Statement of Basis

Draft Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit for the Diamond Shamrock Refining Company, L.P., Valero McKee Refinery

Permit Number: PSD-TX-861-GHG

July 2013

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 2, 2011, Diamond Shamrock Refining Company, L.P., (a Valero company), submitted a Greenhouse Gas (GHG) Prevention of Significant Deterioration (PSD) permit application to EPA Region 6 to authorize a modification at Valero McKee Refinery, an existing major source of criteria pollutants. In connection with the same proposed project, Valero submitted a PSD application for non-GHG pollutants to the Texas Commission on Environmental Quality (TCEQ) on December 2, 2011. In November 2012, Valero requested that TCEQ withdraw its permit amendment application. A new permit application was submitted on December 7, 2012 to the TCEQ for non-GHG pollutants, and an update was submitted to the EPA Region 6 for the GHG PSD permit application. The project at the McKee Refinery, herein referred to as the Crude Expansion Project, proposes to modify certain equipment which will allow for an increase in the overall processing of crude oil from 169,000 barrels per day to 210,000 barrels per day. The Crude Expansion Project would make several changes to existing process units to debottleneck the refinery’s existing crude processing capacity. Specifically, these changes involve - installation and modification of equipment at several existing process units, including: the Nos. 1 and 2 Crude Units, the Nos. 1 and 2 Vacuum Units, the Refinery Light Ends (RLE) Unit, the No. 4 Naphtha Fractionator, the Dehexanizer Tower (a Naphtha Fractionator), the Hydrocracking Unit (HCU), the Gasoline Desulfurization Unit (GDU), the Turbine Fuel Merox Unit, the Diesel Hydrotreater, the Gas Oil Fractionator (GOF), the Sour Water Stripper (SWS), and the Amine Treating and Sulfur Recovery Units (SRUs) at the existing Valero McKee Refinery located in Sunray, Moore County, Texas. In addition, a new steam boiler, new storage tanks, new cooling tower pumps, and new process piping will be added to accommodate the increased crude processing capacity. 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 Valero McKee Refinery.

This SOB documents the information and analysis EPA used to support its decisions made in drafting the air permit. It includes a description of the proposed facility, the applicable air permit requirements, and an analysis showing how the applicant complied with the requirements.

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

II. Applicant

Diamond Shamrock Refining Company, L.P.
A Valero Company
6701 FM 119
Sunray, TX 79086

Facility Physical Address:
6701 FM 119
Sunray, TX 79086

Contact:
Shelly Williamson
Environmental Manager
Diamond Shamrock Refining Company
(806) 935-1354

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). 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 GHGs.

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:
Melanie Magee
Air Permitting Section (6PD-R)
(214) 665-7161

IV. Facility Location

The Diamond Shamrock, Valero McKee Refinery is located in Moore County, Texas. The area is currently designated attainment/unclassified for all criteria pollutants. The geographic coordinates for this facility are as follows:

Latitude: 35º 56' 54" North
Longitude: -101º 53'30" West

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

Figure 1. Diamond Shamrock (Valero), Valero McKee Refinery Location

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

EPA concludes that Valero's application is subject to PSD review for GHGs because the project would result in an emissions increase of GHGs for a facility as described at 40 CFR § 52.21(b)(49)(iv). Under the project, increased GHG emissions will have a mass basis over zero tpy and CO_2e emissions are calculated to exceed the applicability threshold of 75,000 tpy. The permitted emissions from the Crude Expansion Project are 195,625.2 tpy CO_2e. EPA Region 6 implements a GHG PSD FIP for Texas under the provisions of 40 CFR § 52.21 (except paragraph (a)(1)). See 40 CFR § 52.2305.

The applicant represents that the project is subject to PSD irrespective of GHG requirements and that TCEQ has determined that the proposed project is subject to PSD review for Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Ozone (greater than 40 tpy of Volatile Organic Compounds), Sulfur Dioxide (SO_2), Particulate Matter (PM, PM_{10}, and $PM_{2.5}$). At this time, TCEQ has not issued the PSD permit for the non-GHG pollutants.

Accordingly, under the circumstances of this project, the State 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 the EPA document entitled "PSD and Title V Permitting Guidance for Greenhouse Gases" (March 2011). Consistent with this guidance, we have not required the applicant to model or conduct ambient monitoring for GHGs, and we have not required any assessment of impacts of GHGs in the context of the additional impacts analysis or Class I area provisions. Instead, EPA has determined that compliance with the selected Best Available Control Technology (BACT) is the best technique that can be employed at present to satisfy the additional impacts analysis and Class I area requirements of the rules as they relate to GHGs. We note again, however, that the project has triggered review for regulated NSR pollutants that are non-GHG pollutants under the PSD permit sought from TCEQ, so air quality modeling or ambient monitoring may be required in order for TCEQ to issue the PSD permit for the non-GHG pollutants.

For the purposes of PSD applicability, a source is required to look beyond the modified emission unit to determine the extent of emission increases that result from the modification. The PSD and Title V Permitting Guidance for Greenhouse Gases guidance notes that emission increases from sources upstream and downstream of the modified emission unit must also be included in the determination of total project emission increase. However, in the preamble for the 1980 rule that established the current version of 40 CFR § 52.21(j)(3), EPA explained that "BACT applies only to the units actually modified." See 45 FR 52676, 52681 (Aug.7, 1980). The permit application lists the existing unmodified emission units and the anticipated emission increases associated with this proposed project.

[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

VI. Project Description

The Valero McKee Refinery processes crude oil to produce petrochemical products and commercial petroleum products. Crude oil is blended at a separate facility and transferred to the Valero McKee Refinery by pipeline and trucks. The crude oil is then processed and refined into various petrochemical products and commercial petroleum products such as propane, gasoline, jet fuel, diesel fuel, and asphalt.

The proposed GHG PSD permit, if finalized, will allow Valero to install and modify equipment as part of the Crude Expansion Project that will debottleneck parts of the refinery to allow for additional crude processing. The Crude Expansion Project will increase the crude processing capacity of the facility from 169,000 barrels per day to 210,000 barrels per day once completed. The permitted emissions from the Crude Expansion Project are 195,625.2 tpy CO_2e.

VII. General Format of the BACT Analysis

The BACT analyses were conducted in accordance with EPA's *PSD and Title V Permitting Guidance for Greenhouse Gases* (March 2011), which outlines the steps for conducting a top-down BACT analysis. Those steps are listed below.

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

Also, in accordance with the *PSD and Title V Permitting Guidance for Greenhouse Gases*, BACT analyses must take into account the energy, environmental, and economic impacts of the control options. Emission reductions may be determined through the application of available control techniques, process design, and/or operational limitations.

Each of the new and modified emission units submitted in Valero's PSD GHG application was evaluated separately with its own top-down five-step BACT analysis.

VIII. Applicable Emission Units and BACT Discussion

The majority of the contribution of GHGs associated with the project is from combustion sources (i.e., various heaters, boilers, and incinerators). The site has some fugitive emissions from piping components which contribute an insignificant amount of GHGs. Fugitive emissions account for 75 TPY of CO_2e, or less than 0.01% of the project's total CO_2e emissions. Stationary combustion sources primarily emit CO_2, with only small amounts of N_2O and CH_4. In addition to multiple existing, non-modified units (not subject to BACT and outlined in permit application), the following devices are new or modified sources subject to this GHG PSD permit:

Table 1. New or Modified Emission Units Associated with the Crude Expansion Project

Emission Unit	New or Modified
No. 22 Boiler (B-22)	New
No. 1 Vacuum Heater (H-2)	Modified
No. 4 Hydrotreater Charge Heater (H-64)	Modified
SRU No. 1 Incinerator (V-5)	Modified
Process Fugitives	Modified
Portable Combustion Control Device, EFR Tank Degassing (MSSCONTROL)	New
Fugitives (MSSFUG, Equipment Fugitives)	New

IX. Crude Expansion Project BACT Analysis

For the proposed project, the new boiler (EPN: B-22), heaters (EPNs: H-2 and H-64), and Incinerator (EPN: V-5) are capable of considering add-on (post combustion) control technologies that will recover CO_2 from gas streams emitted from combustion units. In lieu of considering add-on technology as part of the BACT analysis for each of these emission unit types, we consider it here as a combined technology for the combustion units.

Step 1. Identify All Available Control Options

The first step in the top-down BACT process is to identify all "available" control options. In general, if a control option has been demonstrated in practice on a range of exhaust gases with similar physical and chemical characteristics and does not have a significant negative impact on process operations, product quality, or the control of other emissions, it may be considered as potentially feasible for application to another process.

Carbon Capture and Storage (CCS)

Carbon capture and storage is an available GHG control technology for "facilities emitting CO_2 in large amounts, including fossil fuel-fired power plants, and for industrial facilities with high-purity CO_2 streams (e.g., hydrogen production, ammonia production, natural gas processing, ethanol production, ethylene oxide production, cement production, and iron and steel manufacturing)."[2] CCS systems involve the use of adsorption or absorption processes to remove CO_2 from flue gas, with subsequent desorption to produce a concentrated CO_2 stream. The three main capture technologies for CCS are pre-combustion capture, post-combustion capture, and oxyfuel combustion (IPCC, 2005). Of these approaches, pre-combustion capture is applicable primarily to gasification plants, where solid fuel such as coal is converted into gaseous components by applying heat under pressure in the presence of steam and oxygen (U.S. Department of Energy, 2011). At this time, oxyfuel combustion has not yet reached a commercial stage of deployment for this type of application. Accordingly, pre-combustion capture and oxyfuel combustion are not considered available control options for this proposed

[2]U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *PSD and Title V Permitting Guidance for Greenhouse Gases*, March 2011, <> (March 2011).

facility; the third approach, post-combustion capture, is applicable to boilers and heaters, such as the new and modified units in Valero's proposed project.

With respect to post-combustion capture, a number of methods may potentially be used for separating the CO_2 from the exhaust gas stream, including adsorption, physical absorption, chemical absorption, cryogenic separation, and membrane separation (Wang et al., 2011). Many of these methods are either still in development or are not suitable for treating heater exhaust gas due to the characteristics of the exhaust stream (Wang, 2011; IPCC, 2005).

Once CO_2 is captured from the flue gas, the captured CO_2 is compressed to 100 atmospheres (atm) or higher for ease of transport (usually by pipeline). The CO_2 would then be transported to an appropriate location for underground injection into a suitable geological storage reservoir, such as a deep saline aquifer or depleted coal seam, or used in crude oil production for enhanced oil recovery (EOR). There is a large body of ongoing research and field studies focused on developing better understanding of the science and technologies for CO_2 storage.[3]

Step 2 – Elimination of Technically Infeasible Alternatives

The CCS option identified in Step 1 is considered technically feasible for this project.[4]

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

Chemical absorption using MEA based solvents is assumed to represent the best post-combustion CO_2 capture option. Valero has estimated that if CCS was determined to be technically feasible, the capture of CO_2 could be up to 90% effective.

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

Carbon Capture and Storage

Valero developed a cost analysis for CCS, and the estimated total annual cost for CCS would be $24,401,017 per year. The estimated project construction cost with CCS is approximately $212,170,164. EPA Region 6 reviewed Valero's CCS cost estimate and believes it adequately approximates the cost of a CCS control for this project and demonstrates those costs are high in relation to the overall cost of the proposed project without CCS, which is estimated at $75,500,000. The addition of CCS would increase the total capital project without CCS costs by more than 180%. Thus, CCS has been eliminated as BACT for this project.

---

[3] U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory *Carbon Sequestration Program: Technology Program Plan*, <http://www.netl.doe.gov/technologies/carbon_seq/refshelf/2011_Sequestration_Program_Plan.pdf>, February 2011

[4] Based on the information provided by Valero and reviewed by EPA for this BACT analysis, while there are some portions of CCS that may be technically infeasible for this project, EPA has determined that overall Carbon Capture and Storage (CCS) technology is technologically feasible at this source.

Furthermore, the recovery and purification of CO_2 from the stack gases would necessitate significant additional processing, including energy, and environmental/air quality penalties, to achieve the necessary CO_2 concentration for effective sequestration. The additional process equipment required to separate, cool, and compress the CO_2, would result in adverse energy and environmental impacts due to increased fuel usage in order to meet the steam and electric load requirements of this system. It is likely that the additional energy consumption would affect the CO_2 efficiency of the new boiler, modified heaters, and the No. 1 SRU. Valero has estimated that by adding CCS, a 15% energy penalty would result due to the increase in the natural gas fuel use of the plant. The additional GHG emissions resulting from additional fuel combustion would either further increase the cost of the CCS system, if the emissions were also captured for sequestration, or reduce the net amount of GHG emission reduction, making CCS even less cost effective than expected.

An additional factor considered for this proposed project is that the CCS system would potentially control CO_2 effluent from the new boiler, two modified heaters, and No. 1 SRU. This proposed action does consider additional CO_2 emissions, but only 194,726 tpy of CO_2, or about 29% of the emissions estimated in the application would be captured.

Therefore, since the cost of CCS would be significantly higher (approximately 180%) than the cost of the current project without CCS, and considering the adverse energy and environmental impacts of CCS, CCS has been eliminated as BACT for this project.

X. New No. 22 Boiler (EPN: B-22)

The existing Valero process utilizes steam produced by the existing boilers and steam produced by heat recovery from certain refinery processes. Based on the proposed process changes and steam balance information, Valero has determined that an incremental increase in steam usage will be needed for the Crude Expansion Project. The incremental increase of steam usage is equivalent to approximately 60 MMBtu/hr (annual average) of 300 psi and 150 psi steam from existing boilers. The existing boilers are considered non-modified sources and are included in the permit application as existing, non-modified emission units. For operational reliability purposes, a new refinery gas-fired 225 MMBtu/hr steam boiler[5] is proposed to be added to the existing process. The new boiler (B-22) will ensure sufficient steam is provided throughout the refinery in the event that an existing boiler is down for maintenance.

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

Step 1 – Identification of Potential Control Technologies for GHGs

- *Use of Low Carbon Fuels* – Fuels vary in the amount of carbon per Btu, which in turn affects the quantity of CO_2 emissions generated per unit of heat input.

[5] Based on Supplemental Information provided by Valero and contained in the Appendix of this document.

- *Use of Good Combustion 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, with the assistance of oxygen trim control.
- *Energy Efficient Design* – Proper design and operation using combustion air preheat, heat recovery, and other energy efficient processes to maximize process heater efficiency.
- *Oxidation Catalysts* - Oxidation catalysts are widely used as a control technology for CO and VOC emissions and would also provide reduction in CH_4 emissions.
- *Carbon Capture and Storage (CCS)* – CCS is an available add-on control technology that is applicable for all of the site's affected combustion units. However, based on the information reviewed for this BACT analysis, while there are some portions of CCS that are technically feasible, EPA has determined that overall, Carbon Capture and Storage (CCS) technology is not economically feasible for this proposed project (see above discussion).

Step 2 – Elimination of Technically Infeasible Alternatives

All options identified in Step 1 are considered technically feasible, except for oxidation catalysts. The installation of oxidation catalysts in a flue gas stream containing more than trace levels of SO_2 will result in poisoning and deactivation of the catalyst by sulfur-containing compounds, as well as increasing the conversion for SO_2 to SO_3. The new boiler's flue gas stream is calculated to contain 10.22 TPY SO_2. The increased conversion of SO_2 to SO_3 will increase condensable particulate matter emissions and increase flue system corrosion rates. For these reasons, catalytic oxidation of CH_4 is not considered technically feasible for the new boiler.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

- Use of low carbon fuels
- Use of good combustion practices
- Energy efficient design

Steam is used throughout industrial sources and is typically generated by boilers and waste heat recovery units.[6] Use of low carbon fuels, good combustion practices, and energy efficient design are all considered effective and have a range of efficiency improvements for steam boiler units and cannot be directly quantified. Therefore, the above ranking is approximate only.

However, an attempt to characterize energy efficiency measures in boilers is provided in the document titled: 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).[7] The table below is from this report and addresses improvement measures and the estimated associated efficiency improvements that can be realized.

[6] Neelis, Maartin. (2008). Energy Efficiency Improvement and Cost Saving Opportunities for the Petrochemical Industry – An ENERGY STAR(R) Guide for Energy and Plant Managers. Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. Retrieved from: http://escholarship.ucop.edu/uc/item/8dg961x6

Table 2: Summary of energy efficiency measures in boilers

Measure	Fuel Saved	Payback Period (years)	Other Benefits
Improved Process Control	3%	0.6	Reduced emissions
Reduced Flue Gas Quantity	2-5%	-	Cheaper emission controls
Reduced Excess Air	1% improvement for each 15% less excess air	-	
Improved Insulation	6-26%	?	Faster warm-up
Boiler Maintenance	10%	0	Reduced emissions
Flue Gas Heat Recovery	1%	2	
Blowdown Steam Heat Recovery	1.3%	1-2.7	Reduced damage to structures (less moist air is less corrosive)
Alternative Fuels	Variable	-	Reduces solid waste stream at the cost of increased air emissions

Step 4 – Economic, Energy, and Environmental Impacts

No bases for elimination of the control options based on economic, energy or environmental impacts have been identified. The applicant has proposed that all control options be adopted into the BACT determination.

Energy Efficient Design

In evaluating the efficiency design of a steam system, it is important to identify where and how the steam is planned to be used. Often the actual steam savings may be hard to quantify and the use of several efficient design elements may be necessary to systemically improve the efficiency potential.

Good Combustion Practices

Good combustion practices include good air/fuel mixing in the combustion zone, sufficient residence time to complete combustion, and good burner maintenance and operation. Some amount of excess air is required to ensure complete fuel combustion, minimize emissions, and for safety reasons. More excess air than needed to achieve these objectives reduces overall heater efficiency. Manual or automated air/fuel ratio controls is used to optimize these parameters and maximize the efficiency of the combustion process. Automated controls are considered more efficient than manual controls.

Use of Low Carbon Fuel

All fossil fuels contain significant amounts of carbon, but the refinery fuel gas and natural gas combusted in the modified heaters is a low carbon fuel. Refinery fuel gas is generally similar to natural gas but contains less methane and more hydrogen and ethane then natural gas does. Natural gas is a very clean burning fuel with respect to criteria pollutants and thus has minimal environmental impact compared to other fuels. If the refinery fuel gas, which is produced during the refining process, is not used in the boiler then the refinery fuel gas will need to be burned elsewhere, such as flaring the refinery fuel gas. The refinery fuel gas has a lower carbon dioxide formation potential than burning diesel fuel, residual oil, coal, and petroleum coke.

Step 5 – Selection of BACT

For the new 225 MMBtu/hr boiler, the proposed BACT limits and requirements are as follows:

FIN	EPN	Description	GHG Mass Basis		TPY $CO_2e^{2,3}$	BACT Requirements
				TPY[2]		
B-22	B-22	New 225 MMBtu/hr No. 22 Boiler	CO_2	112,501.56	113,043	• 0.11 lb CO_2/scf Fuel on a 365-day rolling basis; • Low Carbon Fuels; • Good Combustion and Operating Practices; • Energy Efficient Design
			CH_4	6.52		
			N_2O	1.30		

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

Company / Location	Process Description	Control Device	BACT Emission Limit / Requirements	Year Issued	Reference
BASF Fina Petrochemicals	(2) 425.4 MMBtu/hr Steam Package Boilers located at an existing ethylene cracking process.	Energy Efficiency/ Good Design & Combustion Practices	421,399 TPY CO_2e/ Minimum Thermal Efficiency of 77%	2012	PSD-TX-903-GHG
Iowa Fertilizer Company	472.4 MMBtu/hr Auxiliary Boiler	Energy Efficiency/ Good Design & Combustion Practices	51,748 TPY CO_2e, 117 lb CO_2/MMBtu on a 30-day rolling average	2012	56-10-001

In comparing the proposed Valero boiler to the other similar facilities, it appears that the Valero proposed BACT limit is lower than other recently permitted emission units. However, the other recently permitted boilers have a higher heat rate than the proposed Valero boiler. The CO_2 emission BACT limit from the proposed Valero project is calculated to be 114.16 lb CO_2/MMBtu and is lower than the permitted rated of 117 lb CO_2/MMBtu for the Iowa Fertilizer Company. The following specific BACT practices are proposed for the boiler:

Energy efficient design – The use of the following energy efficient design technologies will be used by the new steam boiler.

- Combustion air preheat;
- Use of process heat to generate steam;
- Process integration and heat recovery;
- Use of newer burner with latest proven engineering design; and
- Excess combustion air monitoring and control

Good combustion practices – The use of the following good combustion practices will be used by the new steam boiler.

- Good air/fuel mixing in the combustion zone: The amount of ambient air in the combustion zone will be controlled to maintain efficiency of the new boiler. Oxygen in the flue gas from the boiler will be controlled by the burner registers and stack dampers. In addition, a thermal tune-up will be conducted annually. The tune-up will consist of inspection of the burner, flame pattern and air-to-fuel ratio. This will ensure that the boiler meets its vendor-guaranteed energy efficiency of 80% (HHV).
- Sufficient residence time to complete combustion;
- Proper fuel gas supply system design and operation in order to minimize fluctuations in fuel gas quality;
- Good burner maintenance and operation;
- High temperatures and low oxygen levels in the primary combustion zone;
- Monitor oxygen levels and air intake to optimize the fuel/air ratio and minimize excess air: The fuel flow and stack O_2 are continuously monitored to ensure that the boiler is operated within the optimum design parameters. The optimum O_2 percentage is suggested by the burner manufacturer and found through operational testing for stability and safety on the boiler. The optimum O_2 percentage target on the boiler allows the burners to perform at the maximum efficiency; therefore, allows the boiler to perform at the maximum efficiency.
- Implementing a maintenance program to monitor fouling conditions in the new boiler. The amount of fouling is monitored by measuring the amount of heat input to the boiler via the amount of fuel gas burned and comparing this to the amount of heat being absorbed into the process. Increased stack temperatures also help identify potential fouling. Once the possibility of fouling is observed, the boiler is further investigated to determine expected run-time to plan turnaround schedule.
- Conduct a thermal tune-up annually. The tune-up will consist of an inspection of the burner, flame pattern and air-to-fuel ratio. Records will be kept onsite and made available of the thermal tune-ups for a period of 5 years.

Low Carbon Fuel – Natural gas and refinery fuel gas will be the only fuels fired in the proposed boiler.

BACT Compliance:

For the new boiler, Valero will maintain records of heater tune-ups, burner tip maintenance, O_2 analyzer calibrations and maintenance for the new steam boiler. In addition, records of fuel usage, and stack exhaust temperature will be maintained.

Valero will demonstrate compliance with the CO_2 limit for the heater based on metered fuel consumption and using the fuel volume and composition. The CO_2 mass emissions will be calculated on a daily basis and divided by the measured fuel usage. The resulting quotient is added to the 365-day rolling total and compared to the BACT requirement to determine compliance with the BACT limit. The equation for estimating CO_2 emissions is based on equation C-5 specified in 40 CFR § 98.33(a)(3)(iii) and defined as follows:

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

Where:

CO_2 = Annual CO_2 mass emissions from combustion of natural gas (short tons)
Fuel = Annual average volume of the gaseous fuel combusted (scf). The volume of fuel combusted must be measured directly, using fuel flow meters calibrated according to § 98.3(i).
CC = Annual average carbon content of the gaseous fuel (kg C per kg of fuel). The monthly average carbon content shall be determined using the same procedures as specified for HHV at § 98.33(a)(2)(ii).
MW = Annual average molecular weight of the gaseous fuel (kg/kg-mole). The annual average molecular weight shall be determined using the same procedure as specified for HHV at § 98.33(a)(2)(ii).
MVC = Molar volume conversion factor at standard conditions, as defined in § 98.6.
44/12 = Ratio of molecular weights, CO_2 to carbon.
0.001 = Conversion of kg to metric tons.
1.102311 = Conversion of metric tons to short tons.

As an alternative, Valero may install, calibrate, and operate a CO_2 CEMS and volumetric stack gas flow monitoring system with an automated data acquisition and handling system for measuring and recording CO_2 emissions. If this alternative is selected, the calculations shall be in accordance with the methodologies provided in 40 CFR § 98.33(a)(4).

The emission limits associated with CH_4 and N_2O are calculated based on emission factors provided in 40 CFR Part 98, Table C-2 and the actual heat input (HHV). Comparatively, the emissions from CO_2 contribute the most (greater than 99%) to the overall emissions from the heaters. Therefore, additional analysis is not required for CH_4 and N_2O. To calculate the CO_2e emissions, the draft permit requires calculation of the emissions based on the procedures and Global Warming Potentials (GWP) contained in the Greenhouse Gas Regulations, 40 CFR Part 98, Subpart A, Table A-1, as published on October 30, 2009 (74 FR 56395). Records of the calculations will be required to be kept on-site and made readily available for inspection to demonstrate compliance with the BACT emission limits on a 12-month rolling average for the CO_2e limit.

An initial stack test demonstration will be required for CO_2 emissions from the new steam boiler. Following the initial CO_2 emissions stack test, a stack test for CO_2 emissions from the new boiler is required every three years thereafter to verify continued performance at permitted emission limits. An initial stack test demonstration for CH_4 and N_2O emissions are not required because the CH_4 and N_2O emission are less than 0.01% of the total CO_2e emissions from the heaters and are considered a *de minimis* level in comparison to the CO_2 emissions.

XI. Modified Heaters (EPNs: H-2 and H-64)

The Valero Crude Expansion Project will modify the No. 1 Vacuum Heater (EPN: H-2) and No. 4 Hydrotreater Charge Heater (EPN: H-64). The process heaters will not require a physical change or an increase in their current permitted firing rates to accommodate the additional processing of crude. The previously permitted firing rates for these heaters were used in the potential to emit calculations of this permit application and were made enforceable through TCEQ's permit 9708. The actual fuel firing rates may increase with increased throughputs. However, the fuel firing rates and type of fuel burned will not exceed the permitted firing rates contained in Table 3 below.

Table 3. Modified Heaters (H-2 and H-64) Previously Permitted Fuel Firing Limit to Determine the Emission Unit PTE.

EPN	EPN Description	Fuel Fired	Carbon Content (%)	TCEQ Permit 9708 Fuel Firing Rate Limit (SCFY)
H-2	No. 1 Vacuum Heater	Natural Gas and Refinery Fuel Gas	69.13	686,104,738.0
H-64	No. 4 Hydrotreater Charge Heater	Natural Gas and Refinery Fuel Gas	69.13	303,702,244.3

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

Step 1 – Identification of Potential Control Technologies for GHGs

- *Use of Low Carbon Fuels* – Fuels vary in the amount of carbon per Btu, which in turn affects the quantity of CO_2 emissions generated per unit of heat input.
- *Use of Good Combustion 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, with the assistance of oxygen trim control.
- *Energy Efficient Design* – Proper design and operation using combustion air preheat, heat recovery, and other energy efficient processes to maximize process heater efficiency.
- *Oxidation Catalysts* - Oxidation catalyst are widely used as a control technology for CO and VOC emissions and would also provide reduction in CH_4 emissions.
- *Carbon Capture and Storage (CCS)* – CCS is an available add-on control technology that is applicable for all of the site's affected combustion units. However, based on the information reviewed for this BACT analysis, while there are some portions of CCS that are technically feasible, EPA has determined that overall, Carbon Capture and Storage (CCS) technology is not economically feasible for this proposed project (see above discussion).

Step 2 – Elimination of Technically Infeasible Alternatives

All options identified in Step 1 are considered technically feasible, except for oxidation catalysts. The typical oxidation catalyst for CH_4 containing exhaust gases is a rhodium or platinum (noble metal) catalyst on an alumina support material. Acceptable catalyst operating temperatures range from 400°F to 1,250 °F, with the optimal range being 850°F to 1,100 °F. To achieve this temperature range in process heaters fired with refinery fuel gas, the catalyst would need to be installed in the heater upstream of any waste heat recovery or air preheat equipment to provide the optimum temperature range for the catalyst. A drawback is that installation of an oxidation catalyst in flue gas containing more than trace levels of SO_2 will result in poisoning and deactivation of the catalyst by sulfur-containing compounds as well as increasing the conversion for SO_2 to SO_3. The increased conversion of SO_2 to SO_3 will increase condensable particulate matter emissions and increase flue system corrosion rates. The SO_2 emissions in the flue gas of the modified heaters is determined to be 4.92 TPY. For these reasons, catalytic oxidation of CH_4 is not considered technically feasible for the refinery fuel gas fired process heaters.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

The average thermal efficiency of a furnace is estimated at 75-90%.[7] Valero has proposed the following measures to ensure optimal efficiency for the modified furnaces:

- Use of low carbon fuels
- Use of good combustion practices
- Energy efficient design

Use of low carbon fuels, good combustion practices, and energy efficient design are all considered effective and have a range of efficiency improvements which cannot be directly quantified. Therefore, the above ranking is approximate only. However, 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)[8]. This report notes that a typical savings of 10% can be achieved in furnace and burner design and operations.

Step 4 – Economic, Energy, and Environmental Impacts

No bases for elimination of the control options based on economic, energy or environmental impacts have been identified. The applicant has proposed that all control options be adopted into the BACT determination.

Energy Efficient Design

Heaters can be designed with efficient burners, more efficient heat transfer efficiency, state-of-the-art refractory and insulation materials in the heater walls, floor, and other surfaces to minimize heat loss and increase overall thermal efficiency. Process integration and heat recovery; rather than increasing heater efficiency, this technology reduces potential GHG emissions by reducing the required heater duty (fuel firing rate), which can substantially reduce overall plant energy requirements.

Good Combustion Practices

[7] Neelis, Maartin. (2008). Energy Efficiency Improvement and Cost Saving Opportunities for the Petrochemical Industry – An ENERGY STAR(R) Guide for Energy and Plant Managers. Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. Retrieved from: http://escholarship.ucop.edu/uc/item/8dg961x6

Good combustion practices include good air/fuel mixing in the combustion zone, sufficient residence time to complete combustion, and good burner maintenance and operation. Some amount of excess air is required to ensure complete fuel combustion, minimize emissions, and for safety reasons. More excess air than needed to achieve these objectives reduces overall heater efficiency. Manual or automated air/fuel ratio controls is used to optimize these parameters and maximize the efficiency of the combustion process. Automated controls are considered more efficient than manual controls.

Use of Low Carbon Fuel

All fossil fuels contain significant amounts of carbon, but the refinery fuel gas and natural gas combusted in the modified heaters is a low carbon fuel. Refinery fuel gas is generally similar to natural gas but contains less methane and more hydrogen and ethane then natural gas does. Natural gas is a very clean burning fuel with respect to criteria pollutants and thus has minimal environmental impact compared to other fuels. If the refinery fuel gas, which is produced during the refining process, is not used in the process heaters then the refinery fuel gas will need to be burned elsewhere, such as flaring the refinery fuel gas. The refinery fuel gas has a lower carbon dioxide formation potential than burning diesel fuel, residual oil, coal, and petroleum coke.

Step 5 – Selection of BACT

For the modified heaters (No.1 Vacuum Heater, No. 2 Vacuum Charge Heater and No. 4 Hydrotreater Charge Heater) the Proposed BACT limits and requirements are as follows:

FIN	**EPN**	**Description**	**GHG Mass Basis**		**TPY $CO_2e^{2,3}$**	**BACT Requirements**
				TPY[2]		
H-2	H-2	No. 1 Vacuum Heater	CO_2	37,571.78	37,754	• 0.11 lbs CO_2/scf fuel on a 365-day rolling average • Low Carbon Fuels; • Good Combustion and Operating Practices; • Energy Efficient Design
			CH_4	2.18		
			N_2O	0.44		
H-64	H-64	No. 4 Hydrotreater Charge Heater	CO_2	16,631.04	16,711	• 0.11 lbs CO_2/scf fuel on a 365-day rolling average • Low Carbon Fuels; • Good Combustion and Operating Practices; • Energy Efficient Design
			CH_4	0.96		
			N_2O	0.19		

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

Company / Location	Process Description	Control Device	BACT Emission Limit / Requirements	Year Issued	Reference
Iowa Fertilizer Company Wever, IA	110.12 MMBtu/hr Natural Gas Fired Start-Up Heater, Fertilizer Production	Energy Efficiency/ Good Design & Combustion Practices	117 lb CO_2/MMBtu; 0.0023 lb CH_4/MMBtu; 0.00063 lb N_2O/MMBtu; 638 Ton CO_2e 12 month rolling average	2012	12-A-390-P
Energy Transfer Company (ETC), Jackson County Gas Plant Ganado, TX	Four Natural Gas Processing Plants 4 Hot Oil Heaters (48.5 MMBtu/hr each) 4 Trim Heaters (17.4 MMBtu/hr each) 4 Molecular Sieve Heaters (9.7 MMBtu/each) 4 Regenerator Heaters (3 MMBtu/hr each)	Energy Efficiency/ Good Design & Combustion Practices	GHG BACT limit for process heaters per plant (one of each heater per plant) of 1,102.5 lbs CO_2/MMSCF 365-day average, rolling daily for each plant	2012	PSD-TX-1264-GHG
Enterprise Products Operating LLC, Eagleford Fractionation Mont Belvieu, TX	NGL Fractionation 2 Hot Oil Heaters (140 MMBtu/hr each) 2 Regenerant Heaters (28.5 MMBtu/hr each	Energy Efficiency/ Good Design & Combustion Practices	Hot Oil Heaters have a minimum thermal efficiency of 85% on a 12-month rolling basis. Regenerant heaters only have good combustion practices.	2012	PSD-TX-154-GHG

Energy Transfer Partners, LP, Lone Star NGL Mont Belvieu, TX	2 Hot Oil Heaters (270 MMBtu/hr each) 2 Regenerant Heaters (46 MMBtu/hr each)	Energy Efficiency/ Good Design & Combustion Practices	Hot Oil Heaters - 2,759 lb CO_2/bbl of NGL processed. Regenerator Heaters - 470 lbs CO_2/bbl of NGL processed. 365-day average, rolling daily	2012	PSD-TX-93813-GHG
Copano Processing L.P., Houston Central Gas Plant Sheridan, TX	2 Supplemental Heaters (25 MMBtu/hr each)	Energy Efficiency/ Good Design & Combustion Practices, and Limited Operation	Each heater will be limited to 600 hours of operation on a 12-month rolling basis.	2013	PSD-TX-104949-GHG

A BACT limit of 0.11 lb CO_2/scf on a 365-day rolling average is proposed for the modified heaters. This proposed BACT limit for the Valero heaters is similar to the Iowa Fertilizer Company BACT permitted limit. To compare the BACT limits, the heater BACT limit is calculated to be 114.16 lb CO_2/MMBtu and is lower than other recently issued BACT limits. To calculate the 114.16 lb CO_2/MMBtu, the BACT limit of 0.11 lb CO_2/scf is divided by the heat input factor of 959.4 Btu/scf and converted to MMBtu. The following specific BACT practices are proposed for the heaters:

- *Energy efficient design* – The use of the following energy efficient design technologies will be used by the process heaters.
  - Combustion air preheat;
  - Use of process heat to generate steam;
  - Process integration and heat recovery;
  - Increase radiant tube surface area when modifying existing heaters;
  - Excess combustion air monitoring and control; and
  - Cogeneration as a CO_2 reduction technique.
- *Good combustion practices* – The use of the following good combustion practices will be used by the process heaters.
  - Good air/fuel mixing in the combustion zone;
  - Sufficient residence time to complete combustion;
  - Proper fuel gas supply system design and operation in order to minimize fluctuations in fuel gas quality;
  - Good burner maintenance and operation;
  - High temperatures and low oxygen levels in the primary combustion zone; and
  - Overall excess oxygen levels high enough to complete combustion while maximizing thermal efficiency.
- *Low Carbon Fuel* – Natural gas and refinery fuel gas will be the only fuels fired in the proposed boiler.

BACT Compliance:

For the modified Heaters, Valero will maintain records of heater tune-ups, burner tip maintenance, and O_2 analyzer calibrations and maintenance for all heaters. In addition, records of fuel usage and stack exhaust temperature will be maintained.

Valero will demonstrate compliance with the CO_2 limit for the heaters based on metered fuel consumption and using the emission factors for natural gas from 40 CFR Part 98 Subpart C, Table C-2 and/or fuel composition and mass balance. The CO_2 mass emissions will be calculated on a daily basis and divided by the measured fuel consumption. The resulting quotient is added to the 365-day rolling total and compared to the BACT requirement to determine compliance with the BACT limit. The equation for estimating CO_2 emissions is based on equation C-5 in 40 CFR § 98.33(a)(3)(iii) and is as follows:

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

Where:

CO_2 = Annual CO_2 mass emissions from combustion of natural gas (short tons)
Fuel = Annual volume of the gaseous fuel combusted (scf). The volume of fuel combusted must be measured directly, using fuel flow meters calibrated according to § 98.3(i).
CC = Annual average carbon content of the gaseous fuel (kg C per kg of fuel). The annual average carbon content shall be determined using the same procedures as specified for HHV at § 98.33(a)(2)(ii).
MW = Annual average molecular weight of the gaseous fuel (kg/kg-mole). The annual average molecular weight shall be determined using the same procedure as specified for HHV at § 98.33(a)(2)(ii).
MVC = Molar volume conversion factor at standard conditions, as defined in § 98.6.
44/12 = Ratio of molecular weights, CO_2 to carbon.
0.001 = Conversion of kg to metric tons.
1.102311 = Conversion of metric tons to short tons.

As an alternative, Valero may install, calibrate, and operate a CO_2 CEMS and volumetric stack gas flow monitoring system with an automated data acquisition and handling system for measuring and recording CO_2 emissions. If this alternative is selected, the calculations shall be in accordance with the methodologies provided in 40 CFR § 98.33(a)(4).

The emission limits associated with CH_4 and N_2O are calculated based on emission factors provided in 40 CFR Part 98, Table C-2 and the actual heat input (HHV). Comparatively, the emissions from CO_2 contribute the most (greater than 99%) to the overall emissions from the heaters and; therefore, additional analysis is not required for CH_4 and N_2O. To calculate the CO_2e emissions, the draft permit requires calculation of the emissions based on the procedures and Global Warming Potentials (GWP) contained in the Greenhouse Gas Regulations, 40 CFR Part 98, Subpart A, Table A-1, as published on October 30, 2009 (74 FR 56395). Records of the calculations will be required to be kept to demonstrate compliance with the CO_2e BACT emission limit on a 12-month rolling basis.

An initial stack test demonstration for CO_2 will be required from these emission units. The CO_2 emission testing shall be performed every five years, plus or minus six months, after the previous performance test was performed, or within 180 days after the issuance of a permit renewal, whichever comes later to verify continued performance at the permitted emission limits. An initial stack test demonstration for CH_4 and N_2O emissions are not required because the CH_4 and N_2O emission are less than 0.01% of the total CO_2e emissions from the heaters and are considered a *de minimis* level in comparison to the CO_2 emissions.

XII. Sulfur Recovery Unit (EPN: V-5, No.1 SRU)

Modifications to the existing amine treating system are planned at the Valero McKee plant and therefore, BACT applies to the modified EPN V-5 emission unit. For EPN V-5, no increase in sulfur production is anticipated from the Crude Expansion Project. However, the EPN V-5 will be modified to increase the production capacity from 35 long tons per day (LTPD) to 50 LTPD. Modifications will be made to the EPN V-5 unit and a tie-in with the existing non-modified SRU unit (EPN V-16) to allow for more operational flexibility and better reliability. The purpose of the SRU units is to remove sulfur from a number of refinery process off-gas streams. The current methods for removing sulfur from the hydrogen sulfide gas streams are typically a combination of processes: the Claus Process followed by the Beaven Process, Scot Process, LoCat Process, Cansolv Process or the Wellman-Lord Process. The existing Valero operation utilizes the Claus process, which consists of partial combustion of the hydrogen sulfide-rich gas stream followed by reaction of the resulting sulfur dioxide and unburned hydrogen sulfide in the presence of a bauxite catalyst to produce elemental sulfur. The BACT analysis evaluates the pre- and post-tail gas treatment system options.

As part of the PSD review, Valero provided a 5-step top-down BACT analysis for the modified SRUs in its GHG permit application. EPA has reviewed Valero's BACT analysis for the modified EPNs; however, since EPN V-16 is not modified, only installation of new piping to piping tie in with EPN V-5 for operational flexibility, EPN V-16 is not subject to BACT. Thus, the BACT analysis applied only to EPN V-5, which has been incorporated into this Statement of Basis, and also provides its own analysis in setting forth BACT for this proposed permit, as summarized below.

Step 1 – Identification of Potential Control Technologies for GHGs

- *Proper Design of amine system to maintain good separation of acid gas*
- *Use of a tail gas treating system*
- *Energy Efficient Design*
- *Carbon Capture and Storage (CCS)* – CCS is an available add-on control technology that is applicable for the site's modified SRU unit. However, based on the information reviewed for this BACT analysis, while there are some portions of CCS that are technically feasible, EPA has determined that overall, Carbon Capture and Storage (CCS) technology is not economically feasible for this proposed project (see above discussion).

Step 2 – Elimination of Technically Infeasible Alternatives

All options identified in Step 1 are considered technically feasible and are carried forward for further analysis.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

- *Proper Design of amine system to maintain good separation of acid gas;*
- *Use of a tail gas treating system,* and
- *Energy Efficient Design.*

Use of low carbon fuels, good combustion practices, and energy efficient design are all considered effective and have a range of efficiency improvements which cannot be directly quantified. Therefore, the above ranking is approximate only.

Step 4 – Economic, Energy and Environmental Impacts

No bases for elimination of the control options based on economic, energy or environmental impacts have been identified. The applicant has proposed that all control options be adopted into the BACT determination.

<u>Proper Design of Amine Treatment System</u>: A typical amine gas treating process includes an absorber unit and a regenerator unit as well as accessory equipment. The purpose of the amine treating system is to provide and maintain good separation of acid gas from amine to prevent/minimize hydrocarbon carryover to the Sulfur Recovery Units (SRUs). Prior to entering the SRU, the gas stream is treated in an amine treatment system that uses amines to remove hydrogen sulfide and CO_2 from the gas stream. This project proposes to modify the existing amine treatment system to include new pumps, a new caustic treater, sand tank, new filtration system for rich and lean amine, new/spare rich amine flash drum, a spare amine overhead system, replacement of existing overhead gas and reflux drum, addition of an amine reboiler, dehexanizer retray and modified fugitive piping. With the addition of these changes to the existing amine treating system, the operational reliability will be improved for the system and the separation of acid gas from hydrocarbons and hydrocarbon carryover will be enhanced.

<u>Use of a Tail Gas Treating System</u>: A tail gas treating system is used to reduce tail gas combustion in the tail gas incinerator; thereby reducing the CO_2 resulting from combustion of hydrocarbon entrained in the tail gas in the SRU tail gas incinerators. In the permit application, Valero has identified several tail gas treatment technologies:

- <u>SCOT Process</u> – The SCOT process is known within the industry for its high sulfur removal and has been demonstrated to be technically feasible at various petroleum refineries. The three-stage Claus burner followed by the SCOT Tail Gas Treatment process will achieve 99.9 % destruction removal efficiency.
- <u>Beavon/Stretford and Beavon/Amine Process</u> – These processes have several technical/operational complications such as lower quality of sulfur produced, tower plugging problems, high operating and chemical consumption costs. Therefore, this option is technically infeasible.

- LoCat Process – This process is a technically feasible alternative; however, in comparison to the SCOT process, a higher chemical consumption demand and waste water loading are associated with the LoCat process.
- Cansolv Process – The Cansolv process is a technically feasible alternative; however, this process does not offer any CO_2 reduction.
- Wellman-Lord Process – The Wellman-Lord process is a technically feasible alternative; however, this process does not offer any CO_2 reduction.

It is determined that the SCOT process should yield a total recovery rate of 99.8% when following a three-stage Claus system and has been demonstrated to be feasible for various other petroleum refineries. As explained above, the remaining tail gas treating systems are determined to not be technically practical or less environmentally effective for Valero's current system and business processes.

Energy Efficient Design: The Claus burners and the SRU incinerators are designed to maximize energy efficiency. Valero has stated in the permit application that the fuel flow, stack O_2 and temperature parameters will be continuously monitored to ensure the system operates within the optimum design parameters. The incinerator temperature and oxygen levels are set in accordance with the terms and conditions contained in the TCEQ permit 9708.

Step 5 – Selection of BACT

For the modified EPN: V-5, the Proposed BACT limits and requirements are as follows:

FIN	EPN	Description	GHG Mass Basis		TPY $CO_2e^{2,3}$	BACT Requirements
				TPY[2]		
V-5	V-5	No.1 SRU equipped with a Claus Burner and Tail Gas Incinerator	CO_2	28,021.28	28,030	• 3-Stage Claus Burner System and SCOT tail gas treatment system; • Good Combustion and Operating Practices; • Energy Efficient Design
			CH_4	0.12		
			N_2O	0.02		

Similar GHG permitted emission units were not identified. Valero proposes to incorporate the proper design of the amine treatment system, a three stage Claus burner system followed by a SCOT tail gas treatment system and energy efficient system design as BACT for the modified SRU unit. An emission limitation of 28,030 tpy CO_2e on a 12-month rolling basis is proposed for EPN V-5.

BACT Compliance:

Valero will utilize a three-stage Claus system equipped with a SCOT process tail gas treating system. In addition, Valero will modify the existing amine system to improve operational reliability and further enhance the separation of acid gas from hydrocarbons and hydrocarbon carryover to provide a more efficient process.

For the modified EPN V-5 unit, Valero will maintain records of fuel flow, acid gas flow and fire-box temperature measurements for the No. 1 SRU. The SRU DRE efficiency is 99.9% and compliance with the DRE shall be demonstrated by maintaining the firebox temperature at a minimum of 1,297°F and exhaust oxygen concentration shall be maintained at not less than 1 percent while waste gas is being fed into the SRU incinerator. The tail gas incinerator shall be operated with not less than the oxygen concentration and firebox average temperature maintained above the minimum temperature maintained during the last satisfactory stack test performed in accordance with Special Condition V.J. However, during startup and shutdown, the oxygen concentration is limited to 0.25 percent for less than one hour and the temperature is limited to 750°F for less than one hour. A record shall be maintained indicating the start and end times for each startup and shutdown activity.

The tail gas incinerator fire box exit temperature and oxygen concentration shall be continuously monitored and recorded. The temperature measurement device shall reduce the temperature readings to an average period of 15-minute blocks or less and record it at that frequency. The temperature monitor shall be installed, calibrated at least annually, and maintained according to the manufacturer's specifications. The device shall have an accuracy of the greater of ±2 percent of the temperature being measured expressed in degrees Celsius or ±2.5°C.

Quality-assured (or valid) data must be generated when the tail gas incinerator is operating except during the performance of a daily zero and span check. Loss of valid data due to periods of monitor break down, out-of-control operation (producing inaccurate data), repair, maintenance, or calibration may be exempted provided it does not exceed 5 percent of the time (in minutes) that the tail gas incinerator operated over the previous rolling 12-month period. The measurements missed shall be estimated using engineering judgment and the methods used recorded.

Valero will demonstrate compliance on a 12-month rolling basis by calculating the monthly mass CO_2 emission limit for EPN V-5 by adding the monthly average to the 12-month rolling total. The monthly EPN V-5 mass CO_2 is calculated by summing the results of the monthly calculations of the Claus Burner and Tail Gas Incinerator unit and SRU mass CO_2 emissions.

The monthly Claus Burner and Tail Gas Incinerator CO_2 mass emissions from supplemental fuel gas are based on metered fuel consumption and fuel composition. The equation for estimating CO_2 emissions is based upon equation C-5 of 40 CFR 98.33(a)(3)(iii) and is modified for this permit as follows:

$$CO_2 = Fuel * \frac{44}{12} * CC * \frac{MW}{MVC} * 0.001 * 1.1025$$

Where:

CO_2 = Annual CO_2 mass emissions from combustion of natural gas (short tons)
Fuel = Annual volume of the gaseous fuel combusted (scf). The volume of fuel combusted must be measured directly, using fuel flow meters calibrated according to § 98.3(i).

CC = Annual average carbon content of the gaseous fuel (kg C per kg of fuel). The annual average carbon content shall be determined using the same procedures as specified for HHV at § 98.33(a)(2)(ii).
MW = Annual average molecular weight of the gaseous fuel (kg/kg-mole). The annual average molecular weight shall be determined using the same procedure as specified for HHV at § 98.33(a)(2)(ii).
MVC = Molar volume conversion factor at standard conditions, as defined in § 98.6.
44/12 = Ratio of molecular weights, CO_2 to carbon.
0.001 = Conversion of kg to metric tons.
1.1025 = Conversion of metric tons to short tons.

The monthly SRU CO_2 mass emissions from SRU tail gas are based on the measured volumetric flow rate and carbon content of the feed to the SRU. Calculation for the SRU incinerator unit is based on the methodologies provided in 40 CFR 98.253(f) and equation Y-12, 40 CFR Part 98 Subpart Y. The equation for estimating CO_2 emissions for this permit is as follows:

$$CO_2 = F_{sg} * \frac{44}{MVC} * MF_c * 0.001 * 1.1025$$

Where:

CO_2 = Annual CO_2 emissions
F_{sg} = Volumetric flow rate of sour gas feed (including sour water stripper gas) to the sulfur recovery unit (scf/year)
44 = Molecular weight of CO_2 (kg/kg-mole)
MVC = Molar volume conversion factor (849.5 scf/kg-mole)
MF_c = Mole fraction of carbon in the sour gas to the sulfur recovery plant (kg-mole C/kg-mole gas); default = 0.20
0.001= Conversion factor, kg to metric tons
1.1025 = Conversion factor, metric tons to us tons

The monthly CH_4 and N_2O emissions associated with EPN V-5 are calculated in accordance with the methodologies and equation C-8 provided in 40 CFR 98.33 and converted to short tons. For compliance purposes, the permittee shall use the measured fuel consumption for the calculations. The equation is as follows:

$$CH_4 or\ N_2O = 1 \times 10^{-3} * Fuel * HHV * EF$$

Where:

CH_4 or N_2O = Annual CH_4 or N_2O emissions from the combustion of a particular type of fuel (metric tons)
Fuel = Mass or volume of the fuel combusted measured directly measured by a fuel flow meter (mass or volume per year)
HHV = Default high heat value of the fuel from Table C-1 of this subpart (MMBtu per mass or volume)
EF = Fuel-specific default emission factor for CH_4 or N_2O) from Table C-2 of this subpart (kg CH_4 or N_2O per MMBtu)

1×10^{-3} = Conversion factor from kilograms to metric tons

As an alternative, Valero may install, calibrate, and operate a CO_2 CEMS and volumetric stack gas flow monitoring system with an automated data acquisition and handling system for measuring and recording CO_2 emissions. If this alternative is selected, the calculations shall be in accordance with the methodologies provided in 40 CFR 98.33(a)(4) for the SRU and 40 CFR Part 98.253(f) for the emission unit.

The emission limits associated with CH_4 and N_2O from the SRU incinerator are calculated based on emission factors provided in 40 CFR Part 98, Table C-2 and the actual heat input (HHV). Comparatively, the emissions from CO_2 contribute the most (greater than 99%) to the overall emissions from the SRU incinerators and; therefore, additional analysis is not required for CH_4 and N_2O. To calculate the CO_2e emissions, the draft permit requires calculation of the emissions based on the procedures and Global Warming Potentials (GWP) contained in the Greenhouse Gas Regulations, 40 CFR Part 98, Subpart A, Table A-1, as published on October 30, 2009 (74 FR 56395). Records of the calculations would be required to be kept to demonstrate compliance with the emission limits on a 12-month rolling basis.

An initial stack test demonstration will be required for CO_2 emissions from the EPN V-5 emission unit. Additional emissions testing for the SRU shall be performed every five years, plus or minus 6 months, after the previous performance test was performed, or within 180 days after the issuance of a permit renewal, whichever comes later to verify continued performance at the permitted emission limits. An initial stack test demonstration for CH_4 and N_2O emissions are not required because the CH_4 and N_2O emission are less than 0.01% of the total CO_2e emissions from the heaters and are considered a *de minimis* level in comparison to the CO_2 emissions.

XIII. Portable Combustion Control Device (EPN: MSSCONTROL)

With this project, Valero proposes to construct two new External Floating Roof (EFR) storage tanks to store crude oil. However, CH_4 is not expected from crude oil tanks since these tanks do not store unstabilized crude oil. Therefore, these crude oil tanks are not subject to GHG permitting, and BACT requirement is not applicable to these crude oil tanks. The new EFR tanks will require maintenance, startup, and shutdown for landings, purges, cleanings and inspections on an anticipated less than annual frequency. In accordance with the state permitting requirements, the purging of the tanks will be controlled by a portable combustion control device, which will result in emissions of GHG.

Step 1 – Identification of Potential Control Technologies for GHGs

The identified control technology associated with the purging of the new EFR storage tanks is the use of a portable combustion control device such as a portable flare or portable thermal oxidizer (TO) which generates GHG emissions.

Step 2 – Elimination of Technically Infeasible Alternatives

Portable flares/TO are technically feasible options for controlling EFR tanks' purged emissions.

Step 3 – Ranking of Remaining Technologies Based on Effectiveness

As stated in Step 1, this evaluation does not compare the effectiveness of different portable flares/TO. However, the portable flare and the portable TO are expected to meet a minimum destruction and removal efficiency (DRE) of 98% in controlling EFR tanks' purged emissions.

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

Valero proposes to use a portable combustion device to control emissions from the new EFR tanks during tank degassing.

Step 5 - Selection of BACT

The emissions from EPN MSSCONTROL were estimated to be 0.002% of the total greenhouse gases emissions for this project. The portable combustion device proposed for this project is a portable flare or portable TO and is considered to be a good combustion practice for a degassing control of the new EFR tanks.

For the portable flare/TO, BACT will be achieved through good combustion practices and proper maintenance of the emission unit.

The CO_2e emissions from a portable TO shall be calculated monthly for the 12-month rolling emission limit and are based on 40 CFR 98, Subpart C, equation C-1. The calculations must be based on the measured parameters required in the permit. In addition, the permittee is required to maintain the combustion temperature at a minimum of 1,400°F at all times when processing waste gases from the new stabilized crude oil tanks. Temperature monitoring of the portable TO will ensure proper operation. The permittee is required to install and maintain a temperature recording device. The firebox temperature shall be monitored continuously and recorded during all times when processing waste gases in the portable TO. In addition, the flow rate of the waste gases routed to the TO is limited to assure at least a 0.5 second combustion chamber residence time at all times when the device is in use.

If a portable flare is used instead of a portable thermal oxidizer, the emissions from the portable flare are calculated based on 40 CFR Part 98, Subpart Y, equations Y-3and Y-5. For a portable flare, the permittee shall use one of the following methods to demonstrate compliance with the requirements of 40 CFR 60.18.

i. The permittee shall continuously monitor the net heating value of the gas stream routed to the flare.
ii. The permittee shall continuously monitor the total volume of supplemental fuel added to the gas stream routed to the flare and continuously maintain sufficient supplemental fuel to meet the minimum net heating value requirements in 40 CFR §60.18 assuming that the net heating value contribution from the degassed vapor is equivalent to a level corresponding to 50% of the lower explosive limit (LEL). The permittee may estimate the volumetric flow rate from the tank or vessel for the

purpose of this calculation if the flow rate of the degassed vapor is not directly monitored.

iii. The permittee shall use calculations to demonstrate that for the material stored in the tank or vessel the net heating value of the gas stream routed to the flare cannot drop below the minimum net heating value requirements in 40 CFR §60.18 until the concentration of VOC in the vapors being routed to the flare is less than 50 percent of the LEL or 34,000 parts per million by volume (ppmv) of VOC at zero percent oxygen.

iv. If the flare is a non-assisted flare that qualifies for the provisions in 40 CFR §60.18(c)(3)(i), the permittee may elect to continuously monitor the hydrogen content of the gas stream routed to the flare and continuously meet the minimum 8.0% by volume hydrogen content requirement in lieu of the requirements in clauses (i) - (iii) of this special condition.

XIV. Fugitive Emission Sources (EPNs: FUGITIVES and MSSFUG)

The Crude Expansion project will include new and modified piping including pumps, valves, and connectors for movement of gas and liquid raw materials, intermediates, and feedstocks. These components are potential sources of CH_4 emissions due to leakage from rotary shaft seals, connection interfaces, valve stems, and similar points. The additional methane emissions from process fugitives have been conservatively estimated to be 3.58 tpy (EPNs FUGITIVES and MSSFUG). Fugitive emissions of GHGs (75.23 tpy CO_2e) account for less than 0.01% of the project's total CO_2e emissions.

Step 1 – Identification of Potential Control Technologies for GHGs

The only identified control technology for process piping fugitive emissions of GHGs, CH_4 in this case, is 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 technically feasible options for controlling 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

Current LDAR programs only focus on VOC emissions. Valero McKee proposes using the existing LDAR program at the site to minimize GHGs measured as CH_4 as applicable. Valero proposes to define that equipment in GHG service is a piece of equipment that contains a fluid (gas or liquid) that is at least five percent by weight of methane.

Step 5 – Selection of BACT

From this analysis, BACT is selected to be the 28 VHP LDAR program that incorporates GHG monitoring as needed for EPNs FUGITIVES and MSSFUG.

XV. 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, Diamond Shamrock Refining Company, L.P., a Valero Company ("Valero"), and its consultant, Atkins, and adopted by EPA.

A draft BA has identified five (5) species listed as federally endangered or threatened in Dallam, Sherman, Hartley and Moore Counties, Texas:

Federally Listed Species for Dallam, Sherman, Hartley and Moore Counties by the U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD)	**Scientific Name**
Birds	
Least Interior Tern	*Sternula antillarum athalossos*
Whooping Crane	*Grus americana*
Fish	
Arkansas River shiner	*Notropis girardi*
Mammals	
Black-footed Ferret	*Mustela nigripes*
Gray Wolf	*Canis lupus*

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

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

Any interested party is welcome to bring particular concerns or information to our attention regarding this project's potential effect on listed species. The final draft biological assessment

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

XVI. National Historic Preservation Act (NHPA)

Section 106 of the NHPA requires EPA to consider the effects of this permit action on properties eligible for inclusion in the National Register of Historic Places. To make this determination, EPA relied on and adopted a cultural resource report prepared by Atkins submitted on May 9, 2013.

For purposes of the NHPA review, the Area of Potential Effect (APE) was determined to be approximately 53 acres of land within the construction footprint of the existing facility. Atkins conducted a field survey of the property and a desktop review on the archaeological background and historical records within approximately 1.5-mile radius area of potential effect (APE) which included a review of the Texas Historical Commission's online Texas Archaeological Site Atlas (TASA) and the National Park Service's National Register of Historic Places (NRHP). Based on the results of the field survey and cultural review, no archaeological resources or historic structures were found within the APE.

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

On May 14, 2013, 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.

XVII. 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.

XVIII. Conclusion and Proposed Action

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

Appendix

Table A-1. New or Modified Emission Units Associated with the Crude Expansion Project

FIN	EPN	Description	GHG Mass Basis		TPY CO_2e[1,2,3]	BACT Requirements
				TPY[2]		
B-22	B-22	No. 22 Boiler	CO_2	112,501.56	113,043	• 0.11 lbs CO_2/scf Fuel on a 365-day rolling basis • See permit condition III.A.2
			CH_4	6.52		
			N_2O	1.30		
H-2	H-2	No. 1 Vacuum Heater	CO_2	37,571.78	37,754	• 0.11 lbs CO_2/scf Fuel on a 365-day rolling basis • See permit condition III. B.2
			CH_4	2.18		
			N_2O	0.44		
H-64	H-64	No. 4 Hydrotreater Charge Heater	CO_2	16,631.04	16,711	• 0.11 lbs CO_2/scf Fuel on a 365-day rolling basis • See permit condition III. B.2
			CH_4	0.96		
			N_2O	0.19		
V-5	V-5	No. 1 SRU equipped with a Claus Burner and Tail Gas Incinerator[6]	CO_2	28,021.28	28,030	• Good combustion and operating practices; • Energy Efficient Design; • 3-Stage Claus Burner System and SCOT tail gas treatment system; • See permit condition III. C
			CH_4	0.12		
			N_2O	0.02		
F-1CRUDE F-2CRUDE F-RLE F-4NHT F-HCU F-DHDSU/ GASPLT F-GHDS F-SRU1 F-SRU2 F-WWTP F-ETNKFRM F-NTNKFRM F-WTNKFRM	FUGITIVES	Process Fugitives[8]	CO_2	No Numerical Limit Established[4]	74.6	Incorporation of 28 VHP Monitoring. See permit condition III.E.
			CH_4	3.55		
			N_2O	No Numerical Limit Established[4]		
MSS-FLARE	MSS-CONTROL	Portable Combustion Control Device	CO_2	11	12	Good combustion and operating practices. See permit condition III.D.
			CH_4	0.03		
			N_2O	No Numerical Limit Established[4]		
MSS Fugitives	MSSFUG	Process Fugitives MSS[8]	CO_2	No Numerical Limit Established[4]	0.63	Incorporation of 28 VHP Monitoring. See permit condition III.E.

FIN	EPN	Description	GHG Mass Basis		TPY CO_2e[1,2,3]	BACT Requirements
				TPY[2]		
			CH_4	0.03		
			N_2O	No Numerical Limit Established[4]		
Totals[5,7]			**CO_2**	**194,736.66**	**195,625.2**	
			CH_4	**13.39**		
			N_2O	**1.95**		

1. Compliance with the annual emission limits (tons per year) is based on a 12-month rolling average.
2. 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 including MSS activities.
3. Global Warming Potentials (GWP): CH_4 = 21, N_2O = 310
4. All values indicated as "No Numerical Limit Established" are less than 0.01 tpy with appropriate rounding. The emission limit will be a design/work practice standard as specified in the permit.
5. The total emissions for CH_4, N_2O, CO_2 and CO_2e do not include the PTE for process fugitive emissions only from increased fugitive components
6. Emissions include greenhouse gas emissions from fuel gas and acid gas combustion in SRU Claus burners and the tail gas incinerator.
7. Totals represent the amount of new or modified emission unit greenhouse gas emissions.
8. Process fugitive emissions are estimated for additional fugitive components only to be added by this project.

Supplemental Information from the TCEQ PSD Permit Application for the Valero Crude Expansion Project

Table C-48

Incremental Increase - Boiler Emission Calculations

Name: Boiler No. 22

FIN: B-22 EPN: B-22

Fuel Type: Refinery Fuel Gas

Gross Heating Value of Fuel Gas / **Combustion Calculations**

Component	Fuel Gas (vol%)	Fuel Gas (wt%)	MW	LHV (BTU/lbmol)	HHV (BTU/lb)	Fuel Molar Flowrate (lbmol/hr)	O_2 Stoic. Coeff.	Oxygen Requirement (lbmol/hr)	CO_2 Stoic. Coeff.	CO_2 Production (lbmol/hr)	H_2O Stoic. Coeff.	H_2O Production (lbmol/hr)
carbon dioxide	3.46%	0.32%	44.0098	-	-	5.6	0	0.0	1	5.6	[illegible]	0.0
carbon monoxide	[illegible]	[illegible]	28.01	135,229	12,232	1.3	0.5	0.6	1	[illegible]	[illegible]	0.0
nitrogen	[illegible]	[illegible]	28.013			[illegible]	0	0.0	0	0.0	[illegible]	0.0
water	[illegible]	[illegible]	18.015	-	-	0.9	0	0.0	0	0.0	[illegible]	0.0
oxygen	[illegible]	0.75%	31.998		-	0.5	0	0.0	0	0.0	[illegible]	0.0
hydrogen	[illegible]	[illegible]	2.0158	122,385	[illegible]	172.6	0.5	86.3	0	0.0	[illegible]	172.6
methane	48.30%	47.85%	16.0426	345,558	23,892.7	288.0	2	576.0	1	288.0	2	576.0
ethane	[illegible]	[illegible]	30.069	613,804	22,312.0	59.5	3.5	208.1	2	[illegible]	3	[illegible]
ethylene	[illegible]	3.84%	28.0536	564,306	21,636	[illegible]	3	66.3	2	[illegible]	2	[illegible]
propane	[illegible]	[illegible]	44.0962	879,203	21,661.7	14.2	5	70.5	3	42.6	4	56.7
propylene	2.07%	[illegible]	42.0804	825,745	[illegible]	[illegible]	4.5	[illegible]	3	[illegible]	3	[illegible]
butane	2.02%	[illegible]	58.123	1,137,464	21,294	7.7	6.5	[illegible]	4	30.8	5	38.5
isobutane	[illegible]	[illegible]	58.123	1,135,002	21,240.5	[illegible]	6.5	[illegible]	4	[illegible]	5	[illegible]
butene	[illegible]	[illegible]	56.1072	1,085,001	[illegible]	[illegible]	6	1.2	4	[illegible]	4	[illegible]
isobutylene	[illegible]	[illegible]	56.1072	1,083,102	[illegible]	0.1	6	0.7	4	0.5	4	0.48
[illegible]	[illegible]	[illegible]	56.1072	1,085,004	[illegible]	0.1	6	[illegible]	4	[illegible]	4	[illegible]
pentane	[illegible]	[illegible]	72.1498	1,376,877	[illegible]	0.8	8	[illegible]	5	3.9	6	[illegible]
isopentane	[illegible]	[illegible]	72.1498	[illegible]	[illegible]	1.9	8	15.5	5	9.7	6	11.64
hexane	[illegible]	[illegible]	86.1	[illegible]	1,295,259	2.2	9.5	21.2	6	13.5	7	[illegible]
	100.0%	100%			TOTALS	606		1,176		581		[illegible]

Average Molecular Weight = 16.65 lb/lbmol

Fuel gas HHV = [illegible] Btu/lb 955 BTU/scf

Fuel gas LHV = [illegible] Btu/lb 859 BTU/scf

Fuel Input

Averaging Period	Heater Duty (HHV) (MMBTU/hr)	Fuel Gas Molar Flowrate (lbmol/hr)	Fuel Gas Vol. Flowrate (scf/hr)	Fuel Gas Vol. Flowrate (scfm)
Annual	225.19	605	234,522	3,906
Hourly	225.0	[illegible]	231,522	3,906

Air Requirements

Composition of Air is 21% O2 and 79% N2

Assume: 18% Excess Air

O2 Flowrate =	O2 Stoich Req. $\times$ (1 + Excess Air)	1,184 lbmol/hr
N2 Flowrate =	[illegible]	5,763 lbmol/hr
Air Flowrate =	[illegible]	6,108 lbmol/hr
Excess Air		[illegible]

Exhaust Emissions - Proposed

Component	Emission Basis: Short Term	Annual	Short Term (scaled)	Annual (scaled)	Units	Max Hourly Emission (lb/hr)	Annual Average Emission (tpy)	Max Hourly Emission (lbmol/hr)	Conc. (% vol)
N_2								[illegible]	[illegible]
O_2								259	3%
H_2O								1125	14%
CH_4	0.003	0.003	0.003	0.003	kg/MMBtu	1.49	6.52	[illegible]	[illegible]
N_2O	0.0006	0.0006	0.0006	0.0006	kg/MMBtu	0.30	1.30	3.71	[illegible]
CO_2						23,236	11,025	58	8%
PM_{10}	7.6	7.6	7.1	7.1	lb/MMscf	1.68	7.34	NA	NA
VOC	5.5	5.5	5.2	5.2	lb/MMscf	1.21	5.31	[illegible]	[illegible]
NOx	0.035	0.035	0.035	0.035	lb/MMBtu	7.88	34.50	0.17	[illegible]
CO					lb/MMBtu	14.53	63.94	0.52	[illegible]
SO_2	162	[illegible]	0.1	[illegible]	[illegible]	6.70	19.22	0.098	[illegible]
Total								6,494	

PM10 Basis: AP-42 Table 1.4-2 (7/98)

VOC Basis: AP-42 Table 1.4-2 (7/98)

NOx Basis: BACT

CO Basis: BACT @ 50 PPM CO

SO_2 Basis: NSPS J

NOTE: (1) VOC [illegible]

35

From: Hill, Russell
To: Robinson, Jeffrey; Magee, Melanie
Cc: Williamson, Shelly; Joe Ibanez
Subject: RE: Diamond Shamrock Refining Company, L.P. - Valero McKee Refinery - GHG Draft Permit Comments
Date: Tuesday, June 11, 2013 3:19:52 PM

Melanie and Jeff,

Thank you for your patience. I do not think that we need more time to work on this permit application as you suggest. Hopefully this e-mail will bring clarity to the issue and address your concerns.

The thermal oxidizer mentioned in the comments on page 13 is not a new piece of equipment and is currently authorized under the Maintenance, Startup and Shutdown (MSS) portion of Permit No. 9708/PSDTX862M2. This equipment is typically provided by our tank cleaning contractor for controlling emissions that would otherwise be emitted to the atmosphere during tank cleanouts (completed once every 5 to 10 years depending on the tank). The thermal oxidizer helps meet the existing MSS control requirements (<10% LEL) currently required in the permit. The current permit provides the refinery the flexibility to use any one of multiple portable combustion devices such as thermal oxidizer, flare or engine. The refinery has historically used the thermal oxidizer in lieu of a portable flare given safety concerns with maintaining an open flame on a flare located in the product storage tank farm.

Section 4.5 of the GHG PSD permit application, currently under your review, addresses BACT related to MSS activity emissions. This analysis was originally, in part, included with the permit application since the proposed project involves adding two new crude storage tanks that will eventually require maintenance. We have since determined that the crude tanks will not store unstabilized crude oil and therefore, removed those from the application. However, considering a thermal oxidizer will still be used to control VOC emissions during MSS activities related to the new tank, we felt it was appropriate to keep Section 4.5, which we believe adequately addresses BACT related to "the portable combustion device." For your convenience, Section 4.5 is restated below.

4.5 Maintenance, Startup, and Shutdown (MSS) – GHG BACT

New EFR tanks for the project will require maintenance, startup and shutdown (MSS). Specifically, the tanks will be landed, purged, cleaned and inspected on what may be a less than an annual frequency. In accordance with state MSS permit requirements the purging of the tanks will be controlled by a portable combustion device, which will result in emissions of CO_2e. For the sake of completeness, these emissions are calculated and included in this application (Tables B-23, B-24), even though the total emissions are less than 0.002% of total emissions (insignificant compared to total). BACT for CO_2e emissions from the portable combustion device is good combustion practices, such as ensuring that minimum heating value will be met. BACT is specified in this section because tank MSS resulting from the new tanks is considered a new source of CO_2e; however, BACT is identical to BACT for existing EFR tank MSS as required by the special conditions in state NSR Air Quality Permit Number 9708. Hence, it is considered unnecessary to re-state BACT for this source in a "top-down" analysis because: (1) the MSS activity for each new tank is intermittent, (2) the emissions are insignificant, and (3) the CO2e emissions are the result of complying with state permit requirements intended to protect public health and welfare.

If you have any additional questions or would like to discuss further, please give me a call at your convenience. Thank you for your prompt attention to this issue and your continued commitment in moving this permit along quickly.

Respectfully,

Russell Hill