Permit Amendment
Source Analysis & Technical Review

Company	**Corpus Christi Liquefaction, LLC**	Permit Numbers	**139479, PSDTX1496, and GHGPSDTX157**
City	**Gregory**	Project Number	**350743**
County	**San Patricio**	Regulated Entity Number	**RN104104716**
Project Type	**Amendment**	Customer Reference Number	**CN604136374**
Project Reviewer	**Christopher Loughran, P.E.**	Received Date	**November 29, 2022**
Site Name	**Corpus Christi Liquefaction**		

Project Overview

Corpus Christi Liquefaction, LLC (CCL), a subsidiary of Cheniere Energy, Inc, owns and operates the liquefied natural gas (LNG) Terminal, located near Gregory, in San Patricio and Nueces Counties, Texas. The TCEQ issued an amendment to permit Nos. 139479/PSDTX1496/GHGPSDTX157 on June 28, 2019 (Project No. 287392) and subsequently altered on October 14, 2019 (Project No. 305742) and October 22, 2019 (Project No. 308069), authorizing the construction of seven additional liquefaction trains, as well as the equipment needed to support the new trains (also known as the Stage 3 Project). CCL submitted its notification of the start of construction for the Stage 3 project by letter dated June 17, 2022.

CCL submitted this application to request an amendment to Permit Nos. 139479/PSDTX1496/GHGPSDT157 to update representations to reflect final design of the flare system. The amendment proposes to eliminate the six elevated flares from the Stage 3 Project while the three ground flares will be constructed at different locations within the site, and the previously represented flow and composition of waste gas are being updated, which will result in reductions in annual allowable flaring emissions of all pollutants from the Stage 3 Project.

Emission Summary

Air Contaminant	Current Allowable Emission Rates (tpy)	Proposed Allowable Emission Rates (tpy)	Change in Allowable Emission Rates (tpy)
PM	19.56	19.56	0.00
PM_{10}	19.56	19.56	0.00
$PM_{2.5}$	19.56	19.56	0.00
VOC	103.66	92.80	-10.86
NO_X	188.16	151.42	-36.74
CO	537.26	390.93	-146.33
SO_2	12.05	12.04	-0.01
H_2S	0.16	0.15	-0.01
CO_2[a]	789,350.27	787,689.27	-1661.00
N_2O[a]	2.52	2.52	0.00
CH_4[a]	300.65	281.38	-19.27
GHGs as CO_2e	797,605.20	795,460.73	-2144.47

[a] For all non-CO_2e GHG emissions, the listed emission rates are given for informational purposes only and do not constitute an enforceable limit as specified in footnote number 4 to the MAERT for GHG Permit No. GHGPSDTX157.

Federal Rules Applicability

Requirement	
Subject to NSPS?	**Yes**
Subparts	**A, Dc, Kb,** & **IIII**
Subject to NESHAP?	**No**
Subparts	**N/A**
Subject to NESHAP (MACT) for source categories?	**Yes**
Subparts	**A** & **ZZZZ**

Nonattainment review applicability:

The plant is located in San Patricio and Nueces Counties, which are currently designated as either attainment or unclassifiable for all pollutants. The permit was initially issued on February 14, 2017 (Project No. 249962), authorizing the construction of two additional liquefaction trains, as well as the equipment needed to support the new trains (also known as the Stage 3 Project). The permit was subsequently amended on June 28, 2019 (Project No. 287392), altered on October 14, 2019 (Project No. 305742), and again altered on October 22, 2019 (Project No. 308069), which authorized the construction of seven additional liquefaction trains, as well as the equipment needed to support the new trains, and represented an as-built amendment to the initial Project No. 249962. The proposed project represents an as-built amendment to the initial February 14, 2017 project and the June 28, 2019 amendment, at which time the area was also designated as either attainment or unclassifiable for all pollutants. Therefore, nonattainment new source review does not apply.

PSD review applicability:

As noted above in the nonattainment new source review discussion, the proposed amendment represents as-built amendments to the initial February 14, 2017 project and the June 28, 2019 amendment. The site is currently an existing non-named PSD major source and was also an existing PSD major source at the time of the original June 14, 2017 initial project. The proposed emissions associated with the initial 2/14/2017 Project No. 249962, the June 28, 2019 Project No. 287392 amendment, and the proposed Project No. 350743 amendment are summarized in the table below. As shown, the initial permit project triggered PSD for NOx, CO, VOC, PM/PM_{10}/$PM_{2.5}$, and CO_2e. The subsequent June 29, 2019 and the proposed amendment continued to show that NOx, CO, VOC, PM_{10}, $PM_{2.5}$, and CO_2e triggered PSD while total PM was below the major modification threshold. However, since the change in allowable emission rates for each pollutant is less than its respective PSD significant emission threshold, neither the June 28, 2019 amendment nor the proposed amendment trigger a new PSD major action.

Pollutant	PSD Major Modification Threshold (tpy)	Initial 2/14/2017 Project No. 249962		Amendment, June 28, 2019 Project No. 287392			Proposed Amendment, Project No. 350743		
		Proposed Emissions[a] (tpy)	PSD Triggered?	Proposed Emissions[a] (tpy)	PSD Triggered?[b]	New PSD Action?[b]	Proposed Emissions (tpy)	PSD Triggered?[b]	New PSD Action?[b]
NOx	40	1730.2	Yes	188.2	Yes	No	151.42	Yes	No
CO	100	1645.9	Yes	537.3	Yes	No	390.93	Yes	No
VOC	40	108.3	Yes	104.6	Yes	No	92.80	Yes	No
PM	25	40.6	Yes	19.6	No	No	19.56	No	No
PM_{10}	15	40.6	Yes	19.6	Yes	No	19.56	Yes	No
$PM_{2.5}$	10	40.6	Yes	19.6	Yes	No	19.56	Yes	No
SO_2	40	24.0	No	12.0	No	No	12.04	No	No
H_2S	10	0.15	No	0.04	No	No	0.15	No	No
CO_2e	75,000	2,372,879	Yes	900,845	Yes	No	795,461	Yes	No

[a] Proposed emission rates taken from TRVs associated with the listed projects.

[b] As shown in the table, the change in emission rates from the initial 2/14/2017 Project No. 249962 and the subsequent 6/28/2019 Project No. 287392 amendment and the proposed Project No. 350743 amendment are less than the PSD significant thresholds. Therefore, the 6/28/2019 Project No. 287392 amendment and the proposed Project No. 350743 amendment did not trigger a new major PSD modification since the change in allowable emissions was less than the PSD significant emission thresholds, and therefore represented as-built updates.

Title V Applicability - 30 TAC Chapter 122 Rules

Requirement
Title V applicability: The site currently operates under Title V Permit No. O3580 for the existing Stage 1 and Stage 2 facilities currently operating at the site. The applicant stated that they will seek an appropriate Title V authorization for the operation of the proposed Stage 3 facilities that is being amended with this NSR permitting action.
Periodic Monitoring (PM) applicability: Periodic monitoring is applicable because the site is a Title V major source subject to 30 TAC Chapter 122. The thermal oxidizers have a minimum temperature monitored by a thermocouple which is read at least every fifteen minutes when waste is directed to the units (Special Condition or SC Nos. 8 and 22.E). The furnace fuel flow rates are monitored and recorded (SC Nos. 14 and 22.A). The 28VHP LDAR program is used to monitor equipment leak fugitives (SC Nos. 16 and 22.F). The 28M LDAR program is used to monitor natural gas fugitive components (SC No. 28) along with daily audio, visual, and olfactory checks (SC No. 29). The operational hours for the standby generators and firewater pumps (SC No. 22.D). Records of planned MSS activities must be kept according to SC No. 22.B.
Compliance Assurance Monitoring (CAM) applicability: CAM is potentially applicable because the site is a Title V major source subject to 30 TAC Chapter 122 The three multi-point ground flares (EPNs MSGFLR1, MSGFLR2, MSGFLR3) are subject to CAM according to 30 TAC 122.604(b) since the pre-control VOC emission rate from each flare exceeds the Title V major source threshold of 100 tpy. The flare pilot flames are continuously monitored by a thermocouple, infrared monitor, or ultraviolet monitor to indicate the control device is functioning (SC Nos. 9.B and 10.B). Flare flow monitors and composition analyzers or calorimeters are used to monitor the flared gas streams (SC Nos. 9.D and 10.A) Capture system monitoring requirements for the ground flares are specified in condition 10.E.

Process Description

CCL is currently constructing the Stage 3 facilities located at the Terminal near Gregory, in San Patricio and Nueces Counties. The Stage 3 project is in the early stages of construction and none of the authorized emissions sources have started operation. Once constructed, the facilities will have the capability to liquefy natural gas from the pipeline system for export as LNG. The facilities will consist of seven mid-scale liquefaction trains, Trains 1 through 7. The LNG produced by the seven trains will be stored in existing LNG storage tanks within the existing Stage 1 and 2 Project. LNG will be exported via LNG carriers that will arrive at the CCL marine terminal. CCL will operate the seven trains continuously (up to 8,760 hours per year) using electric-driven refrigeration compressors.

Each of the seven trains in the liquefaction process is equipped with an Acid Gas Removal Unit (AGRU). To reduce emissions from the acid gas vent stack, sulfur emissions are controlled with sulfur removal equipment. The equipment is designed to remove the sulfur from the acid gas using an amine-based solvent, which will be sent offsite for treatment and/or disposal when spent. There are no vents directly to the atmosphere associated with the sulfur removal system. After sulfur removal, the acid gas is controlled using thermal oxidizers (“TOs”) (EPNs MSTO-1 through MSTO-7), one per train. Acid gas can also be vented to the ground flares (EPNs MSGFLR1, MSGFLR2, and MSGFLR3) when the TOs are out of service for maintenance and repair. Seven fixed roof tanks for storage of amine (EPNs: MSAMTNK1 through MSAMTNK7) will store supplies of fresh amine.

Heavier compounds in the natural gas will be removed as condensate. The condensate will be routed and stored in an existing internal roof floating roof tank (EPN: IFRTK), authorized by NSR Permit Nos. 105710/PSDTX1306/GHGPSDTX123, and loaded into tank trucks or pipeline for delivery to market.

Emissions related to vessel loading will be controlled by an existing marine flare (EPN MRNFLR), authorized by NSR Permit Nos. 105710/PSDTX1306/GHGPSDTX123. The marine flare will be used in two routine scenarios:

1. If a ship arrives with inert gasses (carbon dioxide (CO_2) or nitrogen N_2), the ship vapor will be purged to the marine flare until displaced by methane.
2. Routing warm methane to the marine flare during ship loading until it can be accepted by the Boil Off Gas (BOG) System.

Three ground flares (EPNs MSGFLR1, MSGFLR2, MSGFLR3), will be constructed to control process emissions from the Stage 3 Project liquefaction trains. The ground flares will control emissions from continuous system purge, refrigerant compressor seal leakage, periodic maintenance, startup, and shutdown (MSS) emissions, and emissions during emergency periods. All three ground flares are identical in design. Within each ground flare are three separate vent gas headers, which are the High-Pressure Dry Gas, High-Pressure Wet Gas, and Low-Pressure Acid Gas. The dry and wet flare headers are high-pressure systems designed to control most routine, MSS, and emergency flaring scenarios. The acid gas flare header is a low-pressure system designed to control compressor seal leakage and act as an alternative control device for acid gas when the thermal oxidizers are unavailable. Each of the headers are designed to meet the proposed monitoring requirements. The low-pressure acid gas header burners will meet all 40 CFR 60.18 requirements for flares, including velocity.

Each waste gas system has a common waste gas vent header that feeds the three identical ground flares. The ground flares are identical in terms of number of stages, burners, and pilots for each of the three types of waste gas. During normal operation, all three ground flares will be online. Each ground flare has inlet manifolds (separate for each segregated waste gas system) which are connected to a series of stages with the number of burners. The high-pressure dry flare and high-pressure wet flare systems operate similarly to each other but are not commingled. For these systems, one stage is always open to receive waste gas, and is operated under greater than atmospheric pressures.

When flaring activity occurs and the pressure increases in the vent header and inlet manifolds, pressure-activated valves (alternately, “Staging Valves”) will open subsequent flare stages to receive waste gas. As flaring activity ceases and pressure decreases in the vent header and inlet manifolds, the staging valves are closed to maintain controlled pressure in the flare system. The wet vent gas header in each flare feeds six (6) pressure-assisted stages which have 3, 3, 5, 12, 14, and 28 burners, respectively; the dry vent gas header in each flare feeds nine (9) pressure-assisted stages which have 3, 2, 6, 12, 23, 29, 32, 33, and 35 burners, respectively. Therefore, there are 240 total burners for all of the high-pressure stages combined, which are Zeeco MJ-4 burners. The acid vent gas header in each flare feeds a single conventional (non-pressure-assisted) stage with three (3) burners. Each stage contains two (2) pilots, except that the stage associated with the acid gas header has three (3) pilots.

The worst-case pressure and flow rate to the pressure-assisted portions of the multi-point ground flares depends on the flow scenario (upset/emergency vs. planned flaring) and the header (wet vs. dry). The test report referenced in the application (file for AMOC71) for Zeeco MJ-4-equipped multi-point ground flares included a DRE test using propane as the flared gas with a tip operating at 166.8 MMBtu/hr, a tip pressure of 20.0 psig, and a flow rate of 8,370 lb/hr (about 75,000 scfh), which was intended to approximate a worst-case flow condition. The highest flow conditions for any pressure-assisted tip are 8242 lb/hr and 175 MMBtu/hr, while the corresponding values for planned operations (routine and planned MSS) are considerably lower. The worst-case opening pressure for any of the multi-point ground flares tips is 35 psig. A higher pressure during the test at qualitatively similar flow rates would tend to reinforce aspiration of adequate combustion air into the flare. The test conditions described in the test report are reasonably representative of worst-case conditions at applicant’s facility.

There are also eight standby diesel driven generators (EPNs MSGEN1 through MSGEN8) and two fire water pump diesel engines (EPNs MSFWP1 and MSFWP2). There will be ten fixed roof tanks to store diesel required for the generators and firewater pumps (EPNs MSGENTK1 through MSGENTK8, MSFWPTK1 and MSFWPTK2).

Project Scope

As the design of the project has progressed, the applicant identified an opportunity to reduce overall emissions from the project by removing the elevated wet/dry flares and using the ground flares for the emergency scenarios originally intended for the elevated flares. The specific changes to the flare system representations are the following:

1. Remove the six elevated flares, which are comprised of three pairs of wet and dry gas flares (EPNs MSWDFLR1, MSWDFLR2, MSWDFLR3, WDFLRCAP).
2. Relocate the ground flares (EPNs MSGFLR1, MSGFLR2, MSGFLR3) nearer to the process units and further from the nearest site boundary. The shroud height has also been reduced from 50 feet to 45 feet.
3. Revised flow rates and stream compositions to the ground flares.

The proposed project does not affect the equipment leak fugitive component emission rates. The applicant stated that there was no indication that the facility will materially vary from its prior representations regarding estimated fugitive component counts, but the applicant also stated that they will confirm the accuracy of application representations regarding fugitive component counts and will amend or alter the permit at a future date to the extent required.

The applicant also proposed to amend SC Nos. 10.A and 23 to be consistent with the updated flare design and current BACT requirements for the ground flares. SC Nos. 10.A and 23 in the current permit (prior to the current action) prohibit operation of the ground flares with exit velocities in excess of the values allowed under 40 CFR 60.18(b) prior to the applicant obtaining an alternative means of emission limitation (AMEL) and an alternative means of control (AMOC). These conditions were imposed in TCEQ Project No. 287392 (issued June 28, 2019) based on a determination that the ground flares would not meet the 40 CFR 60.18(b) exit velocity requirements under all conditions. The applicant will not use the ground flare to comply with any NSPS or NESHAP; therefore, no AMEL is required. Because the applicable portions of Chapter 115 do not require compliance with the exit velocity requirements of 40 CFR 60.18(b), no AMOC will be necessary. The applicant stated that the current permit is the only source of an applicable requirement to limit exit velocity from the ground flares. Therefore, the applicant proposed to revise the affected conditions to specify work practice requirements satisfying current BACT requirements for pressure-assisted multi-point flares, which have changed since 2019 and do not require operation at subsonic conditions.

Revised/Additional Special Conditions

As a result of this amendment action, the permit special conditions (SCs) are being revised as summarized below.

Initial SC No.	New SC No.	Description of Change
4	4	Remove the elevated flares in this condition for the authorized sources. These three elevated flares were listed in the condition as “three (3) pairs of wet and dry gas flares (EPNs MSWDFLR1 through MSWDFLR3)”, but that text is being deleted. The EPN that represents the cap from the elevated fare, EPN WDFLRCAP, is also being removed from this condition.
8	8	Specified that when the thermal oxidizers are not operational, vents from the acid gas removal unit must be directed to the Low-Pressure (Acid Gas) Flare burners within each of the Multi-Point Ground Flares (EPNs MSGFLR1 through MSGFLR3). The condition previously did not include the language “Low-Pressure (Acid Gas) Flare burners within each of the”, which is being added for consistency with the amendment application.
9	9	In the introductory paragraph to this special condition, replaced the text “Wet/Dry Gas Flare (EPNs MSWDFLR1 through MSWDFLR3) systems” with “Low-Pressure (Acid Gas) Flare burners within each of the Multi-Point Ground Flares (EPNs MSGFLR1 through MSGFLR3)” to reflect that the low-pressure (acid gas) streams that were previously directed to the elevated flares are now being directed to the low-pressure burners of the three multi-point ground flares.
9.A-C	9.A-C	Replaced “wet/dry” with “low-pressure” to reflect that the low-pressure (acid gas) streams that were previously directed to the elevated flares (EPNs MSWDFLR1 through MSWDFLR3) are now being directed to the low-pressure burners of the three multi-point ground flares (EPNs MSGFLR1 through MSGFLR3).
9.B	9.B	Added ultraviolet monitor to the list of options for pilot monitoring to be consistent with the pilot flame monitoring being added for the high-pressure stages of the ground flares in SC No. 10.B.
-	9.D	Added flare flow meter, composition analyzer, and calorimeter requirements according to the TCEQ’s air permitting boilerplate language. Additionally, a paragraph allowing the use of the cylinder tag value for the net heating value (NHV) as the measure of agreement for daily

		calibration and quarterly audits in lieu of determining the compound-specific calibration error, CE, according to 40 CFR § 63.2450(e)(5)(x) was added at the request of the applicant.
10	10	Revised condition for the three multi-point ground flares (EPNs MSGFLR1, MSGFLR2, MSGFLR3) to remove references to an AMOC and AMEL and to reflect the compliance requirements of the high-pressure (pressure-assisted) stages of the multi-point ground flares. The application represented that there are no federal or state rules in which an AMEL or AMOC would be required, respectively, and therefore this condition is being revised to remove the AMEL and AMOC references and to instead specify the compliance requirements of the high-pressure stages of the three multi-point ground flares. The stream sent to the high-pressure stages of the multi-point ground flares are the dry flare header and wet flare header streams; the acid gas header stream is sent to the low-pressure stages and is covered by SC No. 9 (see above). This condition for the pressure-assisted stages of the multi-point ground flares was developed by referencing the federal rules for pressure-assisted multi-point flares, which include the following: - 40 CFR 63 Subpart CC, National Emission Standards for Hazardous Air Pollutants From Petroleum Refineries. - 40 CFR 63 Subpart YY, National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards. This subpart includes ethylene production and is commonly known as the “EMACT” rule. - 40 CFR 63 Subpart FFFF, National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing. This rule is commonly known as the MON. The initial draft of this special condition included the option to install calorimeter to measure the net heating value, NHVvg, of the flare vent gas streams according to 40 CFR § 63.670(j)(3) and to optionally supplement the heating value data with composition analyzer data. However, the applicant requested to instead calculate the net heating value using compositional data according to 40 CFR 63.670(j)(1), (l)(1), (m)(1), and Table 12 and Table 13 of 40 CFR 63, which is an alternative to using a calorimeter according to 40 CFR 63.670(j). For compliance with the MAERT emission limits, paragraph H of this special condition specifies the “direct calculation method” prescribed 40 CFR 63.670(l)(5)(ii), which requires the regulated entity to apply the composition and resulting calculated heating value data at the time that the sample results become available rather than the time the sample was collected to the flare flow data. For example, if a composition sample is collected at 12:25 a.m. and the analysis is completed at 12:38 a.m., the results are available at 12:38 a.m., and these results would then be used to determine compliance with the flare flow data measured during the 15-minute block period from 12:30 a.m. to 12:45 a.m. to calculate the emission rate. Initially, the draft conditions sent to the applicant would have required the sample collection time and flow data to correspond to the same 15-minute block period (i.e., a “time-aligned” approach), but the applicant instead requested the “direct calculation method” according to 40 CFR 63.670(l)(5)(ii) by providing the following justification: - In the event that data collected during one 15-minute block is not analyzed (and relied upon) until the subsequent 15-minute block, the error introduced is believed to not create statistical bias and its magnitude is no greater than the error introduced through 15-minute block averaging in the first place, considering the accuracy specifications for the instruments. - The initially proposed “time-aligned” compliance method in the initial draft of the special conditions would disincentivize the permit holder to use the “direct calculation method” specified in the federal rules by including a potential enforcement risk to its use.

		In addition to the justification above provided by the applicant, given the expected stability and lack and variability of the compositions of the flared streams associated with an LNG site, the applicant's request to rely upon the direct calculation approach specified in 40 CFR 63.670(l)(5)(ii) was accepted in the final issued permit in paragraph H. The closed-vent capture system requirements to satisfy CAM are contained in SC No. 10.E and were revised to include the TCEQ air permitting boilerplate language for control device bypasses at the request of the applicant.
23	-	Removed this condition that specifies that the three multi-point ground flares (EPNs MSGFLR1, MSGFLR2, MSGFLR3) are not authorized to operate at exit velocities greater than those required by 40 CFR 60.18 until an AMOC and AMEL are granted by the TCEQ and EPA, respectively, and incorporated into the permit. The application represented that there are no federal or state rules in which an AMEL or AMOC would be required, respectively, and therefore this condition is being removed.
31.D	30.D	Removed EPNs MSWDFLR1 through MSWDFLR3 for the elevated flares in the GHG emissions calculation requirement since the elevated flares are being removed from the permit. Changed the flare DRE from 98% for C1-C3 components to 99% for methane and 100% for all other hydrocarbon components for the three multi-point ground flares (EPNs MSGFLR1, MSGFLR2, MSGFLR3) for consistency with the emission calculations.
33.E-G	32.E-G	Updated the special condition number references as a result of deleting SC No. 23.
MAERT		Updated the MAERT for Permit No. 139479 to reflect the proposed amendment project. Specific changes are: • Removed the six elevated flares, which are comprised of three pairs of wet and dry gas flares (EPNs MSWDFLR1, MSWDFLR2, MSWDFLR3, WDFLRCAP). • Revised emission rates for the three pressure-assisted multi-point ground flares, EPNs MSGFLR1, MSGFLR2, MSGFLR3, and GFLRCAP (annual cap). • The source names of the three ground flares, EPNs MSGFLR1, MSGFLR2, MSGFLR3, and GFLRCAP have been revised for clarity at the applicant's request. The word "stage" has been removed so that the names are not mistaken for the names used to refer to the two separate LNG projects at the site; Stages 1 and 2, currently authorized under Permit No. 105710 and Stage 3, the project authorized by Permit No. 139479. Therefore, the source names for EPNs MSGFLR1, MSGFLR2, MSGFLR3, and GFLRCAP are being changed from "Stage 1 Multi-Point Ground Flare", "Stage 2 Multi-Point Ground Flare", "Stage 3 Multi-Point Ground Flare", and "Multi-Point Ground Flare Cap" to "Midscale Ground Flare 1", "Midscale Ground Flare 2", "Midscale Ground Flare 3", and "Midscale Ground Flare Cap", respectively. • Consistent with the previous item, the source names for EPNs MSGFLR1, MSGFLR2, and MSGFLR3 for the flare MSS emissions are being changed from "Stage 1 Multi-Point Ground Flare (MSS)", "Stage 2 Multi-Point Ground Flare (MSS)", and "Stage 3 Multi-Point Ground Flare (MSS)" to "Midscale Ground Flare 1 (MSS)", "Midscale Ground Flare 2 (MSS)", and "Midscale Ground Flare 3 (MSS)", respectively, at the request of the applicant for clarity. The allowable emission rates are not changing for these EPNs. Updated the MAERT for GHG Permit No. GHGPSDTX157 to reflect the proposed amendment project. Specific changes are: • Remove the six elevated flares, which are comprised of three pairs of wet and dry gas flares that were represented as a cap under EPN WDFLRCAP. • Revised GHG emission rates for the three pressure-assisted multi-point ground flares, which are presented as a cap under EPN GFLRCAP.

Best Available Control Technology

BACT for the project is summarized in the table below.

Source Name	EPN	Best Available Control Technology Description
Midscale Ground Flare 1	MSGFLR1	All three multi-point ground flares are identical, and each have two high-pressure headers and one low-pressure header. The high-pressure headers include the "High-Pressure Dry Gas" and "High-Pressure Wet Gas" headers while the low-pressure header consists of the "Low-Pressure Acid Gas" header. VOC: Pressure-assisted (high-pressure) multi-point flares stages will achieve at least 99% destruction/removal efficiency (DRE) by adoption of a work practice standard coinciding with the operational requirements of 40 CFR Part 63, Subparts YY (Generic) and FFFF applicable to pressure-assisted multi-point flares. Subparts YY and FFFF are the National Emission Standards for Hazardous Air Pollutants for Generic Maximum Achievable Control Technology Standards and Miscellaneous Organic Chemical Manufacturing, respectively. Low-pressure stages will comply with 40 CFR 60.18 requirements and achieve at least 99% DRE for C1-C3 compounds and 98% DRE for C4+. CO: Emission factor of 0.5496 lb/MMBtu, taken from TCEQ flare emissions guidance (APD-ID 6v1, revised March 2021) assuming the maximum of the High-Btu (net heating value greater than 1000 Btu/scf) and Low-Btu (net heating value 1000 Btu/scf or less) non-steam-assisted flare emission factors. NOx: Emission factor of 0.138 lb/MMBtu, taken from TCEQ flare emissions guidance (APD-ID 6v1, revised March 2021) assuming the maximum of the High-Btu (net heating value greater than 1000 Btu/scf) and Low-Btu (net heating value 1000 Btu/scf or less) non-steam-assisted flare emission factors. H_2S: Material balance with low sulfur fuel limited to 6 ppmv H_2S. Pressure-assisted multi-point flares stages will achieve 99% DRE for H_2S and low-pressure stages will achieve at least 98% DRE for H_2S. SO_2: Material balance with low sulfur fuel limited to 6 ppmv H_2S. See DRE summary above under H_2S. GHGs: Material balance based represented carbon contents and DRE noted above under VOC. MSS: Same as normal routine operation as summarized above. The applicant provided a summary of previously permitted multi-point ground flares, which is summarized in the table below along with a brief summary of the previous permitted facilities.
Midscale Ground Flare 2	MSGFLR2	
Midscale Ground Flare 3	MSGFLR3	
Midscale Ground Flare Cap (Annual Cap)	GFLRCAP	

The applicant provided a summary of previously permitted multi-point ground flares, which is presented in the table below. The proposed DRE of at least 99% for the pressure-assisted stages of the ground flares and at least 99% DRE for C1-C3 compounds and 98% DRE for C4+ for the low-pressure stages of the ground flares meets or exceeds previously permitted sites as shown in the table below. As shown in the table, a several high-pressure multi-point ground flares are permitted assuming the same default DRE as assumed for low-pressure flares, i.e., 99% DRE for C1-C3 compounds and 98% DRE for C4+, or the DRE is not explicitly specified in the permit special conditions. Three of the permits specify a minimum DRE of 99.5% (Texas Permit Nos. 137856 for Lyondell Channelview, 103048 for ExxonMobil Chemical Baytown/Mt. Belvieu, and 115295 for ExxonMobil Oil Corporation Beaumont) and one of the permits specifies a minimum DRE of 99.9% (Texas Permit No. 107523 for Enterprise Products Mont Belvieu). Additionally, consistent with previously permitted facilities, Special Condition No.10.A of the permit will require that the net heating value of the flare vent gas combustion zone (NHVcz) be greater than or equal to 800 Btu/scf,

Site/Owner	Industry Sector	MPGF Vendor	EPA Approval	EPA Operating Limits (or TCEQ if no AMEL)	EPA Approval Path	Test Results (if tested)	Test Report	TCEQ Permit DRE Basis
Freeport LNG (Freeport, TX)	LNG	Zeeco (MJ-4)	N/A	NHVcz (high-pressure stages) ≥ 800 Btu/scf; continuous monitoring for pilot flame, flow rate and vent stream composition.	N/A	Average DRE 99.996%	AMOC71 permit file.	104840/AMOC71 (2018). SC 7A: Greater than the DRE represented in the [Jul. 2014] permit application (i.e., 98/99%). AMOC71 TRV: "Testing performed … demonstrated > 98% DRE…"
Golden Pass LNG (Sabine Pass, TX)	LNG	John Zink (LRGO)	N/A	§ 60.18(b) requirements, which are superseded if an AMOC is approved (not yet filed).	N/A	N/A	N/A	116055/AMOC169 (2015). Nov. 2015 PDS gives 98/99% DRE. No reference to DRE in permit.
Port Arthur LNG (Port Arthur, TX)	LNG	--	N/A	§ 60.18(b) requirements, which are superseded if an AMOC is approved (not yet filed).	N/A	N/A	N/A	158420 (2022) No reference to DRE in permit. Commission order ¶90 references 98/99% DRE.
Bayport Polymers (Pasadena, TX)	Polyethylene	Zeeco (MJ-4)	N/A	NHVcz (high-pressure stages) ≥ 800 Btu/scf; continuous monitoring for pilot flame, flow rate and vent stream composition.	N/A	Average DRE 99.999%	AMOC155 permit file.	5264/AMOC155 (2021) SC 14.A: 98% or greater. AMOC155 TRV: "Zeeco challenged the performance of the MPGF burners over a range of fuels, pressures, and flow rates that are representative of expected field conditions. Performance of the burners demonstrated flame stability and [DRE] > 99%.
GCGV (Gregory, TX)	Polyethylene, Ethylene	Zeeco (MJ-4)	N/A	NHVcz (high-pressure stages) ≥ 800 Btu/scf; continuous monitoring for pilot flame, flow rate and vent stream composition.	N/A	Average DRE reported > 99.9%	AMOC138 permit file.	146425/AMOC138 (2020, 2021) SC 44: Must comply with AMOC138. AMOC138 has no DRE reference in its conditions. AMOC138 TRV: "The tested worst-case conditions consistently showed 99.9% DRE…"

Lyondell (Channelview, TX)	SOCMI (PO/TBA)	John Zink (LRGO)	4/29/2020 (85 FR 32382)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting	Testing	Avg. CE = 99.36% (overall); 99.97% (LHV > 800)	EPA-HQ-OAR-2014-0738-0097 Table 2	137856/AMOC886 [348499] SC 15A, 99.5% DRE.
Marathon (Garyville, IN)	Refining	John Zink (LRGO)	4/24/2018 (83 FR 18034)	NHVcz limit varies based on vent gas velocity; two pilots/stage employing cross-lighting	Testing	Avg. CE = 99.5% (overall); 99.6% (LHV > 800)	EPA-HQ-OAR-2014-0738-0011 Table A.1-2	N/A
Marathon (Texas City, TX)	Refining	John Zink (LRGO)	4/24/2018 (83 FR 18034)	NHVcz ≥ 600 Btu/scf; two pilots/stage employing cross-lighting	Testing	Same as above	Same as above	47256/AMOC2 [344258] SC14. Default DRE.
Shell Oil (Martinez, CA)	Refining	Callidus	3/11/2019 (84 FR 8715)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting	Engineering Evaluation	Used Oxy test results.	N/A	N/A
ChevronPhillips Chemical (Brazoria County and Harris County, Texas)	Polyethylene, Ethylene	Callidus	4/4/2017 (82 FR 16392)	NHVcz ≥ 600 or 800 Btu/scf (stage-dependent); two pilots/stage employing cross-lighting	Engineering Evaluation with subsequent supplemental testing	Used Oxy test results for 800 Btu/scf limit. Avg. CE = 98.8 % for 600 Btu/scf limit; 99.3% (LHV > 800)	EPA-HQ-OAR-2014-0738-0056 Att. 3 at Table A.1-1	103832/AMOC31 [327941] SC13, default DRE; 1504A/AMOC32 [320798] SC 14G, default DRE.
Occidental Chemical (Ingleside, TX)	Ethylene	Callidus	4/21/2016 (81 FR 23480)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting	Testing	Avg. CE = 99.9% (all runs LHV > 800)	EPA-HQ-OAR-2014-0738-0033 App. B at Table 2	107530/AMOC12 [296742] SC9. Default DRE.
Dow Chemical (Oyster Creek)	Ethylene and On-purpose Propylene	John Zink (LRGO)	8/31/2015 (80 FR 52426)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting	Testing	Avg. CE = 99.8% (overall); 99.8% (LHV > 800)	EPA-HQ-OAR-2014-0738-0008 Table 1	100787/AMOC8 [255844] SC 34A. Default DRE.
ExxonMobil Chemical (Baytown, Mt. Belvieu)	Ethylene, Polyethylene	John Zink (LRGO)	8/31/2015 (80 FR 52426)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting	Engineering Evaluation	Used Dow test results.	n/a	103048/AMOC4 [308470] SC 13. 99.5% DRE.
Lotte Chemical (Louisiana)	Ethylene, MEG	John Zink (Indair, LRGO)	4/24/2018 (83 FR 18034)	NHVcz ≥ 800 Btu/scf (LRGO), NHVcz ≥ 1075 Btu/scf (Indair); two pilots/stage employing cross-lighting	Testing	Electronic report withheld due to copyright restrictions. Presentation slides mention 99.2--99.9% DRE for Indair burner testing.	EPA-HQ-OAR_2014-0738-0073 EPA-HQ-OAR_2014-0738-0073	N/A
MON facilities (Nationwide)	SOCMI	All	8/12/2020 (85 FR 49084)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting; maximum 6 ft burner spacing in absence of cross-light performance demonstration	Rulemaking	N/A	N/A	N/A

Ethylene facilities (Nationwide)	Ethylene	All	7/6/2020 (85 FR 40386)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting; maximum 6 ft burner spacing in absence of cross-light performance demonstration	Rulemaking	N/A	N/A	N/A
Oil and Gas facilities (Nationwide)	Oil and Gas (Upstream and Midstream)	All	Proposed rule (NSPS + § 111(d) guidelines) signed 11/11/2022.	NHVcz ≥ 800 Btu/scf for all pressure-assisted flares.	Rulemaking	N/A	N/A	N/A
ExxonMobil Oil Corp. (Beaumont, TX)	Polyethylene	Zeeco (MJ-4)	AMEL submitted in 2017, likely mooted by MON RTR.	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting	N/A	99.77% avg. combustion efficiency (LHV = 775--781 on each of three runs).	AMOC7 permit file.	115295/AMOC7 [329999]. SC 10. 99.5% DRE. Requires compliance with AMOC as an alternative to § 60.18.
Enterprise Products (Mont Belvieu, TX)	SOCMI (on-purpose C3=)	Zeeco (MJ-4)	n/a (not requested)	NHVcz ≥ 400 Btu/scf (permit) and 800 Btu/scf (AMOC); two pilots/stage employing cross-lighting	N/A	Stability testing only (Jul. 2016), prior Dow/Zink report relied on for DRE.	AMOC37 permit file (summary notes only).	107523/AMOC37 [331393]. SC16. DRE 99.9%. Must comply with AMOC in case of conflict with permit.
Raven Butene-1 (Baytown, TX)	SOCMI (on-purpose C4=)	Callidus (Galaxy)	n/a (not requested)	NHVcz ≥ 800 Btu/scf; two pilots/stage employing cross-lighting	N/A	THC avg. DRE 99.8% (LHV > 800 on each of four runs).	AMOC117 TRV [296158].	162443/AMOC117 [319366]. SC 8E waives 60.18 requirements during operations covered by AMOC.
Valero (Corpus Christi, TX)	Refining	---	n/a (no approval located)	Refinery MACT.	N/A	N/A	N/A	38754 [333877] covers ground flare (EPN 158). SC12 specifies Refinery MACT-based work practice standards. No DRE specified.

Permits Incorporation

Permit by Rule (PBR) / Standard Permit / Permit Nos.	Description (include affected EPNs)	Action (Reference / Consolidate / Void)
N/A	**N/A**	**N/A**

Impacts Evaluation

Was modeling conducted? **Yes** Type of Modeling: **AERSCREEN, version 21112**

Is the site within 3,000 feet of any school? **No**

Additional site/land use information: **Rural terrain assumed for modeling**

Summary of Modeling Results

The applicant provided an air quality analysis, which was audited by the TCEQ ADMT. The air quality analysis (AQA) is acceptable for all review types and pollutants. More detailed information regarding the AQA may be found in the ADMT modelling memo, ADMT Project No. 8456, dated March 1, 2023. The results of the audit memo are summarized below.

Hourly Ground Flares Emissions Comparison (per flare, 3 ground flares total)

Pollutant	Averaging Time	Original Ground Flare Design (lb/hr)	Proposed Ground Flare Design (lb/hr)	Emission Difference (lb/hr)
NO_2	1-hr	3.54	2.31	-1.23
CO	1-hr	14.11	9.22	-4.89
CO	8-hr			

Annual Ground Flares Emissions Comparison

Pollutant	Averaging Time	Original Ground Flare Design (tpy)	Proposed Ground Flare Design (tpy)	Emission Difference (tpy)
NO_2	Annual	42.32	12.63	-29.69

Modeling Results for Ozone PSD De Minimis Analysis in Parts per Billion (ppb)

Pollutant	Averaging Time	GLCmax (ppb)	De Minimis (ppb)
O_3	8-hr	0.26	1

Hourly Ground Flares Emissions Comparison

Pollutant	Averaging Time	Original Ground Flare Design (lb/hr)	Proposed Ground Flare Design (lb/hr)	Emission Difference
SO_2	1-hr	0.0094	0.0050	-0.0044
SO_2	3-hr			
H_2S	1-hr	0.0001	0.00003	-0.00007

Minor NSR Project (Increases Only) Modeling Results for Health Effects

Pollutant & CAS#	Averaging Time	Original GLCmax ($\mu g/m^3$)	Proposed Changes GLCmax ($\mu g/m^3$)	Total GLCmax ($\mu g/m^3$)	10% ESL ($\mu g/m^3$)

ethylene 74-85-1	1-hr	112.35	10.08	122.43	140
ethylene 74-85-1	Annual	1.27	0.45	1.72[a]	3.4
isobutane 75-28-5	1-hr	33.25	10.08	43.33	2300
n-butane 106-97-8	1-hr	214.57	10.08	224.65	6600
isopentane 78-78-4	1-hr	30.63	10.08	40.71	5900
n-pentane 109-66-0	1-hr	22.24	10.08	32.32	5900
n-hexane 110-54-3	1-hr	3.04	10.08	13.12	560
n-hexane 110-54-3	Annual	0.02	0.45	0.47[a]	20
n-heptane 142-82-5	1-hr	4.24	10.08	14.32	1000

[a]Note that the annual GLCmax values shown in the table above were taken from the ADMT audit memo and differ slightly from the results provided by the applicant in their EMEW file dated February 27, 2023 summarized in the table below. However, these discrepancies do not change the overall conclusions of the analysis.

The applicant provided a health effects review as specified in the TCEQ's Modelling and Effects Review Applicability (MERA) guidance (APDG 5874 dated March 2018) for project emissions of non-criteria pollutants. The project emissions of non-criteria pollutants listed below satisfy the MERA and are protective of human health and the environment.

Health Effects Review - Minor NSR Project-Related Results

Pollutant & CAS#	Averaging Time	GLCmax µg/m^3	ESL µg/m^3	Modeling and Effects Review Applicability (MERA) Step in which Pollutant Screened Out
Ethylene 74-85-1	1-hr	122.43	1400	Step 3 - GLCmax < 10% ESL
	Annual	1.63	34	Step 3 - GLCmax < 10% ESL
Propane 74-98-6	1-hr	52.46	N/A	Step 0 – simple asphyxiate
	Annual	0.84	N/A	Step 0 – simple asphyxiate
Isobutane 75-28-5	1-hr	43.33	23,000	Step 3 - GLCmax < 10% ESL
	Annual	0.72	7100	Step 3 - GLCmax < 10% ESL
n-Butane 106-97-8	1-hr	224.65	66,000	Step 3 - GLCmax < 10% ESL
	Annual	2.74	7100	Step 3 - GLCmax < 10% ESL
Isopentane 78-78-4	1-hr	40.71	59,000	Step 3 - GLCmax < 10% ESL

	Annual	0.69	7100	Step 3 - GLCmax < 10% ESL
n-Pentane 109-66-0	1-hr	32.32	59,000	Step 3 - GLCmax < 10% ESL
	Annual	0.61	7100	Step 3 - GLCmax < 10% ESL
n-Hexane 110-54-3	1-hr	13.12	5600	Step 3 - GLCmax < 10% ESL
	Annual	0.38	200	Step 3 - GLCmax < 10% ESL
n-Heptane 142-82-5	1-hr	14.32	10,000	Step 3 - GLCmax < 10% ESL
	Annual	0.40	2700	Step 3 - GLCmax < 10% ESL

In summary, the applicant has demonstrated that the proposed project's emissions will not adversely affect public health and welfare, which includes NAAQS, additional impacts, minor new source review of regulated pollutants without a NAAQS, and air toxics review. The proposed increases in health effects pollutants will not cause or contribute to any federal or state exceedances. Therefore, emissions from the facility are not expected to have an adverse impact on public health or the environment.

Permit Concurrence and Related Authorization Actions

Is the applicant in agreement with special conditions?	**Yes**
Company representative(s):	**Daniel Goodman**
Contacted Via:	**Email**
Date of contact:	**3/24/2023**
Other permit(s) or permits by rule affected by this action:	**N/A**
List permit and/or PBR number(s) and actions required or taken:	**N/A**

Christopher J. Loughran	3/27/2023	Kristyn Campbell	3/28/2023
Project Reviewer Christopher Loughran, P.E.	Date	Section Manager Kristyn Campbell	Date