AIR PERMIT ROUTING/APPROVAL SLIP-Permits

AI No.	201334	Company	Driftwood LNG, LLC	Date Received	
Activity No.	PER20170002	Facility	Driftwood LNG Facility	Permit Type	PSD Initial
CDS No.	0520-00504	Permit No.	PSD-LA-824	Expedited Permit	☒ yes ☐ no

1. Technical Review	Approved	Date rec'd	Date FW	Comments
Permit Writer	Daw		11/8/17	
Air Quality / Modeling	ymo		11/9/17	
Toxics				
Technical Advisor	QMJ		11/13/17	
Other				
2. Management Review (if PN req'd)	**Approved**	**Date rec'd**	**Date FW**	**Comments**
Supervisor				
Manager	QMJ		11/13/17	
Administrator	BDS		1/8/18	as noted
Assistant Secretary (PN)				Applicant requested for a Public Hearing
3. Response to Comments (if PN req'd)	**Approved**	**Date rec'd**	**Date FW**	**Comments**
Supervisor				
Manager				
Administrator	BDS		5/7/18	
Legal (BFD)				
4. Final Approval	**Approved**	**Date rec'd**	**Date FW**	**Comments**
Supervisor				
Manager	QMJ		5/7/18	
Administrator	BDS		5/7/18	
Assistant Secretary	ELD		7/10/18	

1. Technical Review					
PN of App needed	☒ yes ☐ no	Date of PN of App		Newspaper	
Fee paid	☒ yes ☐ no				
NSPS applies	☒ yes ☐ no	PSD/NNSR applies	☒ yes ☐ no	NESHAP applies	☒ yes ☐ no
2. Post-Technical Review					
Company technical review	☒ yes ☐ no ☐ n/a	E-mail date		Remarks received	☐ yes ☐ no
Surveillance technical review	☐ yes ☐ no ☐ n/a	E-mail date		Remarks received	☐ yes ☐ no

3. Public Notice				
Public Notice Required	☒ yes ☐ no	PSD/TV Initial		
Library				
Public Notice - LDEQ Website	Date	2/1/18	Verification	☐ yes ☐ no
Company notification e-mail	Date mailed			
EPA PN notification e-mail sent	Date e-mailed	1/31/18		
OES PN mailout	Date	1/31/18		

4. Final Review					
Public comments received	☑ yes ☐ no	EPA comments rec'd	☐ yes ☑ no	Date EPA Resp. to Comments-mailed	
Company comments received	☐ yes ☑ no	PN info entered into Permit Sec VI	☑ yes ☐ no	Date EPA approved permit	
Comments					

JOHN BEL EDWARDS
GOVERNOR

CHUCK CARR BROWN, PH.D.
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

Certified Mail No.: 7018 0360 0001 4874 6188

Agency Interest No. 201334
Activity No.: PER20170002

Ms. Cathy Rourke
Driftwood LNG LLC
1201 Louisiana Street, Suite 3100
Houston, TX 77002

RE: Prevention of Significant Deterioration (PSD) permit, PSD-LA-824, Driftwood LNG Facility, Driftwood LNG LLC, Carlyss, Calcasieu Parish, Louisiana

Dear Ms. Rourke:

Enclosed is the PSD permit for the facility. Construction of the proposed project is not allowed until such time as the corresponding Part 70 operating permit is issued.

Please be advised that pursuant to provisions of the Environmental Quality Act and the Administrative Procedure Act, the Department may initiate review of a permit during its term. However, before it takes any action to modify, suspend or revoke a permit, the Department shall, in accordance with applicable statutes and regulations, notify the permittee by mail of the facts or operational conduct that warrant the intended action and provide the permittee with the opportunity to demonstrate compliance with all lawful requirements for the retention of the effective permit.

Should you have any questions concerning the permit, contact Dan Nguyen of the Air Permits Division at 225-219-3395.

Sincerely,

Elliott B. Vega
Assistant Secretary

Date 7/10/18

EBV:DCN

c: US EPA Region 6

PSD-LA-824
AI No. 201334

AUTHORIZATION TO CONSTRUCT AND OPERATE A NEW FACILITY PURSUANT TO THE PREVENTION OF SIGNIFICANT DETERIORATION REGULATIONS IN LOUISIANA ENVIRONMENTAL REGULATORY CODE, LAC 33:III.509

In accordance with the provisions of the Louisiana Environmental Regulatory Code, LAC 33:III.509,

Driftwood LNG LLC
1201 Louisiana Street, Suite 3100
Houston, TX 77002

is authorized to construct and operate of the Driftwood LNG Facility at

1170 Burton Shipyard Road
Sulphur, Louisiana 70663

subject to the emissions limitations, monitoring requirements and other conditions set forth hereinafter.

This permit and authorization to construct shall expire at midnight on November 10, 2020, unless physical on site construction has begun by such date, or binding agreements or contractual obligations to undertake a program of construction of the source are entered into by such date.

Signed this 10th day of July, 2018.

Elliott B. Vega
Assistant Secretary
Office of Environmental Services
Department of Environmental Quality

BRIEFING SHEET

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

PURPOSE

To obtain a PSD permit for the Driftwood LNG Facility.

RECOMMENDATION

Approval of the proposed permit.

REVIEWING AGENCY

Louisiana Department of Environmental Quality, Office of Environmental Services, Air Permits Division

PROJECT DESCRIPTION

Driftwood LNG, LLC proposed to construct the Driftwood LNG Facility, which will consist of five (5) liquefaction units with a total nominal design capacity of 26 million metric tons of liquefied natural gas (LNG) per year. Emissions are from turbines, thermal oxidizers, flares, generator engines, pump engines, hot oil heaters, storage tanks, loadings, and fugitives. Emissions from the station in tons per year are as follows:

Pollutant	Emissions	PSD De Minimis	PSD Review
$PM_{10}/PM_{2.5}$	356.18	15/10	Yes
SO_2	73.61	40	Yes
NO_X	1703.93	40	Yes
CO	6039.11	100	Yes
VOC	555.57	40	Yes
CO_2e	9,513,442	75,000	Yes

TYPE OF REVIEW

$PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, VOC, and greenhouse gas (GHG) emissions from the facility will be more than their respective PSD significance levels; therefore, PSD review is required for $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, VOC, and GHG emissions from the proposed facility.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

$PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, VOC, and GHG emissions from Driftwood LNG Facility (turbines, thermal oxidizers, flares, generator engines, pump engines, heaters, storage tanks, loadings, and fugitives) are controlled by BACT. Selected BACT is detailed in Table III of the permit.

BRIEFING SHEET

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

AIR QUALITY IMPACT ANALYSIS

PSD regulations require an analysis of existing air quality for those pollutants emitted in significant amounts from a proposed facility. PM_{10}/$PM_{2.5}$, SO_2, NO_X, CO, and VOC were the pollutants of interest for this facility. Dispersion modeling for PM_{10}, $PM_{2.5}$, SO_2, NO_2, and CO emissions was performed. Refined modeling was required and was performed for $PM_{2.5}$ (24-hour average), SO_2 (1-hour average), and NO_2 (1-hour and annual average) emissions. Emissions from the proposed facility are not expected to cause or significantly contribute to any exceedances. Allowable increment is preserved.

Driftwood LNG utilized the Relative Response Factor (RRF) approach to estimate impacts of emissions from the proposed facility on area ozone concentrations based on the photochemical modeling conducted in support of Sasol Chemicals (USA) LLC's Gas-to-Liquids (GTL) Project and Lake Charles Cracker Project (LCCP). The peak impacts of Driftwood LNG Facility's would be approximately 0.3 ppb. Based on the current monitored ozone concentration of 68 ppb at the Carlyss Monitoring Station for 2014-2016, the Driftwood LNG Facility is not expected to cause or contribute to any ozone NAAQS exceedances.

ADDITIONAL IMPACTS

Soils, vegetation, and visibility will not be adversely impacted by the emissions from the proposed facility, nor will any Class I area be affected. The project will not result in any significant secondary growth effects.

PROCESSING TIME

Application Dated:	March 27, 2017
Additional Information:	July 25, September 29, October 17, December 11, 2017
Effective Completeness:	October 30, 2017

PUBLIC NOTICE

In accordance with LAC 33:III.509.Q.2.c, a notice requesting public comment and announcing a public hearing on the proposed permit was published on the department's website on February 1, 2018. On January 31, 2018, copies of the public notice were mailed to the individuals who have requested to be placed on the mailing list maintained by the Office of Environmental Services (OES). The proposed permit was submitted to EPA on January 31, 2018. A public hearing was held on March 8, 2018. Comments received during the comment period and at the public hearing were considered prior to the permit decision.

PRELIMINARY DETERMINATION SUMMARY

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824; OCTOBER 30, 2017

I. APPLICANT

Driftwood LNG LLC
1201 Louisiana Street, Suite 3100
Houston, TX 77002

II. LOCATION

Driftwood LNG Facility is located at 1170 Burton Shipyard Road, Sulphur, Calcasieu Parish, Louisiana 70663.

III. PROJECT DESCRIPTION

Driftwood LNG, LLC proposed to construct the Driftwood LNG Facility, which will consist of five (5) liquefaction units with a total nominal design capacity of 26 million metric tons of liquefied natural gas (LNG) per year. Emissions are from turbines, thermal oxidizers, flares, generator engines, pump engines, hot oil heaters, storage tanks, loadings, and fugitives. Emissions from the station in tons per year are as follows:

Pollutant	Emissions	PSD De Minimis	PSD Review
$PM_{10}/PM_{2.5}$	356.18	15/10	Yes
SO_2	73.61	40	Yes
NO_X	1703.93	40	Yes
CO	6039.11	100	Yes
VOC	555.57	40	Yes
GHG (CO_2e)	9,513,442	75,000	Yes

$PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, VOC, and greenhouse gas (GHG) emissions from the facility will be more than their respective PSD significance levels; therefore, PSD review is required for $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, VOC, and GHG emissions.

IV. SOURCE IMPACT ANALYSIS

A proposed net increase in the emission rate $PM_{10}/PM_{2.5}$, NO_X, CO, VOC, and greenhouse gas (GHG) above de minimis levels for new major stationary sources requires review under Prevention of Significant Deterioration regulations, LAC 33:III.509. PSD review entails the following analyses:

A. A determination of the Best Available Control Technology (BACT);

B. An analysis of the existing air quality and a determination of whether or not preconstruction or post-construction monitoring will be required;

C. An analysis of the source's impact on total air quality to ensure compliance with the National Ambient Air Quality Standards (NAAQS);

D. An analysis of the PSD increment consumption;

E. An analysis of the source related growth impacts;

F. An analysis of source related growth impacts on soils, vegetation, and visibility;

G. A Class I Area impact analysis; and

H. Toxic impacts

A. BEST AVAILABLE CONTROL TECHNOLOGY

Under current PSD regulations, an analysis of "top down" BACT is required for the control of each regulated pollutant emitted from a new major source in excess of the specified significant emission rates. The top down approach to the BACT process involves determining the most stringent control technique available for a similar or identical source. If it can be shown that this level of control is infeasible based on technical, environmental, energy, and/or cost considerations, then it is rejected and the next most stringent level of control is determined and similarly evaluated. This process continues until a control level is arrived at which cannot be eliminated for any technical, environmental, or economic reason. A technically feasible control strategy is one that has been demonstrated to function efficiently on identical or similar processes.

Driftwood LNG LLC proposes to construct and operate the Driftwood LNG Facility near Carlyss, Calcasieu Parish. $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, VOC, and greenhouse gas (GHG) emissions from the facility will be more than the PSD significance levels and a PSD review, including a BACT analysis, is required for these pollutants.

BACT for NO_X emissions from Turbines

SCONOx^{TM} (also known as EMx^{TM}) uses a coated catalyst to oxidize NOx and CO to NO_2 and CO_2. NO_2 is adsorbed onto the catalyst and then periodically desorbed using a regenerative gas (natural gas). The catalyst is regularly washed. SCONOx^{TM} can reduce NOx emissions from 25 ppmv to 2.5 ppmv while CO control efficiency reaches 90%. However, the SCONOx^{TM} has maintenance issues and high capital and operating cost.

Selective catalytic reduction (SCR) is the technology upon which the great majority of flue gas treatment units are based. SCR units use ammonia (NH_3) to selectively reduce NO_X to nitrogen and water. The ammonia, usually diluted with air or steam, is injected through a grid system into the flue gas stream, upstream of a catalyst bed. On the catalyst surface, the ammonia reacts with NO_X to form molecular nitrogen and water. In order to carry out the catalytic reduction process, the gas stream and the catalyst bed must generally be maintained between 450°F and 850°F, though special catalyst may be employed for higher temperature application. Depending on system design, NO_X removal rates of 60 to 90% are achievable. SCR can be combined with Low NOx burners (LNB) and flue gas recirculation (FGR).

SoLoNO$_X$, Dry Low NO$_X$ (DLN), and Dry Low Emissions (DLE) Combustion Technology employ a variety of principles including lean premix, off-stoichiometric (or staged) combustion (OSC), and flue gas recirculation (FGR). The objective in the application is to minimize NO_X formation while maintaining acceptable combustion of carbon and hydrogen in the fuel. The technology is usually combined with the FGR technique. The air/natural gas mixture fed to the combustion chambers is diluted with hot flue gas to reduce NO_X emissions via lowering flame temperature and suppressing partial oxygen vapor pressure. Thirty percent of total flue gas can be recirculated to reduce NO_X by as much as 75 percent. Continuous monitoring of oxygen in the flue gas provides necessary data for automatic combustion controls. FGR will reduce the equipment efficiency and additional energy is required to recirculate the flue gas.

Selective Non-Catalytic Reduction (SNCR) is a post-combustion technique that involves injecting ammonia or urea into the flue gas. A temperature of between 1,600 °F (870 °C) and 2,200 °F (1,205 °C) is required at the injection site for the process reaction to take place. The ammonia or urea reacts with NO_X in the gas to produce nitrogen and water. Multiple injection locations may be required within several different zones of the turbine to respond to variations in the turbine operating conditions.

Non-selective catalytic reduction (NSCR) is similar to SCR, yet operates with a different catalyst and under different process conditions. NSCR requires precise adjustments of process conditions such as oxygen content (0.2 – 0.7% O2) and temperature (800 – 1,200 °F), and works best with certain windows of inlet concentrations for NO_X (2,000 – 4,000 ppmv), CO (3,000 – 6,000 ppmv), and VOC (1,000 – 2,000 ppmv). These operating windows are necessary because the catalyst was developed to react NO_X, CO, and VOC with one another, reducing emissions of each.

Steam or water injection increases thermal mass in the combustion chamber by dilution, thus lowering the peak flame temperature in NO_X forming regions. The reduction in flame temperature results in lower NO_X formation (60%). Steam or water injection will increase the turbine output. However, CO and VOC emissions are also increased.

Good combustion practices include good equipment design, use of gaseous fuels (for good mixing), and proper combustion techniques such as optimizing the air-to-fuel ratio. While this control option is typically less efficient than other technologies, it has minimal environmental and energy impacts.

The turbines are designed to comply with the NO_X emissions standards of 40 CFR 60 Subpart KKKK. Preventive control options (such as water/steam injection) are not feasible. SCONO$_X$ to lower NO_X emissions is cost prohibitive. Flue gases from the turbines are out of the optimal temperature range of the SNCR while oxygen concentrations are out of the operating range of NSCR. SNCR and NSCR are technically infeasible. Driftwood proposes to control NO_X emissions to no more than 5 ppmvd (at 15% O2) using DLN and SCR. This is determined as BACT for NO_X.

PRELIMINARY DETERMINATION SUMMARY

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824; OCTOBER 30, 2017

BACT for CO and VOC emissions from the turbines

Thermal oxidation is the first control option considered for CO and VOC emissions. Flue gases from combustion equipment could be routed through a thermal oxidizer where the gases will be heated to an operating range of 1200 - 2000^{O}F. At this temperature range, CO and VOC will be burned to carbon dioxide and water. Raising exit gas to the appropriate temperatures will require a significant amount of energy and generate a large quantity of secondary emissions, including NO_X.

Catalytic combustion of carbon monoxide is another control option. Flue gas can be burned in a catalyst bed at 600 - 800^{O}F to convert CO and VOC to carbon dioxide and water. Additional energy is required to maintain flue gas at an appropriate temperature and send it through the catalyst bed. The catalyst bed, containing heavy metals, requires periodic replacement and recycling and/or disposal.

Good combustion practices include good equipment design, use of gaseous fuels (for good mixing), and proper combustion techniques such as optimizing the air to fuel ratio. While this control option is typically less efficient than other technologies, it has minimal environmental and energy impacts.

The thermal and catalytic oxidizers are technically feasible for CO and VOC control. However, the costs for the catalytic oxidation to reduce a ton/year of CO and VOC are $3,540 and $70,680, respectively. The oxidation option is considered not economically feasible. Good combustion practices to limit maximum CO emissions from the turbines to 25 ppmvd @ 15% O_2 and VOC emissions to 0.0021 lb/MM BTU (HHV) are determined as BACT for CO and VOC.

BACT for $PM_{10}/PM_{2.5}$ emissions from the turbines

Control techniques for $PM_{10}/PM_{2.5}$ emissions include cyclones, electrostatic precipitators (ESP), fabric filters, good combustion practices, and use of clean fuels.

Cyclones collect particulate laden gases and force them to spin in a vortex, resulting in a change in direction of the particles. The particles then drop out of the gas stream. Cyclones are generally used to reduce dust loading and collect large particles. PM_{10} and $PM_{2.5}$ emissions of very low concentrations from the turbines would not be effectively captured in a cyclone.

ESPs operate by electrically charging particles and then separating them from the gas stream with a collector of opposite charge. High voltage direct current discharge electrodes, typically wires, are suspended in the gas stream to impose a negative charge on the particles. The particles are driven to positive collecting electrodes (typically plates) located opposite the wires. Particles are removed from the collection plates by rapping devices that strike the collection and discharge electrodes. The dust falls into hoppers and is conveyed to a disposal system. ESPs are usually used to capture coarse particles at high concentrations. Small particles at low concentrations are not effectively collected by an ESP. Capital and operating costs of an ESP are usually high.

In the fabric filter or baghouse, particle laden gas passes through the filter bags, retaining particles on the filters. The filters are periodically cleaned via shaking, reverse air flow, or pulse jet cleaning. During cleaning, particles are deposited in a hopper for subsequent disposal. Fabric filters are used for medium and low gas flow streams with high particulate concentrations.

Turbines flue gas flow rates are very high (490,277 ft^3/min), and particulate loading in flue gas from the gaseous fuel fired turbines are low. At this low loading rate, add-on controls, such as cyclones, ESPs, scrubbers, or fabric filters, are not practical or not feasible. The remaining options are good combustion practices and use of low sulfur facility fuel gas to promote complete combustion. Using low sulfur facility fuel gas as fuel in combination with good combustion practices to limit maximum $PM_{10}/PM_{2.5}$ emissions from the turbines to 0.0066 lb/MM BTU are determined BACT for $PM_{10}/PM_{2.5}$ emissions from the turbines.

BACT for SO_2 emissions from the turbines

Combustion devices, including the turbines, will be fueled by pipeline quality natural gas and/or low sulfur facility fuel gas with maximum sulfur content of 8 ppmvd. Both SO_2 mass emissions and concentrations will be so low that any add-on control would be impractical. Good combustion practices and use of low sulfur facility fuel gas are BACT for SO_2.

BACT for $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, and VOC emissions from IC engines

The proposed diesel-fired engines are to drive stormwater pumps, firewater pumps, and emergency generators. The engines are required to comply with standards of 40 CFR 60 (New Source Performance Standards) Subpart IIII. Because 1) the engines will be subject to the NSPS standards; 2) each engine will operate only for testing, maintenance, to pump stormwater, or in emergency situations; and 3) emissions from each engine will be low, add-on control will not be practical. Compliance with standards of 40 CFR 60 Subpart IIII is determined as BACT for $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, and VOC emissions.

BACT for emissions from acid gas thermal oxidizers

Driftwood LNG proposes to install five thermal oxidizers to control VOC and hydrogen sulfide in the acid gas vent streams which are generated by the amine units. For NOx, flue gas temperature is out of the range of SCR, SNCR, NSCR and SCONOx™. The next options are LNB and then good combustion practices. LNB in combination with good combustion practices are determined as BACT for NO_X.

The thermal oxidizers (themselves) are considered BACT for VOC from the acid gas vents. Installing an add-on control device to further control CO emissions, such as thermal oxidizer or a catalytic oxidizer, is not practical. Good combustion practices in combination with low sulfur facility fuel gas are determined as BACT for $PM_{10}/PM_{2.5}$ and VOC emissions from the thermal oxidizers. Good combustion practices are BACT for CO, and use of a triazine-based H_2S scavenger system is BACT for SO_2 emissions.

BACT for $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, and VOC emissions from the hot oil heaters

The hot oil heaters are designed to operate during the commissioning/startup of the liquefaction trains. Each heater is permitted to operate no more than 336 hour per year. Accordingly, annual emissions from the hot oil heaters are very low (<1.0 tons/year/heater). Any add-on control options are therefore deemed infeasible. The heaters are designed with ultra low NOx burners (ULNB). ULNB in combination with good combustion practices are BACT for NO_X. Good combustion practices in combination with the use of low sulfur facility fuel gas as fuel are BACT for $PM_{10}/PM_{2.5}$, SO_2, and VOC emissions. Good combustion practices are BACT for CO.

BACT for $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, and VOC emissions from the flares

The proposed facility will have nine (9) flares to control emissions from normal operations, startup, shutdown, maintenance, and emergency situations. Due to the low VOC concentrations in vent streams and the open-flame combustion, any add-on controls are not practical. To ensure complete combustion of the flare gas, a flame (fueled by low sulfur facility fuel gas) will be maintained at each flare tip when the vent gas is routed to the flare. This practice will minimize emissions of $PM_{10}/PM_{2.5}$, SO_2, CO, and VOC. Good equipment design, good/best operational practices, maintaining the presence of a flame at the flare tip when the vent gas is routed to the flare, and use of low sulfur facility fuel gas as fuel for the flare tip are determined as BACT for $PM_{10}/PM_{2.5}$, NO_X, SO2, CO, and VOC emissions from the flares.

BACT for VOC emissions from storage tanks

Because emissions from the amine tanks, lube oil tank, and diesel tanks are small (<= 0.01 tons/year), floating roofs and add-on control are not practical. Submerged fill pipes in combination with fixed roofs and good work practices are determined as BACT for VOC. The Process Wastewater Tank and Waste Oil/Amine Tank will be equipped with internal floating roofs (IFR), while emissions from the Condensate Tank and Spent Scavenger Tank will be routed through a closed vent system to the Condensate Vapor Thermal Oxidizer. These control selections are BACT for VOC emissions from these tanks.

BACT for VOC emissions from condensate loading

Potential control technologies for VOC emissions from the loading operation include vapor recovery, combustion, carbon adsorption, vapor-balanced loading, submerged loading, and good operating practices. Driftwood LNG proposes to use a thermal oxidizer (Condensate Vapor Thermal Oxidizer) to control VOC emissions from condensate loading. This is BACT for VOC emissions from condensate loading.

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824; OCTOBER 30, 2017

BACT for VOC emissions from fugitives

Rotary pumps and compressors handling stream containing VOC with a true vapor pressure of 1.5 psia or greater at handling conditions are required to be equipped with mechanical seals or other equivalent equipment (LAC 33:III.2111). All equipment leak components in organic liquids service as described in 40 CFR 63.2338(b)(3) will comply with applicable requirements of 40 CFR 63 Subpart TT, or UU, or H. Driftwood LNG will also conduct good work practices to minimize VOC emissions. These practices are determined as BACT for VOC emissions from fugitives.

BACT for greenhouse gases (GHG) emissions

Controlling of GHG emissions includes preventing GHG formation or emissions, such as monitoring piping components as well as 1) carbon capture and storage (CCS), 2) use of natural gas as fuel, 3) energy efficient measures, and 4) good combustion practices.

CCS is composed of three main components: CO_2 capture and/or compression, transport, and storage. CO_2 could theoretically be captured by scrubbing the exhaust stream with solvents (e.g., amines, ammonia). However, separating CO_2 emissions from the flue gas streams at the Driftwood LNG Facility would be challenging for the following reasons:

- a high volume of gas must be treated because the CO_2 is dilute (< 10%);
- trace impurities (particulate matter, sulfur oxides, nitrogen oxides, etc.) can degrade the CO_2 capture materials; and
- compressing captured CO_2 from near atmospheric pressure to pipeline pressure (about 2000 lbs/in^2 absolute) requires a large auxiliary power load.

Nevertheless, LDEQ generally assumes CCS to be technically feasible, though numerous technical and legal barriers hindering the widespread, cost-effective deployment of this technology have been well documented.

Based on the actual capital cost of the WA Parish Generating Station in Texas (Petra Nova Project) and Boundary Dam Power Station in Canada (Boundary Dam Carbon Capture Project), Driftwood LNG estimates the capital cost of capture and storage of approximately 7.9 million tons of CO_2 emissions from the Driftwood LNG Facility would be $3 billion, and that the annualized cost of the system would therefore be around $540 million. The project would require a compression capacity of about 120,000 horsepower which would generate approximately 1.1 million tons of CO_2 per year. Based on the aforementioned costs, the CCS is determined to be economically infeasible.

The remaining control options are the use of natural gas and/or facility fuel gas as fuel (low carbon fuels), energy efficiency measures, and good combustion practices. Using natural gas and/or facility fuel gas as fuel, energy efficiency measures, and good combustion practices are determined as BACT for GHG emissions from the facility.

B. ANALYSIS OF AMBIENT AIR QUALITY

Prevention of Significant Deterioration (PSD) regulations require an analysis of ambient air quality for those pollutants emitted in significant amounts from a proposed facility. $PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, and VOC were the pollutants of interest for this facility. Screen dispersion modeling indicated that emissions of PM_{10}, $PM_{2.5}$ (annual average), CO, and SO_2 (3-hour, 24-hour, and annual average) will not exceed the monitoring significance or significant impact levels (SIL). Preconstruction monitoring, refined modeling, and increment modeling are not required for these pollutants. Refined modeling is required for $PM_{2.5}$ (24-hour average), SO_2 (1-hour average), and NO_2 (1-hour and annual average) emissions.

The proposed Driftwood LNG Facility will increase both NOx and VOC emissions of more than 100 tons/year. An ambient air quality analysis and preconstruction monitoring are required for ozone. To fulfill the preconstruction monitoring requirements for ozone, Driftwood LNG utilized ozone data obtained from the nearby LDEQ –operated Carlyss Monitoring Station (Monitoring Site No. 220190002).

Driftwood LNG utilized the Relative Response Factor (RRF) approach to estimate impacts of emissions from the proposed facility on area ozone concentrations. The analysis was based on the photochemical grid modeling analysis performed by Alpine Geophysics, LLC (Alpine) for Sasol Chemicals (USA) LLC's Gas-to-Liquids (GTL) Project and Lake Charles Cracker Project (LCCP).[1]

Total NOx and VOC emissions from the proposed LCCP and GTL Projects are 4881 tons/year. According to the Alpine's analysis, at this emission level, the peak impact of Sasol's projects on ozone concentrations at the Carlyss Monitoring Station would be 0.3 ppb and, in unmonitored area, 0.6 ppb. The proposed Driftwood LNG Facility will emit a total of 2260 tons per year of NOx and VOC emissions, which is approximately 46% of the Sasol projects' emissions. Therefore, it can be conservatively assumed that the Driftwood LNG Facility's peak impacts would be approximately 0.3 ppb.

Based on the current monitored ozone concentration of 68 ppb at the Carlyss Monitoring Station for 2014-2016, the Driftwood LNG Facility is not expected to cause or contribute to any ozone NAAQS exceedances.

C. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ANALYSIS

Refined modeling was performed for $PM_{2.5}$ (24-hour average), SO_2 (1-hour average), and NO_2 (1-hour and annual average) emissions. Emissions from the proposed facility are not expected to cause or significantly contribute to any exceedances.

1 McNally, D. and Loomis, C. Alpine Geophysics, LLC, "Ozone and $PM_{2.5}$ Impact of the Proposed Sasol Lake Charles Gas-to Liquids and Lake Charles Cracker Projects," Nov. 15, 2013.

D. PSD INCREMENT ANALYSIS

Increment analysis was performed for $PM_{2.5}$ (24-hour average) and NO_2 (annual average) emissions. Increment consumption will not exceed the allowable increment.

E. SOURCE RELATED GROWTH IMPACTS

Secondary growth effects are minimal. The proposed facility will create 350 permanent jobs and approximately 5400 construction jobs.

F. SOILS, VEGETATION, AND VISIBILITY IMPACTS

Soils, vegetation, and visibility will not be adversely impacted by air emissions from the proposed facility.

G. CLASS I AREA IMPACTS

Breton National Wildlife Area, the nearest Class I area, is approximately 400 kilometers from the site. The calculated Q/d value (5.3) is less than 10; therefore, according to the Federal Land Manager's guidance, the complex has "screened out" of further review.

H. TOXIC IMPACT

The selection of control technology based on the BACT analysis included consideration of control of toxic emissions.

V. CONCLUSION

The Louisiana Department of Environmental Quality, Office of Environmental Services, has made a preliminary determination to approve the PSD permit (PSD-LA-824) for the Driftwood LNG Facility near Carlyss, Calcasieu Parish, Louisiana, subject to the attached conditions. In the event of a discrepancy in the provisions found in the application and those in this Preliminary Determination Summary, the Preliminary Determination Summary shall prevail.

SPECIFIC CONDITIONS

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

1. The permittee is authorized to operate in conformity with the specifications submitted to the Louisiana Department of Environmental Quality (LDEQ) as analyzed in LDEQ's document entitled "Preliminary Determination Summary" dated October 30, 2017 and subject to the selected BACT listed in Table III, emissions limitations in Table IV, and the following condition. Specifications submitted are contained in the application dated March 27, 2017 as well as additional information dated July 27, 2017, September 29, 2017, and October 17, 2017.

2. Both dry gas ground flares (EQT0027 and EQT0028) can only be operated simultaneously 1) during commissioning or 2) if the total gas volume simultaneously flared through both dry gas ground flares doesn't exceed the maximum gas volume from one dry gas ground flare alone.

3. Both wet gas ground flares (EQT0029 and EQT0030) can only be operated simultaneously 1) during commissioning or 2) if the total gas volume simultaneously flared through both wet gas ground flares doesn't exceed the maximum gas volume from one wet gas ground flare alone.

4. Permittee shall comply with the Louisiana General Conditions as set forth in LAC 33:III.537.

5. Permittee shall install the control devices or implement the work practice standards identified in the Preliminary Determination Summary of this permit as best available control technology (BACT).

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

TABLE I: BACT COST SUMMARY

Control Alternatives			Availability/ Feasibility	Negative Impacts (a)	Control Efficiency (%)	Emissions Reduction (TPY)	Capital Cost ($)	Annualized Cost ($/yr)	Cost Effectiveness ($/ton)	Notes
Turbines (20 units)	$SCONO_X$	NOx	yes/No	1	90	2934	638,000,000	145,287,069	49,518	Rejected
Turbines (20 units)	Ox Cat	CO	yes/No	1	90	1,786.14	28,000,000	6,323,002	3,540	Rejected
Turbines (20 units)	Ox Cat	VOC	yes/No	1	90	89.46	28,000,000	6,323,002	70,680	Rejected
Flare Gas Recovery (Marine Flare)		CO	yes/No	1	75	18	15,826,284	2,517,304	139,850	Rejected
Hot Oil Heaters (5 units)	SCR	NOx	yes/No	1	83	1	3,311,214	1,184,004	1,184,004	Rejected
Facility	CCS	GHG	yes/No	1	90		3,000,000,000	540,000,000		Rejected
Notes:	a) Negative impacts: 1) economic, 2) environmental, 3) energy, 4) safety									

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

TABLE II: AIR QUALITY ANALYSIS SUMMARY (μg/m³)

Pollutant	Averaging Period	Preliminary Screening	Significant Monitoring	Significant Impact Level	Background	Maximum Modeled	Modeled + Background	Driftwood Contribution	NAAQS	Modeled PSD Increment Consumption	Allowable Class II PSD Increment
$PM_{2.5}$	24-hour	1.77	4	1.2	16	50.5	66.5	0.02915	35	8.13	-
	Annual	0.24	-	0.3					12		-
PM_{10}	24-hour	2.08	10	5					150		30
	Annual	0.3	-	1					50		17
SO_2	1-hour	11.59	-	7.8	86.2	427.3	513.5	0.123	196.2		-
	3-hour	10.90	-	25					1300		512
	24-hour	3.71	13	5					365		91
	Annual	0.15	-	1					80		20
NO_2	1-hour	26.7	-	7.5	67.7	4718.98	4786.68	0.0008	188.7		-
	Annual	1.21	14	1	11.3	13.8	25.1		100	13.8	25
CO	1-hour	156.1	-	2000					40,000		-
	8-hour	400.6	575	500					10,000		-

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

TABLE III. BACT SELECTION

Equipment	$PM/PM_{10}/PM_{2.5}$	SO_2	NO_X	CO	VOC
Compressor Turbines	0.0066 lb/MM BTU Good Combustion Practices Use of Low Sulfur Facility Fuel Gas	Good Combustion Practices Use of Low Sulfur Facility Fuel Gas	5 ppmvd at 15% O2 DLN and/or SCR	25 ppmvd at 15% O2 Good Combustion Practices	0.0021 lb/MM BTU (HHV) Good Combustion Practices Use of Low Sulfur Facility Fuel Gas
Hot Oil Heaters	0.0075 lb/MM BTU Good Combustion Practices Use of Low Sulfur Facility Fuel Gas	Good Combustion Practices Use of Low Sulfur Facility Fuel Gas	ULNB Good Combustion Practices	Good Combustion Practices	0.0054 lb/MM BTU Good Combustion Practices Use of Low Sulfur Facility Fuel Gas
Acid Gas Thermal Oxidizers	0.0075 lb/MM BTU Good Combustion Practices Use of Low Sulfur Facility Fuel Gas	Acid Gas H_2S Minimization Good Combustion Practices use of a triazine-based H_2S scavenger system	LNB Good Combustion Practices	Good Combustion Practices	0.16 lb/MM BTU Good Combustion Practices Use of Low Sulfur Facility Fuel Gas
Condensate Vapor Thermal Oxidizer	0.008 lb/MM BTU Good Combustion Practices Use of Low Sulfur Facility Fuel Gas	Good Combustion Practices Use of Low Sulfur Facility Fuel Gas	LNB Good Combustion Practices	Good Combustion Practices	Good Combustion Practices Use of Low Sulfur Facility Fuel Gas
Flares	2.5 lb/MM scf Good Equipment Design/Best Operational Practices Use of Low Sulfur Facility Fuel Gas	Good Equipment Design/Best Operational Practices Use of Low Sulfur Facility Fuel Gas	0.0680 lb/MM BTU (HHV) Good Equipment Design/Best Operational Practices Use of Low Sulfur Facility Fuel Gas	0.31 lb/MM BTU (HHV) Good Equipment Design/Best Operational Practices Use of Low Sulfur Facility Fuel Gas	Good Equipment Design/Best Operational Practices Use of Low Sulfur Facility Fuel Gas
IC Engines	40 CFR 60 Subpart IIII Good Combustion Practices	40 CFR 60 Subpart IIII Good Combustion Practices	40 CFR 60 Subpart IIII Good Combustion Practices	40 CFR 60 Subpart IIII Good Combustion Practices	40 CFR 60 Subpart IIII Good Combustion Practices
Amine Surge Tanks, Stormwater Pond 2 Diesel Tank					Fixed roofs, Submerged fill pipes, Good work practices
Process WW Tank Waste Oil/Amine Tank					Internal Floating Roofs
Spent Scavenger Tank					Closed vent system and Control device
Truck Loading Operations Condensate Tank					Controlled by Condensate Vapor Thermal Oxidizer

TABLE III. BACT SELECTION

Equipment	$PM/PM_{10}/PM_{2.5}$	SO_2	NO_x	CO	VOC
Fugitives					Conduct good work practices and comply with LAC 33:III.2111 Component in organic services comply with 40 CFR 63 Subpart TT, or UU, or H
Greenhouse Gas	Use of low-carbon fuel, energy efficiency measures, and good combustion practices. Flares: Use of low-sulfur facility fuel gas for pilots. Fugitives: Leak management program and good work practices.				

LAC 33:III.2111: All rotary pumps and compressors handling volatile organic compounds having a true vapor pressure of 1.5 psia or greater at handling conditions shall be equipped with mechanical seals or other equivalent equipment.

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

TABLE IV - MAXIMUM ALLOWABLE EMISSION RATES												
Liquefaction Section	**Description**	**$PM_{10}/PM_{2.5}$**		**SO_2**		**NO_X**		**CO**		**VOC**		**CO_2e**
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	tons/yr
EQT0001 – EQT0020	Turbines (each)	3.57	15.62	0.76	(a)	7.31	32.01	26.70	97.44	1.13	4.97	277,060
EQT0021 – EQT0025	Acid Gas Thermal Oxidizers (each)	0.58	2.54	9.90	(a), (b)	8.35	36.59	7.27	31.83	12.13	53.14	471,791
EQT0026	Condensate Vapor Thermal Oxidizer	0.77	0.17	0.01	(a)	25.45	10.90	10.19	4.40	40.73	7.97	2939
EQT0027, EQT0028	Dry Gas Ground Flares (each) (c)	24.73			(a)	699.02		3,186.72		66.60		
EQT0029, EQT0030	Wet Gas Ground Flares (each) (c)	22.32			(a)	623.24		2,841.23		50.33		
EQT0031, EQT0032	Dry Flares (each)	0.01	0.04	< 0.01	(a)	0.22	0.96	1.00	4.39	< 0.01	0.01	1,776
EQT0033, EQT0034	Wet Flares (each)	0.01	0.05	0.01	(a)	0.28	1.21	1.26	5.50	< 0.01	0.01	2,225
EQT0035	Marine Flare	2.29	0.10	1.24	(a)	59.76	2.56	272.45	11.67	0.47	0.02	4719
EQT0036	Marine Flare SU/SD & Maintenance	8.08	0.20	4.37	(a)	211.30	5.28	963.29	24.08	7.19	0.18	9745
EQT0038 – EQT0042	Hot Oil Heaters (each)	0.12	0.02	0.01	(a)	1.40	0.23	1.42	0.24	0.09	0.01	317
EQT0045	Storm Water Pond 1 Pump 1	0.02	< 0.01	0.01	< 0.01	0.33	0.06	2.88	0.50	0.16	0.03	100
EQT0046	Storm Water Pond 1 Pump 2	0.01	< 0.01	< 0.01	< 0.01	0.16	0.03	1.44	0.25	0.08	0.01	50
EQT0047	Storm Water Pond 1 Pump 2	0.01	< 0.01	< 0.01	< 0.01	0.16	0.03	1.44	0.25	0.08	0.01	50
EQT0048	Storm Water Pond 2 Pump 1	0.07	0.01	0.01	< 0.01	5.76	1.01	5.76	1.01	0.31	0.05	201
EQT0049	Storm Water Pond 2 Pump 2	0.07	0.01	0.01	< 0.01	5.76	1.01	5.76	1.01	0.31	0.05	201
EQT0050	Storm Water Pond 2 Pump 3	0.01	< 0.01	< 0.01	< 0.01	0.23	0.04	2.01	0.35	0.11	0.02	70
EQT0052	LNG Basin Pump 1	0.07	0.01	0.01	< 0.01	5.76	1.01	5.76	1.01	0.31	0.05	201
EQT0053	LNG Basin Pump 2	0.01	< 0.01	< 0.01	< 0.01	0.13	0.02	1.15	0.20	0.06	0.01	40
EQT0054, EQT0055	Firewater Pumps (each)	0.18	0.01	0.01	< 0.01	3.62	0.18	3.67	0.18	3.62	0.18	31

DRIFTWOOD LNG FACILITY
AGENCY INTEREST NO. 201334
DRIFTWOOD LNG LLC
CARLYSS, CALCASIEU PARISH, LOUISIANA
PSD-LA-824

TABLE IV - MAXIMUM ALLOWABLE EMISSION RATES

Liquefaction Section	Description	$PM_{10}/PM_{2.5}$		SO_2		NO_X		CO		VOC		CO_2e
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	tons/yr
EQT0056 – EQT0060	Essential Generators (each)	0.49	0.02	0.02	< 0.01	15.69	0.78	8.58	0.43	15.69	0.78	85
EQT0061	Main Substation Generator	0.25	0.01	0.01	< 0.01	7.94	0.40	4.34	0.22	7.94	0.40	43
EQT0062	Control Room Generator	0.49	0.02	0.02	< 0.01	15.69	0.78	8.58	0.43	15.69	0.78	85
EQT0063	Loading Substation Generator	0.49	0.02	0.02	< 0.01	15.69	0.78	8.58	0.43	15.69	0.78	85
EQT0065 – EQT0069	Amine Storage Tanks (each)									0.01	0.01	
EQT0071	Scavenger Storage Tank									0.01	0.01	
EQT0072	Process Wastewater Tank									0.01	0.01	
EQT0074	Spent Scavenger Tank											
EQT0075	Waste Oil/Amine Tank									0.01	0.01	
EQT0076	Condensate Storage Tank											
EQT0080	Condensate Truck Loading											
EQT0081	Stormwater Pond 2 Diesel Tank									0.01	0.01	
FUG0001	Facility Fugitive Emissions										93.97	9,267
GRP0001	Ground Flares Group		30.10				847.12		3,861.86		81.75	1575410
GRP0002	Fuel Gas Fired Sources SO2 Cap				73.52							
GRP0003	Acid Gas Thermal Oxidizer SO2 Cap				60.00							
(a) Capped under GRP0002 (b) Capped under GRP0003 (c) Capped under GRP0001												

: