Blue Source's Greenhouse Gas Emission Reduction Protocol for Petro Source's Capture of Vent-Stack CO_2 in Combination with Enhanced Oil Recovery Operations

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1.0 Introduction

Blue Source is an active supplier of emission reductions (ERs) sourced from geologic sequestration, conservation, transportation, and avoidance projects and companies. Petro Source Energy Company (formerly known as Petro Source Carbon Company), hereafter referred to as "Petro Source" is an active gatherer, transporter and marketer of CO_2, and related CO_2 equivalents, sourced from industrial vent stacks for use in enhanced oil recovery (EOR) projects, a process which the Intergovernmental Panel on Climate Change (IPCC) has recognized as a method of sequestering CO_2 that would otherwise be vented to the atmosphere (*Climate Change 1995*, 1996).

Since August 1, 1998, Petro Source sold and delivered CO_2 to crude oil production operators in West Texas for injection into crude production fields. The source of CO_2 supplied by Petro Source was waste CO_2 gas from natural gas processing plants which previously vented these streams to the atmosphere. Petro Source entered into long-term lease of approximately 72,000 hp of compression located adjacent to the gas plants and refurbished about 30,000 hp of compression. Between 1999-2001, Petro Source expanded its pipeline and/or compression facilities to allow it to deliver directly to certain purchasers of CO_2 for EOR.

In 2004, Petro Source completed the 32-mile Sierra Madera pipeline to enable transport of CO_2 captured from the vent stack of the Pikes Peak gas plant. Petro Source installed over 13,000 hp of compression adjacent tothe gas plant, including 9,000 hp of gas engine-driven compressors and about 4,500 hp of electric drive compressors.

The purchasers of Petro Source's vent-sourced CO_2 can obtain underground-sourced CO_2 from reserves at McElmo Dome where it is compressed and transported to the oil fields through the Cortez, Central Basin, and Canyon Reef Carriers (CRC) pipelines. Therefore, the use of vent-sourced CO_2 will replace an equivalent volume of underground-sourced CO_2 and also avoid emissions that would have resulted from its compression and transport.

The ERs generated from August 1998 through December 2000 were registered previously with the Pilot Emissions Reduction Trading (PERT) program in Ontario by Petro Source during April 2001. Over this time period, approximately 2.5 million metric tonnes of CO_2 equivalent (CO_2e) emissions were sequestered. Subsequently about 3.7 million metric tonnes of CO_2e created between January 2001 and June 2004 were registered with the Clean Air Canada (CAC) registry.

This protocol presents the details associated with the approximately 2.9 million metric tonnes of CO_2e ERs resulting from the project for the July 2004 through July 2006 time period.

2.0 Proponent Identification

The locations of the emission reduction sources are shown in Figure 2-1. Vent stack CO_2 is captured and compressed at five compressor stations, and transported by pipeline to various oil fields where it is sequestered in the ground during EOR operations.

The contact information for the ER project are as follows:

Proponent Contact:	Mrs. Lauren Kimble Blue Source, LLC 3165 E. Millrock Road, Suite 340 Holladay, Utah 84121 Phone: (801) 322-4750 Fax: (801) 363-3248 E-mail:lpr@ghgworks.com
Operating Contact:	Mr. Greg West Chief Operating Officer Petro Source Energy Company, LP 6 Desta Drive, Suite 6300 Midland, Texas 79705 Phone: (915) 687-4242 Fax: (915) 687-4244 E-mail:gwest@petrosourceenergy.com

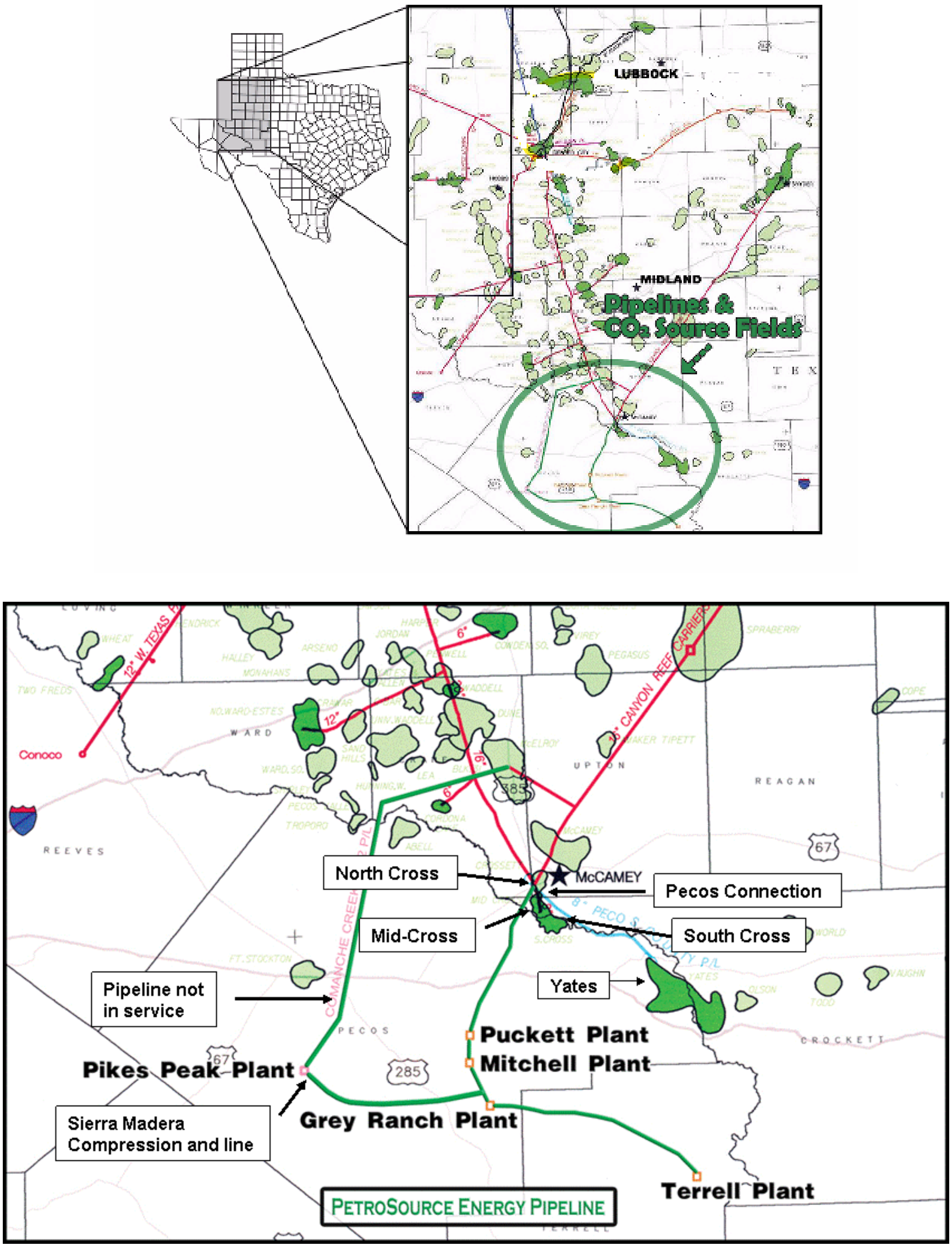

Figure 2-1. Location of Petro Source Emission Reduction Sources for CO_2 Sequestration Project

3.0 Project Description

3.1 Site Description

The system of physical facilities that defines Petro Source's CO_2 emission reduction source is illustrated in Figure 2-1. This system starts with the physical capture by Petro Source's compressor stations of atmospheric pressure, vent-stack CO_2 which is emitted from third party natural gas processing plants. At each of Petro Source's five compressor stations (Terrell, Grey Ranch, Mitchell, Puckett[1], and Sierra Madera) the captured CO_2 is compressed to between 1,500 psig and 1,800 psig for delivery into Petro Source's Val Verde Pipeline which terminates at the McCamey Pump Station. From the custody transfer point at McCamey, Petro Source's CO_2 is delivered to the South Cross Unit lease in Crockett County, Texas, and also follows the Canyon Reef Carriers (CRC) CO_2 pipeline to deliver to the Sharon Ridge lease and Sacroc lease both in Scurry County, Texas. Delivery of Petro Source's CO_2 to the North and South Cross Units in Crockett County, Texas began with annual facility expansions in early 2000 and in March 2002.

In 2004, Petro Source completed the 32-mile Sierra Madera pipeline connecting the Pikes Peak gas plant with the Val Verde system. Petro Source installed over 13,000 hp of compression, including 9,000 hp of gas engine-driven compressors and about 4,500 hp of electric drive compressors. Petro Source began delivery of vent-source CO_2 to the Yates Unit in Pecos County via the Pecos connector in December 2004, and to the Mid Cross Unit in Crockett County in November 2005.

3.2 Pre-Project Conditions

In the early 1970's, the highly prolific Permian Basin oil reservoirs were maturing to the point that producers became interested in pursuing enhanced recovery methods. Most commonly, enhanced oil recovery (EOR) involves injecting fluid into the reservoirs to enhance the natural conditions affecting crude oil production. The result is increased production and the capture of a significant portion of the oil reserves not otherwise recoverable. Historically and today, enhanced oil recovery projects injecting CO_2 primarily purchased the injectant from underground pure CO_2 reserves sourced in the states of Colorado and New Mexico. Underground-sourced CO_2 and recycle CO_2 accounted for 100 percent of all injected CO_2 into the Permian Basin before Petro Source constructed the sequestration project. Since the early 1970s, gas-processing plants have extracted the high-value natural gas and hydrocarbon liquids for sale, while venting large volumes of essentially pure CO_2 to the atmosphere.

3.3 Emission Reduction Strategy

Petro Source secures its source of CO_2 from the vent stacks of these existing gas processing facilities that emit CO_2 to the atmosphere as a byproduct of their primary business activity.

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[1] The Puckett natural gas processing plant is currently not operational, thus there are no CO_2 volumes being captured and minimal electricity consumption due to compression at this facility. Petro Source still has compression equipment at this site and has captured CO_2 from the facility previously.

The captured CO_2 is then compressed and sold to oil producers for EOR operations. During these operations the CO_2 is sequestered in the hydrocarbon reservoirs.

3.4 Action Taken

Petro Source secures its source of CO_2 from the vent stacks of existing gas processing facilities that emit CO_2 to the atmosphere as a byproduct of their primary business activity. In 1998, Petro Source constructed 82 miles of 10" CO_2 gathering pipeline and refurbished approximately 30,000 hp of compression, to capture up to 110 million cubic feet per day (MMCFPD) of CO_2 and deliver that CO_2 to crude oil producers that employ EOR operations in West Texas. Petro Source's delivered CO_2 must compete with the producers' alternative of purchasing CO_2 sourced from underground CO_2 reserves. During the 1999-2001 time-period, Petro Source materially expanded the operations of its CO_2 pipeline and/or compression facilities to allow Petro Source to deliver CO_2 directly to certain EOR projects (North, Mid, and South Cross Units).

In 2004, Petro Source constructed about 32-miles of 10" CO_2 gathering pipeline and installed over 13,000 hp of compression to capture an additional 38 MMCFPD and deliver it to EOR operators.

3.5 Post-Project Conditions

Since the implementation of the project in 1998, CO_2 that was previously emitted to the atmosphere from the five natural gas processing plants is now being sequestered in underground hydrocarbon reservoirs. The project involves the compression of CO_2 by gas-fired engine-driven compressors and electric-driven motor compressors operating in five separate compressor stations, located near each of five gas processing plants that are the source of the CO_2.

As a result of the project, direct CO_2e emissions occur due to fuel combustion in the engine-driven compressor engines. Indirect CO_2e emissions due to electricity usage to operate the compressor stations, the electric motor-driven compressors, and the McCamey pump station also result from the project.

As shown in Section 5-4, these project-related emissions are small in comparison to the amount of sequestered CO_2. Since its implementation in 1998, the project has resulted in a total net reduction of 9.2 million metric tonnes of CO_2e (as of July 2006).

4.0 Validity of Emission Reductions

4.1 Real

For the Petro Source sequestration project, the emission reduction is real because it represents an actual and recognizable action that resulted in direct reductions of CO_2 emissions, which were previously vented to the atmosphere. Petro Source purchases and secures waste CO_2 gas from the vent stacks of natural gas processing plants. Petro Source acquires the commodity CO_2 and exclusively performs the service of capturing the CO_2. The CO_2 gas is sold to crude oil producers for enhanced oil recovery, which is a recognized sequestration technology (*Climate Change 1995*, *1996*). These same crude oil producers have viable alternative purchase opportunities of CO_2 sourced from underground CO_2 reserves, the primary source of injectant CO_2 in the Permian Basin.

4.2 Surplus

The surplus nature of these emission reduction credits is demonstrated by a review of applicable state and federal regulations associated with oil production operations. As summarized in Table 4-1, there are no external requirements for controlling or reducing CO_2 emissions. In addition, Petro Source has no voluntary obligations for reducing or controlling CO_2 emissions.

The Petro Source facilities in this study are not subject to any federal or local regulations that require CO_2 emission reductions. Table 4-1 summarizes the regulations that were considered for this analysis. A review of the Texas Natural Resource Conservation Commission (TNRCC) files for the Petro Source facilities did not indicate that any of the facilities had committed to voluntary CO_2 emission reductions.

Although Petro Source must comply with the regulations referenced in Table 4-1, none of these regulations apply to CO_2 or other greenhouse gas emissions.

4.3 Permanent

Underground-sourced CO_2 and recycle CO_2 accounted for 100 percent of all injected CO_2 into the Permian Basin before Petro Source constructed the sequestration project. As long as there is continued supply of waste CO_2 from the vent stacks of the gas processing plants and demand remains for the use of CO_2 in EOR operations, the project's CO_2e emissions reductions are expected to continue over its complete economic life.

Geologic structural and stratigraphic traps have demonstrated the ability of reservoirs to seal and store hydrocarbons over millions of years. The mechanisms that initially trapped these hydrocarbons remain intact as fluids are extracted from or injected into these reservoirs. The proven ability for hydrocarbon reservoirs to successfully trap and store fluids for up to several million years make storage of CO_2 in depleted hydrocarbon reservoirs "the best currently available option for long term sequestration." (Bachu, 2000)

Table 4-1. Regulations Potentially Requiring CO_2 Emission Reductions for Petro Source Facilities

Agency	Rule/Citation	Applicability to Petro Source
Texas Natural Resource Conservation Commission (TNRCC)	30 TAC Chapter 111 Regulation I Control of Air Pollution from Visible Emissions and Particulate Matter	This regulation does not apply to carbon dioxide emissions.
TNRCC	30 TAC Chapter 112 Regulation II Control of Air Pollution from Sulfur Compounds	This regulation does not apply to carbon dioxide emissions.
TNRCC	30 TAC Chapter 115 Regulation V Control of Air Pollution from VOCs	According to the Petro Source Title V[a] applications, the facilities being reviewed are not subject to this regulation because they are not located in a county that is subject to this rule. Also, this regulation does not apply to carbon dioxide emissions.
TNRCC	30 TAC Chapter 117 Regulation VII Control of Air Pollution from Nitrogen Compounds	According to the Petro Source Title V[a] applications, the facilities being reviewed are not subject to this regulation because they are not located in a county that is subject to this rule. Also, this regulation does not apply to carbon dioxide emissions.
EPA	40 CFR 60 New Source Performance Standards (NSPS)	According to the Petro Source Title V[a] applications, the facilities being reviewed are not subject to any NSPS subpart. Also, this regulation does not apply to carbon dioxide emissions.
EPA	40 CFR 61 National Emission Standards for Hazardous Air Pollutants (NESHAPS)	According to the Petro Source Title V[a] applications, the facilities being reviewed are not subject to any NESHAPS subpart. Also, this regulation does not apply to carbon dioxide emissions.
EPA	40 CFR 63 National Emission Standards for Hazardous Air Pollutants for Source Categories (NESHAPS for Source Categories)	According to the Petro Source Title V[a] applications, the facilities being reviewed are not subject to any subpart of NESHAPS for Source Category. Also, this regulation does not apply to carbon dioxide emissions.

[a]The following are the Title V permits for the Petro Source facilities in this study:

- Permit Number O-01211, for TNRCC Account #TC-0001-S (Terrell Compressor Station) issued May 27, 1999
- Permit Number O-01213, for TNRCC Account #PE-0098-K (Mitchell Compressor Station) issued June 2, 1999
- Permit Number O-01209, for TNRCC Account #PE-0050-P (Grey Ranch Compressor Station) issued May 27, 1999
- Permit Number O-01172, for TNRCC Account #PE-0260-C (Puckett Compressor Station) issued June 2, 1999
- Permit No: O-2760 for the Sierra Madera Compressor Station

For a geologic trap to be considered a suitable mechanism for long term storage, the tectonic structure and setting need to be stable and understood. The Permian Basin is a convergent basin on stable continental platforms that are not prone to significant tectonic activity, earthquakes or proximity to volcanism, which would pose the potential for accidental rapid escape of stored CO_2 back to atmosphere. The Permian Basin, through extensive exploration and production, has geology and hydrogeology that is well understood and documented. These properties make storage of CO_2 in hydrocarbon reservoirs in the Permian Basin a viable long-term option and mitigate the possibility of leakage as a result of natural occurrences.

Notwithstanding the geophysical argument for permanence, as long as recycled CO_2 competes with CO_2 sourced from underground reserves (McElmo Dome), potential geologic leakage, which is the core of permanence in geological sequestration, does not represent a negative impact on the Petro Source vent-stack CO_2 project. In the absence of this project, the project's baseline EOR operations would have occurred anyway with additional underground sourced CO_2, and its associated increased vented CO_2 emissions, as well as potential geologic leakage. This project baseline leakage offsets any leakage that would occur with vent-stack sourced CO_2 from the Petro Source project. Because these quantities are very small and essentially equivalent, they offset each other, and potential leakage in this project is not a negative impact on the definition of permanence, or on the volume of ERs estimated.

4.4 Unique

Emission Reductions from Petro Source's sequestration activities during the creation period of July 2004 through July 2006 have not previously been registered or claimed. The owners/operators of the crude oil producing fields which purchase commodity CO_2 from Petro Source for injection and the owners/operators of the natural gas treating plants supplying the commodity CO_2 to Petro Source have no legal ownership of the ERs, as further described in Section 4.5. Petro Source previously registered CO_2e ERs for the 1998-2000 creation period with PERT and for the 2001-June 2004 period with CAC (as described in section 1.0).

4.5 Claimable

In both contract and law, Petro Source has legal ownership of the CO_2 and CO_2e emission reductions reported in this protocol.

In contract, the nature of Petro Source's CO_2 purchase agreements gives it custody and title to the emission reductions. By contract, Petro Source's legal ownership of the emission reduction benefit is sold to Blue Source.

In law, it is the party who engages in the activity, and its related risks, of reducing CO_2 emissions that is the only party with a rightful claim to the emission reduction resulting therefrom. The act of selling the commodity, CO_2, is not, in and of itself, the act of acquiring the service of CO_2 sequestration. Likewise the act of acquiring the commodity, CO_2, and injecting it into the ground is not, in and of itself, the act of acquiring the service of CO_2 sequestration. Petro Source has never sold the service of CO_2 sequestration along with the delivery of commodity CO_2 to enhanced oil recovery units. On the other hand, the party who takes the risk and exerts the effort to develop a CO_2 sequestration project, invests in the equipment that enables the act of CO_2 sequestration to occur, and operates the facilities which produce the emission reductions is engaging in CO_2 sequestration, i.e., GHG emission reductions. The party both entitled to the resulting emissions reductions, if any, and who must be rewarded in order to foster the activity of GHG emission reductions is the party who takes those risks, exerts those efforts, invests that capital, and operates that equipment.

5.0 Quantification of Emission Reductions

This section includes a description of the process by which Petro Source creates CO_2e emission reductions, and the measurements and data sources used in the quantification of baselines, activity levels, and emission reductions. The procedures used to determine the baseline emissions, project emissions, and emission reductions are also described. Procedures that could be used for subsequent third-party verification of ERs created under this protocol are also discussed.

5.1 Process Description

A schematic showing the GHG emission sources associated Petro Source's operations and the project's baseline is shown in Figure 5-1. Petro Source purchases and captures waste CO_2 gas from the vent stacks of five natural gas processing plants in West Texas that separate CO_2 from natural gas, to improve the heat content of the natural gas product. Prior to the sale of the waste CO_2 to Petro Source, those CO_2 gas streams from the gas plants were previously vented to the atmosphere.

Petro Source leases and operates five compressor stations, with each one located adjacent to one of the five gas plants, in order to gather the CO_2 gas, dehydrate it (i.e., remove moisture which is highly corrosive), and compress it for transportation to downstream oil fields. To compress the CO_2 gas stream, natural gas-fired reciprocating engines that drive multi-stage CO_2 gas compressors are used.

After compression, the CO_2 is transported as a high-pressure dense gas by pipeline to the McCamey pump station (or to dedicated pipeline delivery laterals for direct delivery to customers), where it then joins into an existing CO_2 distribution system in the Permian Basin of West Texas. From this custody transfer-point, the CO_2 is transported to various crude production fields for enhanced oil recovery purposes.

Underground-sourced CO_2 can be obtained from McElmo Dome, where it is compressed using several large engine-driven compressors and transported to the EOR sites.

This ER report is focused on Petro Source's portion of the CO_2 that is sold to operators of EOR leases along the pipeline route. These include:

- The South Cross, North Cross, and Mid Cross Unit leases, all located in Crockett County, Texas, and served by dedicated laterals;
- The Sharon Ridge Canyon, Sacroc, and Cogdell Unit leases, all located in Scurry County, Texas, and served by the CRC pipeline; and
- The Yates Unit lease, located in Pecos County, Texas, and served by the Pecos connector.

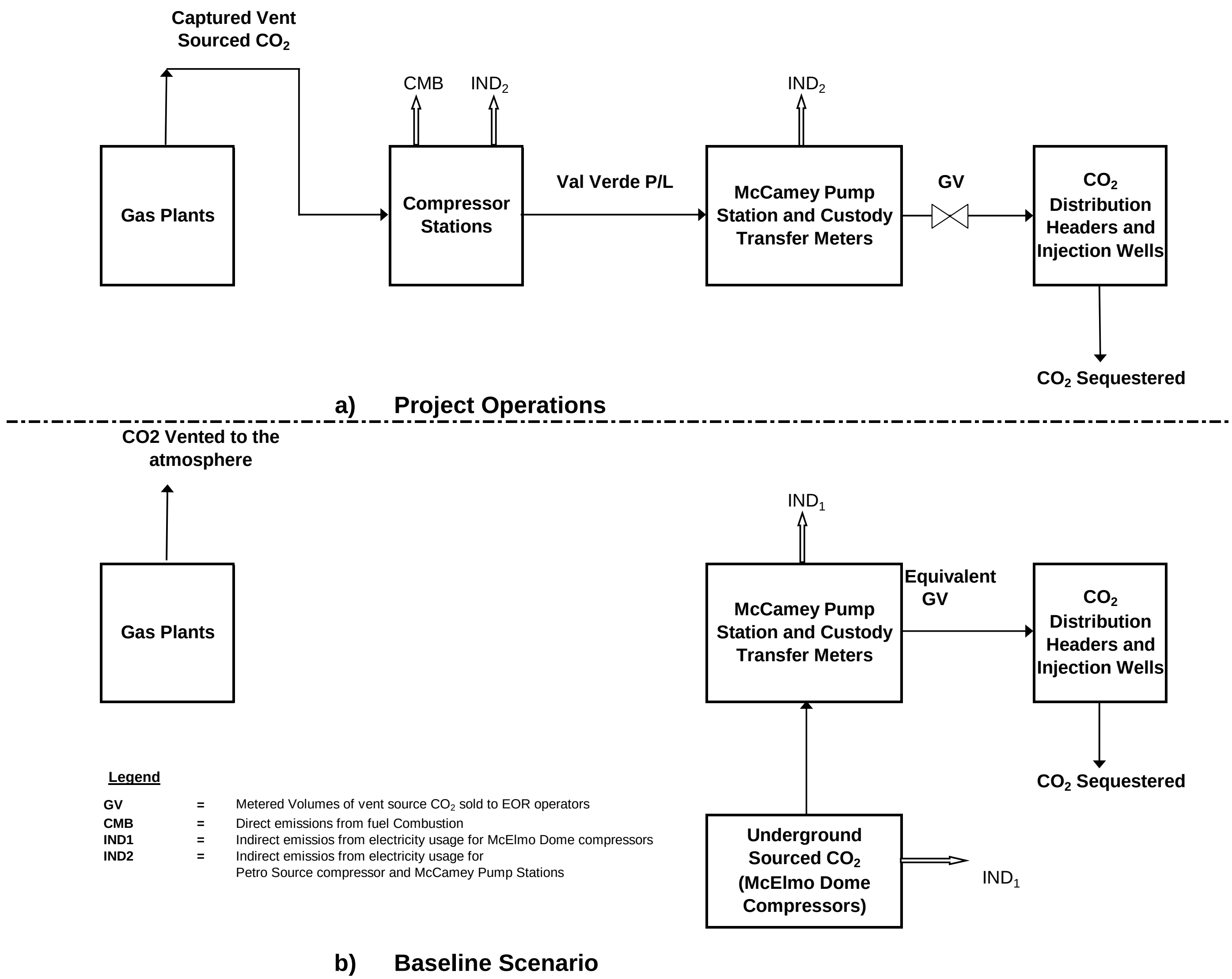

Figure 5-1. Schematic Showing Sources of CO_2e Emissions for Project Operations and Baseline Scenario

The location of the compressor stations, pipeline route, and production fields are illustrated in Figure 2-1.

5.2 Data Collection

The specifications of the metering systems used to measure the data used in the emission reductions estimates are shown in Table 5-1.

Table 5-1. Instrument Specification for Measured Parameters Used in ER Estimation

Parameter/Location	**Instrument Type (Make, Model)**
CO_2 Sales Gas Meters Located at McCamey Station	
CRC Pipeline Sales (Meter 505)	Rosemount; Smart Family; Serial #0739661 (Static Pressure)
	Rosemount; Smart Family; Serial #0447350 (Differential Pressure)
	Rosemount; Smart Family Model 3144; Serial #0355251 (Temperature)
	Omni Flow Computer; Model 6000; Serial #60686
South Cross Sales (Meter 701)	Rosemount; Smart Family; Serial #0893553 (Static Pressure)
	Rosemount; Smart Family; Serial #0924439 (Differential Pressure)
	Rosemount; Smart Family Model 3144 DIB5; Serial #0346429 (Temperature)
	Omni Flow Computer; Model 3000; Serial #32530
North Cross Sales (Meter 801)	Rosemount; Smart Family; Serial #1168339 (Static Pressure)
	Rosemount; Smart Family; Serial #1168337 (Differential Pressure)
	Rosemount; Smart Family Model #644; Serial #010118 (Temperature)
Mid Cross Sales (Meter 601)	Rosemount; Smart Family; Serial #0924441 (Static Pressure)
	Rosemount; Smart Family; Serial #0924440 (Differential Pressure)
	Rosemount; Smart Family Model #644; Serial #010117 (Temperature)
Yates Sales (Meter 100)	Omni Flow Computer; Model 3000; Serial #32285
Fuel Gas Meters Located at Adjacent Gas Plants	
Grey Ranch	Total Flow; Model 6610; Serial # 23348
Puckett	Total Flow; Model 6413; Serial # 65015
Terrell	Total Flow; Model 6413; Serial # 6413X2D3J722
Mitchell	Total Flow; Model N/A; Serial # 69508 Total Flow Measurement & Control System – 6413 Flow Computer.
Sierra Madera	
Electricity Meters Located On-site	
Grey Ranch	Digital Meter ABB Model Type A1D
Puckett	Digital Meter ABB Model Type A1D
Terrell	Digital Meter ABB Model Type A1D
Mitchell	Digital Meter ABB Model Type A1D
Sierra Madera	Digital Meter ABB Model Type A1D
McCamey	Digital Meter ABB Model Type A1D
CO_2 sales gas and fuel gas composition	Gas Chromatograph; analysis performed by independent third party laboratory

The gross volume of CO_2 gas that is sold by Petro Source is metered at the custody transfer point at McCamey station. Five separate metering systems each measure the vent sourced CO_2 gas supplied to the CRC pipeline (Sharon Ridge, Sacroc, and Cogdell fields), the North Cross fields, the South Cross fields, the Mid Cross fields, and the Yates fields. Daily sales volumes measured by the five sales meters at McCamey are compiled each month to provide a monthly total of sales gas volumes sold by Petro Source. The meters are calibrated monthly to within ±2 percent by an independent company.

The total metered volumes at the five sales meters include the total vent sourced gas compressed at the five compressor stations. Redundant flow meters that measure the compressed CO_2 gas throughput are also located at each of the five compressor stations, serving as an independent check to the total sales volumes metered. These meters are calibrated monthly.

Fuel gas used to operate the engines at each of the five compressor stations is supplied by the gas plants that are located adjacent to each of the five compressor stations. Fuel flow rates are measured at these gas plants using calibrated orifice meters. The fuel flow meters are calibrated to within ±2 percent on a quarterly basis. Redundant fuel flow meters installed at each of the five compressor stations also measure the total fuel consumption at each station, and serve as a check on the total fuel consumption values. Electricity consumption rates at each compressor station and at McCamey are measured using electric meters that are calibrated and maintained by the electric power company.

The CO_2 gas and fuel gas compositions are analyzed once per month to quantify the mass fraction of organic species. These analytical procedures are performed in accordance with standard established procedures (e.g., Gas Processor’s Association (GPA) Methods 2261 and 2286).

5.3 Baseline Determination

Baseline emissions for Petro Source’s activities are the actual CO_2e emissions that would have been discharged to the atmosphere in the absence of Petro Source’s CO_2 capture and sequestration operations. However, this volume is not directly quantifiable because there is no measurement of the waste CO_2 gas generated by the gas plants and released to the atmosphere.

In the absence of a directly measurable baseline, two approaches were evaluated for quantifying the gross volume of gas that represents the theoretical total volume of gas that would have been released to the atmosphere as waste gas from the gas plants:

1. The first approach assumes the gross volume is equivalent to the CO_2 gas volume metered at the compressor stations (i.e., representative of the CO_2 volumes bought by Petro Source that were previously vented to the atmosphere). This approach would require estimating the CO_2 emissions associated with dehydrating, compressing, transporting, and distributing the CO_2 gas to the points of sequestration (the injection wells) to calculate the creation period leakages.

2. The second approach establishes the gross volume as the CO_2 gas volumes metered further downstream in the pipeline at the point of sale for enhanced oil recovery. The sales meter readings already account for any CO_2 gas losses that occur within the compressor stations, the pump station, and length of upstream pipeline.

In both approaches, any additional CO_2 that was generated and released to the atmosphere as a result of the sequestration operations (e.g., GHG emissions released from fuel burning in the compressor engines, and indirect emissions from electricity generation necessary to operate the compressor stations, electric-drive compressors, and the pump station) are included in the calculation of the net GHG emission reductions.

To ensure the most accurate estimate of the net ERs created for Petro Source's operations, the second approach is used. Since the sales volumes are accurately metered and monitored, these values are more accurate and verifiable than estimates of losses associated with upstream operations.

Since the sales gas contains trace amounts of VOCs and H_2S, some gas plant operators may be required to incinerate waste gas streams prior to venting. A review of available permit data and field observations indicated that the gas streams supplied to the Terrell and Mitchell compressor stations may require incineration prior to venting, if Petro Source did not capture those streams for EOR. Permit data for Pikes Peak indicated no such requirement and available information on Grey Ranch was not conclusive.

Based on these data, the baseline for this creation period was conservatively estimated by assuming the CH_4 in the vent streams from Terrell, Mitchell, and Grey Ranch would have been incinerated prior to venting. Additional conservative assumptions involve the exclusion from the baseline of GHG emissions that would have occurred from combustion of supplemental fuel in the incinerators and CO_2 emissions from combustion of higher hydrocarbons (ethane, propane, etc.) in the incinerated sales gas streams. These emissions are avoided by the project.

As shown in Figure 5-1, baseline emissions also include indirect CO_2e emissions that would have occurred from electricity used to compress underground-sourced CO_2 volumes (equal to Petro Source's vent-sourced volumes) at McElmo Dome for transport to the oil fields in West Texas. These emissions are avoided in the post-project scenario but would have occurred in the absence of the project, and therefore, these emissions are included in the project baseline.

In summary, baseline emissions include the gross gas volume which is the volume of CO_2 that is sold by Petro Source for injection into the enhanced oil recovery production wells, and avoided indirect emissions from electric-drive compressors at McElmo Dome.

5.4 Emission Reduction Calculation

The net emission reductions are calculated using the following equation:

$$\text{Net ERs created} = \text{Baseline Emissions} - \text{Project Emissions}$$
$$= (GV + IND_1) - (PE) \qquad \text{(Equation 5-1)}$$

where:

Net ER = Net emission reduction (expressed as tonnes CO_2e for this protocol);

GV = Gross volume of gas (based on monthly metered volumes and converted to tonnes CO_2e);

IND_1 = Indirect emissions that would have occurred from electricity usage to compress underground-sourced CO_2 for transport from McElmo Dome to the oil fields (expressed as tonnes CO_2e); and

PE = project emissions (estimated on a monthly basis).

The net reduction in CO_2e emissions takes into account the project emissions. These include the CO_2 and methane emissions associated with the fuel usage for compression operations and indirect emissions associated with electricity usage. A schematic showing the sources of these losses was shown Figure 5-1.

The approach for estimating PE takes into account losses and emissions associated with Petro Source's operations to capture, compress, and transport CO_2 to the injection wells, as defined below:

$$PE = CMB + IND_2 \qquad \text{(Equation 5-2)}$$

where:

CMB = Combustion emissions associated with compression of CO_2, tonnes CO_2e; and

IND_2 = Indirect emissions associated with electrical usage, tonnes CO_2e.

The emissions associated with combustion of natural gas to compress the CO_2 for transport is estimated based on a mass balance approach, assuming all carbon in the fuel is converted to CO_2. Methane emissions from the combustion exhaust are also taken into account and converted to a CO_2 equivalent basis, using a Global Warming Potential (GWP) of 21(EPA, 1999). This conservative approach double counts the carbon that remains in the exhaust as unburned methane.

Indirect emissions from electricity consumption at the compressor stations and the pump station are also taken into account.

<u>Sample Calculation</u>

The calculation procedures and algorithms are discussed using a detailed sample calculation for the gross volume (GV), avoided emissions (IND_1), project emissions ($CMB + IND_2$), and the net ERs for the month of July 2004. Calculation results on a monthly basis for the entire creation period are shown in Table A-1. Supporting data are included in Tables A-2 – A-9 (Appendix A).

The gross gas volumes (converted from scf/month to tonnes/month) reflect the total CO2e that would have been vented from the gas plants were calculated as the sum of the CO_2e sales metered to South Cross, North Cross, Mid Cross, Yates (Pecos Connection), and the production leases served by the CRC pipeline. The CO_2 and CH_4 concentrations in the gas were based on measured values for each month. Based A GWP of 21 was used for methane. Calculated values of GV for each month are shown in Table A-2.

For the baseline, the total CO_2 emissions were calculated as the sum of the CO_2 emissions from the sales gas (based on the measured CO_2 concentrations in the sales gas) and the CO_2 produced from the conversion of CH_4 to CO_2 during incineration of the sales gas stream.

CO_2 in sales gas= (Sales to South Cross + Sales to North Cross + Sales to Mid Cross[1] + Sales to Yates[1] + Sales to CRC[2])

= (Sales volume) × [CO_2 fraction]

$$= (639{,}250{,}000 + 303{,}780{,}000 + 0 + 0 + 636{,}340{,}000)\ \text{scf gas} \times \left(0.96437\,\frac{\text{scf CO}_2}{\text{scf gas}} \times \frac{\text{lb mole CO}_2}{379.3\,\text{scf CO}_2} \times 44\,\frac{\text{lb CO}_2}{\text{lb mole CO}_2} \times \frac{\text{tonne}}{2205\,\text{lb}}\right)$$
$$= 80{,}129\ \text{tonnes CO}_2$$

The CO_2 produced from CH_4 in the sales gas during incineration was based on the fraction of total sales gas that would have been incinerated under the baseline scenario. This includes sales gas obtained from Terrell, Mitchell, and Grey Ranch compressor stations. The sales gas obtained from Pikes Peak would not have to be incinerated under the baseline scenario. The fraction of sales gas incinerated was calculated from the sales gas volumes metered at each of the compressor stations. These data and the calculated fraction of gas incinerated are shown in Table A-9.

CO_2 from CH_4 combustion = (fraction of sales gas incinerated) x (total sales gas volume) x (CH_4 concentration in sales gas) x (conversion factors)

$$= (1.0) \times (639{,}250{,}000 + 303{,}780{,}000 + 0 + 0 + 636{,}340{,}000)\ \text{scf gas} \times \left(0.02196\,\frac{\text{scf CO}_2}{\text{scf gas}} \times \frac{\text{lb mole CO}_2}{379.3\,\text{scf CO}_2} \times 16\,\frac{\text{lb CH}_4}{\text{lb mole CH}_4} \times \frac{44\,\text{lb CO}_2}{16\,\text{lb CH}_4} \times \frac{\text{tonne}}{2205\,\text{lb}}\right)$$
$$= 1{,}825\ \text{tonnes CO}_2$$

The above estimate is conservative as it does not include CO_2 produced during the incineration of other hydrocarbons in the sales gas or that produced during the combustion of additional fuel that would have been used in the incinerator to combust the low-Btu sales gas stream.

The CH_4 emissions are calculated from

CH_4 in sales gas = (1.0 – fraction of sales gas incinerated) x (total sales gas volume) x (CH_4 concentration in sales gas) x (conversion factors)

---

[1] No sales to Mid Cross and Yates Units during July 2004
[2] Includes sales to Sharon Ridge, Oxy Cogdell, and Sacroc.

$$= (1-1)\times(639{,}250{,}000 + 303{,}780{,}000 + 0 + 0 + 636{,}340{,}000)\ \text{scf gas}\times \left(0.02196\ \frac{\text{scf CO}_2}{\text{scf gas}}\times\frac{\text{lb mole CO}_2}{379.3\ \text{scf CO}_2}\times 16\ \frac{\text{lb CH}_4}{\text{lb mole CH}_4}\times\frac{\text{tonne}}{2205\ \text{lb}}\right)$$

$$= 0\ \text{tonnes CH}_4$$

GV (July 2004) = 80,129 + 1,825 + 21 x 0

= 81,953 tonnes CO_2e

Baseline Emissions that would have occurred if underground-sourced CO_2 were purchased from McElmo Dome rather than recycling vent-sourced CO_2, were calculated based on the electricity required to drive the compressors. Fresh CO_2 from McElmo Dome would have to be compressed to approximately 2,300 psig and transported to the EOR sites. Electric-drive compressors for these operations would require about 800 kW-hr/MMscf based on discussions with McElmo Dome operations personnel and would generate indirect emissions (IND_1) at the power supplier's facility.

Indirect emissions were calculated from emission factors compiled by the U.S. Energy Information Administration (EIA) (EIA, 2002) for emissions of CO_2, CH_4, and N_2O from electric utilities in the State of Colorado. The total CO_2e emissions were calculated using a GWP of 21 for CH_4, and 310 for N_2O. Calculated values of IND_1 by month are included in Table A-2.

$$\text{IND}_1\ \text{(energy)} = (639{,}250 + 303{,}780 + 636{,}340)\ \text{MMscf gas}\times\frac{800\ \text{kW-hr}}{\text{MMscf gas}}\times\frac{\text{MW}}{1000\ \text{kW}}$$

$$= 1{,}263\ \text{MW-hrs}$$

$$\text{CO}_2\ \text{emissions} = 0.873\ \frac{\text{tonnes}}{\text{MW-hr}}\times 1{,}263\ \text{MW-hrs} = 1{,}103\ \text{tonnes}$$

$$\text{CH}_4\ \text{emissions} = 0.0127\ \frac{\text{lbs}}{\text{MW-hr}}\times 1{,}263\ \text{MW-hr}\times\frac{\text{tonne}}{2205\ \text{lbs}} = 0.007\ \text{tonnes}$$

$$\text{N}_2\text{O emissions} = 0.0289\ \frac{\text{lbs}}{\text{MW-hr}}\times 1{,}263\ \text{MW-hr}\times\frac{\text{tonne}}{2205\ \text{lbs}} = 0.017\ \text{tonnes}$$

$$\text{IND}_1\ \text{(Jul. 2004) CO}_2\text{e} = 1{,}103\ \text{tonnes} + (21\times 0.007\ \text{tonnes CH}_4) + (310\times 0.017\ \text{tonnes N}_2\text{O}) = 1{,}108\ \text{tonnes CO}_2\text{e}$$

CMB was calculated for each compressor station from the measured fuel consumption rates and fuel analysis data. These data are included in Tables A3 – A6. The fuel analysis provided information on fuel composition (i.e., percentage of methane, ethane) of the fuel and fuel properties (i.e., density, heating value). The CO_2 emissions from fuel combustion were conservatively estimated by assuming that all the carbon in the fuel is converted to CO_2 during the combustion process and discharged to the atmosphere.

Based on the monthly fuel analysis data, the moles of CO_2 emitted from the combustion of a mole of fuel was calculated for each month. An example calculation is shown in Table A-7 for the July 2004 data from the Grey Ranch compressor station. The CO_2 emissions were then calculated as shown below:

CMB = CO_2 Emissions at Grey Ranch + CO_2 Emissions at Puckett[3]
+ CO_2 Emissions at Terrell + CO_2 Emissions at Mitchell
+ CO_2 Emissions at Sierra Madera[1]

= (Fuel usage) × (heating value) × (CO_2 emitted based on the carbon balance, assuming complete combustion)

$$= \left[\begin{array}{l} (12{,}993)\ \text{MMBtu} \times \dfrac{10^6\ \text{Btu}}{\text{MMBtu}} \times \dfrac{\text{scf fuel}}{1{,}019\ \text{Btu}} \times \dfrac{\text{lb mole fuel}}{379.3\ \text{scf fuel}} \\ \times 1.031 \dfrac{\text{lb mole } CO_2}{\text{lb mole fuel}} \times 44 \dfrac{\text{lb } CO_2}{\text{lb mole } CO_2} \times \dfrac{\text{tonne}}{2205\ \text{lb}} \end{array} \right] + 0$$

$$\left[\begin{array}{l} (51{,}655)\ \text{MMBtu} \times \dfrac{10^6\ \text{Btu}}{\text{MMBtu}} \times \dfrac{\text{scf fuel}}{985\ \text{Btu}} \times \dfrac{\text{lb mole fuel}}{379.3\ \text{scf fuel}} \\ \times 0.999 \dfrac{\text{lb mole } CO_2}{\text{lb mole fuel}} \times 44 \dfrac{\text{lb } CO_2}{\text{lb mole } CO_2} \times \dfrac{\text{tonne}}{2205} \end{array} \right] +$$

$$\left[\begin{array}{l} (30{,}345)\ \text{MMBtu} \times \dfrac{10^6\ \text{Btu}}{\text{MMBtu}} \times \dfrac{\text{scf fuel}}{998\ \text{Btu}} \times \dfrac{\text{lb mole fuel}}{379.3\ \text{scf fuel}} \\ \times 1.005 \dfrac{\text{lb mole } CO_2}{\text{lb mole fuel}} \times 44 \dfrac{\text{lb } CO_2}{\text{lb mole } CO_2} \times \dfrac{\text{tonne}}{2205} \end{array} \right] + 0$$

$$= 689 + 0 + 2{,}757 + 1{,}608 + 0$$
$$= 5{,}053 \text{ tonnes } CO_2$$

To calculate emissions of CH_4 due to incomplete combustion of the fuel, all the fuel metered at the compressor station was assumed to be burned in the compressor engines. This is a reasonable assumption since any fuel consumed by the dehydrator and heaters located at some of the compressor stations is small in comparison. The CH_4 emissions were calculated

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[3] No fuel usage for Puckett and Sierra Madera compressor stations in July 2004.

from U.S. Environmental Protection Agency (EPA) AP-42 emission factors for 2-stroke gas-fired engines (EPA, 2000).

For example, the CH_4 emissions from the combustion sources for July 2004 are calculated as:

$$
\begin{aligned}
CH_4 \text{ Emissions} &= (\text{emission factor}) \times (\text{fuel usage}) \\
&= \left[(1.45)\ \frac{\text{lb}}{\text{MMBtu}} \times (12{,}993)\ \text{MMBtu} \times \frac{\text{tonne}}{2205\ \text{lb}} \right] + 0 \\
&+ \left[(1.45)\ \frac{\text{lb}}{\text{MMBtu}} \times (51{,}655)\ \text{MMBtu} \times \frac{\text{tonne}}{2205\ \text{lb}} \right] \\
&+ \left[(1.45)\ \frac{\text{lb}}{\text{MMBtu}} \times (30{,}345)\ \text{MMBtu} \times \frac{\text{tonne}}{2205\ \text{lb}} \right] + 0 \\
&= 9 + 0 + 34 + 0 + 20 \\
&= 62 \text{ tonnes } CH_4
\end{aligned}
$$

Finally, the CO_2 equivalent (CO_2e) emissions for combustion sources were calculated using a GWP of 21 for methane.

$$
\begin{aligned}
\text{CMB (Jul. 2004) } CO_2e &= CO_2 + (21 \times CH_4) \\
&= 5{,}053 + (21 \times 62) \\
&= 6{,}364 \text{ tonnes } CO_2e
\end{aligned}
$$

Indirect emissions (IND_2) were calculated from emission factors compiled by the U.S. Energy Information Administration (EIA) (EIA, 2002) for emissions of CO_2, CH_4, and N_2O from electric utilities in the State of Texas. The indirect emissions represent the emissions due to the generation of electricity required to operate the five compressor stations and the McCamey pump station. These emissions were calculated from actual electricity usage data as reflected in the electric utility bills for each station. Electricity usage data and calculated emissions by month are shown in Table A-8. The total CO_2e emissions were calculated using a GWP of 21 for CH_4 and 310 for N_2O.

$$
\begin{aligned}
&\text{Emissions} = (\text{emission factor}) \times (\text{electrical usage}) \\
&CO_2 \text{Emissions} = (0.664)\ \frac{\text{tonne } CO_2}{\text{MW - hr}} \times \frac{\text{MW}}{1000\ \text{kW}} \\
&\qquad \times [152{,}400 + 0 + 306{,}600 + 32{,}720 + 0 + 161{,}682]\ \text{kW - hr} \\
&\qquad = 434 \text{ tonnes } CO_2
\end{aligned}
$$

$$CH_4 \text{ Emissions} = (3.49 \times 10^{-6}) \frac{\text{tonne } CH_4}{\text{MW - hr}} \times \frac{\text{MW}}{1000\ k\text{W}}$$
$$\times [152{,}400 + 0 + 306{,}600 + 32{,}720 + 0 + 161{,}682] \text{ kW - hr}$$
$$= 0.002 \text{ tonne } CH_4$$

$$N_2O \text{ Emissions} = (6.62 \times 10^{-6}) \frac{\text{tonne } N_2O}{\text{MW - hr}} \times \frac{\text{MW}}{1000\ k\text{W}}$$
$$\times [152{,}400 + 0 + 306{,}600 + 32{,}720 + 0 + 161{,}682] \text{ kW - hr}$$
$$= 0.004 \text{ tonne } N_2O$$

$$IND_2 \text{ (Jul. 2004) } CO_2e = 434 \text{ tonnes } CO_2 + (21 \times 0.002 \text{ tonnes } CH_4)$$
$$+ (310 \times 0.004 \text{ tonnes } N_2O)$$
$$= 435 \text{ tonnes } CO_2e$$

Project Emissions during July 2004 is:

$$PE \text{ (Jul. 2004)} = CMB + IND_2$$
$$= 6{,}364 + 435$$
$$= 6{,}800 \text{ tonnes } CO_2e$$

The net ER created for July 2004 is calculated from:

$$\text{Net ER} = GV + IND_1 - PE$$
$$= 81{,}953 + 1{,}108 - 6{,}800$$
$$= 76{,}262 \text{ tonnes } CO_2e$$

ERs Created

The total net ERs generated from the Petro Source sequestration activities are expressed as the difference between baseline emissions and the project emissions on a monthly basis over the creation period. The equation for estimating the net emission reductions follows, with each variable defined below.

$$\text{Net ER} = \sum_{i=1}^{CA} (GV + IND_1 - PE) \qquad \text{(Equation 5-3)}$$

where:

Net ER = Net emission reduction (tonnes CO_2e for creation period) summed for each of the months included in the creation period;
GV = Gross volume of sales gas (tonnes CO_2e on a monthly basis);
IND_1 = Avoided emissions (tonnes CO_2e on a monthly basis);
PE = Project Emissions (tonnes CO_2e on a monthly basis); and
CA = Creation period activity (month).

The net emission reduction is summed over each month of operation during the creation period, July 2004 through July 2006.

Table 5-2 presents the annual and total GHG emission reductions (expressed as CO_2e) associated with Petro Source's sequestration operations over the creation period. Detailed calculation results on a monthly basis are summarized in Appendix A.

Table 5-2. Annual Net Emission Reduction Summary (tonnes CO_2e)

	2004 (Jul. – Dec.)	2005 (Jan. – Dec.)	2006 (Jan. – Jul.)	TOTAL (Jul. 2004 – Jul. 2006)
GV	518,977	1,397,809	820,701	2,737,487
IND_1	6,900	17,325	10,203	34,428
Total Baseline	**525,877**	**1,415,134**	**830,904**	**2,771,915**
CMB	39,781	93,335	59,708	192,824
IND_2	2,429	14,838	9,871	27,138
PE	**42,210**	**108,174**	**69,578**	**219,962**
Net ER	**483,667**	**1,306,960**	**761,326**	**2,551,953**

5.5 Verifiability

The data sources used to develop the emission are readily verifiable by third party review. Measurement data records (i.e., metered volumes, fuel usage rates, electrical usage rates) are managed by Petro Source and are available for audit. Sample calculations for the emission reductions are provided in Section 5-4. All assumptions are documented and data sources are referenced.

Verification activities could include the following:

- Verify composition and metered volumes of CO_2 injection gas sold to customers that are serviced by the CRC pipeline, North Cross, South Cross, Mid Cross, and Yates fields. These volumes are metered at the McCamey pump station. Volumes can be compared against redundant measurements made by Petro Source at each compressor station. Monthly volumes are obtained from daily records that are maintained by Petro Source. Injected gas composition analysis is performed by an independent third-party. These records are managed by Petro Source.

- Verify fuel usage and composition data. Fuel usage data are provided to Petro Source by the individual gas plants supplying the fuel. Redundant fuel flow measurements are performed by Petro Source at individual compressor stations. Fuel composition analysis is performed by an independent third-party. Both fuel usage and fuel composition records are managed by Petro Source.

- Verify electricity usage data. Monthly electric energy usage for the five compressor stations and the McCamey pump station are billed by individual power companies. These bills are retained by Petro Source.

- Verify emission factors, estimation methodology, and documents related to ownership of emission created by the project.

6.0 Reporting of Emission Reductions

The emission reductions spreadsheet workbook to be submitted with the creation report will follow the calculation procedures shown in Section 5-4. The workbook contains the following sheets

- Creation period summary by month showing baseline emissions, project emissions, and emissions reductions.
- Spreadsheets showing direct project emission calculations for each compressor station
- Spreadsheet showing indirect project emission calculations for each compressor station and the McCamey pump station.
- Spreadsheets showing the calculation of CO_2 emissions based on fuel combustion for each compressor station.

7.0 Other Impacts

7.1 Internal Impacts

Petro Source's sequestration operations involve the compression of CO_2 for gathering and transport to downstream oil reservoirs. The compression operation requires the combustion of natural gas, which results in NO_x, CO, and VOC emissions associated with combustion. Estimates of NO_x, CO, and VOC emissions for the creation period were calculated from the fuel usage rates measured for the Petro Source compressor engines and appropriate emission factors based on AP-42 (EPA, 2000). These emissions are small, compared to the volume of CO_2 sequestered as a direct result of the project and the remote location of the project in West Texas.

7.2 External Impacts

The use of electricity to operate the compressors results in air emissions of $NO_{x,}$ SO_2 and mercury (Hg) associated with the fossil fuel combustion required for electricity generation at the electric power supplier's facility. However, these emissions are offset by the avoided emissions due to reduced electricity usage at McElmo Dome.

8.0 Documents Examined

Bachu, S., Sequestration of CO_2 in geologic media: criteria and approach for site selection in response to climate change, Energy Conversion & Management, 41:954, (2000).

Baes, C.F., S.E. Beall, and D.W. Lee, *The Collection, Disposal, and Storage of Carbon Dioxide*, Interactions of Energy and Climate, W. Bach, J. Pankrath, and J. Williams, Eds. Reidel Publishing Co., pp. 495-519 (1980).

Clark, N.J., *Elements of Petroleum Reservoirs*, Society of Petroleum Engineers at AIME, USA, p 195, (1969).

Climate Change 1995. Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Section 19.2.3.3, Cambridge University Press, 1996.

Department of Energy (DOE). *Instructions for Form EIA 1605 Voluntary Reporting of Greenhouse Gases*, Appendix C – Adjusted Electricity Emission Factors by State. DOE-EIA Form 1605(b), Sector Specific Issues (Volumes 1 and 2), 1997.

Energy Information Administration (EIA). *Updated State- and Regional-level Greenhouse Gas Emission Factors for Electricity* (March 2002). http://eia.doe.gov/pub/oiaf/1605/dcrom/pdf/e-supdoc.pdf.

ISO, *Guide to the Expression of Uncertainty in Measurement*, Geneva, Switzerland, 1995.

Sparrow, F.T., et al., *Carbon Dioxide from Flue Gases for Enhanced Oil Recovery*, ANL-CNSV-65, Argonne National Laboratory, Argonne, IL (1988).

Tanaka, S., H. Koide, and A. Sasagawa, *Possibility of Underground CO_2 Sequestration in Japan*, Energy Conversion & Management, 36:527-530 (1995).

U.S. Environmental Protection Agency (EPA). *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources*, AP-42, (GPO 055-000-005-001), U.S. EPA Office of Air Quality Planning and Standards, Fifth Edition, Supplement F, Table 3.2-1, July, 2000.

U.S. Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997*. EPA 236-R-99-003, U.S. EPA Office of Policy Planning and Evaluation, April, 1999.

U.S. Environmental Protection Agency. *Protocol for Equipment Leak Emission Estimates*, EPA 453/R-95-017, U.S. EPA Office of Air Quality Planning and Standards, November, 1995.

9.0 Warranty

"I hereby warrant that all information provided in this protocol is true and factual and that all matters affecting the validity of this protocol or consequent emission reduction claims have been fully disclosed. This protocol has not been previously registered with any other emission reduction agency or program."

Lauren Kimble ________________________________

Appendix A

Petro Source Data Supporting Calculations

Table A-1. Summary of Baseline Emissions, Project Emissions, and Emissions Reductions by Month (tonnes CO_2e)

Month-Year	Baseline Emissions			Project Emissions			Emission Reductions
	Metered Volumes (GV)	Avoided Emissions (IND_1)	Total	Combustion (CMB)	Indirects (IND_2)	Total	
July-04	81,953	1,108	83,062	6,364	435	6,800	**76,262**
August-04	84,127	1,138	85,264	7,074	422	7,496	**77,769**
September-04	73,934	1,000	74,933	6,382	352	6,734	**68,199**
October-04	94,644	1,243	95,887	7,089	527	7,616	**88,271**
November-04	90,125	1,166	91,291	6,261	371	6,632	**84,659**
December-04	94,194	1,245	95,439	6,611	322	6,933	**88,506**
January-05	108,634	1,378	110,012	7,579	495	8,073	**101,939**
February-05	106,372	1,341	107,713	7,420	810	8,231	**99,482**
March-05	138,380	1,710	140,090	9,066	1,281	10,347	**129,743**
April-05	115,821	1,408	117,229	6,865	1,997	8,862	**108,367**
May-05	108,383	1,403	109,786	7,634	1,621	9,255	**100,530**
June-05	101,135	1,296	102,431	7,178	641	7,819	**94,612**
July-05	114,306	1,464	115,770	7,742	912	8,654	**107,116**
August-05	119,844	1,558	121,402	9,348	984	10,332	**111,070**
September-05	125,955	1,516	127,471	8,475	1,002	9,477	**117,994**
October-05	124,129	1,478	125,607	7,474	1,364	8,838	**116,769**
November-05	116,124	1,361	117,485	7,110	1,748	8,858	**108,627**
December-05	118,726	1,412	120,138	7,445	1,983	9,427	**110,711**
January-06	110,190	1,334	111,524	7,074	1,971	9,045	**102,479**
February-06	91,471	1,188	92,660	6,213	1,709	7,922	**84,738**
March-06	115,582	1,479	117,061	9,010	1,543	10,553	**106,508**
April-06	119,631	1,491	121,122	8,865	1,304	10,169	**110,952**
May-06	131,475	1,639	133,115	9,942	1,144	11,087	**122,028**
June-06	126,415	1,528	127,942	9,052	1,353	10,404	**117,538**
July-06	125,936	1,545	127,481	9,551	847	10,398	**117,083**
TOTAL (Jul. - Dec. 2004)	518,977	6,900	525,877	39,781	2,429	42,210	**483,667**
TOTAL (Jan. - Dec. 2005)	1,397,809	17,325	1,415,134	93,335	14,838	108,174	**1,306,960**
TOTAL (Jan. - Jul. 2006)	820,701	10,203	830,904	59,708	9,871	69,578	**761,326**

Table A-2. Metered Sales Gas Volumes, Gas Composition, and Avoided Emissions (IND_1) by Month

	Metered Volumes						Gas Comp.		GHG Content						Avoided Indirect Emissions				
Month-Year	Pecos	CRC	North Cross	South Cross	Mid Cross	Total	CO_2	CH_4	CO_2 (A)	CH_4 (B)	CH4 incinerated (C)	CO2 from incinerated CH4 (D)	CH4 Vented (E=B-C)	Total CO2e (GV= A+D+21xE)	Avoided Energy Usage	CO_2	CH_4	N_2O	Total CO_2e (IND_1)
	(Mscf)						(% mole)		(tonnes)						(MW-hr)	(tonnes)			
July-04		636,340	303,780	639,250		1,579,370	96.437	2.196	80,129	664	664	1,825	-	**81,953**	1,263	1,103	0.007	0.017	**1,108**
August-04		561,090	365,930	694,310		1,621,330	95.921	2.707	81,818	840	840	2,309	-	**84,127**	1,297	1,132	0.007	0.017	**1,138**
September-04		463,600	324,230	636,680		1,424,510	95.711	2.943	71,728	802	802	2,206	-	**73,934**	1,140	995	0.007	0.015	**1,000**
October-04		637,900	368,440	764,370		1,770,710	96.588	2.34	89,977	793	656	1,805	136	**94,644**	1,417	1,237	0.008	0.019	**1,243**
November-04		617,550	380,800	663,890		1,662,240	96.588	2.34	84,465	744	546	1,502	198	**90,125**	1,330	1,161	0.008	0.017	**1,166**
December-04	293,660	390,690	388,140	701,980		1,774,470	97.409	1.347	90,935	457	348	956	110	**94,194**	1,420	1,239	0.008	0.019	**1,245**
January-05	310,269	465,530	386,720	800,910		1,963,429	95.122	3.699	98,256	1,389	1,030	2,833	359	**108,634**	1,571	1,371	0.009	0.021	**1,378**
February-05	276,619	565,720	335,020	734,030		1,911,389	95.141	3.919	95,670	1,433	1,063	2,922	370	**106,372**	1,529	1,335	0.009	0.020	**1,341**
March-05	467,043	737,190	374,120	858,650		2,437,003	95.141	3.919	121,979	1,827	1,204	3,310	623	**138,380**	1,950	1,702	0.011	0.026	**1,710**
April-05	292,688	474,598	344,760	894,550		2,006,596	95.455	3.4	100,767	1,305	677	1,862	628	**115,821**	1,605	1,401	0.009	0.021	**1,408**
May-05	361,172	364,580	365,900	907,270		1,998,922	97.106	1.721	102,118	658	414	1,139	244	**108,383**	1,599	1,396	0.009	0.021	**1,403**
June-05	358,322	332,760	332,220	823,000		1,846,302	96.145	2.605	93,388	920	634	1,744	286	**101,135**	1,477	1,289	0.009	0.019	**1,296**
July-05	347,355	316,060	354,559	1,068,180		2,086,154	96.662	2.148	106,087	857	536	1,474	321	**114,306**	1,669	1,457	0.010	0.022	**1,464**
August-05	384,280	423,681	360,839	1,050,799		2,219,599	96.705	1.97	112,924	837	583	1,604	253	**119,844**	1,776	1,550	0.010	0.023	**1,558**
September-05	360,099	387,570	347,130	1,065,420		2,160,219	94.564	4.255	107,469	1,758	1,010	2,779	748	**125,955**	1,728	1,509	0.010	0.023	**1,516**
October-05	205,337	242,310	361,590	1,297,594		2,106,831	94.564	4.255	104,813	1,715	915	2,516	800	**124,129**	1,685	1,471	0.010	0.022	**1,478**
November-05	617	213,210	358,140	1,305,145	62,226	1,939,338	94.453	4.46	96,367	1,655	821	2,259	833	**116,124**	1,551	1,354	0.009	0.020	**1,361**
December-05		225,280	372,710	1,335,860	78,520	2,012,370	95.422	3.615	101,022	1,392	631	1,736	760	**118,726**	1,610	1,405	0.009	0.021	**1,412**
January-06	-	169,550	392,610	1,280,870	57,420	1,900,450	95.681	3.202	95,663	1,164	544	1,495	621	**110,190**	1,520	1,327	0.009	0.020	**1,334**
February-06	-	168,800	464,520	1,001,680	58,390	1,693,390	96.849	1.23	86,281	398	174	479	224	**91,471**	1,355	1,183	0.008	0.018	**1,188**
March-06	193,859	213,510	601,340	1,044,470	53,740	2,106,919	97.348	1.863	107,904	751	443	1,219	308	**115,582**	1,686	1,471	0.010	0.022	**1,479**
April-06	428,652	174,140	534,880	940,420	46,450	2,124,542	95.595	3.364	106,847	1,367	873	2,400	494	**119,631**	1,700	1,484	0.010	0.022	**1,491**
May-06	416,716	223,610	574,660	1,083,810	37,075	2,335,871	96.398	2.698	118,462	1,206	674	1,854	531	**131,475**	1,869	1,631	0.011	0.024	**1,639**
June-06	375,837	225,900	570,700	899,600	104,730	2,176,767	94.91	4.107	108,689	1,710	997	2,741	714	**126,415**	1,741	1,520	0.010	0.023	**1,528**
July-06	379,379	215,830	509,520	992,360	104,650	2,201,739	94.824	4.188	109,836	1,764	1,148	3,156	616	**125,936**	1,761	1,538	0.010	0.023	**1,545**
TOTAL (Jul. - Dec. 2004)	293,660	3,307,170	2,131,320	4,100,480	-	9,832,630			499,051	4,299	3,855	10,602	444	**518,977**	7,866	6,867	0.045	0.103	**6,900**
TOTAL (Jan. - Dec. 2005)	3,363,801	4,748,489	4,293,708	12,141,408	140,746	24,688,152			1,240,862	15,746	9,519	26,178	6,227	**1,397,809**	19,751	17,242	0.114	0.259	**17,325**
TOTAL (Jan. - Jul. 2006)	1,794,443	1,391,340	3,648,230	7,243,210	462,455	14,539,678			733,681	8,361	4,852	13,344	3,508	**820,701**	11,632	10,155	0.067	0.152	**10,203**

Table A-3. Fuel Usage, Project Combustion Emissions (CMB), and Fuel Properties by Month for Grey Ranch Compressor Station

Month-Year	Station Fuel Usage		Emissions			Fuel Composition (mole %)												Mole CO_2/mole fuel	Fuel HHV (Btu/scf)
	(MMBtu)	(scf)	CO_2 (tonnes)	CH_4 (tonnes)	CO_2e (tonnes)	Nitrogen	CO_2	methane	ethane	propane	n-butane	iso-butane	n-pentane	iso-pentane	hexanes/+	heptanes +	Total		
July-04	12,933	12,691,855	689	9	867	0.730	1.194	95.428	1.966	0.387	0.112	0.049	0.037	0.034	0.034	0.028	99.999	1.031	1,019
August-04	19,981	19,705,128	1,057	13	1,333	1.111	0.637	96.029	1.735	0.303	0.066	0.039	0.020	0.023	0.018	0.020	100.001	1.019	1,014
September-04	16,909	16,352,998	899	11	1,132	1.196	0.623	94.230	2.894	0.676	0.141	0.083	0.030	0.035	0.029	0.061	99.998	1.045	1,034
October-04	9,132	8,797,688	486	6	612	1.162	0.568	94.145	2.868	0.792	0.196	0.102	0.044	0.050	0.035	0.037	99.999	1.050	1,038
November-04	2,390	2,302,505	127	2	160	1.162	0.568	94.145	2.868	0.792	0.196	0.102	0.044	0.050	0.035	0.037	99.999	1.050	1,038
December-04	2,733	2,632,948	145	2	183	1.162	0.568	94.145	2.868	0.792	0.196	0.102	0.044	0.050	0.035	0.037	99.999	1.050	1,038
January-05	13,996	13,721,569	741	9	935	1.020	0.683	95.574	2.077	0.425	0.088	0.051	0.024	0.025	0.018	0.015	100.000	1.027	1,020
February-05	18,950	18,578,431	1,005	12	1,267	1.093	0.784	95.377	2.079	0.396	0.089	0.051	0.027	0.029	0.025	0.049	99.999	1.028	1,020
March-05	27,103	26,339,164	1,440	18	1,814	1.413	0.610	94.386	2.583	0.600	0.147	0.084	0.041	0.044	0.037	0.055	100.000	1.039	1,029
April-05	24,304	23,944,828	1,286	16	1,622	1.121	0.678	96.017	1.627	0.326	0.072	0.044	0.021	0.025	0.018	0.051	100.000	1.021	1,015
May-05	26,799	26,402,956	1,418	18	1,788	1.121	0.678	96.017	1.627	0.326	0.072	0.044	0.021	0.025	0.018	0.051	100.000	1.021	1,015
June-05	11,173	11,029,615	591	7	745	1.000	0.696	96.269	1.588	0.266	0.061	0.039	0.016	0.020	0.016	0.030	100.001	1.018	1,013
July-05	19,387	19,006,863	1,027	13	1,295	0.876	0.725	95.780	2.056	0.340	0.079	0.048	0.024	0.027	0.020	0.025	100.000	1.027	1,020
August-05	40,990	40,304,818	2,169	27	2,735	1.009	0.656	95.949	1.853	0.323	0.069	0.045	0.020	0.020	0.018	0.038	100.000	1.023	1,017
September-05	30,778	30,144,956	1,636	20	2,061	0.838	0.936	95.423	2.094	0.431	0.098	0.057	0.030	0.033	0.025	0.034	99.999	1.032	1,021
October-05	3,893	3,812,929	207	3	261	0.838	0.936	95.423	2.094	0.431	0.098	0.057	0.030	0.033	0.025	0.034	99.999	1.032	1,021
November-05	10,454	10,238,981	556	7	700	0.838	0.936	95.423	2.094	0.431	0.098	0.057	0.030	0.033	0.025	0.034	99.999	1.032	1,021
December-05	16,718	17,306,418	898	11	1,128	1.437	2.812	95.738	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	100.001	0.986	966
January-06	16,918	17,513,458	908	11	1,142	1.437	2.812	95.738	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	100.001	0.986	966
February-06	14,091	14,586,957	785	9	980	0.725	1.136	96.094	1.475	0.322	0.087	0.043	0.028	0.028	0.021	0.039	99.998	1.023	966
March-06	29,524	30,531,541	1,591	19	1,999	1.352	3.124	95.314	0.157	0.000	0.000	0.000	0.000	0.000	0.053	0.000	100.000	0.991	967
April-06	41,953	43,161,523	2,249	28	2,828	1.231	2.595	95.982	0.174	0.000	0.000	0.000	0.000	0.000	0.018	0.000	100.000	0.990	972
May-06	44,997	46,293,210	2,414	30	3,036	1.292	2.692	95.812	0.150	0.000	0.000	0.000	0.000	0.000	0.054	0.000	100.000	0.991	972
June-06	43,243	44,261,003	2,314	28	2,911	1.133	2.378	96.205	0.223	0.000	0.000	0.000	0.000	0.000	0.060	0.000	99.999	0.994	977
July-06	44,961	46,447,314	2,412	30	3,033	1.344	2.714	95.883	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	99.999	0.987	968
TOTAL (Jul. - Dec. 2004)	64,078	62,483,122	3,402	42	**4,287**														
TOTAL (Jan. - Dec. 2005)	244,545	240,831,527	12,974	161	**16,351**														
TOTAL (Jan. - Jul. 2006)	235,687	242,795,005	12,674	155	**15,929**														
Note:																			
For highlited months, fuel composition data were based on previous month's values																			

Table A-4. Fuel Usage, Project Combustion Emissions (CMB), and Fuel Properties by Month for Terrell Compressor Station

Month-Year	Station Fuel Usage		Emissions			Fuel Composition (mole %)											Mole CO_2/mole fuel	Fuel HHV (Btu/scf)
	(MMBtu)	(scf)	CO_2 (tonnes)	CH_4 (tonnes)	CO_2e (tonnes)	Nitrogen	CO_2	methane	ethane	propane	n-butane	iso-butane	n-pentane	iso-pentane	hexanes +	Total		
July-04	51,655	52,441,624	2,757	34	3,470	0.573	2.219	96.748	0.425	0.030	0.002	0.002	0.001	0.000	0.000	100.000	0.999	985
August-04	56,821	57,686,294	3,031	37	3,816	0.606	2.090	96.865	0.405	0.030	0.002	0.002	0.000	0.000	0.000	100.000	0.999	985
September-04	49,107	50,109,184	2,631	32	3,309	0.644	2.551	96.379	0.406	0.018	0.001	0.001	0.000	0.000	0.000	100.000	0.998	980
October-04	61,590	62,591,463	3,286	41	4,137	0.575	2.184	96.869	0.372	0.000	0.000	0.000	0.000	0.000	0.000	100.000	0.998	984
November-04	52,405	53,257,114	2,796	34	3,520	0.575	2.184	96.869	0.372	0.000	0.000	0.000	0.000	0.000	0.000	100.000	0.998	984
December-04	56,010	56,862,944	2,987	37	3,760	0.591	2.079	96.923	0.381	0.026	0.000	0.000	0.000	0.000	0.000	100.000	0.998	985
January-05	57,236	58,107,614	3,051	38	3,842	0.580	2.120	96.915	0.377	0.005	0.001	0.001	0.000	0.001	0.000	100.000	0.998	985
February-05	52,848	54,092,119	2,842	35	3,571	0.566	2.951	96.089	0.372	0.017	0.002	0.002	0.000	0.001	0.000	100.000	0.999	977
March-05	56,814	58,151,484	3,055	37	3,839	0.566	2.951	96.089	0.372	0.017	0.002	0.002	0.000	0.001	0.000	100.000	0.999	977
April-05	22,858	23,229,675	1,221	15	1,537	0.567	2.257	96.735	0.400	0.035	0.003	0.002	0.001	0.001	0.000	100.001	0.999	984
May-05	36,488	37,043,655	1,945	24	2,449	0.583	2.101	96.949	0.361	0.002	0.001	0.001	0.001	0.001	0.000	100.000	0.998	985
June-05	54,306	55,189,024	2,896	36	3,646	0.645	2.097	96.878	0.367	0.014	0.000	0.000	0.000	0.000	0.000	100.001	0.998	984
July-05	49,332	50,134,146	2,633	32	3,314	0.576	2.134	96.918	0.352	0.016	0.001	0.001	0.000	0.000	0.000	99.998	0.998	984
August-05	54,204	55,085,366	2,892	36	3,641	0.624	2.121	96.858	0.381	0.015	0.001	0.001	0.000	0.000	0.000	100.001	0.998	984
September-05	47,985	48,765,244	2,557	32	3,220	0.720	2.053	96.840	0.365	0.021	0.000	0.000	0.000	0.000	0.000	99.999	0.997	984
October-05	54,948	55,841,463	2,929	36	3,687	0.720	2.053	96.840	0.365	0.021	0.000	0.000	0.000	0.000	0.000	99.999	0.997	984
November-05	54,034	55,136,735	2,895	36	3,641	0.589	2.560	96.471	0.364	0.014	0.001	0.001	0.000	0.000	0.000	100.000	0.998	980
December-05	52,917	53,613,982	2,816	35	3,546	0.581	1.854	97.180	0.364	0.021	0.000	0.000	0.000	0.000	0.000	100.000	0.998	987
January-06	54,051	54,985,758	2,889	36	3,635	0.571	2.282	96.732	0.398	0.016	0.001	0.001	0.000	0.000	0.000	100.001	0.999	983
February-06	47,410	48,279,022	2,537	31	3,191	0.596	2.379	96.578	0.425	0.020	0.001	0.001	0.000	0.000	0.000	100.000	0.999	982
March-06	53,184	54,103,764	2,843	35	3,577	0.578	2.379	96.606	0.417	0.020	0.000	0.000	0.000	0.000	0.000	100.000	0.999	983
April-06	44,643	45,322,843	2,381	29	2,997	0.558	2.121	96.921	0.399	0.000	0.000	0.000	0.000	0.000	0.000	99.999	0.998	985
May-06	50,850	51,676,829	2,715	33	3,417	0.545	2.281	96.756	0.418	0.000	0.000	0.000	0.000	0.000	0.000	100.000	0.999	984
June-06	49,643	50,450,203	2,651	33	3,337	0.566	2.258	96.759	0.408	0.019	0.000	0.000	0.000	0.000	0.000	100.010	0.999	984
July-06	49,643	50,450,203	2,649	33	3,335	0.583	2.194	96.830	0.393	0.000	0.000	0.000	0.000	0.000	0.000	100.000	0.998	984
TOTAL (Jul. - Dec. 2004)	327,588	332,948,624	17,488	215	**22,012**													
TOTAL (Jan. - Dec. 2005)	593,970	604,390,507	31,732	391	**39,934**													
TOTAL (Jan. - Jul. 2006)	349,424	355,268,623	18,665	230	**23,490**													
Note:																		
For highlited months, fuel composition data were based on previous month's values																		

Table A-5. Fuel Usage, Project Combustion Emissions (CMB), and Fuel Properties by Month for Mitchell Compressor Station

Month-Year	Station Fuel Usage		Emissions (tonnes)			Fuel Composition (mole %)												Mole CO_2/mole fuel	Fuel HHV (Btu/scf)
	(MMBtu)	(scf)	CO_2	CH_4	CO_2e	Nitrogen	CO_2	methane	ethane	propane	n-butane	iso-butane	n-pentane	iso-pentane	hexanes	heptanes +	Total		
July-04	30,345	30,405,812	1,608	20	2,027	0.577	1.336	97.343	0.623	0.027	0.019	0.009	0.012	0.011	0.017	0.026	100.000	1.005	998
August-04	28,844	28,901,804	1,527	19	1,925	0.588	1.202	97.483	0.632	0.018	0.013	0.007	0.01	0.009	0.014	0.024	100.000	1.004	998
September-04	28,966	29,024,048	1,540	19	1,940	0.605	1.621	96.945	0.645	0.029	0.02	0.01	0.014	0.012	0.02	0.079	100.000	1.009	998
October-04	25,583	25,685,743	1,359	17	1,713	0.578	1.6	96.99	0.717	0.028	0.017	0.009	0.01	0.009	0.014	0.028	100.000	1.006	996
November-04	25,691	25,794,177	1,365	17	1,720	0.578	1.6	96.99	0.717	0.028	0.017	0.009	0.01	0.009	0.014	0.028	100.000	1.006	996
December-04	26,468	26,521,042	1,408	17	1,774	0.56	1.606	96.831	0.849	0.031	0.019	0.01	0.013	0.011	0.02	0.049	99.999	1.009	998
January-05	26,254	26,227,772	1,387	17	1,749	0.598	1.02	97.637	0.623	0.023	0.023	0.011	0.016	0.013	0.022	0.015	100.001	1.005	1001
February-05	23,510	23,463,074	1,243	15	1,567	0.596	1.005	97.643	0.607	0.023	0.019	0.008	0.012	0.011	0.017	0.059	100.000	1.007	1002
March-05	27,446	27,391,218	1,451	18	1,830	0.596	1.005	97.643	0.607	0.023	0.019	0.008	0.012	0.011	0.017	0.059	100.000	1.007	1002
April-05	27,183	27,183,000	1,439	18	1,814	0.656	1.148	97.381	0.659	0.031	0.028	0.013	0.018	0.015	0.022	0.03	100.001	1.006	1000
May-05	26,802	26,855,711	1,420	18	1,790	0.596	1.296	97.399	0.576	0.03	0.026	0.012	0.017	0.014	0.021	0.015	100.002	1.005	998
June-05	24,956	25,006,012	1,322	16	1,667	0.595	1.315	97.368	0.599	0.025	0.018	0.008	0.012	0.01	0.014	0.037	100.001	1.005	998
July-05	24,660	24,734,203	1,304	16	1,644	0.598	1.144	97.746	0.416	0.023	0.016	0.008	0.01	0.009	0.012	0.018	100.000	1.002	997
August-05	24,956	25,081,407	1,322	16	1,667	0.602	1.346	97.679	0.245	0.022	0.014	0.008	0.012	0.01	0.016	0.047	100.001	1.002	995
September-05	21,465	21,529,589	1,138	14	1,434	0.608	1.343	97.282	0.658	0.026	0.018	0.009	0.011	0.01	0.013	0.021	99.999	1.005	997
October-05	23,746	23,817,452	1,259	16	1,587	0.608	1.343	97.282	0.658	0.026	0.018	0.009	0.011	0.01	0.013	0.021	99.999	1.005	997
November-05	11,202	11,224,449	593	7	748	0.595	1.268	97.505	0.51	0.026	0.017	0.008	0.011	0.009	0.013	0.038	100.000	1.004	998
December-05	8,069	8,101,406	428	5	540	0.608	1.519	97.124	0.628	0.03	0.018	0.009	0.011	0.01	0.012	0.032	100.001	1.005	996
January-06	3,301	3,314,257	175	2	221	0.608	1.519	97.124	0.628	0.03	0.018	0.009	0.011	0.01	0.012	0.032	100.001	1.005	996
February-06	326	327,309	17	0	22	0.608	1.519	97.124	0.628	0.03	0.018	0.009	0.011	0.01	0.012	0.032	100.001	1.005	996
March-06	21,665	21,795,775	1,150	14	1,450	0.695	1.484	97.135	0.573	0.026	0.017	0.004	0.004	0.003	0.06	0	100.001	1.003	994
April-06	19,623	19,662,325	1,041	13	1,312	0.596	1.357	97.33	0.561	0.027	0.015	0.004	0	0	0.111	0	100.001	1.006	998
May-06	20,473	20,534,604	1,082	13	1,365	0.587	1.112	97.787	0.442	0.023	0	0	0	0	0.049	0	100.000	1.001	997
June-06	15,196	15,226,453	803	10	1,013	0.582	1.129	97.781	0.393	0.024	0.017	0.006	0	0	0.067	0	99.999	1.003	998
July-06	23,880	24,024,145	1,265	16	1,595	0.61	1.366	97.549	0.402	0.03	0	0	0	0	0.043	0	100.000	1.001	994
TOTAL (Jul. - Dec. 2004)	165,897	166,332,625	8,807	109	**11,098**														
TOTAL (Jan. - Dec. 2005)	270,249	270,615,292	14,304	178	**18,036**														
TOTAL (Jan. - Jul. 2006)	104,464	104,884,867	5,534	69	**6,976**														

Note:
For highlited months, fuel composition data were based on previous month's values

Table A-6. Fuel Usage, Project Combustion Emissions (CMB), and Fuel Properties by Month for Sierra Madera Compressor Station

Month-Year	Station Fuel Usage		Emissions			Fuel Composition (mole %)											Mole CO_2/mole fuel	Fuel HHV (Btu/scf)
	(MMBtu)	(scf)	CO_2 (tonnes)	CH_4 (tonnes)	CO_2e (tonnes)	Nitrogen	CO_2	methane	ethane	propane	n-butane	iso-butane	n-pentane	iso-pentane	hexanes +	Total		
July-04																		
August-04																		
September-04																		
October-04	9,187	8,774,594	501	6	628	0.784	2.347	91.308	3.366	1.290	0.353	0.161	0.102	0.088	0.200	99.999	1.085	1,047
November-04	12,615	12,048,711	688	8	862	0.784	2.347	91.308	3.366	1.290	0.353	0.161	0.102	0.088	0.200	99.999	1.085	1,047
December-04	13,089	12,501,815	713	9	894	0.784	2.347	91.308	3.366	1.290	0.353	0.161	0.102	0.088	0.200	99.999	1.085	1,047
January-05	15,417	14,724,928	840	10	1,053	0.784	2.347	91.308	3.366	1.290	0.353	0.161	0.102	0.088	0.200	99.999	1.085	1,047
February-05	14,943	14,150,568	808	10	1,015	0.783	1.557	91.916	3.494	1.359	0.385	0.168	0.111	0.092	0.135	100.000	1.086	1,056
March-05	23,312	22,075,758	1,261	15	1,583	0.783	1.557	91.916	3.494	1.359	0.385	0.168	0.111	0.092	0.135	100.000	1.086	1,056
April-05	27,876	26,397,727	1,508	18	1,893	0.783	1.557	91.916	3.494	1.359	0.385	0.168	0.111	0.092	0.135	100.000	1.086	1,056
May-05	23,593	22,257,547	1,282	16	1,607	0.777	1.838	91.285	3.622	1.452	0.417	0.183	0.120	0.103	0.203	100.000	1.095	1,060
June-05	16,383	15,707,574	893	11	1,119	1.939	2.152	89.953	3.547	1.404	0.398	0.173	0.116	0.101	0.218	100.001	1.081	1,043
July-05	21,761	20,607,008	1,189	14	1,489	0.791	2.407	90.629	3.638	1.471	0.427	0.186	0.131	0.105	0.216	100.001	1.097	1,056
August-05	18,808	16,340,573	1,045	12	1,305	0.765	1.853	88.675	3.735	1.492	0.471	0.197	0.281	0.184	2.348	100.001	1.216	1,151
September-05	25,737	23,525,594	1,404	17	1,760	0.720	1.518	90.042	4.290	1.796	0.543	0.235	0.165	0.141	0.550	100.000	1.135	1,094
October-05	28,367	25,929,616	1,548	19	1,940	0.720	1.518	90.042	4.290	1.796	0.543	0.235	0.165	0.141	0.550	100.000	1.135	1,094
November-05	29,550	27,010,969	1,612	19	2,021	0.720	1.518	90.042	4.290	1.796	0.543	0.235	0.165	0.141	0.550	100.000	1.135	1,094
December-05	32,996	34,228,216	1,774	22	2,230	1.505	2.972	95.486	0.037	0.000	0.000	0.000	0.000	0.000	0.000	100.000	0.985	964
January-06	30,734	31,848,705	1,651	20	2,076	1.484	2.925	95.549	0.042	0.000	0.000	0.000	0.000	0.000	0.000	100.000	0.986	965
February-06	29,545	27,951,750	1,612	19	2,020	0.747	2.282	90.590	3.909	1.507	0.407	0.186	0.114	0.108	0.151	100.001	1.096	1,057
March-06	29,028	27,462,630	1,583	19	1,984	0.747	2.282	90.590	3.909	1.507	0.407	0.186	0.114	0.108	0.151	100.001	1.096	1,057
April-06	25,279	23,915,799	1,379	17	1,728	0.747	2.282	90.590	3.909	1.507	0.407	0.186	0.114	0.108	0.151	100.001	1.096	1,057
May-06	31,083	29,406,812	1,696	20	2,125	0.747	2.282	90.590	3.909	1.507	0.407	0.186	0.114	0.108	0.151	100.001	1.096	1,057
June-06	26,540	27,445,708	1,424	17	1,790	1.517	2.726	95.694	0.046	0.000	0.000	0.000	0.000	0.000	0.018	100.001	0.986	967
July-06	23,557	24,360,910	1,264	15	1,589	1.517	2.726	95.694	0.046	0.000	0.000	0.000	0.000	0.000	0.018	100.001	0.986	967
TOTAL (Jul. - Dec. 2004)	34,891	33,325,119	1,902	23	**2,383**													
TOTAL (Jan. - Dec. 2005)	278,743	262,956,079	15,165	183	**19,014**													
TOTAL (Jan. - Jul. 2006)	195,766	192,392,315	10,609	129	**13,312**													

Note:
Fuel composition data for Oct-Dec 04 were based on Jan 05 values. For other highlited months, fuel composition data were based on previous month's values

Table A-7. Example Calculation of CO_2 in Exhaust Due to Fuel Combustion (Grey Ranch Compressor Station, July 2004)

	mole percent	mole fraction	moles of CO_2 in flue gas per mole fuel specie	moles of CO_2 in flue gas
Specie	(m.p.)	(m.f.)=(m.p)/100	(c.c.)	(c.c. x m.f.)
nitrogen	0.730	0.00730	0.00	0.0000
carbon dioxide	1.194	0.01194	1.00	0.0119
methane	95.428	0.95428	1.00	0.9543
ethane	1.966	0.01966	2.00	0.0393
propane	0.387	0.00387	3.00	0.0116
i-butane	0.112	0.00112	4.00	0.0045
n-butane	0.049	0.00049	4.00	0.0020
i-pentane	0.037	0.00037	5.00	0.0019
n-pentane	0.034	0.00034	5.00	0.0017
hexane	0.034	0.00034	6.00	0.0020
heptane+	0.028	0.00028	7.00	0.0020
TOTAL	**99.999**	**0.99999**		**1.0311**

Table A - 8. Project Electricity Usage and Indirect Emissions (IND_2) by Month

Month-Year	Electricty Usage (kW-hr)							Indirect Emissions (tonnes)			
	Terrell	Mitchell	Grey Ranch	Puckett	Sierra Madera	McCamey	TOTAL	CO_2	CH_4	N_2O	Total CO_2e
July-04	306,600	32,720	152,400			161,682	653,402	434	0.0023	0.0043	**435**
August-04	287,400	30,800	148,800			166,828	633,828	421	0.0022	0.0042	**422**
September-04	211,200	32,280	133,200			151,668	528,348	351	0.0018	0.0035	**352**
October-04	294,420	35,240	90,000		212,333	158,897	790,890	525	0.0028	0.0052	**527**
November-04	258,600	38,640	46,800		212,333		556,373	369	0.0019	0.0037	**371**
December-04	240,000	38,840	60,000		144,216		483,056	321	0.0017	0.0032	**322**
January-05	258,910	20,800	81,600	1,360	250,196	129,600	742,466	493	0.0026	0.0049	**495**
February-05	234,770	32,000	117,600	1,680	690,126	140,400	1,216,576	808	0.0042	0.0081	**810**
March-05	252,080	32,200	154,800	1,680	1,267,100	215,100	1,922,960	1,277	0.0067	0.0127	**1,281**
April-05	251,400	36,560	159,600	1,520	2,396,157	152,100	2,997,337	1,990	0.0105	0.0198	**1,997**
May-05	142,110	42,600	152,400	1,520	1,913,553	181,800	2,433,983	1,616	0.0085	0.0161	**1,621**
June-05	270,600	41,960	79,200	1,440	404,859	164,700	962,759	639	0.0034	0.0064	**641**
July-05	321,600	37,080	140,400	720	707,415	162,000	1,369,215	909	0.0048	0.0091	**912**
August-05	259,800	27,960	192,000	640	814,671	182,700	1,477,771	981	0.0052	0.0098	**984**
September-05	341,940	33,120	154,800	720	778,819	194,400	1,503,799	999	0.0053	0.0100	**1,002**
October-05	234,550	33,920	25,200	640	1,596,956	156,600	2,047,866	1,360	0.0072	0.0136	**1,364**
November-05	257,690	32,480	50,400	640	2,121,946	161,100	2,624,256	1,743	0.0092	0.0174	**1,748**
December-05	252,539	27,600	67,200		2,483,414	145,800	2,976,553	1,976	0.0104	0.0197	**1,983**
January-06	286,800	30,800	66,000	640	2,448,034	126,957	2,959,231	1,965	0.0103	0.0196	**1,971**
February-06	241,800	21,280	46,800	640	2,107,444	147,390	2,565,354	1,703	0.0090	0.0170	**1,709**
March-06	238,200	32,880	100,800	640	1,768,123	175,560	2,316,203	1,538	0.0081	0.0153	**1,543**
April-06	330,000	26,280	208,800	640	1,211,272	180,910	1,957,902	1,300	0.0068	0.0130	**1,304**
May-06	258,600	26,000	182,400	640	1,030,209	219,877	1,717,726	1,141	0.0060	0.0114	**1,144**
June-06	298,800	25,160	192,000	560	1,321,397	192,637	2,030,554	1,348	0.0071	0.0134	**1,353**
July-06	307,800	40,840	223,200	720	503,329	195,153	1,271,042	844	0.0044	0.0084	**847**
TOTAL (Jul. - Dec. 2004)	1,598,220	208,520	631,200	0	568,882	639,075	3,645,897	2,421	0.0127	0.0241	**2,429**
TOTAL (Jan. - Dec. 2005)	3,077,989	398,280	1,375,200	12,560	15,425,212	1,986,300	22,275,541	14,791	0.0778	0.1475	**14,838**
TOTAL (Jan. - Jul. 2006)	1,962,000	203,240	1,020,000	4,480	10,389,808	1,238,484	14,818,012	9,839	0.0517	0.0981	**9,871**

Table A - 9. Calculation of Incinerated Sales Gas Fraction Under Baseline

Month-Year	Metered Volumes												
	Terrell	Grey Ranch	Mitchell	Puckett	Pikes Peak	Total	Terrell (A)	Grey Ranch (B)	Mitchell (C)	Puckett (D)	Pikes Peak (E)	Total	Fraction Incinerated (A+B+C)
	(Mscf)						(Percent of Total/100)						
July-04	829,958	233,440	503,760			1,567,158	0.53	0.15	0.32	0.00	0.00	1.00	1.00
August-04	900,200	237,680	444,583			1,582,463	0.57	0.15	0.28	0.00	0.00	1.00	1.00
September-04	781,680	217,250	391,140			1,390,070	0.56	0.16	0.28	0.00	0.00	1.00	1.00
October-04	988,580	113,960	366,430		305,000	1,773,970	0.56	0.06	0.21	0.00	0.17	1.00	0.83
November-04	856,128	47,600	368,110		461,070	1,732,908	0.49	0.03	0.21	0.00	0.27	1.00	0.73
December-04	901,870	81,580	377,100		429,473	1,790,023	0.50	0.05	0.21	0.00	0.24	1.00	0.76
January-05	922,190	179,800	370,420		513,611	1,986,021	0.46	0.09	0.19	0.00	0.26	1.00	0.74
February-05	840,010	272,910	320,220		499,621	1,932,761	0.43	0.14	0.17	0.00	0.26	1.00	0.74
March-05	854,000	393,500	381,580		843,668	2,472,748	0.35	0.16	0.15	0.00	0.34	1.00	0.66
April-05	332,060	351,060	349,500		958,126	1,990,746	0.17	0.18	0.18	0.00	0.48	1.00	0.52
May-05	527,090	381,140	345,750		739,324	1,993,304	0.26	0.19	0.17	0.00	0.37	1.00	0.63
June-05	804,700	149,600	329,300		578,558	1,862,158	0.43	0.08	0.18	0.00	0.31	1.00	0.69
July-05	715,610	264,100	320,870		779,247	2,079,827	0.34	0.13	0.15	0.00	0.37	1.00	0.63
August-05	783,642	444,140	324,095		673,483	2,225,360	0.35	0.20	0.15	0.00	0.30	1.00	0.70
September-05	692,910	267,500	284,000		921,100	2,165,510	0.32	0.12	0.13	0.00	0.43	1.00	0.57
October-05	808,960	12,990	325,640		1,003,299	2,150,889	0.38	0.01	0.15	0.00	0.47	1.00	0.53
November-05	802,380	45,820	119,870		981,908	1,949,978	0.41	0.02	0.06	0.00	0.50	1.00	0.50
December-05	765,410	89,250	73,200		1,117,418	2,045,278	0.37	0.04	0.04	0.00	0.55	1.00	0.45
January-06	803,600	87,030	12,120		1,030,771	1,933,521	0.42	0.05	0.01	0.00	0.53	1.00	0.47
February-06	699,750	55,200			973,060	1,728,010	0.40	0.03	0.00	0.00	0.56	1.00	0.44
March-06	787,280	213,300	281,820		889,763	2,172,163	0.36	0.10	0.13	0.00	0.41	1.00	0.59
April-06	661,700	447,770	247,900		769,005	2,126,375	0.31	0.21	0.12	0.00	0.36	1.00	0.64
May-06	713,241	360,090	229,100		1,026,499	2,328,930	0.31	0.15	0.10	0.00	0.44	1.00	0.56
June-06	715,137	419,330	150,540		919,989	2,204,996	0.32	0.19	0.07	0.00	0.42	1.00	0.58
July-06	763,879	456,050	251,170		790,117	2,261,216	0.34	0.20	0.11	0.00	0.35	1.00	0.65
TOTAL (Jul. - Dec. 2004)	5,258,416	931,510	2,451,123	-	1,195,543	9,836,592							
TOTAL (Jan. - Dec. 2005)	8,848,962	2,851,810	3,544,445	-	9,609,363	24,854,580							
TOTAL (Jan. - Jul. 2006)	5,144,587	2,038,770	1,172,650	-	6,399,204	14,755,211							