Statement of Basis
Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit
For INEOS Olefins & Polymers U.S.A.

Permit Number: PSD-TX-97769-GHG

June 2012

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 July 28, 2011, INEOS submitted to EPA Region 6 a Prevention of Significant Deterioration (PSD) permit application for Greenhouse Gas (GHG) emissions for a proposed expansion to the No 2 Olefins unit at the existing Chocolate Bayou plant in Alvin, Brazoria County, Texas. The Chocolate Bayou plant is an existing major stationary source of regulated New Source Review (NSR) pollutants. Major components of this application were withdrawn and resubmitted to EPA on February 24, 2012 to allow processing of the application without the hindrance of confidential business information claims that applied to the initial application. EPA began processing this permit based on the application submitted on February 24, 2012 and the update of May 24, 2011 and does not maintain records on the components of the application of July 28, 2011 that have been withdrawn. INEOS has also simultaneously submitted to the state agency, the Texas Commission on Environmental Quality (TCEQ), an application to authorize the modification and to permit increases of non-GHG pollutants. The applicant indicates that the project will not constitute a major modification in TCEQ's permitting, because the net emissions increases of regulated NSR pollutants other than GHG are not significant. Accordingly, TCEQ has proposed a draft minor NSR permit which commenced public notice on July 27, 2012 and is expected to end on August 27, 2012.

INEOS proposes to add an eleventh ethylene cracking furnace to the No. 2 Olefins unit. This project is designed to increase plant production by ensuring that unit operational rates are maximized during periods when a furnace is off-line for decoking. The addition of the new furnace will not affect emissions from the existing upstream or downstream units at the plant, since the effluent will be processed with existing equipment in the No. 2 olefins unit. After reviewing the application, EPA Region 6 has prepared the following Statement of Basis (SOB) in support of the draft air permit to authorize the construction and modification of GHG air emission sources at the INEOS No. 2 Olefins unit.

This SOB documents the information and analysis EPA used to support the decisions EPA made in drafting the air permit. It includes a description of the proposed facility, the applicable air permit requirements, and an analysis demonstrating that the proposed permit conditions meet all applicable legal and regulatory requirements.

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

II. Applicant

INEOS Olefins & Polymers USA
P.O. Box 1488
Alvin, Texas 77512

Physical Address:
INEOS Olefins & Polymers U.S.A.
Chocolate Bayou Plant
2 miles south of FM 2917 on FM 2004
Alvin, TX 77511

Contact: Mr. Daniel Lutz, Environmental Compliance Advisor
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III. Permitting Authority

On May 3, 2011, EPA published a federal implementation plan (FIP) that makes EPA Region 6 the PSD permitting authority for the pollutant GHG. 75 FR 25178 (promulgating 40 CFR § 52.2305). Texas still retains approval of its plan and PSD program for pollutants that were subject to regulation before January 2, 2011, i.e., regulated NSR pollutants other than GHG.

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:

Bonnie Braganza
Air Permitting Section (6PD-R)
(214) 665-7340

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

Air Permits Division (MC-163)
Texas Commission on Environmental Quality (TCEQ)
P.O. Box 13087, Austin, TX 78711-3087

Facility Location

The INEOS plant is located in Brazoria County, Texas. This area is currently in attainment for all NAAQS with the exception of the 8 hour Ozone standard, for which it is classified as a serious non-attainment area. The nearest Class I area is the Breton National Wildlife Refuge, which is located well over 100 km from the site. The geographic coordinates for this facility are as follows:

Latitude: 29.99107
Longitude: -93.992672

Figure1. INEOS Chocolate Bayou Facility Location

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

EPA concludes INEOS's application is subject to PSD review for the pollutant GHG, because the project would lead to an emissions increase of GHG in excess of the emission thresholds described at 40 CFR § 52.21 (b)49(v). The facility is an existing major stationary source (as well as a source with a PTE that equals or exceeds 100,000 TPY CO2e and 100/250TPY GHG mass basis), and the planned modification has a GHG emissions increase (and net emissions increase) that equals or exceeds 75,000 TPY CO2e (and 0 TPY GHG mass basis). INEOS calculated a CO_2e emissions increase of 216,779 TPY for the proposed project. Additionally, as part of any PSD applicability determination, to determine if the modification was major, the applicant provided a 5 year contemporaneous change analysis and netting calculations that demonstrated the project could not net out of PSD for GHG. 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.

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; hereinafter "GHG Permitting Guidance"). Consistent with that guidance, we have not required the applicant to model or conduct ambient monitoring for GHG, and we have not required any assessment of impacts of GHG in the context of the additional impacts analysis or Class I area provisions. Instead, EPA has determined that compliance with 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 related to GHG. The applicant submitted an analysis to meet the requirements of 40 CFR § 52.21(o), as it may otherwise apply to the project

TCEQ already recognizes the facility as an existing major stationary source under the PSD program, and therefore the state agency remains responsible for ensuring that the modification is not otherwise subject to PSD. Under the circumstances of this project, EPA's PSD permitting action will only authorize emissions of GHG, while the state agency issues permits for other regulated NSR pollutants.[1] TCEQ has determined the modification is subject to the minor NSR review for non-GHG pollutants.

V. Project Description

The proposed GHG PSD permit, if finalized, will allow INEOS to add an eleventh ethylene cracking furnace and decoker drum to the existing No. 2 Olefins unit. The addition of this new cracking furnace rated at 495 MMBtu/hr is to allow an increase in capacity by ensuring that unit rates are maximized during periods when a furnace is off-line for decoking. As explained below, this furnace is designed to only use ethane as a feedstock in order to minimize overall emissions. The cracking process is used to convert saturated paraffinic hydrocarbons into lower molecular weight unsaturated olefinic hydrocarbons such as ethylene and propylene and also produces hydrogen as a byproduct. With this higher energy efficient furnace, it is expected that there will be an increase in products from the No. 2 Olefins unit estimated to be 150,000 million pounds ethylene per year and also an increase in steam production which may decrease steam consumption from the plant boilers. The new furnace is estimated to produce as much as 509,000,000 lbs per year ethylene.

As a result of the cracking process, coke is gradually deposited on the inner walls of the furnace tubes that need to be periodically "decoked." Typically decoking occurs at lower firing rates with

[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

the introduction of steam to purge the hydrocarbons to the cracked gas header. Then air is controlled to create a controlled combustion that burns off the coke from the tube wall. These combustion products enter the decoke header to the decoke cyclone to remove the particulates and then the gases are released to the atmosphere through the decoke stack.

The start-up and shutdown conditions in the permit are related to the decoking process described above. The permit, upon final issuance, will apply to all operating conditions including normal operations, maintenance, start-up, and shutdown for the new ethylene cracking furnace and decoking drum.

GHG Emissions

The existing No. 2 Olefins unit is permitted to utilize several different gaseous and liquid hydrocarbon feedstocks. However the proposed 11^{th} furnace will only use ethane as a feedstock to minimize all pollutants, including GHG. In properly tuned units, nearly all of the fuel carbon (99.9 percent) in the fuel gas is converted to CO_2 during combustion. This conversion is relatively independent of the type of combustion unit. Fuel carbon not converted to CO_2 results in CH_4, CO, and/or VOC emissions and is due to incomplete combustion. Even in units operating with poor combustion efficiency, the amount of CH_4, CO, and VOC produced is insignificant compared to CO_2 levels. Since this furnace will be equipped with Selective Catalyst Reduction to reduce NO_x emissions, there may be a consequential reduction in N_2O. Formation of N_2O emissions are minimized when combustion temperatures are kept high (above 1,475 ^oF) and excess oxygen is kept to a minimum (less than 1 percent). Methane emissions are highest during low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycles[2].

VI. BACT Considerations and Emission Limits

The majority of the contribution of GHG associated with the project is from the operations of the cracking furnace. EPA reviewed available GHG PSD permitting precedent including the RACT/BACT/LAER Clearinghouse. As of this date, there have been two permits issued for ethylene cracking furnaces and the data from those permits is summarized below. It should be noted that the ethylene production utilizes different technology and therefore the table below represents the information provided in the permits without noting the differences in technology applications, which is proprietary information. Since INEOS is only utilizing ethane gas, it can be compared to the Williams Olefins unit and has comparable furnace efficiency. The major difference in the output based numbers is that the Williams Olefins unit has much smaller ethylene crackers and utilizes electric power for their compressors in the downstream units.

[2] **AP-42 Natural Gas combustion Chapter 1.4**

Table 1

Permit	Williams Olefins LDEQ PSD-LA-759	BASF- Region 6 PSD-TX-903-GHG	Proposed INEOS- Region 6 PSD-TX-97769
	2 ethylene crackers each 182MMBtu/hr	One ethylene furnace rated 498MMBtu/hr	One ethylene crackers rated 495MMBtu/hr
Fuel composition	25% hydrogen in process gas	Fuel monitoring required.	35% hydrogen in fuel maintain a 0.71 carbon percentage in fuel
Feed composition	Only ethane gas	Liquid and gaseous	Ethane gas only
Furnace Efficiency	92.5%	Not stated- monitor stack temperature at 309^0F for thermal efficiency	92.6%- monitor stack temperature at 340^oF for thermal efficiency
Ethylene Production Billion pounds/year	0.55	0.42	0.509
GHG emissions CO_{2e} tons/year	182,265	256,914 only from the furnace	216,567
Output rates lbs of CO_2e/lb of ethylene		1.22	0.85

The BACT analyses and other technical information in INEOS's application are incorporated into this Statement of Basis.

Carbon Capture and Sequestration

Carbon Capture and Sequestration (CCS) is an available add-on control technology that is evaluated as BACT[3] for the ethylene furnace. The evaluation of the technology is significantly different from the remaining energy efficiency and operational control measures considered below, and therefore for brevity it is considered separately.

EPA considers CCS to be an available control option for high-purity CO_2 streams that merits initial consideration as part of the BACT review process, especially for new facilities. INEOS initially objected to recognizing CCS technology as a viable control option for their specific industry based on the fact it was not explicitly cited in the GHG Permitting Guidance. However, the unit operations occurring at the site are closely related or shared inherent process operations and parameters with examples cited in the text.

[3] Pg 36 of the PSD and title V permitting guidance for Greenhouse gases available at: http://www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf

As noted in EPA's GHG Permitting Guidance, a control technology is "available" if it has a potential for practical application to the emissions unit and the regulated pollutant under evaluation. Thus, even technologies that are in the initial stages of full development and deployment for an industry, such as CCS, can be considered "available" as that term is used for the specific purposes of a BACT analysis under the PSD program. In 2010, the Interagency Task Force on Carbon Capture and Storage was established to develop a comprehensive and coordinated federal strategy to speed the commercial development and deployment of this clean coal technology. As part of its work, the Task Force prepared a report that summarized the state of CCS and identified technical and non-technical challenges to implementation.[4] EPA, which participated in the Interagency Task Force, supported the Task Force's conclusion that although current technologies could be used to capture CO_2 from new and existing plants, they were not ready for widespread implementation at all facility types. This conclusion was based primarily on the fact that the technologies had not been demonstrated at the scale necessary to establish confidence in their operations. EPA Region 6 has completed a research and literature review and has found that nothing has changed dramatically in the industry since the August 2010 report and there is no specific evidence of the feasibility and cost-effectiveness of a full scale carbon capture system for the project and equipment proposed by INEOS.

INEOS provided supplemental application materials to address EPA concerns. INEOS first developed a feasibility analyses and determined that the CO_2 separation would require the removal of particulate matter (PM) from the streams without creating too much back pressure on the upstream system. In addition, the effluent stream would require compression to increase the pressure from the atmospheric stack to the pressure required for the efficient CO_2 separation. Cooling would also be required to reduce the stack temperature from about 400^0 F to less than 100 ^{0}F prior to separation, compression and transmission. The most common separation for this flue gas would be the amine system. The design and operation of the entire system would require additional energy consumption and result in an adverse environmental impact of additional GHG and other criteria pollutants. Additionally assuming that CCS was feasible and cost effective, there still are logistical issues such as obtaining the right of way (ROW) for the pipeline and obtaining contracts from a third party for storage and transportation of the $CO_{2\ that}$ is unknown at this time.

INEOS's analysis for CCS also provided the basis for eliminating the technology in step 4 of the BACT process as a viable control option based on cost. INEOS used several documents to base the costs for storage and pipeline costs such as the Oil and Gas Journals and the DOE/NETL report on Economic Evaluation of CO_2 storage and Sink Enhancement Option. The majority of the cost was attributed to the capture and compression facilities that would be required. The total capital cost of CCS for only the furnace would be $238,022,140. INEOS estimates that the capital cost of the project will be greater than $25,000,000[5]. Accordingly, the addition of CCS would represent a

[4] See *Report of the Interagency Task Force on Carbon Capture and Storage* available at http://www.epa.gov/climatechange/policy/ccs_task_force.html
[5] INEOS application, TCEQ Form- Table 30

substantial (almost ten-fold) increase in the total cost of the project and therefore has been rejected. EPA Region 6 reviewed INEOS's CCS cost estimate and believes it adequately approximates the cost of a CCS control for this project and demonstrates those costs are prohibitive in relation to the overall cost of the proposed project, and thus CCS has been eliminated as BACT for this project.

Fuel Combustion Units (DDB105, DDF106)

Both these units essentially use the same combustion furnace and share common parameters or requirements with respect to the analysis of BACT for efficiency and operational controls for the control GHG emissions, and have therefore been grouped for the purposes of this portion of the review.

As part of the PSD review, INEOS provided in the GHG permit application a 5-step top-down BACT analysis of controls for the 11th furnace project as well as an analysis showing that it was selecting a overall furnace design with the most efficient product yield for this project. EPA has reviewed INEOS's BACT analysis for the above referenced fuel combustion units, finds it sufficient, and our analysis is set forth for this proposed permit, as summarized below.

INEOS has selected an energy efficient technology to optimize thermal efficiency which will result in fewer overall emissions of all air pollutants per unit of product. While minimizing GHG, the burners will also be using SCR to reduce NO_x emissions. INEOS benchmarked the efficiency of the furnace based on vendor supplied data, compatibility with their current furnaces and the availability factor shown in Table 2. Availability is defined as the hours where the furnace is in hydrocarbon cracking service and excludes decoking and other downtime. During decoking, there is no production output from the energy input to the furnace, therefore a higher availability equates to a better product efficiency with less GHG emissions (lbs of GHG/lbs of product).

Even though Design B in the Table 2 below appears to be better than the chosen design, the ethylene product yield is lower in Design B per pound of ethane as shown in Table 3. INEOS has experience with the chosen design that is compatible with the existing furnaces to complement the overall efficiency of the No. 2 Olefins unit as well as meet the specifications of the product ethylene. Based on the annual availability, decoking for the furnace will not exceed 420 hours/year.

Table 2

	Overall Furnace Efficiency %	Annual Availability %
Chosen Design	92.6	96.83
Design A	93.6	95.21
Design B	93.1	97.78
Design C	93.2	96.39
Design E	93.9	95.89
Existing (1993)	92.2	96.66
Existing (1976)	89.0	96.58
Existing (1973)	85.0	95.62
LDEQ Permit for Williams Olefins issued April 12, 2012	92.5%	Not provided

The efficiency of the furnace will be monitored by the stack temperature as a rolling 24 hour, 365 day average not to exceed 340^{o}F. Upon request, the furnace efficiency will be calculated based on representations in the application. INEOS has provided additional BACT analyses as below:

Step 1 – Identification of Potential Control Technologies:

To maximize thermal efficiency at the INEOS plant, the following thermal efficiency measures have been identified and are currently implemented for the existing cracking furnaces, package boilers, and combustion turbine duct burners. These measures will continue to be implemented and will be incorporated into the 11th furnace design as well. These technologies include the following:

1. *Low Carbon Fuel* to the furnace – Use of Hydrogen gas as fuel
2. *Use of gaseous feedstock* that inherently reduces the energy consumption required for the production of ethylene when compared to liquid feedstocks such as naphtha, refinery raffinate etc.
3. *Oxygen Trim Control* – Monitoring of oxygen concentration in the flue gas is conducted, and the inlet air flow is adjusted to maximize thermal efficiency.
4. *Periodic Tune-up* – The combustion unit burners are tuned periodically to maintain optimal thermal efficiency based on vendor recommendations.
5. *Maximize heat recovery* - Heat recovery will be maximized by the design of the radiant and convection section of the cracker that preheats boiler feed water and produces high pressure steam that is used in the plant operations.

Step 2 – Elimination of Technically Infeasible Alternatives

All options identified in Step 1 are considered technically feasible. Because use of gaseous feedstock, oxygen trim control, and maximizing heat recovery are already proposed in the design and/or implemented in existing units, ranking by effectiveness (Step 3) and a subsequent evaluation (Step 4) of these technologies was not considered necessary for the BACT determination.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

The remaining technologies not already included in the proposed combustion units design in order of most effective to least effective include:

- *Low Carbon fuel with the use of Product Hydrogen as a Fuel* – Substitution of pure hydrogen for natural gas (methane) results in essentially 100% control of the GHG emissions that would otherwise be emitted by each pound of methane replaced. However, the actual effectiveness is dependent upon the hydrogen and methane content of the hydrogen-rich product stream and the availability of this stream for use as fuel.
- *Periodic tune-up* – Currently, periodic tune-ups of the existing combustion units are performed as needed. The effectiveness of this control option cannot be directly quantified, and is therefore ranked as the least effective alternative.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective

- *Low Carbon Fuel:* INEOS's business plans call for sale of the produced hydrogen-rich stream. Market conditions will dictate which feeds are used, and the resulting quantity of hydrogen-rich product will vary as the feed composition varies. Market conditions, and subsequent contracts for product, will also dictate how much hydrogen can be sold. Therefore, a requirement to use hydrogen as fuel in place of natural gas when available and not sold as product is a viable operating practice. When hydrogen is not being sold, it enters the process gas system. The process gas system consists typically of 35-40% hydrogen and INEOS will maintain a carbon content of the fuel gas at 0.71 %, which is that of natural gas.
- *Periodic tune-up* – The furnace operations will include preventive maintenance checks of fuel gas flow meters annually, preventive maintenance check of oxygen control analyzers quarterly, cleaning of burner tips on an as-needed basis, and cleaning of convection section finned tubes on an as-needed basis. (Note: These activities insure maximum thermal efficiency is maintained; however, it is not possible to quantify an efficiency improvement, although convection cleaning has shown improvements in the 0.5 to 1.5% range.)

Step 5 – Selection of BACT

Low Carbon Fuel:
Fuel for the furnace will be natural gas or plant process gas. Both fuel gases have been calculated to have a carbon composition of 0.71% in the fuel (lbs carbon in fuel/total lbs of fuel). Plant process gas will have an average of 0.35% hydrogen in the fuel.

Feedstock Composition:

INEOS will only use ethane gas as feed to the furnace. Utilizing ethane gas versus liquid feedstocks, such as naphtha, debutanized natural gasoline, etc., is known to reduce pollutants since heat is not used to vaporize the liquid feedstocks.

Furnace Operations on Oxygen Trim Control:
Excess air will be limited to ensure complete combustion and INEOS will limit the amount of excess oxygen added to the furnace to less than 3.5% through the use of continuous oxygen and carbon monoxide analyzers that are monitored quarterly to meet the EPA specification standards in 40 CFR Appendix B4. The CO analyzer will ensure complete combustion to reduce methane emissions. These control practices are part of the existing No. 2 Olefins unit and will also be utilized for the 11th furnace operations. Periodic tuning of the furnace and burners also ensure uniform heat throughout the tubes, improves furnace efficiency and reduces carbon buildup.

The design of the furnace will use technological advanced heat transfer equipment in the radiant and convection section of the furnaces. Additionally, the hot effluent from the cracking furnace is cooled in the existing primary and secondary quench exchangers that produce high pressure steam for use in the plant. The convective section of the furnace is used to preheat or superheat boiler feed water, hydrocarbon feed and produce high pressure steam for the plant. The final flue gas temperature is reduced to its practical limit of dew point temperatures and temperature of the process streams being heated. The stack temperature proposed of 340^{o}F is based on current operations of the other 10 furnaces and to reduce CO emissions.

Steam condensate form the equipment is routinely recovered as feed water for the steam producing equipment at the plant. This furnace will also incorporate this condensate recovery.

Additional heat recovery and optimization includes the heat exchange maintenance program. There are three heat exchangers involved with the furnace operations. The primary and secondary exchangers cool the cracked gas effluent by producing steam from boiler feed water. The tertiary exchanger cools the cracked gas effluent by preheating the feed. The cracked gas effluent remains in the gaseous state to minimize fouling in the tubes. INEOS treats the boiler feed water to remove dissolved solids and control pH and corrosion and typically does not have fouling in the exchangers. The efficiency of these exchangers is monitored and cleaning is performed during normal scheduled maintenance periods on an as needed basis.

<u>**Furnace Efficiency:**</u>
Furnace efficiency is also related to product yields. Ethylene yield is defined as the percentage of ethane converted to ethylene by the furnace. A higher yield provides for making the same amount of useful products with less heat input, which means that less combustion is needed and fewer emissions are produced. The chosen design is significantly higher on this yield measurement. Additionally, the steam production that occurs in the convection section of the furnace also contributes to effective furnace design and efficiency. When steam is produced in the furnace,

additional fuel is not required by boilers and cogeneration facilities for downstream processes. INEOS expects that with the new furnace, the steam requirement from the plant boilers will decrease but at this time has not quantified this decrease. Benchmark data from the vendors and existing plan has been provided below for the design of the 11th furnace. INEOS also considered the design that is similar to five furnaces currently operating.

Table 3

	Lbs ethylene/ lb ethane	High pressure Steam (Mlbs/hr)
Chosen Design	0.573	177
Design A	0.552	178
Design B	0.561	175
Design C	0.550	182
Design E	0.545	169
Existing (1993)	0.52	105
Existing (1976) & (1973)	0.49	70

From the above data, INEOS has indicated that the best yields for their operations are the design that will maximize ethylene production using the lowest quantity of fuel and therefore will have the lowest quantity of GHG emitted per pound of ethylene produced. The BACT output limit for the furnace based on an annual average will be 0.85 lbs of GHG per lb of ethylene produced. Calculations are in the Appendix of this document.

Process Fugitives (F-1)

Hydrocarbon emissions from leaking piping components (process fugitives) associated with the proposed project include methane, a GHG. The additional methane emissions from process fugitives have been conservatively estimated to be 25 TPY as CO_2e. This is a negligible contribution to the total GHG emissions for the project and accounts for less than 0.01% of the total GHG emissions for the facility; however, for completeness, they are addressed in this BACT analysis.

Step 1 – Identification of Potential Control Technologies

The only identified control technology for process fugitive emissions of GHG are use of a leak detection and repair (LDAR) program. LDAR programs vary in stringency as needed for control of VOC emissions; however, due to the negligible amount of GHG emissions from fugitives, LDAR programs would not be considered for control of GHG emissions alone. As such, evaluating the relative effectiveness of different LDAR programs is not warranted.

Step 2 – Elimination of Technically Infeasible Alternatives

LDAR programs are a technically feasible option for controlling process fugitive GHG emissions.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

As stated in Step 1, this evaluation does not compare the effectiveness of different levels of LDAR programs.

Step 4 – Evaluation of Control Technologies in Order of Most Effective to Least Effective

Although technically feasible, use of an LDAR program to control the negligible amount of GHG emissions that occur as process fugitives would be cost prohibitive. However, if an LDAR program is being implemented for VOC control purposes, it will also result in effective control of the small amount of GHG emissions from the same piping components. INEOS uses TCEQ's 28 VHP- LDAR program to minimize process fugitive VOC emissions at the plant, and this program has also been proposed for the additional fugitive VOC emissions associated with the project. 28 VHP is TCEQ's most stringent LDAR program that will reduce VOC emissions by 97%.

Step 5 – Selection of BACT

Due to the negligible amount of GHG emissions from process fugitives, the currently used plant available control is the implementation of an LDAR program. INEOS will implement TCEQ's 28VHP[6] LDAR program for VOC BACT purposes, which will also effectively minimize CH_4 (GHG) emissions. Therefore, the proposed VOC LDAR program will satisfy GHG BACT requirements when monitoring for methane. However, since numeric limits for application of the LDAR are not practically enforceable, such limits will not be included in the permit.

VII. Threatened and Endangered Species

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 and reviewed by EPA. Further, EPA designated INEOS and its consultant, TRC Environmental Corp. ("TRC"), as non-federal representatives for purposes of preparation of the BA.

A draft BA has identified seventeen (17) species listed as federally endangered or threatened in Chambers County, Texas by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS) and the Texas Parks and Wildlife Department (TPWD). Four species,

[6] The boilerplate special conditions for the TCEQ 28 VHP LDAR program can be found at http://www.tceq.state.tx.us/assets/public/permitting/air/Guidance/NewSourceReview/bpc_rev28laer.pdf. These conditions are included in the TCEQ issued NSR permit.

Sprague's pipit, the sharpnose shiner, the smooth pimpleback, and the Texas fawnsfoot, are listed as a candidate species by the USFWS and are considered in the BA.

Federally Listed Species for Brazoria County	Scientific Name
Birds	
Piping Plover	*Charadrius melodus*
Sprague's pipit (candidate)	*Anthus spragueii*
Eskimo Curlew	*Numenius borealis*
Whooping Crane	*Grus americana*
Fish	
Smalltooth Sawfish	*Pristis pectinata*
Sharpnose Shiner (candidate)	*Notropis oxyrhynchus*
Mammals	
Louisiana Black Bear	*Ursus americanus luteolus*
Ocelot	*Leopardus pardalis*
Jaguarundi	*Puma yagouaroundi*
Red Wolf	*Canis rufus*
Mollusks	
Smooth pimpleback (candidate)	*Quadrula houstonensis*
Texas fawnsfoot (candidate)	*Truncilla macradon*
Reptiles	
Green Sea Turtle	*Chelonia mydas*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Leatherback Sea Turtle	*Dermochelys coriacea*
Loggerhead Sea Turtle	*Caretta caretta*
Hawksbill Sea Turtle	*Eretmochelys imbricate*

EPA has determined that issuance of the proposed permit to INEOS for construction of a new cracking furnace unit will have no effect on any of the thirteen listed species or on the four candidate species, as there is no occurrence of any of any of these species, their critical habitat, or potential habitat within action area of the proposed project.

VIII. Magnuson-Stevens 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 NOAA's National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), 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 the applicant and reviewed by EPA.

The facility property is located adjacent to tidally influenced portions of the Chocolate Bayou which empties into Chocolate Bay, which is part of the Galveston Bay system. These tidally influenced portions have been identified as potential habitats of postlarval, juvenile, and subadult red drum (*Sciaenops ocellatus*), white shrimp (*Penaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*). 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 INEOS to construct the new cracking furnace unit within the existing facility property will have no adverse impacts on listed marine and fish habitats.

IX. 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 a cultural resource report prepared by TRC, INEOS's consultant, submitted on June 25, 2012.

TRC conducted an a cultural resource review within a 1-mile radius area of potential effect (APE) of the construction site which included a review of the Texas Historical Commission's online Texas Archaeological Site Atlas (TASA) and data from a previous archaeological survey in 1979 sponsored by the United States Army Corps of Engineers. Based on the information provided in the cultural resources report, no archaeological resources or historic structures were found within the APE. The construction site is located in a modern industrial facility in an industrialized zone adjacent to other oil and gas refineries.

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

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 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.

X. 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 GHG. 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 GHG 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.

XI. Conclusion and Proposed Action

Based on the information supplied by INEOS, our review of the analyses contained the TCEQ 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 GHG under the terms contained in the draft permit. Therefore, EPA is proposing to issue INEOS a PSD permit for GHG for the project, 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

Supporting Calculations For BACT Conditions

Calculation of the Annual GHG output based Factor

Furnace estimated ethylene production is 509,000,000 lbs/year

Maximum GHG allowable emissions is 216,567 CO_{2e}

Output factor = lbs of CO_{2e}/lbs of ethylene produced

= 216567*2000/509000000

=0.85

INEOS USA LLC
CHOCOLATE BAYOU
PLANT INITIAL PERMIT
APPLICATION
FUGITIVE EMISSIONS (EPN: FUG-ADDF)

EQUIPMENT TYPE	SERVICE	VOC	COUNT a	EMISSION FACTOR (lb/hr/source)[2] b	REDUCTION CREDIT (%)[1] c	VOC EMISSIONS (lb/hr) d	VOC EMISSIONS (tpy) e
Valves	Gas/Vapor	With Ethylene		0.0258			
		Average		0.0132			
		Without Ethylene	64	0.0089	97	0.02	0.07
	Light Liquid	With Ethylene		0.0459			
		Average		0.0089			
		Without Ethylene		0.0035			
	Heavy Liquid	With Ethylene		0.0005			
		Average		0.0005			
		Without Ethylene		0.0007			
Pump Seals	Light Liquid	With Ethylene		0.1440			
		Average		0.0439			
		Without Ethylene		0.0386			
	Heavy Liquid	With Ethylene		0.0046			
		Average		0.0190			
		Without Ethylene		0.0161			
Flanges/Connectors	Gas/Vapor	With Ethylene		0.0053			
		Average		0.0039			
		Without Ethylene	128	0.0029	30	0.26	1.14
	Light Liquid	With Ethylene		0.0052			
		Average		0.0005			
		Without Ethylene		0.0005			
	Heavy Liquid	All		0.00007			
Compressor Seals	All	All		0.5027			
Relief Valves	All	All		0.2293			
Open Ended Lines	All	With Ethylene		0.0075			
		Average		0.0038			
		Without Ethylene		0.004			
Sampling Connections	All	All		0.033			
Total			**192**		**Total**	**0.28**	**1.21**

Notes:

1. Reduction credit based on TCEQ - 28 VHP monitoring program.
2. Emissions were calculated using the applicable SOCMI factor.
3. All relief valves are vented to the flare.
4. This speciation is based on maximum content in natural gas.

Speciation:

Pollutant	Wt %	Emission Rate lb/hr	Emission Rate tpy
Methane	98.0%	0.27	1.19
CO2e		5.70	24.96

d = a*b*[1-(c/100)]

e = d*8760/2000

FURNACE EMISSIONS (EPN: DDB-105) FUEL ANALYSIS

Natural Gas Fuel Analysis

Chemic al		MW	atoms C/mol	H H	sampl e 1	sample 2	average mol frac.	M W	HH V	C C
Methan	CH4	1	1	23861	86.1	94.69	0.9	14.5	90	0.605
Ethane	C2H6	3	2	22304	6.28	1.99	0.0	1.2	7	0.055
Propan	C3H8	4	3	21646	0.77	0.26	0.0	0.2	1	0.010
Butane	C4H1	5	4	21490	0.36	0.12	0.0	0.1	8	0.006
Pentane	C5H1	7	5	21072	0.09	0.03	0.0	0.0	2	0.002
Nitroge	N2	2	0	0	0.45	0.32	0.0	0.1	0	0.000
Carbon	CO2	4	1	0	5.87	1.79	0.0	1.6	0	0.025
Oxygen	O2	3	0	0	0.08	0	0.0	0.0	0	0.000
					100.0	99.2	1	17.9	995.09	0.71

HHV, Btu/lb 21300

INEOS Fuel Gas Analysis

Chemic al		MW	atoms C/mol	H H	averag e	max	average mol frac.	M W	HH V	C C
Methan	CH4	1	1	23861	6	6	0.6	10.0	6	0.66
Ethylen	C2H	2	2	21884	2	2	0.0	0.5	3	0.04
Hydroge	H2	2	0	61084	3	3	0.3	0.7	1	0.00
					1	1	1	11.3	767.62	0.71

HHV, Btu/lb 26061