Statement of Basis
Draft Greenhouse Gas Prevention of Significant Deterioration
Preconstruction Permit for
Formosa Plastics Corporation, Texas
Low Density Polyethylene Plant

Permit Number: PSD-TX-1384-GHG

June 2014

This document serves as the statement of basis 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 under 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 December 11, 2012, Formosa Plastics Corporation, Texas (Formosa) submitted to EPA Region 6 a Prevention of Significant Deterioration (PSD) permit application for Greenhouse Gas (GHG) emissions for the proposed new Low Density Polyethylene (LDPE) plant portion of the overall 2012 Expansion Project at Formosa's Point Comfort chemical plant complex. The project at the Formosa plant will involve construction of the following emission units: two regenerative thermal oxidizers, pellet blending and product silos, natural gas piping fugitives, maintenance, startup and shutdown (MSS) emission, emergency generator, contribution emission to the Olefins 3 elevated plant flare. After reviewing the application, EPA Region 6 has prepared the following Statement of Basis (SOB) and draft air permit to authorize construction of air emission sources at the Formosa Point Comfort chemical complex.

EPA Region 6 concludes that Formosa'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 requested by EPA and provided by Formosa, and EPA's own technical analysis. EPA is making all this information available as part of the public record.

II. Applicant

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III. Permitting Authority

On May 3, 2011, EPA published a federal implementation plan that makes EPA Region 6 the PSD permitting authority for the pollutant GHGs. 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:

Erica Le Doux
Environmental Engineer
Air Permitting Section (6PD-R)
U.S. EPA, Region 6
1445 Ross Avenue, Suite 1200
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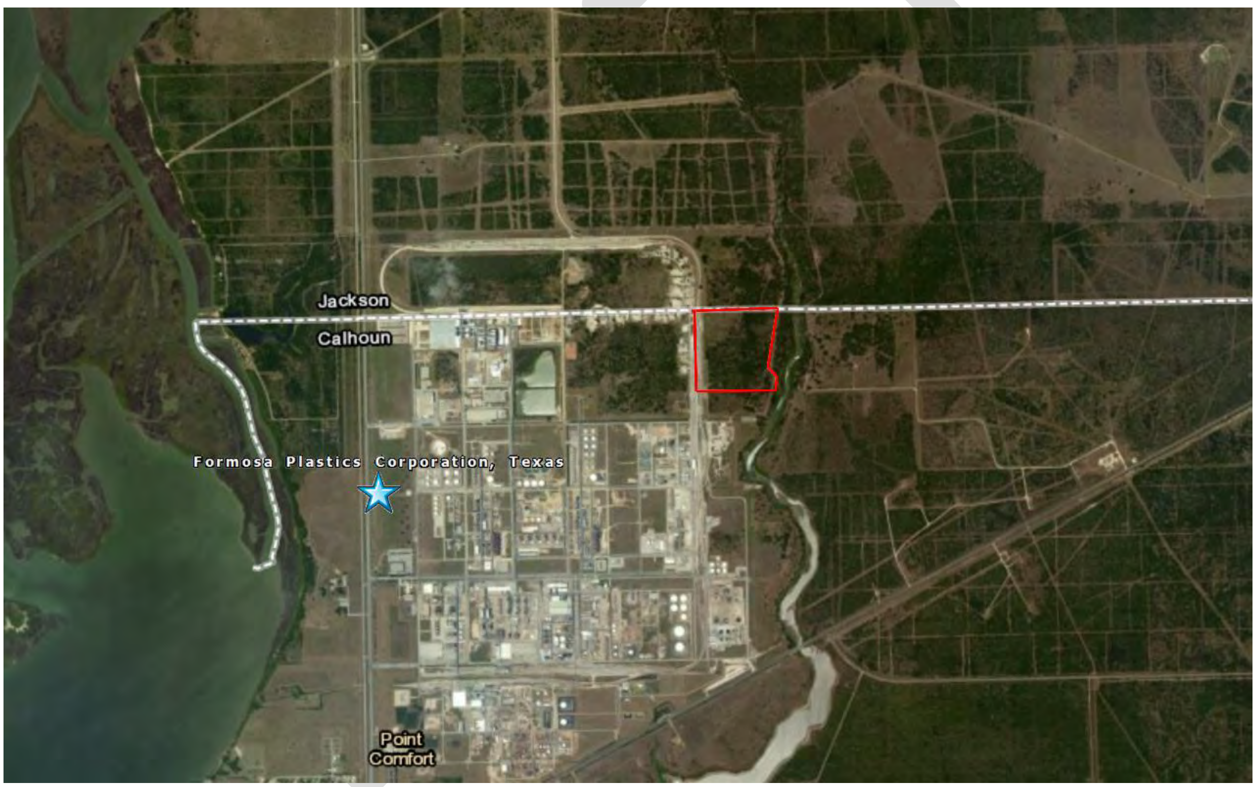
IV. Facility Location

The Formosa Plastic Corporation, Texas chemical complex is located in Point Comfort, Calhoun County, Texas. The geographic coordinates for this facility are as follows:

Latitude: 28º 41' 20" North
Longitude: 96º 32' 50" West

Calhoun County is currently designated attainment or unclassified for all pollutants. The nearest Class 1 area is Big Bend National Park, which is located over 500 miles from the site.
The figure below illustrates the facility location for this draft permit.

Figure 1. Formosa Plastics Corporation, Texas Point Comfort new LDPE plant Location



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

EPA concludes Formosa's application is subject to PSD review for the pollutant GHGs, because the project would lead to an emissions increase of 75,000 TPY CO_2e as described at 40 CFR § 52.21(b)(49)(iv)(b) and an emissions increase greater than zero TPY on a mass basis as described at 40 CFR § 52.21(b)(23)(ii) (Formosa calculated a CO_2e emissions increase of 96,196 TPY attributable to the LDPE plant). 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 that trigger PSD (other than GHGs), TCEQ has determined that the proposed project is subject to PSD review for non-GHG pollutants. TCEQ has determined that the proposed project is subject to PSD for VOC, CO, NO_2, CO, and $PM/PM_{10}/PM_{2.5}$. At this time, TCEQ has not issued a PSD permit for the non-GHG pollutants. Accordingly, under the circumstances of this project, the TCEQ will issue the non-GHG portion of the PSD permit and EPA will issue the GHG portion.[1]

EPA Region 6 applies the policies and practices reflected in EPA's *PSD and Title V Permitting Guidance for Greenhouse Gases* (March 2011). Consistent with that guidance, we have not required the applicant to model or conduct ambient monitoring for GHGs, nor have we 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 BACT is the best technique that can be employed at present to satisfy additional impacts analysis and Class I area requirements of the rules as they relate to GHGs. We note again, however, that the proposed project has regulated NSR pollutants that are non-GHG pollutants, which will be addressed by the PSD permit to be issued by TCEQ.

VI. Project Description

The proposed GHG PSD permit, if finalized, will authorize Formosa to modify their existing chemical complex to add a new LDPE plant. In the proposed LDPE plant, the polymerization process will be accomplished with a high pressure tubular reactor process. The LDPE plant will have the capability of producing 626,500 TPY (1,253 million pound-per-year) of many different grades of LDPE products including products that use vinyl acetate as a co-monomer.

Ethylene Feed System

Ethylene is the primary monomer in the polymerization reaction. Ethylene is received from neighboring Olefins plants by pipeline. The polymerization reaction takes place at high pressure; therefore, the ethylene feed stream must be compressed prior to entering the tubular reactor.

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[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

Compressor System

The compressor system includes primary and secondary compressors, a low pressure booster compressor, and an initiator compressor. Ethylene is typically received from battery limits at approximately 370 psig. The recycled ethylene from the low pressure recovery system is compressed by the low pressure booster compressor to combine with the fresh ethylene feed. The combined flow is then boosted to approximately 4,000 psig by the primary compressor. The high pressure recovery gas is mixed with the feed stream after primary compressor discharge. The combined flow is then boosted up to approximately 50,000 psig in the secondary compressor prior to reactor entry. After compression additional reactants are added before entering the reactor as described below.

Peroxide Feed System

Organic peroxide is used as an initiator for the polymerization reaction. The peroxide is received in cylinders and is stored in a refrigerated storage area. The storage refrigeration system is powered by the Formosa centralized utility power system with backup provided by an emergency generator. The peroxide must be mixed with a solvent prior to introduction to the process. Both peroxide and solvent are then transferred into a mix tank, the mixed peroxide/solvent stream is transferred with metering pumps into the reactor feed stream upstream of the reactor preheater.

Vinyl Acetate Monomer Feed System

Vinyl Acetate (VA) may be used as co-monomer in the polymerization reaction depending on the product grade being produced. The VA is received by truck and transferred into a storage tank. When making vinyl acetate co-monomer product, VA is pumped from the tank into the reactor feed stream (ethylene) upstream of the secondary compressor.

Propionaldehyde Feed System

Propionaldehyde is used as moderator to control the rate of the polymerization reaction. Propionaldehyde is received in truck and transferred into a storage tank after which it is pumped, after the addition of propylene modifier (described below) through metering pumps into the secondary ethylene compressor feed stream.

Propylene Feed System

Propylene is introduced into the reaction system as a modifier to produce certain grades of LDPE. When LDPE grades that require propylene are produced, then propylene is received from the neighboring Olefins plant by pipeline and mixed with the propionaldehyde moderator prior to metering it into the primary compressor discharge line to mix with the ethylene feed.

Reactor Polymerization System

The ethylene, peroxide, VA, propionaldehyde, and propylene mixture (depending on the LDPE product grade being produced) are fed to the tubular reactor to produce a polyethylene solution. The polymerization reaction occurs in the tubular reactor which consists of several reactor zones. Close control of process conditions, material feed rates, such as the monomer, co-monomer, initiator, moderator and modifiers discussed above are used to produce the various grades of LDPE resin desired.

High Pressure and Low Pressure Gas Recovery System

The reactor effluent, a solution of polyethylene and un-reacted monomer, leaves the reactor, before entering a high pressure separator. The high pressure separator separates un-reacted monomer from polyethylene product. A small amount of low molecular weight polymer (wax) leaves with the monomer gas stream after separation. The wax is considered a byproduct of the LDPE process and will be sold or transferred offsite for disposal.

After the high pressure separation described above, the molten polymer stream is routed into the low pressure separation system to further separate the dissolved gas from polymer. The overhead gas stream from the separation knockout drum is further separated with a condenser into a recycle monomer stream and a vinyl acetate stream. The gas/recycle monomer stream is routed to the inlet of the low pressure booster compressor to be combined with fresh feed to the reactor. The molten polymer from the bottom of the low pressure separator flows continuously into the melt extruder.

VA Recovery System

The un-reacted vinyl acetate from the low pressure separator system polymer knockout (KO) drum is sent to the vinyl acetate recovery column. From the column, the purified VA is recycled back to the VA feed tank.

Additive Feed, Extrusion and Dryer System

This section consists of an additive system, melt extrusion system and equipment used to dry and convey pellets. The polymer from the low pressure separator is directly discharged into the melt extruder to mix with additives. The melted, mixed polymer is then forced through a die plate to make plastic “string.” This plastic “string” enters the enclosed cutter box, which is submerged in water, where it is cut underwater into smaller pieces by cutter knives, resulting in uniform plastic pellets. The pellets are instantly solidified and carried out of the cutter box by the circulating water to a centrifugal pellet dryer. The circulating water is removed from the pellets in the dryer and after being treated to adjust PH as described below, the water is recycled for reuse in the cutter box again. The pellets are transferred into the degassing, blending and product silos as described below.

Degassing/Blending/Product Silos/ Rail Car Loading System

The final product pellets are sent to degassing silos. The silos are equipped with an air purge system to strip VOCs. The purge air and the stripped VOCs are routed to one of two regenerative thermal oxidizers (RTOs) for control (EPNs: LD-022A/B, LD-023A/B), which are sources of GHG emissions from the combustion of pilot gas and waste gas. The product is then sent to blending and product silos (EPNs: LD-014, LD-015) for storage after which the final product is sent for bagging, bulk truck or rail car loading.

GHGs (methane and CO_2) can be formed in the polymerization reaction as an unfavorable side reaction. The reaction conversion rate can vary depending on the type of LDPE process technology selected, which means that a significant quantity of un-reacted ethylene will be present in the reactor effluent. Formosa is proposing to design the LDPE plant with a technology that will maximize the feed conversion (yield) rate. In comparison, another LDPE process design option, with a lower conversion rate, would require significant additional ethylene recovery capacity as compared to Formosa's proposed process design. To recover this additional quantity of un-reacted ethylene, the separation system compressor would require additional electrical consumption. Thus, by selecting a process design that maximizes reaction conversion rate, less electrical energy is required to recover un-reacted feed. The proposed process technology was chosen over other design options because it uses a multi-ethylene side feed, instead of the straight feed found in other process licenses. The multi-side feed process provides higher ethylene conversion (amount of ethylene converted to polymer) and therefore with higher conversion, less reactants are available for side reactions.[2] In order to maximize production of saleable product, the LDPE process design and control system inherently limits this side reaction; however, the side reaction kinetics cannot be completely eliminated. Residual non-polymerized materials, including un-reacted feed material and the methane and CO_2 resulting from the peroxide side reaction described above, are expected to be removed from the polymer pellets in the degassing silos with the air purge stripping system described above. The blending silos are sources of GHG emissions as they may contain trace residual concentrations of GHGs that remain in the pellets after air stripping in the degassing silos.

VII. General Format of the BACT Analysis

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

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

[2] Formosa provide process technology comparison data in Table 1 on response to comments received May 10, 2013 http://www.epa.gov/earth1r6/6pd/air/pd-r/ghg/formosa-ldpe-response.pdf

(5) Select BACT.

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

VIII. Applicable Emission Units and BACT Discussion

The majority of the contribution of GHGs associated with the project is from combustion sources (i.e., regenerative thermal oxidizers, flares, and emergency engine testing). The site has some fugitive emissions from piping components which contribute an insignificant amount of GHGs. These stationary combustion sources primarily emit carbon dioxide (CO_2), and small amounts of nitrous oxide (N_2O) and methane (CH_4).The following devices are subject to this GHG PSD permit:

- Regenerative Thermal Oxidizers (RTOs) (EPNs: LD-022A/B, and LD-023A/B,);
- Pellet Blending Silos (EPNs: LD-014 and LD-015)
- Emergency Generator Engine (EPNs: LD-002);
- Contributions to the Olefins 3 Elevated Flare Systems (EPNs: OL3-FLRA and OL3-FLRB);
- Natural Gas Piping Fugitives (EPNs: NG-FUG);
- Maintenance, startup and shutdown (MSS) activities (EPNs: LD-MSS)

IX. Regenerative Thermal Oxidizers (EPNs: LD-022A/B and LD-023A/B)

Formosa is proposing two (2) RTOs (FIN/EPNs: LD-022A/B, LD-023A/B). Each RTO has two (2) stacks (A and B). Under normal operation, the RTO emissions are routed to one stack and the second stack is used for startup, shutdown and combustion chamber temperature maintenance purposes. Also during normal operations, one RTO will receive waste gas while the second RTO is maintained in hot stand-by mode (natural gas firing). The RTOs are operated to abate VOC emissions for emission sources downstream of the extruder (the pellet dryer and degassing silos). The RTOs emit GHGs as a result of waste gas and fuel gas combustion. The RTOs will achieve 99% VOC destruction and removal efficiency as described in the non-GHG State PSD permit application. It should be noted that the waste gas routed to the RTO will not contain GHG species (e.g., methane). GHGs are emitted as a result of the combustion process, not from residual (uncontrolled) waste gas.
Step 1 – Identification of Potential Control Technologies for GHGs

- *Carbon Capture and Storage* – Carbon, compression, transport and geological storage. CO_2 emissions from the RTO flue gas could be absorbed in a conventional amine solvent. The

CO_2 emissions could then be concentrated in an amine regenerator vent stream, compressed and routed to oil production facilities using CO_2 for EOR or stored in geologic formations.

- *Low Carbon Fuels* – Use of fuels containing lower concentrations of carbon generate less CO_2 than other higher-carbon fuels. Natural gas has the lowest carbon intensity of any available fuel, thus selection of natural gas as the RTO fuel will minimize emissions of GHGs from RTO fuel combustion.
- *Energy Efficient Design* – Energy efficiency is inherent in the operation of an RTO. Specific technologies include feed preheating, insulation, and optimization of the fuel/air mixture, variable speed combustion blower and natural gas conservation (NGC) system for the RTOs.
- *Good Operating and Maintenance Practices* – Good combustion practices includes the following: appropriate maintenance of equipment, operating within the recommended combustion air and fuel ranges of the equipment as specified by its design. Also, includes periodic refractory repair and cleaning when required to maximize thermal efficiency.

Step 2 – Elimination of Technically Infeasible Alternatives

Carbon Capture and Sequestration (CCS)

EPA generally considers a technology to be technically feasible if it: (1) has been demonstrated and operated successfully on the same type of source under review, or (2) is available and applicable to the source type under review. PSD and Title V Permitting Guidance for Greenhouse Gases (March 2011), pg. 33. CO_2 capture technologies, including post-combustion capture, have not been demonstrated in practice on RTOs or a similar VOC control device. Moreover, while CO_2 capture technologies may be commercially available generally, we believe that there is insufficient information at this time to conclude that CO_2 capture is applicable to sources that have low volume and low concentration CO_2 streams, such as the RTOs for this project, which has CO_2 volumes of less than 500,000 TPY and CO_2 concentrations of approximately 0.10%.[3] As a result, EPA believes that CCS is technically infeasible for the RTOs and can be eliminated as BACT.[4] In regards to the remaining control options, EPA finds that all are technically feasible.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

- Low Carbon Fuel (approximately 40%)
- Energy Efficient Design

[3] Formosa provided a revised BACT analysis in response to EPA's request for detailed CCS cost analysis April 14, 2014. http://www.epa.gov/earth1r6/6pd/air/pd-r/ghg/formosa-olefins-expansion-appendix-c-bact-analysis041414.pdf.On page 15 of the submittal, Table 6-2 entitled, "Candidate CCS Source Exhaust Stream CO_2 Concentrations and Flow Rates, by Unit Type" indicates the CO_2 concentration in the flue gas of the RTOs is only about 0.10% volume".

[4] In addition, we note that Formosa provided further evidence that supports rejection of CCS as BACT in step 4 based on economic costs, as well as environmental and energy impacts.

- Good Operating and Maintenance Practices - Good combustion practices include appropriate maintenance of equipment and operating within the recommended combustion air and fuel ranges of the equipment as specified by its design

The use of low-carbon fuels, energy efficient design, and good combustion practices are all considered effective and have a range of efficiency improvements which cannot be directly quantified; therefore, the above ranking is approximate only. These technologies all may be used concurrently. 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 efficiencies associated with new equipment.

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

All of the remaining options identified for controlling GHG emissions from the RTO are considered effective and have a range of efficiency improvements which cannot be directly quantified and can all be used together.[5]

Low-Carbon Fuel

Natural gas has the lowest carbon intensity of any available fuel gas, thus selection of natural gas as the RTO fuel will minimize emissions of GHGs from RTO fuel combustion.

Energy Efficient Design

The use of an energy efficient RTO unit design is economically and environmentally practicable for the proposed project, as discussed above. 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 environmental benefits as well.

The RTOs are designed for redundant operation where waste gas can be routed to either RTO. Both RTOs may combust natural gas ("fuel gas") simultaneously to keep the units at proper VOC destruction temperature. Regenerative thermal oxidizers are inherently designed with energy efficiency in mind and provide superior energy efficiency compared to a standard (non-

[5] Formosa conducted an analysis of the capital cost impact of CCS on all three proposed projects using project specific data along with the data provided by the Report of the Interagency Task Force on Carbon Capture and Storage (August 2010). Formosa estimated the total capital costs for CCS to be $1.52 billion with geologic storage and $925 million with enhanced oil recovery use. Given that the LDPE project is estimated to contribute less than 1% of the CO2 flow rate, Formosa maintains that CCS is not economically feasible for this project

regenerative) thermal oxidizer unit. RTOs are specifically designed to minimize the amount of fuel required to maintain the minimum firebox temperature. Specifically, the RTO firebox is lined with ceramic fiber refractory material to provide superior heat retention. RTOs are designed for high (more than 90%) thermal efficiency. By selecting an RTO instead of a non-regenerative thermal oxidizer, Formosa estimates as much as 50% reduction in fuel gas combustion, or approximately 316,000 MMBTU/yr (for both RTOs) of energy savings as compared to a non-regenerative (traditional) oxidizer unit. This fuel gas savings equates to an avoidance of 9,200 tpy CO_2e GHG emissions[6].

The LDPE plant's RTOs will also be designed with unique natural gas conservation (NGC) system which allows the RTO to maintain its combustion temperature without use of the primary burner. The primary burner may be switched off while natural gas is injected into one of the four corners of the system in the upper flow quadrant. The injected natural gas ignites as it rises up through the ceramic bed. This design feature results in the consumption of up to 20% less natural gas (approximately 79,000 MMBTU/yr for both RTOs), thus avoiding GHG emissions upward of 4,600 tpy CO_2e.[7]

The RTOs will also be designed to minimize the electrical power used to drive the combustion blower by installation of a variable speed blower and corresponding instrumentation and control systems. Compared to a traditional thermal oxidizer, Formosa expects 40 kWh less electrical consumption. By selecting a variable speed blower and corresponding instrumentation and control systems, Formosa estimates an energy savings resulting in avoidance of approximately 160 tpy CO_2e in upstream electrical generation emissions at Formosa's utilities plant.[8]

Good Operating and Maintenance Practices

Good operation and maintenance practices for the RTOs include monitoring and analysis of waste gas flow rate, monitoring temperature in the combustion chamber, and periodic maintenance.

Step 5 – Selection of BACT

To date, other similar facilities with a GHG BACT limit are summarized in the following table:

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[6] Calculated using the GHG methodology for this source based on selected design heat input of 36 MMBtu/hr (316,000 MMBtu/yr) of fuel gas for both RTOs.

[7] Formosa provided additional manufacturer data for the RTOs http://www.epa.gov/earth1r6/6pd/air/pd-r/ghg/formosa-ldpe-response-070113.pdf

[8] Value calculated using combined cycle turbine emission rate of 0.913 lb CO_2/kW.

Company / Location	Process Description	Control Device	BACT Emission Limit / Requirements	Year Issued	Reference
ExxonMobil Chemical Company Mont Belvieu Plastics Plant, Mont Belvieu, TX	Low Density Polyethylene Production	Low carbon fuels; Energy efficient design; Good Operating and Maintenance practices	Firebox Temperature >1400 °F on an hourly basis	2013	PSD-TX-103048-GHG
Occidental Chemical Corporation	Ethylene Production	Low carbon fuels; Energy efficient design; Good Operating and Maintenance practices	Firebox Temperature >1300 °F on an hourly basis Oxygen concentration >10% averaged daily Feed flow monitoring on natural gas, waste gas, and combustion air flows	2014	PSD-TX-1338-GHG

Formosa will use natural gas as the RTO fuel gas and utilize energy efficient design and operation of the RTO, as described above, to limit the amount of fuel gas required to maintain the minimum firebox temperature and achieve 99% destruction of VOCs (the primary function of the RTO). Since the proposed energy efficiency design options, described above, are not independent features but are interdependent and represent an integrated energy efficiency strategy, Formosa is proposing a BACT limit for each RTO which takes into consideration the operation, variability and interaction of all these energy efficient features in combination. A holistic BACT limit considers the ultimate performance of the entire unit, rather than individual independent subsystem performance which would be un-necessarily complex because the interdependent nature of operating parameters means that one parameter cannot necessarily be controlled independently without affecting the other operating parameters.

EPA has reviewed this analysis and concurs with Formosa that the following specific operational practices are proposed for each RTO:

- *Low Carbon Fuels* – Formosa shall combust only pipeline quality natural gas in their RTOs.
- *Energy Efficient Design* – Formosa will be utilizing highly energy efficient RTOs with natural gas conservation system and include an on-line spare RTO, to achieve 99% VOC destruction and removal efficiency. Use computer control application to minimize assist gas firing in the RTOs. Waste gas feed, supplemental natural gas fuel and combustion air flow will be metered to each oxidizer. Formosa will continuously monitor the heat input to the

RTOs to maintain proper combustion characteristics and verify compliance with the 18 MMBtu/hr per RTO heat input limit. An oxygen analyzer in each stack will be provided to assure the proper amount of air is used in the combustion process. Monitor the temperature of the RTOs and maintain the temperature above the minimum demonstrated temperature or manufacturer recommended temperature. The firebox will be lined with refractory to minimize heat losses to the atmosphere.

- *Good Operating and Maintenance Practices* – Periodic maintenance will help preserve the efficiency of the RTOs. Visually inspect the burners during routine preventative maintenance outages and prior to start-up to ensure proper operation. Periodic refractory repair and cleaning of waste heat recovery systems when required will maximize thermal efficiency.

BACT Limits and Compliance:

By implementing the operational measures above, Formosa will meet an emission limit for the RTOs of 32,405 tpy CO_2e total for both RTOs. In addition to meeting the quantified emission limit and the proposed maximum heat input of 18 MMBtu/hr per RTO on a 12-month rolling average, EPA is proposing that Formosa will demonstrate compliance by also monitoring and recording the combustion temperature of the RTOs and maintain it at or above 1,400 F. The following parameters for the RTOs to demonstrate continuous compliance

Formosa will demonstrate compliance with the CO_2e emission limit for the RTOs using the site specific fuel analysis for natural gas and the emission factors for natural gas from 40 CFR Part 98 Subpart C, Table C-1. The equation for estimating CO_2 emissions as specified in 40 CFR 98.33(a)(3)(iii) is as follows:

$$CO_2 = DRE * \frac{44}{12} * Fuel * C * \frac{MW}{MVC} * 0.001 * 1.102311$$

Where:

CO_2 = Annual CO_2 mass emissions from combustion of gaseous fuels (short tons)
Fuel = Annual volume of the gaseous fuels 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 fuels (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 fuels (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.

DRE = VOC destruction efficiency
1.102311 = Conversion of metric tons to short tons.

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 fuel gas, and the actual heat input (HHV). However, the emission limit is for all GHG emissions from the RTOs, and is met by aggregating total emissions. 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, as published on November 29, 2013 (78 FR 71904). Records of the calculations would be required to be kept to demonstrate compliance with the CO_2e emission limit on a 12-month average, rolling monthly.

X. Pellet Blending Silos (EPNs: LD-014 and LD-015)

The pellet blending silos receive LDPE pellets from the degassing silos via pneumatic conveyance. This conveyance air is exhausted to the atmosphere through bag filters (EPNs: LD-014, LD-015) and may contain small concentrations of GHGs (methane and CO_2) that result from peroxide side reaction during the polymerization process. While, Formosa does not expect GHG concentrations in the blending silo exhaust to be significant, this permit application provides a worst-case GHG emission calculation from these silos.

Step 1 – Identification of Potential Control Technologies

By operating the degassing silos and associated air purge stripping system, located upstream of the blending silos (described in the process description), Formosa does not expect any measurable amount of GHG compounds to be emitted from the pellet blending silos (downstream of the stripping silos). However, Formosa is including GHG emissions from the pellet blending silos as a worst-case. Operation of the pellet degassing silos to minimize the pellets' residual concentration of CO_2 and methane is the only GHG control option available for this source.

A detailed analysis under Steps 2-4 is not necessary because the applicant has selected the only available control option.

Step 5 – Selection of BACT

Formosa is proposing to operate the upstream stripping silos and monitor the pellet blending silo exhaust stream heating value as BACT. Monitoring the heating value of the pellet blending silo will alert Formosa operations in the case that insufficient stripping (upstream) is being achieved. The heating value measurement is a direct indicator of the presence of volatiles (including

GHGs) in the blending silo exhaust stream. Formosa is proposing an initial control point of 5 Btu/scf, based on a 3-hour average measurement. Exhaust stream heating value measurements at or above this value will trigger operations to increase the quantity of stripping air in the upstream stripping silos. To demonstrate ongoing compliance, Formosa will retain records of the exhaust stream heating value and corresponding records of air purge stripping system operational adjustments (e.g., increasing stripping air flow rate) that are made when the measured heating value is equal to or greater than the control point. EPA has reviewed this analysis and concurs with the BACT limit of 5 Btu/scf.

BACT Limits and Compliance:

By implementing the operational measures above, Formosa will meet an emission limit for the pellet blending silos of 20,400 tpy of CO_2e for each silo. In addition to meeting the quantified emission limit, EPA is proposing that Formosa will demonstrate compliance by monitoring the silos exhaust heating value with a control point of 5 Btu/scf based on a 3-hour rolling average.

Formosa will demonstrate compliance with the CO_2e emission limit for the pellet blending silo vents in accordance with the procedures in the Mandatory Greenhouse Reporting Rules, Subpart Y for process vents. The equation for estimating CO_2 emissions is as follows:

$$\mathrm{CO_2} = VR * MF * \frac{MW}{MVC} * 0.001 * 1.102311$$

Where:

CO_2 = Annual CO_2 mass emissions from process vent (short tons)
VR = Volumetric flow of process vent gas during venting, standard cubic feet/yr based on the maximum design exhaust flow rate (i.e. blower capacity/rating);
MF = Mole fraction of GHG in process vent stream, based on engineering estimate;
MW = Molecular weight of GHG (kg/kg-mole).
MVC = Molar volume conversion factor = 849.5 scf/kg-mole at standard conditions,
0.001 = Conversion of kg to metric tons.
1.102311 = Conversion of metric tons to short tons.

The emission limits associated with CH_4 is also calculated based on the above equation. Records of the calculations of CO_2 and CH_4 shall be kept to demonstrate compliance with the CO_2e emission limit on a 12-month average, rolling monthly. Also, the Formosa shall perform weekly analyses of the gas being exhausted from each silo for carbon content, high heating value (HHV), and molecular weight in accordance with 40 CFR 98.33(a)(2)(ii).

XI. LDPE Contributions to Olefins 3 Elevated Flare (EPNs: OL3-FLR)

The high-pressure LDPE plant that Formosa is proposing requires routing of process vents from the front-end (reaction section) of the process to elevated flare for control. Only those process vents in the back-end are proposed to be routed to the RTOs. For these vents, Formosa is proposing to use two (redundant) RTOs for emission control. Normal emission sources from the LDPE process upstream of and including the extruder are routed to the LDPE flare header. There are several flare header connections in the compression and reaction systems. The LDPE plant's flare gas header is routed to the Olefins 3 elevated flare header where the waste gas is combusted along with waste gas from the Olefins 3 process. The contribution of GHG emissions from the combustion of the LDPE's waste gas in the Olefins 3 elevated flare are addressed in this permit application (EPN: OL3-FLR).

Step 1 – Identification of Potential Control Technologies

Proper operation of the elevated flare, consistent with 40 CFR 60.18 (addressed in the Olefins 3 GHG permit application) will ensure proper destruction of hydrocarbons, including methane. Operating the LDPE plant to minimize the amount of hydrocarbon waste gas routed to the flare will minimize the quantity of GHG emissions resulting from flaring of LDPE plant waste gas. It is estimated that proper operation of the LDPE plant (with the recycle and reuse described in the process description) is expected, based on the process design, to minimize waste gas routed to the flare by several orders of magnitude, which corresponds to a GHG emission reduction of approximately 4.3 million tons/yr CO_2e.

A detailed analysis under Steps 2-4 is not necessary because the applicant has selected the only available control option.

Step 5 – Selection of BACT

Formosa proposes the selection of all available design and operational elements that minimize GHG emissions presented in Step 1 as BACT for the elevated flare. Since the proposed design and operating elements, described in Step 1 above, are not independent features but are interdependent and represent an integrated energy efficiency strategy, Formosa is proposing a BACT limit for the flare which takes into consideration the operation, variability and interaction of all these features in combination. A holistic BACT limit which accounts for the ultimate performance of the entire unit was chosen, rather than individual independent subsystem performance. Otherwise, monitoring and maintaining energy efficiency would be unnecessarily complex because the interdependent nature of operating parameters means that one parameter cannot necessarily be controlled independently without affecting the other operating parameters.

EPA has reviewed and concurs with Formosa that minimization of waste gas along with the use of good flare design, and best operational and maintenance practices are BACT. Therefore, Formosa shall design, build operate and maintain the flare systems (OL3-FLRA, OL3-FLRB) in accordance with 40 CFR §60.18. This will ensure the flare system achieves at least a 98% DRE for VOCs and at least a 99% DRE for methane. Included within this practice, EPA proposes that Formosa shall:

- Continuously monitor and record the waste gas flow at Olefins 3the flare headers;
- Determine composition of the waste gas to the Olefins 3 flare on an hourly basis by use of a composition analyzer or equivalent at the flare headers;
- Calibrate the composition analyzer to identify at least 95% of the compounds in the waste gas;
- Continuously monitor and meter supplemental natural gas to maintain a minimum heating value necessary for flame stability;
- Continuously monitor for the presence of a pilot flame with a thermocouple of other approved device;
- Monitor the pressure to the multi-point ground flare to demonstrate that flow routed to the multi-point ground flare system exceeds 4 psig; however, if a lower pressure can be demonstrated to achieve the same level of combustion efficiency, then this lower limit may be implemented after approval by EPA;
- Monitor and maintain a minimum heating value of 800 Btu/scf of the off gas including assist gas (adjusted for hydrogen) routed to the multi-point ground flare system to ensure the intermittent stream is combustible; however, if a lower heating value limit can be demonstrated to achieve the same level of combustion efficiency, then this lower limit may be implemented after approval by EPA

Formosa shall ensure the flow meters and analyzers used for flare compliance are operational at least 95% of the time when waste gas is being sent to the flare systems, averaged over a running 12-month period. Formosa shall calibrate flow meters biannually, and the composition analyzer shall have a single point calibration check weekly when the flares are receiving waste gas.

Using these operating practices above will result in an emission limit for the LDPE waste gas streams going to the elevated flare system of 22,257 CO_2e TPY. Formosa will demonstrate compliance with the CO_2e emission limit using the emission factors for natural gas from 40 CFR Part 98, Subpart C, Table C-1, and the site specific fuel analysis for waste gas. The equation for estimating CO_2 emissions as specified in 40 CFR 98.253(b)(1)(ii)(A) is as follows:

$$CO_2 = DRE \times 0.001 \times \left(\sum_{p=1}^{n} \left[\frac{44}{12} \times (Flare)_p \times \frac{(MW)_p}{MVC} \times (CC)_p \right] \right) * 1.102311$$

Where:

CO_2 = Annual CO_2 emissions for a specific fuel type (short tons/year).
DRE = Assumed combustion efficiency of the flare.

0.001 = Unit conversion factor (metric tons per kilogram, mt/kg).
n = Number of measurement periods. The minimum value for n is 52 (for weekly measurements); the maximum value for n is 366 (for daily measurements during a leap year).
p = Measurement period index.
44 = Molecular weight of CO_2 (kg/kg-mole).
12 = Atomic weight of C (kg/kg-mole).
$(Flare)_p$ = Volume of flare gas combusted during the measurement period (standard cubic feet per period, scf/period). If a mass flow meter is used, measure flare gas flow rate in kg/period and replace the term "$(MW)_p$/MVC" with "1".
$(MW)_p$ = Average molecular weight of the flare gas combusted during measurement period (kg/kg-mole). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average.
MVC = Molar volume conversion factor (849.5 scf/kg-mole).
$(CC)_p$ = Average carbon content of the flare gas combusted during measurement period (kg C per kg flare gas). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average.
1.102311 = Conversion of metric tons to short tons.

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 fuel gas, and the actual heat input (HHV). However, the emission limit is for all GHG emissions from the reactor, and is met by aggregating total emissions. 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, as published on November 29, 2013 (78 FR 71904). Records of the calculations would be required to be kept to demonstrate compliance with the CO_2e emission limit on a 12-month average, rolling monthly

XII. Emergency Generator Engine (EPNs: LD-002)

The emergency generator engine (FIN/EPN: LD-002) combusts diesel fuel and is a source of GHG emissions. The emergency generator will be limited during non-emergency operating hours to testing and readiness checks as it is subject to NSPS Subpart IIII.

Formosa will install a diesel-fired emergency generator engine. The engine shall be rated at 400 horsepower and have a design maximum heat input of 2.8 MMBtu/hr. The generator engine is designed to use diesel fuel, stored in onsite tanks, so that emergency power is available for safe shutdown of the facility in the event of a power outage that may also include natural gas supply curtailments. The CO_2e emissions from the emergency generator engine results from the combustion of diesel fuel and accounts for less than .002% of the total project emissions.

Step 1 – Identification of Potential Control Technologies

- *Low Carbon Fuels* – Use of fuels containing lower concentrations of carbon generate less CO_2, than other higher-carbon fuels. Typically, gaseous fuels such as natural gas contain less carbon, and thus lower CO_2 potential, than liquid or solid fuels such as diesel or coal.
- *Good Operating and Maintenance Practices* – Good operating and maintenance practices include appropriate maintenance of equipment and operating within the recommended air to fuel ratio recommended by the manufacturer.

Step 2 – Elimination of Technically Infeasible Alternatives

- *Low Carbon Fuels* – The purpose of the engine is to provide a power source during emergencies, which include site power outages and natural disasters, such as hurricanes. As such, the power source must be available during emergencies. Electricity is not a source that is available during a power outage, which is the specific event for which the backup generator is designed to operate. Natural gas supply may be curtailed during an emergency such as a hurricane; thereby not providing fuel to the engine during the specific event for which the backup generator is designed to operate. The engine must be powered by a liquid fuel that can be stored in a tank and supplied to the engine on demand, such as motor gasoline or diesel. Therefore, Formosa proposes to use diesel fuel for the emergency generator engine, since non-volatile fuel must be used for emergency operations. The use of low-carbon fuel is considered technically infeasible for emergency generator operation and is not considered further for this analysis.
- *Good Operating Combustion Practices and Maintenance* – Is considered technically feasible.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

Only one option, good operation and maintenance practices, has been identified as available and technically feasible for controlling GHG emissions from engines; 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

Because Formosa is proposing to implement the one option technically available, a detailed energy, environmental and economic impact analysis is not required under Step 4.

Step 5 – Selection of BACT

The following specific BACT practices are proposed for the engines:

Good operation and maintenance practices for compression ignition engines include appropriate maintenance of equipment, periodic testing conducted weekly, and operating within the recommended air to fuel ratio, as specified by its design. Compliance with 40 CFR 60, subpart IIII will inherently demonstrate use of efficient engines and limiting the engines to a non-emergency use of 100 hours or less is considered BACT.

Using the operating and maintenance practices identified above results in a BACT limit of 229.1 TPY CO_2e. Formosa will demonstrate compliance with the CO_2 emission limit using the emission factors for diesel fuel from 40 CFR Part 98, Subpart C, Table C-1. The equation for estimating CO_2 emissions as specified in 40 CFR 98.33(a)(3)(ii) is as follows:

$$CO_2 = \frac{44}{12} * Fuel * CC * 0.001 * 1.102311$$

Where:

CO_2 = Annual CO_2 mass emissions from combustion of diesel fuel (short tons)
Fuel = Annual volume of the liquid fuel combusted (gallons). 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 liquid 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).
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 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.

XIII. Natural Gas Piping Fugitives (EPN: NG-FUG)

The proposed project will include new piping components for movement of fuel gas. These components are potential sources of GHG emissions due to emissions from rotary shaft seals, connection interfaces, valves stems, and similar points. GHGs from piping component fugitives are mainly generated from natural gas lines for the proposed project. Process lines in VOC service are not expected to contain GHGs, but could contain trace amounts of methane.

Step 1 – Identification of Potential Control Technologies

The following available control technologies for fugitive piping components emitting GHGs (those in natural gas and fuel gas service) were identified:

- Installation of leakless technology components to eliminate fugitive emission sources.
- Implementing leak detection and repair (LDAR) programs (those used for VOC components) in accordance with applicable state and federal air regulations.
- Implement alternative monitoring using a remote sensing technology such as infrared camera monitoring.
- Implementing an audio/visual/olfactory (AVO) monitoring program typically used for non-VOC compounds.

Leakless valves are primarily used where highly toxic or otherwise hazardous materials are present. Leakless valves are expensive in comparison to a standard (non-leakless) valve. These technologies are generally considered cost prohibitive except for specialized service.

LDAR programs are typically implemented for control of VOC emissions from materials in VOC service (at least 5 wt% VOC), however instrument monitoring may also be technically feasible for components in CH_4 service, including the fuel gas and natural gas piping fugitives.

Remote sensing technologies have been proven effective in leak detection and repair, especially on larger pipeline-sized lines. The use of sensitive infrared camera technology has become widely accepted as a cost-effective means for identifying leaks of hydrocarbons depending on the number of sources.

AVO monitoring methods are also capable of detecting leaks from piping components as leaks can be detected by sound (audio) and sight. AVO programs are commonly used in industry and technically feasible for the GHG fugitives in the LDPE plant.

Step 2 – Elimination of Technically Infeasible Alternatives

All the available options are considered technically feasible and have been used in industry as described below.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

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. However, because of their high cost, these specialty components are, in practice, selectively applied only as absolutely necessary to toxic or hazardous components. 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. Method 21 Instrument monitoring has historically been used to identify leaks in need of repair. However, instrument monitoring requires significant allocation of manpower as compared to AVO monitoring, while AVO is expected to be equally effective at identifying significant leaks.

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.[9] Remote sensing using infrared imaging has been accepted by EPA as an acceptable alternative to Method 21 instrument monitoring and leak detection effectiveness is expected to be comparable. Although less manpower may be required for remote sensing compared to Method 21 depending on the number of sources, the frequency of monitoring is more limited than AVO because the number of simultaneous measurements will be limited by the availability of the remote sensing equipment.

AVO monitoring has been implemented historically at the Point Comfort plant. AVO detections can be performed very frequently, at lower cost and with less additional manpower and equipment than Method 21 instrument or remote sensing monitoring; since it does not require a specialized piece of monitoring equipment. 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. Therefore, for components in methane (natural gas or fuel gas) service AVO is considered the most preferred technically feasible alternative.

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

The use of leakless components, instrument LDAR and/or remote sensing of piping fugitive emission in natural gas or fuel gas service may be somewhat more effective than as-observed AVO methods, but the incremental GHG emissions controlled by implementation of the TCEQ 28 LAER LDAR program or a comparable remote sensing program is considered a *de minimis* level in comparison to the total project's proposed CO_2e emissions. Given that GHG fugitives are conservatively estimated to comprise less than 0.5% CO_2e emissions from the facility, there is, in any case, a negligible difference in emissions between the considered control alternatives.

[9] 73 FR 78199-78219 (December 22, 2008).

Accordingly, given the costs of installing leakless technology (which is estimated to be 3 to 10 times higher than comparable high quality valves) or implementing 28LAER or a comparable remote sensing program when not otherwise required, these methods are not economically practicable for GHG control from components in natural gas or fuel gas service. AVO monitoring is expected to be effective in finding leaks and can be implemented at the greatest frequency and lowest cost due to being incorporated into routine operations.

Step 5 – Selection of BACT

Based on the economic impracticability of leakless technology, instrument monitoring and remote sensing for fuel gas and natural gas piping components, Formosa proposes to incorporate as-observed AVO as BACT for the piping components associated with this project in fuel gas and natural gas service. The proposed permit contains a condition to implement an AVO program on a weekly basis.

For the GHG fugitive emission sources in this plant that are in natural gas service, Formosa is proposing:

- To implement an Audio Visual and Olfactory (AVO) monitoring program for equipment in natural gas and fuel gas service.
    - To perform the AVO monitoring on a weekly basis
    - To maintains a written log of weekly inspections identifying the operating area inspected, the date inspected, the fuel gas and natural gas equipment inspected (valves, lines, flanges, etc), whether any leaks were identified by visual, audible or olfactory inspections, and corrective actions/repairs taken
- For leaks identified, immediately of detection of the leak, plant personnel will take the following action:
    - Tag the leaking equipment
    - Commence repair or replacement of the leaking component as soon as practicable, but no later than 15 days after detection.

Process lines in VOC service contain a minimal quantity of GHGs. Additionally, process lines in VOC service are proposed to incorporate the TCEQ 28VHP leak detection and repair (LDAR) and a quarterly connector monitoring program (equivalent to the TCEQ 28LAER) for fugitive emissions control in the TCEQ permit 107520/PSD-TX-1384. EPA concurs with Formosa's assessment that using the TCEQ 28VHP[10] LDAR program is an appropriate control of GHG emissions. As noted above, LDAR programs would not normally be considered for control of GHG emissions alone due to the negligible amount of GHG emissions from fugitive sources, and although the existing LDAR program is being imposed in this instance, it is imposed as a work

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[10] The boilerplate special conditions for the TCEQ 28VHP LDAR program can be found at http://www.tceq.state.tx.us/assets/public/permitting/air/Guidance/NewSourceReview/bpc_rev28vhp.pdf. These conditions are included in the TCEQ issued NSR permit.

practice. See 40 CFR § 51.166(b)(12) (technological and economic limitations make measurement methodology infeasible under the circumstances here).

XIV. Maintenance, Startup and Shutdown (MSS) Activities (EPN: LD-MSS)

The LDPE plant will emit GHGs as a result of periodic and routine planned MSS activities. These activities will result in the following types of GHG emissions:

- Products of combustion from the elevated flare from degassing of hydrocarbon containing process equipment to the flare header;
- Fraction of un-combusted methane and CO_2 from degassing of process vessels with methane-containing process streams to the elevated flare header; and
- Fugitive emissions of GHG from opening of process equipment to atmosphere (after degassing) for process streams containing GHGs (methane, CO_2).

Step 1 – Identification of Potential Control Technologies

Per BACT requirements, to reduce VOC emissions associated with MSS Activities, gas streams from these activities must be routed to a flare.

Formosa will be required to perform the following procedures (to satisfy BACT for VOCs for MSS activities) when preparing to open process equipment to the atmosphere:

- Remove and recover liquid and vapor to the maximum extent practicable;
- Depressurize equipment in VOC service to the elevated flare;
- If necessary, purge with nitrogen (to the flare) to reduce the amount of process material remaining in the equipment; and, then
- Open equipment to atmosphere for maintenance, after equipment is purging is completed.

Routing these MSS gas streams to the flare also reduces the amount of methane that would otherwise be emitted directly to the atmosphere. It is not physically possible to capture the combustion products formed by the flare since they are formed in an open flame process. Therefore, there is no available control option to reduce the GHG emissions produced from the flare used to control VOC and GHG emissions from MSS activities.

A detailed analysis under Steps 2-4 is not necessary because the applicant has selected the only available control option.

Step 5 – Selection of BACT

As described earlier, under the for MSS activities, Formosa will be required to remove liquid, depressurize equipment to the elevated flare, and purge with nitrogen (to the flare) before opening equipment to the atmosphere for maintenance.

Following these procedures for MSS activities will also satisfy BACT for GHG emissions. These permit conditions will require demonstration of compliance with these procedures. (We also note that the TPY GHG emissions limits for the various components addressed in this GHG permit must also include MSS emissions, as explained in Table 1, Footnote 1 of the proposed.

XV. 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) dated February 14, 2014, prepared by the applicant, and reviewed and adopted by EPA. Further, EPA designated Formosa Plastics Corporation ("Formosa") and its consultant, Zephyr Environmental Corporation ("Zephyr"), as non-federal representatives for purposes of preparation of the BA and for conducting informal consultation. Formosa's expansion project is comprised of three separate sub-projects: an olefins expansion project involving the construction of a new olefins cracking unit, identified as Olefins 3 unit, and a propane dehydrogenation unit; a new low density polyethylene plant; and a utilities project involving the construction of two new natural gas-fired combined cycle combustion turbines. Formosa has submitted three (3) GHG (Greenhouse Gas) permit applications for each project; however, for Section 7 ESA purposes, EPA is relying on a Biological Assessment that includes the collective emissions from all three projects and their impacts to endangered species. The biological assessment performed for Formosa projects included in its field survey the physical land area where the new Formosa facilities will be built within Formosa's existing chemical complex.

A draft BA has identified twenty-one (21) species as endangered or threatened in Calhoun and Jackson County, Texas by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD) and is listed in the table below:

Federally Listed Species for Calhoun and Jackson Counties by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Texas Parks and Wildlife Department (TPWD)	**Scientific Name**
Birds	
Eskimo curlew	*Numenius borealis*
Interior least tern	*Sterna antillarum alhalassos*
Northern aplomado falcon	*Falco femoralis septentrionalis*
Piping Plover	*Charadrius melodus*
Whooping crane	*Grus americanus*
Mammals	
Jaguarundi	*Herpailurus yagourondi*
Louisiana black bear	*Urus americanus luteolus*
Ocelot	*Leopardus pardalis*
Red wolf	*Canis rufus*
West Indian manatee	*Trichechus manatus*
Reptiles	
Hawksbill Sea Turtle	*Eretmochelys imbricate*
Green Sea Turtle	*Chelonia mydas*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Leatherback Sea Turtle	*Dermochelys coriacea*
Loggerhead Sea Turtle	*Caretta caretta*
Fish	
Smalltooth Sawfish	*Pristis pectinata*
Whales	
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaengliae*
Sei whale	*Balaenoptera borealis*
Sperm whale	*Physeter macrocephalus*

EPA has determined that issuance of the proposed permit to Formosa for the expansion project will have no effect on fifteen (15) of the twenty-one (21) federally-listed species, specifically the Northern aplomado falcon (Falco femoralis septentrionalis), red wolf (Canis rufus), Louisiana black bear (Urus americanus luteolus), jaguarundi (Herpailurus yagouaroundi cacomitli), ocelot (Leopardus pardalis), eskimo curlew (Numenius borealis), West Indian manatee (Trichechus manatus), smalltooth sawfish (Pristis pectinata), hawksbill sea turtle (Eretmochelys imbricate), blue whale (Balaenoptera musculus), finback whale (Balaenoptera physalus), humpback whale (Megaptera novaeangliae), sei whale (Balaenoptera borealis), sperm whale (Physeter macrocephalus) and leatherback sea turtle (Dermochelys coriacea). These species are either thought to be extirpated from these counties or Texas or not present in the action area.

Three (3) of the twenty-one (21) federally-listed species are species that may be present in the Action Area and are under the jurisdiction of USFWS. As a result of this potential occurrence and based on the information provided in the draft BA, the issuance of the permit may affect, but is not likely to adversely affect the following species:

- Interior least tern (*Sterna antillarum alhalassos*)
- Piping plover (*Charadrius melodus*)
- Whooping crane (*Grus americana*)

On April 16, 2014, EPA submitted the final draft BA to the Southwest Region, Corpus Christi, Texas Ecological Services Field Office of the USFWS for its concurrence that issuance of the permit may affect, but is not likely to adversely affect these six federally-listed species.

Three (3) of the twenty-three federally-listed species identified are marine species that may be present in the Action Area and are under the jurisdiction of NOAA. As a result of this potential occurrence and based on the information provided in the draft BA, the issuance of the permit may affect, but is not likely to adversely affect the following species:

- green sea turtle (*Chelonia mydas*)
- Kemp's ridley sea turtle (*Lepidochelys kempii*)
- loggerhead sea turtle (*Caretta caretta*)

On February 14, 2014, EPA submitted the final draft BA to the NOAA Southeast Regional Office, Protected Resources Division of NMFS for its concurrence that issuance of the permit may affect, but is not likely to adversely affect these three federally-listed species. NOAA provided concurrence and agreed with EPA's determinations on May 23, 2014.

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 BA can be found at EPA's Region 6 Air Permits website at http://yosemite.epa.gov/r6/Apermit.nsf/AirP.

XVI. Magnuson-Stevens Fishery Conservation and Management Act

The 1996 Essential Fish Habitat (EFH) amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth a mandate for the National Oceanic Atmospheric Administration's National Marine Fisheries Service (NMFS), regional fishery management councils, and other federal agencies to identify and protect important marine and anadromous fish habitat.

To meet the requirements of the Magnuson-Stevens Act, EPA is relying on an EFH assessment prepared by Zephyr on behalf of Formosa and reviewed and adopted by EPA. The EFH assessment looks at the total emissions and impacts from all three projects on marine and fish habitats.

The facility is affects tidally influenced portions of the Lavaca Bay, Keller Bay, and Carancahua Bay that adjoins to the Corpus Christi Bay leading to the Gulf of Mexico. These tidally influenced portions have been identified as potential habitats of postlarval, juvenile, subadult or adult stages of red drum (Sciaenops ocellatus), shrimp (4 species), and reef fish (43 species) and the stone crab (Menippe mercenaria). The EFH information was obtained from the NMFS's website (http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html).

Based on the information provided in the EFH Assessment, EPA concludes that the proposed PSD permit allowing Formosa's three expansion projects will have no adverse impacts on listed marine and fish habitats. The assessment's analysis, which is consistent with the analysis used in the BA discussed above, shows the projects' construction and operation will have no adverse effect on EFH.

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 essential fish habitat report can be found at EPA's Region 6 Air Permits website at: http://yosemite.epa.gov/r6/Apermit.nsf/AirP.

XVII. National Historic Preservation Act (NHPA)

Section 106 of the NHPA requires EPA to consider the effects of this permit action on properties eligible or potentially eligible for inclusion in the National Register of Historic Places. To make this determination, EPA relied on a cultural resources report dated January 10, 2014 prepared by Horizon Environmental Services, Inc. ("Horizon") on behalf of Formosa's consultant, Zephyr, and reviewed and adopted by the EPA. For purposes of the NHPA review, the Area of Potential Effect (APE) was determined to be approximately 372 acres of land that contains the construction footprint of the three projects. Horizon performed a field survey of the property and a desktop review on the archaeological background and historical records within a 1-mile radius of the APE.

Based on the results of the field survey, including shovel tests, no archaeological resources or historic structures were found within the APE. Based on the desktop review for the site, no cultural resource sites were identified within a 1-mile radius of the APE.

Based upon the information provided in the cultural resources report, EPA Region 6 determines that because no historic properties are located within the APE of the facility site and a potential for the location of archaeological resources is low within the construction footprint itself, issuance of the permit to Formosa will not affect properties on or potentially eligible for listing on the National Register.

On February 24, 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.

XVIII. 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.

Conclusion and Proposed Action:

Based on the information supplied by Formosa, our review of the analyses contained the TCEQ NSR 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 facility would employ BACT for GHGs under the terms contained in the draft permit.

Therefore, EPA is proposing to issue Formosa a PSD permit for GHGs for the facility, subject to the PSD permit conditions specified therein. This draft 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 total, rolling monthly, shall not exceed the following: Double check permit condition references

FIN	EPN	Description	GHG Mass Basis		TPY CO_2e[1,2]	BACT Requirements
				TPY		
LD-022 A/B LD-023 A/B	LD-022 A/B LD-023 A/B	Regenerative thermal oxidizers	CO_2	31,482[3]	32,405[3]	Natural gas heat input limit of 18 MMBtu/hr per RTO on 12-month average, rolled monthly; Minimum firebox temperature of 1400 °F. See permit condition III.A.1.
			CH_4	34[3]		
			N_2O	.24[3]		
OL3-FLRA/B	OL3-FLRA/FLRB	LDPE contribution to Olefins 3 elevated flare	CO_2	21,900[4]	22,257[4]	Use of Good Operating and Maintenance Practices. See permit condition III.A.3.
			CH_4	11[4]		
			N_2O	.32[4]		
LD-014	LD-014	Pellet blending silo 1	CO_2	4,168	20,400	Use of Good Operating and Maintenance Practices; See permit condition III.A.2.
			CH_4	649		
LD-015	LD-015	Pellet blending silo 2	CO_2	4,168	20,400	Use of Good Operating and Maintenance Practices; See permit condition III.A.2.
			CH_4	649		
LD-002	LD-002	Emergency generator engine	CO_2	229[5]	229[5]	Use of Good Operating and Maintenance Practices. See permit condition III.A.4.
			CH_4	No Numerical Limit Established[5]		
			N_2O	No Numerical Limit Established[5]		
NG-FUG	NG-FUG	LDPE fugitives	CO_2	No Numerical Limit Established[6]	No Numerical Limit Established[6]	See permit condition III.A.5.
			CH_4	No Numerical Limit Established[6]		
LDPE-MSS	LDPE-MSS	LDPE MSS Vessel opening	CO_2e	No Numerical Limit Established[7]	No Numerical Limit Established[7]	See permit condition III.A.6.
Totals[8]			**CO_2**	61,948	96,196	
			CH_4	1,363		
			N_2O	.56		

1. 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.
2. Global Warming Potentials (GWP): CO_2 = 1; CH_4 = 25; N_2O = 298
3. The GHG Mass Basis TPY limit and the CO_2e TPY limit for the RTO applies to both combined.
4. The OL-3 elevated flare (Olefins Plant Flare) emissions are for the contribution from the LDPE plant from normal operations and MSS activities.
5. These emissions are less than 0.01 TPY with appropriate rounding. The emission limit will be a design/work practice standard as specified in the permit.
6. LDPE fugitives have a PTE of 0.69 TPY CO_2, 20.2 TPY CH_4, and 506 TPY CO_2e. The emission limit will be a design/work practice standard as specified in the permit.
7. LDPE MSS emissions to the atmosphere from vessel opening (EPN: LDPE-MSS) are estimated to not exceed 0.09 TPY CO_2e. The emission limit will be a design/work practice standard as specified in the permit.
8. Total emissions include the PTE for fugitive emissions. Totals are given for informational purposes only and do not constitute emission limits.