

# SOUTHERN UTE INDIAN TRIBE WESTSIDE CBM SEEP CAPTURE & USE PROJECT MONITORING REPORT #6



Prepared By Karen Spray, Southern Ute Indian Tribe Growth Fund - Department of Energy

<b>Project Title</b>	Southern Ute Indian Tribe Westside CBM Seep Capture & Use Project
<b>Version</b>	Version 1.2
<b>Report ID</b>	Monitoring Report #6
<b>Date of Issue</b>	Issued on 13-March-2017
<b>Project ID</b>	937
<b>Monitoring Period</b>	01-January-2016 to 30-November-2016
<b>Prepared By</b>	Karen Spray, Southern Ute Indian Tribe Growth Fund - Department of Energy
<b>Contact</b>	14929 Hwy 172 Ignacio, CO 81137, 970-563-5556, <a href="mailto:kspray@sudoe.us">kspray@sudoe.us</a> , <a href="http://www.suitdoe.com">www.suitdoe.com</a>

## Table of Contents

1	PROJECT DETAILS	3
	1.1 Summary Description of the Implementation Status of the Project	.3
	1.2 Sectoral Scope and Project Type	..3
	1.3 Project Proponent	.3
	1.4 Other Entities Involve in the Project	..4
	1.5 Project Start Date	.5
	1.6 Project Crediting Period	..5
	1.7 Project Location	5
	1.8 Title and Reference of Methodology	.6
	1.9 Other Programs	6
	1.10 Sustainable Development	.6
2	IMPLEMENTATION STATUS	6
	2.1 Implementation Status of the Project Activity	..6
	2.2 Deviations	..6
	2.2.1 Methodology Deviations	.6
	2.2.2 Project Description Deviations	7
	2.3 Grouped Project	.8
	2.4 Safeguards	8
	2.4.1 No Net Harm	.8
	2.4.2 Local Stakeholder Consultation	.8
3	DATA AND PARAMETERS	.8
	3.1 Data and Parameters Available at Validation	8
	3.2 Data and Parameters Monitored	.11
	3.3 Monitoring Plan	..18
4	QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS	..21
	4.1 Baseline Emissions	21
	4.2 Project Emissions	...22
	4.3 Leakage	22
	4.4 Net GHG Emission Reductions and Removals	..22

APPENDIX A – PROJECT GEOGRAPHIC AREA

APPENDIX B – SUPPORTING DATA AND EQUATIONS

## 1 PROJECT DETAILS

### 1.1 Summary Description of the Implementation Status of the Project

The Westside Interceptor well project consists of three activities: (1) interception and removal of fugitive coalbed methane, (2) piping raw gas to a compression station and gas processing plant which uses an amine gas scrubber process to produce pipeline quality natural gas (3) compression and injection of the purified gas into a natural gas transmission pipeline.

The project is currently active. Initial construction of vent wells began in 1998. Several wells and pipelines were added between 1998 and 2014. The original pipeline infrastructure used to gather the gas was constructed in the summer/fall of 2008. Commercial operations began on 01-January-2009 and the project has been operating continuously since then.

During the period described in this monitoring report (01-January-2016 through 30-November-2016), the project reduced GHG emissions by 42,549 tCO<sub>2</sub> equivalent. The monitoring report period was reduced to 11 months due to gas processing facility changes on 01-December-2016.

### 1.2 Sectoral Scope and Project Type

The SUIT project falls into Sectoral Scope Numbers 1 and 10 as defined by the United Nations Framework Convention on Climate Change (UNFCCC) and the Verified Carbon Standard (VCS).

The project is a grouped project including three instances. The first instance is referred to as Phase I, the second instance as Phase II-a, and the third instance as Phase II-b for a total of 29 wells. Total well count was 29 in 2016. No new wells were added to the system in 2016. A new compressor was added at the Red Willow Coyote Compressor Station in May 2016. A single Caterpillar JGT4 unit was added that replaced two older Waukesha JGK/4 units. This reduction from two to one compressor(s) resulted in a decrease in overall fuel use at the Compression Station (CM<sub>MECH,CS,PJ</sub>) and is reflected in the calculations.

### 1.3 Project Proponent

Organization name	Southern Ute Indian Tribe – Growth Fund – Department of Energy
Contact person	Karen Spray
Title	E&P Manager
Address	14929 Highway 172 PO Box 1500 Ignacio, CO 81137
Telephone	970-563-5556
Email	<a href="mailto:kspray@sudoe.us">kspray@sudoe.us</a>

### 1.4 Other Entities Involved in the Project

Organization name	Red Cedar Gathering
Role in the project	Red Cedar is responsible for gas cleanup, processing, and marketing including monitoring key project parameters and calibration of equipment.
Contact person	Davis Dunagan
Title	Pipeline Systems Manager
Address	125 Mercado Street Durango, CO 81301
Telephone	970-764-6900
Email	<a href="mailto:ddunagan@redcedargathering.com">ddunagan@redcedargathering.com</a>

Organization name	Red Willow Production Company
Role in the project	Red Willow is responsible for operations and maintenance
Contact person	Mike Yocum
Title	Operations Foreman
Address	14933 Hwy 172 Ignacio, CO 81137
Telephone	970-563-5000
Email	<a href="mailto:myocum@rwpc.us">myocum@rwpc.us</a>

Organization name	WSP Environment & Energy
Role in the project	WSP E&E is responsible for providing consulting services to the Southern Ute Growth Fund regarding the carbon credit aspect of the project.
Contact person	Tim Kidman
Title	Project Director, Sustainability and Energy Environmental
Address	401 B Street, Suite 1650, San Diego, CA, 92101
Telephone	619-525-8399
Email	<a href="mailto:Tim.Kidman@WSPGroup.com">Tim.Kidman@WSPGroup.com</a>

**1.5 Project Start Date**

The project began operations on 01-January-2009.

**1.6 Project Crediting Period**

The project crediting period began on 01-January-2009 and will end 31-December-2018 for a total of 10 years.

**1.7 Project Location**

The methane capture project is located in La Plata County, Colorado, United States. The project site, including Phase I and Phase II (a & b), is situated approximately 25 miles west of Ignacio, Colorado where the tribe’s headquarters is located. The gas compression station, processing plant, central delivery point (CDP), and pipeline injection point are also located at this site but approximately 1.5 miles south. The zip code for this location is 81326. The project is located in the WECC Rockies eGRID sub-region. The boundaries of the project include the 29 wells used to intercept and collect methane. The project GPS boundaries are shown in Table 2 and are mapped in Appendix A. Gas compression, upgrading equipment, the CDP site, and the pipeline injection point shared by other CBM operations are not included in this boundary.

Figure 1: Map of Colorado showing location of La Plata County

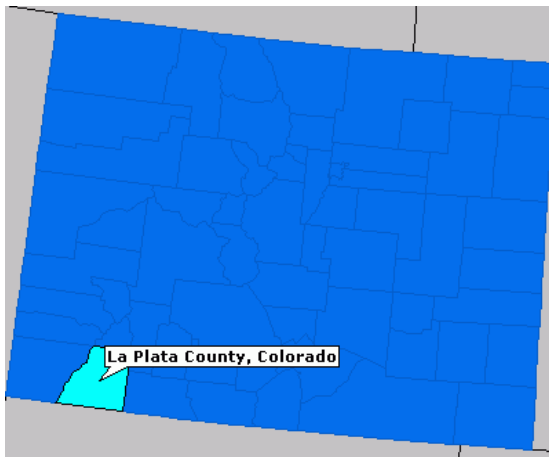


Figure 2: Map of La Plata County, CO, showing project location starred

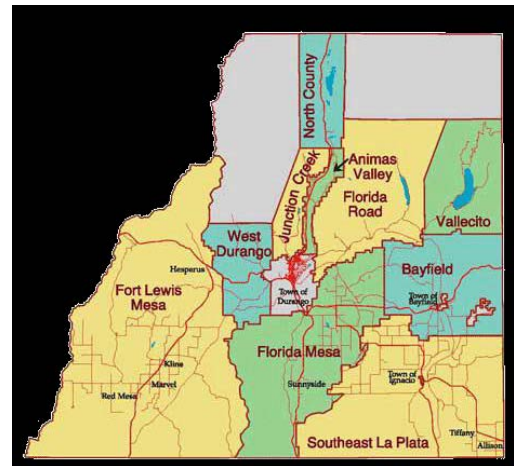


Table 2: Project GPS Boundaries including Phase I, Phase II wells

Boundary	Latitude (degrees)	Longitude (degrees)
Northwest	37.109103	-108.076449

Northeast	37.109815	-108.048896
Southeast	37.001630	-108.086512
Southwest	37.001681	-108.115573

### 1.8 Title and Reference of Methodology

The project participants use the approved VCS baseline and monitoring methodology VM0014 “Interception and destruction of fugitive methane from Coal Bed Methane (CMB) seeps”, Version 1 and the “Combined tool to identify the baseline scenario and demonstration of additionality” V 3.0.

### 1.9 Other Programs

The project is not associated with any other programs.

### 1.10 Sustainable Development

The project contributes to the Protection of the Atmosphere as outlined under Agenda 21 Section 9 (UNCED, 1992) and the UNCED 2030 Agenda for Sustainable Development Paragraph 31 that call for the reduction of greenhouse gas emissions. By intercepting and producing methane that historically entered the atmosphere through natural geologic seeps the project contributes to the ultimate objective of stabilizing greenhouse gas concentrations. Geologic seepage flux is monitored on an annual basis and gas collection, treatment and sales is monitored on a continuous (collection) and monthly (treatment and sales) basis.

## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

The project is currently active. Commercial operations began on 01-January-2009 and the project has been operating continuously since then. The reporting period was reduced to 11 months to accommodate facility changes that occurred on 01-December-2016. The Red Cedar Coyote Gulch Treatment Plant was closed on 01-December-2016 with all collected gas now being routed to the Red Cedar Arkansas Loop Treatment Plant. These changes will be addressed for the 2017 reporting period.

### 2.2 Deviations

#### 2.2.1 Methodology Deviations

There were no deviations from the methodology during 2016.

The following methodology deviation was approved for the Project during 2014 and continues forward.

1. The Project utilizes a regional default value for the CO<sub>2</sub> emission factor for displaced gas grid fuel (EF<sub>CO<sub>2</sub>,i</sub>) instead of site-specific data for calculating the emission factor for pipeline natural gas replaced by the project (EF<sub>GAS</sub>).

### 2.2.2 Project Description Deviations

There were no new deviations from the project description during this monitoring period.

The following project description deviations have occurred in the past and all are still relevant.

1. **Additionality Criteria for New Instances** - The delineation of additionality in the Project Description did not provide specific criteria from which to assess new project instances. The project utilized the UNFCCC for CDM “Combined tool to identify the baseline scenario and demonstrate additionality” V. 3 to define additionality, specifically an investment analysis. The baseline analysis outlined an overall IRR threshold benchmark of 17.08% to demonstrate economic viability. In lieu of completing a full investment analysis the following key criteria will be used to demonstrate additionality.
  - a. The baseline investment analysis for economic viability demonstrated that \$6.24/MCF natural gas price is the lower threshold. Therefore the addition of any new project instances will need to demonstrate gas prices at or below that threshold on the date of the Tribal Resolution approving project implementation or a new investment analysis provides a different threshold.
  - b. The project is a first of its kind methane seepage mitigation system. No regulations exist which would require natural gas producers to install a comparable mitigation system nor is there likely to be in the future. Methane seepage mechanisms are complicated with no definitive causes being quantifiable. At the time of new instances of the project, naturally occurring methane seepage mitigation should not be mandated or regulated by any federal, state or local regulatory authority.
2. A fuel source was changed for a small heating device that provides freeze protection heating to a small shed housing some of the monitoring equipment. Previously, the operators had been using CBM gas as a fuel source but in November 2013 began using LPG at this location. The heater is only used during the winter months and fuel consumption is minimal and is expected to contribute approximately 1 tCO<sub>2</sub>e to the project emissions. For completeness, a carbon emission factor (CEF<sub>LPG</sub>) and a fuel source CONS<sub>LPG,PJ</sub> have been added to the calculation of emission reductions. The consumption of LPG at this location is recorded annually and included in ER calculations going forward. These two parameters have been added to the parameter tables in this monitoring report. Use of the LPG fired heater will continue to be a part of the project going forward and is considered a part of the current project description.
3. Additional changes to the gas cleanup process were implemented to ensure a higher degree of product quality and consistency in 2013. First, an H<sub>2</sub>S scavenger which injects a chemical to eliminate H<sub>2</sub>S in the product gas was installed. Next a water injection system is used to increase the gas moisture content and improve the effectiveness of the H<sub>2</sub>S scrubber, which is

already in place. Both devices have minimal power requirements and are powered by PV panels. These changes have been made to improve the operation of the cleanup process and have no impact of the project's GHG emissions, applicability of choice of methodology, baseline or additionality. Use of the H<sub>2</sub>S scavenger and water injection system will continue to be a part of the project going forward and is considered a part of the current project description.

4. Additional calibration accuracy testing was conducted at the Vent Gas Fuel flow meter (Meter #0400501) and the Vent Gas flow meter (Meter #0410501). These meters are scheduled to be calibrated on a quarterly basis; however, monthly checks of calibration accuracy began in July 2013 as a best management practice and continued through 2016. Records demonstrate that both meters were tested on a monthly basis during 2016. In accordance with Red Cedar O&M 1006 Electric Flow Measurement Procedure however, actual calibration is only required when the as-found condition is +/- 0.2% of the calibrated span (CS). This condition was not exceeded on either meter during the reporting period. Additional calibrations may be conducted at the discretion of the field technician and were conducted on both meters during 2016.
5. Red Willow Production Company and Red Cedar Gathering Company were incorrectly identified in the project description. This identification error was inadvertent and these two entities have been properly identified in this monitoring report. However, this discrepancy represented a deviation from the project description. The proper identification of the entities is now correct and is considered a part of the project description going forward.

### 2.3 Grouped Project

The project is a grouped project. No new instances were implemented during the 2016 monitoring period.

### 2.4 Safeguards

#### 2.4.1 No Net Harm

No negative environmental or socio-economic impacts are created by the project.

#### 2.4.2 Local Stakeholder Consultation

The project is fully contained within the Southern Ute Indian Reservation. The Tribe both owns and operates the project and the lands it is constructed on, therefore no local stakeholders are involved.

## 3 DATA AND PARAMETERS

### 3.1 Data and Parameters Available at Validation

Data / Parameter	CEF_ELEC
------------------	----------



Data unit	kg CO <sub>2</sub> / kWh
Description	Carbon emission factor for electricity from WECC Rockies grid sub-region
Source of data	US EPA eGRID 2014 January 13, 2017
Value applied	0.805
Justification of choice of data or description of measurement methods and procedures applied	The US EPA's eGRID database is the foremost authority on scope 2 greenhouse gas emissions from purchases of grid electricity in the United States. The source is appropriate because it provides an up to date CO <sub>2</sub> emission rate per kWh purchased that is specific to the region in which the project is located.
Purpose of the data	Parameter is used in the project emission calculations, for electricity used to capture and treat gas
Comments	Updated periodically

Data / Parameter	CEF <sub>CH<sub>4</sub></sub>
Data unit	tCO <sub>2</sub> / tCH <sub>4</sub>
Description	Carbon emission factor for methane combustion
Source of data	VM0014; IPCC 2007
Value applied:	2.75
Justification of choice of data or description of measurement methods and procedures applied	This is a prescribed emission factor
Purpose of the data	Parameter is used in the project emission calculations, for combustion of captured methane
Comments	N/A

Data / Parameter	EF <sub>gas</sub>
Data unit	kg CO <sub>2</sub> / MMBtu
Description	Carbon emission factor for natural gas combustion replaced by the project activity
Source of data	VM0014; IPCC 2007
Value applied:	53.06
Justification of choice of data or description of measurement methods and procedures applied	This is a default value in the methodology, and is appropriate when the end use and location is unknown because it is representative of the US average gas emission factor

Purpose of the data	Parameter is used in the baseline emissions calculation to determine emissions replaced by the project activity
Comments	Constant for project duration

Data / Parameter	GWP <sub>CH4</sub>
Data unit	N/A
Description	Global warming potential of methane
Source of data	VM0014; IPCC 2007
Value applied:	21
Justification of choice of data or description of measurement methods and procedures applied	Prescribed value
Purpose of the data	Parameter is used to convert methane emissions to carbon dioxide equivalent for project and baseline emissions calculations
Comments	N/A

Data / Parameter	CEF <sub>FossFuel</sub>
Data unit	kg CO <sub>2</sub> / MMBtu
Description	Carbon emission factor for coalbed methane fuel
Source of data	Ex ante gas composition analysis
Value applied:	58.86
Justification of choice of data or description of measurement methods and procedures applied	This value was proposed in the Project Description. It is appropriate because it is based on gas composition analyses collected during the first year of the project operation.
Purpose of the data	Parameter is used to calculate project emissions from the use of CBM as fuel gas to capture and destroy methane
Comments	Assumed constant for project duration

Data / Parameter	Den <sub>CH4</sub>
Data unit	Metric tonnes/ mmscf
Description	Density of methane at 14.74 psi and 60 °F
Source of data	Ex ante gas composition analysis
Value applied:	19.22
Justification of choice of	This value was determined ex ante in the Project Description and is

data or description of measurement methods and procedures applied	representative of the actual gas used. It is based on actual gas analyses collected during the first year of project operations.
Purpose of the data	Parameter is used to convert methane flow rates from mmscf as measured to metric tonnes
Comments	N/A

Data / Parameter	CBM <sub>CH4</sub>
Data unit	Metric tonnes / MMBtu
Description	Factor to convert MMBtu of coalbed methane gross calorific value to tonnes of methane, based on average methane content
Source of data	Ex ante gas composition analysis
Value applied:	0.019
Justification of choice of data or description of measurement methods and procedures applied	This value was determined ex ante in the Project Description and is representative of the actual gas used. It is based on actual gas analyses collected during the first year of project operations.
Purpose of the data	Parameter is used to convert MMBtu values from gas sales invoices into tonnes of methane equivalent contained in gas sold, used for both project and baseline emission calculations
Comments	Assumed constant for project duration

Data / Parameter	CEF <sub>LPG</sub>
Data unit	kgCO <sub>2</sub> /gallon
Description	Carbon emission factor for LPG used for freeze protection of equipment at the central delivery point.
Source of data	US EPA Climate Leaders Stationary Combustion Guidance, May 2008, Table B-5
Value applied	5.79
Justification of choice of data or description of measurement methods and procedures applied	This value was determined <i>ex ante</i> using the EPA Climate Leaders Guidance, a foremost authority for US GHG emission factors and is appropriate because it represents a typical mix of LPG gases.
Purpose of the data	Calculation of project emissions
Comments	N/A

### 3.2 Data and Parameters Monitored

Data / Parameter	PC,CH4,CDP
Data unit	% wet (v/v)
Description	Concentration of methane in the CBM delivered and sold to Red Cedar at the central delivery point (CDP).
Source of data	Portable gas chromatograph used at sample point located at the CDP, near flow meter # 0410501
Description of measurement methods and procedures to be applied	Gas samples are taken at regular intervals using two PGI International gas interceptors (for redundancy). The machine automatically takes a small gas sample approximately every 660 SCF of gas flow and stores the sample in a 300 cc bottle. Each month, a Red Cedar field technician will empty the gas cylinder and run a composite sample through a portable gas chromatograph. Using this approach, the GC analysis is performed once monthly, but is representative of nearly continuous monitoring since the gas cylinder contains 4500 samples spaced at regular intervals. The portable gas chromatograph takes monthly readings and the data is downloaded to a computer in the office after each sample is taken.
Frequency of monitoring/recording	A small 0.5 cubic centimeter sample is extracted from the gas flow and stored in the gas cylinder at a volumetric flow interval of 660 SCF. At an expected flow rate of 550 MCF/day, this would result in a sample frequency of 1 minute and 44 seconds. The pressure inside the cylinder is higher than the line pressure, so the device can store more than 600 x 0.5 cc samples.
Value monitored:	63.77%
Monitoring equipment	A PGI International Gas Sampler with model number PF3MP and serial number 032516. An Agilent Technologies 3000 Micro Gas Chromatograph, various serial numbers.
QA/QC procedures to be applied	Red Cedar field technicians calibrate portable gas chromatographs on a daily basis. Calibration is performed using a standard gas cylinder. GC's are baked-out weekly to remove water build-up and each unit is inspected monthly.
Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	PC,NMHC,CDP
Data unit	% wet (v/v)
Description	Concentration of non-methane hydrocarbons in the CBM

	delivered and sold to Red Cedar at the CDP.
Source of data	Portable gas chromatograph used at sample point located at the CDP, near flow meter # 0410501
Description of measurement methods and procedures to be applied	Gas samples are taken at regular intervals using two PGI International gas interceptors (for redundancy). The machine automatically takes a small gas sample approximately each 660 SCF of gas flow and stores the sample in a 300 cc bottle. Each month, a Red Cedar field technician will empty the gas cylinder and run a composite sample through a portable gas chromatograph. Using this approach, the GC analysis is performed once monthly, but is representative of nearly continuous monitoring since the gas cylinder contains 4500 samples spaced at regular intervals. The portable gas chromatograph takes monthly readings and the data is downloaded to a computer in the office after each sample is taken.
Frequency of monitoring/recording	A small 0.5 cubic centimeter sample is extracted from the gas flow and stored in the gas cylinder at a volumetric flow interval of 660 SCF. At an expected flow rate of 550 MCF/day, this would result in a sample frequency of 1 minute and 44 seconds. The pressure inside the cylinder is higher than the line pressure, so the device can store more than 600 x 0.5 cc samples.
Value monitored:	Below 1% for 2016.
Monitoring equipment	A PGI International Gas Sampler with model number PF3MP and serial number 032516. An Agilent Technologies 3000 Micro Gas Chromatograph, various serial numbers.
QA/QC procedures to be applied	Red Cedar field technicians calibrate portable gas chromatographs on a daily basis. Calibration is performed using a standard gas cylinder. GC's are baked-out weekly to remove water build-up and each unit is inspected monthly.
Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	%NMHCs are neglected unless they cumulatively account for >1% of the raw gas.

Data / Parameter	CONS <sub>FossilFuel,PJ</sub>
Data unit	MMBtu
Description	Million Btus of coal bed methane consumed by gas engine driven compressors located at the vent wellheads and the CDP.

Source of data	Monthly Red Cedar gas sales invoices, wellhead compressor fuel use reported as "Vent Gas Fuel Charge" on invoice.
Description of measurement methods and procedures to be applied	CBM consumption is metered with a flow meter located near the CDP and maintained by Red Cedar Gathering Company. Monthly totals appear on gas sales invoices.
Frequency of monitoring/recording	Continuously
Value monitored:	48,378
Monitoring equipment	The gas flow rates are determined using a Daniel orifice type flow meter with a static pressure range of 500 psi and a differential pressure range of 250 psi, a meter tube diameter of 2.067 inches and an orifice diameter of 0.5 inches. A Fisher recorder, with serial number 16984801 is used to meter and record the gas flow rates. The gas flow meter has been assigned the system number 0400501 by Red Cedar.
QA/QC procedures to be applied	Gas flow meters are calibrated four times annually by Red Cedar field technicians and monthly gas composition is determined using portable gas chromatographs which are calibrated daily. All data is stored on-site at Red Cedar offices in Durango, and is remotely backed up. Monthly meter calibrations were initiated in July 2013 as an ongoing best management practice, as described as a Project Description deviation in Section 2.2.2.
Purpose of the data	Calculation of project emissions
Calculation method	Gas Btu content determined from volumetric consumption and gas composition using Flow Calc software.
Comments	Measuring equipment inspection and calibration reports have been provided to First Environment for inspections occurring over the monitoring period.

Data / Parameter	CONS <sub>LPG,PJ</sub>
Data unit	Gallons
Description	Gallons of LPG used by freeze protection equipment located at the CDP.
Source of data	Purchase invoices from AmeriGas or other LPG vendors.
Description of measurement methods and procedures to be applied	Parameter relies on the measurement equipment used by vendor.
Frequency of monitoring/recording	Data recording only to occur when fuel deliveries are made
Value monitored:	421.3

Monitoring equipment	N/A, parameter relies on measurement equipment used by the vendor
QA/QC procedures to be applied	N/A, parameter relies on measurement equipment used by the vendor
Purpose of the data	Calculation of project emissions
Calculation method	LPG fuel volumes in gallons multiplied by a carbon emission factor for LPG.
Comments	Fuel deliveries and consumption are minimal and are a negligible source of project emissions but are included for completeness.

Data / Parameter	CM <sub>MECH,CS,PJ</sub>
Data unit	MMBtu
Description	Million Btu of coal bed methane used by engine driven compressors at the Red Willow Coyote Gulch Compression station.
Source of data	Monthly Red Cedar gas sales invoices, compressor fuel allocation reported as "Coyote Compressor Fuel" on invoice.
Description of measurement methods and procedures to be applied	CBM consumption is metered with a flow meter located at the compressor station and maintained by Red Cedar Gathering Company. Monthly totals appear on gas sales invoices.
Frequency of monitoring/recording	Continuously
Value monitored:	12,556
Monitoring equipment	An orifice type flow meter measures flow rates, with a Fisher FloBoss recorder / monitor with serial number 17957472. Red Cedar assigns the number 0269901 to this station.
QA/QC procedures to be applied	Gas flow meters are calibrated four times annually by Red Cedar field technicians and monthly gas composition is determined using portable gas chromatographs which are calibrated daily. All data is stored on-site at Red Cedar offices in Durango, and is remotely backed up.
Purpose of the data	Calculation of project emissions
Calculation method	Gas Btu content determined from volumetric consumption and gas composition using Flow Calc software.
Comments	Gas consumption apportioned to the fugitive CBM is prorated by Red Cedar.

Data / Parameter	CM <sub>MECH,TP,PJ</sub>
Data unit	MMBtu

Description	Million Btus of coal bed methane used in engine driven compressors, process heating equipment, and reboilers located at the Red Cedar Coyote Gulch Treating Plant.
Source of data	Monthly Red Cedar gas sales invoices, fuel use allocation is 5.5% of CBM delivered to the CDP
Description of measurement methods and procedures to be applied	CBM consumption is metered with a flow meter located at the treating plant and maintained by Red Cedar Gathering Company and prorated to the project on a Btu basis. Monthly totals appear on gas sales invoices.
Frequency of monitoring/recording	Continuously
Value monitored:	6,371
Monitoring equipment	various; maintained by another party
QA/QC procedures to be applied	Gas flow meters are calibrated four times annually by Red Cedar field technicians and monthly gas composition is determined using portable gas chromatographs which are calibrated daily. All data is stored on-site at Red Cedar offices in Durango, and is remotely backed up.
Purpose of the data	Calculation of project emissions
Calculation method	Gas Btu content determined from volumetric consumption and gas composition using Flow Calc software.
Comments	Gas consumption apportioned to the fugitive CBM is prorated by Red Willow.

Data / Parameter	CM <sub>GAS,PJ</sub>
Data unit	MMBtu
Description	Million Btu of gas purchased by Red Cedar at the CDP. This value, less fuel use deductions, is the amount of gas ultimately sold to Kinder Morgan and pipelined.
Source of data	Monthly Red Cedar gas sales invoices, labeled as "Net Receipts" on invoice.
Description of measurement methods and procedures to be applied	Captured aggregated CBM is metered with a flow meter located at the CDP and maintained by Red Cedar Gathering Company.
Frequency of monitoring/recording	Continuously
Value monitored:	96,838
Monitoring equipment	The gas flow rates are determined using a Daniel orifice type flow meter with a static pressure range of 250 psi and a differential pressure range of 250 psi, a tube ID of 3.068 inches and an orifice diameter of 1.750 inches. An Emerson recorder is used to meter and record the gas flow rates. The gas flow meter station has been assigned the system number 0410501 by Red Cedar. Daniel orifice flow meter SN: 08250275



	Meter Tube Number: F080118-006 Emerson FloBoss SN: 18329633
QA/QC procedures to be applied	Gas flow meters are calibrated four times annually by Red Cedar field technicians and monthly gas composition is determined using portable gas chromatographs which are calibrated daily. All data is stored on-site at Red Cedar offices in Durango, and is remotely backed up. Monthly meter calibrations were initiated in July 2013 as an ongoing best management practice, as described as a Project Description deviation in Section 2.2.2.
Purpose of the data	Calculation of project emissions and baseline emissions
Calculation method	Gas Btu content determined from volumetric consumption and gas composition using Flow Calc software.
Comments	Measuring equipment inspection and calibration reports have been provided for inspections occurring over the monitoring period.

Data / Parameter	CONSELEC,PJ,Specific
Data unit	kWh/MMBtu
Description	Specific consumption of electricity by equipment used to treat CBM to pipeline quality natural gas.
Source of data	Calculated from total gas production and total electricity purchase invoices, over the reporting period
Description of measurement methods and procedures to be applied	Electricity will be metered by the La Plata Electric Association electric meters located on-site and monthly invoices with kWh totals are sent to Red Cedar.
Frequency of monitoring/recording	Consumption is monitored continuously and recorded monthly
Value monitored:	0.35
Monitoring equipment	Electric meters located at the Coyote Gulch treating plant
QA/QC procedures to be applied	Electric invoices are received monthly by Red Cedar and are stored electronically.
Purpose of the data	Calculation of project emissions
Calculation method	Total electricity consumed during each month of the reporting period divided by total energy of gas delivered during each month of the reporting period.
Comments	N/A

Data / Parameter	CEF <sub>NMHC</sub>
Data unit	tCO <sub>2</sub> /tNMHC

Description	Carbon emission factor for non-methane hydrocarbons contained in the product gas
Source of data	Computed from annual average gas composition and known gas properties at the start of the project.
Value applied:	2.97
Justification of choice of data or description of measurement methods and procedures applied	This value was determined ex ante using a two year average gas composition analysis and is considered representative for the gas. Since the % NMHC is not expected to exceed 1%, it was decided not to monitor this parameter annually.
Purpose of the data	Calculation of project emissions
Comments	Total % NMHC is less than 1%, so this is not used in ex ante calculations

### 3.3 Monitoring Plan

Monitoring at SUIT is required to establish the volumes of methane which are injected into the natural gas pipeline. This volume of injected methane defines the gross volume of methane emissions prevented from escaping to the atmosphere. Flow meters and a gas chromatograph take measurements of the total flow of gas being pipeline injected as well as the concentration of methane by volume. The monthly sales volumes in million Btu of gas (MMBtu) are available from gas sales invoices and are used for emission reduction calculations. Electricity and fossil fuel consumption required by the project to compress and treat gas are available from sales invoices and utility invoices. SUGF and its partners Red Willow Gathering Company and Red Cedar Production Company are responsible for all field operations and data collection and management. Table 1 presents the location of unit operations and monitoring equipment used by the project.

**Table 1: Collection and Monitoring**

Location	Function	Monitoring
Interception Wells & Collection system	There are a total of 29 wellheads associated with the project, each with a gas flow meter. These wells intercept methane from the seam, and the collection system aggregates gas from the various wells. There are also 14 gas engine driven compressors used to inject the intercepted gas into the gathering system pipeline.	Coalbed methane (“Vent Gas Fuel”) is purchased from Red Cedar and delivered to engine driven wellhead compressors. Quantities of CBM gas combusted by the compressors are reported in gas purchasing invoices as “Vent Well Fuel Charge”. Gas composition analysis of CBM fuel gas combusted is provided along with invoices, this is used to calculate CEF <sub>FOSSFUEL</sub> .
Central Delivery Point (CDP)	The CDP meters the total gas flow rate captured by the interceptor well system, and is the point of custody transfer to	Flow meter and GC record data to a plant computer. Gas composition analysis is used to determine NMHC content and BTU value. Flow meter

	Red Cedar. A gas interceptor takes gas samples every 30 minutes and stores them in a gas cylinder. A portable gas chromatograph takes monthly gas samples from the cylinder to determine gas composition and Btu value.	used to establish volumes sold to Red Cedar. A second flow meter located near the CDP is installed on the pipeline which supplies the wellhead compressors (from above) with CBM fuel. The same process is used to establish Btu value.
Red Willow Coyote Gulch Compressor Station	Dehydration and pressurization of gas prior to gas treatment. Here CDP gas from the interceptor project is blended with CBM captured from surrounding operations.	Quantities of captured methane used for mechanical energy generation are reported in gas purchasing invoices as "Coyote Compressor Fuel".
Red Cedar Coyote Gulch Treating Plant	Gas upgrading for pipeline injection; includes H <sub>2</sub> S removal, CO <sub>2</sub> removal by amine scrubbers.	Quantities of captured methane used for mechanical energy generation are reported at 5.5% of CDP gas in the gas sales invoices. Electricity used to treat gas is reported in LPEA purchase invoices. Net gas delivered to the pipeline is equal to the gross gas sold at CDP less gas used to generate mechanical energy at the compressor station and the treating plant.

**Roles and Responsibilities**

Monitored data at the project site are analyzed and summarized monthly. Two field operations companies are responsible for data monitoring and quality control and assurance. Red Willow Production Company provides maintenance support and operates the interceptor well system, the CDP and the gas compression facility. Red Cedar Gathering Company operates the treating plant. SUIT receives monthly gas purchase invoices from Red Cedar which summarize gross production and sales, captured CBM gas which is consumed onsite for mechanical energy generation, and CBM fossil fuel purchases. Additionally, Red Cedar is responsible for maintaining and calibrating all data acquisition and storage equipment including gas flow meters and gas chromatographs.

SUIT Growth Fund Department of Energy is responsible for aggregating and managing monitoring data necessary to calculate project emission reductions according to the monitoring plan outlined in the Project Description. SUIT Growth Fund Department of Energy also prepares monitoring reports and assists with project validation and verification.

**Data Collection / Monitoring Equipment**

A flow meter located at the central delivery point (CDP) meters the volume of captured fugitive CBM which is collected and supplied to Red Cedar for processing and ultimately to Kinder Morgan. A gas interceptor system automatically takes small (0.2 cc) gas samples each 30 minutes and stores these in a 300 cc gas cylinder. A portable gas chromatograph takes monthly readings from this gas cylinder to determine gas composition, which together with continuous volumetric flow rate data, is used to establish the gas Btu content. Monthly totals appear on gas sales invoices.

The CDP represents the transfer of custody from SUIT to Red Cedar but not the point of sale to the final gas buyer. Gas processing downstream of the CDP is tracked and included in the project boundary. The PC hard drives will store data for the entire duration of the crediting period and an additional 2 years thereafter. The PC can be accessed and data can be downloaded remotely by SUIT staff.

The SUIT project also purchases CBM from Red Cedar to operate the wellhead compressors and process equipment at the CDP. This fuel gas is metered at a location near the CDP (meter # 0410501) before the stream is split and sent to both locations. Again, a portable GC samples the stream to determine the gas composition on a regular basis. These data are used to determine the Btus purchased by the project.

Gas flow meters are calibrated four times per year according to the manufacturer's procedure. A copy of a gas flow meter calibration records for the CDP gas sales meter (gas sold by the project) and the vent fuel gas meter (gas consumed by project) is provided along with this report. Gas composition analysis is conducted monthly using portable gas chromatographs at various locations. Portable GCs are calibrated each day prior to use by Red Cedar field technicians according to a company procedure which uses a standard gas cylinder. A copy of the GC Standard Operation Procedure is provided along with this report.

Downstream of the transfer of custody, Red Willow & Red Cedar both use captured coalbed methane pulled directly off of the product stream to operate mechanical energy generation equipment such as engine driven compressors and process heaters. Energy used to operate these equipment are prorated to the quantity of natural gas produced by the interceptor well project and are reported as MMBtu deductions on the sales gas invoices received by SUIT. The difference between gross gas sent to the CDP and these deductions represent the net production quantity being injected into the natural gas pipeline. All gas sales invoices will be kept by SUIT for 2 years following the end of the project crediting period. The same procedure as described above is used here to determine the gas flow rate and composition used to develop Btu energy consumption values.

### **Fossil Fuel Consumption**

Coalbed methane is purchased by the project from Red Cedar and is piped to the interceptor wellhead compressors and used to evacuate fugitive methane from the seam. Red Cedar reports monthly gas purchase quantities on the sales gas invoices that SUIT receives. In addition, Red Cedar provides a gas composition analysis for the CBM fuel gas combusted by the compressors. This is used to determine the MMBtu quantity of fuel gas sold to the project. This is also used by the project to develop a carbon emission factor for the gas which is determined ex ante and used throughout the project crediting period. Red Cedar is responsible for maintaining the accuracy and integrity of gas flow meters and the gas chromatograph which are used. All gas sales invoices will be kept by SUIT for 2 years following the end of the project crediting period. In November of 2013, the project began consuming LPG to fire a freeze protection heater (which previously used CBM gas) at the CDP and these volumes are tracked annually using fuel delivery invoices.

**Electricity Consumption**

Electric power is supplied to the Red Cedar Coyote Gulch Gas Treating Plant by La Plata Electric Association (LPEA), a Rural Electric Cooperative. Monthly electricity purchase invoices are tracked by Red Cedar and are pro-rated to the quantity of gas produced by the interceptor well project. These data are not reported on gas sales invoices, but are provided separately by Red Cedar staff to the project. LPEA is responsible for maintaining the accuracy of electric meters located on-site. All electricity purchase invoices will be kept by Red Cedar for 2 years following the end of the project crediting period.

**Quality Assurance**

Volumes of coalbed methane captured and sold by the project, purchased by the project, and used by the project to generate energy used to capture methane are all metered and using differential type gas flow meters. Each flow meter used by the project has an assigned meter number and is inspected and calibrated by Red Cedar field technicians four times annually.

Copies of inspection and calibration records have been provided to the project validator. The composition of coalbed methane captured and sold by the project, purchased by the project, and used by the project to generate energy used to capture methane are all determined using a portable gas chromatograph. GCs are calibrated daily before each use according to a Red Cedar company procedure. A standard gas cylinder is used during the calibration and equipment is regularly inspected to ensure accuracy. A copy of the operations and maintenance procedure produced by Red Cedar technicians has been provided to the project validator.

There is not currently an internal audit program for meter and GC calibration, however Red Cedar field technicians calibrate and document each piece of equipment used and that data is backed up and kept on file to support outside audits. All collected data are utilized in the calculations so sample size is 100%. QA/QC procedures are included in Red Cedar operations and maintenance documents which have been provided to the project validator.

**4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS**

**4.1 Baseline Emissions**

Baseline emissions for the project include emissions of natural gas combustion replaced by the project activity as well as baseline methane releases to the atmosphere of fugitive methane avoided by the project. The avoided fugitive methane emission rates in the baseline are equal to methane removal rate by the project.

Monitoring Period	Vintage	BE <sub>MR</sub> (tCO <sub>2</sub> e)	BE <sub>Use</sub> (tCO <sub>2</sub> e)	BE(tCO <sub>2</sub> e)
01-January-2016 to 30-November-2016	2016	46,356	5,138	51,495
Sum of Reporting Period		46,356	5,138	51,495

Details on the input parameters and supporting equations can be found in Section 3.0 and Appendix B of this report and Methodology VM0014, v1.0.

## 4.2 Project Emissions

The emissions generated by the project through the use of electricity and CO<sub>2</sub> generated from the combustion of coalbed methane used for energy generation are summarized in the two tables below for these two periods.

Monitoring Period	Vintage	PE <sub>ME</sub> (tCO <sub>2</sub> e)	PE <sub>MD</sub> (tCO <sub>2</sub> e)	PE(tCO <sub>2</sub> e)
01-January-2016 to 30-November-2016	2016	2,875	6,070	8,946
Sum of Reporting Period		2,875	6,070	8,946

Details on the input parameters and supporting equations can be found in Section 3.0 and Appendix B of this report and Methodology VM0014, v1.0.

## 4.3 Leakage

As discussed in the PD, project leakage emissions are considered to be zero.

## 4.4 Net GHG Emission Reductions and Removals

The emissions reductions achieved by the project are presented in the table below

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 2009	31,820	4,895	0	26,925
Year 2010	34,650	5,471	0	29,179
Year 2011	27,312	4,380	0	22,932
Year 2012	56,106	8,990	0	47,116
Year 2013	56,745	9,054	0	47,691
Year 2014	67,032	10,669	0	56,363
Year 2015	71,919	11,560	0	60,359
Year 2016*	51,495	8,946	0	42,549
<b>Total</b>	397,079	63,965	0	333,114

\* 2016 reporting period restricted to 11 months due to facility changes

This monitoring report is summarized as follows:

Period: 01-January-2016 through 30-November-2016

Project Emissions: 8,946 tCO<sub>2</sub> equivalent

Baseline Emissions: 51,495 tCO<sub>2</sub> equivalent

Emission Reductions: 42,549 tCO<sub>2</sub> equivalent

Emissions reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER <sub>y</sub>	= Emission reductions in year <i>y</i> (t CO <sub>2</sub> e/yr)
BE <sub>y</sub>	= Baseline emissions in year <i>y</i> (t CO <sub>2</sub> e/yr)
PE <sub>y</sub>	= Project emissions in year <i>y</i> (t CO <sub>2</sub> /yr)
LE <sub>y</sub>	= Leakage emissions in year <i>y</i> (t CO <sub>2</sub> /yr)

Baseline emissions are calculated as follows:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{USE,y}$$

Where:

BE <sub>y</sub>	= Baseline emissions in year <i>y</i> (t CO <sub>2</sub> e/yr)
BE <sub>MD,y</sub>	= Baseline emissions from destruction of methane in the baseline scenario in year <i>y</i> (t CO <sub>2</sub> e/yr)
BE <sub>MR,y</sub>	= Baseline emissions from release of methane into the atmosphere in year <i>y</i> that is avoided by the project activity (t CO <sub>2</sub> e/yr)
BE <sub>USE,y</sub>	= Baseline emissions from the production of power, heat or supply to the gas grid replaced by the project activity in year <i>y</i> (t CO <sub>2</sub> e/yr)

Project emissions are calculated as follows:

$$PE_y = PE_{ME,y} + PE_{MD,y} + PE_{UM,y}$$


Where:


PE <sub>y</sub>	= Project emissions in year <i>y</i> (t CO <sub>2</sub> e/yr)
PE <sub>ME,y</sub>	= Project emissions from energy use to capture and use methane in year <i>y</i> (t CO <sub>2</sub> e/yr)
PE <sub>MD,y</sub>	= Project emissions from methane destroyed in year <i>y</i> (t CO <sub>2</sub> e/yr)
PE <sub>UM,y</sub>	= Project emissions from un-combusted methane in year <i>y</i> (t CO <sub>2</sub> e/yr)

Details on the input parameters and supporting equations can be found in Section 3.0 and Appendix B of this report and Methodology VM0014, v1.0.

**APPENDIX A: PROJECT GEOGRAPHIC AREA**

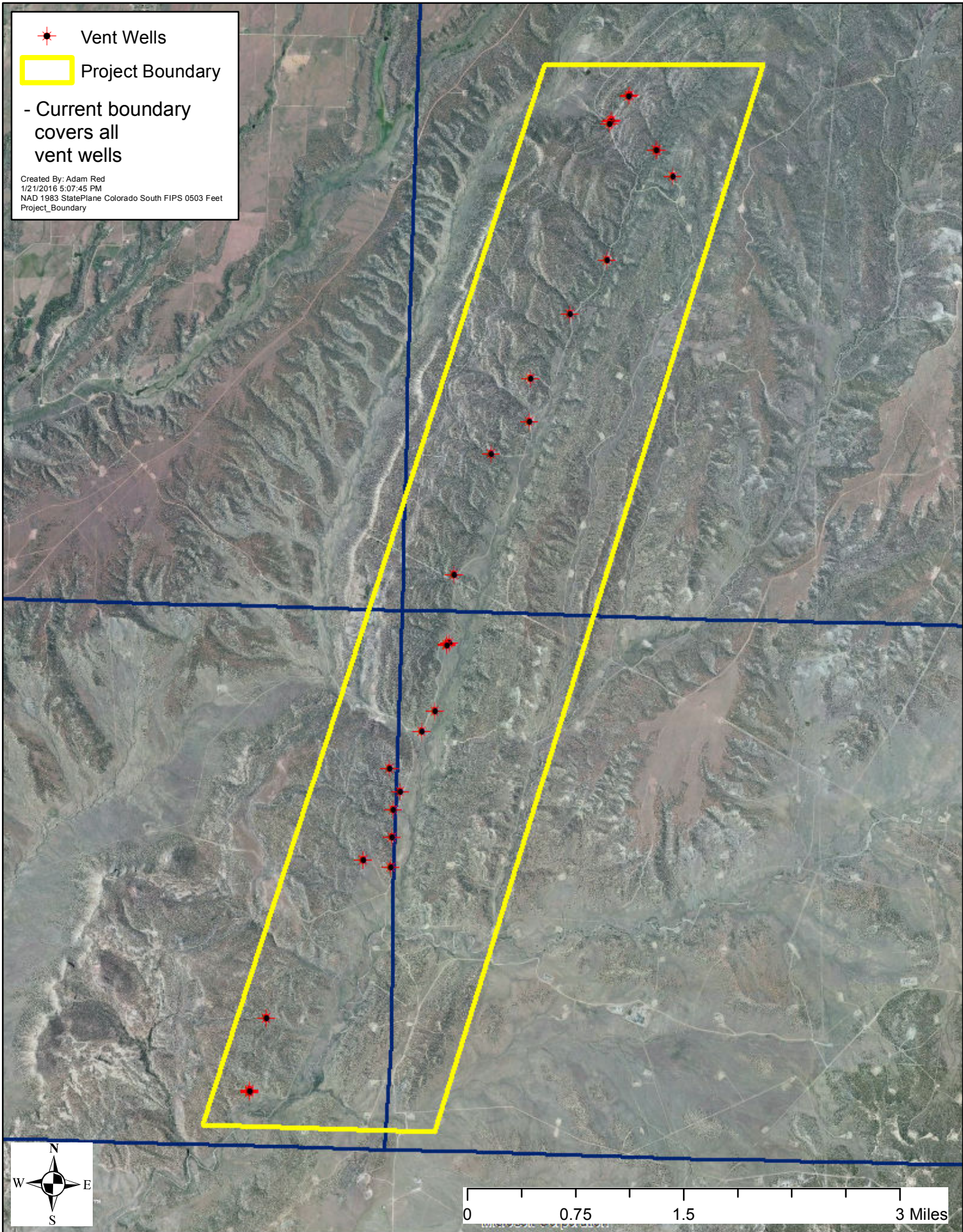


 Vent Wells

 Project Boundary

- Current boundary covers all vent wells

Created By: Adam Red  
1/21/2016 5:07:45 PM  
NAD 1983 StatePlane Colorado South FIPS 0503 Feet  
Project\_Boundary



**APPENDIX B: SUPPORTING DATA AND EQUATIONS**



Ex-post calculation of emission reductions

Average tCO2e/yr	42,078
Sum tCO2e	333,114

VM00014 Parameter		Sixth Verification Monitoring Report											
		Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	
Monitored Parameters	CBM captured by project and sent to CDP (mmcf)	13.22	15.09	17.52	18.51	17.02	17.27	16.66	15.54	16.44	17.12	16.12	
	CM <sub>PJ,vol</sub>												
	CBM captured by project and sent to CDP (MMBtu)	8,508	9,722	11,419	11,817	11,100	10,873	10,582	9,856	10,568	11,039	10,342	
	CM <sub>PJ,energy</sub>												
	Concentration of methane in gas sent to CDP (% v/v)	64.18%	63.37%	64.76%	63.21%	64.98%	62.73%	62.89%	63.12%	64.24%	64.00%	64.03%	
	PC <sub>-CH4,CDP</sub>												
	Concentration of NMHC in gas sent to CDP (% v/v)	0.26%	0.62%	0.35%	0.42%	0.27%	0.27%	0.42%	0.31%	0.20%	0.36%	0.23%	
	PC <sub>-NMHC,CDP</sub>												
	CONS <sub>-FossilFuel,PJ</sub>												
	CBM use at Interceptor Well Compressors (MMBtu)	4,887	4,749	4,848	4,834	4,321	4,179	4,263	4,108	4,266	4,067	3,856	
	CM <sub>use</sub> at Interceptor Station (MMBtu)												
	CM use at CG Compression Station (MMBtu)	1,187	1,429	1,294	1,422	1,205	1,002	1,017	917	1,017	1,040	1,026	
	CM <sub>Mech,CS,PJ</sub>												
	CM use at CG Treating Plant (MMBtu)	468	535	628	650	611	598	582	542	581	607	569	
CM <sub>Mech,TP,PJ</sub>													
LPG use at CDP (gallons)												421.3	
CONS <sub>-LPG,PJ</sub>													
Grid Electricity Use at CG Processing Plant (kW/h/MMBtu)	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.4	0.4	
CONS <sub>-ELEC,PJ,Specific</sub>													
Grid Electricity use at CG Processing Plant (MWh)	2	2	3	3	3	4	3	3	3	3	4	3	
CONS <sub>-ELEC,PJ</sub>													
Captured Methane sent to pipeline (MMBtu)	6,792	7,758	9,497	9,745	9,284	9,273	8,983	8,397	8,970	9,392	8,747		
CM <sub>GAS,PJ</sub>													
Captured Methane destroyed after being sent to pipeline (tCH4)	130	148	181	186	177	177	171	160	171	179	167		
CM <sub>GAS,PJ</sub>													
Captured Methane destroyed by mechanical energy generation	32	37	37	40	35	31	30	28	30	31	30		
CM <sub>Mech,PJ</sub>													
Concentration of methane in gas sent to pipeline (% v/v)	95.77%	95.76%	95.36%	95.61%	95.73%	95.84%	95.67%	95.86%	95.74%	95.82%	95.77%		
PC <sub>-CH4,GridFuel</sub>													
Concentration of NMHC in gas sent to pipeline (% v/v)	2.40%	2.39%	2.76%	2.66%	2.48%	2.44%	2.53%	2.55%	2.53%	2.75%	2.54%		
PC <sub>-NMCH,GridFuel</sub>													
Project Emissions	Emissions from energy to capture and destroy (tCO2)	289	281	288	287	257	249	253	245	253	242	230	
	PE <sub>ME</sub>												
	Combustion Emissions from use of captured methane (tCO2e)	443	510	599	620	582	570	555	517	554	579	542	
PE <sub>MD</sub>													
Project Emissions (tCO2e)	732	791	887	907	839	819	808	761	808	821	772		
PE <sub>y</sub>													
Baseline Emissions	Baseline emissions of CBM in year y (tCH4)	161	185	218	225	212	207	202	188	202	210	197	
	CM <sub>BL</sub>												
	Baseline CH4 Release (tCO2e)	3,382	3,893	4,573	4,732	4,445	4,354	4,237	3,947	4,232	4,420	4,141	
	BE <sub>MRY</sub>												
Baseline emissions from energy use replaced by project (tCO2)	360	412	504	517	493	492	477	446	476	498	464		
BE <sub>Use,y</sub>													
Baseline Emissions (tCO2e)	3,743	4,305	5,076	5,249	4,937	4,846	4,714	4,392	4,708	4,919	4,605		
BE <sub>y</sub>													
VCUs	VCUy (tCO2e/yr)	3,011	3,513	4,190	4,342	4,099	4,027	3,906	3,631	3,900	4,098	3,833	
	ER <sub>y,Gross Project</sub>												
	Σ VCUy (tCO2e)	293,575	297,089	301,278	305,620	309,719	313,746	317,652	321,282	325,183	329,280	333,114	