VALERO

McKEE REFINERY • Diamond Shamrock Refining Company, L.P., a Valero Company • 6701 FM 119 • Sunray, TX 79086-2013 • Telephone (806) 935-2141

CERTIFIED MAIL: 7012 1010 0001 8564 1928

August 2, 2012

Mr. Carl Edlund, P.E.
Director Multimedia Planning and Permitting Division
Environmental Protection Agency, Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

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AIR PERMITS SECTION
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RE: Response to EPA Information Request
GHG PSD Permit Application
Diamond Shamrock Refining Company, L.P., a Valero Company
Valero McKee Refinery – Crude Expansion Project
Sunray, Moore County, Texas

Dear Mr. Edlund;

This letter is provided in response to the U.S. Environmental Protection Agency (EPA)'s information request dated June 05, 2012, in relation to Diamond Shamrock Refining Company, L.P., a Valero Company (Valero) McKee Refinery's Greenhouse Gas Prevention of Significant Deterioration permit application. Per your request, Valero understands that you need additional information to complete your review. The response to each of your requests is provided in the attachment. The EPA items/questions contained in the request are provided in **bold** followed by Valero's responses in *italics*.

During the preparation of this response, Valero has identified several possible changes to the scope of construction and operational changes related to this project. These changes are currently under further evaluation, and any necessary updates to this application will be submitted promptly. Valero does not anticipate the proposed changes will compromise your continued review of this application, including this response.

If you have any questions or comments, please contact me at (806) 935-1354. Thank you for your attention to this matter, and we look forward in finalizing this permit application soon.

Sincerely,

Shelly Williamson
Environmental Manager
Valero McKee Refinery

Attachments

cc: Mr. Mike Wilson, P.E.
Director, Air Permits Division
Texas Commission on Environmental Quality, MC163
P.O. Box 13087
Austin, TX 79109-4933
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Response to EPA Information Request for
Diamond Shamrock Refining Company, LP a Valero Company
Application for Greenhouse Gas Prevention of Significant Deterioration
Valero McKee Refinery – Crude Expansion Project
Sunray, Moore County, Texas

Process Description

1. **On pages 2-2, 2-3, 2-6 and 2-8 of the permit application, it states that proposed changes to the #1 and #2 Crude Process Heaters, #2 Vacuum Heater, Gas oil fractionators Charge Heater and the #2 Reformer will not cause an increase in current permitted emission rates to accommodate the additional processing of crude. Please provide the supporting calculations for the GHG Pollutant.**

Answer:

The heaters' GHG Potentials-to-Emit (PTE) were represented on Table B-10. Table B-12 was provided in the application to show the calculation for H-26, the one modified heater. Further engineering review has resulted in the determination that the modifications described in the application for H-26 are not necessary for this project, and the No. 2 Vacuum Unit Heater is no longer proposed to be physically modified. Therefore, there are no modified heaters in this submittal, only affected heaters. The scope of construction and operational changes related to the demonstrations documented in this application is under further evaluation, and any updates to the application will be provided promptly.

CO2e emissions from affected heaters are calculated using EPA Equations C-5 and C-8 in the revised Table B-10 included in Attachment A. This table includes the data used and the supporting calculations for PTEs of GHG pollutants for all affected heaters including the heaters in the #1 and #2 Crude Process units, #2 Vacuum unit, Gas oil fractionators and the #2 Reformer (EPNs: H-1, H-11, H-41, H-9, H-26, H-13, H-38 and H-39). The revised PTEs are different from the PTEs in the application due to inadvertent linking error.

2. **On pages 2-2 of the permit application, it states that "the increased feed rate will result in a firing rate increase at the No. 1 Vacuum Unit Charge Heater (EPN: H2), but will not require an increase in its current represented firing rate." Please clarify if the "represented firing rate" is a practically enforceable limit in the permit and provide supporting data for the GHG pollutant. Also, please clarify and provide the same for similar statements made on pages 2-9 and 2-10 pertaining to the PDA system and the Gasoline Desulfurization Unit Charge Heater, respectively, with respect to the GHG Pollutant.**

Answer:

The firing rates for No. 1 Vacuum Unit Charge Heater (EPN H-2) as well as from the heaters in the PDA (EPNs: H-6 and H-40) and Gasoline Desulfurization (EPN: H-80) units are represented in NSR Permit 9708 as follows:

H-2: 75.1 MMBtu/hr (annual average)
H-6: 28.3 MMBtu/hr (annual average)
H-40: 66.3 MMBtu/hr (annual average)
H-80: 98.4 MMBtu/hr (annual average)

Valero does not currently operate to the full potential of these heaters. With this project, the operating firing rates will increase; however, they will not exceed the previously represented rates. As part of this project, Valero agrees to make these represented rates federally enforceable limits.

The calculations for GHG PTEs are based on the represented firing rates for these heaters and are provided in the revised Table B-10 of Attachment A.

3. **On pages 2-12 of the permit application, the discussion pertaining to product loading states "with the increased production of motor fuels, turbine fuel, and diesel associated with this project, product loading is expected to increase and is therefore affected. However, the increase will not require any new loading racks or an increase in the currently permitted emission rates for the current loading racks, except for the truck loading (EPN:L-11) and diesel railcar (EPNs: L-5 and L-13)." The truck loading rack and the diesel railcar loading rack are controlled by vapor combustion. What is the applicant's proposed monitoring method for the vapor combustor to ensure that it operates optimally to minimize GHG emissions?**

Answer:

The projected increase in emissions at the loading facility vapor combustor (EPN: FL-7) are based on the projected increase in gasoline throughput at the truck loading rack L-11 and the railcar loading rack L-13. The diesel railcar loading rack L-5 is not controlled by the vapor combustor. The temperature downstream of the combustion chamber is required to be maintained above 1197° F. Assisted natural gas is used to maintain the required minimum temperature. The vapor combustor's control logic will not allow vapors from the loading rack until the minimum temperature is met. During loading, natural gas flow is constrained by the design of the combustor so that only the minimum amount of natural gas is used to maintain the minimum operating temperature. Natural gas is provided to the vapor line through a fuel injection orifice that was sized to supplement flows from transport tank displacement with adequate BTU content and mixing energy. Since there are multiple loading bays consisting of ten arms (eight trucks, two rails), but as few as one may be used at a time, the vapor flow was broken into two paths, or stages, to accommodate the turndown. The first stage can handle 1/3 of the total flow and the second stage can handle the remaining 2/3. Each stage has a separate assist blower and shutoff damper so that no extra air is introduced into the combustion chamber when there is low flow of lean vapors. Considering that the majority of heating *content is from natural gas and the proper amount of natural gas is known through temperature due to system design, continuous temperature monitoring will ensure optimal combustion and GHG minimization.*

4. **On pages 2-12 of the permit application, it states that the refinery currently operates four process unit flares (EPNs: FL-1, FL-3, FL-4, FL-8) that receive routine and non-routine vent streams from multiple process units throughout the refinery. With the increased crude processing, there is an expected increase in waste gas that may be generated during routine operations. The application states that the refinery plans to have installed by the end of 2011 a flare gas recovery system that will recover and process the current and future waste gas flare streams. Has this flare gas recovery system been installed? Please provide GHG emission rates for the flares/flares recovery system affected sources.**

Answer:

Flares FL-1, FL-3, FL-4 and FL-8 are not considered affected units with respect to the Crude Expansion Project. The Flare Gas Recovery (FGR) system that was installed in 2011 has the capacity to accommodate any additional flows associated with this project without increasing emissions at the flares. In addition, there will not be any new lines routed to the flares with the proposed expansion. Therefore, Valero believes GHG emissions rates do not need to be calculated for the referenced flares for this PSD application.

BACT Analysis

5. **On pages 4-10 of the permit application for capture of CO_2, it states that "the primary concern with MEA is the corrosion in the presence with O_2 and other impurities, high solvent degradation rates due to reactions with SO_2 and NOx, and energy requirements for solvent regeneration." Have other solvents, such as DEA, been considered for this project? Please supplement the 5-step top down BACT analysis to support the elimination of DEA from consideration.**

Answer:

CO_2 separation from effluent stream via a scrubber using solvent scrubbers is part of the control technology review for Carbon Capture and Storage (CCS), as it relates to BACT for the modified No. 2 Vacuum Heater. As explained above, the No. 2 Vacuum Unit Heater will not be a modified unit subject to BACT determination and further analysis of CO_2 scrubbing is not required.

On pages 4-12 of the permit application in section entitled, "use of Low Carbon Fuels, Good Combustion Practices, and Energy Efficient Design," it states that "good combustion practices are inherent in the design and operation of the No. 2 Vacuum Unit Heater."

A. Please provide supplemental benchmark data comparing the heater to other existing or similar sources, i.e., the percent energy efficiency of the heater.

Answer:

As explained above, the No. 2 Vacuum Unit Heater will not be a modified unit subject to BACT determination.

B. How will the modifications to the radiant section of the heater and its effects on overall skin temperature on the internal tubes, translate to decreasing coking potential as is asserted in the application? What percentage of coke reduction in the tubes will occur in lbs coke/lbs of product processed? Please include manufacturer's technical data that supports your conclusions, as well as the associated decrease in GHG per pound of product.

Answer:

As explained above, the No. 2 Vacuum Unit Heater will not be a modified unit subject to BACT determination.

C. What design or process operation modifications will ensure the uniform distribution of the feed and heating in the tubes? Please indicate what operating parameters will be monitored to ensure the heat recovery efficiency.

Answer:

As explained above, the No. 2 Vacuum Unit Heater will not be a modified unit subject to BACT determination.

D. The permit application also indicates "other energy efficient designs will be incorporated as feasible, depending on the existing heater configuration; Specifically, the use of Combustion Air Preheat, Process Heat to Generate Steam, Process Integration and Heat Recovery, and Excess Combustion Air Monitoring and Controls." On page 4-14 Section 4.2.6, the BACT selection does not specifically provide the energy efficient design that will be incorporated in the heater. Please provide clarification on exactly what will be implemented and the proposed monitoring and recordkeeping strategy for the operating indicators. Each of the possibilities should be considered in the design of the heater or justifiably eliminated as BACT.

Answer:

As explained above, the No. 2 Vacuum Unit Heater will not be a modified unit subject to BACT determination.

6. **Beginning on page 4-12 of the permit application, the cost estimates provided for the Carbon Capture and Storage (CCS) appear to solely rely on the August 2010 report entitled, "Report of the Interagency Task Force on Carbon Capture and Storage." BACT is a case-by-case determination. Please provide site-specific facility data to evaluate the eliminate CCS from consideration. This material should contain detailed information on the quantity and concentration of CO_2 that is in the waste stream and the equipment for capture, storage and transportation. Please include cost of construction, operation and maintenance, cost per pound of CO_2 removed by the technologies evaluated and include the feasibility and cost analysis for storage or transportation for these options. Please discuss in detail any site specific safety or environmental impacts associated with such a removal system.**

Answer:

Carbon Capture and Storage (CCS) Technology is part of the 5-Step BACT determination for the modified No. 2 Vacuum Heater. As explained above, the No. 2 Vacuum Unit Heater will not be a modified unit subject to BACT determination and further analysis of CCS is not required.

7. **Being mindful of EPA's PSD and title V Permitting Guidance for GHG dated March 2011 on page 17, which states the following:**

"The CAA and correspondence implementing regulations require that a permitting authority conduct a BACT analysis on a case-by-case basis, and the permitting authority must evaluate the amount of emissions reductions that each available emissions-reducing technology or technique would achieve, as well as the energy, environmental, economic and other costs associated with each technology or technique. Based on this assessment, the permitting authority must establish a numeric emissions limitation that reflects the maximum degree of reduction achievable for each pollutant subject to BACT through the application of the selected technology or technique. However, if the permitting authority determines that technical or economic limitations on the application of a measurement methodology would make a numerical emissions standard infeasible for one or more pollutants, it may establish design, equipment, work practices or operational standards to satisfy the BACT requirement."

Please propose short-term emissions limitations or efficiency based limits for all PSD modified emission sources. Please provide an analysis that substantiates any reasons for infeasibility of a numerical emission limitations are infeasible, please propose an operating work practice standard that can be practically enforceable.

Answer:

Valero believes a short-term limit for CO_2e such as lb/hr is unwarranted since it is not linked to a health-based Effective Screen Level or NAAQS-based demonstration. An *output-based standard such as CO2e/bbl cannot be accurately estimated for affected process units due to refining complexity; and there are no heaters subject to BACT demonstration. Because of the infeasibility of these numerical limitations performing monitoring in accordance with the site's GHG Monitoring plan is proposed as the operating work practice standard.*

8. **On page 4-15 of the GHG PSD permit application provided to EPA, it states that "Valero McKee Refinery proposes to use a LDAR program that incorporates GHG monitoring as needed." Please specify level of LDAR to be used? Will all fugitive components in the refinery be monitored by the LDAR program, because this project affects most refinery fugitive components? Please provide a 5-step top down analysis that evaluates technologies considered to reduce methane fugitive emissions. The technologies could include, but are not limited to, the following:**
   - **Installing leakless technology components to eliminate fugitive emission sources;**
   - **Implementing an alternative monitoring program using a remote sensing technology such as infrared camera monitoring;**
   - **Designing and constructing facilities with high quality components and materials of construction compatible with the process known as the Enhanced LDAR standards.**
   - **Monitoring of flanges for leaks**
   - **Using a lower leak detection level for components**

Answer:

BACT only applies to new and modified sources. For this expansion project, the new and modified sources with fugitive component impacts include: No. 1 Crude unit, No. 2 Crude unit, Dehexanizer, RLE unit, No. 4 Fractionator, the Hydrocracker, the Diesel Hydrodesulfurization unit, and Turbine Merox unit. Valero proposes to use an LDAR program similar to Texas's 28VHP program for all new and modified components associated with this project. The 28VHP program is currently implemented for VOC sources at the refinery and is equivalent to the 40 CFR Part 63 MACT H LDAR standards. Valero will incorporate any affected components that may contain CH_4 that are not currently in the program. This program would apply only to new/modified components that have greater than or equal to 5 wt% of CH_4 with leak definition of 2000 ppmv for pumps/compressors and 500 ppmv for all other components. All new/modified components would be monitored quarterly, with the exception of connectors. Connectors would be inspected weekly via an AVO walkthrough.

Valero does not propose to implement GHG component across the refinery, only to equipment sources that are affected by this project.

Please see Attachment B for an updated Equipment Fugitive BACT analysis that includes the alternative technologies to reduce CH_4 emissions.

Emission Calculations

9. **Table B1 has the Potential to Emit (PTE) annual emissions (tpy) for CO_2e for the "affected" units. These numbers do not compute with the annual average (tpy) or the maximum hourly emission (lb/hr) on Table B-10. Please account for the differences.**

Answer:

Table B-1 has been revised to incorporate the GHG PTE from the revised Table B-10. The revised Table B-1 is included in Attachment C. The differences were due to inadvertent linking errors.

10. **Please provide the supporting data used to determine the fuel carbon content factor of 0.66 represented in Table B12. This fuel factor is used in equation C-5 from 40 DFR 98, Subpart C to calculate CO2e annual emissions. Please include a fuel analysis sample results that supports the carbon factor and meets the requirements of 40 CFR 98.33(a)(2)(ii).**

Answer:

The analysis is provided as Attachment D of this submittal.

11. **Please provide supporting data that determines the baseline emissions for the GHG pollutants and include the associated practical permit limits/numbers for the "affected" units.**

Answer:

The highest rolling 24-month average firing rate for the affected heaters was retrieved from a database containing continuous firing rate data from 2001 to 2011, and is represented in Table B-11. This table has been updated and the supporting calculations are also included. This table is included in Attachment A.

12. **Please provide the Heat and Material Balance Data Sheets with sources identified that are referenced in the footnotes for Tables B-3 through B-9.**

Answer:

The requested Heat and Material Balance Data Sheets referenced in Tables B-3 through B-8 can be found in Attachment E. These data sheets demonstrate the stream for which the maximum amount of CH_4 *is present. Upon review of those material balances, Valero has determined that the wt% of* CH_4 *should be based on the maximum wt% of all streams rather than the average. This assures that all fugitive calculations are properly accounting for all* CO_2e *emissions. Updated Fugitive calculations with the maximum values can be found in Attachment F.*

Please note that Table B-9 does not use the Heat and Material Balance Data Sheets for the GHG content for that fugitive source. No change to Table B-9 was made.

13. Please provide flare gas analysis results that are used to determine the carbon content of the flare gas for the factors required in equations Y-3, Y-4, and Y-5 from 40 CFR 98, Subpart Y.

Answer:

FL-6 is the only affected flare represented in the application. Equation Y-3 requires the average carbon content of the flare gas from analysis results or engineering calculations of startup, shutdown, or malfunction (SSM) events. Valero is not proposing any increase in emissions related to SSM events for FL-6. Equation Y-4 requires the weight fraction of carbon in the flare gas prior to combustion that is contributed by methane. Valero opted to use the given default factor 0.4. Equation Y-5 is based on an emission factor located in Table C-2 and a default CO_2 *emission factor.*

Therefore, a flare gas analysis was not used to determine carbon content for equations Y-3, Y-4, and Y-5.

Attachment A

This attachment contains the following items:

Table B-10: Modified and Affected Heaters - PTE Calculations Valero McKee Refinery

Table B-11: Modified and Affected Heaters - Baseline Calculations - Valero McKee Refinery

Table B-10
Modified and Affected Heaters - PTE Calculations
Valero McKee Refinery

EPN	Name	PTE Annual Average Firing Rate (MMBtu/hr)	PTE Heat Input Value (BTU/scf)	Equivalent Fuel Usage (SCFY)	Average Carbon Content wt%	Average Molecular Weight of Fuel Kg/Kg-mole	Molar Volume Conversion Factor (SCF/Kg)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)	CO_2e Total (tons/yr)
B-10	No. 18 Boiler	20.0	959.4	182,614,248.9	66%	16.65	849.5	9,506.53	0.58	0.12	9,554.6
B-11	No. 19 Boiler	20.0	959.4	182,614,248.9	66%	16.65	849.5	9,506.53	0.58	0.12	9,554.6
B-12	600# Boiler	20.0	959.4	182,614,248.9	66%	16.65	849.5	9,506.53	0.58	0.12	9,554.6
B-4	No. 11 Boiler	20.0	959.4	182,614,248.9	66%	16.65	849.5	9,506.53	0.58	0.12	9,554.6
B-6	No. 13 Boiler	20.0	959.4	182,614,248.9	66%	16.65	849.5	9,506.53	0.58	0.12	9,554.6
B-8	No. 15 Boiler	20.0	959.4	182,614,248.9	66%	16.65	849.5	9,506.53	0.58	0.12	9,554.6
B-9	No. 16 Boiler	20.0	959.4	182,614,248.9	66%	16.65	849.5	9,506.53	0.58	0.12	9,554.6
H-1	No. 1 Crude Charge Heater (ULN, CUB-LE)	265.2	959.4	2,421,546,134.2	66%	16.65	849.5	126,060.82	7.68	1.54	126,698.6
H-11	No. 2 Crude Charge Anderson (ULN, LE)	77.4	959.4	706,284,289.2	66%	16.65	849.5	36,767.74	2.24	0.45	36,953.8
H-13	GO Fractionator Heater	40.3	959.4	368,276,807.9	66%	16.65	849.5	19,171.75	1.17	0.23	19,268.7
H-14	Unifiner Charge Heater	26.5	959.4	242,154,613.4	66%	16.65	849.5	12,606.08	0.77	0.15	12,669.9
H-15	No. 1 Nap. Hydrotreater DeS2 Reboiler	36.1	959.4	329,935,660.8	66%	16.65	849.5	17,175.79	1.05	0.21	17,262.7
H-2	No. 1 Vacuum Heater	75.1	959.4	686,104,738.0	66%	16.65	849.5	35,717.23	2.18	0.44	35,897.9
H-26	No. 2 Vacuum Charge Heater (ULN, SMR)	81.8	959.4	746,643,391.4	66%	16.65	849.5	38,868.75	2.37	0.47	39,065.4
H-36	No. 2 NHT DeSulfur Reboiler Heater	57.5	959.4	524,650,737.1	66%	16.65	849.5	27,312.26	1.66	0.33	27,450.4
H-37	No. 2 Nap. Hydrotreater Charge Heater (ULN, LE)	36.5	959.4	332,997,082.8	66%	16.65	849.5	17,335.16	1.06	0.21	17,422.9
H-38	No. 2 Reformer Charge & InterHeater (ULN, SMR)	246.3	959.4	2,248,894,475.0	66%	16.65	849.5	117,072.92	7.14	1.43	117,665.2
H-39	No. 2 Reformer Stab. Reboiler	24.3	959.4	221,975,062.3	66%	16.65	849.5	11,555.58	0.70	0.14	11,614.0
H-40	No. 1 PDA Asphalt Heater (Asphalt-South) (LN)	66.3	959.4	605,386,533.6	66%	16.65	849.5	31,515.21	1.92	0.38	31,674.7
H-41	No. 2 Crude Charge-Born (ULN, SMR)	274.2	959.4	2,503,276,123.7	66%	16.65	849.5	130,315.52	7.94	1.59	130,974.8
H-42	HCU Recycle Gas Heater, (ULN, LE)	85.1	959.4	776,912,718.1	66%	16.65	849.5	40,444.51	2.47	0.49	40,649.1
H-43	HCU DeC4 Reboiler Heater (ULN, LE)	87.1	959.4	795,074,314.1	66%	16.65	849.5	41,389.97	2.52	0.50	41,599.4
H-45	No. 1 Nap. Hydrotreater Charge Heater (ULN, SMR)	70.1	959.4	640,062,942.4	66%	16.65	849.5	33,320.39	2.03	0.41	33,489.0
H-48	DHDS Charge Heater (ULN, CUB-L)	105.0	959.4	958,724,806.7	66%	16.65	849.5	49,909.29	3.04	0.61	50,161.8
H-6	DAGO Heater	28.3	959.4	258,298,254.3	66%	16.65	849.5	13,446.49	0.82	0.16	13,514.5
H-64	No. 4 Hydrotreater Charge Heater	33.3	959.4	303,702,244.3	66%	16.65	849.5	15,810.13	0.96	0.19	15,890.1
H-8	HCU Fractionator Charge Heater (ULN, LE)	88.4	959.4	807,154,980.1	66%	16.65	849.5	42,018.86	2.56	0.51	42,231.5
H-80	GDU HDS Charge Heater (ULN, Free Jet)	98.4	959.4	898,462,104.5	66%	16.65	849.5	46,772.13	2.85	0.57	47,008.8
H-9	No. 2 Crude Heater-PetroChem (raw gas burners)	88.4	959.4	807,154,980.1	66%	16.65	849.5	42,018.86	2.56	0.51	42,231.5

Note: Boiler emissions represent incremental increases only.

Sample Calculations for H-01

Equation C-5 from 40 CFR Part 98, Subpart C

CO_2 = Fuel * (44/12) * Carbon Content * (MW/MVC) * 0.001

CO_2 = 2,421,546,134 (scf/yr) * (44/12) * 0.66 * (16.6 (kg/kg-mole) / 849.5 (scf/kg)) * 0.001 * 1.1025 (US ton/Metric ton) = 126,060.8 tons/yr

Equation C-8 from 40 CFR Part 98, Subpart C

CH_4 or N_2O= 0.001 * Fuel * HHV * EF

CH_4 = 0.001 * 2,421,546,134 (scf/yr) * 959.4 (Btu/scf) * 0.003 (kg/MMBtu) * 1.1025 (US ton/Metric ton) = 7.68 tons/yr

where EF_{CH4} = 0.003 kg/MMBtu from Table C-2 of 40 CFR Part 98, Subpart C

N_2O = 0.001 * 2,421,546,134 (scf/yr) * 959.4 (Btu/scf) * 0.0006 (kg/MMBtu) = 1.54 tons/yr

where EF_{N2O} = 0.0006 kg/MMBtu from Table C-2 of 40 CFR Part 98, Subpart C

$CO_2e = CO_2 + (21*CH_4) + (310*N_2O)$

CO_2e= 126,060.82 (tons/yr) + (7.68 (tons/yr) *21) + (1.54 (tons/yr) * 310) = 126,698.6 tons/yr

Table B-11
Modified and Affected Heaters - Baseline Calculations
Valero McKee Refinery

EPN	Baseline Heat Input Rate (MMBtu/hr)	Base Line Heat Input Value (BTU/SCF)	Baseline Fuel Usage (SCFY)	Average Carbon Content wt%	Average Molecular Weight of Fuel Kg/Kg-mole	Molar Volume Conversion Factor (SCF/Kg)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)	CO_2e Total (tons/yr)
H-1	218.2	888.6	2,151,213,893.6	66%	15.43	849.5	103,816.73	6.32	1.26	104,341.5
H-11	66.1	888.6	651,802,637.1	66%	15.43	849.5	31,455.74	1.92	0.38	31,614.7
H-13	10.0	888.6	98,965,680.4	66%	15.43	849.5	4,776.04	0.29	0.06	4,800.2
H-14	11.1	888.6	109,625,034.7	66%	15.43	849.5	5,290.46	0.32	0.06	5,317.2
H-15	22.7	888.6	223,821,446.3	66%	15.43	849.5	10,801.53	0.66	0.13	10,856.1
H-2	53.4	888.6	526,266,633.3	66%	15.43	849.5	25,397.42	1.55	0.31	25,525.8
H-26	70.0	888.6	689,672,731.9	66%	15.43	849.5	33,283.33	2.03	0.41	33,451.6
H-36	19.3	888.6	190,370,296.5	66%	15.43	849.5	9,187.20	0.56	0.11	9,233.6
H-37	32.3	888.6	318,213,571.2	66%	15.43	849.5	15,356.86	0.94	0.19	15,434.5
H-38	156.2	888.6	1,540,007,154.0	66%	15.43	849.5	74,320.14	4.53	0.91	74,695.8
H-39	16.8	888.6	165,901,466.5	66%	15.43	849.5	8,006.34	0.49	0.10	8,046.8
H-40	23.3	888.6	229,908,635.1	66%	15.43	849.5	11,095.30	0.68	0.14	11,151.4
H-41	224.4	888.6	2,212,583,704.0	66%	15.43	849.5	106,778.41	6.50	1.30	107,318.1
H-42	52.6	888.6	518,349,657.0	66%	15.43	849.5	25,015.35	1.52	0.30	25,141.8
H-43	46.6	888.6	459,495,998.5	66%	15.43	849.5	22,175.10	1.35	0.27	22,287.2
H-45	19.6	888.6	192,820,757.7	66%	15.43	849.5	9,305.45	0.57	0.11	9,352.5
H-48	20.8	888.6	205,446,872.2	66%	15.43	849.5	9,914.78	0.60	0.12	9,964.9
H-6	7.4	888.6	73,064,045.2	66%	15.43	849.5	3,526.04	0.21	0.04	3,543.9
H-64	12.5	888.6	122,975,166.9	66%	15.43	849.5	5,934.73	0.36	0.07	5,964.7
H-8	48.2	888.6	475,266,215.8	66%	15.43	849.5	22,936.16	1.40	0.28	23,052.1
H-80	0.0	888.6	0.0	66%	15.43	849.5	0.00	0.00	0.00	0.0
H-9	36.0	888.6	355,124,258.3	66%	15.43	849.5	17,138.16	1.04	0.21	17,224.8

Note: 1) Baseline emissions for boiler are not presented, because increased emissions from boilers are incremental.
2) H-80 was not operating during the baseline period.

Sample Calculations

CO2 = (44/12) * Fuel * CC * (MW/MVC) x 0.001
CO2 = 2,151,213,894 (scf/yr) * (44/12) * (15.4 (kg/kg-mole) / 849.5 (scf/kg)) * 0.66 * 0.001 * = 103,816.7 tons/yr

CH4 = 0.001 * Fuel * HHV * EF
CH4 = 0.001 * 2,151,213,894 (scf/yr) * 888.6 (Btu/scf) * 0.003 (kg/MMBtu) = 6.32 tons/yr

N2O = 0.001 * Fuel * HHV * EF
N2O= 0.001 * 2,151,213,894 (scf/yr) * 888.6 (Btu/scf) * 2,151,213,893.5647 (kg/MMBtu) = 1.26 tons/yr

CO2e = CO2 + (21*CH4) + (310*N2O)
CO2e = 103,816.73 (tons/yr) + (6.32 (tons/yr) * 21) + (1.26 (tons/yr) * 310) = 104,341.5 tons/yr

Attachment B

This attachment contains the following items:

Equipment Fugitive Top Down BACT Analysis

1.1 Equipment Fugitives

The Valero McKee Refinery 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, valves stems, and similar points.

1.1.1 Step 1 - CO_2e Control Technologies

The identified available control technologies for process fugitive emissions of methane are as follows:

- Installation of leakless technology components;
- Leak detection and repair program utilizing remote sensing technology;
- Designing and constructing facilities with high quality component and materials of construction with the process known as Enhanced LDAR standards.
- Instrumented Leak Detection (Method 21) and Repair Program;
- Implementing audio/visual/olfactory leak detection methods; and
- Implementing lower leak detection level for components.

1.1.2 Step 2 - Eliminate Technically Infeasible Options

1.1.2.1 *Leakless Technology Components*

Leakless technology is available and in use in industry. It includes leakless valves and sealless pumps and compressors. Common leakless valves include bellows valves and diaphragm valves; and common sealless pumps are diaphragm pumps, canned motor pumps, and magnetic drive pumps. Leaks from pumps can also be reduced by using dual seals with or without barrier fluid. In addition, welded connections in lieu of flanged or screwed connections may provide for leakless operation.

This technology is considered technically feasible.

1.1.2.2 *Leak Detection and Repair Program Utilizing Remote Sensing Technology*

Remote sensing of leaks has been proven as a technology using infrared cameras. The use of these devices has been approved by the EPA as an alternative to EPA Method 21 in certain instances. The remote sensing technology can detect Methane emissions.

Therefore, this technology is considered technically feasible.

1.1.2.3 *Designing and Constructing Facilities with High Quality Component and Materials of Construction*

This technology is typically utilized/implemented under consent decrees issued by the EPA and DOJ in order to minimize leak frequency and severity.

This technology is considered technically feasible.

1.1.2.4 *Instrumented Leak Detection (Method 21) and Repair Program*

LDAR programs based on EPA Method 21 instrument monitoring for leak detection and repair provisions are viable for streams containing combustible gases, including methane.

This technology is considered technically feasible.

1.1.2.5 *Implementing Audio/Visual/Olfactory (AVO) Leak Detection Methods*

AVO methods of leak detection are considered technically feasible.

1.1.2.6 *Implementing Lower Leak Detection Level for Components*

Lower leak detection levels for components is typically utilized/implemented under consent decrees issued by the EPA and DOJ I order to minimize leak frequency and severity.

This technology is considered technically feasible.

1.1.3 Step 3 – Rank Remaining Control Technologies

The following technologies and control efficiencies were identified as technically feasible for methane control options for fugitive emissions components based on available information and data sources.

Table 1-1: Summary Fugitive BACT Technology Control Efficiencies

Technology	Control Efficiency (%)
Leakless Technology	100
Remote Sensing Technology	>75
Enhanced LDAR - high quality component and materials of construction	Undefined
Instrumented LDAR program (Method 21)	97
AVO Program	30
Lower Leak Detection Levels	Undefined

1.1.3.1 *Leakless Technology Components*

Leakless technologies should be nearly 100 percent effective in eliminating leaks except when certain components of the technology suffer from a physical failure. These technologies do not, however, eliminate emissions at all leak interfaces, even when working as designed. Those interfaces are typically stationary interfaces and therefore leak frequency would be expected to be low. Following a failure of one of the essential elements of a component such as a valve steam or diaphragm, the component is likely to be non-repairable without a unit shutdown.

1.1.3.2 *Remote Sensing Technology*

Remote sensing technology for detecting leaks has been approved by the EPA as an alternative to Method 21 monitoring under certain instances. Based on the equivalency to Method 21 monitoring, remote sensing technology is assumed to have no less than 75% control efficiency.

1.1.3.3 *Designing and constructing facilities with high quality component and materials of construction compatible with the process known as the enhanced LDAR standards*

Enhanced LDAR is used by the EPA to describe actions that plants must take to attain and go beyond regulatory compliance for LDAR components. The requirements of Enhanced LDAR are typically included in consent decrees issued by the EPA and DOJ for facilities that are not in compliance with current LDAR regulations and requirements. Part of this program requires equipment upgrades including valve replacement and improvement with low-leak valve and packing technologies. Additionally, it requires certain connectors to be replaced with an "improved" type of connector (i.e. gasket replacement or improvement for a flange connection) or replaced with a like-kind connector that are less likely to leak then the existing connector where process and safety conditions allow.

Control efficiencies associated with this technology have not been defined.

1.1.3.4 *Instrumented Leak Detection (Method 21) and Repair Program*

LDAR programs that are based on a quarterly EPA Method 21 monitoring of components with a leak definition of 500 ppmv are considered to have a control efficiency of 97 percent for the majority of components. The Texas 28 VHP fugitive monitoring program requires all components (except connectors) to be monitored quarterly via EPA Method 21. Connectors are required to have a weekly AVO inspection. The leak definitions for the 28 VHP program is similar to MACT Subpart H standards: 2000 ppmv for pumps and compressors and 500 ppmv for all other components. Table 1-2 summarizes the control efficiency and leak definition based on the type of component.

Table 1-2: 28 VHP LDAR Program Control Efficiencies

Equipment	Leak Definition (ppmv)	Control Efficiency
Valves (Gas/Vapor)	500	97%
Valves (Light Liquid)	500	97%
Flanges/Connectors	500	30%
Pumps	2000	93%
Compressors	2000	95%
Relief Valves	500	97%
Open-Ended Lines	500	97%
Sampling Connections	500	97%

1.1.3.5 *Audio/Visual/Olfactory (AVO) Leak Detection Method*

The effectiveness of AVO methods of leak detection and repair are dependent on the system pressure and on odor of the process chemicals as well as the frequency of the AVO inspections. Several LDAR programs state components with a weekly AVO inspection have equivalent to 30% control efficiency.

1.1.3.6 *Lower Leak Detection Level for Components*

Using lower leak detection levels than those in current regulatory programs such as MACT or NSR programs are typically utilized/implemented under consent decrees issued by the EPA and DOJ in order to minimize leak frequency and severity of leaks.

Control efficiencies associated with lower leak detection levels have not been defined.

1.1.4 Step 4 – Evaluate the Most Effective Controls and Document Results

1.1.4.1 *Leakless Technology Components*

While leakless technology components provide the highest level of control of the six technologies identified, they are not justified for components in Methane service when considering the other control options available. Leakless technologies have not been universally adopted as LAER or BACT. They are also not required for toxic or hazardous services for components covered under the MACT programs. Therefore it is reasonable to state that these technologies are unwarranted for control of Methane with no acute impact. Any further considered of available leakless technologies for GHG controls is unnecessary.

1.1.4.2 *Remote Sensing Technology*

Remote sensing of fugitive components in Methane service can provide an effective means to identify fugitive leaks. However, Valero is requesting to use an instrumented LDAR program that has higher control efficiencies overall than remote sensing technology for this application. Therefore, this option is not considered BACT.

1.1.4.3 *Instrumented Leak Detection (Method 21) and Repair Program*

LDAR programs for which instrumented detection of leaks have traditionally be developed and implemented for control of VOC emissions. BACT determinations related to equipment leaks in VOC service have been identified as an instrumented LDAR program. Although Methane is not considered a VOC, it can be detected and quantified by using the same methods in EPA Method 21. Instrumented programs are widely implemented throughout the US for manufacturing sites, including the Valero McKee Refinery.

Valero McKee proposes using the existing 28 VHP LDAR program at the site to minimize GHGs measured as Methane as applicable. Valero proposes to define that equipment in GHG service is a piece of equipment that contains a liquid (gas or liquid) that is at least 5 percent by weight of Methane. The percent value is based on the percent value deemed to be in organic hazardous air pollutant service as defined in 40 CFR §63.161.

1.1.4.4 *Audio/Visual/Olfactory Leak Detection Methods*

Methane leaking components can be identified through AVO methods. However, Valero is requesting to use an instrumented LDAR program that has higher control efficiencies overall than AVO technology for components other than connectors. Valero will use AVO methods for connectors to be consistent with the current requirements for connectors containing VOC in this application. Therefore, this option is considered BACT for connectors only.

1.1.5 Step 5 - Selection of BACT

Valero McKee Refinery proposes to use the 28 VHP LDAR program that incorporates GHG monitoring as needed.

Attachment C

This attachment contains the following items:

Revised Table B-1
Valero McKee Refinery-Crude Expansion Project PSD Analysis

Table B-1
Valero McKee Refinery
Crude Expansion Project PSD Analysis

EPN	Unit #	Unit	Description	New, Modified or Affected?	GHG CO_2e Baseline Emissions (tpy)	GHG CO_2e PTE (tpy)	GHG CO_2e PTE - Baseline (tpy)
Multiple	Multiple	Multiple	Additional Fugitive Components	Modified			41.06
H-1	110	No. 1 Crude	No. 1 Crude Charge Heater (ULN, CUB-LE)	Affected	104,341	126,699	22,357
H-2	210	No. 1 Vacuum	No. 1 Vacuum Heater	Affected	25,526	35,898	10,372
H-6	250	PDA	DAGO Heater	Affected	3,544	13,515	9,971
H-8	430	Hydrocracking Unit	HCU Fractionator Charge Heater (ULN, LE)	Affected	23,052	42,231	19,179
H-9	120	No. 2 Crude	No. 2 Crude Heater-PetroChem (raw gas burners)	Affected	17,225	42,231	25,007
H-11	120	No. 2 Crude	No. 2 Crude Charge Anderson (ULN, LE)	Affected	31,615	36,954	5,339
H-13	230	GO Fractionator	GO Fractionator Heater	Affected	4,800	19,269	14,469
H-14	390	Unifiner	Unifiner Charge Heater	Affected	5,317	12,670	7,353
H-15	350	#1 Nap Hydrotreater	No. 1 Nap. Hydrotreater DeS2 Reboiler	Affected	10,856	17,263	6,407
H-26	220	No. 2 Vacuum	No. 2 Vacuum Charge Heater (ULN, SMR)	Affected	33,452	39,065	5,614
H-36	370	#2 Nap Hydrotreater	No. 2 NHT DeSulfur Reboiler Heater	Affected	9,234	27,450	18,217
H-38	375	#2 Reformer	No. 2 Reformer Charge & InterHeater (ULN, SMR)	Affected	74,696	117,665	42,969
H-39	375	#2 Reformer	No. 2 Reformer Stab. Reboiler	Affected	8,047	11,614	3,567
H-40	250	PDA	No. 1 PDA Asphalt Heater (Asphalt-South) (LN)	Affected	11,151	31,675	20,523
H-41	120	No. 2 Crude	No. 2 Crude Charge-Born (ULN, SMR)	Affected	107,318	130,975	23,657
H-45	350	#1 Nap Hydrotreater	No. 1 Nap. Hydrotreater Charge Heater (ULN, SMR)	Affected	9,352	33,489	24,136
H-48	150	TFHDSU	DHDS Charge Heater (ULN, CUB-L)	Affected	9,965	50,162	40,197
H-64	395	#4 HDS/Isom	No. 4 Hydrotreater Charge Heater	Affected	5,965	15,890	9,925
H-42	370	Hydrocracking Unit	HCU Recycle Gas Heater, (ULN, LE)	Affected	25,142	40,649	15,507
H-43	370	Hydrocracking Unit	HCU DeC4 Reboiler Heater (ULN, LE)	Affected	22,287	41,599	19,312
H-80	400	FCC HDS	GDU HDS Charge Heater (ULN, Free Jet)	Affected	0	47,009	47,009
H-37	370	#2 Nap Hydrotreater	No. 2 Nap. Hydrotreater Charge Heater (ULN, LE)	Affected	15,434	17,423	1,988
B-4	Utilities	Boiler	No. 11 Boiler	Affected			9,555
B-6	Utilities	Boiler	No. 13 Boiler	Affected			
B-8	Utilities	Boiler	No. 15 Boiler	Affected			
B-9	Utilities	Boiler	No. 16 Boiler	Affected			
B-10	Utilities	Boiler	No. 18 Boiler	Affected			
B-11	Utilities	Boiler	No. 19 Boiler	Affected			
B-12	Utilities	600# Boiler	600# Boiler	Affected			

Table B-1
Valero McKee Refinery
Crude Expansion Project PSD Analysis

					GHG CO_2e		
EPN	Unit #	Unit	Description	New, Modified or Affected?	Baseline Emissions (tpy)	PTE (tpy)	PTE - Baseline (tpy)
S-184	Tank Farm	Tank Farm	Tank 940T1 (Sour Water)	Affected	13.54	17.75	4.20
S-195	Tank Farm	Tank Farm	Tank T101 (Sour Water)	Affected			
S-196	Tank Farm	Tank Farm	Tank T102 (Sour Water)	Affected			
S-197	Tank Farm	Tank Farm	Tank T109 (Sour Water)	Affected			
S-199	Tank Farm	Tank Farm	Tank T115 (Sour Water)	Affected			
S-022	Tank Farm	Tank Farm	Tank 120M2 (Crude Oil (RVP 7)	Affected			
S-023	Tank Farm	Tank Farm	Tank 120M3 (Crude Oil (RVP 7)	Affected			
S-183	Tank Farm	Tank Farm	Tank 120M4 (Crude Oil (RVP 7)	Affected			
S-186	Tank Farm	Tank Farm	Tank 80M1 (Crude Oil (RVP 7)	Affected			
S-176	Tank Farm	Tank Farm	Tank 200M1 (Crude Oil (RVP 7)	Affected			
FL-6	Wastewater	Wastewater	Wastewater Flare	Affected	7,779	8,062	283
FL-7	Multiple	Loading	Loading Rack Vapor Combustor	Affected			392
V-21	375	#2 Reformer	No. 2 Reformer Cat Regenerator Vent	Affected	20	50	30
V-5	820	#1 SRU	SRU No. 1 Incinerator	Affected	2,395	8,643	6,247
V-16	830	#2 SRU	SRU No. 2 Incinerator	Affected	8,994	14,862	5,868
				Project Increases Only			**415,492**
				PSD Significance Levels			**75,000**
				Triggers Contemporaneous Netting			**Y**

Note:

1. Only GHG incremental increase from boilers and the vapor combustor included in the project increase total.

Attachment D

This attachment contains the following items:

Fuel Analysis Sample

Fuel Carbon Content Historical Data Analysis
Valero McKee Refinery

Year 2006 Average; 1 mole basis							
Compound	measured mole%	Corrected mole%	Carbon in Compound	Mole of Carbon	MW	Mass of Compound	Mass of Carbon
HELIUM	0.00021	0.00021	0	0.0000	4.00	0.0008	0.0000
HYDROGEN	0.35698	0.35093	0	0.0000	2.02	0.7075	0.0000
METHANE	0.43372	0.42637	1	0.4264	16.04	6.8394	5.1164
C6+	0.00512	0.00504	6	0.0302	86.17	0.4340	0.3627
ETHANE	0.08330	0.08188	2	0.1638	30.07	2.4620	1.9652
ETHYLENE	0.02991	0.02940	2	0.0588	28.05	0.8247	0.7056
CARBON DIOXIDE	0.01001	0.00984	1	0.0098	44.01	0.4333	0.1181
PROPANE	0.02486	0.02444	3	0.0733	44.09	1.0777	0.8799
CYCLOPROPANE	0.00000	0.00000	3	0.0000	42.08	0.0000	0.0000
PROPYLENE	0.00619	0.00609	3	0.0183	42.08	0.2561	0.2191
ISOBUTANE	0.00635	0.00624	4	0.0250	58.12	0.3625	0.2994
N-BUTANE	0.00491	0.00483	4	0.0193	58.12	0.2806	0.2317
ACETYLENE	0.00000	0.00000	2	0.0000	26.04	0.0000	0.0000
PROPADIENE	0.00067	0.00066	3	0.0020	40.06	0.0266	0.0239
HYDROGEN SULFIDE	0.00072	0.00071	0	0.0000	34.00	0.0241	0.0000
T-2-BUTENE	0.00022	0.00021	4	0.0009	56.10	0.0120	0.0103
1-BUTENE	0.00034	0.00033	4	0.0013	56.10	0.0188	0.0160
ISOBUTENE	0.00038	0.00038	4	0.0015	56.10	0.0212	0.0181
C-2-BUTENE	0.00014	0.00014	4	0.0006	56.10	0.0078	0.0067
ISOPENTANE	0.00203	0.00200	5	0.0100	72.14	0.1440	0.1198
N-PENTANE	0.00081	0.00080	5	0.0040	72.14	0.0576	0.0479
ARGON/OXYGEN	0.00459	0.00452	0	0.0000	39.95	0.1804	0.0000
1,3-BUTADIENE	0.00001	0.00001	3	0.0000	54.09	0.0007	0.0005
NITROGEN	0.04574	0.04497	0	0.0000	28.02	1.2598	0.0000
CARBON MONOXIDE	0.00000	0.00000	1	0.0000	28.01	0.0000	0.0000
Total	1.017	1.000				**15.432**	**10.141**
Percent of Carbon in Compound =			**65.72 % (g Carbon/ g Fuel Gas)**				

Attachment E

This attachment contains the following items:

Heat and Material Balance Data Sheets

HEAT AND MATERIAL BALANCE
RLE - 04222011 RLE and GP Model

PFD Stream		C2-OFFGAS
Mass Flow	lb/hr	5,213
Molar Flow	lbmol/hr	192
Std Vol Flow	SBPD	1,025
Temperature	°F	-6
Pressure	psig	223
Total Enthalpy	MM Btu/hr	-6.90
Vapor		
Mass Flow	lb/hr	5,213
Std Gas Flow	MM SCFD	1.75
Mol Weight		27.171
Density	lb/ft3	1.66
Viscosity	cP	0.01
Heat Capacity	Btu/lb-°F	0.488
Therm Cond	Btu/hr-ft-°F	0.013
Compressibilty		0.799
Liquid		
Mass Flow	lb/hr	0
Actual Flow	GPM	0
Density	lb/ft3	28.04
API Gravity		256.31
Viscosity	cP	0.08
Heat Capacity	Btu/lb-°F	0.756
Therm Cond	Btu/hr-ft-°F	0.060
Surface Tension	dyne/cm	6.11
Aqueous Liquid		
Mass Flow	lb/hr	—
Actual Flow	GPM	—
Density	lb/ft3	—
Viscosity	cP	—
Heat Capacity	Btu/lb-°F	—
Therm Cond	Btu/hr-ft-°F	—
Surface Tension	dyne/cm	—
Components		
Methane	lbmol/hr	27.10
Methane in Total Stream	wt%	8.32%

HEAT AND MATERIAL BALANCE
#1 Crude/Vac Base - #1 CDU Plant Match 4-13-07

PFD Stream		Hot Well Gas
Mass Flow	lb/hr	203
Molar Flow	lbmol/hr	6
Std Vol Flow	SBPD	29
Temperature	°F	100
Pressure	psig	0
Total Enthalpy	MM Btu/hr	-0.24
Vapor		
Mass Flow	lb/hr	203
Std Gas Flow	MM SCFD	0.06
Mol Weight		32.767
Density	lb/ft3	0.08
Viscosity	cP	0.01
Heat Capacity	Btu/lb-°F	0.436
Therm Cond	Btu/hr-ft-°F	0.017
Compressibilty		0.992
Liquid		
Mass Flow	lb/hr	0
Actual Flow	GPM	0
Density	lb/ft3	48.06
API Gravity		49.41
Viscosity	cP	0.86
Heat Capacity	Btu/lb-°F	0.475
Therm Cond	Btu/hr-ft-°F	0.065
Surface Tension	dyne/cm	23.12
Aqueous Liquid		
Mass Flow	lb/hr	0
Actual Flow	GPM	0
Density	lb/ft3	62.28
Viscosity	cP	0.68
Heat Capacity	Btu/lb-°F	1.030
Therm Cond	Btu/hr-ft-°F	0.363
Surface Tension	dyne/cm	69.87
Components		
Methane	**lbmol/hr**	**1.37**
Methane in Total Stream	wt%	**10.85%**

PFD Stream		Cracked Gas
Mass Flow	lb/hr	457
Molar Flow	lbmol/hr	19
Std Vol Flow	SBPD	71
Temperature	°F	760
Pressure	psig	-13
Total Enthalpy	MM Btu/hr	-0.39
Vapor		
Mass Flow	lb/hr	457
Std Gas Flow	MM SCFD	0.18
Mol Weight		23.745
Density	lb/ft3	0.00
Viscosity	cP	0.02
Heat Capacity	Btu/lb-°F	0.621
Therm Cond	Btu/hr-ft-°F	0.048
Compressibilty		1.000
Liquid		
Mass Flow	lb/hr	---
Actual Flow	GPM	---
Density	lb/ft3	---
API Gravity		---
Viscosity	cP	---
Heat Capacity	Btu/lb-°F	---
Therm Cond	Btu/hr-ft-°F	---
Surface Tension	dyne/cm	---
Aqueous Liquid		
Mass Flow	lb/hr	---
Actual Flow	GPM	---
Density	lb/ft3	---
Viscosity	cP	---
Heat Capacity	Btu/lb-°F	---
Therm Cond	Btu/hr-ft-°F	---
Surface Tension	dyne/cm	---
Components		
Methane	lbmol/hr	8.75
Methane in Total Stream	wt%	30.63%

Attachment F

This attachment contains the following items:

Revised Table B-2
Fugitive GHG (Methane) Increase Summary

Revised Table B-3
Increased Fugitive GHG (Methane) Emissions Calculation Valero McKee Refinery – No. 1 Crude- EPN: F-1CRUDE

Revised Table B-4
Increased Fugitive GHG (Methane) Emissions Calculation Valero McKee Refinery – Dehexanizer- EPN: F-1CRUDE

Revised Table B-5
Increased Fugitive GHG (Methane) Emissions Calculation Valero McKee Refinery – No. 2 Crude- EPN: F-2CRUDE

Revised Table B-6
Increased Fugitive GHG (Methane) Emissions Calculation Valero McKee Refinery – RLE - EPN: F-RLE

Revised Table B-7
Increased Fugitive GHG (Methane) Emissions Calculation Valero McKee Refinery – #4 Fractionator - EPN: F-4HT

Revised Table B-8
Increased Fugitive GHG (Methane) Emissions Calculation Valero McKee Refinery – Hydrocracker - EPN: F-HCU

Table B-2
Fugitive GHG (Methane) Increase Summary
Valero McKee Refinery

EPN	Process Unit	Total Methane TPY	Total CO_2e TPY
F-1CRUDE	#1 Crude Unit	0.1295	2.7202
F-1CRUDE	Dehexanizer	0.0051	0.1079
F-2CRUDE	#2 Crude Unit	0.4286	9.0013
F-RLE	RLE	0.0629	1.3203
F-4HT	#4 Fractionator	0.0472	0.9910
F-HCU	Hydrocracker	1.2813	26.9067
F-DHDSU	Diesel Hydrodesulfurization Unit and Turbine Merox Unit	0.0004	0.0088
Total		**0.67**	**41.06**

Table B-3

Increased Fugitive GHG (Methane) Emissions Calculations

Valero McKee Refinery - No. 1 Crude

EPN: F-1CRUDE

Component	Service	Comp. Count	Emission Factor[1] (lb/hr/source)	Control Efficiency[2] (percent)	Emissions[4] (lb/hr)	Emissions[5] (ton/yr)
Valves	Gas	15	0.05900	97	0.03	0.12
	LL	65	0.02400	97	0.05	0.20
	HL	0	0.00051	30	0.00	0.00
Pump Seals	LL	4	0.25100	85	0.15	0.66
	HL	0	0.04600	30	0.00	0.00
Agitators	Gas	0	0.25100	85	0.00	0.00
Connectors (flanges)	All	99	0.00055	30	0.04	0.17
Compressor seals		0	1.39900	95	0.00	0.00
PRVs		1	0.35000	97	0.01	0.05
Open-ended lines		0	0.00510	100	0.00	0.00
Sampling connections		0	0.03300	97	0.00	0.00
				Total	0.27	1.19

	Wt %[3]			Emissions	
Compound	GV	LL	HL	lb/hr	ton/yr
Methane	10.85	10.85	0.00	2.96E-02	1.30E-01

Notes:

[1] Emission factors taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft)

[2] 28 VHP Control efficiencies taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft) for all components except for compressor seals which uses 28MID control credit

[3] Wt % of Methane was determined using Heat and Material Balance Data Sheet

[4] lb/hr = (count)(factor)(1-efficiency)

[5] ton/yr = (lb/hr)(8760 hr/yr)/(2000 lb/ton)

Table B-4

Increased Fugitive GHG (Methane) Emissions Calculations

Valero McKee Refinery - Dehexanizer

Part of EPN: F-1CRUDE

Component	Service	Comp. Count	Emission Factor[1] (lb/hr/source)	Control Efficiency[2] (percent)	Emissions[4] (lb/hr)	Emissions[5] (ton/yr)
Valves	Gas	0	0.05900	97	0.00	0.00
	LL	7	0.02400	97	0.01	0.02
	HL	0	0.00051	30	0.00	0.00
Pump Seals	LL	0	0.25100	85	0.00	0.00
	HL	0	0.04600	30	0.00	0.00
Agitators	Gas	0	0.25100	85	0.00	0.00
Connectors (flanges)	All	15	0.00055	30	5.78E-03	0.03
Compressor seals		0	1.39900	95	0.00	0.00
PRVs		0	0.35000	97	0.00	0.00
Open-ended lines		0	0.00510	100	0.00	0.00
Sampling connections		0	0.03300	97	0.00	0.00
				Total	0.01	0.05

	Wt %[3]			Emissions	
Compound	GV	LL	HL	lb/hr	ton/yr
Methane	10.85	10.85	0.00	1.17E-03	5.14E-03

Notes:

[1] Emission factors taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft).

[2] 28 VHP Control efficiencies taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft) for all components except for compressor seals which uses 28MID control credit.

[3] Wt % of Methane was determined using Heat and Material Balance Data Sheet

[4] lb/hr = (count)(factor)(1-efficiency)

[5] ton/yr = (lb/hr)(8760 hr/yr)/(2000 lb/ton)

Table B-5
Increased Fugitive GHG (Methane) Emissions Calculations
Valero McKee Refinery - No. 2 Crude
EPN: F-2CRUDE

Component	Service	Comp. Count	Emission Factor[1] (lb/hr/source)	Control Efficiency[2] (percent)	Emissions[4] (lb/hr)	Emissions[5] (ton/yr)
Valves	Gas	0	0.05900	97	0.00	0.00
	LL	63	0.02400	97	0.05	0.20
	HL	24	0.00051	30	0.01	0.04
Pump Seals	LL	6	0.25100	85	0.23	0.99
	HL	5	0.04600	30	0.16	0.71
Agitators	Gas	0	0.25100	85	0.00	0.00
Connectors (flanges)	All	125	0.00055	30	0.05	0.21
Compressor seals		0	1.39900	95	0.00	0.00
PRVs		0	0.35000	97	0.00	0.00
Open-ended lines		0	0.00510	100	0.00	0.00
Sampling connections		0	0.03300	97	0.00	0.00
				Total	0.49	2.14

	Wt %[3]			Emissions	
Compound	GV	LL	HL	lb/hr	ton/yr
Methane	30.63	30.63	0.02	9.79E-02	4.29E-01

Notes:

[1] Emission factors taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft)

[2] 28 VHP Control efficiencies taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft) for all components except for compressor seals which uses 28MID control credit.

[3] Wt % of Methane was determined using Heat and Material Balance Data Sheet

[4] lb/hr = (count)(factor)(1-efficiency)

[5] ton/yr = (lb/hr)(8760 hr/yr)/(2000 lb/ton)

Table B-6
Increased Fugitive GHG (Methane) Emissions Calculations
Valero McKee Refinery - RLE
EPN: F-RLE

Component	Service	Comp. Count	Emission Factor[1] (lb/hr/source)	Control Efficiency[2] (percent)	Emissions[4] (lb/hr)	Emissions[5] (ton/yr)
Valves	Gas	1	0.05900	97	1.77E-03	0.01
	LL	5	0.02400	97	3.60E-03	0.02
	HL	0	0.00051	30	0.00	0.00
Pump Seals	LL	4	0.25100	85	0.15	0.66
	HL	0	0.04600	30	0.00	0.00
Agitators	Gas	0	0.25100	85	0.00	0.00
Connectors (flanges)	All	43	0.00055	30	0.02	0.07
Compressor seals		0	1.39900	95	0.00	0.00
PRVs		0	0.35000	97	0.00	0.00
Open-ended lines		0	0.00510	100	0.00	0.00
Sampling connections		0	0.03300	97	0.00	0.00
				Total	0.17	0.76

Compound	Wt %[3]			Emissions	
	GV	LL	HL	lb/hr	ton/yr
Methane	8.32	8.32	0.00	0.01	0.06

Notes:

[1] Emission factors taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft)

[2] 28 VHP Control efficiencies taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft) for all components except for compressor seals which uses 28MID control credit

[3] Wt % of Methane was determined using Heat and Material Balance Data Sheet

[4] lb/hr = (count)(factor)(1-efficiency)

[5] ton/yr = (lb/hr)(8760 hr/yr)/(2000 lb/ton)

Table B-7
Increased Fugitive GHG (Methane) Emissions Calculations
Valero McKee Refinery - #4 Fractionator
EPN: F-4HT

Component	Service	Comp. Count	Emission Factor[1] (lb/hr/source)	Control Efficiency[2] (percent)	Emissions[4] (lb/hr)	Emissions[5] (ton/yr)
Valves	Gas	14	0.05900	97	0.02	0.11
	LL	0	0.02400	97	0.00	0.00
	HL	0	0.00051	30	0.00	0.00
Pump Seals	LL	0	0.25100	85	0.00	0.00
	HL	0	0.04600	30	0.00	0.00
Agitators	Gas	0	0.25100	85	0.00	0.00
Connectors (flanges)	All	27	0.00055	30	1.04E-02	0.05
Compressor seals		0	1.39900	95	0.00	0.00
PRVs		0	0.35000	97	0.00	0.00
Open-ended lines		0	0.00510	100	0.00	0.00
Sampling connections		0	0.03300	97	0.00	0.00
				Total	0.04	0.15

	Wt %[3]			Emissions	
Compound	GV	LL	HL	lb/hr	ton/yr
Methane	30.63	30.63	0.00	1.08E-02	4.72E-02

Notes:

[1] Emission factors taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft).

[2] 28 VHP Control efficiencies taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft) for all components except for compressor seals which uses 28MID control credit.

[3] Wt % of Methane was assumed the same as the maximum concentration in the Heat and Material Balance Data Sheet for #3 Crude & Vacuum Unit

[4] lb/hr = (count)(factor)(1-efficiency)

[5] ton/yr = (lb/hr)(8760 hr/yr)/(2000 lb/ton)

Table B-8

Increased Fugitive GHG (Methane) Emissions Calculations

Valero McKee Refinery - Hydrocracker

EPN: F-HCU

Component	Service	Comp. Count	Emission Factor[1] (lb/hr/source)	Control Efficiency[2] (percent)	Emissions[4] (lb/hr)	Emissions[5] (ton/yr)
Valves	Gas	203	0.05900	97	0.36	1.57
	LL	115	0.02400	97	0.08	0.36
	HL	64	0.00051	30	0.02	0.10
Pump Seals	LL	2	0.25100	85	0.08	0.33
	HL	3	0.04600	30	0.10	0.42
Agitators	Gas	0	0.25100	85	0.00	0.00
Connectors (flanges)	All	955	0.00055	30	0.37	1.61
Compressor seals		1	1.39900	95	0.07	0.31
PRVs		0	0.35000	97	0.00	0.00
Open-ended lines		0	0.00510	100	0.00	0.00
Sampling connections		0	0.03300	97	0.00	0.00
				Total	1.07	4.71

	Wt %[3]			Emissions	
Compound	GV	LL	HL	lb/hr	ton/yr
Methane	30.63	30.63	0.00	2.93E-01	1.28E+00

Notes:

[1] Emission factors taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft).

[2] 28 VHP Control efficiencies taken from TCEQ Technical Guidance Package for Chemical Sources "Equipment Leak Fugitives" dated October 2000 (Draft) for all components except for compressor seals which uses 28MID control credit.

[3] Wt % of Methane was assumed the same as the maximum concentration in the Heat and Material Balance Data Sheet for #3 Crude & Vacuum Unit

[4] lb/hr = (count)(factor)(1-efficiency)

[5] ton/yr = (lb/hr)(8760 hr/yr)/(2000 lb/ton)

VALERO®

GHG Monitoring Plan for Modified Sources in Crude Expansion Application submitted 12/2/2011

McKee Refinery

Table of Contents

1. Purpose of Plan

The purpose of this Greenhouse Gas Monitoring Plan is to document the monitoring methods and corresponding quality assurance methods used to ensure a complete and accurate inventory of greenhouse gas emissions at the McKee refinery related to the proposed Crude Expansion Permit Application as it relates to demonstrating BACT for CO_{2e} emissions. The elements of this plan satisfy recordkeeping requirements pursuant to 40 CFR §98.3(g)(5).

2. Facility Description

The McKee Refinery is a continuously operating oil refinery that produces a wide range of petroleum products including LPG's, gasolines, mid-distillate products, asphalt, and molten sulfur. Below is a list of units that will be modified through the proposed Crude Expansion Permit Application:

- Fugitive sources in the following areas:
    - #1 & #2 Crude/Vac Units
    - Refinery Light Ends
    - #4 Hydrotreater
    - HCU
    - TF Merox (Gas Plant)
    - DHT

3. Job Responsibilities

The McKee Environmental Health and Safety Director is responsible for overall accuracy and completeness of the GHG inventory. Other responsible parties include:

Instrument technicians – responsible for performing QA activities and repairs on instruments discussed in this plan

Analyzer technicians – responsible for performing QA activities and repairs on analyzers and CEMS discussed in this plan

Environmental Department – responsible for analyzing and QA of data prior to uploading to Essential software/database

Corporate I/S – responsible for maintaining and making changes to the Essential software/database

4. Modified Sources subject to GHG

A list of 40 CFR 98-applicable sources and GHG calculation methodologies are shown in Attachment 1 Table 1 for the proposed modification in the Crude Expansion Permit Application dated 12/2/2011.

5. Monitoring Plan

The material presented below documents how the McKee refinery will comply with the mandatory greenhouse gas reporting rule as it applies for the proposed Crude Expansion Permit Application related to modified sources. The modified sources represented in the permit application are various fugitive components. This plan only covers those sources that were modified, the remaining sources at the refinery follow the Refinery Wide GHG Monitoring Plan. The applicable Subpart for the modified sources is Y; therefore, representations for how McKee will adhere to that subpart is listed below for the proposed modified sources.

5.1. Standard Temperature and Pressure

Unless otherwise stated, Valero's practice is to correct flow rates to a temperature of 60 °F and a pressure of 14.7 psia. Therefore, Valero uses a molar correction factor of 836.6 scf/kg-mol in all GHG calculations where a molar correction factor is needed.

5.2. Subpart Y (Petroleum Refineries)

The only modified source subject to Subpart Y are fugitives, all other source types are not proposed to be modified as part of the Crude Expansion.

5.2.1. Fugitive Emissions

The McKee refinery will use Equation Y-21 to calculate CH_4 emissions from fugitive sources. The values for each of the variable in Equation Y-21 can be found in Attachment 2.

6. Emission Calculations

The GHG emission calculations discussed earlier have been programmed into a software system by ESS customized for Valero (ValAir). A description of the GHG emission calculations can be found in Attachment 2. Monthly GHG activity data and other data needed for the GHG Inventory Report is examined either in an Excel workbook, or in the emissions workbench and bulk uploaded to the ESS software on a quarterly basis.

Attachment 1: Tables

Table 1 - List of Modified Sources

Unit EPN	Description	Subpart
F-1CRUDE, F-2CRUDE, F-RLE, F-4HT, F-HCU, F-GASPLT, F-DHDSU	Fugitive Sources	Y

Attachment 2: Emission Calculation Formulas

1. Fugitive Emissions

(a) CH4 - Fugitive emissions using default emission factors [Part 98, Equation Y-21]

The following equation can be used to estimate fugitive methane emissions in place of actual monitoring data.

$$CH_4 = (0.4 * N_{CD}) + (0.2 * N_{PU1}) + (0.1 * N_{PU2}) + (4.3 * N_{H2}) + (6 * N_{FGS})$$

Where:

CH_4 = Uncontrolled VOC Emissions, lbs
N_{CD} = Number of atmospheric crude oil distillation columns
N_{PU1} = Cumulative number of catalytic cracking units, coking units, hydrocracking, and full-range distillation columns (including depropanizers and debutanizers)
N_{PU2} = Cumulative number of hydrotreating/hydrorefining, catalytic reforming units and visbreaking units
N_{H2} = Number of Hydrogen plants
N_{FGS} = Number of fuel gas systems