Statement of Basis

Draft Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit for the Equistar Chemicals L.P., Corpus Christi Operations

Permit Number: PSD-TX-761-GHG

March 2014

This document serves as the statement of basis (SOB) for the above-referenced draft permit, as required by 40 CFR § 124.7. This document sets forth the legal and factual basis for the draft permit conditions and provides references to the statutory or regulatory provisions, including provisions in 40 CFR § 52.21, that would apply if the permit is finalized. This document is intended for use by all parties interested in the permit.

I. Executive Summary

On March 6, 2013, Equistar Chemicals, LP (Equistar) submitted to EPA Region 6 a Prevention of Significant Deterioration (PSD) permit application for greenhouse gas (GHG) emissions. A revised application was submitted on October 22, 2013 (hereinafter, referred to as "the application"). In connection with the same proposed project, Equistar submitted PSD and New Source Review (NSR) permit applications for non-GHG pollutants to the Texas Commission on Environmental Quality (TCEQ) on March 1, 2013. Those permits are PSDTX761M3 and 4862B respectively. Equistar proposes to expand production at the Olefins Plant at the existing Corpus Christi Complex. The capacity expansion includes modification of existing cracking furnaces and steam superheaters to allow increased firing rates, and the addition of some related process equipment. After reviewing the application, EPA Region 6 has prepared the following Statement of Basis (SOB) and draft air permit to authorize construction of new equipment and modification of existing equipment at Equistar's Corpus Christi Complex.

This SOB provides the information and analysis used to support EPA's decisions in drafting the air permit. It includes a description of the facility and proposed modification, the air permit requirements based on BACT analyses conducted on the proposed new units, and the compliance terms of the permit.

EPA Region 6 concludes that Equistar's application is complete and provides the necessary information to demonstrate that the proposed project meets the applicable air permit regulations. EPA's conclusions rely upon information provided in the permit application, supplemental information provided by Equistar at EPA's request, and EPA's own technical analysis. EPA is making this information available as part of the public record.

II. Applicant

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Corpus Christi, TX 78410

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III. Permitting Authority

On May 3, 2011, EPA published a federal implementation plan (FIP) that made EPA Region 6 the PSD permitting authority for the pollutant GHGs. See 75 FR 25178 (promulgating 40 CFR § 52.2305).

The GHG PSD Permitting Authority for the State of Texas is:

EPA, Region 6
1445 Ross Avenue
Dallas, TX 75202

The EPA Region 6 Permit Writer is:
Aimee Wilson
Air Permitting Section (6PD-R)
(214) 665-7596

IV. Facility Location

The Equistar Corpus Christi Complex is located in Nueces County, Texas, and this area is currently designated attainment for all criteria pollutants. The nearest Class 1 area is the Big Bend National Park, which is located over 100 miles from the site. The geographic coordinates for the center of the affected unit are as follows:

Latitude:	27° 48' 40.9" North
Longitude:	- 97° 35' 37.7" West

Below, Figure 1 illustrates the facility location for this draft permit.

Figure 1. Equistar Chemicals, Corpus Christi Complex Location

V. Applicability of Prevention of Significant Deterioration (PSD) Regulations

EPA concludes that Equistar's application is subject to PSD review for GHGs because the project would result in an emissions increase of 75,000 tpy CO_2e or more as described at 40 CFR § 52.21(b)(49)(v)*(b)* and an emissions increase greater than zero tpy on a mass basis as described at 40 CFR § 52.21(b)(23)(ii) (Equistar calculates an increase of 1,061,999 tpy CO_2e). EPA Region 6 implements a GHG PSD FIP for Texas under the provisions of 40 CFR § 52.21 (except paragraph (a)(1)). See 40 CFR § 52.2305.

As the permitting authority for regulated NSR pollutants other than GHGs, TCEQ has determined that the project is subject to PSD review for VOC and NOx as ozone precursors, CO, PM_{10}, $PM_{2.5}$, and NO_2. TCEQ is in the process of issuing the required PSD and NSR permits for this proposed modification, PSDTX761M3 and 4862B respectively[1].

EPA Region 6 applies the policies and practices reflected in the EPA document entitled "PSD and Title V Permitting Guidance for Greenhouse Gases" (March 2011). Consistent with this guidance, we have not required the applicant to model or conduct ambient monitoring for GHGs, and we have not required any assessment of impacts of GHGs in the context of the additional impacts analysis or Class I area provisions of 40 CFR § 52.21(o) and (p), respectively. Instead, EPA has determined that compliance with the selected Best Available Control Technology (BACT) is the best technique that can be employed at present to satisfy the additional impacts analysis and Class I area requirements of the rules with respect to emissions of GHGs. We note again, however, that the project has triggered review for non-GHG regulated NSR pollutants under the PSD and NSR permit amendments sought from TCEQ, so required air quality modeling for the non-GHG pollutants has been completed in order for TCEQ to issue those permits.

VI. Project Description

Hydrocarbon feedstocks are received at the Olefins Plant where they are fed into pyrolysis furnaces. The pyrolysis furnaces, which are fired on natural gas as a primary fuel and process gas (including high hydrogen fuel gas) as a secondary fuel, heat the feedstock to a high temperature where it cracks and reforms as alkenes or olefins. The proposed GHG PSD permit, if finalized, will allow Equistar to expand the Olefins Plant by modifying the existing cracking furnaces, modifying the existing steam superheaters, installing new distillation towers and adding/modifying fugitive components at the existing facility at the Corpus Christi Complex located in Corpus Christi, Nueces County, Texas. The project will increase the plant's nominal production capacity

[1] *See* EPA, Question and Answer Document: Issuing Permits for Sources with Dual PSD Permitting Authorities, April 19, 2011, http://www.epa.gov/nsr/ghgdocs/ghgissuedualpermitting.pdf

by 423,550 TPY of ethylene. The plant also produces other products at varying capacities, but ethylene is the predominant product.

The process effluent from the furnaces is quenched then cooled to separate fuel oil and pyrolysis gasoline (pygas) products from cracked gas stream. The cracked gases are compressed, dried, and cooled prior to a series of purification/distillation steps. A hydrogen-rich stream from the final chilling step is further purified in a reactor to convert the remaining CO to methane and water prior to being sold as product, being added to fuel gas, or being consumed internally within the process.

The purification section consists of a series of distillation columns that separate the process gas stream into acetylene, ethylene, propylene, mixed C4s, and pyrolysis gasoline (pygas) products. Acetylene is converted to ethylene and ethane. Ethane and propane recovered during distillation and separation are recycled as process gas feedstock into the pyrolysis (cracking) furnaces.

Periodically, coke (primarily carbon) deposited in the furnace tubes must be removed. The decoking operation consists of two steps, of which only the second produces GHG emissions:

- An initial steam purge which moves hydrocarbons and coke particles further into the process, and
- A burn step which produces CO and CO_2, and routes the vent stream including coke particles to a cyclone separator.

VII. General Format of the BACT Analysis

The BACT analyses for this draft permit were conducted by following the "top-down" BACT approach recommended in EPA's *PSD and Title V Permitting Guidance for Greenhouse Gases* (March 2011) and earlier EPA guidance. The five steps in the "top-down" process are listed below.

(1) Identify all potentially available control options;
(2) Eliminate technically infeasible control options;
(3) Rank remaining control options;
(4) Evaluate the most effective controls and document the results; and
(5) Select BACT.

VIII. Applicable Emission Units for BACT

The majority of the GHGs associated with the proposed project are from combustion units (i.e., cracking furnaces and steam superheaters). The site has some fugitive emissions from piping components, which contribute a relatively small amount of GHGs. Some increases of Maintenance Startup and Shutdown (MSS) emissions are anticipated to result from clearing of new equipment. These stationary combustion units primarily emit carbon dioxide (CO_2) and small amounts of nitrous oxide (N_2O) and methane (CH_4). The following new/modified emission units are subject to this GHG PSD permit:

- Cracking Furnaces (EPNs: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1J, 1K, 1L, 1M, 1N, 3A and 3B)
- Steam Superheaters (EPNs: 5A and 5B)
- Decoke Pot (EPNs: 9A and 9B)
- Fugitive Emissions (EPNs: FUG)
- MSS Debottleneck Flaring (EPNs: 10 DBN MSS)

IX. BACT Analysis for Cracking Furnaces (1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1J, 1K, 1L, 1M, 1N, 3A and 3B) and Steam Superheaters (5A and 5B)

The Olefins Unit expansion consists of modifying 15 cracking furnaces (1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1J, 1K, 1L, 1M, 1N, 3A and 3B) and modifying two (2) steam superheaters (5A and 5B). The cracking furnaces and steam superheaters will be equipped with ultra-low NO_x burners to control NO_x emissions. The cracking furnaces and steam superheaters combust natural gas as the primary fuel and process gas (containing ethane,propane and/or hydrogen) as a secondary fuel when practicable and available. The steam superheaters are designed similar to a cracking furnace in that they are both "furnaces" with a radiant and convection sections, induced draft fans, and similar flue gas composition.

As part of the PSD review, Equistar provides in the GHG permit application a 5-step top-down BACT analysis for the cracking furnaces and steam superheaters. EPA has reviewed Equistar's BACT analysis for the cracking furnaces and steam superheaters, which has been incorporated into this Statement of Basis, and also provides its own analysis in setting forth BACT for this proposed permit, as summarized below.

Step 1 – Identification of Potential Control Technologies for GHGs

- *Carbon Capture and Storage* – CCS is an available add-on control technology that is applicable for all of the site's affected combustion units.
- *Fuels Selection* –When burned, fuels containing lower concentrations of carbon generate less CO_2 than other higher-carbon fuels. Typically, gaseous fuels such as natural gas or a hydrogen-rich gas stream contain less carbon, and thus lower CO_2 potential, than liquid or solid fuels such as diesel or coal. Equistar proposes to use natural gas as the primary fuel and a hydrogen-rich process gas stream as the secondary fuel for the furnaces.
- *Energy Efficient Design* – When modified, Equistar's furnace and steam superheater designs would maximize efficiency by incorporating the latest improvements in heat transfer and fluid flow to maximize energy efficiency and energy recovery.

- *Best Operation Practices* – Best operation practices include periodic tune-ups and oxygen trim controls. The tune-ups will include instrument calibrations and cleaning of dirty or fouled mechanical parts. Oxygen trim control allows excess oxygen to be controlled at optimum levels, allowing the furnace to operate at continuous high levels of efficiency.
- *N_2O Catalysts* – N_2O catalysts have been used in nitric/adipic acid plants to minimize N_2O emissions.
- *Low NO_x Burners* – Low NO_x burners limit the formation of NO_x (including N_2O) emissions.
- *Post-Combustion Catalytic Oxidation* – Post-combustion catalytic oxidation provides rapid conversion of hydrocarbons including CH_4 into CO_2 and water vapor in the presence of available oxygen.

Step 2 – Elimination of Technically Infeasible Alternatives

All options identified in Step 1 are considered technically feasible except for Carbon Capture and Storage (CCS), N_2O catalysts, and post-combustion catalytic oxidation.

Carbon Capture and Storage (CCS)

CCS is a GHG control process that can be used by "facilities emitting CO_2 in large concentrations, including fossil fuel-fired power plants, and for industrial facilities with high- purity CO_2 streams (e.g., hydrogen production, ammonia production, natural gas processing, ethanol production, ethylene oxide production, cement production, and iron and steel manufacturing)."[2] As explained below, CCS at this modification of existing cracking furnaces and steam superheaters is technically infeasible in at least two ways.

First, the use of CCS on low CO_2 concentration emission streams from cracking furnaces in an olefins plant has not been demonstrated in practice. Equistar estimated the CO_2 concentration in the furnace exhaust stacks following the modification would be approximately 4% to 8.3%. At low concentrations, adsorption into amine solutions is much less effective than installation on coal fired units where the concentration ranges from 7% to 14% and CCS has not been demonstrated in practice on the types of low CO_2 concentration emission streams that will be produced at this existing facility, and CCS has not been demonstrated in practice on streams from cracking furnaces or steam superheaters in an olefins plant. Although CCS technology is generally available from commercial vendors, we do not have information indicating that this technology can be applied to streams with chemical and physical characteristics similar to the

[2] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *PSD and Title V Permitting Guidance for Greenhouse Gases*, March 2011, <http:/www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf> (March 2011)

dilute emissions streams generated from cracking furnaces which will go in and out of decoke cycles throughout the year. Thus, we do not have sufficient information at this time to determine CCS to be applicable, and therefore, technically feasible for the exhaust streams at this facility.

In addition, installation of CCS is not applicable to retrofit of the existing cracking furnaces at the Corpus Christi Complex. The existing furnaces at the Corpus Christi Complex are not identical, but rather represent three different designs. While all of these furnaces operate with firebox pressures being under slight vacuum, they have differing limitations and none are designed to tolerate any flue gas back pressure, let alone variability that would be introduced by connecting the furnace stacks to a common CO_2 capture system. The variability would be caused by the furnaces going in and out of decoke cycles, and when furnaces change firing rates. The induced draft (ID) fans on the furnaces and steam superheaters are designed to maintain the furnaces at a slight vacuum while discharging to atmospheric pressure. Any increase in discharge pressure, such as venting to a carbon capture and storage system, will result in furnace pressures higher than atmospheric conditions. The combustion gases generated within the furnace are greater than 1,900 ^oF and are thus easily capable of destroying the furnace and surrounding equipment upon failure of the induced draft fan that is designed to remove these hot gases as they are generated. Failure of the ID fan closes all fuel gas to the affected furnace to prevent critical failure of the equipment. Any operation of the furnaces at a positive pressure, even for short durations, will result in flame escaping the furnace with the possibility of damaging adjacent piping (hydrocarbon containing), instrumentation, personnel, and structures. High enough pressures will result in furnace wall damage, with eventual uncontrolled furnace fire and furnace collapse with potential impact to the environment and community. This safety consideration alone makes the installation of CCS technically infeasible as a retrofit on the existing furnaces and steam superheaters.

N_2O Catalyst

N_2O catalysts have not been used to control N_2O emissions from cracking furnaces and steam superheaters. In addition, the low N_2O concentrations present in the exhaust stream would make installation of N_2O catalysts technically infeasible. The N_2O concentration of the furnace exhaust is less than 1 ppm. In comparison, the application of a catalyst in the nitric acid industry sector has been effective due to the high (1,000 – 2,000 ppm) N_2O concentration in those streams. N_2O catalysts are therefore eliminated as a technically feasible option for the proposed project.

Catalytic Oxidation

The cracking furnace and steam superheater flue gas maximum temperature is expected to approach 420 ^oF. The flue gas is expected to contain about 1 ppmv CH_4. The temperature is below the lowest operating temperature for catalytic oxidation of 482 ^{o}F or greater. In addition, the flue gas CH_4 concentration is about two orders of magnitude below the lower end of VOC concentration streams that would typically be fitted with catalytic oxidation for control. Therefore, the addition of post-combustion catalytic oxidation to the reformer furnace for control of CH_4 is not an applicable control option for the proposed project and can be eliminated as technically infeasible.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

- Fuel Selection
- Energy Efficient Design
- Best Operation Practices
- Low NO_X Burners

Hydrogen has no capacity to produce CO_2 when combusted. Combusting hydrogen as a primary fuel would provide 100% effectiveness in control of CO_2 emissions from the cracking furnace and is thus considered to be the most effective control.

Combusting low carbon fuels can reduce emissions of CO_2 by varying amounts depending on the fuel. If methane was used as the primary fuel, as opposed to another fossil fuel, it could have a minimum of 12% control effectiveness. Natural gas is the lowest carbon fuel that could be relied upon for continuous fueling of the proposed operation. The olefins unit includes a demethanizer, which is a distillation column that separates methane from the process stream of heavier components. This is a primary source of plant-produced process gas that could be used for fuel value in the cracking furnaces, steam superheaters and other combustion devices instead of being combusted in the flare.

Energy efficient design, use of low-carbon fuel, and best operation practices are all considered effective and have a range of efficiency improvements that cannot be directly quantified; therefore, the above ranking is approximate only. The estimated efficiencies were obtained from Energy Efficiency Improvement and Cost Saving Opportunities for the Petrochemical Industry: An ENERGY STAR Guide for Energy and Plant Managers (Environmental Energy Technologies Division, University of California, sponsored by USEPA, June 2008). This report addressed improvements to existing energy systems as well as new equipment. Low NOx burners limit the formation of NOx including N_2O.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

Fuel Selection

The use of low-carbon fuel is economically and environmentally practicable for the proposed project. Natural gas is the lowest emitting carbon fuel that could be relied upon for the proposed operation. Olefins plants produce gas streams (process gas containing low carbon levels) that are suitable for introduction to a fuel gas system. These gases are primarily methane and hydrogen, along with occasional quantities of materials such as acetylene. The Olefins Unit includes a demethanizer, which is a distillation column that separates methane from the heavier components of the process stream. This is one of the primary sources of plant-produced process gas. If flared as opposed to being used as a fuel, essentially all carbon content of the process gas would be converted to CO_2 with no beneficial use of the heating value of the flared gases. The furnaces may combust hydrogen rich process gas as a secondary fuel when practicable and when available. The process produces hydrogen that may enter the commercial hydrogen market. If a portion of the produced hydrogen is not exported from the unit as a product, it may be used as a fuel to capture its heating value, thus offsetting some of the heat input that would otherwise come from natural gas or process gas. The availability of hydrogen for combustion in the furnaces is not assured. Further, combustion of natural gas and process gas in lieu of higher carbon-based fuels such as diesel and coal reduces emissions of other combustion products such as NO_x, CO, VOC, PM_{10}, and SO_2, thereby providing additional environmental benefits.

Energy Efficient Design

In considering optimization of energy efficient design for this permit, it is important to note that the Olefins Unit capacity increase includes modification of existing furnaces, with no new cracking furnaces or steam superheaters being constructed. As a result, the fundamental cracking furnace and steam superheater designs are already established, and the energy efficiencies are constrained by the existing design and the heat integration with the existing Olefins Unit. When the existing production design limitations are considered, Equistar expects the energy efficiency of each furnace to be 87% or higher. The steam superheaters will meet an exhaust gas temperature of 420 ^oF or less. The use of energy efficient furnace and steam superheater designs and overall unit thermal efficient designs are economically and environmentally practicable for the proposed project. By optimizing energy efficiency, the project requires less fuel than comparable less-efficient operations, resulting in cost savings. Further, reduction in fuel consumption corresponding to energy efficient design reduces emissions of other combustion products such as NO_x, CO, VOC, PM_{10}, and SO_2, providing additional environmental benefits. Equistar has utilized designs for the cracking furnaces and steam superheaters to be energy efficient and has implemented the latest improvements and technologies in heat transfer and fluid flow to maximize the energy efficiency and energy recovery. The radiant tubes in the fireboxes for the cracking furnaces are located in the center of the box in a configuration to minimize the shadowing effect of adjacent radiant tubes, which allows for increased radiant heat transfer to the radiant tubes and high radiant transfer efficiency. The burner layout is engineered to allow radiant heat to be transferred uniformly. This helps maintain high energy efficiency of radiant heat transfer. A combination of high temperature brick and ceramic fiber insulation has been utilized on the walls of the firebox to reduce heat loss and to maximize reflection of radiant heat back to the radiant tubes. The steam superheaters also use a combination of high temperature brick and ceramic fiber insulation to reduce firebox heat loss. The modification of the burners in both the cracking furnaces and steam superheaters will be designed to operate with minimum excess air to maintain high combustion efficiency. The convection section of the cracking heater has been designed to maximize heat recovery. The cracking furnaces and steam superheaters are designed with an induced draft fan in combination with a stack damper to allow for oxygen to be controlled at the desired low level for efficiency. Integral quench exchangers/steam drum are provided with the cracking furnaces to increase overall efficiency.

Best Operation Practices

Best operation practices effectively support the energy efficient design of both the cracking furnaces and steam superheaters. Thus, the economic and environmental benefits of energy efficient design techniques also apply to the use of best operation practices.

Low NO_x Burners

The use of low NO_x burners in both the cracking furnaces and steam superheaters will limit the formation of NOx, including N_2O emissions. In light of the low cost of low NOx burners, and the lack of energy or environmental impacts associated with this technology, they are not eliminated.

Step 5 – Selection of BACT

To date, there are no similar cracking furnace or steam superheater retrofit projects that have received GHG permits. We are aware of GHG PSD permits issued for nine other olefins production facilities, all with new construction cracking furnaces and GHG BACT limits, and two methanol reformers with GHG BACT limits all of which are summarized in the table below. We note that while the proposed thermal efficiency of 87% and stack temperature, 420°F are lower and higher, respectively, than the limits from other permits that are summarized below, those parameters represent BACT for this facility given the differences inherent in addressing a modification of existing cracking furnaces. The facility has the constraints imposed by the existing equipment design and the variable feedstock to the facility. Further, the existing cracking furnaces and steam superheaters currently utilize waste heat recovery in generating/heating steam, which results in a lower exhaust gas temperature that does not contain sufficient residual thermal energy to allow the effective recovery of additional heat through retrofit technology. For example, use of flue gas heat recovery to preheat the furnace combustion air is typically only considered practical if the exhaust gas temperature is higher than 650 °F[3]. The cracking furnaces are modified existing units and will meet a thermal efficiency of 87%. Similar to the cracking furnaces the steam superheaters are modifications of existing units and have a proposed stack temperature of ≤420°F.

Company / Location	Process Description	Control Device	BACT Emission Limit / Requirements	Year Issued	Reference
BASF FINA Petrochemicals LP, NAFTA Region Olefins Complex Port Arthur, TX	Ethylene Production	Energy Efficiency/ Good Design & Combustion Practices	Limit flue gas exhaust temperature . 309°F 365-day average, rolling daily	2012	PSD-TX-903-GHG
Williams Olefins LLC, Geismar Ethylene Plant Geismar, LA	Ethylene Production	Energy Efficiency/Low-emitting Feedstocks/Lower-Carbon Fuels	Cracking heaters to meet a thermal efficiency of 92.5% Ethane/Propane to be used as feedstock Fuel gas containing 25% volume hydrogen on an annual basis	2012	PSD-LA-759
Ineos Olefins & Polymers U.S.A. Alvin, TX	Ethylene Production	Energy Efficiency Low Carbon Fuels	Cracking heater to meet thermal efficiency of 92.6% and flue gas exhaust temperature ≤ 340 °F. 0.85 lbs GHG/lbs of ethylene 35% hydrogen in fuel to maintain a 0.71 carbon percentage in fuel	2012	PSD-TX-97769-GHG

[3] *Energy Efficiency Improvement and Cost Saving Opportunities for the Petrochemical Industry: An ENERGY STAR Guide for Energy Plant Managers* (Environmental Energy Technologies Division, University of California, sponsored by USEPA, June 2008)

Company / Location	Process Description	Control Device	BACT Emission Limit / Requirements	Year Issued	Reference
Chevron Phillips, Olefins Unit Cedar Bayou, TX	Ethylene Production	Energy Efficiency/ Good Design & Combustion Practices	Limit flue gas exhaust temperature ≤ 350 °F. 365-day average, rolling daily	2013	PSD-TX-748-GHG
Equistar Chemicals, Channelview Plant Channelview, TX	Methanol Production	Energy Efficiency/ Good Design & Combustion Practices	Reformer furnace to meet a thermal efficiency of 90% and flue gas exhaust temperature ≤ 320 °F	2013	PSD-TX-1280-GHG
Equistar Chemicals, La Porte Complex La Porte, TX	Ethylene Production	Energy Efficiency/ Good Design & Combustion Practices	Cracking furnaces to meet a thermal efficiency of 91% and flue gas exhaust temperature ≤ 302 °F	2013	PSD-TX-752-GHG
Equistar Chemicals, Channelview, Olefins 1 & 2 Expansion – Channelview, Tx	Ethylene Production	Energy Efficient Design, Low Carbon Fuels, Best Operating Practices, and low-NOx burners.	Furnace Gas Exhaust Temperature ≤ 408°F. Maintain a Minimum Thermal Efficiency of 89.5%.	2013	PSD-TX-1272-GHG
Chevron Phillips, Olefins Unit Cedar Bayou, TX	Ethylene Production	Energy Efficiency/ Good Design & Combustion Practices	Limit flue gas exhaust temperature ≤ 350°F, 365-day average, rolling daily	2013	PSD-TX-748-GHG
Celanese, Ltd. Clear Lake Plant Pasadena, TX	Methanol Production	Energy Efficiency/ Good Design & Combustion Practices	Furnace Gas Exhaust Temperature ≤ 350°F.	2013	PSD-TX-1296-GHG
ExxonMobil Baytown Olefins Plant Baytown, TX	Ethylene Production	Energy Efficient Design, Low Carbon Fuels, & Good Operating Practices	Limit flue gas exhaust temperature ≤ 340°F, 365-day average, rolling daily	2013	PSD-TX-102982-GHG

Of the projects listed above, only one is a retrofit of an existing facility constructed prior to 1990. That is the Equistar Methanol Unit at Channelview, Texas. That unit's furnace is a large downdraft reformer with roof-mounted burners, which is not directly comparable to the proposed project. Additionally, the Equistar Methanol furnace has a fired duty several times that of any of the cracking furnaces or steam superheaters being modified as part of this project. Therefore any comparison of the retrofit furnaces in this project with that modified furnace in a BACT evaluation must consider those significant differences.

In addition, all of the listed ethylene production projects listed above are for newly constructed furnaces. Even with the newly constructed furnace projects, however, there is much variation among them, and this has a significant impact on the level of efficiency that can be practicably achieved. For example, the BASF process uses steam-driven compressor drivers and cracks multiple feedstocks, whereas Williams uses electrical-driven compressors and only ethane/propane as a feedstock, which requires less energy consumption. The Chevron Phillips facility will be constructed similar to the BASF facility in that it too will use steam drivers and will utilize ethane as the primary feedstock. The Chevron Phillips facility also uses a configuration that combines the steam production of eight cracking furnaces with a very high pressure boiler. The Corpus Christi Equistar Olefins cracking furnaces for this project are not all of the same type. Feedstock to the furnaces will be variable, some furnaces will crack ethane/propane feeds, whereas others may crack heavier liquid feeds. Cracking furnace feeds vary based on availability and market conditions. In light of the limitations inherent in the specific types of modifications occurring in the project at this existing facility, the following specific BACT practices are proposed for the cracking furnaces and the steam superheaters:

- *Energy Efficient Design* -A thermal efficiency of no less than 87% will be maintained on each of the cracking furnaces on a 12-month rolling average basis, including periods of startup, shutdown, and hot standby. The steam superheaters will maintain an exhaust gas temperature of $\leq$420°F on a 12-month rolling average basis. Equistar will modify the existing cracking furnaces and steam superheaters to increase firing capacity, while maintaining the energy efficient design The radiant tubes in the firebox for the cracking furnaces will be located in the center of the box in a configuration to minimize the shadowing effect of adjacent radiant tubes, which allows for increased radiant heat transfer to the radiant tubes and high radiant transfer efficiency. The burner layout for the cracking furnaces and steam superheaters will be engineered to allow radiant heat to be transferred uniformly. This will help maintain high energy efficiency of radiant heat transfer. On both the cracking furnaces and steam superheaters a combination of high temperature brick and ceramic fiber insulation will be utilized on the walls of the firebox to reduce heat loss and to maximize reflection of radiant heat back to the radiant tubes. The burners will be designed to operate with minimum excess air to maintain high combustion efficiency. The convection section of the cracking furnace will be utilized to maximize heat recovery to the extent practicable. The cracking furnaces and steam superheaters shall be equipped with an induced draft fan in combination with a stack damper to allow for oxygen to be controlled at the desired low level for efficiency. Integral quench exchangers/steam drum will be provided with the cracking furnaces to increase overall heater efficiency.
- *Low Carbon Fuels* – Using natural gas as the primary fuel, and process gas containing hydrocarbons (methane) and/or hydrogen as a supplemental fuel provides a reduction in combustion CO_2 when compared to diesel or coal.

- *Best Operation Practices* – The use of best operation practices includes periodic combustion tune-ups and maintaining the recommended combustion air and fuel ranges of the equipment as specified by its design, with the assistance of oxygen trim control.
- *Low NO_x Burners* – The use of low NO_x burners will limit the formation of NO_x including N_2O emissions.

BACT Compliance:

Equistar elects to demonstrate compliance with energy efficient operations by continuously monitoring the thermal efficiency of the cracking furnaces and the exhaust stack temperature of each steam superheater. Thermal efficiency will be calculated monthly from these parameters using equation G-1 from American Petroleum Institute (API) methods 560 (4th ed.) Annex G. Equistar determined that they could maintain a thermal efficiency of no less than 87% on a 12-month rolling average basis. The maximum stack exit temperature of 420^{o}F on a 365-day rolling average basis, will be calculated daily for each steam superheater. Efficient cracking furnace and steam superheater design, use of low carbon fuels, and good combustion practices of the cracking furnaces and steam superheaters corresponds to the following tpy CO_2e for each cracking furnace and steam superheater (the annual emission limit includes emissions from the cracking furnaces and steam superheaters during all operations and includes MSS activities):

Description	EPN	Maximum Firing Rate (MMBtu/hr	CO_2e Emission Rate (tpy)
U.S.C. FURNACE “A”	1A	188	94,303
U.S.C. FURNACE “B”	1B	188	94,303
U.S.C. FURNACE “C”	1C	290	145,468
U.S.C. FURNACE “D”	1D	290	145,468
U.S.C. FURNACE “E”	1E	290	145,468
U.S.C. FURNACE “F”	1F	290	145,468
U.S.C. FURNACE “G”	1G	290	145,468
U.S.C. FURNACE “H”	1H	290	145,468
U.S.C. FURNACE “J”	1J	290	145,468
U.S.C. FURNACE “K”	1K	188	94,303
U.S.C. FURNACE “L”	1L	188	94,303
U.S.C. FURNACE “M”	1M	290	145,468
U.S.C. FURNACE “N”	1N	290	145,468
V.M.R. FURNACE “A”	3A	126.7	63,542
V.M.R. FURNACE “B”	3B	126.7	63,542
STEAM SUPERHEATER “A”	5A	146	73,018
STEAM SUPERHEATER “B”	5B	146	73,018

Equistar will modify the cracking furnaces and steam superheaters to maintain an energy efficient design. Equistar will utilize the following to ensure efficient operation of the cracking furnaces and steam superheaters:

- Radiant section thermal efficiency for the cracking furnaces - Process tube placement to assure uniform heating, and to minimize shadowing.
- Sealed system for both the cracking furnaces and steam superheaters - Minimize air infiltration with proper sealing of firebox penetrations.
- Reduce heat loss for both the cracking furnaces and steam superheaters - Brick and ceramic fiber insulation to reduce heat loss.
- Energy recovery for the cracking furnaces - Preheating of process fluids in the convection section. Use of integral quench exchangers and steam drum.
- Physical characteristics - For the cracking furnaces the use of triangular pitch in the convection section, with corbels to control hot combustion gas flow and maximize transfer of heat into the process fluids. For both the cracking furnaces and steam superheaters, properly sized and designed induced draft fans, and properly sized and placed stacks.
- Burner design for both the cracking furnaces and steam superheaters - Minimum excess air design to enhance efficiency. Low-NO_x burners.
- For the cracking furnaces - Careful control of feedstock/steam ratios, temperatures, pressures, and residence times to maximize production rate at normal firing rates.
- For the steam superheaters - Careful control of steam flows, temperatures, pressures, and residence times to optimize steam super-heating at normal firing rates.

Equistar will demonstrate compliance with the CO_2 emission limit for each cracking furnace and steam superheater using the emission factors for natural gas from 40 CFR Part 98 Subpart C, Table C-2, and the site specific fuel analysis for process fuel gas.

The equation for estimating CO_2 emissions as specified in 40 CFR § 98.33(a)(3)(iii) is as follows:

$$CO_2 = (44/12)*Fuel*CC*(MW/MVC)*0.001*1.102311$$

Where:

CO_2 = Annual CO_2 mass emissions from combustion of natural gas (short tons)
Fuel = Annual volume of the gaseous fuel combusted (scf). The volume of fuel combusted must be measured directly, using fuel flow meters calibrated according to § 98.3(i).
CC = Annual average carbon content of the gaseous fuel (kg C per kg of fuel). The annual average carbon content shall be determined using the same procedures as specified for HHV at § 98.33(a)(2)(ii).
MW = Annual average molecular weight of the gaseous fuel (kg/kg-mole). The annual average molecular weight shall be determined using the same procedure as specified for HHV at § 98.33(a)(2)(ii).
MVC = Molar volume conversion factor at standard conditions, as defined in § 98.6.

44/12 = Ratio of molecular weights, CO_2 to carbon.
0.001 = Conversion of kg to metric tons.
1.102311 = Conversion of metric tons to short tons.

The proposed permit also includes an alternative compliance demonstration method in which Equistar may install, calibrate, and operate a CO_2 Continuous Emissions Monitoring System (CEMS) and volumetric stack gas flow monitoring system with an automated data acquisition and handling system for measuring and recording CO_2 emissions.

The emission limits associated with CH_4 and N_2O are calculated based on emission factors provided in 40 CFR Part 98, Table C-2, site-specific analysis of process fuel gas, and the actual heat input (HHV). Comparatively, the CO_2 emissions contribute the most (greater than 99%) to the overall GHG emissions from the furnaces and, therefore, additional analysis is not required for CH_4 and N_2O. To calculate the CO_2e emissions, the draft permit requires calculation of the emissions based on the procedures and Global Warming Potentials (GWP) contained in the Greenhouse Gas Regulations, 40 CFR Part 98, Subpart A, Table A-1. Records of the calculations are required to demonstrate compliance with the emission limits on a 365-day rolling daily average.

An initial stack test demonstration will be required for CO_2 emissions from representative emission units. An initial stack test demonstration for CH_4 and N_2O emissions are not required because the CH_4 and N_2O emission are less than 0.01% of the total CO_2e emissions from the furnaces and are considered a *de minimis* level in comparison to the CO_2 emissions.

X. BACT Analysis for Decoke Pots (EPNs: 9A and 9B)

Cracking furnaces require periodic decoking to remove coke deposits from the furnace tubes. Coke buildup is unavoidable in cracking furnaces, and removal of coke at optimal periods maintains the furnace at efficient conversion rates without increasing energy (fuel) demand. Decoking too frequently is unnecessary and results in excess shutdown/start-up cycles, whereas insufficient decoking frequency results in fouled furnace tubes that reduce conversion rates and increases heat demand. The GHG emissions consist of CO_2 that is produced from combustion of the coke buildup on the coils.

Step 1 – Identification of Potential Control Technologies

There are no available technologies that have been applied to furnace decoking activities to control CO_2 emissions once generated. Proper design and operation of the furnaces in accordance with manufacturer's recommendations is important in managing the formation of coke in furnace tubes.

Step 2 – Elimination of Technically Infeasible Alternatives

Proper cracking furnace design and operation to minimize coke formation is considered technically feasible for the cracking furnaces.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

The only options, proper design and operation of the cracking furnace, have been identified for controlling GHG emissions from decoking operations. Therefore, ranking by effectiveness is not applicable.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

The options for control of CO_2 from decoking operations is to follow the design and operational parameters integrated into the cracking furnaces to limit the need for decoking, thereby reducing the corresponding CO_2 emissions generated. As such, it is inherent in the design and operation of cracking furnaces to minimize coke formation as an economic necessity.

Step 5 – Selection of BACT

Equistar proposes to incorporate a combination of design features and recommended operations practices to limit coke formation in the tubes to the extent practicable. These operating practices will result in an emission limit of 1,270 TPY of CO_2. This value is based on performing decokes on each furnace and steam superheater as shown in the Table below.

Decoke Stack EPN	Furnace EPN	Description	CO Emission Factor (lb/decoke)	Number of Decokes per Year	CO_2 Emissions TPY
9B	1A	U.S.C. FURNACE “A”	870.26	14	29.12
9B	1B	U.S.C. FURNACE “B”	870.26	14	29.12
9B	1C	U.S.C. FURNACE “C”	870.26	14	29.12
9B	1D	U.S.C. FURNACE “D”	2809.46	18	115.87
9B	1E	U.S.C. FURNACE “E”	2809.46	18	115.87
9B	1F	U.S.C. FURNACE “F”	2809.46	18	115.87
9A	1G	U.S.C. FURNACE “G”	2809.46	18	115.87
9A	1H	U.S.C. FURNACE “H”	2809.46	18	115.87
9A	1J	U.S.C. FURNACE “J”	2809.46	18	115.87
9A	1K	U.S.C. FURNACE “K”	2809.46	18	115.87

Decoke Stack EPN	Furnace EPN	Description	CO Emission Factor (lb/decoke)	Number of Decokes per Year	CO_2 Emissions TPY
9A	1L	U.S.C. FURNACE "L"	870.26	14	29.12
9A	1M	U.S.C. FURNACE "M"	2809.46	18	115.87
9A	1N	U.S.C. FURNACE "N"	2809.46	18	115.87
9B	3A	V.M.R. FURNACE "A"	1330.73	18	54.89
9B	3B	V.M.R. FURNACE "B"	1330.73	18	54.89

Timing and frequency of decokes depends on several factors including furnace tube pressure drop, furnace tube temperature, and safety considerations (e.g., force majeure or equipment malfunctions). These factors are monitored by operations personnel and/or by electronic means. Estimated CO_2 emissions from decoke operations are negligible compared to the annual total from the furnaces. Managing coke buildup through such methods will result in limited CO_2 formation from decoking operations.

XI. BACT Analysis for Fugitive Emissions (EPNs: FUG)

GHG emissions from leaking pipe components (fugitive emissions) in the proposed project contain CO_2 and CH_4. The majority of the fugitive emissions are CH_4.

Step 1 – Identification of Potential Control Technologies

- *Installation of leakless technology components to eliminate fugitive emission sources.*
- *Instrumented Leak Detection and Repair (LDAR) program (Method 21).*
- *Leak Detections and Repair with remote sensing technology*
- *Auditory, Visual, and Olfactory (AVO) monitoring program.*
- *Design and construct facilities with high quality components, with materials of construction compatible with the process.*

Step 2 – Elimination of Technically Infeasible Alternatives

All of the options identified in Step 1 are technically feasible.

Leakless/Sealless Technology – Leakless technology valves may be incorporated as part of this project, however some technologies, such as bellows valves, cannot be repaired without a unit shutdown.

Instrument LDAR Programs – LDAR programs have traditionally been developed for control of VOC emissions. Instrumented monitoring is considered technically feasible for components in CH_4 service.

Remote Sensing – Remote sensing technologies have been proven effective in leak detection and repair. The use of sensitive infrared camera technology has become widely accepted as a cost effective means for identifying leaks of hydrocarbon.

AVO Monitoring – Leaking components can be identified through AVO methods. AVO programs are common and in use in the olefins industry and are considered technically feasible.

High quality components - A key element in control of fugitive emissions is the use of high quality equipment that is designed for the specific service in which it is employed. The olefins unit at Equistar's La Porte plant utilizes such components and materials of construction, including gasketing, that are compatible with the service in which they are employed.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

- Leakless Technologies (~100%)
- Instrumented LDAR 28VHP (up to 97%)
- LDAR with Remote Sensing (>75%)
- AVO Monitoring Program (30%)
- Design and Construct Using High Quality Components (Not Measurable)

Leakless technologies are nearly 100% effective in eliminating fugitive emissions from the specific interface where installed. However, leak interfaces remain even with leakless technology components in place. In addition, the sealing mechanism, such as a bellows, is not repairable online and may leak in the event of a failure until the next unit shutdown. This is the most effective control.

Instrumented monitoring can identify leaking CH_4, making possible the identification of components requiring repair. This is the second most effective control.

Remote sensing using an infrared imaging has proven effective for identification of leaks. Instrument LDAR programs and the alternative work practice of remote sensing using an infrared camera have been determined by EPA to be equivalent methods of piping fugitive controls.[4]

As-observed AVO methods are generally somewhat less effective than instrument LDAR and remote sensing because they are not conducted at specific intervals. This method cannot generally identify leaks at as low a leak rate as instrumented reading can identify. This method, due to frequency of observation, is effective for identification of larger leaks.

[4] 73 FR 78199-78219 (December 22, 2008).

Use of high quality components is effective in preventing emissions of GHGs relative to use of lower quality components.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

Use of leakless technology can have adverse environmental impacts. Following a failure of one of these parts, the component is most often not repairable online and may leak until the next unit shutdown, resulting in the emissions from the leak itself as well as the emissions of GHGs and other criteria pollutants that result from the need to shut down and re-start the facility. Maintenance activities in the process unit would potentially require a process unit shut down since isolation of the equipment would not be available. Emissions of GHG and conventional pollutants from maintenance activities would be increased due to having to degas larger sections of piping and perform unit shutdowns. Flanges and connectors inherently cannot be leakless, and the facility cannot be properly and effectively constructed, operated, or maintained without the use of flanges and connectors. Equistar cannot eliminate the use of flanges and connectors, but will use welded piping where practicable in the expansion project. Some leakless valve technologies, such as diaphragm valves, are not available for some high pressure systems. Components such as leakless valves are significantly more expensive than typical valves with conventional seals that are currently used in the existing plant. The cost of leakless valves is estimated to be 3 to 10 times higher than comparable high quality valves. The contribution of GHG emissions for this project is 3.5 TPY of methane or 74 TPY of CO_2e (since the flanges and connectors would still have GHG emissions). Equistar used a very conservative estimate that the cost for leakless valves would be three times higher than comparable high quality valves, the cost of leakless technologies would be $4.8 million greater than high quality valves alone. This makes the cost effectiveness of leakless technology to be approximately $65,120/ton of CO_2e. Based on these economic and adverse environmental impacts, leakless technologies are eliminated as BACT.

LDAR programs for which instrumented detection of leaks is an essential activity have traditionally been developed for control of VOC emissions. The adverse impact of non-VOC fugitive emissions of CH_4 due to global warming potential has not been quantified, and no reasonable cost effectiveness has been assigned. Equistar proposes to use TCEQ method 28VHP for components already required to be monitored by existing LDAR rules or other permits.

Remote sensing of fugitive components in CH_4 service can provide an effective means to identify leaks. Equistar proposes to conduct quarterly remote sensing for detection of leaks for fugitive emissions from components that are not required to be monitored via instrumented Method 21 monitoring by another permit or rule.

The adverse environmental impacts of as-observed AVO methods have not been noted, and no reasonable cost-effectiveness has been assigned. Equistar proposes to use AVO methods as additional monitoring for leaks.

Design to incorporate high quality components is effective in proving longer term emissions control and Equistar proposes to design using these components.

Step 5 – Selection of BACT

Equistar proposes to use TCEQ method 28VHP for LDAR for fugitive emissions of methane for components that are in methane service and for which components are required to be monitored via instrumented Method 21 monitoring by another permit or rule. Equistar proposes to conduct quarterly remote sensing for detection of leaks and fugitive emissions from components that are not required to be monitored via instrumented Method 21 monitoring by another permit or rule. EPA concurs with Equistar's assessment that using the TCEQ 28VHP LDAR program and remote sensing are an appropriate control of GHG emissions. As noted above, LDAR programs and remote sensing would not normally be considered for control of GHG emissions alone due to the small amount of GHG emissions from fugitives. In addition, Equistar will use AVO methods and appropriate design to further control fugitive emissions.

XII. BACT Analysis for Flares (10 DBN MSS)

MSS emissions associated with the project will be directed to the existing Olefins flare (EPN 10). Existing flare emissions will not be evaluated for BACT. CO_2 emissions from MSS activities are produced from the combustion of carbon containing compounds (e.g., CO, VOCs, CH_4) present in the MSS gas streams. CO_2 emissions from the flare are based on the estimated flow rates of CO_2 and flared carbon-containing gases derived from heat and material balance data. Flares are examples of control devices in which the control of certain pollutants causes the formation of collateral GHG emissions. Specifically, control of CH_4 in the process gas by flaring results in the creation of additional CO_2 emissions via the combustion reaction mechanism. However, given the relative GWPs of CO_2 and CH_4, it is appropriate to apply flare combustion controls to reduce CH_4 emissions since the impact of that GHG reduction will be greater than the GHG impact of the additional CO_2 emissions resulting from combustion, and there will also be concurrent destruction of VOCs and HAPs. The flare has a destruction and removal efficiency of 99.5% for methane.

Step 1 – Identification of Potential Control Technologies

- *Flare Gas Recovery* – Flaring can be reduced by installation of commercially available recovery systems, including recovery compressors and collection and storage tanks.

- *Waste Gas Minimization* – Minimizing the gas streams sent to the flare by returning them to the process reduce GHG emissions.
- *Use of Natural Gas for Pilots* - Natural gas is a readily available low carbon fuel that can be used for fuel to the pilots.
- *Good Flare Design* – Good flare design can be employed to destroy large fractions of the flare gas. Good flare design includes pilot flame monitoring, flow measurement, and monitoring/control of waste gas heating valves.

Step 2 – Elimination of Technically Infeasible Alternatives

The only option identified in Step 1 considered technically infeasible for this project is flare gas recovery. While installing a flare gas recovery system to recover flare gas to the fuel gas system is generally considered feasible control technology for industrial flares. However, given that this permit addresses modification of existing production facility, the specific emissions from the existing flare in this project have to be considered. Those flares are intermittent for combusting MSS emissions, and the MSS streams sent to the flares comprise a waste stream that cannot be routed to the fuel gas system or to a process unit due to its composition and variability. Accordingly, for this project, flare gas recovery is eliminated as technically infeasible.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

Natural gas-fired pilots, waste gas minimization, and good flare design will be applied as GHG BACT to minimize emissions from the flare. Because all technically feasible options will be used, no ranking is necessary.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective, with Consideration of Economic, Energy, and Environmental Impacts

No significant adverse energy or environmental impacts are associated with using natural gas-fired pilots, waste gas minimization, or good flare designs are expected.

Step 5 – Selection of BACT

Natural gas-fired pilots, waste gas minimization and good flare design will be applied as GHG BACT to minimize emissions from the flare, which will meet the requirements of 40 CFR §60.18, and will be properly instrumented and controlled. These operational practices result in an emission limit of 4,148 tpy CO_2e for EPN 10 DBN MSS.

Equistar will demonstrate compliance with the CO_2 emission limits using the emission factors for natural gas from 40 CFR Part 98 Subpart C, Table C-1, and the site specific fuel analysis for process fuel gas. The equation for estimating CO_2 emissions as specified in 40 CFR 98.253(b)(1)(ii)(A). The emission limits associated with CH_4 and N_2O are calculated based on emission factors provided in 40 CFR Part 98 Subpart C, Table C-2, site specific analysis of process fuel gas, and the actual heat input (HHV).

XIII. Endangered Species Act

Pursuant to Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1536) and its implementing regulations at 50 CFR Part 402, EPA is required to insure that any action authorized, funded, or carried out by EPA is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species or result in the destruction or adverse modification of such species' designated critical habitat.

To meet the requirements of Section 7, EPA is relying on a Biological Assessment (BA) prepared by the applicant, Equistar Chemicals, LP ("Equistar") and its consultant, Whitenton Group ("Whitenton"), and adopted by EPA.

A draft BA has identified fifteen (15) species listed as federally endangered or threatened in Nueces County, Texas:

Federally Listed Species for Nueces County by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD)	**Scientific Name**
Plant	
South Texas ambrosia	*Ambrosia cheiranthifolia*
Slender rush-pea	*Hoffmannseggia tenella*
Birds	
Piper Plover North Aplomada falcon	*Charadrius melodus* *Falco femoralis septentrionalis*
Eskimo curlew	*Numenius borealis*
Whooping Crane	*Grus americana*
Fish	
Smalltooth sawfish	*Pristis pectinata*
Mammals	
Ocelet	*Leopardus pardalis*
West Indian manatee	*Trichechus manatus*
Red Wolf	*Canis rufus*

Federally Listed Species for Nueces County by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD)	**Scientific Name**
Reptiles	
Green sea turtle	*Chelonia mydas*
Hawkbill sea turtle	*Eretmochelys imbricata*
Kemp's ridley sea turtle	*Lepidochelys kempii*
Leatherback sea turtle	*Dermochelys coriacea*
Loggerhead sea turtle.	*Caretta caretta*

EPA has determined that issuance of the proposed permit will have no effect on any of the 15 listed species, as there are no records of occurrence, no designated critical habitat, nor potential suitable habitat for any of these species within the action area.

Because of EPA's "no effect" determination, no further consultation with the USFWS and NMFS is needed.

Any interested party is welcome to bring particular concerns or information to our attention regarding this project's potential effect on listed species. The final draft biological assessment can be found at EPA's Region 6 Air Permits website at http://yosemite.epa.gov/r6/Apermit.nsf/AirP.

XIV. National Historic Preservation Act (NHPA)

Section 106 of the NHPA requires EPA to consider the effects of this permit action on properties eligible for inclusion in the National Register of Historic Places. To make this determination, EPA relied on and adopted a cultural resource report prepared by Horizon Environmental Services, Inc. ("Horizon"), on behalf of Enterprise's consultant, Whitenton, submitted on November 11, 2013.

For purposes of the NHPA review, the Area of Potential Effect (APE) was determined to be 27.4 acres which covers the existing Corpus Christi facility and is the construction site of the proposed Olefins Unit Expansion. Horizon conducted a desktop review within a 1.0-mile radius area of potential effect (APE). The desktop review included an archaeological background and historical records review using the Texas Historical Commission's online Texas Archaeological Site Atlas (TASA) and the National Park Service's National Register of Historic Places (NRHP). Based on the desktop review, one cultural resources survey, that included a field survey, was previously performed in 1978 with an APE that includes the current APE of this project. Based on the desktop review, no cultural resources were recorded within the APE and no cultural resources were identified within 1-mile of the APE.

EPA Region 6 determines that because no historic properties are located within the APE and that a potential for the location of archaeological resources within the construction footprint itself is low, issuance of the permit to Equistar will not affect properties potentially eligible for listing on the National Register.

On February 4, 2014, EPA sent letters to Indian tribes identified by the Texas Historical Commission as having historical interests in Texas to inquire if any of the tribes have historical interest in the particular location of the project and to inquire whether any of the tribes wished to consult with EPA in the Section 106 process. EPA received no requests from any tribe to consult on this proposed permit. EPA will provide a copy of the report to the State Historic Preservation Officer for consultation and concurrence with its determination. Any interested party is welcome to bring particular concerns or information to our attention regarding this project's potential effect on historic properties. A copy of the report may be found at http://yosemite.epa.gov/r6/Apermit.nsf/AirP.

XV. Environmental Justice (EJ)

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes federal executive branch policy on environmental justice. Based on this Executive Order, the EPA's Environmental Appeals Board (EAB) has held that environmental justice issues must be considered in connection with the issuance of federal Prevention of Significant Deterioration (PSD) permits issued by EPA Regional Offices [See, e.g., *In re Prairie State Generating Company*, 13 E.A.D. 1, 123 (EAB 2006); *In re Knauf Fiber Glass*, Gmbh, 8 E.A.D. 121, 174-75 (EAB 1999)]. This permitting action, if finalized, authorizes emissions of GHG, controlled by what we have determined is the Best Available Control Technology for those emissions. It does not select environmental controls for any other pollutants. Unlike the criteria pollutants for which EPA has historically issued PSD permits, there is no National Ambient Air Quality Standard (NAAQS) for GHGs. The global climate-change inducing effects of GHG emissions, according to the "Endangerment and Cause or Contribute Finding", are far-reaching and multi-dimensional (75 FR 66497). Climate change modeling and evaluations of risks and impacts are typically conducted for changes in emissions that are orders of magnitude larger than the emissions from individual projects that might be analyzed in PSD permit reviews. Quantifying the exact impacts attributable to a specific GHG source obtaining a permit in specific places and points would not be possible [PSD and Title V Permitting Guidance for GHGs at 48]. Thus, we conclude it would not be meaningful to evaluate impacts of GHG emissions on a local community in the context of a single permit. Accordingly, we have determined an environmental justice analysis is not necessary for the permitting record.

XVI. Conclusion and Proposed Action

Based on the information supplied by Equistar, our review of the analyses contained in the TCEQ PSD Permit Application and the GHG PSD Permit Application, and our independent evaluation of the information contained in our Administrative Record, it is our determination that the proposed conditions in the draft permit represent BACT for GHGs. Therefore, EPA is proposing to issue Equistar a PSD permit for GHGs for the facility, subject to the PSD permit conditions specified therein. This permit is subject to review and comments. A final decision on issuance of the permit will be made by EPA after considering comments received during the public comment period.

APPENDIX

Annual Facility Emission Limits

Annual emissions, in tons per year (TPY) on a 12-month, rolling average, shall not exceed the following:

Table 1. Facility Emission Limits

FIN	EPN	Description	GHG Mass Basis		TPY $CO_2e^{2,3}$	BACT Requirements
				TPY[1]		
1A	1A	Cracking Furnace	CO_2	93,838	94,303	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o.
			CH_4	5.5		
			N_2O	1.1		
1B	1B	Cracking Furnace	CO_2	93,838	94,303	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o.
			CH_4	5.5		
			N_2O	1.1		
1C	1C	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o.
			CH_4	8.4		
			N_2O	1.7		
1D	1D	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
1E	1E	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
1F	1F	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
1G	1G	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
1H	1H	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
1J	1J	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
1K	1K	Cracking Furnace	CO_2	93,838	94,303	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	5.5		
			N_2O	1.1		
1L	1L	Cracking Furnace	CO_2	93,838	94,303	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	5.5		
			N_2O	1.1		

FIN	EPN	Description	GHG Mass Basis		TPY CO_2e[2,3]	BACT Requirements
				TPY[1]		
1M	1M	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
1N	1N	Cracking Furnace	CO_2	144,751	145,468	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	8.4		
			N_2O	1.7		
3A	3A	Cracking Furnace	CO_2	63,241	63,542	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	3.7		
			N_2O	0.7		
3B	3B	Cracking Furnace	CO_2	63,241	63,542	Maintain a Minimum Thermal Efficiency of 87%. See permit condition III.A.1.m. through o
			CH_4	3.7		
			N_2O	0.7		
5A	5A	Steam Superheater	CO_2	72,675	73,018	Steam Superheater Gas Exhaust Temperature ≤ 420 °F. See permit condition III.A.1.m. through o
			CH_4	4.2		
			N_2O	0.8		
5B	5B	Steam Superheater	CO_2	72,675	73,018	Steam Superheater Gas Exhaust Temperature ≤ 420 °F. See permit condition III.A.1.m. through o
			CH_4	4.2		
			N_2O	0.8		
9A 9B	9A 9B	Decoke Pot	CO_2	1,270[4]	1,270[4]	Proper furnace design and operation. See permit condition III.A.1.p and q
FUG	FUG	Fugitive Process Emissions	CH_4	No Emission Limit Established[5]	No Emission Limit Established[5]	Implementation of LDAR/Remote Sensing program. See permit condition III.A.2.
10 DBN MSS	10 DBN MSS	Elevated Flare - MSS	CO_2	3,866	4,201	Good Combustion Practices. See permit condition III.A.3.
			CH_4	13.3		
			N_2O	0.01		
Totals[6]			**CO_2**	**1,955,080**	**CO_2e 1,965,475**	
			CH_4	**145**		
			N_2O	**23**		

1. The GHG Mass Basis TPY limits are informational only and do not constitute an enforceable limit.
2. Compliance with the annual emission limits (tons per year) is based on a 12-month rolling total, to be updated the last day of the following month. The TPY emission limits specified in this table are not to be exceeded for this facility and include emissions from the facility during all operations and include MSS activities.
3. Global Warming Potentials (GWP): CH_4 = 25, N_2O = 298
4. The decoke pot (EPN: 9A and 9B) emissions are estimated to be 1,270 TPY CO_2/CO_2e for both decoke pots combined.
5. Fugitive process emissions from FUG are estimated to be 18.4 TPY of CH_4, and 460 TPY CO_2e. In lieu of an emission limit, the emissions will be limited by implementing a design/work practice standard as specified in the permit.
6. Total emissions include the PTE for fugitive emissions. Totals are given for informational purposes only and do not constitute emission limits.