

US EPA ARCHIVE DOCUMENT



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	4/5/2013	Permit No.:	100114/PSDTX1282/N150; 104840/PSDTX1302/N170	Regulated Entity No.:	RN103196689/106481500
Area Name:	Freeport LNG Development, L.P.			Customer Reference No.:	CN601720345

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND PER HOUR	(B) TPY
65B-81A	65B-81A	Heating Medium Heater A	CO ₂ e	15210.33	24978.40
			CO ₂	15195.43	24953.93
			N ₂ O	0.03	0.05
			CH ₄	0.29	0.47
65B-81B	65B-81B	Heating Medium Heater B	CO ₂ e	15210.33	24976.91
			CO ₂	15195.43	24953.93
			N ₂ O	0.03	0.04
			CH ₄	0.29	0.47
65B-81C	65B-81C	Heating Medium Heater C	CO ₂ e	15210.33	24978.40
			CO ₂	15195.43	24953.93
			N ₂ O	0.03	0.05
			CH ₄	0.29	0.47
65B-81D	65B-81D	Heating Medium Heater D	CO ₂ e	15210.33	2555.34
			CO ₂	15195.43	2552.83
			N ₂ O	0.03	0.00
			CH ₄	0.29	0.05
65B-81E	65B-81E	Heating Medium Heater E	CO ₂ e	15210.33	2555.34
			CO ₂	15195.43	2552.83
			N ₂ O	0.03	0.00
			CH ₄	0.29	0.05
TO1	AU1/TO1	Amine Unit / Thermal Oxidizer 61	CO ₂ e	68799.20	301340.50
			CO ₂	68798.63	301337.99
			N ₂ O	0.00	0.005
			CH ₄	0.01	0.05
TO2	AU2/TO2	Amine Unit / Thermal Oxidizer 62	CO ₂ e	68799.20	301340.50
			CO ₂	68798.63	301337.99
			N ₂ O	0.00	0.005
			CH ₄	0.01	0.05
TO3	AU3/TO3	Amine Unit / Thermal Oxidizer 63	CO ₂ e	68799.20	301340.50
			CO ₂	68798.63	301337.99
			N ₂ O	0.00	0.005
			CH ₄	0.01	0.05



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Table 1(a) Emission Point Summary

Date:	4/5/2013	Permit No.:	100114/PSDTX1282/N150; 104840/PSDTX1302/N170	Regulated Entity No.:	RN103196689/106481500
Area Name:	Freeport LNG Development, L.P.			Customer Reference No.:	CN601720345

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND PER HOUR	(B) TPY
CT	CT	Combustion Turbine	CO ₂ e	128234.77	561668.31
			CO ₂	128109.13	561117.99
			N ₂ O	0.24	1.06
			CH ₄	2.42	10.58
PTFFLARE	PTFFLARE	PTF Flare	CO ₂ e	92.16	2211.94
			CO ₂	92.00	2208.07
			N ₂ O	0.00	0.01
			CH ₄	0.00	0.06
PTFFWP	PTFFWP	Fire Water Pump - Pretreatment	CO ₂ e	755.84	37.79
			CO ₂	753.30	37.67
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.002
PTFEG-1	PTFEG-1	Emergency Generator Train 61	CO ₂ e	864.63	21.62
			CO ₂	861.73	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001
PTFEG-2	PTFEG-2	Emergency Generator Train 62	CO ₂ e	864.63	21.62
			CO ₂	861.73	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001
PTFEG-3	PTFEG-3	Emergency Generator Train 63	CO ₂ e	864.63	21.62
			CO ₂	861.73	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001
PTFEG-4	PTFEG-4	Emergency Generator Utility Area	CO ₂ e	864.63	21.62
			CO ₂	861.73	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001
PTFEG-5	PTFEG-5	Emergency Generator Utility Area	CO ₂ e	864.63	21.62
			CO ₂	861.73	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	4/5/2013	Permit No.:	100114/PSDTX1282/N150; 104840/PSDTX1302/N170	Regulated Entity No.:	RN103196689/106481500
Area Name:	Freeport LNG Development, L.P.			Customer Reference No.:	CN601720345

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND PER HOUR	(B) TPY
PTFEAC-1	PTFEAC-1	Emergency Air Compressor	CO ₂ e	343.56	8.59
			CO ₂	342.41	8.56
			N ₂ O	0.00	0.000
			CH ₄	0.01	0.000
FUG-TREAT	FUG-TREAT	Pretreatment VOC Fugitives	CO ₂ e	124.95	547.27
			CO ₂	0.00	0.000
			N ₂ O	0.00	0.000
			CH ₄	5.95	26.06
FUG-PTFSF6	FUG-PTFSF6	Pretreatment Circuit Breakers	CO ₂ e	13.34	58.44
			SF ₆	0.001	0.002
LIQFWP-1	LIQFWP-1	Fire Water Pump 1 - Liquefaction	CO ₂ e	755.84	37.79
			CO ₂	753.31	37.67
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.002
LIQFWP-2	LIQFWP-2	Fire Water Pump 2 - Liquefaction	CO ₂ e	755.84	37.79
			CO ₂	753.31	37.67
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.002
LIQEG-1	LIQEG-1	Emergency Generator 1 - Liquefaction	CO ₂ e	864.64	21.62
			CO ₂	861.74	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001
LIQEG-2	LIQEG-2	Emergency Generator 2 - Liquefaction	CO ₂ e	864.64	21.62
			CO ₂	861.74	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001
LIQEG-3	LIQEG-3	Emergency Generator 3 - Liquefaction	CO ₂ e	864.64	21.62
			CO ₂	861.74	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001
LIQEG-4	LIQEG-4	Emergency Generator 4 - Liquefaction	CO ₂ e	864.64	21.62
			CO ₂	861.74	21.54
			N ₂ O	0.01	0.000
			CH ₄	0.03	0.001



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	4/5/2013	Permit No.:	100114/PSDTX1282/N150; 104840/PSDTX1302/N170	Regulated Entity No.:	RN103196689/106481500
Area Name:	Freeport LNG Development, L.P.			Customer Reference No.:	CN601720345

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND PER HOUR	(B) TPY
LIQEG-5	LIQEG-5	Emergency Generator - Guard House / Admin Area	CO ₂ e	864.64	21.62
			CO ₂	861.74	21.54
			N ₂ O	0.01	0.00
			CH ₄	0.03	0.00
LIQEAC-1	LIQEAC-1	Emergency Air Compressor	CO ₂ e	344	8.59
			CO ₂	342	8.56
			N ₂ O	2.78E-03	0.00
			CH ₄	1.39E-02	0.00
LIQEG-6	LIQEG-6	Emergency Generator - Dock 2	CO ₂ e	458	11.45
			CO ₂	457	11.41
			N ₂ O	3.70E-03	0.00
			CH ₄	1.85E-02	0.00
LIQFLARE	LIQFLARE	Ground Flare - Liquefaction	CO ₂ e	160.04	11523.03
			CO ₂	159.89	11511.74
			N ₂ O	0.00	0.02
			CH ₄	0.00	0.22
FUG-LIQ	FUG-LIQ	Liquefaction Fugitives	CO ₂ e	173.21	758.68
			CO ₂	0.00	0.000
			N ₂ O	0.00	0.000
			CH ₄	8.25	36.13
FUG-LIQSF6	FUG-LIQSF6	Liquefaction Circuit Breakers	CO ₂ e	77.52	339.56
			SF ₆	0.003	0.014



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Table 1(a) Emission Point Summary

Date:	4/5/2013	Permit No.:	100114/PSDTX1282/N150; 104840/PSDTX1302/N170	Regulated Entity No.:	RN103196689/106481500
Area Name:	Freeport LNG Development, L.P.			Customer Reference No.:	CN601720345

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AIR CONTAMINANT DATA			EMISSION POINT DISCHARGE PARAMETERS										
1. Emission Point			4. UTM Coordinates of Emission Point			Source							
						5. Building Height (Ft.)	6. Height Above Ground (Ft.)	7. Stack Exit Data			8. Fugitives		
EPN (A)	FIN (B)	Name ©	Zone	East (Meters)	North (Meters)			Diameter (Ft.) (A)	Velocity (FPS) (B)	Temperature (°F) (C)	Length (Ft.) (A)	Width (Ft.) (B)	Axis Degrees (C)
65B-81A	65B-81A	Heating Medium Heater A	15	275,039	3,208,376		50	6.00	46.42	600			
65B-81B	65B-81B	Heating Medium Heater B	15	275,038	3,208,361		50	6.00	46.42	600			
65B-81C	65B-81C	Heating Medium Heater C	15	275,038	3,208,345		50	6.00	46.42	600			
65B-81D	65B-81D	Heating Medium Heater D	15	275,082	3,208,331		50	6.00	46.42	600			
65B-81E	65B-81E	Heating Medium Heater E	15	275,037	3,208,315		50	6.00	46.42	600			
TO1	TO1	Amine Unit / Thermal Oxidizer 61	15	275,051	3,208,436		80	2.66	60.00	102			
TO2	TO2	Amine Unit / Thermal Oxidizer 62	15	274,933	3,208,443		80	2.66	60.00	102			
TO3	TO3	Amine Unit / Thermal Oxidizer 63	15	274,817	3,208,449		80	2.66	60.00	102			
CT	CT	Combustion Turbine	15	275,048	3,208,261		80	15.00	71.00	302			
PTFFLARE	PTFFLARE	PTF Flare	15	274,745	3,208,268		7	8.62	65.62	1832			
PTFFWP	PTFFWP	Fire Water Pump - Pretreatment	15	275,031	3,208,050		10	0.83	140.00	1,187			
PTFEG-1	PTFEG-1	Emergency Generator Train 61	15	275,108	3,208,446		10	0.50	220.00	810			
PTFEG-2	PTFEG-2	Emergency Generator Train 62	15	274,991	3,208,453		10	0.50	220.00	810			
PTFEG-3	PTFEG-3	Emergency Generator Train 63	15	274,875	3,208,458		10	0.50	220.00	810			
PTFEG-4	PTFEG-4	Emergency Generator Utility Area	15	275,147	3,208,369		10	0.50	220.00	810			
PTFEG-5	PTFEG-5	Emergency Generator Utility Area	15	275,098	3,208,165		10	0.50	220.00	810			
PTFEAC-1	PTFEAC-1	Emergency Air Compressor	15	275,218	3,208,237		10	0.50	180.00	800			
FUG-TREAT	FUG-TREAT	Pretreatment Fugitives	15	275,061	3,208,254		3				8	13	3
FUG-PTFSF6	FUG-PTFSF6	Pretreatment Circuit Breakers	15	274,965	3,208,510								
LIQFWP-1	LIQFWP-1	Fire Water Pump 1 - Liquefaction	15	273,958	3,202,732		14	0.83	140.00	1,187			
LIQFWP-2	LIQFWP-2	Fire Water Pump 2 - Liquefaction	15	273,959	3,202,734		14	0.83	140.00	1,187			
LIQEG-1	LIQEG-1	Emergency Generator 1 - Liquefaction	15	273,780	3,202,122		12	0.50	220.00	810			
LIQEG-2	LIQEG-2	Emergency Generator 2 - Liquefaction	15	273,578	3,202,020		12	0.50	220.00	810			
LIQEG-3	LIQEG-3	Emergency Generator 3 - Liquefaction	15	273,377	3,202,917		12	0.50	220.00	810			
LIQEG-4	LIQEG-4	Emergency Generator 4 - Liquefaction	15	273,897	3,202,127		12	0.50	220.00	810			
LIQEG-5	LIQEG-5	Emergency Generator - Guard House / Admin Area	15	273,200	3,201,808		12	0.50	220.00	810			
LIQEAC-1	LIQEAC-1	Emergency Air Compressor	15	273,761	3,202,304		12	0.50	180.00	800			
LIQEG-6	LIQEG-6	Emergency Generator - Dock 2	15	274,863	3,203,554		12	0.50	220.00	810			
LIQFLARE	LIQFLARE	Liquefaction Emergency Flare	15	272,945	3,201,737		7	0.25	0.00	1832			
FUG-LIQ	FUG-LIQ	Liquefaction Fugitive	15	273,451	3,202,097		3	0.003	0.003	ambient			
FUG-LIQSF6	FUG-LIQSF6	Liquefaction Circuit Breakers	15	273,451	3,202,097								

**Freeport LNG Development, L.P.
GHG Project Summary of Emissions**

**Liquefaction Project GHG Emissions Summary
Freeport LNG**

EPN	Description	Annual Emissions (tons/yr)				
		CO ₂	CH ₄	N ₂ O	SF ₆	CO ₂ e ²
PTFFWP	Fire Water Pump - Pretreatment	37.67	0.002	0.0003	--	38
PTFEG-1	Emergency Generator Train 61	21.54	0.001	0.0002	--	22
PTFEG-2	Emergency Generator Train 62	21.54	0.001	0.0002	--	22
PTFEG-3	Emergency Generator Train 63	21.54	0.001	0.0002	--	22
PTFEG-4	Emergency Generator Utility Area	21.54	0.001	0.0002	--	22
PTFEG-5	Emergency Generator Utility Area	21.54	0.001	0.0002	--	22
PTFEAC-1	Emergency Air Compressor	8.56	0.000	0.0001	--	9
65B-81A	Heating Medium Heater A	24,953.93	0.471	0.0471	--	24,978
65B-81B	Heating Medium Heater B	24,953.93	0.471	0.0423	--	24,977
65B-81C	Heating Medium Heater C	24,953.93	0.471	0.0471	--	24,978
65B-81D	Heating Medium Heater D	2,552.83	0.048	0.0048	--	2,555
65B-81E	Heating Medium Heater E	2,552.83	0.048	0.0048	--	2,555
TO1	Amine Unit / Thermal Oxidizer 61	301,337.99	0.05	4.83E-03	--	301,341
TO2	Amine Unit / Thermal Oxidizer 62	301,337.99	0.05	4.83E-03	--	301,341
TO3	Amine Unit / Thermal Oxidizer 63	301,337.99	0.05	4.83E-03	--	301,341
PTFFLARE	PTF Flare	2,208.07	0.058	0.0085	--	2,212
CT	Combustion Turbine	561,117.99	10.583	1.0583	--	561,668
FUG-TREAT	Pretreatment Fugitives	0.00	26.060	--	--	547
FUG-PTFSF6	Pretreatment Circuit Breakers	0.00	--	--	0.002	58
LIQFWP-1	Fire Water Pump 1	37.67	0.002	0.0003	--	38
LIQFWP-2	Fire Water Pump 2	37.67	0.002	0.0003	--	38
LIQEG-1	Emergency Generator 1	21.54	0.001	0.0002	--	22
LIQEG-2	Emergency Generator 2	21.54	0.001	0.0002	--	22
LIQEG-3	Emergency Generator 3	21.54	0.001	0.0002	--	22
LIQEG-4	Emergency Generator 4	21.54	0.001	0.0002	--	22
LIQEG-5	Emergency Generator - Guard House / Admin Area	21.54	0.001	0.0002	--	22
LIQEAC-1	Emergency Air Compressor	8.56	0.000	0.0001	--	9
LIQEG-6	Emergency Generator - Dock 2	11.41	0.000	0.0001	--	11
LIQFLARE	Ground Flare	11,511.74	0.217	0.0217	--	11,523
FUG-LIQ	Fugitives Liquefaction	--	36.127	--	--	759
FUG-LIQSF6	Liquefaction Circuit Breakers	--	--	--	0.01	340
Project Totals		1,559,176.19	74.71	1.25	0.017	1,561,531

Freeport LNG Development, L.P.
Pretreatment Facility GHG Summary of Emissions

Pretreatment Facility GHG Summary of Emissions

EPN	Description	Annual Emissions (tons/yr)				
		CO ₂	CH ₄	N ₂ O	SF ₆	CO ₂ e ¹
PTFFWP	Fire Water Pump - Pretreatment	37.67	1.53E-03	3.06E-04	--	38
PTFEG-1	Emergency Generator Train 61	21.54	8.74E-04	1.75E-04	--	22
PTFEG-2	Emergency Generator Train 62	21.54	8.74E-04	1.75E-04	--	22
PTFEG-3	Emergency Generator Train 63	21.54	8.74E-04	1.75E-04	--	22
PTFEG-4	Emergency Generator Utility Area	21.54	8.74E-04	1.75E-04	--	22
PTFEG-5	Emergency Generator Utility Area	21.54	8.74E-04	1.75E-04	--	22
PTFEAC-1	Emergency Air Compressor	8.56	3.47E-04	6.94E-05	--	9
65B-81A	Heating Medium Heater A	24,953.93	0.47	0.05	--	24,978
65B-81B	Heating Medium Heater B	24,953.93	0.47	0.04	--	24,977
65B-81C	Heating Medium Heater C	24,953.93	0.47	0.05	--	24,978
65B-81D	Heating Medium Heater D	2,552.83	0.05	4.81E-03	--	2,555
65B-81E	Heating Medium Heater E	2,552.83	0.05	4.81E-03	--	2,555
PTFFLARE	PTF Flare	2,208.07	0.06	8.53E-03	--	2,212
CT	Combustion Turbine	561,117.99	10.58	1.06	--	561,668
TO1	Amine Unit / Thermal Oxidizer 61	301,337.99	0.05	4.83E-03	--	301,341
TO2	Amine Unit / Thermal Oxidizer 62	301,337.99	0.05	4.83E-03	--	301,341
TO3	Amine Unit / Thermal Oxidizer 63	301,337.99	0.05	4.83E-03	--	301,341
FUG-TREAT	Pretreatment Fugitives	--	26.06	--	--	547
FUG-PTFSF6	Pretreatment Circuit Breakers	--	--	--	2.45E-03	58
Total Emissions		1,547,461.43	38.36	1.23	0.002	1,548,706

¹ CO₂e emissions based on GWPs for each greenhouse gas pollutant
CO₂e Annual Emission Rate (ton/yr) = CO₂ Emission Rate (ton/yr) x CO₂ GWP + CH₄ Emission Rate (ton/yr) x CH₄ GWP + N₂O Emission Rate (ton/yr) x N₂O GWP + SF₆ Emission Rate (ton/yr) x SF₆ GWP
Example CO₂e Emission Rate for PTFFWP (ton/yr) = $\frac{38 \text{ ton}}{\text{yr}} + \frac{1}{\text{yr}} + \frac{1.53\text{E-}03 \text{ ton}}{\text{yr}} + \frac{21}{\text{yr}} + \frac{3.06\text{E-}04 \text{ ton}}{\text{yr}} + \frac{310}{\text{yr}} = 38 \text{ ton/yr}$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1. Total CO₂e emissions are calculated based on the following Global Warming Potentials

CO ₂	1
CH ₄	21
N ₂ O	310
SF ₆	23,900

Freeport LNG Development, L.P.
Liquefaction Plant GHG Summary of Emissions

Liquefaction Plant GHG Summary of Emissions

EPN	Description	Annual Emissions (tons/yr)				
		CO ₂	CH ₄	N ₂ O	SF ₆	CO ₂ e ¹
LIQFWP-1	Fire Water Pump 1	37.67	1.53E-03	3.06E-04	--	38
LIQFWP-2	Fire Water Pump 2	37.67	1.53E-03	3.06E-04	--	38
LIQEG-1	Emergency Generator 1	21.54	8.74E-04	1.75E-04	--	22
LIQEG-2	Emergency Generator 2	21.54	8.74E-04	1.75E-04	--	22
LIQEG-3	Emergency Generator 3	21.54	8.74E-04	1.75E-04	--	22
LIQEG-4	Emergency Generator 4	21.54	8.74E-04	1.75E-04	--	22
LIQEG-5	Emergency Generator - Guard House / Admin Area	21.54	8.74E-04	1.75E-04	--	22
LIQEAC-1	Emergency Air Compressor	8.56	3.47E-04	6.94E-05	--	9
LIQEG-6	Emergency Generator - Dock 2	11.41	4.63E-04	9.26E-05	--	11
LIQFLARE	Ground Flare	11,511.74	0.22	0.02	--	11,523
FUG-LIQ	Fugitives Liquefaction	--	36.13	--	--	759
FUG-LIQSF6	Fugitives Liquefaction	--	--	--	0.01	340
Total Emissions		11,714.76	36.35	0.02	0.01	12,825

¹ CO₂e emissions based on GWPs for each greenhouse gas pollutant

CO₂e Emission Rate (ton/yr) = CO₂ Emission Rate (ton/yr) x CO₂ GWP + CH₄ Emission Rate (ton/yr) x CH₄ GWP + N₂O Emission Rate (ton/yr) x N₂O GWP + SF₆ Emission Rate (ton/yr) x SF₆ GWP

Example CO₂e Emission Rate for LIQFWP (ton/yr) =
$$\frac{038 \text{ lb}}{\text{hr}} \times 1 + \frac{1.53\text{E-}03 \text{ lb}}{\text{hr}} \times 21 + \frac{3.06\text{E-}04 \text{ lb}}{\text{hr}} \times 310 = 38 \text{ ton/yr}$$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting*, Subpart A, Table A-1. Total CO₂e emissions are calculated based on the following Global Warming Potentials

CO ₂	1
CH ₄	21
N ₂ O	310
SF ₆	23,900

Freeport LNG Development, L.P.
Pretreatment Facility GHG Emissions from Combustion Sources

Sources of GHG Emissions

Parameter	Units	Fire Water Pump - Pretreatment	Emergency Generator Train 61	Emergency Generator Train 62	Emergency Generator Train 63	Emergency Generator Utility Area	Emergency Generator Utility Area	Emergency Air Compressor	Combustion Turbine
EPN	-	PTFFWP	PTFEG-1	PTFEG-2	PTFEG-3	PTFEG-4	PTFEG-5	PTFEAC-1	CT
Rated Capacity ¹	MMBtu/hr	4.62	5.29	5.29	5.29	5.29	5.29	2.10	1096
Hours of Operation per Year	hrs/yr	100	50	50	50	50	50	50	8,760
Natural Gas Potential Throughput ²	scf/yr	--	--	--	--	--	--	--	9,339,455,253
Diesel Potential Throughput ²	gal/yr	3,300	1,888	1,888	1,888	1,888	1,888	750	--
Natural Gas High Heat Value (HHV) ³	MMBtu/scf	--	--	--	--	--	--	--	0.001
No.2 Fuel Oil High Heat Value (HHV) ³	MMBtu/gal	0.138	0.138	0.138	0.138	0.138	0.138	0.138	--

¹ Per AP-42 Table 3.3-1 Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines Brake Specific Fuel Consumption Factor = 7,000 BTU/hp-hr

² Natural gas throughput is based on heat capacity of the unit, hours of operation and the fuel's high heating value

³ High heating value for No.2 Fuel Oil and Natural Gas obtained from 40 CFR Part 98, Subpart C, Table C-1.

Sources of GHG Emissions

Parameter	Units	Heaters with CT Up					Heaters with CT Down				
		Heating Medium Heater A	Heating Medium Heater B	Heating Medium Heater C	Heating Medium Heater D	Heating Medium Heater E	Heating Medium Heater A	Heating Medium Heater B	Heating Medium Heater C	Heating Medium Heater D	Heating Medium Heater E
EPN	-	65B-81A	65B-81B	65B-81C	65B-81D	65B-81E	65B-81A	65B-81B	65B-81C	65B-81D	65B-81E
Rated Capacity ¹	MMBtu/hr	130.00	130.00	130.00	130.00	130	130.00	130.00	130.00	130.00	130.00
Hours of Operation per Year	hrs/yr	8,424	8,424	8,424	0	0	336	336	336	336	336
Natural Gas Potential Throughput ²	scf/yr	372,852,140	372,852,140	372,852,140	0	0	42,490,272	42,490,272	42,490,272	42,490,272	42,490,272
Diesel Potential Throughput ²	gal/yr	--	--	--	--	--	--	--	--	--	--
Natural Gas High Heat Value (HHV) ³	MMBtu/scf	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Load Factor		35%	35%	35%	--	--	100%	100%	100%	100%	100%

¹ Per AP-42 Table 3.3-1 Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines Brake Specific Fuel Consumption Factor = 7,000 BTU/hp-hr

² Natural gas throughput is based on heat capacity of the unit, hours of operation and the fuel's high heating value

³ High heating value for No.2 Fuel Oil and Natural Gas obtained from 40 CFR Part 98, Subpart C, Table C-1.

GHG Emission Factors for Diesel Fuel

Pollutant	Emission Factor	Emission Factor Units
CO ₂ ¹	73.960	kg CO ₂ /MMBtu
CH ₄ ²	0.003	kg CH ₄ /MMBtu
N ₂ O ²	0.0006	kg N ₂ O/MMBtu

¹ Emission factors from 40 CFR Part 98, Subpart C, Table C-1 for Distillate Fuel Oil No. 2.

² Emission factors Per 40 CFR Part 98, Subpart C, Table C-2 for petroleum fuel.

GHG Emission Factors for Natural Gas

Pollutant	Emission Factor	Emission Factor Units
CO ₂ ¹	53.020	kg CO ₂ /MMBtu
CH ₄ ²	0.001	kg CH ₄ /MMBtu
N ₂ O ²	0.0001	kg N ₂ O/MMBtu

¹ Emission factors from 40 CFR Part 98, Subpart C, Table C-1 for Natural Gas.

² Emission factors Per 40 CFR Part 98, Subpart C, Table C-2 for Natural Gas.

Freeport LNG Development, L.P.
Pretreatment Facility GHG Emissions from Combustion Sources

GHG Potential Emission Calculations

EPN	Description	Fuel Type	Tier Used	Hourly Emissions ^{1,2} (lb/hr)				Annual Emissions ³ (tons/yr)				BACT Limit lb CO ₂ e/MMBtu
				CO ₂	CH ₄	N ₂ O	CO ₂ e ⁴	CO ₂	CH ₄	N ₂ O	CO ₂ e ⁴	
PTFFWP	Fire Water Pump - Pretreatment	No.2 Fuel Oil	Tier I	753	0.03	6.11E-03	756	38	1.53E-03	3.06E-04	38	
PTFEG-1	Emergency Generator Train 61	No.2 Fuel Oil	Tier I	862	0.03	6.99E-03	865	21.5	8.74E-04	1.75E-04	22	
PTFEG-2	Emergency Generator Train 62	No.2 Fuel Oil	Tier I	862	0.03	6.99E-03	865	22	8.74E-04	1.75E-04	22	
PTFEG-3	Emergency Generator Train 63	No.2 Fuel Oil	Tier I	862	0.03	6.99E-03	865	22	8.74E-04	1.75E-04	22	
PTFEG-4	Emergency Generator Utility Area	No.2 Fuel Oil	Tier I	862	0.03	6.99E-03	865	22	8.74E-04	1.75E-04	22	
PTFEG-5	Emergency Generator Utility Area	No.2 Fuel Oil	Tier I	862	0.03	6.99E-03	865	22	8.74E-04	1.75E-04	22	
PTFEAC-1	Emergency Air Compressor	No.2 Fuel Oil	Tier I	342	0.01	2.78E-03	344	9	3.47E-04	6.94E-05	9	
Heating Medium Heater A	Heating Medium Heater A	Natural Gas	Tier I	15,195	0.29	0.03	15,210	24,954	4.71E-01	4.71E-02	24,978	117.00
Heating Medium Heater B	Heating Medium Heater B	Natural Gas	Tier I	15,195	0.29	0.03	15,210	24,954	4.71E-01	4.23E-02	24,977	117.00
Heating Medium Heater C	Heating Medium Heater C	Natural Gas	Tier I	15,195	0.29	0.03	15,210	24,954	4.71E-01	4.71E-02	24,978	117.00
Heating Medium Heater D	Heating Medium Heater D	Natural Gas	Tier I	15,195	0.29	0.03	15,210	2,553	4.81E-02	4.81E-03	2,555	117.00
Heating Medium Heater E	Heating Medium Heater E	Natural Gas	Tier I	15,195	0.29	0.03	15,210	2,553	4.81E-02	4.81E-03	2,555	117.00
CT	Combustion Turbine	Natural Gas	Tier I	128,109	2.42	0.24	128,235	561,118	10.6	1.06	561,668	
Total				209,490.63	4.07	0.43	209,709	641,239.38	12.10	1.21	641,867	
Total CO ₂ e Emissions ⁴				-	-	-	209,709	-	-	-	641,867	

¹ CO₂ emissions from No.2 Fuel Oil and Natural Gas combustion calculated per Equation C-1 and Tier I methodology provided in 40 CFR Part 98, Subpart C.

CH₄ and N₂O emissions No.2 Fuel Oil and Natural Gas combustion calculated per Equation C-8 provided in 40 CFR Part 98, Subpart C.

Hourly Emissions (lb/hr) = Emission Factor (kg /MMBtu) x Rated Capacity (MMBtu/hr) x Conversion factor (lb/kg)

Example CO₂ Hourly Emissions (lb/hr) =

73.96 kg CO2	4.62 MMBtu	2.2046 lb	=	753 lb/hr
MMBtu	hr	kg		

² kg to lb conversion 2.2046 lb/kg

³ Annual Emissions (tons/yr) = Annual Emissions (lb/hr) x Annual Operating Hours (hr/yr) / Conversion factor (lb/tons)

Example CO₂ Annual Emissions (tons/yr) =

753 lb	100 hr	tons	=	38 tons/yr
hr	yr	2000 lb		

⁴ CO₂e emissions based on GWPs for each greenhouse gas pollutant

CO₂e Hourly Emission Rate (lb/hr) = CO₂ Emission Rate (lb/hr) x CO₂ GWP + CH₄ Emission Rate (lb/hr) x CH₄ GWP + N₂O Emission Rate (lb/hr) x N₂O GWP

Example CO₂e Hourly Emission Rate (lb/hr) =

753 lb	1	+	0.03 lb	21	+	6.11E-03 lb	310	=	756 lb/hr
hr			hr			hr			

Per 40 CFR 98 - Mandatory Greenhouse Gas Reporting, Subpart A, Table A-1. Total CO2e emissions are calculated based on the following Global Warming Potentials.

CO ₂	1
CH ₄	21
N ₂ O	310

Freeport LNG Development, L.P.
Liquefaction Plant GHG Emissions from Combustion Sources

Sources of GHG Emissions

Source Name	Units	Fire Water Pump 1	Fire Water Pump 2	Emergency Generator 1	Emergency Generator 2	Emergency Generator 3	Emergency Generator 4	Emergency Generator - Guard House / Admin Area	Emergency Air Compressor	Emergency Generator - Dock 2
EPN	-	LIQFWP-1	LIQFWP-2	LIQEG-1	LIQEG-2	LIQEG-3	LIQEG-4	LIQEG-5	LIQEAC-1	LIQEG-6
Rated Capacity	hp	660	660	755	755	755	755	755	300	400
Heat Input Capacity ¹	MMBtu/hr	4.62	4.62	5.29	5.29	5.29	5.29	5.29	2.10	2.80
Hours of Operation per Year	hrs/yr	100	100	50	50	50	50	50	50	50
Potential Throughput ²	gal/yr	3,300	3,300	1,888	1,888	1,888	1,888	1,888	750	1,000
No.2 Fuel Oil High Heat Value (HHV) ³	MMBtu/gal	0.138	0.138	0.138	0.138	0.138	0.138	0.138	0.138	0.138

¹ Per AP-42 Table 3.3-1 Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines Brake Specific Fuel Consumption Factor = 7,000 BTU/hp-hr

² 1 gallon of No. 2 Fuel Oil has a heating value of 140,000 Btu.

³ High heating value for No.2 Fuel Oil obtained from 40 CFR Part 98, Subpart C, Table C-1.

GHG Emission Factors for Diesel Fuel

Pollutant	Emission Factor	Emission Factor Units
CO ₂ ¹	73.960	kg CO ₂ /MMBtu
CH ₄ ²	0.003	kg CH ₄ /MMBtu
N ₂ O ²	0.0006	kg N ₂ O/MMBtu

¹ Emission factors from 40 CFR Part 98, Subpart C, Table C-1 for Distillate Fuel Oil No. 2

² Emission factors Per 40 CFR Part 98, Subpart C, Table C-2 for petroleum fuel.

GHG Potential Emission Calculations

EPN	Description	Fuel Type	Tier Used	Hourly Emissions ^{1,2} (lb/hr)				Annual Emissions ³ (tons/yr)			
				CO ₂	CH ₄	N ₂ O	CO ₂ e	CO ₂	CH ₄	N ₂ O	CO ₂ e
LIQFWP-1	Fire Water Pump 1	No.2 Fuel Oil	Tier I	753	3.06E-02	6.11E-03	756	37.67	1.53E-03	3.06E-04	37.79
LIQFWP-2	Fire Water Pump 2	No.2 Fuel Oil	Tier I	753	3.06E-02	6.11E-03	756	37.67	1.53E-03	3.06E-04	37.79
LIQEG-1	Emergency Generator 1	No.2 Fuel Oil	Tier I	862	3.50E-02	6.99E-03	865	21.54	8.74E-04	1.75E-04	21.62
LIQEG-2	Emergency Generator 2	No.2 Fuel Oil	Tier I	862	3.50E-02	6.99E-03	865	21.54	8.74E-04	1.75E-04	21.62
LIQEG-3	Emergency Generator 3	No.2 Fuel Oil	Tier I	862	3.50E-02	6.99E-03	865	21.54	8.74E-04	1.75E-04	21.62
LIQEG-4	Emergency Generator 4	No.2 Fuel Oil	Tier I	862	3.50E-02	6.99E-03	865	21.54	8.74E-04	1.75E-04	21.62
LIQEG-5	Emergency Generator - Guard House / Admin	No.2 Fuel Oil	Tier I	862	3.50E-02	6.99E-03	865	21.54	8.74E-04	1.75E-04	21.62
LIQEAC-1	Emergency Air Compressor	No.2 Fuel Oil	Tier I	342	1.39E-02	2.78E-03	344	8.56	3.47E-04	6.94E-05	8.59
LIQEG-6	Emergency Generator - Dock 2	No.2 Fuel Oil	Tier I	457	1.85E-02	3.70E-03	458	11.41	4.63E-04	9.26E-05	11.45
Total				6,614.27	0.27	0.05	6,637	203.02	8.24E-03	1.65E-03	204
Total CO ₂ e Emissions ⁴					-	-	6,637		-	-	204

¹ CO₂ emissions from No.2 Fuel Oil combustion calculated per Equation C-1 and Tier I methodology provided in 40 CFR Part 98, Subpart C.

CH₄ and N₂O emissions No.2 Fuel Oil combustion calculated per Equation C-8 provided in 40 CFR Part 98, Subpart C.

Hourly Emissions (lb/hr) = Emission Factor (kg /MMBtu) x Rated Capacity (MMBtu/hr) x Conversion factor (lb/kg)

Example CO ₂ Hourly Emissions (lb/hr) =	$\frac{73.96 \text{ kg CO}_2}{\text{MMBtu}}$	$\frac{4.62 \text{ MMBtu}}{\text{hr}}$	$\frac{2.20462 \text{ lb}}{\text{kg}}$	=	753 lb/hr
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² kg to lb conversion 2.20462 lb/kg

³ Annual Emissions (tons/yr) = Annual Emissions (lb/hr) x Annual Operating Hours (hr/yr) / Conversion factor (lb/tons)

Example CO ₂ Annual Emissions (tons/yr) =	$\frac{753 \text{ lb}}{\text{hr}}$	$\frac{100 \text{ hr}}{\text{yr}}$	$\frac{\text{tons}}{2000 \text{ lb}}$	=	38 tons/yr
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⁴ CO₂e emissions based on GWPs for each greenhouse gas pollutant

CO₂e Hourly Emission Rate (lb/hr) = CO₂ Emission Rate (lb/hr) x CO₂ GWP + CH₄ Emission Rate (lb/hr) x CH₄ GWP + N₂O Emission Rate (lb/hr) x N₂O GWP

Example CO ₂ e Hourly Emission Rate (lb/hr) =	$\frac{753 \text{ lb}}{\text{hr}}$	$\frac{1}{\text{hr}}$	+	$\frac{0.03 \text{ lb}}{\text{hr}}$	$\frac{21}{\text{hr}}$	+	$\frac{6.11\text{-}03 \text{ lb}}{\text{hr}}$	$\frac{310}{\text{hr}}$	=	756 lb/hr
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Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1. Total CO₂e emissions are calculated based on the following Global Warming Potentials.

CO ₂	1
CH ₄	21
N ₂ O	310