

CORINTH ABANDONED MINE METHANE RECOVERY PROJECT

Document Prepared By Environmental Commodities Corporation

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Keyrock Energy, LLC ("Keyrock") owns and operates the Corinth Abandoned Mine Methane Recovery Project ("Project"). All technologies/measures were fully operational for the entire duration of the reporting period.

The Project was commissioned on September 26, 2002. The Project was shut down in 2004 and restarted in 2005. The Project has since operated continuously.

This Monitoring Report covers operations from January 1, 2013 to December 31, 2014. The Project generated 272,222 (tCO_{2e}) emission reductions during this time.

1.2 Sectoral Scope and Project Type

Sectoral scopes 8 and 10 apply to the Project.

The Project is not a grouped project.

1.3 Project Proponent

Organization name	Keyrock Energy LLC
Contact person	Chris Shea
Title	Operations Manager
Address	106 Ferrell Avenue, Suite 5, Kingsport, TN 37663
Telephone	423-726-2070
Email	CShea@KeyrockEnergy.com

1.4 Other Entities Involved in the Project

Organization name	Environmental Commodities Corporation
Role in the project	Technical Advisor
Contact person	Ben Apple
Title	Principal
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1.5 Project Start Date

September, 26 2002

1.6 Project Crediting Period

January 1, 2010 – December 31, 2019

1.7 Project Location

The Project is located in Illinois (U.S.) in Jefferson, Franklin, and Williamson counties.

The main plant of the Project is located at N 37.8691, W 88.7879.

1.8 Title and Reference of Methodology

The following methodologies apply to the Project:

1. ACM0008v06, Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation
2. VMR0002v01, Revision to ACM0008 to Included Methane Capture and Destruction from Abandoned Coal Mines, Version 1.0
3. Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion (Version 02)

1.9 Other Programs

- Emission Trading Programs and Other Binding Limits: The Project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading other than the Verified Carbon Standard
- Other Forms of Environmental Credit: The Project did not seek and did not receive any other form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period.
The Project was not eligible to create another form of GHG-related environment credit during the Monitoring Period.
- Participation under Other GHG Programs: The Project was not registered under any other GHG program during the Monitoring Period.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

- The Project was operational during the entire Monitoring Period.
- There were no changes to the entities with interests in the Project during the Monitoring Period.
- The project did not extract gas from Old Ben Coal 15 during this reporting period.
- The project did not utilize Compressor Station #6 during this reporting period.

2.2 Deviations

2.2.1 Methodology Deviations

- Continuous gas monitoring (existing) – The Methodology states that methane concentration of mine gas must be monitored continuously. The Project utilizes continuous samplers that collect small samples of gas approximately once every 40 minutes and store the samples in a collection bottle. At the end of monthly periods, an empty sample bottle is exchanged for the bottle containing the sample to be analyzed. The sample bottle, which contains a collection of samples gathered over the previous month period, is then analyzed by a 3rd-party lab. This procedure is acceptable to VCSA per the “VCS PROJECT REVIEW REPORT (11 August 2014)”.
- Carbon emissions factor for grid electricity (existing) – An emission factor for electricity generation is assigned a value of 0.8216 tonnes CO₂ per MWh based on US EPA’s eGRID 9th edition Version 1.0 for the SRMW subregion. This value was updated from the previous verification based on the most recent eGRID report. Use of this factor was approved at validation. Use of this factor does not impact conservativeness of the quantification of GHG emission reductions or removals.
- Density of methane (existing) – As with previous reporting periods and documented in the previous Monitoring Reports, project gas flows were adjusted from ambient conditions to standard reference conditions at 60°F and one atmosphere of pressure, which is standard in the natural gas industry. These conditions correspond to a methane density of 0.68 kg/m³. This contrast with the methodology’s defined normal conditions of temperature and pressure (20°C and 1 atm) and density of methane (0.67kg/m³). Use of this value was approved at validation and does not impact conservativeness of the quantification of GHG emission reductions or removals.
- Records describing $V_{AMM, is}$ are not available due to the years that the mines were abandoned. The value of $V_{AMM, is}$ is determined through a series of equations using established concepts of fluid flow in porous media and other historical data about the individual mines, including the mass of coal that will contribute methane, the methane content of the coal (scf/ton) that is in the coal prior to mining, the methane remaining at abandonment, the methane emission rate at abandonment, determined from the partial pressure of methane in the void of the mine. $V_{AMM, is}$ is considered the replenishment rate of methane into the mine at the time the mine pressure is measured. This rate is then compared to the decline curve emission rate at that same point in time (the time of pressure measurement) in order to get the S factor, where $S = V_{AMM, is} / V_{AMM, i}$ and $V_{AMM, i}$ is the rate on the decline curve at the same time as when $V_{AMM, is}$ is calculated. The calculated replenishment rate is based on the pressure in the mine and the productivity index calculated at the time of mine closure (when the gas pressure in the coal was higher). Use of this value was approved at validation and does not impact conservativeness of the quantification of GHG emission reductions or removals.

2.2.2 Project Description Deviations

- Project ownership (existing) – As noted in a previous Monitoring Report, Keyrock Energy LLC purchased the Project from DTE Methane Resources.
- Wet vs. dry basis of methane analysis (existing) – As with previous reporting periods and documented in the previous Monitoring Reports, the project measured flow and methane concentration on a wet basis for AMM_{COMP} and AMM_{BOILER} and on a dry basis for AMM_{GAS} .

This is contrary to the methodology, which prescribed consistent measurement on a wet basis for the parameter (PC_{CH_4}). This deviation was previously accepted without adjustment for two reasons. First, the temperature of the extracted gas was not significantly high (i.e., not greater than 60°C, referencing UNFCCC “Tool to determine project emissions from flaring gases containing methane”), and therefore the difference between measured flow on a wet or dry basis is minimal. Second, the monitored gas flow and concentration for pipeline sales did not serve as a data element in calculating baseline emissions because the abandoned mines produce more methane than the *ex ante* decline curve calculations indicated (by 77% and 85% in 2013 and 2014, respectively). In accordance with the methodology, the baseline emission number used for emission reduction calculations was the lower of the measured methane produced by the mines or the validated *ex ante* calculated emissions.

- New methane analyzer (new) – The original gas chromatograph located the point of pipeline delivery was replaced on October 24, 2013. Details are noted in Section 3.3 (ref. AMM_{GAS} and PC_{CH_4} , for pipeline). The activity does not impact the additionality, baseline calculation, conservativeness of the quantification of GHG emission reductions or removals. This deviation relates only to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology.
- Methane analyzer calibrations (new) – The gas analyzer used to determine methane concentration for AMM_{GAS} and AMM_{NRU} is automatically calibrated daily. The Project Description indicates this is performed monthly. This methane analyzer is manually calibrated quarterly (as described in the Project Description). The gas analyzer (for sample bottles) for gas samples taken in the field and in the plant is calibrated monthly. The Project Description indicates that the analyzer is calibrated before each reading is taken. To clarify, the instrument is calibrated *before* the readings are taken, but not necessarily immediately before each reading is taken. The calibration process of the sophisticated gas chromatograph is manual and takes a considerable amount of time to conduct. It is not practical to calibrate the analyzer before each of the 10+ samples are analyzed every month. The activity does not impact the additionality, baseline calculation, conservativeness of the quantification of GHG emission reductions or removals. This deviation relates only to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology.
- Gas flow meters (new) – The flow meters operated very stably over 2013 and 2014. The accuracy drift of the meters in the field (compressor stations) were only inspected once during the two year reporting period, in December 2014. The results of the inspection show very little drift (maximum drift was 3.5%, most observed drift was below 1.0%). Calibrations were only performed if an instrument fails an accuracy check. If an instrument passed an accuracy check, then the instrument was not calibrated (i.e., it was not necessary). The flow meters at the boiler and compressors performed as expected throughout the reporting period so there was no need to calibrate the meters during normal operations. The activity does not impact the additionality, baseline calculation, conservativeness of the quantification of GHG emission reductions or removals. This deviation relates only to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology.

2.3 Grouped Project

The Project is not grouped.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	B
Data unit	None
Description	The hyperbolic exponent
Source of data	Publicly available government data
Value applied:	2.314585
Justification of choice of data or description of measurement methods and procedures applied	Data published by the U.S. EPA for individual coal basins here: http://www.epa.gov/cmop/docs/abandoned_mine_variables_by_basin.pdf
Purpose of the data	Value used is the medium value for vented mine.
Purpose of the data	Determine AMM emissions decline curve
Comments	None
Data / Parameter	CEFC _{CH4}
Data unit	tCO ₂ / tCH ₄
Description	Carbon emission factor for combusted methane
Source of data	ACM0008v06, Pg. 10
Value applied:	2.75
Justification of choice of data or description of measurement methods and procedures applied	Commonly accepted conservative value.
Purpose of the data	Calculation of baseline and project emissions
Comments	None
Data / Parameter	CEFE _{ELEC}
Data unit	tCO ₂ /MWh
Description	Carbon emissions factor of electricity used by the project
Source of data	eGRID 9th edition Version 1.0, Year 2010 Summary Tables, (created February 2014), http://www.epa.gov/cleanenergy/documents/egridzips/eGRID_9th_edition_V1-0_year_2010_Summary_Tables.pdf , SRMW value
Value applied:	0.8216
Justification of choice of data or description of measurement methods and procedures applied	Used in accordance with Project Description
Purpose of the data	Calculate project emissions.
Comments	None
Data / Parameter	CEF _{GASOLINE}
Data unit	tCO ₂ /GJ
Description	Carbon emissions factor of gasoline (fossil fuel) used by coal mine
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf , pages 3.16, 3.21
Value applied:	0.0693
Justification of choice of data or description of measurement methods and procedures applied	Used in accordance with Project Description
Purpose of the data	Calculate project emissions
Comments	This parameter is equivalent to CEF _{FOSS FUEL}

Data / Parameter	CEF _{NMHC}
Data unit	tCO ₂ /MWh
Description	Carbon emissions factor of non-methane hydrocarbons combusted by gas
Source of data	Calculated if PC _{NMHC} exceeds 1%
Value applied:	n/a. PC _{NMHC} <1% for 2013 and 2014.
Justification of choice of data or description of measurement methods and procedures applied	Used in accordance with Project Description
Purpose of the data	Calculate project emissions.
Comments	None
Data / Parameter	D _i
Data unit	1/yr
Description	Initial decline rate
Source of data	2007 US EPA Report: Methane Emissions from Abandoned Coal Mines in the United States: Emissions Inventory Methodology and 1990-2007 Emission Estimates, use the medium value from the table for Vented Mines, Illinois. See: http://www.epa.gov/cmop/docs/abandoned_mine_variables_by_basin.pdf
Value applied:	1.335535
Justification of choice of data or description of measurement methods and procedures applied	Follows VMR0002 V01
Purpose of the data	Calculate baseline emissions
Comments	None
Data / Parameter	Eff _i
Data unit	%
Description	Overall efficiency of methane destruction/oxidation through destruction device i.
Source of data	ACM0008v06, pg 11-12 and the Project Description
Value applied:	Eff _{GAS} = 98.5% Eff _{COMP} = 99.5% Eff _{BOILER} = 98.0% Eff _{NRU} = 98.1%
Justification of choice of data or description of measurement methods and procedures applied	ACM0008v08 specifies use of most recent IPCC report.
Purpose of the data	Calculation of project emissions
Comments	None
Data / Parameter	GWP _{CH4}
Data unit	None
Description	Global warming potential of methane
Source of data	Established by Kyoto Protocol
Value applied:	21
Justification of choice of data or description of measurement methods and procedures applied	Commonly accepted conservative value for methane.
Purpose of the data	Calculation of baseline and project emissions
Comments	None
Data / Parameter	t
Data unit	years
Description	The time elapsed from the date of mine closure to midpoint of the current crediting year y in years, expressed as a decimal and not rounded to an integer

Source of data	The date of mine closure and the midpoint of the current crediting year.
Value applied:	n/a
Justification of choice of data or description of measurement methods and procedures applied	Established in Project Description
Purpose of the data	To calculate emissions of CH ₄ from the decline curve of the abandoned mine in the baseline scenario.
Comments	None
Data / Parameter	Unit Conversion
Data unit	GJ/U.S. gallon gasoline
Description	Energy per volume unit of gasoline
Source of data	U.S. Consumption 2009: 124,238 Btu/ U.S. gal (DOE EIA) and energy conversion factor: 1 KJ = 0.947817 Btu
Value applied:	0.131078
Justification of choice of data or description of measurement methods and procedures applied	Most accurate source of data available.
Purpose of the data	Calculation of project emissions
Comments	None
Data / Parameter	V _{AMM,i,s}
Data unit	m ³ / day
Description	The daily flow rate of methane from abandoned mine after closure
Source of data	Government data or calculation
Value applied:	Varies by well, ranging from 20,000 to 45,000
Justification of choice of data or description of measurement methods and procedures applied	Indicated by ACM0008v06
Purpose of the data	Calculate baseline emissions
Comments	None

3.2 Data and Parameters Monitored

Data / Parameter	AMM _{BOILER}
Data unit	tCH ₄
Description	Methane sent to boiler
Source of data	Calculated from measured data on gas flow rate, temperature, pressure and methane content. Measurements taken with an ABB Total Flow 6713 (volume) and a composite sampling system and Perkin Elmer Sigma 3B gas chromatograph (CH ₄ %).
Measurement procedures (if any):	The flow meter measures gas volumes. The meter automatically corrects measurement reference temperature and pressure to standard conditions of 60°F and 1 atm. A composite gas sampler collects boiler fuel gas at a sample point downstream of the dehydration system. The system collects gas samples every 40 minutes. Sample bottles are sent to an independent laboratory (CapRock Laboratory) for analysis on a monthly basis.
Monitoring frequency	Flow: Continuously Methane concentration: Continuous collection, monthly analysis
QA/QC procedures:	The flow meter is inspected, checked, and calibrated (if necessary) on a quarterly basis. The check on this flow meters does not include an automatic calibration

	sequence. The instrument is only calibrated if necessary and in accordance with industry standards (observed drift greater than 0.25%). Perkin Elmer Sigma 3B is manually calibrated before each reading or on a monthly basis.
Any Comments	None
Data / Parameter	AMM _{COMP} (for Field Compressors and Plant Compressors)
Data unit	tCH ₄
Description	Methane sent to compressors (field compressor stations and plant compressors)
Source of data	<u>Field Compressors</u> - Calculated from measured data on gas flow rate, temperature, pressure and methane content. Measurements taken with Floboss 103 flow computers (volume) and composite sampling system and Perkin Elmer Sigma 3B gas chromatograph (CH₄%). <u>Plant Compressors</u> (Inlet Compressor and Sales Compressor) - Calculated from measured data on gas flow rate, temperature, pressure and methane content. Measurements taken with an ABB Total Flow 6713 (volume) and a composite sampling system and Perkin Elmer Sigma 3B gas chromatograph (CH₄%).
Measurement procedures (if any):	<u>Field Compressors</u> – Volume readings from field compressors are manually downloaded from the instruments to a laptop computer on a monthly basis and then uploaded to a remote server. Flow meters at the field compressors adjust measurements to 68°F/1 atm. The values generated by these instruments are manually corrected to 60°F/1atm in the emission reduction calculation spreadsheets. <u>Plant Compressors</u> –Volume readings from plant compressors are manually observed and recorded on a daily basis, entered into a computer, and uploaded to a remote server. Flow meters at the plant compressors automatically correct measurements to a reference temperature and pressure of 60°F and 1 atm. Composite gas sampler systems collect gas at compressor discharge points (field) and downstream of the dehydration system (plant). The systems collect gas samples every 40 minutes. Sample bottles are sent to an independent laboratory (CapRock Laboratory) for analysis on a monthly basis.
Monitoring frequency	Flow: Continuously Methane concentration: Continuous collection, monthly analysis
QA/QC procedures:	<u>Field Compressors, volume</u> – inspected, checked, and calibrated on an annual basis (See Methodology Deviation). The check is conducted with a laptop and fluke meter. The check on these flow meters automatically includes a calibration sequence. <u>Field Compressors, CH₄%</u> - The Perkin Elmer Sigma 3B is manually calibrated before each measurement, or on a monthly basis. <u>Plant Compressors, volume</u> – inspected, checked, and calibrated (if necessary) on a quarterly basis. The check on these flow meters does not include an automatic calibration sequence. The instruments are only calibrated if necessary and in accordance with industry standards (observed drift greater than 0.25%). <u>Plant Compressors, CH₄%</u> - The Perkin Elmer Sigma 3B is manually calibrated before each measurement, or on a monthly basis.
Any Comments	None
Data / Parameter	AMM _{GAS}
Data unit	tCH ₄

Description	Methane sent to gas grid for end users
Source of data	Calculated from measured data on gas flow rate, temperature, pressure and methane content. <u>Pipeline</u> - Instruments located at the point of pipeline delivery: Daniel SR Orifice plate flow meter and Fischer RTU computer (volume). Instromet EnCal 200 gas analyzer (1/1/2013-10/23/2014) and ABB NGC 8200 series gas chromatograph (10/24/2013-12/31/2014) (CH₄%). <u>Third-party gas</u> volume is allocated based on volumes reported from an orifice flow meter and monthly spot sample gas quality analysis. AMM_{GAS} is adjusted for third party gas sales in the emission reduction calculations.
Measurement procedures (if any):	The flow meter automatically corrects measurement reference temperature and pressure to standard conditions of 60°F and 1 atm. Pipeline gas quality readings are a daily average from an on-line gas analyzer.
Monitoring frequency	Flow: Continuous Methane concentration: Continuous
QA/QC procedures:	The Orifice plate flow meter is inspected and calibrated on a quarterly basis. The gas analyzer performed an auto-calibration every day. A manual inspection and calibration is performed quarterly.
Any Comments	AMM_{GAS} is equal to gas delivered to the pipeline minus third-party sales. Flow meter field readings are automatically corrected to standard conditions of 14.7 psia and 60°F.
Data / Parameter	AMM _{NRU}
Data unit	tCH ₄
Description	Methane sent to the NRU
Source of data	Calculated based on AMM _{GAS}
Measurement procedures (if any):	The amount of methane sent to the NRU is estimated by adding to the gas delivered to the pipeline an estimate of the volume of methane vented by the NRU. The manufacturer's estimate of methane vented by the NRU is 1.9% of total methane sent to the NRU, which is based on manufacturer's simulation using project production data.
Monitoring frequency	Flow: Continuous Methane concentration: Continuous
QA/QC procedures:	The Orifice plate flow meter is inspected and calibrated on a quarterly basis. The gas analyzer performed an auto-calibration every day. A manual inspection and calibration is performed quarterly
Any Comments	Flow meter field readings are automatically corrected to standard conditions of 14.7 psia and 60°F.
Data / Parameter	CONS _{ELEC,PJ}
Data unit	MWh
Description	Additional electricity consumption for capture and use or destruction of methane
Source of data	Measured by electricity service provider. Documented with monthly electric bills.
Measurement procedures (if any):	Service provider (utility company) measures electricity used at all electric meters supplying electricity to the Project. The service providers are responsible for measurement of the parameter.
Monitoring frequency	Continuous

QA/QC procedures:	None
Any Comments	None
Data / Parameter	CONS _{GASOLINE}
Data unit	GJ
Description	Additional gasoline (fossil fuel) consumption for capture and use or destruction of methane. All gasoline is combusted in motor vehicles
Source of data	Point of sale (gas station). Internal record keeping
Measurement procedures (if any):	Gas stations measure gasoline volume sold to consumers.
Monitoring frequency	Every time gasoline is purchased
QA/QC procedures:	n/a
Any Comments	This parameter is used with the conversion factor "GJ/U.S. gallon gasoline" in Section 3.1 in the emission reduction calculations.
Data / Parameter	PC _{CH₄} , for compressors and boiler
Data unit	%
Description	Concentration (in mass) of methane in extracted gas (%)
Source of data	Measurement with Perkin Elmer Sigma 3B analyzer
Measurement procedures (if any):	Composite gas samplers collect gas downstream of the dehydration unit every 40 minutes. The samples are sent to an independent lab (CapRock laboratory), which uses a Perkin Elmer Sigma 3B gas chromatograph (CH ₄ %).
Monitoring frequency	Monthly
QA/QC procedures:	The Perkin Elmer Sigma 3B is manually calibrated before each measurement, or on a monthly basis.
Any Comments	None
Data / Parameter	PC _{CH₄} , for pipeline
Data unit	%
Description	Concentration (in mass) of methane in extracted gas (%)
Source of data	Measured
Measurement procedures (if any):	Methane concentration readings are a daily average from an Instronet EnCal 200 gas analyzer (1/1/2013-10/23/2014) and ABB NGC 8200 series gas chromatograph (10/24/2013-12/31/2014) (CH ₄ %).
Monitoring frequency	Continuous. The GC cycle time is between 5 and 6 minutes.
QA/QC procedures:	The gas analyzer performed an auto-calibration every day. A manual inspection and calibration is performed quarterly.
Any Comments	None
Data / Parameter	PC _{NMHC}
Data unit	%
Description	Non-methane hydrocarbon concentration (in mass) in extracted abandoned coal mine gas.
Source of data	Gas samples taken from inlet compressor, analyzed by a third-party lab
Measurement procedures (if any):	Composite gas samplers collect gas at the plant inlet. The systems collect gas samples every 40 minutes. Sample bottles are sent to an independent laboratory for analysis on a monthly basis. The lab uses a Perkin Elmer Sigma 3B gas chromatograph (CH ₄ %).

Monitoring frequency	Continuous.
QA/QC procedures:	The Perkin Elmer Sigma 3B is manually calibrated before each measurement, or on a monthly basis.
Any Comments	None

3.3 Monitoring Plan

The purpose of monitoring is to measure the amount of AMM captured and destroyed by the project activity that would have otherwise been released to the atmosphere in the baseline scenario.

The on-site facility manager is responsible for field execution of the Monitoring Plan. The objectives of the Monitoring Plan are as follows:

- Measure gas volumes from mines, compressor fuel lines, compressor outputs, plant component fuel lines, and sales transfer point.
- Monitor methane concentration of mine gas, compressor fuel, boiler fuel, and sales gas.
- Establish standards for analyzing gas content on a regular basis.
- Document calibration methods and results of metering, testing, and sampling equipment.
- Format and archive data to demonstrate the generation of GHG emission reductions.

Data acquisition has been established at all key points of the Project including points of AMM capture and points of AMM destruction. The points of capture are at the vertical boreholes, which have been drilled into the abandoned mines. The field compressors draw the gas from the mines via wells and then transport the gas to the Plant for processing and delivery to the gas pipeline grid. Fuel is supplied to operate plant compressors from the discharge of the compressors. Points of destruction include all of the field compressors, two compressors in the Plant, a boiler in the Plant, and the gas pipeline grid.

Each well is equipped with a flow meter (Floboss 103 or Fisher Roc 306) and each field compressor is equipped with a flow meter (Floboss 503 or Floboss 103). These flowmeters measure temperature, pressure, and volumetric flow rate. Field personnel visit each meter on a monthly or a bi-monthly basis to download raw data from the Floboss instruments (in spreadsheet format). Production and pressure data from the field compressor stations is transmitted daily to the main gas plant via a satellite connection or a telephone modem. The plant manager and other Keyrock personnel have access to the data.

Continuous gas samplers are installed at each of the ten active field compressor stations discharge points, plant inlet, and plant fuel system. There was no compressor station 6 throughout the years 2013 and 2014; it was taken off-line prior to 2013.

Throughout 2013 and 2014, one or two compressors were used to service Compressor Stations 25, 27, and Blackstar ("Bstar"). Each compressor station can support one compressor. Compressors were rotated among these three compressor stations as mine methane became available or unavailable at the compressor stations and wells connected to the compressor stations. Composite gas samplers were installed on the two compressors that rotated among compressor stations 25, 27, and Bstar.

The continuous samplers collect a small portion of the gas stream approximately once every 40 minutes and store that sample in a collection bottle. At the end of each month, the full bottle is removed and replaced with an empty sample bottle. The full bottle is then analyzed by a 3rd-party laboratory. Daily flow measurements are multiplied by the methane concentration to calculate the quantity of methane that is destroyed on-site and the gas that is delivered to the plant.

There is no procedure used for handling any internal auditing and any non-conformities identified.

Project data will be maintained by Keyrock in digital and/or hardcopy format for at least ten years after the crediting period.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

See “Emission Reduction Calculations.xlsx” for accompanying calculations.

The quantity of AMM that is eligible for crediting during the crediting year (y) is defined by Equation (26):

$$A_{i,y} = m \left(\sum_i A_{i,P,i,y}, A_{i,D,y} \right)$$

AMM_i is comprised of AMM destroyed by the following destruction devices:

- AMM_{GAS} – AMM sent to the gas pipeline grid
- AMM_{COMP} – AMM sent to compressors
- AMM_{BOILER} – AMM sent to the boiler

Calculated values are in the table below.

Destruction Device (i)	AMM ₂₀₁₃	AMM ₂₀₁₄
Pipeline	256,850	255,214
Compressors	70,268	77,347
Boiler	24,162	28,649
$\sum_i \text{AMM}_{i,y} \text{ (tCO}_2\text{e)}$	351,280	361,210

In both 2013 and 2014, the amount of AMM eligible for crediting is limited by the amount of AMM that would have been released in the absence of the project activity (the “decline curve”).

The decline curve is calculated using Equation (25):

$$A_{i,D,y} = V_{A_{i,i}} \times D_{C_{4,C}} \times 365 \times S \times (1 + b + D_i \times t)^{-1/b}$$

Where:

- $V_{AMM,i}$ = Emissions of methane prior to mine closure at time (t_0) in normal m^3/day . The values used are the same values that were used for previous reporting periods.
- ρ = Density of methane, set by ACM0008v06
- b = Hyperbolic exponent. The value used are the same values that were used for previous reporting periods.
- D_i = Initial decline rate. The value used are the same values that were used for previous reporting periods.

Calculated values are in the table below.

	AMM _{DC, 2013}	AMM _{DC, 2014}
$\sum AMM_{DC,y}$ (tCO _{2e})	198,674	194,970

Baseline emissions are calculated with Equation (11):

$$B_y = B_{M,y} + B_{M,y} + B_{U,y}$$

BE_y is comprised of AMM emissions from the following sources:

- BE_{MD,y} – emissions from destruction of AMM in the baseline scenario in year y. There was no destruction of AMM in the baseline (BE_{MD,2013-2014} = 0).
- BE_{MR,y} – emissions from the release of AMM into the atmosphere in year y that is avoided by the project activity. This is the only source of baseline emissions and is therefore equal to AMM_y
- BE_{Use,y} – emissions from the production of power, heat, or other forms of useful energy replaced by the project activity in year y. These emissions are not included (BE_{Use,2013-2014} = 0). This reduces the amount of eligible emission reductions and is a conservative assumption.

Calculated values are in the table below.

	2013	2014
BE _y (tCO _{2e})	198,674	194,970

4.2 Project Emissions

See “Emission Reduction Calculations.xlsx” for accompanying calculations.

Project emissions are calculated with Equation (1):

$$P_y = P_{M,y} + P_{M,y} + P_{U,y}$$

- PE_{ME,y} – Project emissions from energy use to capture and use methane in year y
- PE_{MD,y} – Project emissions from destruction of captured methane in year y
- PE_{UM,y} – Project emissions from un-combusted methane in year y

The largest source of project emissions is PE_{MD,GAS}.

Calculated values are in the table below.

	2013	2014
PE _y (tCO _{2e})	60,103	61,319

4.3 Leakage

The Project utilizes methane only from abandoned coal mines. Therefore, gas production by the Project has no impact on coal mining activities or coal production. Therefore, there is no leakage attributed to this project (LE_y = 0).

4.4 Net GHG Emission Reductions and Removals

The emission reductions generated by the Project activity during years 2013 and 2014 are the differences between the baseline emissions and project emissions.

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emissions reductions of the project activity during the year y (tCO_{2e})

BE_y = Baseline emissions during the year y (tCO_{2e})

PE_y = Project emissions during the year y (tCO_{2e})

LE_y = Leakage emissions in year y (tCO_{2e})

Calculated values are in the table below.

Year	2013	2014	Total
BE	198,674	194,970	
PE	60,103	61,319	
LE	0	0	
Total (tCO_{2e})	138,571	133,651	272,222

Generated values throughout the emission reduction calculations were evaluated and screened for unanticipated trends, outlying data points, and unusual patterns. This screening is used to identify potentially erroneous data points, false instrument readings, or calculation errors. Given the large number of data points created over the two-year reporting period, this is a useful and effective method to identify errors that might not otherwise be noticed. No potentially erroneous values or unanticipated patterns were observed during this additional screening.