



10-4-13
AIR PERMIT ROUTING/APPROVAL SLIP-Permits



AI No.	99407	Company	Cameron LNG LLC	Date Received	8/21/2012
Activity No.	PER20120002	Facility	Cameron LNG Facility	Permit Type	PSD
CDS No.	0560-00184	Permit No.	PSD-LA-766	Expedited Permit	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no

1. Technical Review	Approved	Date rec'd	Date FW	Comments
Permit Writer			10/6/12	
Air Quality / Modeling	TAN	5/22/13	5/22/13	
Toxics				
Technical Advisor Review	QMJ	5/6/13	5/6/13	
Supervisor				
Other				
2. Management Review (if PN req'd)	Approved	Date rec'd	Date FW	Comments
Supervisor				
Manager	DWC		10/6/12	
Assistant Secretary (PN)	JAT		2/20/13	PH OK JAT
3. Response to Comments (if PN req'd)	Approved	Date rec'd	Date FW	Comments
Supervisor				
Manager				
Administrator				
Legal (BFD)				
4. Final Approval	Approved	Date rec'd	Date FW	Comments
Supervisor				
Manager	DWC		10/1/13	See RTC
Administrator				
Assistant Secretary	JAT		10/1/13	

1. Technical Review					
PN of App needed	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no	Date of PN of App	9/6/12	Newspaper	Cameron Parish Pilot
Fee paid	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no				
NSPS applies	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no	PSD/NNSR applies	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no	NESHAP applies	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no

2. Post-Technical Review					
Company technical review	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> n/a	E-mail date	10/16/12	Remarks received	<input type="checkbox"/> yes <input type="checkbox"/> no
Surveillance technical review	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> n/a	E-mail date	10/16/12	Remarks received	<input type="checkbox"/> yes <input type="checkbox"/> no

3. Public Notice					
Public Notice Required	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no	TV Renewal / PSD			
Library	Cameron Parish lib - Hackberry Branch				886 5398
PN newspaper 1/City	The Advocate/Baton Rouge	PN Date	6/7/13	EDMS Verification	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
PN newspaper 2/City		PN Date	6/6/13	Verification	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Company notification letter sent	Date mailed	6/5/13		8873241	
EPA PN notification e-mail sent	Date e-mailed	6/6/13			
OES PN mailout	Date	6/5/13			

4. Final Review					
Public comments received	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no	EPA comments rec'd	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no	Date EPA Resp. to Comments-mailed	NA
Company comments received	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no	PN info entered into Permit Sec VI	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no	Date EPA approved permit	NA
Comments					

BOBBY JINDAL
GOVERNOR



PEGGY M. HATCH
SECRETARY

State of Louisiana
DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

Certified Mail No.: 7006 0810 0000 2888 9511

Agency Interest No. 99407
Activity No.: PER20120002

Mr. Randy Oakley
Cameron LNG, LLC
Post Office Box 439
Hackberry, Louisiana 70645

RE: Prevention of Significant Deterioration (PSD) permit, PSD-LA-766, Cameron LNG Facility, Cameron LNG, LLC, Hackberry, Cameron Parish, Louisiana

Dear Mr. Oakley:

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 at 225-219-3395.

Sincerely,

A handwritten signature in cursive script, appearing to read "S. L. Phillips".

Sam L. Phillips
Assistant Secretary

October 1, 2013

Date

SLP: DCN

c: US EPA Region 6

PSD-LA-766
AI No. 99407

**AUTHORIZATION TO CONSTRUCT AND OPERATE A NEW OR MODIFIED
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,

Cameron LNG, LLC
Post Office Box 439
Hackberry, Louisiana 70645

is authorized to continue the operations of the LNG vaporization facility and to construct and operate the natural gas liquefaction project at

301 North Main Street
Hackberry, Louisiana 70645

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

This permit and authorization to construct shall expire at midnight on April 1, 2015 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 1 day of October, 2013.



Sam L. Phillips
Assistant Secretary
Office of Environmental Services

BRIEFING SHEET

**CAMERON LNG FACILITY
AGENCY INTEREST NO. 99407
CAMERON LNG, LLC
HACKBERRY, CAMERON PARISH, LOUISIANA
PSD-LA-766**

PURPOSE

To obtain a PSD permit for the Cameron LNG Facility.

RECOMMENDATION

Approval of the proposed permit.

REVIEWING AGENCY

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

PROJECT DESCRIPTION

Cameron LNG facility currently imports, stores, and vaporizes liquefied natural gas (LNG) for the U.S. natural gas markets. LNG from ships is unloaded and stored in atmospheric storage tanks. LNG is then vaporized using ten submerged combustion vaporizers and then injected into a sales pipeline. The facility has capacity to vaporize 1.60 billion scf/day of natural gas.

Cameron LNG, LLC requests a PSD permit for a proposed natural gas liquefaction facility which will include six refrigeration compressor turbines, flares, emergency generators, water pumps, and associated equipment. Permitted emissions in tons per year are as follows:

Pollutant	Before	After	Change	PSD De Minimis	PSD Review
PM ₁₀ /PM _{2.5}	72.65	166.97	+ 94.02	15/10	Yes
SO ₂	13.59	12.48	- 1.11	40	No
NO _x	473.88	2,567.73	+ 2,093.85	40	Yes
CO	336.12	1,075.52	+ 739.40	100	Yes
VOC	56.97	124.57	+ 67.60	40	Yes
CO _{2e}	-	3,958,392	3,958,392	75,000	Yes
Lead	-	0.002	+ 0.002	0.6	No

TYPE OF REVIEW

PM₁₀/PM_{2.5}, NO_x, CO, VOC, and greenhouse gas (GHG) emissions from the facility will increase more than the PSD significance levels. A netting analysis is required. There is no creditable reduction within the contemporaneous period. A PSD review is required for PM₁₀/PM_{2.5}, NO_x, CO, VOC, and GHG emissions from the project.

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BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

Turbines: The use of dry low NO_x (DLN) burner technology to limit maximum NO_x emissions from turbines to 15.0 ppm@15% O₂ is determined as BACT for NO_x emissions. The use of good combustion practices to limit maximum CO emissions from turbines to 0.040 lb/MM BTU is determined as BACT for CO emissions. Good combustion practices and the use of natural gas are determined as BACT for VOC and PM/PM₁₀ emissions. Utilizing high thermal efficiency turbines that are fueled by natural gas in combination with good combustion/operating practices is BACT for GHG.

Water Pump and Generator Engines: Complying with requirements of 40 CFR 60 Subpart IIII is determined as BACT for NO_x, CO, VOC, and PM/PM₁₀ emissions. Good combustion and proper operating practices are determined as BACT for GHG emissions.

Thermal Oxidizers: Good equipment design and proper operating practices are BACT for PM₁₀/PM_{2.5}, NO_x, CO, and VOC. Using natural gas as low carbon fuels and good combustion/operating practices are determined as BACT for GHG.

Flares: Proper plant operations to minimize flare gas and maintain the presence of the flame when the gas is routed to the flare - determined as BACT for PM/PM₁₀/PM_{2.5}, NO_x, CO, VOC, and GHG.

Storage Tanks: A closed vent and a control system that meet requirements of 40 CFR 60 Subpart Kb are BACT for VOC.

Truck Loading Operation: Good equipment design and proper operating practices are BACT for VOC emissions from truck loading.

Fugitives: 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 (LAC 33:III.2111) - Determined as BACT for VOC emissions. Conducting a leak detection and repair (LDAR) program is BACT for GHG.

AIR QUALITY IMPACT ANALYSIS

Prevention of Significant Deterioration (PSD) regulations require an analysis of existing air quality for those pollutants emitted in significant amounts from a proposed facility. PM₁₀/PM_{2.5}, NO_x, CO, VOC, and GHG were the pollutants of interest for this facility. Screen dispersion modeling indicated that PM₁₀/PM_{2.5} and CO emissions from the proposed facility will be below the PSD significant impact level and monitoring exemption level. Preconstruction monitoring, refined modeling, and incremental modeling are not required for these pollutants.

Screen dispersion modeling indicated that NO_x emissions from the proposed facility will be above the PSD significant impact level and monitoring exemption level. Refined model is required. The refined model indicated that the project contribution to the impact is minimal (less than the NAAQS). Preconstruction monitoring and incremental modeling are not required.

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Modeling for GHG emissions is not required. An ozone analysis was performed. The project will have insignificant impacts on 8-hour ozone.

ADDITIONAL IMPACTS

Soils, vegetation, and visibility will not be adversely impacted by 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:	August 16, 2012
Additional Information:	September 4, 2012; October 18, 2012 April 8, 2013; April 25, 2013; April 30, 2013
Effective Completeness:	May 20, 2013

PUBLIC NOTICE

To provide the public an opportunity to comment on the proposed permit a notice requesting public comment on the proposed permit was published in *The Advocate*, Baton Rouge, on June 7, 2013; and in the *Cameron Parish Pilot*, Cameron, on June 6, 2013; and was mailed to concerned citizens listed in the Office of Environmental Services Public Notice Mailing List. The permit application, the proposed permit, and the Statement of Basis were submitted to the Cameron Parish Library – Hackberry Branch. The proposed permit and the Statement of Basis were submitted to US EPA Region 6. A Public hearing was held on July 11, 2013, at the Hackberry Community Center, 986 Main Street, Hackberry, Louisiana. Prior to this permit decision, all comments were considered, responded, and documented in the “Public Comments Response Summary”.

PRELIMINARY DETERMINATION SUMMARY

**CAMERON LNG FACILITY
AGENCY INTEREST NO. 99407
CAMERON LNG, LLC
HACKBERRY, CAMERON PARISH, LOUISIANA
PSD-LA-766, MAY 20, 2013**

I. APPLICANT

Cameron LNG, LLC
Post Office Box 439
Hackberry, Louisiana 70645

II. LOCATION

Cameron LNG Facility is located at 301 North Main Street, Hackberry, Louisiana 70645. Approximate NAD83 UTM coordinates are 467.9 kilometers East and 3,322.1 kilometers North, zone 15.

III. PROJECT DESCRIPTION

Cameron LNG facility currently imports, stores, and vaporizes liquefied natural gas (LNG) for the U.S. natural gas markets. LNG from ships is unloaded and stored in atmospheric storage tanks. LNG is then vaporized using ten submerged combustion vaporizers and then injected into a sales pipeline. The facility has capacity to vaporize 1.60 billion scf/day of natural gas.

Cameron LNG, LLC requests a PSD permit for a proposed natural gas liquefaction facility which will include six refrigeration compressor turbines, flares, emergency generators, water pumps, and associated equipment. Permitted emissions in tons per year are as follows:

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Lead	-	0.002	+ 0.002	0.6	No

IV. SOURCE IMPACT ANALYSIS

A proposed net increase in the emission rate PM₁₀/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:

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- 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.

Cameron LNG, LLC proposes to construct and operate a natural gas liquefaction facility. BACT is required for PM₁₀/PM_{2.5}, NO_x, CO, VOC, and greenhouse gas (GHG) emissions from the proposed equipment (six turbines, flares, emergency generators, water pumps, and associated equipment).

BACT for NO_x emissions from the turbines

NO_x controls can be classified as preventive controls and add-on controls. Preventive controls are options that prevent the formation of pollutant, such as, good equipment design, good combustion practices, flue gas recirculation (FGR), low NO_x burners (LNB), and steam/water injection. Add-on controls include devices to destroy or remove the pollutants, such as SCONO_xTM, selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), nonselective catalytic reduction (NSCR).

Selective catalytic reduction (SCR) is the most advanced of the potential flue-gas control technologies for reducing NO_x emissions, and is the technology upon which the great majority of flue gas treatment units are based. SCR units use ammonia (NH₃) to

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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 be maintained between 550°F and 800°F. However, catalyst technology has recently been demonstrated at commercial scale for turbine exhaust temperature up to 1,000°F. Depending on system design, NO_x removal rates of 80 to 90% are achievable.

Selective non-catalytic reduction (SNCR) is a post-combustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or connective pass of a boiler or process heater. A temperature of between 1,600°F and 2,000°F 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 boiler to respond to variations in the boiler 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°F – 1,200°F), and works best with certain windows of inlet concentration 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 the NO_x, CO and VOC with one another, reducing the emission of each. The catalytic reaction requires a certain temperature band, and the presence of a small amount of oxygen. However, at optimal conditions it has the potential to reduce emissions of NO_x, CO and VOC simultaneously. It has been used to control emissions from internal combustion engines and nitric acid plants.

SCONO_xTM or EMx is primarily a NO_x control technology which works by oxidizing NO to NO₂, and trapping the NO₂ molecules as nitrates or nitrites on a potassium carbonate catalyst bed. Carbon monoxide is also oxidized across the catalyst, to CO₂. The catalyst bed must then be regenerated with a steam and hydrogen vapor stream, producing water and diatomic nitrogen. EMx operates best when treating gases that have a steady temperature, in the range of 280°F – 650°F. EMx technology has been utilized through LAER as a multi-pollutant control technology applied to natural gas combustion turbines.

In the flue gas recirculation (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 will provide necessary data for automatic combustion controls. FGR will reduce the equipment efficiency and additional energy is required to recirculate the flue gas.

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Low NO_x burners (LNB) or dry LNB (DLN) has been used since the early 1970s for thermal NO_x control. These specially designed burners employ a variety of principles including off-stoichiometric (or staged) combustion (OSC) and flue gas recirculation (FGR). The objective in the application of LNBs is to minimize NO_x formation while maintaining acceptable combustion of carbon and hydrogen in the fuel.

The differences between a low NO_x burner and a burner featuring FGR are not always clear. In general, LNBs implement OSC, FGR, or a combination of these techniques. In a stricter sense, LNBs have been defined as burners that control NO_x formation by carrying out the combustion in stages (OSC) and, further, by controlling the staging at and within the burner rather than in the firebox. Consistent with this definition, LNBs can be designed with staged air burners or staged fuel burners. Staged air burners are designed to reduce flame turbulence, delay fuel/air mixing, and establish fuel-rich zones for initial combustion. The reduced availability of oxygen in the initial combustion zone inhibits fuel NO_x conversion. Radiation of heat from the primary combustion zone results in reduced temperature as the final unburned fuel gases mix with excess air to complete the combustion process. The longer, less intense flames resulting from the staged stoichiometry lower peak flame temperatures and reduce thermal NO_x formation.

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. Steam or water injection is available control technologies.

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 minimum environmental and energy impacts.

The proposed turbines will operate in the simple cycle mode which will have flue gas temperature of approximately 1000°F. At this temperature, SNCR deems technically infeasible. SCONO_xTM has not been commercially demonstrated for simple cycle turbines (1000°F) and is consider technically infeasible. Turbine flue gas with approximately 13 volume percent (vol%) of oxygen will make the NSCR technically feasible. Based on the economic analysis, the SCR cost to remove a ton of NO_x will be in the range of \$9000 – \$10,000. At this range, SCR is considered economically infeasible. The next options are DLN, water or steam injection, and good combustion practices. Water or steam injection has lower NO_x control efficiency than the DLN, thus eliminated from further consideration. The DLN in combination with good combustion practices to limit maximum NO_x emissions from the turbines to 15 ppmv at 15% O₂ – are determined as BACT.

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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°F. At this temperature range, CO and VOC will be burned to carbon dioxide. Raising exit gas to the appropriate temperatures will require a significant amount of energy and generate a large quantity of secondary emissions.

Catalytic combustion of carbon monoxide is another control option. Flue gas can be burned in a catalyst bed at 600 - 800°F. Approximately 90 percent of the CO and VOC would be converted to carbon dioxide. 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 minimum environmental and energy impacts.

VOC can be recovered by condensation using a condenser, absorption using a wet scrubber, or adsorption using a carbon bed. However, fouling and plugging (solid formation) are common problems of the condensers. Several NO_x controls also reduce CO and VOC emissions, such as SCR (in combination with oxidation catalyst), NSCR, and SCONO_xTM. These options were discussed and eliminated in the NO_x BACT analysis section.

BACT for NO_x is also considered BACT for CO and VOC, since optimizing burners for CO and VOC influences NO_x emissions. The thermal and catalytic oxidizers are feasible for CO and VOC control. However, the cost for these options is in the same range with the SCR of \$9000 - \$10,000 per ton of CO and VOC. The oxidation option is considered not economically feasible. Good combustion practices and fueled by natural gas are determined to be BACT to limit maximum CO emissions from the turbines to 0.040 lb/MM BTU. Good combustion practices and fueled by natural gas are also determined as BACT for VOC.

BACT for PM₁₀/PM_{2.5} emissions from the turbines

Control techniques for PM₁₀/PM_{2.5} emissions include cyclones, electrostatic precipitators (ESP), fabric filters, scrubbers, 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. PM₁₀ and PM_{2.5} emissions of very low concentrations from the turbines would not be effectively captured in a cyclone.

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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.

In a wet scrubber, the gas stream is brought into contact with a scrubbing liquid, typically by spraying the liquid in a contacting tower to remove the particles, or by some other contact method. Inlet gas characteristics and dust properties are of primary importance. Wet scrubbers remove dust particles by capturing them in the liquid droplets, dissolving other pollutants in the liquid droplets, and have the ability to handle gaseous streams with high moisture content.

Turbines flue gas flow rates are very high (1.425 MM ft³/hr) and particulate loading in flue gas from the natural gas fired turbines are very low (6.0 lbs/hr). 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 fueled by natural gas to promote complete combustion. Using clean natural gas as fuel in combination with good combustion practices are determined BACT for particulate (PM₁₀/PM_{2.5}) emissions from the turbines.

BACT for PM₁₀/PM_{2.5}, NO_x, CO, and VOC emissions from IC engines

The proposed IC engines include diesel-fired engines for fire water pumps, river water pumps, and emergency generators. The engines are required to comply with PM₁₀, NO_x, CO, and VOC standards of 40 CFR 60 (New Source Performance Standards) Subpart IIII. The engines also comply with 40 CFR 63 (National Emissions Standards for Hazardous Air Pollutants) Subpart ZZZZ by complying with 40 CFR 60 Subpart IIII. Because 1) the engines will be subject to the NSPS standards, 2) each engine will operate for less than 100 hours/year, and 3) emissions from each engine will be very low, additional control will not be practical. Compliance with standards of 40 CFR 60 Subpart IIII is determined as BACT for PM₁₀/PM_{2.5}, NO_x, CO, and VOC emissions.

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BACT for PM₁₀/PM_{2.5}, NO_x, CO, and VOC emissions from thermal oxidizers

Cameron LNG proposes to install two thermal oxidizers to control VOC and hydrogen sulfide in the acid gas vent streams which are generated by three amine units. Therefore, the thermal oxidizers will be designed to maximize the destruction efficiency by maximizing the combustion temperature. Any NO_x reduction by lowering combustion temperature, such as LNB and FGR, are not feasible. Each proposed thermal oxidizer will emit less than 0.01 lbs/hr of NO_x; an add-on NO_x control is not practical. Good equipment designs and proper operating practices are determined as BACT for NO_x.

Installing an add-on control device to control CO or VOC emissions, such as thermal oxidizer or a catalytic oxidizer is not practical. Any add-on devices to control VOC (< 0.01 lbs/hr) and PM₁₀/PM_{2.5} (< 0.01 lbs/hr) are not practical. Good equipment designs and proper operating practices in combination with natural gas fuel are determined as BACT for PM₁₀/PM_{2.5}, CO, and VOC emissions from the thermal oxidizers.

BACT for PM₁₀/PM_{2.5}, NO_x, CO, and VOC emissions from the flares

There will be three flares at the proposed liquefaction area of the facility: a wet flare, a dry flare, and an operational flare. The wet flare and the dry flare will be used to control vents from the pressure relief devices and depressurizing valves of the liquefaction trains.

Due to the short periods of operations and low VOC concentration in vent streams, emissions from the flares are low (PM₁₀/PM_{2.5} ≤ 0.05 tpy, NO_x ≤ 0.49 tpy, CO ≤ 2.69 tpy, VOC ≤ 0.01 tpy). Add-on controls are not practical. To ensure complete combustion of the flare gas, a flame is maintained at the flare tip when the vent gas is routed to the flare. This practice will minimize emissions of PM₁₀/PM_{2.5}, CO, and VOC. Proper plant operations to minimize flare gas and maintain the presence of a flame at the flare tip when the vent gas is routed to the flare are determined as BACT for PM₁₀/PM_{2.5}, NO_x, CO, and VOC emissions from the flares.

The existing flare at the vaporization section is used to control natural gas and VOC from warm ship cool downs, emergency emissions, and maintenance activities. Emissions from this flare will increase due to this project. No physical modification will be made to this flare. BACT analysis is not required for this (the existing) flare.

BACT for VOC emissions from the condensate tank

VOC emissions from the tank are nocturnal, very low at the night time, high at the day time, and maximized during the tank loadings. The tank operates at an atmospheric pressure. Adsorption will generate solid wastes or will require regeneration / combustion. Absorption, condensation, internal floating roof, and external floating roof can achieve comparable control efficiency. Cameron LNG Facility proposes to use a closed vent system that routes to a control device. This control option also meets requirements of 40 CFR Part 60 (NSPS) Subpart Kb. Closed vent system and a control device that meet requirements of NSPS Subpart Kb are determined as BACT.

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BACT for VOC emissions from loading operation

Potential control technologies for VOC emissions from the loading operation include vapor recovery, thermal oxidation, good operation practices, carbon adsorption, and submerged loading. Due to the operation schedule of one hour per year, any add-on control will not be practical. Good equipment design and proper operating practices are BACT for VOC emissions from loading.

BACT for VOC emissions from fugitives

Volatile organic compounds (VOC) are also present in the (natural) gas streams at the facility at very low concentrations. All rotary pumps and compressors handling VOC having a true vapor pressure of 1.5 psia or greater at handling conditions shall be equipped with mechanical seals or other equivalent equipment (LAC 33:III.2111) – This practice is determined as BACT for VOC emissions from fugitives.

BACT for Greenhouse Gas (GHG) Emissions

GHG emissions from the proposed facility are from the turbines, engines, thermal oxidizers, flares, condensate tank, loading, and fugitives. Controlling of GHG emissions includes preventing the GHG formation or emissions, such as, monitoring piping component to prevent GHG emissions as well as 1) carbon capture and storage, 2) using the most thermally efficient equipment, 3) use of low carbon fuels, 4) utilization of renewable energy sources (solar, wind, etc.), 5) Solid Oxide Fuel Cell Technology, and 6) good combustion/operating practices.

Carbon capture and storage (CCS) was eliminated in Step 2 of the top-down BACT selection process. CCS is composed of three main components: CO₂ capture and/or compression, transport, and storage.

Approximately 90 percent of the “CO_{2e}” emissions from the proposed equipment will originate from the natural gas-fired turbines. CO₂ could theoretically be captured by scrubbing the exhaust stream with solvents (e.g., amines, ammonia). However, separating CO₂ from this flue gas is challenging for the following reasons:

- a high volume of gas must be treated because the CO₂ is dilute (3 to 4 percent by volume in natural gas-fired systems);
- trace impurities (particulate matter, sulfur oxides, nitrogen oxides, etc.) can degrade the CO₂ capture materials; and
- compressing captured CO₂ from near atmospheric pressure to pipeline pressure (about 2000 psia) requires a large auxiliary power load.¹

¹ “Report of the Interagency Task Force on Carbon Capture and Storage,” August 2010, pp. 29-30. This document is available at <http://www.epa.gov/climatechange/downloads/CCS-Task-Force-Report-2010.pdf>.

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EPA has also indentified "a low purity CO₂ stream" as a "significant and overwhelming technical" issue.²

According to the "Report of the Interagency Task Force on Carbon Capture and Storage," the U.S. Department of Energy (DOE) is pursuing three post-combustion CO₂ capture demonstration projects using currently available technologies; however, these projects are targeting pulverized coal-fired boilers (where the flue gas has a higher concentration of CO₂ by volume – 13 to 15 percent). In addition, the first is not scheduled to commence until 2014.³

There are no known installations where the post-combustion capture of CO₂ has been installed and operated successfully on gas-fired turbines. According to EPA, an "applicant is generally not required to undergo extensive delays and expense to research and test unproven technologies as part of the BACT process." Further, the agency has held that "technologies in the pilot scale testing stages of development would not be considered available for BACT review."⁴ Therefore, LDEQ finds CO₂ capture to be technically infeasible.

Moreover, LDEQ finds both CO₂ storage (at or near the site) and CO₂ transport to be technically infeasible.

Dedicated sequestration was rejected due to the lack of suitable geologic reservoirs (e.g., basalt formations, organic rich shale basins, un-mineable coal areas, and saline formations) or opportunities for enhanced oil recovery in the immediate vicinity of the facility. According to the DOE, no basalt formations exist any nearer to the project site than Alabama. Organic-rich shale basins and un-mineable coal areas exist in northern Louisiana, but not in the region of southwestern Louisiana where the facility will be located.⁵

Saline formations are layers of porous rock that are saturated with brine. These formations are known to exist throughout southern Louisiana. However, as described by the DOE, "less is known about saline formations because they lack the characterization experience that industry has acquired through resource recovery from oil and gas reservoirs and coal seams. Therefore, there is an amount of uncertainty regarding the suitability of saline formations for CO₂ storage."⁶ LDEQ was unable to find characterization studies of saline formations in the region of southwestern Louisiana, and

2 "PSD and Title V Permitting Guidance for Greenhouse Gases," March 2011, pg. 36. This document is available at <http://www.epa.gov/nsr/ghgpermitting.html>.

3 "Report of the Interagency Task Force on Carbon Capture and Storage," pp. A-19-A-20

4 Draft New Source Review Workshop Manual, October 1990, pg. B.18

5 "2010 Carbon Sequestration Atlas of the United States and Canada," Third Edition, U.S. Dept. of Energy, National Energy Technology Laboratory. See http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlasIII.

6 *Ibid.*, p. 27

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no saline sequestration projects have been proposed along the Gulf coast. Due to the high degree of uncertainty in utilizing saline formations for dedicated CO₂ storage, this type of sequestration was deemed technically infeasible.

Regarding CO₂ transport, Denbury Resources' CO₂ pipeline runs through Calcasieu Parish, Louisiana, Orange County, Texas, and Jefferson County, Texas, areas which border Cameron Parish. However, in order for the facility to connect to this pipeline, Cameron LNG would have to secure the necessary right-of-ways (or perhaps purchase additional property) and construct a pipeline in excess of 20 miles. For these reasons, CCS was eliminated from further consideration.

To prevent the freezing problems, carbon dioxide (CO₂) in natural gas is removed and vented to the atmosphere through the thermal oxidizers. No CO₂ controls are available for these vent streams. Preventing GHG to emit is the best control option for fugitive sources. Implementing a leak detection and repair program to minimize methane emissions is determined as BACT for GHG emissions from fugitive sources.

The flares are designed to convert any flare gas to carbon dioxide, a component of GHG. There is no additional control for the GHG emissions from the flares. Proper plant operations to minimize flare gas are determined as BACT for GHG emissions.

With the CO₂ collection and storage option determined as infeasible, there is no known applicability of solar thermal technology or solid oxide fuel cell technology to any facilities that are similar to the Cameron LNG Facility. The remaining control options are utilizing the most efficient turbines, low carbon fuels, and good combustion/operating practices.

Cameron LNG proposes to install compressor turbines GE 7EA, which are high thermal efficiency turbine model. The proposed turbines will be fired with natural gas, a low carbon fuel. Good combustion/operating practices will increase the thermal efficiency. Good combustion/operating practices may not reduce CO₂ emissions; however, they will reduce methane emissions (a GHG component). Nitrous oxide (N₂O) emissions are minimal. Controlling N₂O will potentially increase other criteria pollution, such as NO_x. Therefore additional N₂O control is not practical. Utilizing natural gas fired high thermal efficiency turbines in combination with good combustion/operating practices are determined as BACT for GHG emissions from the turbines.

Cameron LNG proposed to install several diesel fired generator engines and water pumps engines to support plant operations during emergency situations. Each engine will be operated less than 100 hours/year. Good combustion/operating practices are the only feasible control options for GHG. These are determined as BACT.

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B. ANALYSIS OF EXISTING AIR QUALITY

Screen dispersion modeling indicated that PM₁₀/PM_{2.5} and CO emissions from the proposed facility will be below the PSD significant impact level and monitoring exemption level. Preconstruction monitoring, refined modeling, and incremental modeling are not required for these pollutants. Modeling for GHG emissions is not required.

Screen dispersion modeling indicated that NO_x emissions from the proposed facility will be above the PSD significant impact level and monitoring exemption level. Refined model is required. The refined model indicated that the project contribution to the impact is minimal (less than the NAAQS). Preconstruction monitoring and incremental modeling are not required.

Cameron LNG proposed to construct a natural gas liquefaction facility adjacent to the existing LNG vaporization section. The liquefaction operations are in the opposite direction to the vaporization operations. Therefore, even though this permit allows Cameron LNG both to vaporize and liquefy natural gas at the same time, Cameron LNG will most likely either vaporize or liquefy natural gas at any given time. So, the most significant impact on ambient air will occur when the facility liquefies or vaporizes natural gas at full capacity. However, emissions from the vaporization operations are below the PSD major source thresholds, an air quality analysis is not required. Therefore, emissions from the LNG vaporization section are not expected to have any significant impacts on the ambient air.

C. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ANALYSIS

Refined modeling is not required.

Following USEPA modeling guidance for ozone modeling of the 8-hour NAAQS, state-of-science photochemical modeling has been conducted to estimate the project impacts of the proposed Cameron LNG project impacts on 8-hr ozone air quality in the Houston/Galveston and Beaumont/Port Arthur areas. The modeling was based on the final modeling database developed by LDEQ for the Baton Rouge Redesignation plan for June 2006, a period of high ozone in the Galveston/Port Arthur region. The project impacts were evaluated both at the monitor locations and at areas removed from the monitors and an absolute basis, and using the EPA preferred relative response factor basis.

On a relative basis at the ozone monitors the project impact is estimated to change the 8-hour design value by a maximum of 0.2 ppb at three monitors in Calcasieu Parris and at two monitors in Jefferson County, Texas. On the relative basis at areas removed from the monitors the maximum impact the model does not impact any areas greater than 1 ppb either on-land or off-shore.

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Using the Region VI suggested absolute basis metrics the project is estimated to impact on-land grid cells greater than 2.0 ppb at limited areas on a single episode day with the majority of the impact restricted to a very limited area close to the project site on Lake Calcasieu in Cameron Parish. Depending on the metric, the Project emissions are estimated to increase the metric in the Beaumont/Port Arthur area between 0.0% and 2.7%. In Houston/Galveston the Actual emissions are estimated to increase the metrics by between 0.2% and 0.8%.

D. PSD INCREMENT ANALYSIS

Incremental modeling is not required.

E. SOURCE RELATED GROWTH IMPACTS

Secondary growth effects are minimal. The project will create approximate 100 – 200 permanent jobs and average of 1800 jobs during the four years of construction.

F. SOILS, VEGETATION, AND VISIBILITY IMPACTS

There will be no significant impact on soils, vegetation, and visibility.

G. CLASS I AREA IMPACTS

Breton National Wildlife Area, the nearest Class I area, is more than 100 miles from the site, precluding any significant impact.

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-766) for the Cameron LNG Facility near Hackberry, in Cameron Parish, Louisiana, subject to the attached specific and general 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

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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 May 20, 2013 and subject to the BACT determinations listed in Table III, and emission limitations listed in Table IV. Specifications submitted are contained in the application dated August 16, 2012 as well as additional information dated September 4, 2012; October 18, 2012; April 8, 2013; April 25, 2013; and April-30, 2013.

2. Permittee shall comply with the Louisiana General Conditions as set forth in LAC 33:III.537.
3. To ensure compliance with permitted emission limits, permittee shall test PM and CO emissions from compressor turbines (EQT0068 through EQT0073), using specified methods and procedures from New Source Performance Standards, 40 CFR 60, Appendix A: Method 5 - Determination of particulate matter emissions from stationary sources and Method 10 - Determination of Carbon Monoxide Emissions from Stationary. Use alternate stack test methods only with the prior approval of the Office of Environmental Services.
4. To maintain impacts of NO_x and CO emissions below the National Ambient Air Quality Standards (NAAQS), Permittee shall not operate or test (excluding operations during emergency situations) more than two generators/fire water pumps at the same time.

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TABLE I: BACT COST SUMMARY

Control Alternatives For NOX	Availability/ Feasibility	Negative Impacts (a)	Control Efficiency (%)	Emissions Reduction (TPY)	Capital Cost (\$)	Annualized Cost (\$/yr)	Cost Effectiveness (\$/ton)	Notes
GE7EA SCR/CO	Yes/No	1,2	88	433	18,759,131	4,428,162	10,238	Rejected
GE7EA (w/WHU) SCR/CO	Yes/No	1,2	88	433	18,759,131	3,904,862	9,027	Rejected

Notes: a) Negative impacts: 1) economic, 2) environmental, 3) energy, 4) safety

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TABLE II: AIR QUALITY ANALYSIS SUMMARY ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Period	Preliminary Screening	Significant Monitoring	Level of Significant Impact	At Monitoring Station		Background	Maximum Modeled	Modeled + Background	NAAQS	Modeled PSD Increment Consumption	Allowable Class II PSD Increment
					Monitored Values	Modeling Results						
PM _{2.5}	24-hour	0.69	4	1.2						35		9
	Annual	0.05		0.3						15		12
NO ₂	1-hour	35.4		7.5					(*) 3113	188		
	Annual	0.8	14	1						100		25
CO	1-hour	162.8		2000						40,000		
	8-hour	51.3	575	500						10,000		
NAAQS = National Ambient Air Quality Standards (*) Project's maximum contribution to an exceedance of the NAAQS is 3.68 $\mu\text{g}/\text{m}^3$. Project's maximum contribution to the maximum concentration of 3113 $\mu\text{g}/\text{m}^3$ is 0.00014 $\mu\text{g}/\text{m}^3$.												

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TABLE III. BACT SELECTION

Equipment	PM ₁₀ /PM _{2.5}	NO _x	CO	VOC	GHG
Turbines	Good combustion practices Fueled by natural gas	DLN & good combustion practices 15 ppmv @ 15% O ₂	Good combustion practices and fueled by natural gas 0.040 lb/MM BTU	Good combustion practices and fueled by natural gas	Fueled by natural gas Use high thermal efficiency turbines Good combustion / operating practices
Water Pump & Generator Engines	40 CFR 60 Subpart IIII	40 CFR 60 Subpart IIII	40 CFR 60 Subpart IIII	40 CFR 60 Subpart IIII	Good combustion / operating practices
Thermal Oxidizers	Good equipment design and proper operating practices Natural gas fuel	Good equipment design and proper operating practices	Good equipment design and proper operating practices Natural gas fuel	Good equipment design and proper operating practices Natural gas fuel	Fueled by natural gas good combustion / operating practices
Flares	Proper plant operations and maintain the presence of the flame at the flare tips when vent gas is routed to the flares				
Condensate Tank				Closed vent and control device that meet 40 CFR 60 Subpart Kb	
Loading Operations				Good equipment design and proper operating practices	
Fugitives				LAC 33:III.2111	LDAR

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

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TABLE IV - MAXIMUM ALLOWABLE EMISSION RATES

EQT No.	Description	PM ₁₀ /PM _{2.5}		NO _x		CO		VOC		CO ₂ e	
		lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
EQT0044 - EQT0046	Emergency Fire Water Pumps	0.10	0.01	1.90	0.09	1.96	0.09	1.90	0.09	330	16
EQT0049 - EQT0050	Emergency River Water Pumps	0.05	< 0.01	0.99	0.05	1.01	0.05	0.99	0.05	171	8
EQT0051 - EQT0054	Emergency Generators	0.96	0.05	32.14	1.53	16.95	0.81	32.14	1.53	3346	159
EQT0055	Emergency Generator (Spare)	0.96		32.14		16.95		32.14		3346	
EQT0056	Thermal Oxidizer	< 0.01	< 0.01	< 0.01	0.01	< 0.01	0.01	< 0.01	< 0.01	105,694	462,939
EQT0057	Thermal Oxidizer (Spare)	< 0.01		< 0.01		< 0.01		< 0.01		105,694	
EQT0068 - EQT0073	Turbines	6.00	21.90	105.60	385.44	37.20	135.78	2.15	7.85	134,238	489,968
EQT0074 - EQT0075	Flares (Emergency)	0.01	0.05	0.11	0.49	0.61	2.69	0.01	0.04	197	861
EQT0076	Operational Flare	< 0.01	0.02	0.03	0.14	0.17	0.75	< 0.01	0.01	55	239
EQT0077	Condensate Storage Tank									3.58	
EQT0078	Condensate Loading							3.35	1.22		
FUG0001	Fugitive Emissions								36.68		