Response to Margin Comments

Statement of Basis
Draft Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit
Freeport LNG Liquefaction Project
Freeport LNG Development, L.P
August 15, 2013

The following is provided to address comments embedded in the initial draft Statement of Basis (Margin Comments) and are intended to provide additional information or clarification to support the Statement of Basis. The comment numbers shown below correspond to the numbers as shown in the draft document provided by the EPA on 31 July 2013.

Page 1 - Margin Comment [AW1]: They are getting 2 PSD permits from Texas the other # is 1282

Freeport LNG Response:

The proposed permit number "PSD-TX-1302-GHG" corresponds to the proposed permit number "PSD-TX-1302" for the proposed Pretreatment Facility. However, as discussed in the Statement of Basis (SOB), the proposed GHG PSD permit for the Freeport LNG Liquefaction Project applies to the construction of a natural gas liquefaction plant contiguous to Freeport LNG's existing Liquefied Natural Gas Terminal facility on Quintana Island and a natural gas pretreatment facility to be located approximately six 3.5 miles from the Quintana Island Terminal, both in Brazoria County, Texas. The corresponding Texas Commission on Environmental Quality (TCEQ) permits are PSD permit No. PSD-TX-1302 and Nonattainment New Source Review (NNSR) permit No. N170 for the pretreatment facility and permit No. PSD-TX-1282 and N150 for the liquefaction plant.

Page 14 – Margin Comment [AW3]: From 091812 response.

Freeport LNG Response:

The Margin Comment is with regard to a discussion of the increased cost to the proposed liquefaction project if a Carbon Capture and Sequestration Project were to be implemented. In support of this comment, Freeport LNG provided the following documentation to the U.S. EPA by letter dated 17 September 2012:

As shown in Tables 1 and 2 of the document submitted to the Mr. Carl Eglund, P.E., EPA Region 6, on July 20, 2012, the use of Carbon Capture and Sequestration (CCS) to remove CO2 from the proposed Amine

Treatment Units would result in an added cost to the project in the range of $46MM to $115MM depending on whether the CO_2 captured is sequestered or used for enhanced oil recovery. Similarly, the use of CCS to remove CO_2 from the proposed combustion turbine exhaust stream would result in an added cost to the project in the range of $444MM - $466MM, as shown in Tables 3 and 4 in the July 20th document. The combined cost is estimated to be in the range of $490MM to $581MM. It is estimated that this would about 50% to 60% of the cost of the Pretreatment Facility.

Page 15 – Margin Comment [j4] - It does appear that they provided you info on an energy penalty and additional fuel use. I would suggest directly tying this to the energy penalty estimate which would result in increased NOx and VOC emissions and [AW5] Freeport did not state this, but should apply.

Freeport LNG Response:

As discussed in the response to EPA Request for Additional Information submitted to the EPA by letter dated 20 July 2012, the estimated energy penalty associated with the installation of a CCS system would be about 62-63% of produced energy from the proposed combustion turbine. Since the facility thermal energy need is approximately equal to the recoverable exhaust energy of the proposed combustion turbine, a larger combustion turbine would be required to meet the additional energy requirements for CCS. Assuming approximately 30 to 45% more fuel will be required to produce this additional electric output, it is estimated that an additional 3.5 billion cubic feet of natural gas per year would be burned that would produce an additional 209,000 tons of CO_2 per year just to support the electrical energy requirements for CCS in addition to the non-GHG criteria pollutants produced as products of combustion.

Page 15, Margin Comment [j6] Can you add another sentence or two on what these are and why simple cycle is important to the project.

Freeport LNG Response:

The combustion turbine proposed by Freeport LNG for the Pretreatment Facility is being installed in a combined heat and power (CHP) configuration, and it is a model that is well suited to this application. The Pretreatment Facility will include one General Electric (GE) Frame 7EA natural gas-fired combustion turbine (CT) exhausting to a heat exchanger for waste heat recovery. Since combustion turbine exhaust energy is being recovered and harnessed for use along with electrical energy from the generator, more of the fuel burned in a CHP application is recovered as useful energy than in a simple-cycle combustion turbine application.

Page 19, Margin Comment [AW7] - Based on net – Do we want to get in gross? Proposed NSPS for EGUs is in gross;

and

Margin Comment [j8] - We need to look to provide more explanation as to why it is lower. Is it the configuration or the purpose/use in this case of the turbines.

Freeport LNG Response:

For the Combustion Turbine, Freeport LNG is proposing an output-based CO2 limit based on equivalent useful energy produced of 738 pounds CO2 per megawatt-hour. This is based on an adjusted Gross CT Energy Heat Rate with consideration of equivalent energy produced for the CT of 5,210 Btu per kilowatt-hour (Btu/kWh) after allowances for initial and long-term degradation in equipment performance. A summary showing the basis for the proposed equivalent useful energy output-based limit is shown in the attached Table 2.

As discussed in the March 14th submittal to the EPA, the PTF combustion turbine is being installed in a combined heat and power (CHP) configuration, and it is a model that is well suited to this application. Since combustion turbine exhaust energy is being recovered and harnessed for use along with electrical energy from the generator, more of the fuel burned in a CHP application is recovered as useful energy than in a simple-cycle combustion turbine application. As such, the useful thermal energy recovered from the combustion turbine exhaust must be added to the combustion turbine net electrical output to determine the total useful energy recovered from burned fuel in order to calculate the lb CO2/MWh in any meaningful way. This is the same methodology that requires the electrical output of a steam turbine to be added to the electrical output of the combustion turbine in order to arrive at the total useful energy recovered in a combined-cycle combustion turbine application. In the case of CHP, at the PTF, the useful thermal energy recovered from the combustion turbine exhaust converted to the same unit of measure, kW, as the combustion turbine electrical output is analogous to the steam turbine electrical output.

It is Freeport LNG's belief that to establish an enforceable BACT condition that can be achieved over the life of the facility, the output-based CO2 limit must account for short-term degradation in performance as the unit is broken in; anticipated degradation of the combustion turbine over time between regular maintenance cycles; and potential degradation of other elements of the system over time.

On the basis of total useful energy recovered in exchange for fuel consumed, the BACT for the CHP combustion turbine proposed at PTF is essentially 35% lower than the "best" simple-cycle BACT example (LMS100 for Puget Sound Energy) provided in the summary table in the SOB:

[(1,138 – 738)/1138] = 35%.

Page 22, Margin Comment [AW10] – Freeport did not provide a ranking.

Freeport LNG Response:

As stated in the SOB, efficient heater design, fuel selection, and good combustion, operation, and maintenance practices are all considered effective and have a range of efficiency improvements which cannot be directly quantified; therefore, ranking is not possible.

Page 26, Margin Comment [AW11] - Page 27 of response states the thermal efficiency of the proposed heaters is 80% on an LHV basis.

Freeport LNG Response:

As discussed in the Response to Request for Information submitted to the EPA by letter dated 20 July 2012, the thermal efficiency of each proposed heating medium heater is 80% on an LHV basis. This is consistent with the EPA's energy performance indicators for furnaces and process heaters. According to the EPA's guidance, the average thermal efficiency of furnaces is estimated at 75-90%.

Page 26, Margin Comment [J12] Still evaluating whether this will be a 12-month or 365-day rolling average.

Freeport LNG Response:

The Greenhouse Gas reporting methods utilized by the EPA for annual reporting of GHG emissions from combustion of fuel under 40 CFR Part 98, is based on the mass or volume of fuel combusted on a monthly basis. For consistency with the GHG reporting requirements, it is Freeport LNG's belief that a demonstration of compliance on a rolling 12 month basis would provide an adequate demonstration of compliance with the CO2 emission limit.

Page 26, Margin Comment [AW13] – Freeport did not provide any of these details in the application.

Freeport LNG Response:

As discussed in the Response to Request for Information submitted to the EPA by letter dated 20 July 2012, Freeport LNG will operate and maintain the heating medium heaters in accordance with the vendor-recommended operating procedures and operating and maintenance manuals. To maintain optimal performance, Freeport LNG will also:

- Calibrate and perform preventative maintenance checks of the fuel gas flow meters on an annual basis;
- Perform preventative maintenance checks of oxygen control analyzers on a quarterly basis; and
- Perform tune-ups of the heaters at a minimum of annually.

Freeport LNG will maintain a file of all records, data, measurements, reports, and documents related to the operation of the proposed heaters, including, but not limited to, the following:

- Records or reports pertaining to significant maintenance performed; and
- Records relating to performance tests and monitoring of combustion equipment.

Page 28, Margin Comment [AW14] From page 34 of response.

Freeport LNG Response:

The initial information provided by a vendor of Regenerative Thermal Oxidizer systems indicated 99% VOC destruction efficiency or an outlet concentration of 20 ppmv as Cl (methane), whichever is less stringent per EPA Method 25A. However, based on follow-on engineering and equipment evaluation, the current RTO under consideration as being representative of the type that may be used, indicates the RTO will be designed for a VOC destruction and removal efficiency of 99% or an outlet concentration of 10 ppmv VOC as propane corrected to 3% oxygen, whichever limit is less stringent.

Page 30, Margin Comment [AW15]: Freeport did not provide any specifics.

Freeport LNG Response:

In its Application for Prevention of Significant Deterioration Permit for GHG Emissions, Section 10.4.5, Page 10-23, Freeport LNG proposes the following design elements and work practices as BACT for the thermal oxidizers:

- Proper Thermal Oxidizer Design and Operation;

- Use of BOG or natural gas as fuel; and
- Implementation of good combustion, operating, and maintenance practices.

As discussed in the Response to Request for Information submitted to the EPA by letter dated 20 July 2012, Freeport provides additional details as follows:

Thermal Oxidizer Design Efficiency/Comparative Benchmark Data

The RTO will use a set of ceramic heat transfer beds in order to effectively carry out its heat recovery functions. Apart from being much more durable and also providing a much longer usage lifespan in comparison to the heat exchangers that are used in recuperative thermal oxidizers, the ceramic beds are also known to offer improved thermal efficiency. The thermal efficiency of the RTO is about 90 to 95 percent, in comparison to the 50 to 75 percent that is offered by recuperative thermal oxidizers. The increased thermal efficiency provided by RTO results in reduced energy savings and operational costs.

As shown in the data sheet for the RTO provided in Appendix C of the July 20th response, it is anticipated the proposed RTO will achieve 95 % Thermal Energy Recovery and 95% nominal heat transfer efficiency.

Good Combustion and Operating Practices – Thermal Oxidizers

Freeport LNG will operate and maintain the thermal oxidizers in accordance with vendor-recommended operating procedures and operating and maintenance manuals. To maintain optimal performance, Freeport LNG will also:

- Calibrate and perform preventative maintenance checks of the fuel gas flow meters on an annual basis;
- Perform preventative maintenance checks of oxygen control analyzers on an annual basis; and
- Perform tune-ups of the oxidizers at a minimum of annually.

Good combustion practices proposed for the thermal oxidizer include, but are not limited to the following:

- Good air/fuel mixing in the combustion zone;
- Allowing sufficient residence time to achieve a VOC conversion efficiency of 99% or an outlet concentration of 10 ppmv VOC as propane corrected to 3% O2, whichever limit is less stringent.
- Maintenance of proper fuel gas supply system design and operation in order to minimize fluctuations in fuel gas quality;
- Good burner maintenance and operation;

- Monitoring and maintenance of proper operating temperature in the primary combustion zone; and
- Maintaining overall excess oxygen levels high enough to complete combustion while maximizing thermal efficiency.

Page 31, Margin Comment [j16] What are these numbers….FINs? EPN's? Model Numbers? and [aw17] I believe these are model numbers – Freeport please verify.

Freeport LNG Response:

The proposed ground flare will consist of a warm flare system (68Z-70) and a cold flare system (68Z-71). Each system is identified by a unique identification number, 68Z-70 and 68Z-71.

Page 32, Margin Comment [AW18]: Step 1 listed "Limited vent gas releases to flare" but they don't mention it in any other step.

Freeport LNG Response:

Freeport LNG is proposing to minimize vent gas releases to the flare. Minimizing the number and duration of planned MSS events will result in reducing the total contribution of GHG emissions from the flares. Freeport will also operate the Liquefaction Plant and the Pretreatment Facility such that vent gas releases to the flare systems that may result from plant upsets or emergencies will be minimized.

Page 32, Margin Comment [AW19]: Freeport, please provide a very detailed analysis on FGR infeasibility – Sierra club and our enforcement group are looking at these very closely and may not agree with any determination that they are not feasible.

Freeport LNG Response:

For a process flare used for the control of continuous vent gas streams, flaring may be reduced by the installation of commercially available flare gas recovery systems comprised of, for example, vapor recovery compressors, flow controls, piping systems, and collection and storage systems. The recovered gas may then be utilized by introducing it into the fuel system or recycling back into the process, as appropriate.

In the gas processing industry, flare gas recovery is considered most feasible in situations where:

- the gas that is vented or flared does so on a continuous basis.
- the volumetric rate of the gas that is vented or flared is generally small, or alternatively, a small percentage of the overall throughput of the facility in question.

- the potential for air ingress into the recovered gas is not a significant process or safety concern.

For the Pretreatment Facility, flaring will be limited to upsets or emergency situations and during planned startup and shutdown events that are anticipated to be of short duration. In addition, the emergency ground flare systems proposed by Freeport LNG are designed for significant instantaneous release rates with varying induced back-pressure in the flare collection system. The rates of flared gas, although of short duration, could potentially reach millions of pounds per hour, which is a significant percentage of the facility gas-processing throughput. Any recovered gas of this magnitude would be much greater than the total Facility fuel demand. Additionally, potential oxygen contamination of the gas from air ingress would be extremely undesirable as recycling gas, could potentially have severe consequences in the amine treating systems (corrosion), molecular sieve dehydration systems (inability to obtain water dew-point specifications), and even the LNG product (off-spec due to high levels of oxygen).

Due to infrequent MSS activities and the reasons stated above, the use of a flare gas recovery system is technically infeasible.

Page 32, Margin Comment [AW20] – If we are considering this.

Freeport LNG Response:

As previously discussed, Freeport LNG is proposing to limit vent gas releases to the flare.

Page 32, Margin Comment [AW21] If we want to include this.

Freeport LNG Response:

As previously discussed, Freeport LNG is proposing to limit vent gas releases to the flare.

Page 34, Margin Comment [JJR22] They gave no specification as to what type or make of engine? Does it meet any efficiency standard? I know we have them for highway based engines….not sure about this category of engines.

and

[AW23] The response states that they are not selected - but they are proposing Tier 3 emission standards for non-road engines 40 CFR 89.112(a).

and

Page 35, Margin Comment [j24] Then I would make 40 CFR Part 60 Subpart IIII engines a part of the BACT selection.

Freeport LNG Response:

The emergency engines have not been selected at this time so the exact make and model are not known at this time. However, Freeport LNG is proposing to install new emergency generators and firewater pumps, and thus, it is anticipated that the engines will be designed to optimal combustion efficiency. In addition, Freeport LNG will purchase emergency internal combustion engines certified by the manufacturer to meet applicable emission standards at the time of installation and applicable requirements of 40 CFR Subpart IIII, "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines."

Page 37, Margin Comment [BST25] Does this plant have mixed refrigerants that may include HFCs? If they did, I imagine they'd not be permitted for release, but would be treated as was done with BASFs.

Freeport LNG Response:

The mixed refrigerants used at the plant will not include hydrofluorocarbons (HFCs).