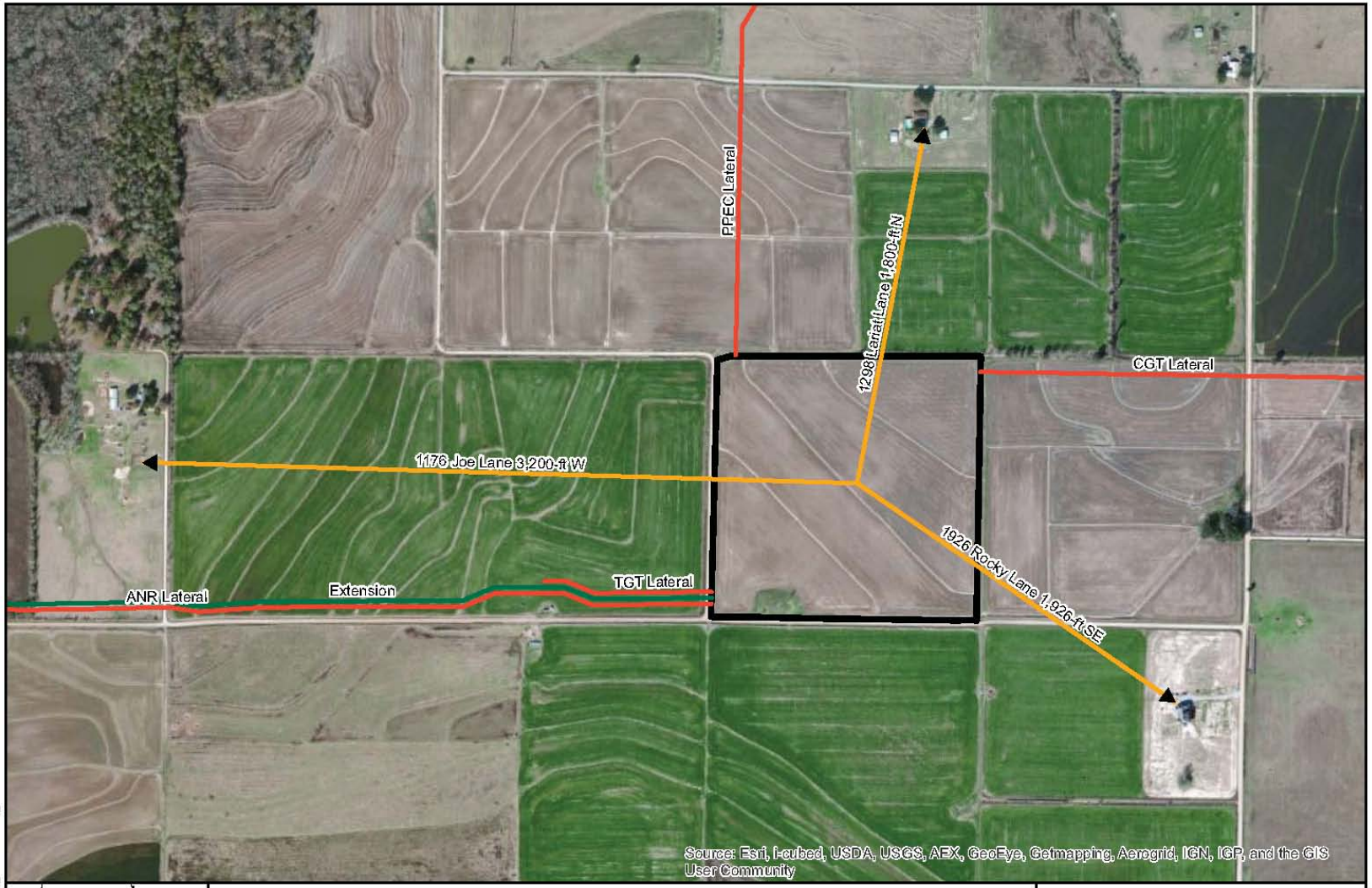
SPLNG Terminal

CHENIERE

NSAs - SPLNG Terminal

Sabine Pass Liquefaction and CCTPL Expansion Projects

Figure 1	July 2013



N

0 250 500 Feet

Extension

Lateral

Distance to Nearest NSA

Mamou Compressor Station

CHENIERE

NSAs - Mamou Compressor Station

Sabine Pass Liquefaction and CCTPL Expansion Projects

Figure 2

July 2013