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5 April 2013

Mr. Jeff Robinson
Air Permit Section Chief
U.S. Environmental Protection Agency, (6PD-R)
1445 Ross Ave
Dallas, TX 75202-2733

ATKINS Project No. 044167600

RE: Update to the Application for Prevention of Significant Deterioration (PSD) Permit for Greenhouse Gas Emissions – Proposed Liquefaction Project
Freeport LNG Development, L.P., Brazoria County, Texas

Dear Mr. Robinson:

On behalf of Freeport LNG Development, L.P. (Freeport LNG), I am submitting this update to the application for the referenced Greenhouse Gas PSD Permit for Freeport LNG's proposed Liquefaction Project. Freeport LNG submitted an application to the U.S. Environmental Protection Agency (EPA), Region 6 for an Air Quality Prevention of Significant Deterioration (PSD) Permit for Greenhouse Gas (GHG) emissions to authorize the construction of a proposed Liquefaction Project in Brazoria County, Texas. The Liquefaction Project consists of two new sources - a Pretreatment Facility and a Liquefaction Plant. Because of the interdependence of the Liquefaction Plant and the Pretreatment Facility, the two plants are considered by the EPA to be a single project for PSD permitting purposes. Accordingly, a single application for permitting of GHG emissions under the PSD Tailoring Rule was submitted to the EPA in December 2011 for the proposed Liquefaction Project and updated in July 2012.

As discussed in the previous documentation submitted to the EPA, the Liquefaction Plant will be located adjacent to the terminal facility on Quintana Island and will consist of three propane pre-cooled mixed refrigerant trains, each capable of producing a nominal 4.4 million tonnes (metric tons) per annum (mtpa) of Liquefied Natural Gas (LNG), which equates to a total liquefaction capacity of approximately 1.98 BSCFD of natural gas. In support of the proposed Liquefaction Plant, Freeport LNG plans to construct a natural gas Pretreatment Facility to purify pipeline quality natural gas to be sent to the Liquefaction Plant for the production of LNG. The Pretreatment Facility will be located approximately 3.5 miles inland to the northeast of the Quintana Island Terminal along Freeport LNG's existing 42-inch natural gas pipeline route. Collectively, the proposed development of the Liquefaction Plant and the Pretreatment Facility is referred to as the "Liquefaction Project". The term "Liquefaction Project" will be used to describe the project as a whole.

As a result of further development of the project and the progression of more detailed engineering, the proposed equipment and configuration of the Liquefaction Project have been adjusted. The overall project description and production capacity have not changed. The resulting equipment changes have resulted in:

- More efficient and safer operation of the plant;
- Fewer emission sources; and

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- An overall reduction in total emissions of methane (CH4), nitrous oxide (N2O) and carbon dioxide equivalents (CO2e) compared to the previous application information as follows:

LIQUEFACTION PROJECT EMISSIONS COMPARISON – PREVIOUS PROJECT EMISSIONS VERSUS UPDATED PROJECT EMISSIONS

Source	Annual Emissions (tpy)				
	CO_2	CH_4	N_2O	SF_6	CO_2e
Previous Project Emissions Total	1,579,155	43.39	1.30	0.017	1,580,866
Updated Project Emissions total	1,559,204	74.72	1.25	0.017	1,561,559

Freeport LNG is proposing to utilize essentially the same process description and process equipment, production rate, and type of air emission sources as previously identified in the initial GHG PSD application. However, the change in configuration of the Pretreatment Facility and the Liquefaction Plant has resulted in a change to the area map, site plans and location coordinates for proposed air emission sources.

In addition, a more detailed engineering design for the Pretreatment Facility has identified the need for the following emission sources at the Pretreatment Facility:

- Five heating medium heaters instead of ten;
- Two additional emergency engines;
- One additional emergency air compressor engine; and
- Addition of an emergency ground flare system in lieu of the elevated NGL Flare and Atmospheric Release Vent proposed in the previous application documentation.

Similarly for the Liquefaction Plant, more detailed engineering has identified the need for two additional emergency generator engines and one additional of emergency air compressor engine.

The proposed heating medium heaters and emergency engines will be similar in terms of the type of emission sources as those identified in the previous submittals to the EPA. A more detailed description of the proposed changes is attached.

We believe the evaluation of BACT as discussed in Section 10 of the initial permit application and follow-on information submitted to the EPA is applicable to the heating medium heaters, emergency generator and firewater pump engines proposed for the Pretreatment Facility and the Liquefaction Plant as these emission sources will be similar to the corresponding emission sources proposed in the initial application. Thus, the proposed changes should not alter the conclusions of the BACT evaluation for these emission sources.

I hope this updated information will allow you to continue and complete your review of the permit application. We will continue to coordinate with EPA staff and greatly appreciate your time and guidance on this effort.

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Thank you for your consideration. Should you have any questions regarding this updated information, please contact Mr. Mark Mallett, P.E., Freeport LNG Development, L.P. at (713) 333-4271 or me at (512) 342-3395 or by email: Ruben.Velasquez@atkinsglobal.com.

Sincerely,

Ruben I. Velasquez, P.E.
Senior Engineer - Air Quality
Atkins North America, Inc.

ATKINS
TBPE REG. #F-474

Enclosures

cc: Mr. Mike Wilson, Director, Air Permits Division, TCEQ
Mr. Mark Mallett, P.E., Vice-President, Freeport LNG Development, L.P

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Update to the Application for Prevention of Significant Deterioration (PSD) Permit for Greenhouse Gas Emissions – Proposed Liquefaction Project
Freeport LNG Development, L.P., Brazoria County, Texas

Freeport LNG proposes to construct a Liquefaction Plant will be located adjacent to the terminal facility on Quintana Island that will consist of three propane pre-cooled mixed refrigerant trains, each capable of producing a nominal 4.4 million tonnes (metric tons) per annum (mtpa) of Liquefied Natural Gas (LNG), which equates to a total liquefaction capacity of approximately 1.98 BSCFD of natural gas. In support of the proposed Liquefaction Plant, Freeport LNG also plans to construct a natural gas Pretreatment Facility to purify pipeline quality natural gas to be sent to the Liquefaction Plant for the production of LNG. The Pretreatment Facility will be located approximately 3.5 miles inland to the northeast of the Quintana Island Terminal along Freeport LNG's existing 42-inch natural gas pipeline route. Collectively, the proposed development of the Liquefaction Plant and the Pretreatment Facility is referred to as the "Liquefaction Project". The term "Liquefaction Project" will be used to describe the project as a whole.

In the previous documentation submitted to the EPA, potential GHG emissions from the proposed Liquefaction Project were shown from the following emission units:

- Pretreatment Facility
    - Ten process heaters (EPNs: 6B-1811A, 6B-1811B, 6B-1811C, 6B-1811D, 6B-1811E, 6B-1811F, 6B-1811G, 6B-1811H, 6B-1812A, and 6B-1821B);
    - Four emergency generators (EPNs: PTFEG-1, PTFEG-2, PTFEG-3, and PTFEG-4);
    - One fire water pump (EPN: PTFFWP);
    - Three thermal oxidizers (EPNs: TO1, TO2, TO3);
    - A combustion turbine (EPNs: CT1(A) and CT1(B));
    - NGL flare (EPN: NGLFLARE);
    - Fugitive CH4 emissions from piping components (EPN: FUG-TREAT); and
    - Fugitive emissions from SF6 circuit breakers (6) (EPN: FUGPTFSF6).
- Liquefaction Plant
    - Four new emergency generators (EPNs: LIQEG-1, LIQEG-2, LIQEG-3, and LIQEG-4);
    - Two firewater pump (EPN: LIQFWP-1 and LIQFWP-2);
    - Liquefaction flare (EPN: LIQFLARE);
    - Fugitive CH4 emissions from piping components (EPN: FUG-LIQ); and
    - Fugitive emissions from SF6 circuit breakers (40) (EPN: FUGLIQSF6).

As a result of further development of the project and the progression of more detailed engineering, the proposed equipment and configuration of the Liquefaction Project has been adjusted. The change in configuration and proposed equipment will result in an overall reduction in total emissions of carbon dioxide (CO2), nitrous oxide (N2O) and carbon dioxide equivalents (CO2e) compared to the previous application information.

A summary of the proposed changes to emissions sources is discussed below for the Pretreatment Facility and the Liquefaction Plant.

PRETREATMENT FACILITY

1.0 HEATING MEDIUM HEATERS

Previous Representations:

The previous application for the Pretreatment Facility included the use of 10 combustion heaters (Emission Point Numbers [EPNs]: 65B-81A, 65B-81B, 65B-81C, 65B-81D, 65B-81E, 65B-81F, 65B-81G, 65B-81H, 65B-81I, and 65B-81J). These ten heaters were rated at 85 million British thermal units per hour (MMBtu/hr) and would be fired with either BOG or natural gas fuel.

Updated Information:

Instead of the ten process heaters, Freeport is proposing the use of five process heaters (EPNs: 65B-81A, 65B-81B, 65B-81C, 65B-81D, and 65B-81E), each with a maximum heat input capacity of 130 MMBtu/hr. Each heater may be fired with BOG or natural gas fuel.

Freeport LNG is proposing to operate any three of the five heaters simultaneously with the combustion turbine waste heat recovery unit, albeit at reduced heater capacity. The combustion turbine waste heat recovery unit will be used to transfer heat to hot oil. The hot oil will be used in the amine units and dehydration system units in lieu of burning natural gas fuel in the heating medium heaters. However, recovery of energy from the combustion turbine generator exhaust gas will not be sufficient to meet all of the energy supply requirements for all three pretreatment trains. Additional energy will be provided to the system by any three of the five natural gas-fired heating medium heaters in order to fully meet heating demands. It is anticipated the combustion turbine will be down for planned maintenance 14 days of each year. When the combustion turbine is not in operation, Freeport LNG will utilize all five heaters as needed to meet the plant's heating requirements.

Consistent with the previous permit application information, Freeport LNG proposes the following design elements and work practices as BACT for the process heaters:

- Use of natural gas as fuel;
- Implementation of good combustion, operating, and maintenance practices,
- Use of waste heat recovery in the Combustion Turbine;
- Efficient heater design; and
- Limit hours of operation for the equivalent of two of the proposed heaters as needed when the combustion turbine is down for maintenance; approximately 336 hours per year (based on a 12-month rolling total).

Freeport LNG would like the flexibility to utilize any heater as operationally necessary and apply the GHG emission and operational hours limit to the group of heaters.

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2.0 REGENERATIVE THERMAL OXIDIZERS

Previous Representations:

The Pretreatment Facility will be equipped with three regenerative thermal oxidizers (EPNs: TO1, TO2, and TO3), one for each pretreatment train. As discussed in the permit application, the CO2, hydrogen sulfide (H2S), other stripped sulfur compounds, and light hydrocarbons removed from the incoming gas stream by the amine units will be routed to the regenerative thermal oxidizers for the control of sulfur compounds and volatile organic compounds (VOC) emissions. The inlet H2S to the thermal oxidizers will be converted and emitted as sulfur dioxide (SO2) from the thermal oxidizers.

Updated Information:

To provide for a reduction in SO2 emissions and provide for an improvement in air quality impacts, the exhaust stream from each RTO will be routed to a packed-bed liquid scrubber; each scrubber system will be designed to achieve a minimum SO2 removal efficiency of 95%. To minimize particulate matter emissions from the exhaust of each scrubber system, Freeport LNG will install a wet electrostatic precipitator (WESP) to reduce particulate matter emissions that may be emitted in the mist from the packed-bed water scrubber.

These proposed installation of additional emissions control equipment is for the purpose of reducing emissions of non-GHG emissions and will not result in an increase in GHG emissions, therefore, the BACT proposed for the GHG emissions for the thermal oxidizers in the previous application representations is still applicable.

3.0 PROPOSED GROUND FLARE

Previous Representations:

The initial application proposed the use of a Natural Gas Liquids (NGL) Flare (EPN: NGLFLARE). This flare system would service only the NGL removal unit and would consist of a flare header and an elevated flare providing for the safe disposal of hydrocarbon releases from relief vents and relief valves/devices on all equipment from the NGL unit.

An Atmospheric Relief Vent was also proposed. Pressure relief vents from the amine treatment units would be designed to relieve to an atmospheric vent stack during over pressurization or in an emergency situation. These releases will consist primarily of a natural gas stream or CO_2 stream containing process gas concentrations of H_2S and other sulfur and light organic compounds depending on the location of the pressure relief vents. It is anticipated that these releases to the atmospheric vent will be of limited duration. This atmospheric relief vent stack would be designed and constructed so as to assure these potential gas releases will be vented safely to the atmosphere.

Updated Information:

In lieu of the NGL Flare (EPN: NGLFLARE) and the Atmospheric Relief Vent, Freeport is proposing the use of a ground flare system (EPN: PTFFLARE) to serve the three gas processing trains and common facilities/utilities. The proposed ground flare will consist of a Warm Flare System (68Z-70) and a Cold Flare System (68Z-71). Both the Warm and Cold Flare Systems will use multipoint ground flares that will be located in a common enclosed radiation fence. Enclosed ground flares

were selected based on Freeport LNG's desire to minimize the impact of flaring on the surrounding environment. The ground flare and radiation fence dimensions will be based upon no visible flame at grade with simultaneous flaring of the Warm Flare (68Z-70) and Cold Flare (68Z-71). It is expected that smokeless flaring will be achieved over the operating range of the flares. Both flare systems will be purged with nitrogen to minimize emissions.

The Warm Flare system will include collection headers, a Warm Flare Scrubber to capture and recovery any entrained liquid in the flared gas, and a dedicated multipoint ground flare (68Z-70). The Warm Flare will be located in a common enclosed radiation fence with the Cold Flare (68Z-71). This flare system will be dedicated primarily to emergency reliefs that are warm and/or wet from the common feed gas and residue gas compression areas, AGRU and dehydration units.

The Cold Flare system will include collection headers, a Cold Flare Scrubber and Cold Flare Scrubber Heater to capture and recover any entrained liquid in the flared gas, and a dedicated multipoint ground flare (68Z-71). The Cold Flare system will be dedicated primarily to emergency reliefs that are cold and dry from the NGL extraction units located in each PTF processing train. The Cold Flare system is provided to segregate the cold relief streams from wet relief streams to minimize the risk of freezing water in the relief systems. It will also be used to control maintenance, startup, and shutdown emissions from the NGL unit, as discussed in the permit application.

Both ground flare systems are provided for the reliable and safe disposal of hydrocarbon vapor streams that may result from upsets and emergencies. Each flare system will be provided with an automatic electronic ignition system or an equivalent that is designed for individual manual ignition of pilots. Each pilot will have two thermocouples or equivalent for sensing pilot status. The ignition system shall automatically re-light the pilot upon sensing pilot failure.

Consistent with the previous permit application information, natural gas-fired pilots and good flare design will be applied as GHG BACT for the proposed ground flare system in order to minimize emissions from the flare. The flare will meet the requirements of 40 CFR §60.18 and will be properly instrumented and controlled.

4.0 COMBUSTION TURBINE EXHAUST STACK

Previous Representations:

In the permit application indicated the exhaust gases from the combustion turbine/SCR catalyst system would be split and exhausted through two waste heat recovery units, each having its own flue gas stack to the atmosphere (EPNs: CT1(A) and CT1(B)).

Updated Information:

Freeport LNG is proposing to use only one flue gas stack (EPN: CT) for the combustion turbine.

This change will not result in an increase in GHG emissions; therefore, the BACT proposed for the combustion turbine in the previous application and follow-on documentation is applicable.

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5.0 ADDITION OF EMERGENCY GENERATOR AND BACKUP AIR COMPRESSOR ENGINES

Previous Representations:

In the previous permit documentation, Freeport LNG proposed to install four emergency generators powered with diesel-fired engines (EPNs: PTFEG-1, PTFEG-2, PTFEG-3, and PTFEG-4), each rated at 755 horsepower, to serve as a reliable power source for lighting and other emergency equipment in the event of a power failure. Each generator engine would be limited to 100 hours/year (hrs/yr) of operation for purposes of maintenance and testing.

Updated Information:

Freeport is proposing the installation of an additional emergency generator engine (EPN: PTFEG-5), a backup air compressor engine (EPN: PTFEAC-1), and associated diesel day tanks (EPN: PTFEGT-5 and PTFEACT-1). These engines will be rated at 755 and 300 horsepower, respectively, and will be fired with ultra-low sulfur diesel fuel.

Freeport is also proposing to limit the operation of the backup diesel firewater pump engines to no more than 2 hours per day and 100 hours per year for routine testing, maintenance, and inspection purposes only. The emergency generator engines and emergency air compressor engine will be limited for a maximum of 2 hours per day and 50 hours per year for routine testing, maintenance, and inspection purposes only.

The evaluation of BACT for the emergency engines in Section 10.6 of the initial permit application and follow-on information submitted to the EPA is applicable to the additional diesel-fueled, emergency generator and backup air compressor engines proposed for the Pretreatment Facility as the additional engines will be identical or similar to the corresponding emergency engines proposed in the initial application.

6.0 ADDITION TO FUGITIVE EQUIPMENT COMPONENT COUNT

The equipment count used to estimate fugitive emissions has been increased based on the updated plant equipment configuration resulting in an increase in GHG emissions.

Fugitive methane is the major component of the GHG emissions from piping components. Consistent with the previous permit application representations, Freeport LNG proposes to implement a work practice as BACT. The 28MID LDAR program will be used to detect any leaks and repairs will be performed as soon as practicable. In addition, Freeport LNG will implement an AVO program in between LDAR checks.

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LIQUEFACTION PLANT

1.0 ADDITION OF EMERGENCY GENERATOR AND BACKUP AIR COMPRESSOR ENGINES

Previous Representations:

In the previous permit application documentation submitted to the EPA, Freeport LNG proposed to install four emergency generators powered with diesel-fired engines (EPNs: LIQEG-1, LIQEG-2, LIQEG-3, and LIQEG-4) each rated at 755 horsepower to serve as a reliable power source for lighting and other emergency equipment in the event of a power failure. Each generator engine will be fired with ultra low sulfur diesel fuel and will be limited to 100 hrs/yr of operation for purposes of maintenance and testing.

Updated Information:

Freeport LNG is proposing the installation of two additional emergency generator engines (EPNs: LIQEG-5 and LIQEG-6), one emergency air compressor engine (EPN: LIQEAC-1), and associated diesel day tanks (EPNs: LEGT-5, LEGT-6, and LEACT-1). The emergency generator engines will each be rated at 755 horsepower and the emergency air compressor engine will be rated at 300 horsepower. These engines will be fired with ultra-low sulfur diesel fuel.

Freeport is also proposing to limit the operation of the backup diesel firewater pump engines to no more than 2 hours per day and 100 hours per year for routine testing, maintenance, and inspection purposes only. The emergency generator engines and emergency air compressor engine will be limited for a maximum of 2 hours per day and 50 hours per year for routine testing, maintenance, and inspection purposes only.

The evaluation of BACT for the emergency engines in Section 10.6 of the initial permit application and follow-on information submitted to the EPA is applicable to the additional diesel-fueled, emergency generator and backup air compressor engines proposed for the Liquefaction Facility as the additional engines will be identical or similar to the corresponding emergency engines proposed in the initial application.

2.0 ADDITION TO FUGITIVE EQUIPMENT COMPONENT COUNT

The equipment count used to estimate fugitive emissions has been increased based on the updated plant equipment configuration resulting in an increase in GHG emissions.

Fugitive methane is the major component of the GHG emissions from piping components. Consistent with the previous permit application representations, Freeport LNG proposes to implement a work practice as BACT. The 28MID LDAR program will be used to detect any leaks and repairs will be performed as soon as practicable. In addition, Freeport LNG will implement an AVO program in between LDAR checks.

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UPDATED SITE PLANS AND EMISSIONS INFORMATION

Updated site plans and emissions information for the Pretreatment Facility and Liquefaction Plant are found in the following attachments:

- Attachment 1 - Liquefaction Plant Area Map and Plot Plan showing the location of the proposed Liquefaction Plant relative to the surrounding area
- Attachment 2 – Pretreatment Facility Area Map and Plot Plan showing the location of proposed Pretreatment Facility relative to the surrounding area
- Attachment 3 – Area Map showing the location of the Pretreatment Facility and Liquefaction Plant relative to each other
- Attachment 4 – Page 4 of 9 of TCEQ Form PI-1, "General Application for Air Preconstruction Permit and Amendment". Section F on Page 4 of 9 has been revised to show the updated annual GHG emission rate (as Carbon Dioxide Equivalents) for the Liquefaction Project.
- Attachment 5 - Table 1(a) for the Liquefaction Project showing updated emissions and emission point parameters.
- Attachment 6 – Emissions Summary Tables for the Liquefaction Project incorporating the updates to emission sources as described above. For your convenience, a complete set of emission summary tables showing all emission sources is included.

These updated documents should be substituted for the corresponding information included in the previous permit application documentation submitted to the EPA.

UPDATED EMISSIONS SUMMARY

The change in the proposed equipment will result in a change in the estimated GHG emissions identified in previous permit application submitted to the EPA. As shown in Table 1, the change in emission sources will result in a decrease in emissions of CO2, N2O and overall CO2e emissions compared to the previous permit application. This increase in methane (CH4) emissions is primarily due to the increase in fugitive component counts resulting in an increase in methane emissions, as discussed above.

TABLE 1. LIQUEFACTION PROJECT EMISSIONS COMPARISON – PREVIOUS PROJECT EMISSIONS VERSUS UPDATED PROJECT EMISSIONS

Source	Annual Emissions (tpy)				
	CO_2	CH_4	N_2O	SF_6	CO_2e
Previous Project Emissions Total	**1,579,155**	**43.39**	**1.30**	**0.017**	**1,580,866**
Updated Project Emissions total	**1,559,204**	**74.72**	**1.25**	**0.017**	**1,561,559**

Emissions Summary Tables for the Liquefaction Project providing the basis and breakout emissions by source are found in Attachment 6.

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ATTACHMENT 1

Updated Area Map and Plot Plan
Liquefaction Plant

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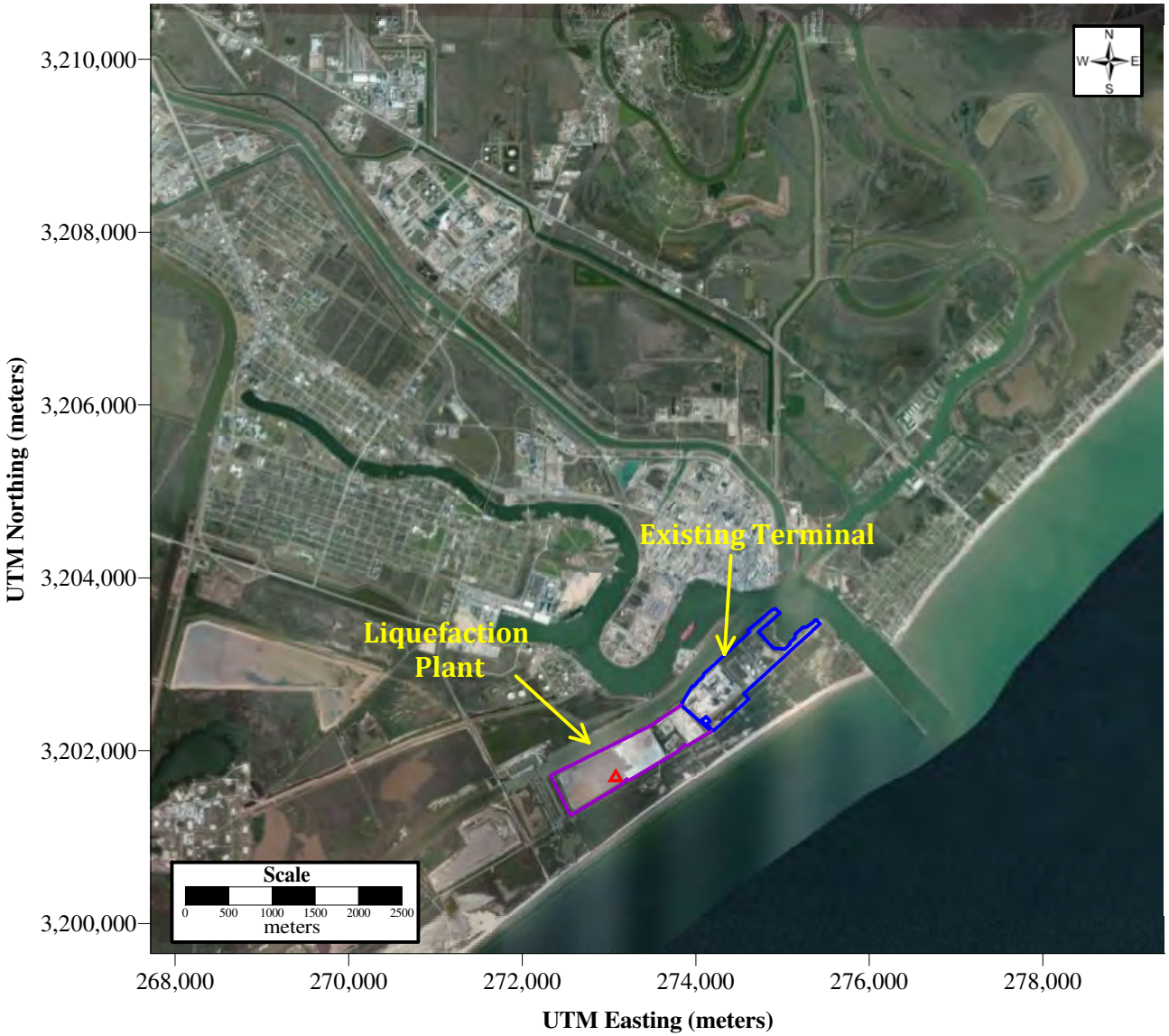
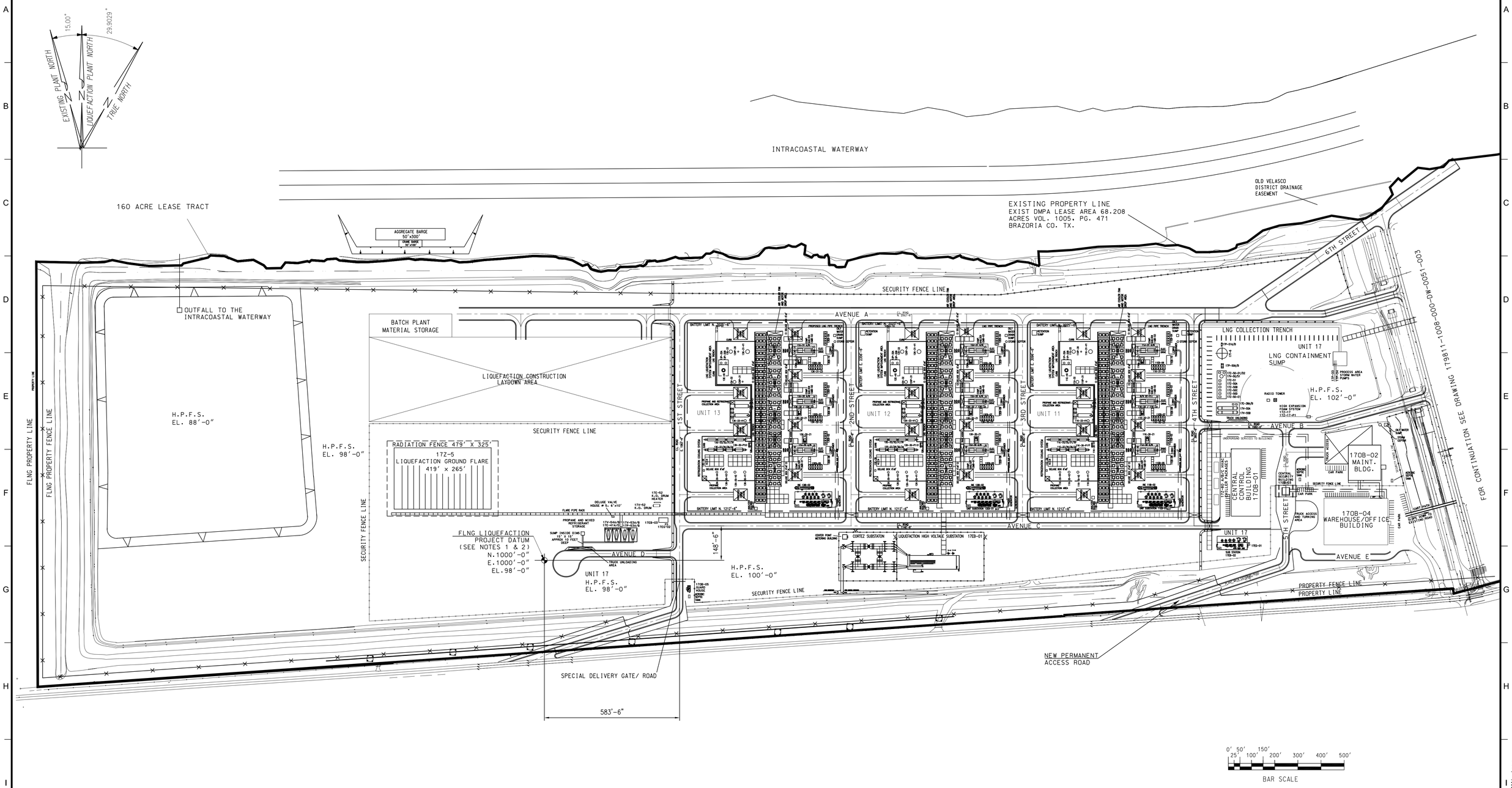
Figure 3-1. Area Map of the Proposed Liquefaction Plant



Benchmark coordinates: 273,078 m E, 3,201,689 m N (UTM NAD83, Zone 15)
3,143,000 E, 13,538,000 N (Texas South Central, NAD83, U.S. Survey Feet)

UTM coordinates in Zone 15, NAD83 datum.

Source: 15R 267,719m E 3,200,221m N. Bing Aerial. Accessed: January 22, 2013.



NOTE:
1. FOR CROSS-REFERENCE OF PROJECT DATUM POINT TO THE TEXAS SOUTH CENTRAL, NAD83 U.S. SURVEY (FEET) SEE PROJECT DRAWING 179811-1008-000-DW-0052-003.0001.
2. H.P.FINISHED SURFACE EL. 100'-0" = 26'-0" ABOVE NAVD88
3. FOR UNIT PLOT PLANS SEE DRAWING KEY PLAN DWG NO.179811-1008-000-DW-0053-002

REV	DATE	BY	DESCRIPTION	CHK'D	TECH.	PROJ.	ENG	OPS	P.M.
J	03-OCT-2012	BP	ISSUED FOR INFORMATION	RB	AK				
I	27-JUL-2012	DT	ISSUED FOR FERC SUBMITTAL	RB	AK				
M	20-FEB-2013	BP	ISSUED FOR INFORMATION	RB	AK				
L	18-FEB-2013	BP	ISSUED FOR ESTIMATE	RB	AK				
K	18-FEB-2013	BP	ISSUED FOR ESTIMATE	RB	AK				
				CONTRACTOR			FREEPORT LNG		

FILE NAME: 179811-1008-DW-0051-001.0001.DWG
SCALE: SEE BAR SCALE

ZACHRY | CB&I

Project	Area	Doc Type	Eng Code	Seq No	Rev
1008	000	DW	0051	001	M

FREEPORT LNG

PLOT PLAN

OVERALL LIQUEFACTION FACILITIES

	BY	DATE
DESIGN	RB	10JAN12
DRAWN	RB	10JAN12

DRAWING NO.

SHEET:

REV. NO. M

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ATTACHMENT 2

Updated Area Map and Plot Plan
Pretreatment Facility

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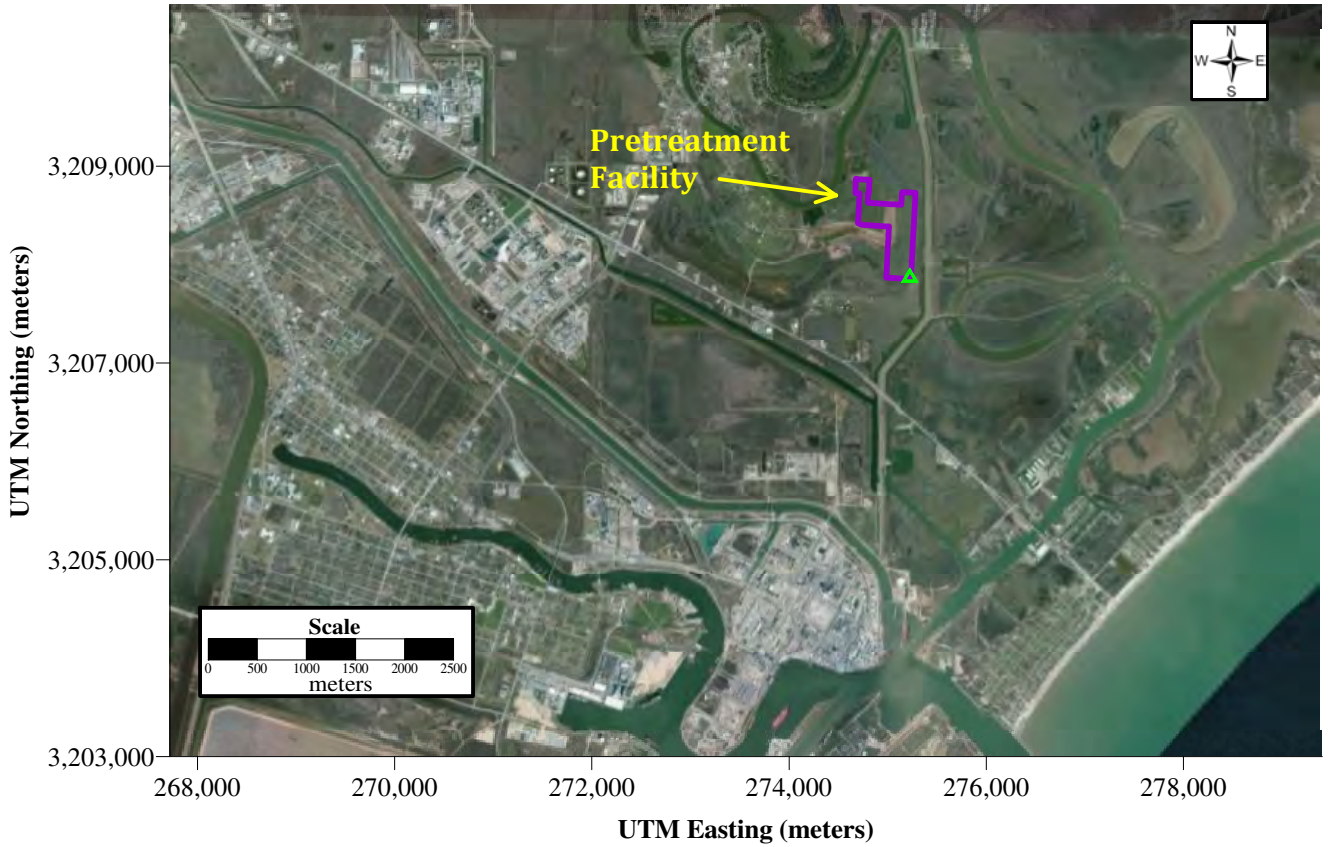
Figure 3-2. Area Map of the Proposed Pretreatment Facility



Benchmark coordinates: 275,226 m E, 3,207,869 m N (UTM NAD83, Zone 15)
3,149,000 E, 13,558,600 N (Texas South Central, NAD83, U.S. Survey Feet)

UTM coordinates in Zone 15, NAD83 datum.

Source: 15R 267,719m E 3,200,221m N. Bing Aerial. Accessed: January 22, 2013.


PREVAILING WIND
18°
PLANT & TRUE NORTH
UNIT 60 - INLET / OUTLET FACILITIES COMPRESSOR AREA
UNIT 61 - PRETREATMENT TRAIN 1
UNIT 62 - PRETREATMENT TRAIN 2
UNIT 63 - PRETREATMENT TRAIN 3
UNIT 64 - (RESERVED FOR FLNG USE)
UNIT 65 - COMMON UTILITIES AND AUXILLARIES
UNIT 66 - FIRE WATER AREA
UNIT 67 - STORAGE AREA
UNIT 68 - VENT AND FLARE
PROPERTY LINE
RETENTION POND
DETENTION POND
CONSTRUCTION ACCESS
GUARD HOUSE
UNIT 68
68Z-70 68Z-71 GROUND FLARE (310' x 270')
UNIT 63
UNIT 62
UNIT 61
UNIT 65
UNIT 66
UNIT 67
UNIT 60
RADIO TOWER
CENTER POINT SWITCHYARD 375' X 350'
65EB-02 PTF ELECTRICAL MAIN SUBSTATION 350' X 350'
650B-03 SECURITY BUILDING
TRUCK TURNING AREA
60K-40A
60K-40B
60K-40C
60K-11A
60K-11B
60K-11C
LAUNCHER/RECEIVER AREA (BY OTHERS)
NIGHT GATE SLIDE TYPE WITH CARD READER
FLNG PRE-TREATMENT FACILITY PROJECT DATUM
N.1100'-0"
E.3000'-0"
EL.100'-0"
PER NAD83
N:13558600'-0"
E:3149000'-0"
EL:8'-0" NAVD88
SECOND SITE ENTRANCE GATE SLIDE TYPE WITH CARD READER
E.1000'-0"
E.1500'-0"
E.2000'-0"
E.2500'-0"
E.3000'-0"
E.3500'-0"
N.500'-0"
N.1000'-0"
N.1500'-0"
N.2000'-0"
N.2500'-0"
N.3000'-0"
N.3500'-0"
N.4000'-0"
N.4500'-0"
0' 50' 100' 200' 300' 400' 500'
SCALE BAR

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REV	DATE	BY	DESCRIPTION	CHK'D	TECH.	PROJ.	ENG	OPS	P.M.
K	26-FEB-2013	BP	ISSUED FOR INFORMATION	RB	AK				
J	26-FEB-2013	RB	ISSUED FOR INFORMATION	RB	AK				
I	31-JAN-2013	RB	ISSUED FOR FERC SUBMITTAL	PO'S	AK				
H	22-JUN-2012	LG	ISSUED FOR FERC SUBMITTAL	DG	AK				
G	17-MAY-2012	RB	ISSUED FOR FERC SUBMITTAL	DG	AK				
				CONTRACTOR		FREEPORT LNG			

FILE NAME: 179811-1009-000-DW-0051-001.0001.DWG

SCALE: SEE SCALE BAR

ZACHRY | CB&I JOINT VENTURE

Project	Unit	Doc Type	Eng Code	Seq No	Rev
1009	000	DW	0051	001	K

FREEPORT LNG

PLOT PLAN

PRE-TREATMENT FACILITY
GRID LAYOUT TO PLANT COORDINATES

	BY	DATE
DESIGN	MJM	17AUG11
DRAWN	MJM	17AUG11

DRAWING NO.

SHEET: 1 OF 1

REV. NO. K

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ATTACHMENT 3

Area Map
Pretreatment Facility and
Liquefaction Plant

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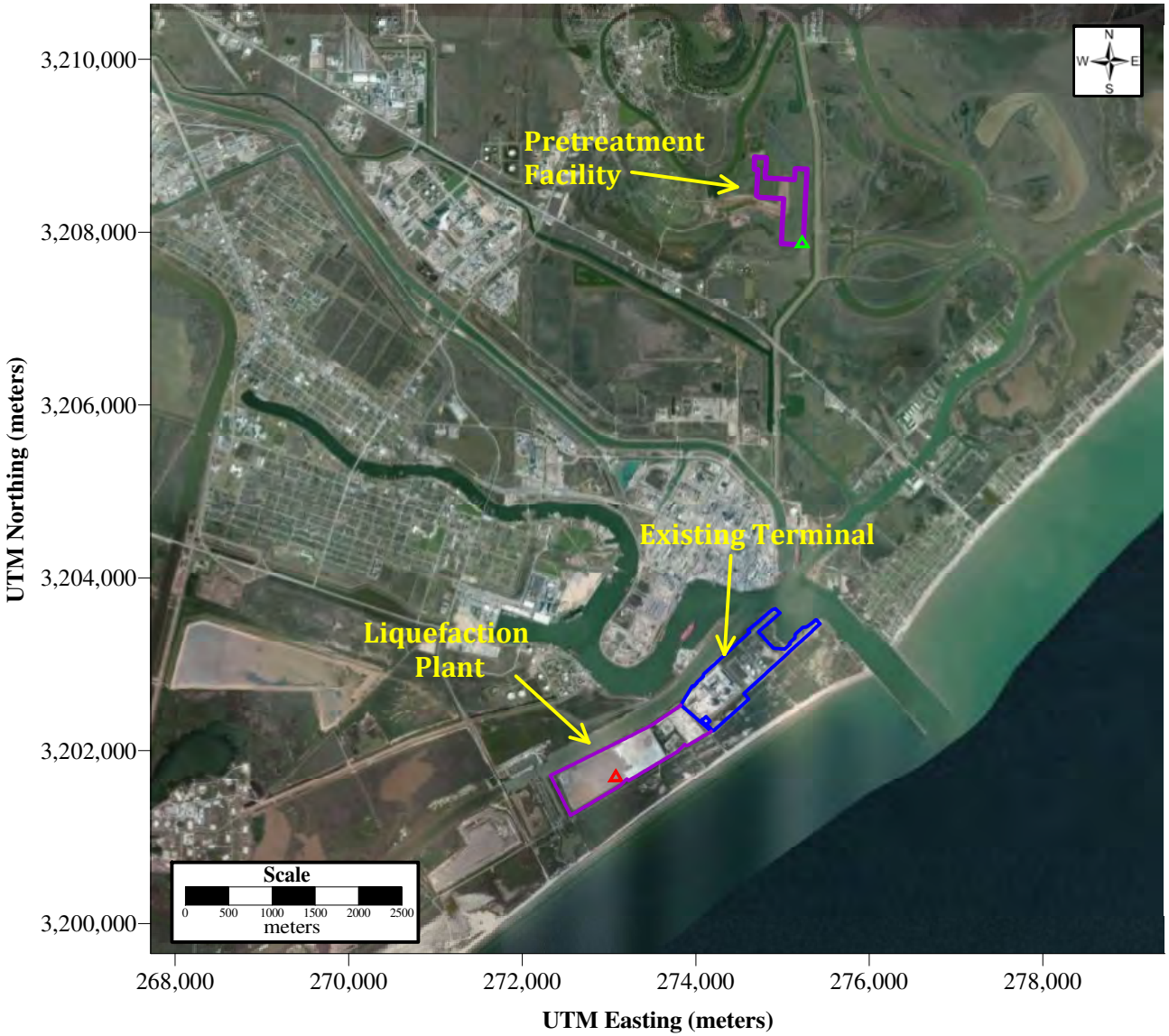
Figure 3-3. Area Map of the Proposed Liquefaction Project



Benchmark coordinates: 275,226 m E, 3,207,869 m N (UTM NAD83, Zone 15)
3,149,000 E, 13,558,600 N (Texas South Central, NAD83, U.S. Survey Feet)

Benchmark coordinates: 273,078 m E, 3,201,689 m N (UTM NAD83, Zone 15)
3,143,000 E, 13,538,000 N (Texas South Central, NAD83, U.S. Survey Feet)

UTM coordinates in Zone 15, NAD83 datum.

Source: 15R 267,719m E 3,200,221m N. Bing Aerial. Accessed: January 22, 2013.

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ATTACHMENT 4

Updated TCEQ Form PI-1
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III. Type of Permit Action Requested (continued)		
H.	Federal Operating Permit Requirements (30 TAC Chapter 122 Applicability) *(continued)*	
2.	Identify the type(s) of FOP(s) issued and/or FOP application(s) submitted/pending for the site. (check all that apply) **To Be Determined**	
GOP Issued ☐	GOP application/revision application submitted or under APD review ☐	
SOP Issued ☐	SOP application/revision application submitted or under APD review ☐	
IV. Public Notice Applicability		
A.	Is this a new permit application or a change of location application?	☒ YES ☐ NO
B.	Is this application for a concrete batch plant? If Yes, complete V.C.1 – V.C.2.	☐ YES ☒ NO
C.	Is this an application for a major modification of a PSD, nonattainment, FCAA 112(g) permit, or exceedance of a PAL permit?	☐ YES ☒ NO
D.	Is this application for a PSD or major modification of a PSD located within 100 kilometers of an affected state?	☐ YES ☒ NO
If *Yes*, list the affected state(s).		
E.	Is this a state permit amendment application? If Yes, complete IV.E.1. – IV.E.3. NO	
1.	Is there any change in character of emissions in this application?	☐ YES ☐ NO
2.	Is there a new air contaminant in this application?	☐ YES ☐ NO
3.	Do the facilities handle, load, unload, dry, manufacture, or process grain, seed, legumes, or vegetables fibers (agricultural facilities)?	☐ YES ☐ NO
F.	List the total annual emission increases associated with the application (*list* **all** *that apply and attach additional sheets as needed*) **:	
Volatile Organic Compounds (VOC): 24 tpy		
Sulfur Dioxide (SO_2): 25 tpy		
Carbon Monoxide (CO): 94 tpy		
Nitrogen Oxides (NO_x): 65 tpy		
Particulate Matter (PM): 87 tpy		
PM $_{10}$ microns or less (PM_{10}): 87 tpy		
PM $_{2.5}$ microns or less ($PM_{2.5}$): 87 tpy		
Lead (Pb): 0.00 tpy		
Hazardous Air Pollutants (HAPs): 6.13 tpy		
Other speciated air contaminants **not** listed above: CO_2e :1,561,559 tpy; H_2SO_4 : 2 tpy; H_2S : 2 tpy; NH_3 : 76.5 tpy		

****Total emissions increases for the Liquefaction Project including Liquefaction Plant and Pretreatment Facilities.**

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ATTACHMENT 5

Updated Table1(a)
Liquefaction Project

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_2e	15210.33	24978.40
			CO_2	15195.43	24953.93
			N_2O	0.03	0.05
			CH_4	0.29	0.47
65B-81B	65B-81B	Heating Medium Heater B	CO_2e	15210.33	24976.91
			CO_2	15195.43	24953.93
			N_2O	0.03	0.04
			CH_4	0.29	0.47
65B-81C	65B-81C	Heating Medium Heater C	CO_2e	15210.33	24978.40
			CO_2	15195.43	24953.93
			N_2O	0.03	0.05
			CH_4	0.29	0.47
65B-81D	65B-81D	Heating Medium Heater D	CO_2e	15210.33	2555.34
			CO_2	15195.43	2552.83
			N_2O	0.03	0.00
			CH_4	0.29	0.05
65B-81E	65B-81E	Heating Medium Heater E	CO_2e	15210.33	2555.34
			CO_2	15195.43	2552.83
			N_2O	0.03	0.00
			CH_4	0.29	0.05
TO1	AU1/TO1	Amine Unit / Thermal Oxidizer 61	CO_2e	68799.20	301340.50
			CO_2	68798.63	301337.99
			N_2O	0.00	0.005
			CH_4	0.01	0.05
TO2	AU2/TO2	Amine Unit / Thermal Oxidizer 62	CO_2e	68799.20	301340.50
			CO_2	68798.63	301337.99
			N_2O	0.00	0.005
			CH_4	0.01	0.05
TO3	AU3/TO3	Amine Unit / Thermal Oxidizer 63	CO_2e	68799.20	301340.50
			CO_2	68798.63	301337.99
			N_2O	0.00	0.005
			CH_4	0.01	0.05

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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**
CT	CT	Combustion Turbine	CO_2e	128234.77	561668.31
			CO_2	128109.13	561117.99
			N_2O	0.24	1.06
			CH_4	2.42	10.58
PTFFLARE	PTFFLARE	PTF Flare	CO_2e	92.16	2211.94
			CO_2	92.00	2208.07
			N_2O	0.00	0.01
			CH_4	0.00	0.06
PTFFWP	PTFFWP	Fire Water Pump - Pretreatment	CO_2e	755.84	37.79
			CO_2	753.30	37.67
			N_2O	0.01	0.000
			CH_4	0.03	0.002
PTFEG-1	PTFEG-1	Emergency Generator Train 61	CO_2e	864.63	21.62
			CO_2	861.73	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001
PTFEG-2	PTFEG-2	Emergency Generator Train 62	CO_2e	864.63	21.62
			CO_2	861.73	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001
PTFEG-3	PTFEG-3	Emergency Generator Train 63	CO_2e	864.63	21.62
			CO_2	861.73	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001
PTFEG-4	PTFEG-4	Emergency Generator Utility Area	CO_2e	864.63	21.62
			CO_2	861.73	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001
PTFEG-5	PTFEG-5	Emergency Generator Utility Area	CO_2e	864.63	21.62
			CO_2	861.73	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001

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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_2e	343.56	8.59
			CO_2	342.41	8.56
			N_2O	0.00	0.000
			CH_4	0.01	0.000
FUG-TREAT	FUG-TREAT	Pretreatment VOC Fugitives	CO_2e	124.95	547.27
			CO_2	0.00	0.000
			N_2O	0.00	0.000
			CH_4	5.95	26.06
FUG-PTFSF6	FUG-PTFSF6	Pretreatment Circuit Breakers	CO_2e	13.34	58.44
			SF_6	0.001	0.002
LIQFWP-1	LIQFWP-1	Fire Water Pump - Liquefaction	CO_2e	1030.70	51.53
			CO_2	1027.24	51.36
			N_2O	0.01	0.000
			CH_4	0.04	0.002
LIQFWP-2	LIQFWP-2	Fire Water Pump Backup - Liquefaction	CO_2e	1030.70	51.53
			CO_2	1027.24	51.36
			N_2O	0.01	0.000
			CH_4	0.04	0.002
LIQEG-1	LIQEG-1	Emergency Generator 1 - Liquefaction	CO_2e	864.64	21.62
			CO_2	861.74	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001
LIQEG-2	LIQEG-2	Emergency Generator 2 - Liquefaction	CO_2e	864.64	21.62
			CO_2	861.74	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001
LIQEG-3	LIQEG-3	Emergency Generator 3 - Liquefaction	CO_2e	864.64	21.62
			CO_2	861.74	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001
LIQEG-4	LIQEG-4	Emergency Generator 4 - Liquefaction	CO_2e	864.64	21.62
			CO_2	861.74	21.54
			N_2O	0.01	0.000
			CH_4	0.03	0.001

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**
LIQEG-5	LIQEG-5	Guard House / Admin Area	CO_2e	864.64	21.62
			CO_2	861.74	21.54
			N_2O	0.01	0.00
			CH_4	0.03	0.00
LIQEAC-1	LIQEAC-1	Emergency Air Compressor	CO_2e	344	8.59
			CO_2	342	8.56
			N_2O	2.78E-03	0.00
			CH_4	1.39E-02	0.00
LIQEG-6	LIQEG-6	Dock 2	CO_2e	458	11.45
			CO_2	457	11.41
			N_2O	3.70E-03	0.00
			CH_4	1.85E-02	0.00
LIQFLARE	LIQFLARE	Ground Flare - Liquefaction	CO_2e	160.04	11523.03
			CO_2	159.89	11511.74
			N_2O	0.00	0.02
			CH_4	0.00	0.22
FUG-LIQ	FUG-LIQ	Liquefaction Fugitives	CO_2e	173.21	758.68
			CO_2	0.00	0.000
			N_2O	0.00	0.000
			CH_4	8.25	36.13
FUG-LIQSF6	FUG-LIQSF6	Liquefaction Circuit Breakers	CO_2e	77.52	339.56
			SF_6	0.003	0.014

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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			EMISSION POINT DISCHARGE PARAMETERS										
1. Emission Point			4. UTM Coordinates of Emission Point			Source							
						5. Building Height	6. Height Above Ground	7. Stack Exit Data			8. Fugitives		
EPN (A)	FIN (B)	Name ©	Zone	East (Meters)	North (Meters)	(Ft.)	(Ft.)	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 - Liquefaction	15	273,958	3,202,732		14	0.83	140.00	1,187			
LIQFW-2	LIQFW-2	Fire Water Pump Backup - 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	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	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								

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ATTACHMENT 6

Updated Emissions Summary Tables
Liquefaction Project

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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_2O**	**SF_6**	**CO_2e** [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	51.36	0.002	0.0004	--	52
LIQFW-2	Fire Water Pump Backup	51.36	0.002	0.0004	--	52
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
LIQFLARE	Guard House / Admin Area	21.54	0.001	0.0002	--	22
FUG-LIQ	Emergency Air Compressor	8.56	0.000	0.0001	--	9
FUG-LIQSF6	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		**1,559,203.59**	**74.72**	**1.25**	**0.017**	**1,561,559**

Pretreatment Facility GHG Summary of Emissions

EPN	Description	Annual Emissions (tons/yr)				
		CO_2	CH_4	N_2O	SF_6	CO_2e [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] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Annual Emission Rate (ton/yr) = CO_2 Emission Rate (ton/yr) x CO_2 GWP + CH_4 Emission Rate (ton/yr) x CH_4 GWP + N_2O Emission Rate (ton/yr) x N_2O GWP + SF_6 Emission Rate (ton/yr) x SF_6 GWP

Example CO_2e Emission Rate for PTFFWP (ton/yr) = $\frac{38 \text{ ton}}{\text{yr}} \left| \frac{1}{} \right. + \frac{1.53\text{E-}03 \text{ ton}}{\text{yr}} \left| \frac{21}{} \right. + \frac{3.06\text{E-}04 \text{ ton}}{\text{yr}} \left| \frac{310}{} \right. = 38 \text{ ton/yr}$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials

CO_2	1
CH_4	21
N_2O	310
SF_6	23,900

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Liquefaction Plant GHG Summary of Emissions

EPN	Description	Annual Emissions (tons/yr) CO_2	CH_4	N_2O	SF_6	CO_2e [1]
LIQFWP-1	Fire Water Pump	51.36	2.08E-03	4.17E-04	--	52
LIQFW-2	Fire Water Pump Backup	51.36	2.08E-03	4.17E-04	--	52
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	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	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	**11,742.16**	**36.35**	**0.02**	**0.01**	**12,852**

[1] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Emission Rate (ton/yr) = CO_2 Emission Rate (ton/yr) x CO_2 GWP + CH_4 Emission Rate (ton/yr) x CH_4 GWP + N_2O Emission Rate (ton/yr) x N_2O GWP + SF_6 Emission Rate (ton/yr) x SF_6 GWP

Example CO_2e Emission Rate for LIQFWP (ton/yr) = $\frac{051\ \text{lb}}{\text{hr}} \left| \frac{1}{} \right. + \frac{2.08\text{E-}03\ \text{lb}}{\text{hr}} \left| \frac{21}{} \right. + \frac{4.17\text{E-}04\ \text{lb}}{\text{hr}} \left| \frac{310}{} \right.$ = 52 ton/yr

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials

CO_2	1
CH_4	21
N_2O	310
SF_6	23,900

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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

		Heaters with CT Up					Heaters with CT Down				
Parameter	Units	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_2O [2]	0.0006	kg N_2O/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_2O [2]	0.0001	kg N_2O/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.

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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) CO_2	CH_4	N_2O	CO_2e [4]	Annual Emissions [3] (tons/yr) CO_2	CH_4	N_2O	CO_2e [4]	BACT Limit lb CO_2e/MMBtu
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_2e Emissions [4]	-	-	-	209,709	-	-	-	641,867	

[1] CO_2 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.
CH_4 and N_2O 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 CO_2 Hourly Emissions (lb/hr) = $\frac{73.96 \text{ kg CO2}}{\text{MMBtu}} \times \frac{4.62 \text{ MMBtu}}{\text{hr}} \times \frac{2.2046 \text{ lb}}{\text{kg}}$ = 753 lb/hr

[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 CO_2 Annual Emissions (tons/yr) = $\frac{753 \text{ lb}}{\text{hr}} \times \frac{100 \text{ hr}}{\text{yr}} \times \frac{\text{tons}}{2000 \text{ lb}}$ = 38 tons/yr

[4] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Hourly Emission Rate (lb/hr) = CO_2 Emission Rate (lb/hr) x CO_2 GWP + CH_4 Emission Rate (lb/hr) x CH_4 GWP + N_2O Emission Rate (lb/hr) x N_2O GWP

Example CO_2e Hourly Emission Rate (lb/hr) = $\frac{753 \text{ lb}}{\text{hr}} \times 1 + \frac{0.03 \text{ lb}}{\text{hr}} \times 21 + \frac{6.11E\text{-}03 \text{ lb}}{\text{hr}} \times 310$ = 756 lb/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_2O	310

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

Sources of GHG Emissions

Source Name	Units	Fire Water Pump	Fire Water Pump Backup	Emergency Generator 1	Emergency Generator 2	Emergency Generator 3	Emergency Generator 4	Guard House / Admin Area	Emergency Air Compressor	Dock 2
EPN	-	LIQFWP-1	LIQFWP-2	LIQEG-1	LIQEG-2	LIQEG-3	LIQEG-4	LIQEG-5	LIQEAC-1	LIQEG-6
Rated Capacity	hp	900	900	755	755	755	755	755	300	400
Heat Input Capacity [1]	MMBtu/hr	6.30	6.30	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	4,500	4,500	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_2O [2]	0.0006	kg N_2O/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) CO_2	CH_4	N_2O	CO_2e	Annual Emissions [3] (tons/yr) CO_2	CH_4	N_2O	CO_2e
LIQFWP-1	Fire Water Pump	No.2 Fuel Oil	Tier I	1027	4.17E-02	8.33E-03	1031	51.36	2.08E-03	4.17E-04	51.53
LIQFWP-2	Fire Water Pump Backup	No.2 Fuel Oil	Tier I	1027	4.17E-02	8.33E-03	1031	51.36	2.08E-03	4.17E-04	51.53
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	Guard House / Admin Area	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	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	7,162.13	0.29	0.06	7,186	230.42	9.35E-03	1.87E-03	231
			Total CO_2e Emissions [4]		-	-	7,186		-	-	231

[1] CO_2 emissions from No.2 Fuel Oil combustion calculated per Equation C-1 and Tier I methodology provided in 40 CFR Part 98, Subpart C.
CH_4 and N_2O 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) = $\frac{73.96 \text{ kg CO2}}{\text{MMBtu}} \times \frac{6.3 \text{ MMBtu}}{\text{hr}} \times \frac{2.20462 \text{ lb}}{\text{kg}}$ = 1027 lb/hr

[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) = $\frac{1027 \text{ lb}}{\text{hr}} \times \frac{100 \text{ hr}}{\text{yr}} \times \frac{\text{tons}}{2000 \text{ lb}}$ = 51 tons/yr

[4] CO_2e emissions based on GWPs for each greenhouse gas pollutant
CO_2e Hourly Emission Rate (lb/hr) = CO_2 Emission Rate (lb/hr) x CO_2 GWP + CH_4 Emission Rate (lb/hr) x CH_4 GWP + N_2O Emission Rate (lb/hr) x N_2O GWP

Example CO_2e Hourly Emission Rate (lb/hr) = $\frac{1027 \text{ lb}}{\text{hr}} \times 1 + \frac{0.04 \text{ lb}}{\text{hr}} \times 21 + \frac{8.33E\text{-}03 \text{ lb}}{\text{hr}} \times 310$ = 1031 lb/hr

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials.

CO_2	1
CH_4	21
N_2O	310

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Freeport LNG Development, L.P.
Pretreatment Facility GHG Process Emissions from the Thermal Oxidizer

Thermal Oxidizer Process GHG Potential Emission Calculations

FIN	EPN	Source Name	Total Molar Flow for CO_2 [1] (lbmol/hr)	Annual Hours of Operation (hr/yr)	Hourly Emissions for CO_2 [2] (lb/hr)	Annual Emissions for CO_2 [3] (tpy)
TO1	TO1	Amine Unit / Thermal Oxidizer 61	1,550.32	8,760	68,214	298,778
TO2	TO2	Amine Unit / Thermal Oxidizer 62	1,550.32	8,760	68,214	298,778
TO3	TO3	Amine Unit / Thermal Oxidizer 63	1,550.32	8,760	68,214	298,778
				Total CO_2 Emissions	**204,643**	**896,334**

[1] Total molar flow for carbon dioxide obtained from Anguil Environmental Systems Thermal Oxidizer Proposal dated September 28, 2011.

[2] Hourly Emissions (lb/hr) = Total Molar Flow (lbmol/hr) * Molecular Weight of CO_2

$$\text{EPN TO1 } CO_2 \text{ Hourly Emissions (lb/hr)} = \frac{1{,}550.32 \text{ lb mol}}{\text{hr}} \times \frac{44 \text{ lb}}{\text{lbmol}} = 68{,}214 \text{ lb/hr}$$

[3] Annual Emissions (tpy) = Hourly Emissions (lb/hr) * Annual Operating Hours (hrs/yr) * 1 / 2,000 (ton/lb)

$$\text{EPN TO1 } CO_2 \text{ Annual Emissions (tpy)} = \frac{68{,}214 \text{ lb}}{\text{hr}} \times \frac{8{,}760 \text{ hr}}{\text{yr}} \times \frac{1 \text{ ton}}{2{,}000 \text{ lb}} = 298{,}778 \text{ tpy}$$

Thermal Oxidizer Combustion Emissions

Parameter	Units	Amine Unit / Thermal Oxidizer 61	Amine Unit / Thermal Oxidizer 62	Amine Unit / Thermal Oxidizer 63
EPN	-	TO1	TO2	TO3
Rated Capacity [1]	MMBtu/hr	5	5	5
Hours of Operation per Year	hrs/yr	8,760	8,760	8,760
Natural Gas Potential Throughput [2]	scf/yr	42,607,004	42,607,004	42,607,004
Natural Gas High Heat Value (HHV) [3]	MMBtu/scf	0.001	0.001	0.001

[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 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_2O [2]	0.0001	kg N_2O/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.

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GHG Potential Emission Calculations for Combustion of Natural Gas

EPN	Description	Fuel Type	Tier Used	Hourly Emissions [1, 2] (lb/hr) CO_2	CH_4	N_2O	CO_2e [4]	Annual Emissions [3] (tons/yr) CO_2	CH_4	N_2O	CO_2e [4]
TO1	Amine Unit / Thermal Oxidizer 61	Natural Gas	Tier I	584	0.01	1.10E-03	585	2,560	4.83E-02	4.83E-03	2,562
TO2	Amine Unit / Thermal Oxidizer 62	Natural Gas	Tier I	584	0.01	1.10E-03	585	2,560	4.83E-02	4.83E-03	2,562
TO3	Amine Unit / Thermal Oxidizer 63	Natural Gas	Tier I	584	0.01	1.10E-03	585	2,560	4.83E-02	4.83E-03	2,562
			Total	1,753.32	0.03	3.31E-03	1,755	7,679.53	0.14	0.01	7,687
			Total CO_2e Emissions [4]	-	-	-	1,755	-	-	-	7,687

[1] CO_2 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.
CH_4 and N_2O 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 CO_2 Hourly Emissions (lb/hr) = $\frac{53.02 \text{ kg CO2}}{\text{MMBtu}} \times \frac{5 \text{ MMBtu}}{\text{hr}} \times \frac{2.2046 \text{ lb}}{\text{kg}}$ = 584 lb/hr

[2] kg to lb conversion 2.2046 lb/kg

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

Example CO_2 Annual Emissions (tons/yr) = $\frac{584 \text{ lb}}{\text{hr}} \times \frac{8760 \text{ hr}}{\text{yr}} \times \frac{\text{tons}}{2000 \text{ lb}}$ = 2560 tons/yr

[4] CO_2e emissions based on GWPs for each greenhouse gas pollutant
CO_2e Hourly Emission Rate (lb/hr) = CO_2 Emission Rate (lb/hr) x CO_2 GWP + CH_4 Emission Rate (lb/hr) x CH_4 GWP + N_2O Emission Rate (lb/hr) x N_2O GWP

Example CO_2e Hourly Emission Rate (lb/hr) = $\frac{584 \text{ lb}}{\text{hr}} \times 1 + \frac{0.01 \text{ lb}}{\text{hr}} \times 21 + \frac{1.10E\text{-}03 \text{ lb}}{\text{hr}} \times 310$ = 585 lb/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_2O	310

Thermal Oxidizer Total GHG Potential Emission

FIN	EPN	Source Name	Hourly Emissions (lb/hr) CO_2 [1]	CH_4 [2]	N_2O [2]	CO_2e [3]	Annual Emissions (tons/yr) CO_2 [1]	CH_4 [2]	N_2O [2]	CO_2e [3]
TO1	TO1	Amine Unit / Thermal Oxidizer 1	68,799	0.01	1.10E-03	68,799	301,338	4.83E-02	4.83E-03	301,341
TO2	TO2	Amine Unit / Thermal Oxidizer 2	68,799	0.01	1.10E-03	68,799	301,338	4.83E-02	4.83E-03	301,341
TO3	TO3	Amine Unit / Thermal Oxidizer 3	68,799	0.01	1.10E-03	68,799	301,338	4.83E-02	4.83E-03	301,341
		Total	206,396	0.03	0.00	206,397.61	904,014	0.14	0.01	904,022
		Total CO_2e Emissions [4]	-	-	-	206,398	-	-	-	904,022

[1] CO_2 Emissions are the sum of Thermal Oxidizer combustion and process GHG Emissions

Example CO_2 Hourly Emission Calculations (lb/hr) = $\frac{68,214 \text{ lb}}{\text{hr}} + \frac{584 \text{ lb}}{\text{hr}}$ = 68,799 lb/hr

[2] CH_4 and N_2O Emissions are the from Thermal Oxidizer combustion only

[4] CO_2e emissions based on GWPs for each greenhouse gas pollutant
CO_2e Hourly Emission Rate (lb/hr) = CO_2 Emission Rate (lb/hr) x CO_2 GWP + CH_4 Emission Rate (lb/hr) x CH_4 GWP + N_2O Emission Rate (lb/hr) x N_2O GWP

Example CO_2e Annual Emission Rate (lb/hr) = $\frac{68799 \text{ lb}}{\text{hr}} \times 1 + \frac{0.01 \text{ lb}}{\text{hr}} \times 21 + \frac{1.10E\text{-}03 \text{ lb}}{\text{hr}} \times 310$ = 68,799 lb/hr

Per 40 CFR 98 - Mandatory Greenhouse Gas Reporting, Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials.

CO_2	1
CH_4	21
N_2O	310

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Flare Design and Operational Parameters

Flare Parameters [1]	Value	Units
Pilot Gas Flow	1,870,000	Btu/hr
Annual Pilot Gas Flow	16,381	MMBtu/yr
Molecular Weight	18.3	lb/lbmol
Heating Value of Flare Gas	1,080	Btu/scf
Flare Design Basis	945,000	lb/hr
Flare Design Basis	19,984,426	scf/hr
Annual volumetric flow rate based on MSS events	167,212,461	scf/yr [2]
Annual mass flow rate based on MSS events	3,953	tpy [3]

[1] Data obtained from Callidus Flare Proposal 10/3/2011

[2] Flow rate (scf/yr) calculated by Mr. Ruben Velasquez (Atkins) submitted to Mr. John Barrientez via email on October 24,2011. The total flow is equivalent to one start-up and shut-down event each year.

[3] Annual Mass Flow rate Based on MSS Events (tpy) = Volumetric Flow Rate (scf/yr) * Molecular Weight (lb/mol) * 1 / 2,000 (ton/lb) / 387 (scf/lbmol)

$$\text{Annual mass flow rate based on MSS events (tpy)} = \frac{167{,}212{,}461 \text{ scf}}{\text{yr}} \times \frac{18.3 \text{ lb}}{\text{lbmol}} \times \frac{1 \text{ ton}}{2{,}000 \text{ lb}} \times \frac{\text{lbmol}}{387 \text{ scf}} = 3{,}953 \text{ tpy}$$

GHG Emission Factors - Natural Gas Combustion

Greenhouse Gas	Emission Factor [1] (kg/MMBtu)
CO_2	53.02
CH_4	1.0E-03
N_2O	1.0E-04

[1] Per 40 CFR Part 98 dated December 17, 2010, Table C-1 of Subpart C - *Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel* and Table C-2 of Subpart C - *Default CH_4 and N_2O Emission Factors for Various Types of Fuel*. Emission factors for natural gas (unspecified heat value, weighted U.S. average) are used.

GHG Emission Rates From the Flare

Heat Input Capacity [1] (MMBtu/yr)	Annual Emissions [2, 3] (tons/yr)			
	CO_2	CH_4	N_2O	CO_2e [4]
196,970.66	11,512	0.22	0.02	11,523

[1] Heat Input Capacity (MMBtu/yr) = Annual Natural Gas Flowrate (scf/yr) * Higher Heating Value (Btu/scf) * 1 / 1,000,000 (Btu/MMBtu) + Pilot Gas Annual Flowrate (MMBtu/yr)

$$\text{Heat Input Capacity (MMBtu/yr)} = \frac{167{,}212{,}461 \text{ scf}}{\text{yr}} \times \frac{1{,}080 \text{ Btu}}{\text{scf}} \times \frac{\text{MMBtu}}{1{,}000{,}000 \text{ Btu}} + \frac{16{,}381 \text{ MMBtu}}{\text{yr}} = 196{,}971 \text{ MMBtu/yr}$$

[2] Annual Emissions (tons/yr) = Emission Factor (kg/MMBtu) * Heat Input Capacity (MMBtu/yr) * 0.001102 (ton/kg)

$$\text{Annual Emissions of } CO_2 \text{ (tons/yr)} = \frac{53.02 \text{ kg}}{\text{MMBtu}} \times \frac{196{,}970.66 \text{ MMBtu}}{\text{yr}} \times \frac{0.001102 \text{ tons}}{\text{kg}} = 11{,}511.74 \text{ tons/yr}$$

[3] kg to lb conversion 0.0011023 ton/kg

[4] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Annual Emission Rate (tons/yr) = CO_2 Emission Rate (tons/yr) x CO_2 GWP + CH_4 Emission Rate (tons/yr) x CH_4 GWP + N_2O Emission Rate (tons/yr) x N_2O GWP

$$\text{Example } CO_2e \text{ Annual Emission Rate (tons/yr)} = \frac{11{,}512 \text{ tons}}{\text{yr}} \times 1 + \frac{2.17\text{E-}01 \text{ tons}}{\text{yr}} \times 21 + \frac{2.17\text{E-}02 \text{ tons}}{\text{yr}} \times 310 = 11{,}523 \text{ tons/yr}$$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting*, Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials

CO_2	1
CH_4	21
N_2O	310

US EPA ARCHIVE DOCUMENT

Flare Design and Operational Parameters

Flare Parameters [1]	Value	Units
Pilot Gas Heating Value	0.001	MMBtu/scf
Pilot Gas Flow[2]	3,230	scf/hr
Annual Pilot Heat Input	28,295	MMBtu/yr
Heating Value of Flare Gas	2,695	Btu/scf
Waste Gas Flow Rate	379,981	scf/hr
Waste Gas Annual Venting Basis	8	hrs/yr

[1] Data obtained from Callidus Flare Proposal dated 9/12/2011.

[2] Based on email from Ruben Valasquez 2/21/13

GHG Emission Factors - Natural Gas and Propane Combustion

Greenhouse Gas	Natural Gas Emission Factors [1] (kg/MMBtu)	Propane Emission Factor [2] (kg/MMBtu)
CO_2	53.02	61.46
CH_4	1.0E-03	3.00E-03
N_2O	1.0E-04	6.00E-04

[1] Per 40 CFR Part 98 dated December 17, 2010, Table C-1 of Subpart C - *Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel* and Table C-2 of Subpart C - *Default CH_4 and N_2O Emission Factors for Various Types of Fuel*.

[2] Per 40 CFR Part 98 dated December 17, 2010, Table C-1 of Subpart C - *Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel* and Table C-2 of Subpart C - *Default CH_4 and N_2O Emission Factors for Various Types of Fuel*.

GHG Emission Rates From the Flare

Annual Pilot Heat Input (MMBtu/yr)	Waste Gas Heat Input [1] (MMBtu/yr)	Annual Emissions [2, 3] (tons/yr) CO_2	CH_4	N_2O	CO_2e [4]
28,295	8,192.39	2,208.07	5.83E-02	8.53E-03	2,211.94

[1] Waste Gas Heat Input (MMBtu/yr) = Waste Gas Flowrate (scf/hr) * Heating Value of Flare Gas (Btu/scf) * 1 / 1,000,000 (Btu/MMBtu) * Waste Gas Annual Venting Basis (hrs/yr)

$$\text{Heat Input Capacity (MMBtu/yr)} = \frac{379{,}981\ \text{scf}}{\text{hr}} \times \frac{2{,}695\ \text{Btu}}{\text{scf}} \times \frac{\text{MMBtu}}{1{,}000{,}000\ \text{Btu}} \times \frac{8\ \text{hrs}}{\text{yr}} = 8{,}192.39\ \text{MMBtu/yr}$$

[2] Annual Emissions (tons/yr) = Natural Gas Emission Factor (kg/MMBtu) * Annual Pilot Heat Input (MMBtu/yr) * 0.001102 (ton/kg) + Propane Emission Factor (kg/MMBtu) * Waste Gas Heat Input (MMBtu/yr) * 0.001102 (ton/kg)

$$\text{Annual Emissions of } CO_2 \text{ (metric tons/yr)} = \frac{53.02\ \text{kg}}{\text{MMBtu}} \times \frac{28{,}294.80\ \text{MMBtu}}{\text{yr}} \times \frac{0.001102\ \text{tons}}{1\ \text{kg}} + \frac{61.46\ \text{kg}}{\text{MMBtu}} \times \frac{8{,}192.39\ \text{MMBtu}}{\text{yr}} \times \frac{0.001102\ \text{tons}}{1\ \text{kg}} = 2208.07\ \text{tons/yr}$$

[3] kg to lb conversion 0.001102 ton/kg

[4] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Annual Emission Rate (tons/yr) = CO_2 Emission Rate (tons/yr) x CO_2 GWP + CH_4 Emission Rate (tons/yr) x CH_4 GWP + N_2O Emission Rate (tons/yr) x N_2O GWP

$$\text{Example } CO_2e \text{ Annual Emission Rate (tons/yr)} = \frac{2208.07\ \text{tons}}{\text{yr}} \times 1 + \frac{5.83\text{E-}02\ \text{tons}}{\text{yr}} \times 21 + \frac{8.53\text{E-}03\ \text{tons}}{\text{yr}} \times 310 = 2211.94\ \text{tons/yr}$$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting*, Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials

CO_2	1
CH_4	21
N_2O	310

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Freeport LNG Development, L.P.
Pretreatment GHG Fugitives Emissions

Freeport LNG
Pretreatment Facility

FIN/EPN: FUG-TREAT

Pretreatment VOC Fugitives

Components [1]	Phase	Oil and Gas Production Factors [1] (lb/hr/component)	Actual Component Count [2]	Assumed % CH_4 content	28 MID Credit % [1]	Controlled VOC Emission Rates [3,4] (lb/hr)	(tpy)
Valves	Gas/ Vapor	0.00992	3,684	91.40	97	1.00	4.39
	Light Liquid	0.0055	871	91.40	97	0.13	0.58
	Heavy Liquid	0.0000185	543	91.40	0	9.17E-03	0.04
Pressure Relief Valves	Gas/Vapor	0.0194	144	91.40	97	0.08	0.33
Pump Seals	Light Liquid	0.02866	11	91.40	93	0.02	0.09
	Heavy Liquid	0.00113	6	91.40	0	6.46E-03	0.03
Flanges/Connectors	Gas/ Vapor	0.00086	7,978	91.40	30	4.39	19.23
	Light Liquid	0.000243	1,780	91.40	30	0.28	1.21
	Heavy Liquid	0.00000086	1,451	91.40	30	7.99E-04	3.50E-03
Compressor Seals	Gas/Vapor	0.0194	30	91.40	95	0.03	0.12
Open Ended Lines	All	0.00441	0	91.40	97	--	--
Sampling Connections	All	0.033	11	91.40	97	0.01	0.04
TOTAL EMISSIONS (CH_4)						**5.95**	**26.06**
TOTAL EMISSIONS (CO_2e) [5]						**124.95**	**547.27**

[1] Values obtained from *Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives, Air Permits Division, TCEQ* (October 2000).

[2] Data provided by Mr. Ruben Velasquez (Atkins) to Ms. Melissa Dakas (Trinity Consultants) via email on October 7, 2011 and October 13, 2011.

[3] Hourly Controlled CH_4 Emission Rate (lb/hr) = Oil and Gas Factor * Component Count * (%CH_4 content in LNG / 100)*(1-28MID Credit % / 100)

$$\text{Hourly Emission Rate for Valves from Gas/Vapor (tpy)} = \frac{9.92\text{E-}03 \text{ MMbtu}}{\text{hr/component}} \times 3{,}684 \times \frac{91.40}{100} \times \frac{97.00}{100} =$$

[4] Annual Controlled CH_4 Emission Rate (tpy) = Hourly CH_4 Emission Rate (lb/hr) * 8,760 (hr/yr) / 2,000 (lb/ton)

$$\text{Annual Emission Rate for Valves from Gas/Vapor (tpy)} = \frac{1 \text{ lb}}{\text{hr}} \times \frac{8{,}760 \text{ hr}}{\text{yr}} \times \frac{1 \text{ ton}}{2{,}000 \text{ lb}} = 4.39 \text{ tpy}$$

[5] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Hourly Emission Rate (lb/hr) = CH_4 Emission Rate (lb/hr) x CH_4 GWP

$$\text{Example } CO_2e \text{ Hourly Emission Rate (lb/hr)} = \frac{5.95 \text{ lb}}{\text{hr}} \times 21 = 124.95 \text{ lb/hr}$$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials.

CO_2	1
CH_4	21

US EPA ARCHIVE DOCUMENT

Liquefaction Fugitives

Components	Phase	Oil and gas Production Factors [1] (lb/hr/component)	Actual Component Count [2]	Assumed % CH_4 content	28 MID Credit %	Controlled VOC Emission Rates[3,4] (lb/hr)	(tpy)
Valves	Gas/ Vapor	0.0099	5,659	91.40	97	1.54E+00	6.73
Pressure Relief Valves	Gas/Vapor	0.0194	225	91.40	97	1.20E-01	0.52
Pump Seals	Light Liquid	0.0287	11	91.40	93	2.07E-02	0.09
Flanges/Connectors	Gas/ Vapor	0.0009	11,314	91.40	30	6.51E+00	28.53
Compressor Seals	Gas/Vapor	0.0194	30	91.40	95	2.66E-02	0.12
Open Ended Lines	All	0.0040	0	91.40	97	0.00E+00	0.00
Sampling Connections	All	0.0330	34	91.40	97	3.05E-02	0.13
Other	All	0.0194	0	91.40	97	0.00E+00	0.00
TOTAL EMISSIONS (CH_4)						**8.25**	**36.13**
TOTAL EMISSIONS (CO_2e)[5]						**173.21**	**758.68**

[1] Values obtained from *Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives, Air Permits Division, TCEQ* (10/00).

[2] Data provided by Mr. Ruben Velasquez (Atkins) to Ms. Melissa Dakas (Trinity Consultants) via email on October 7, 2011.

[3] Hourly Controlled CH_4 Emission Rate (lb/hr) = Oil and Gas Factor * Component Count * (%CH_4 content in LNG / 100)*(1-28MID Credit % / 100)

$$\text{Hourly Emission Rate for Valves from Gas/Vapor (tpy)} = \frac{9.90\text{E-}03 \text{ lb}}{\text{MMBtu}} \times 5659 \times \frac{91.40}{100} \times \frac{97.00}{100} = 1.54 \text{ lb/hr}$$

[4] Annual Controlled CH_4 Emission Rate (tpy) = Hourly CH_4 Emission Rate (lb/hr) * 8,760 (hr/yr) / 2,000 (lb/ton)

$$\text{Annual Emission Rate for Valves from Gas/Vapor (tpy)} = \frac{1.54\text{E+}00 \text{ lb}}{\text{hr}} \times \frac{8{,}760 \text{ hr}}{\text{yr}} \times \frac{1 \text{ ton}}{2{,}000 \text{ lb}} = 6.73 \text{ tpy}$$

[5] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Hourly Emission Rate (lb/hr) = CH_4 Emission Rate (lb/hr) x CH_4 GWP

$$\text{Example } CO_2e \text{ Hourly Emission Rate (lb/hr)} = \frac{8.25 \text{ lb}}{\text{hr}} \times 21 = 173.21 \text{ lb/hr}$$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1. Total CO_2e emissions are calculated based on the following Global Warming Potentials

CO_2	1
CH_4	21

US EPA ARCHIVE DOCUMENT

Freeport LNG Development, L.P.
Liquefaction Project Circuit Breaker Emissions

Liquefaction Project SF_6 Inventory

Area	Liquefaction	Liquefaction	Pretreatment
Breaker Rating	138 kV	69 kV	138 kV
Number of Breakers	13	27	6
SF_6 lb per Breaker	163	132	163

Liquefaction Project SF_6 GHG Emissions

Component	Liquefaction		Pretreatment	
Total Project SF_6 Capacity (lb) [1]	5683	lb	978	lb
Leak Rate	0.50%	% per year	0.50%	% per year
Potential Annual Leakage [2]	28.42	lb SF_6/year	4.89	lb SF6/year
	0.014	ton/year.	0.002	ton/year.
	0.003	lb/hr	0.001	lb/hr
Annual CO_2e emissions [3]	339.56	ton/year.	58.44	ton/year.
	77.52	lb/hr	13.34	lb/hr

[1] Total Project SF_6 Capacity (lb) = ∑(Number of breakers * SF_6 lb per Breaker)

Example, Total Project SF_6 Capacity (lb) for Liquefaction = $\frac{13 \text{ Breaker}}{} \times \frac{163 \text{ lb SF6}}{\text{Breaker}} + \frac{27 \text{ Breaker}}{} \times \frac{132 \text{ lb SF6}}{\text{Breaker}} = 5683 \text{ lb}$

[2] Potential Annual Leakage calculated as follows

Total as lb SF_6/year = Total Project SF_6 capacity (lb) * Leak Rate (% per year)

Example calculation for Liquefaction (lb SF_6/year) = $\frac{5683 \text{ lb}}{} \times \frac{0.005 \%}{\text{yr}} = 28.42 \text{ lb SF6/year}$

Total as ton/year = Total Potentia Annual Leakage (lb SF_6/year) / 2000 (lb/ton)

Example calculation for Liquefaction (ton SF_6/year) = $\frac{28.42 \text{ lb SF6}}{\text{year}} \times \frac{\text{ton}}{2000 \text{ lb}} = 0.014 \text{ ton/year.}$

Total as lb/hr = Total Potentia Annual Leakage (lb SF_6/year) / Annual Operating hours (hr/yr)

Example calculation for Liquefaction (lb SF_6/hr) = $\frac{28.42 \text{ lb SF6}}{\text{year}} \times \frac{\text{yr}}{8{,}760 \text{ hr}} = 0.003 \text{ lb/hr}$

[3] CO_2e emissions based on GWPs for each greenhouse gas pollutant

CO_2e Annual Emission Rate (ton/yr) = SF_6 Emission Rate (ton/yr) x SF_6 GWP

Example CO_2e Annual Emission Rate (ton/yr) = $\frac{0.014 \text{ ton}}{\text{year}} \times \frac{23900}{} = 339.56 \text{ ton/yr}$

Per 40 CFR 98 - *Mandatory Greenhouse Gas Reporting* , Subpart A, Table A-1.

CO_2	1
SF_6	23,900