BLUE SOURCE SPARTANBURG COUNTY LANDFILL GAS COMBUSTION PROJECT

Document Prepared By: Blue Source LLC.

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1 PROJECT DETAILS

1.1 Summary Description of Project

The Wellford Landfill (the "Landfill") consists of six phases designated as Phases I through VI. Phases I through IV include approximately 65 acres of unlined cells and Phase V includes an approximately 35 acre Subtitle D lined landfill. The Landfill is currently operating in Phase V1, Cell 1; a 16 acre lined Subtitle D landfill.

The Project consists of three stages, all implemented at the Wellford Landfill. Stage one (1) of the Project involves the installation of an active gas collection system consisting of 60 wells and associated piping in Phases I through V (with planned future expansion into Phase VI) of the Landfill. During this stage, the gas captured from this system is flared, thereby converting methane to biogenic CO_2. As evidenced by the meeting minutes from SCS Engineers from April 29, 2010, the project start date is April 29, 2010 when these wells were connected and began extracting and combusting landfill gas (LFG)The system will continue to be expanded throughout the duration of the crediting period. Note that the piping systems and headers for the project LFG collection and control system (LFGCCS) were constructed separately from the pre-project system and the LFG collected from the pre-project and project LFGCCS does not meet until a point just before the existing blower/flare station.

Stage two (2) of the Project involves the implementation of a beneficial use project, whereby captured biogas will be transported by pipeline approximately 6.5 miles to the Milliken Dewey Chemical Plant (the "Milliken Facility") for use in its natural gas equipment (i.e. two steam boilers and one hot oil boiler). As part of this stage, gas will be compressed, treated and transported to the Milliken Facility for direct use. The date of commisioning of this phase was June 23, 2011.

Stage three (3) of the Project involves the implementation of a LFG to electricity project, whereby LFG will be sold to Lockhart Power ("Lockhart") for use in electricity generation. Lockhart will use the captured biogas to generate up to 1.6 MW of electricity using a Caterpillar 3520 engine-generator unit. The unit first ran offline (burning LFG but not generating electricity) on May 3rd 2011. May 12th is when the meter first turned, but the unit didn't run consistently and stable until June 1, 2011. Note that no emission reductions are claimed for offsetting grid connected electricity generation.

Stage one (1) of the Project is owned and operated by Spartanburg County (the "County"). Stage two (2) of the Project is owned and operated by both the County and Milliken Company ("Milliken"). In particular, the County owns the first and second stage LFG treatment system, the pipeline used to transport gas to the Milliken Facility and associated metering equipment. Lockhart has a contract with the County to maintain and operate control of the gas through to the plant, this includes flow meter equipment and the single gas analyser, control of pipeline activities. Milliken owns and operates the boilers and all equipment used to produce energy at the Milliken Facility for the facility's use. Stage three (3) of the Project is owned and operated by Lockhart Power. Lockhart owns and operates the energy facility and all equipment used to generate electricity at the site and will operate the first and second stage LFG treatment systems. The County owns and operates the pipeline used to transport gas to Lockhart.

The installation of an active LFG collection system in 2010 was completely voluntary. The objective of this expansion was to increase gas flow and demonstrate the feasibility of developing a future beneficial use project with Milliken. The system was not installed in response to odor complaints or gas migration issues.

No permits were required for the LFG collection system expansion. A South Carolina Department of Health and Environmental Control (DHEC) Construction Permit (Permit No. 2060-0489-CA) was obtained

for the installation of a generator at the Lockhart facility. A permit will also be required to operate the engine and must be requested within 12 months of initial startup. The application was submitted on January 31st, 2012.

A permit is not required to use LFG at the Milliken Facility. Instead a letter was submitted to the DHEC in February 2011 requesting permission to use LFG in the boilers and oil heater at the facility. This change will be incorporated into the facility's Title V permit at the next reissuance or revision. The existing version (Permit No. TV-2060-0300), was issued on October 5, 2009 with an effective date of January 1, 2010.

The Project was validated in accordance with the requirements of the Voluntary Carbon Standard (v.3.2) in March 2012.

1.2 Sectoral Scope and Project Type

- Waste Handling and Disposal, Sectoral Scope 11
- Individual Project

1.3 Project Proponent

The Landfill is owned and operated by Spartanburg County. The gas collection system, gas treatment system and flare are also owned by the County.

Lockhart has contracted with the County to maintain operational control of the gas through to the plant, including meters and analyzers, control of pipeline activites as well as the flow meter. As outlined in Section H of the sales agreement between Lockhart Power and Spartanburg County, dated Dec 29, 2009, Lockhart is entitled to develop the VERs associated with offsetting fossil fuel based energy generation at the Milliken facility. Revenues are then shared with the County.

Milliken receives gas transported by the pipeline. Milliken owns and operates the boilers and all equipment used to produce energy at the Milliken Facility for the facility's use.

Project Proponent(s):

Bryan Stone, P.E.	Cassidy Carlile	Travis Brown
Chief Operating Officer	Director of Corporate Environmental	Wellford Landfill
Lockhart Power	Milliken & Company	Spartanburg County DPW
P.O Box 10 420 River Street	P.O. Box 1926	P.O. Box 5666
Lockhart, SC 29364	Spartanburg, SC 29304	Spartanburg, SC 29304
Phone: (864) 545-2575	Phone: 864.503.1569	Phone: 864-949-1658
Email bstone@lockhartpower.com	Email: Cassidy.Carlile@milliken.com	Email: twbrown@spartanburgcounty.org

1.4 Other Entities Involved in the Project

Blue Source LLC ("Blue Source") has been contracted by Lockhart Power to create and monetize the greenhouse gas (GHG) emission reduction credits generated by the Project.

Project Developer: Kevin Townsend
Chief Commercial Officer
Blue Source, LLC
3165 East Millrock Dr. Suite 340
Holladay, UT 84121
Phone: 801-438-1540

1.5 Project Start Date

The project start date is April 29, 2010 when the County began collecting and destructing LFG from the project collection system.

1.6 Project Crediting Period

The crediting period start date is defined as June 15, 2010. This corresponds with the installation of metering equipment for the project system and does not correspond with the project start date. The crediting period will extend from June 15, 2010 to June 14, 2020, assuming the Landfill is not required to install a LFG capture system during this time.

The crediting period will be reassessed on an annual basis to ensure that the Project does not exceed the NSPS threshold for NMOC emissions and is not required to collect and destruct LFG. If the landfill does become subject to regulations which would require it to collect and destroy landfill gas in the future, no credits will continue to be claimed, from either methane destruction or fossil fuel displacement.

1.7 Project Location

The Landfill is a municipal solid waste landfill located on 390 acres in Spartanburg County, South Carolina. It is bordered by Little Mountain Road, Montgomery Road and the North Tyger River.

The address of the facility is:

595 Little Mountain Road
Wellford, South Carolina

The latitude and longitude of the Landfill are as follows:

- Latitude: 35.001193
- Longitude: -82.13042

The Landfill opened in 1977 and had an estimated 2.26 million Megagrams of waste in place as of January 2009. The design capacity is 3.44 million Megagrams.

The site includes two closed and unlined MSW landfill cells, an active and lined MSW area, a closed construction and demolition (C&D) waste cell and an active C&D waste cell. The two closed MSW areas are referred to as Phases I through IV. The active MSW areas are referred to as Phase V and VI.

Phases I through IV were operational from 1977 through 1992, Phase V accepted waste from 1992 through 2009 and Phase VI opened in 2009 and is expected to operate until 2022. Additional permitting may be obtained to extend the life of the Landfill past 2022.

1.8 Title and Reference of Methodology

Approved consolidated baseline methodology ACM0001: "Consolidated baseline and monitoring methodology for landfill gas project activities": Version 11

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The Project was fully operational throughout the monitoring period (June 15, 2010 – September 30, 2012) and was implemented according to the validated PD. As indicated in the PD stage 3, (LFG to electricity), and stage 2, (LFG that is compressed, treated and transported to the Milliken Facility) took place in the middle of 2011 as described in the PD. The amount of the landfill gas flow going to the flare decreased significantly, thus reducing the amount of project emissions from flaring. Landfill gas proportion sent to the three different destruction devices in 2011 compared to 2012 changed significantly as well. In 2011 about a quarter of the total flow went to both Lockhart and Milliken and the remaining half went to the flare. In 2012, half of the total flow went to Lockhart, forty-one percent went to Milliken and less than ten percent went to the flare. The distribution to the different destruction devices could affect the overall emission reduction estimates. Also in the early fall of 2012 the collection system was also connected to 10 leachate wells which has increased flows over the last couple months of the monitoring period.

2.2 Deviations from the Monitoring Plan

There are a couple minor deviations to the monitoring plan that do not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario, and the project remains in compliance with the applied methodology. These minor deviations are:

- The flow meter for the project is a FCI, which states that a "Delta R" check should occur every 18 months. It also states that for landfill applications a 12 month calibration interval for the first two years is recommended. After that period if no calibration corrections are required the frequency of verification can be extended to 24 months. The PDD was written in Spring 2012, which stated the annual for the first two years would be followed, but in actuality the 18 month recommendation was implemented. Thus the factory calibration occurred 3/19/2010; the piece of equipment was installed 6/15/2010 and it was first calibrated 9/20/2011. Once it was realized that it was calibrated after 18 months instead of 12 the site sent it away to be calibrated by the end of the monitoring period. The manufacturer calibrated the flow meter on 09/27/2012. Both of the calibrations were well within the accuracy range. The site desires that the two calibrations within the 18 month timeframe, count for the first two annual calibrations, thus allowing the site the option to extend the calibration frequency to 24 months.
- The PDD states that the flow meters to Milliken and Lockhart would be measured and recorded at 60F 1 atm. The two flow meters were Factory calibrated to 68 F instead of 60 F, and thus the appropriate methane density for 68 F (20C) has been used in the calculations to accurately account for the methane destroyed at both Milliken and Lockhart.
- The PDD states that the equations 6-8 ($MD_{flared,y}$, $MD_{electricity,y}$, and $MD_{thermal,\ y}$) are calculated by using a equation format such as $MD_{destructiondevice,y} = LFG_{\ Project\ total,y} * w_{CH4,y} * D_{CH4} * Proportion_{\ destructiondevice,y}$, This equation format could result in overstating emission reductions thus a change to the equation is necessary. This overstatement is possible if the LFG eligible project is more than LFG destroyed. Therefore for conservativeness a comparison of CH4 eligible vs CH4 destroyed is taken into consideration so that emission reductions would not be overstated. This

is taken into consideration in the calculations on tabs "Project_Flaring, Project Milliken, Project_Lockhart" in column D. An IF statement is used to determine: If the eligible gas is greater than the amount destroyed:- if true, then the destroyed amount (which is lesser of the two) is used to multiply against the % proportion.- if eligible gas is less than the amount destroyed (false) then the eligible amount of gas (which is less than destroyed) is used to multiply the % proportion.

- The PDD states that the flow meter to Milliken, located at the Lockhard flare skid would be a "Rosemount 3051 SFC-Compact conditioning orifice plate mass flowmeter". This meter is at the Milliken Facility and is not used for carbon credit data calculations. The meter that is used is a Rosemount 2051 SFC-Compact conditioning orifice plate mass flowmeter (SN 0042055).

2.3 Grouped Project

This section is not applicable as the project is an individual project.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

A listing of the variables that are estimated or quantified using emission factors or default values is provided below

Data / Parameter:	$MD_{BL,y}$
Data unit:	tonnes CH_4
Description:	Amount of methane destroyed historically for the previous year before the start of the Project.
Source of data:	N/A
Value applied:	0
Purpose of the data:	This is used for baseline emissions
Any comment:	Prior to project implementation, some LFG was captured and flared. However, gas flow / composition from the project system is metered prior to comingling with the pre-project system. A baseline deduction is not required.

Data / Parameter:	$\eta_{flare,h}$
Data unit:	%
Description:	Default Flare Efficiency
Source of data:	CDM Methodological "Tool to determine project emissions from flaring gases containing methane)
Value of data applied:	98.0
Purpose of the data:	Project Emissions
Any comment:	A more accurate flare efficiency for the open flare is applied based on guidance from the US EPA and the Climate Action Reserve (CAR). This approach is justified on the basis that it is more accurate

	for equipment and conditions in the United States (versus ACM0001). Further, the flare is designed and operated in accordance with 40 CFR 60.18. This standard specifies requirements for flare operating variables (i.e. Btu content, exit velocity) that must be met in order to achieve a 98% or higher flare destruction efficiency. These include max/min exit velocity, max/min BTU content, max/min flare temperature and confirmation that there are no visual emissions. The design maximum capacity of the flare is 1000 scfm. The flow meter data can be compared to the design capacity to ensure that max exit velocity is being met. The current temperature shutdown is 300F, but this value may be adjusted according to changing conditions. There is also a UV scanner (flame detection system) and thermocouple to make sure the flare stays lit, and to shut it down when it doesn't. Additionally, minimum fuel Btu content can be demonstrated through continuous methane monitoring system. Since this flare is non-assisted, it is required to have a minimum fuel content of 200 Btu/scf. This would translate into a minimum methane content of approximately 20%. Continuously monitored methane content can be reviewed to demonstrate minimum Btu Content. For visual emissions, Lockhart has the standard operating procedure for their operator to look at stack emissions when he is on site and when the flare is operating, and record any unusual visual emissions for follow-up maintenance. Beginning on March 1, 2012, a formal checklist requiring that this be done on a daily basis for each day that the operator is on site will be implemented. Currently the operator is on site 4 days per week.

Data / Parameter:	ϵ_{boiler}
Data unit:	%
Description:	Energy efficiency of the boilers used to generate thermal energy in the absence of the Project
Source of data:	Guidance from ACM0001
Value applied:	100%
Purpose of the Data:	This is used for baseline emissions.
Any comment:	To be conservative, Option B from the methodology is applied

Data / Parameter:	$\epsilon_{boiler,BL}$
Data unit:	%
Description:	Energy efficiency of the boilers used to generate thermal energy in the absence of the Project
Source of data:	CDM “Tool to determine the baseline efficiency of thermal or electric energy generation systems,” Version 01
Value applied:	87%
Purpose of the Data:	This is used for baseline emissions.
Any comment:	Selected the value for “Old natural gas fired boiler” since it is the

	most conservative relevant equipment type.

Data / Parameter:	GWP_{CH4}
Data unit:	$tCO_2e/tCH4$
Description:	Global warming potential of CH_4
Source of data:	IPCC
Value of data applied:	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Purpose of data:	Baseline and Project Emissions
Any comment:	

Data / Parameter:	$\rho_{CH4,n}$ / D_{CH4}
Data unit:	tCH_4/m^3CH_4
Description:	Density of Methane at normal conditions
Source of data:	http://cdm.unfccc.int/methodologies/inputsconsmeth/MGM_methane.pdf for 60 degrees F, 68 degrees F, and calculated for 75 degrees F (see comments)
Value of data applied:	60 degrees F and 1 atm: $1.915x10^{-5}$ tonnes CH_4/ft^3CH_4 75 degrees F and 1 atm: $1.867x10^{-5}$ tonnes CH_4/ft^3CH_4
Purpose of data:	Project Emissions
Any comment:	Density at 75 degrees F and 1 atm is calculated using the ideal gas law, P*V = n*R*T = (m/M)*R*T, where: ρ_{CH4} = m/V M = Molar mass of methane (16.04 g/mol) M = Mass of methane (g) P = Pressure, 1 atm = 101.325 kPa = 14.7 psia T = Temperature, 75 F = 23.89 C = 297.15 K R = Ideal Gas Constant = 8.314 J/(mol K)

Data / Parameter:	F
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories and LandGEM default value.
Value of data applied:	0.5
Purpose of data:	This is used for baseline and project emissions
Any comment:	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.

Data / Parameter:	Lo
Data unit:	m^3/Mg
Description:	Potential methane generation capacity
Source of data:	Site-specific value developed by SCS Engineers applied to the LandGem model
Value of data applied:	[COMMERCIALLY SENSITIVE INFORMATION REMOVED]
Purpose of this data	This is used for baseline and project emissions

Any comment:	

Data / Parameter:	k
Data unit:	-
Description:	Decay rate
Source of data:	Site-specific value developed by SCS Engineers applied to the LandGem model
Value of data applied:	[COMMERCIALLY SENSITIVE INFORMATION REMOVED]
Purpose of this data	Baseline and Project emissions
Any comment:	

Data / Parameter:	$TDL_{Grid,y}$
Data unit:	%
Description:	Average technical transmission and distribution losses for grid in year y
Source of data:	Recent, accurate and reliable data from the United States is used to quantify the average line losses. This value is obtained from the US EPA eGRID2012 Year 2009 Grid Gross Loss- Eastern Region[1]
Value applied:	5.82%
Purpose of the Data:	This is used for baseline and project emissions
Any comment:	This value should be updated annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.

Parameter	$L_{Milliken}$
Data Unit	MW
Description	Electricity consumption ratings of the blower fans used to operate Milliken's boilers. Fans are rated at 20 hp (for the 600 hp boiler), 7.5 hp (for the 250 hp boiler) and 15 hp (for the 400 hp boiler).
Source of Data	Manufacturer specifications
Value Applied	0.01492 MW for 20 hp fan 0.005595 MW for 7.5 hp fan 0.01119 MW for 15 hp fan Total is 0.03171 MW for all three fans
Purpose of the Data:	This is used for project emissions
Any Comment	Full load will be used in calculations for conservativeness. Relevant equipment and applicable load ratings may change and will be verified during each monitoring period.

Data / Parameter:	$NCV_{methane}$
Data unit:	GJ / scf
Description:	Energy content of methane
Source of data:	U.S. EPA Landfill Methane Outreach Program Interactive Conversion Tool (http://www.epa.gov/lmop/projects-candidates/interactive.html)

[1] U.S EPA eGRID2012 http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html page 9

	The value of 1,012 Btu per scf was obtained from US EPA and was converted to units of GJ per scf by dividing the factor by a conversion factor of 947,817 Btu per GJ.
Value applied:	0.0010677
Purpose of the Data:	This is used for baseline and project emissions
Any comment:	Values will be reviewed annually to ensure they are appropriate or following any future revision of US EPA guidelines, as applicable.

Data / Parameter:	$NCV_{natural\ gas,\ BL}$
Data unit:	GJ / scf
Description:	Energy content of natural gas
Source of data:	U.S. EPA Inventory of GHG Emissions and Sinks The value of 1,029 Btu per scf was obtained from US EPA and was converted to units of GJ per scf by dividing the factor by a conversion factor of 947,817 Btu per GJ.
Value applied:	0.0010857
Purpose of the Data	This is used for baseline emissions
Any comment:	Values will be reviewed annually to ensure they are appropriate or following any future revision of US EPA guidelines, as applicable.

Data / Parameter:	$EF_{natural\ gas,BL}$
Data unit:	tCO_2 / scf
Description:	CO_2 emission factor of the fossil fuel type used in the boiler (natural gas) for heat generation in the absence of the project activity
Source of data:	U.S. EPA Inventory of GHG Emissions and Sinks
Value applied:	0.0000546
Purpose of the Data	This is used for baseline emissions
Any comment:	Values will be reviewed annually to ensure they are appropriate or following any future revision of US EPA guidelines, as applicable.

Data / Parameter:	$NCV_{propane}$
Data unit:	MMBtu / gallon
Description:	Energy content of propane
Source of data:	U.S. EPA Guidelines, Inventory of US Greenhouse Gas Emissions and Sinks, April 2011, Annex 2, Table A-46 The value of 3.836 MMBtu per barrel was obtained from US EPA and was converted to units of MMBtu per gallon by dividing the factor by a conversion factor of 42 gallons per barrel.
Value applied:	0.09133
Purpose of the Data:	This is used for baseline emissions
Any comment:	Values will be reviewed annually to ensure they are appropriate or following any future revision of US EPA guidelines, as applicable. Note that IPCC values are not available for propane.

Data / Parameter:	$EF_{CO2,Propane,y}$
Data unit:	t CO_2 / MMBtu
Description:	CO_2 emission factor for propane
Source of data:	U.S. EPA Guidelines, Inventory of US Greenhouse Gas Emissions and Sinks, April 2011, Annex 2, Table A-46 The value of 16.76 kg C per MMBtu was obtained from the US EPA, and was multiplied by a factor of 44/12 to convert carbon to carbon

	dioxide and divided by 1000 to convert from kilograms to tons.
Value applied:	0.061453 tonnes CO_2 / MMBtu
Purpose of the Data	This is used for baseline emissions
Any comment:	Value will be reviewed annually to ensure it is appropriate or following any future revision of the US EPA emission factors, as applicable. Note that IPCC values are not available for propane.

3.2 Data and Parameters Monitored

Data / Parameter:	Regulatory requirements relating to LFG
Data unit:	-
Description:	Regulatory requirements relating to LFG
Source of data:	Publicly available information of the host country's regulatory requirements relating to LFG.
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Annual
Value Monitored	N/A
Monitoring equipment	N/A
QA/QC procedures:	N/A
Calculation Method:	N/A
Any comment:	Annual review of the Landfill's NSPS status and any other applicable regulations, followed by a review of the Project's crediting period, to ensure the Project is still surplus to regulatory requirements. The information though recorded annually, will be used for changes to $MD_{BL,y}$ at the renewal of the credit period. Changes to regulation will be converted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{BL,y}$).

Data / Parameter:	$LFG_{Project\ total,y}$
Data unit:	ft^3
Description:	Total amount of LFG collected from the project system at normal temperature and pressure conditions (likely to 60 degrees F and 1 atm).
Source of data:	Measured
Description of measurement methods and procedures to be applied:	FCI Thermal Mass Flowmeter (Serial No. 324341)
Frequency of Monitoring/Recording	Continuous Monitoring; Recording every 15 minutes
Value Monitored	812 to 944 scfm used in ex-ante projections
Monitoring Equipment	FCI Thermal Mass Flowmeter (Serial No. 324341)
QA/QC procedures:	The flowmeter was calibrated (3/29/2010) by the manufacturer prior to installation (6/15/2010). It was also calibrated on 9/20/2011 and 9/27/2012.

	Consistent with manufacturer recommendations, the flowmeter should have a "Delta R" check every 18 months should be performed or for landfill applications the flow meter should be calibrated starting at a 12 month interval. If no calibration correction is required for the first two calibrations (i.e. for two years), the calibration interval will be extended to 24 months. Calibration will consist of a "Delta R" check to validate the electronics and resistance values of the sensor element. If test results are within the manufacturer recommended tolerance, calibration is complete. If test results are not within recommended tolerance, in-field recalibration will be conducted.
Calculation Method:	N/A
Any comment:	This parameter is measured on a wet basis prior to comingling with the pre-project gas stream. If the flow meter is found to be correcting to a temperature and pressure other than 60 degrees F and 1 atm, $\rho_{CH4,n}$ will be updated accordingly for relevant data.

Data / Parameter:	w CH_4 / $fv_{CH4,RG}$
Data unit:	ft^3 CH4 / ft^3 LFG
Description:	Methane fraction in the LFG
Source of data:	Siemens Ultramat 23 Continuous Gas Analyzer
Description of measurement methods and procedures to be applied:	Measured
Frequency of Monitoring/Recording	Continuous Monitoring; Recorded every 15 minutes
Value Monitored	50% used in ex-ante projections
Monitoring Equipment	Siemens Ultramat 23 Continuous Gas Analyzer
QA/QC procedures:	The unit is currently calibrated once a month, although the OEM recommendation is only once every 6-12 months, and the interval between calibrations may be extended to align with this recommendation. If the unit malfunctions, Lockhart will attempt to repair it on site, calling out an OEM representative if necessary. If a malfunction occurs, the unit will indicate "malfunction" on the screen , and it will be the responsibility of Lockhart personnel to review the malfunction code and correct if applicable. If the unit cannot be repaired on site, Lockhart would either send it to the OEM to repair off-site or order a replacement unit, depending on the cost of repairs versus replacement.
Calculation Method	N/A
Any comment:	Gas composition is measured on a wet basis prior to comingling with the pre-project gas stream. Flow is measured on a wet basis at the same location.

Data / Parameter:	$LFG_{flare,y}$
Data unit:	ft^3
Description:	Total amount of LFG flared at standard temperature and pressure

	conditions. Flow will be corrected via post-processing, likely to 60 degrees F and 1 atm from the project start date through February 7, 2011. From February 7, 2011 onwards no correction will be required.
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Thermal Instruments TI 62/9 thermal mass flowmeter (Serial No. 98181)
Frequency of Monitoring/Recording	Monitoring continuous, Recorded every 15 minutes
Value Monitored	N/A
Monitoring Equipment	Thermal Instruments TI 62/9 thermal mass flowmeter (Serial No. 98181)
QA/QC procedures:	The flowmeter was calibrated by the manufacturer (9/16/2009) prior to installation on June 15, 2010; and calibrated by the manufacturer 02/07/2011; and 7/27/2012. The flowmeter will be calibrated every 12 to 18 months following manufacturer recommendations.
Calculation Method	N/A
Any comment:	Flow is measured on a wet basis and the flow meter is located at the flare inlet, after the blowers. There is no liquid or condensate removal between the blower inlet and flare inlet. The flowmeter was calibrated at 75 degrees F and 1 atm in the fall of 2009. It was recalibrated to 60 degrees F on February 7, 2011. Data is corrected for temperature and pre-calibrated for pressure. According to Thermal Instruments, no pressure adjustment is needed given the expected operating pressures of this application, because significant changes in thermal convection do not occur unless pressure changes by 150 psi or more. If the flow meter is found to be correcting to a temperature and pressure other than 60 degrees F and 1 atm, $\rho_{CH4,n}$ will be updated accordingly for relevant data.

Data / Parameter:	$w_{CH4\ flare,y} / w_{CH4\ electricity,y}$
Data unit:	ft^3 CH4 / ft^3 LFG
Description:	Methane fraction in the LFG flared and Methane fraction in the LFG delivered to the Lockhart facility
Source of data:	Siemens Ultramat 23 Continuous Gas Analyzer
Description of measurement methods and procedures to be applied:	Measured
Frequency of Monitoring/Recording	Continuous Monitored; Recorded every 15 minutes
Value Monitored	50% used in ex-ante projections
Monitoring Equipment	Siemens Ultramat 23 Continuous Gas Analyzer
QA/QC procedures:	The unit is currently calibrated once a month, although the OEM

	recommendation is only once every 6-12 months, and the interval between calibrations may be extended to align with this recommendation. If the unit malfunctions, Lockhart will attempt to repair it on site, calling out an OEM representative if necessary. If a malfunction occurs, the unit will indicate "malfunction" on the screen, and it will be the responsibility of Lockhart personnel to review the malfunction code and correct if applicable. If the unit cannot be repaired on site, Lockhart would either send it to the OEM to repair off-site or order a replacement unit, depending on the cost of repairs versus replacement.
Calculation Method:	N/A
Any comment:	The analyzer is located at the billing gate between Lockhart and the County. Composition is measured on a wet basis.

Data / Parameter:	$LFG_{electricity,y}$
Data unit:	ft^3
Description:	Total amount of LFG combusted by Lockhart for electricity generation at temperature and pressure conditions of 68 degrees F and 1 atm).
Source of data:	Measured and/or based on supplier invoices
Description of measurement methods and procedures to be applied:	Gas flow and composition to the Lockhart facility is metered for invoicing purposes. Rosemount 3051 SFC compact conditioning orifice plate mass flowmeter with integrated pressure and temperature integration.
Frequency of Monitoring/Recording	Continuous Monitoring; Recorded once every 15 minutes
Value Monitored	N/A
Monitoring Equipment	Rosemount 3051 SFC Serial Number: 43190
QA/QC procedures:	The official Emerson manufacturer recommended maintenance practices are that Rosemount orifice plate technologies should be inspected once every 3 years. Emerson also recommends that calibration occur once every 3 years. The sensors do not have separate model numbers from the 3051. Since it is an orifice-based flow meter, calibration is addressed by checking the pressure sensor. The pressure sensor is currently calibrated on an approximately annual basis, but this may be extended to the 3 year interval in accordance with the manufacturer's recommendations. The flow meter was configured by a Rosemount technician. A calibration was performed on 4/6/2011. If an alternate flowmeter is purchased it will be calibrated following manufacturer recommendations.
Calculation Method:	N/A
Any comment:	Flow will be measured on a wet basis at the delivery point between the Landfill and the Lockhart facility. The flowmeter will automatically correct flow for temperature and pressure. There will be a gas treatment and compression process prior to this meter. If the flow meter is found to be correcting to a temperature and

	pressure other than 60 degrees F and 1 atm, $\rho_{CH4,n}$ will be updated accordingly for relevant data.

Data / Parameter:	$LFG_{thermal,y}$
Data unit:	ft^3
Description:	Total amount of LFG combusted in Milliken's boilers at standard temperature and pressure conditions (i.e. 60 degrees F and 1 atm).
Source of data:	Measured and/or based on supplier invoices
Description of measurement methods and procedures to be applied:	Gas flow and composition to the Milliken facility is metered for invoicing purposes. Rosemount 2051 SFC compact conditioning orifice plate mass flowmeter with integrated pressure and temperature integration.
Frequency of Monitoring/Recording	Continuous monitoring; Recorded once every 15 minutes
Value Monitored	353 scfm used in ex-ante projections
Monitoring Equipment:	Rosemount 2051 SFC Serial Number: 0042055
QA/QC procedures:	The official Emerson manufacturer recommended maintenance practices are that Rosemount orifice plate technologies should be inspected once every 3 years. Emerson also recommends that calibration occur once every 3 years. The sensors do not have separate model numbers from the 2051.Since it is an orifice mass flow meter, calibration is addressed by checking the pressure sensor. The pressure sensor is currently calibrated on an approximately annual basis, but this may be extended to the 3 year interval in accordance with the manufacturer's recommendations. A calibration was performed on 03/02/2011. If an alternate flowmeter is purchased it will be calibrated following manufacturer recommendations.
Calculation Method:	N/A
Any comment:	Flow will be metered on a dry basis at the delivery point between the Landfill and the Milliken Facility. The flowmeter will automatically correct flow for temperature and pressure. If process changes materially alter measurement accuracy, calculations will be updated accordingly. To ensure that all LFG sent to the Milliken boilers is burned and not vented to the atmosphere, Milliken has fail-safes built into the control system on each boiler gas train that include two automatic valves that shut anytime the landfill gas line is switched off or the boiler goes down. This stops the flow of gas to the boiler.

Data / Parameter:	$w_{CH4,thermal,y}$
Data unit:	ft^3 CH4 / ft^3 LFG
Description:	Methane fraction in the LFG delivered to the Milliken facility
Source of data:	Siemens Ultramat 23 Continuous Gas Analyzer
Description of measurement methods and procedures to be applied:	Measured
Frequency of	Continuous monitoring; Recorded every 15 minutes

Monitoring/Recording:	
Value Monitored	50% used in ex-ante projections
Monitoring equipment	Siemens Ultramat 23 Continuous Gas Analyzer
QA/QC procedures:	The unit is currently calibrated once a month, although the OEM recommendation is only once every 6-12 months, and the interval between calibrations may be extended to align with this recommendation. If the unit malfunctions, Lockhart will attempt to repair it on site, calling out an OEM representative if necessary. If a malfunction occurs, the unit will indicate "malfunction" on the screen, and it will be the responsibility of Lockhart personnel to review the malfunction code and correct if applicable. If the unit cannot be repaired on site, Lockhart would either send it to the OEM to repair off-site or order a replacement unit, depending on the cost of repairs versus replacement.
Calculation Method:	N/A
Any comment:	Composition will be measured on a wet basis.

Data / Parameter:	$ET_{LFG,y}$
Data unit:	GJ
Description:	Quantity of thermal energy produced utilizing LFG
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	The flow rate of LFG will be monitored at locations '1' and '4' to determine the relative quantity of gas that is collected from the Project system and delivered to the Milliken Facility. The flow rate and composition of LFG at location '1' will then be multiplied by the relative quantity of gas delivered to the Milliken Facility. Flow will then be converted to units of GJ and multiplied by the thermal efficiency of the boilers to determine the quantity of thermal energy produced.
Frequency of monitoring/recording:	Continuous monitoring;
Value Monitored	100,764 used in ex-ante projections
Monitoring Equipment:	See applicable flow parmeters
QA/QC procedures:	See applicable flow parameters
Calculation Method:	See Equation 11
Any comment:	The County will likely bill Milliken based on monthly total delivery of LFG. This monthly energy flow will be totalized on an annual basis. Note that the flow of LFG to the Milliken facility is directly proportional to utilization of the LFG at the facility as the process control systems only allow for compression and distribution of LFG when utilized by the boilers.

.	$PE_{flare,y}$
Data unit:	tonnes CO_{2E}
Description:	Project emissions from flaring of the residual gas stream in year y
Source of data:	Calculated as per the "Tool to determine project emissions from flaring gases containing Methane".
Description of measurement methods and procedures to be applied:	Calculated
Frequency of	Annual

monitoring/recording	
Value Monitored	5,126 to 6,087 used in ex-ante projections
Monitoring Equipment	N/A
QA/QC procedures:	N/A
Calculation Method	See Equation 10
Any comment:	For this project flare efficiency is not monitored and a default value is used.

Data / Parameter:	$MG_{PR,y}$
Data unit:	tonnes CH_4
Description:	Amount of methane generated during year y of the project activity
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	Estimated based on the quantity of waste disposed in the Landfill and using the US EPA's LandGEM Landfill Gas Emissions Model, Version 3.02
Frequency of monitoring/recording	Annually
Value Monitored	1,054 to 1,226 scfm used in ex-ante projections
Monitoring Equipment	N/A
QA/QC procedures:	N/A
Calculation Method	Calculated using the US EPA LandGEM model
Any comment:	ACM001 requires that this parameter be estimated using the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site. However, the US EPA LandGEM model is the accepted standard for estimating landfill methane emissions in the United States and is used instead.

Data / Parameter:	W_x
Data unit:	tons
Description:	Total amount of waste disposed in year x
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Measured by the Project Proponent
Frequency of monitoring/recording	Annual
Value Monitored	116,000 tpy used in ex-ante projections
Monitoring Equipment	Continuous with monthly and annual aggregation of data
QA/QC procedures:	N/A
Calculation method:	N/A
Any comment:	Quantity of waste disposed determined based on facility records.

Data / Parameter:	Other flare operation parameters
Data unit:	-
Description:	This should include data to monitor whether the flare operates within the range of operating conditions specified by the manufacturer.

Source of data:	Measured
Description of measurement methods and procedures to be applied:	A Pyromation thermocouple and ultraviolet flame detector are used to monitor flame temperature and ensure proper operation of the flare. The flare also has provisions for auto-shutdown if the flare flame fails. The flare is equipped with an automatic shutoff valve that shuts immediately upon loss of combustion at the flare, power failure or other alarm conditions. As a result, when the flare is not operational no gas is discharged and no flow is recorded. The flare is currently programmed to shut down at 300 degrees F but this value may be adjusted according to changing conditions. During a shutdown, the automatic shutoff valve closes and the blowers turnoff. If a thermocouple burns out, it will read an improperly low or high temperature, causing the automatic control system to shut the station down. Landfill gas flow data to the flare will be excluded from emission reduction calculations if temperature measurements are below the temperature cut-off setpoint (currently 300 F, but may be adjusted as long as flare operation in accordance with 40 CFR 60.18 continues).
Frequency of Monitoring/recording:	Continuous monitoring; Recorded every 15 minutes
Value monitored	N/A
Monitoring equipment:	Pyromation thermocouple and ultraviolet flame
QA/QC procedures:	Thermocouples are replaced as required and are not calibrated.
Calculation method:	N/A
Any comment:	A stack test cannot be performed for the flare; however, the flare manufacturer has guaranteed a destruction efficiency of 98 percent for this flare model.

Data / Parameter:	Operation of the Lockhart energy plant
Data unit:	Hours
Description:	Operation of the energy plant
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Wattmeter or similar
Frequency of monitoring/recording	Continuous with readings taken every 15 minutes.
Value monitored	N/A
Monitoring equipment	Wattmeter or similar
QA/QC procedures:	Maintenance will be performed according to instrument manufacturer's recommendations, if any.
Calculation method:	N/A
Any comment:	Note that the quantity of electricity produced will also be metered and this information may be used to demonstrate operation of the

	generators at the Lockhart facility.

Data / Parameter:	$CEF_{ther,BL,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission intensity of the fuel used by the boiler(s) to generate thermal energy that is displaced by LFG based thermal energy generation
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording	N/A
Value monitored:	0.5029
Monitoring equipment:	N/A
QA/QC procedures:	N/A
Calculation method:	See Equation 12
Any comment:	

Data / Parameter:	$PE_{EC,y}$
Data unit:	tonnes CO_2
Description:	Project emissions from electricity consumption by the project activity during the year y
Source of data:	Calculated as per the “Tool to determine project, baseline, and / or leakage emissions from electricity consumption”.
Description of measurement methods and procedures to be applied:	Calculated
Frequency of monitoring/recording	Annual
Value monitored	N/A
Monitoring equipment	N/A
QA/QC procedures:	N/A
Calculation method:	See Equation 14
Any comment:	For this project electricity is sourced from the regional grid, and Scenario A applies.

Data / Parameter:	$EC_{PJ, Grid,y}$
Data unit:	MWh
Description:	Quantity of electricity consumed by the project in year y
Source of data:	Calculated as per the “Tool to determine baseline, project and / or leakage emissions from electricity consumption”.
Description of measurement methods and procedures to be	Direct metering and/or calculation based on equipment load ratings.

applied:	
Frequency of monitoring/recording	Annual
Value monitored	N/A
Monitoring Equipment	N/A
QA/QC procedures:	N/A
Calculation method:	N/A
Any comment:	This parameter is calculated as the sum of $EC_{flare\ and\ transport}$, and $EC_{Milliken}$

Data / Parameter:	$EC_{flare\ and\ transport,y}$
Data unit:	MWh
Description:	Sum of quantity of electricity consumed to transport gas to the flare and quantity of electricity consumed to treat and compress gas for transportation to the Milliken and Lockhart facilities
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Dedicated electricity meter. Electricity supplier invoices will be the source of this data.
Frequency of monitoring/recording	Monthly
Value monitored	N/A
Monitoring equipment	Dedicated electricity meter
QA/QC procedures:	3rd party statements/invoices are used to ensure accuracy of data.
Calculation method	N/A
Any comment:	Note that compression/treatment skids will be installed to transport LFG to the two beneficial use facilities. This system will also be used to provide vacuum to the well-field and transport any excess LFG to the flare. Following the energy project coming online, the existing blower is only be operated when the compression/treatment skid is down. The flare and the two blower skids have a dedicated electricity meter that is used to quantify energy use.

Data / Parameter:	$EC_{Milliken,y}$
Data unit:	MWh
Description:	Quantity of electricity consumed to operate the boiler fans used by Milliken's boilers
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	Direct metering and/or calculation based on equipment load ratings
Frequency of monitoring/recording	Monthly
Value monitored	N/A
Monitoring equipment	N/A

QA/QC procedures:	In the case of direct metering, 3rd party statements/invoices are used to ensure accuracy of data. In the case of equipment load ratings, such load ratings are to be verified by the verification body during each verification.
Calculation method:	See Comments below
Any comment:	Electricity usage will be calculated by multiplying the manufacturer specified load ratings of the blower motor by the operating hours of the blower on a monthly basis. Relevant equipment and applicable load ratings may change and will be verified during each monitoring period.

Data / Parameter:	$t_{Milliken,m}$
Data unit:	hours
Description:	Hours of operation of the boiler fans used to operate the boilers at the Milliken facility in month, m.
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Hour meter or assumed to be operational 24 hours a day and 365 days per year to be conservative.
Frequency of monitoring/recording:	Continuous
Value monitored:	N/A
Monitoring equipment:	Hour Meter (if applicable)
QA/QC procedures:	N/A
Calculation method:	Totalized hourly readings or assumption of 24 hour / 365 day operation
Any comment:	If hourly operational data is not available, it will be assumed that the equipment is operational 24 hours a day and 365 days per year. This is conservative.

Data / Parameter:	$FE_{EL,Grid,y}$
Data unit:	tonnes CO_2/MWh
Description:	Emission factor for electricity generation in year y
Source of data:	Following the CDM Annex 7 "Tool to calculate baseline, project and / or leakage emissions from electricity consumption" Option A2, regional values are used as the default value provided by the tool was not representative of the emission intensity of grid-connected electricity generation in the United States. The emission factor is sourced from the US EPA's Emissions & Generation Resource Integrated Database (eGrid) 2012, Version 1.1: Year 2009 Summary Tables. Emission factor for SRVC.
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording	Annual check for most recent value
Value monitored	0.46999
Monitoring	N/A

equipment	
QA/QC procedures to be applied	N/A
Calculation method:	N/A
Any comment:	Value will be reviewed annually upon release of the US EPA eGrid Summary Tables to ensure they are appropriate. The "Tool to calculate the emission factor for an electricity system" Version 01.1 was not used as calculation of an emission factor is fairly extensive given that the project does not consume or generate a significant quantity of electricity and electricity consumption does not represent a large emission source for the project.

Data / Parameter:	$PE_{Propane,,y}$
Data unit:	tonnes CO_{2E}
Description:	Annual project emissions from fossil fuel combustion
Source of data:	Calculated as per the "Tool to determine project or leakage CO_2 emissions from fossil fuel combustion".
Description of measurement methods and procedures to be applied:	Calculated
Frequency of monitoring/recording:	Annual
Value monitored:	N/A
Monitoring equipment:	N/A
QA/QC procedures:	N/A
Calculation method:	See Equation 18
Any comment:	

Data / Parameter:	$FC_{flare,propane,y}$
Data unit:	gallons / year
Description:	Quantity of propane combusted as flare pilot fuel during the year y
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Based on an supplier invoices
Frequency of monitoring/recording:	Annual
Value monitored:	N/A
Monitoring equipment:	N/A
QA/QC procedures:	3rd party statements/invoices are used to ensure accuracy of data.
Calculation method:	N/A
Any comment:	

3.3 Description of the Monitoring Plan

The purpose of monitoring is to measure the quantity of methane captured by the Project Activity that would have been released to the atmosphere in the baseline condition.

Types / Origin of data and information: The estimate of GHG emission reductions claimed for this project relies on data provided by Lockhart Power. Lockhart Power provides access to an online data acquisition system with the following raw data: flow rate of eligible landfill gas captured and flared, composition of landfill gas and flare temperature. Lockhart Power also provides supplier invoices documenting the quantity of electricity and fossil fuels consumed.

Baseline Emissions

Monitoring Equipment

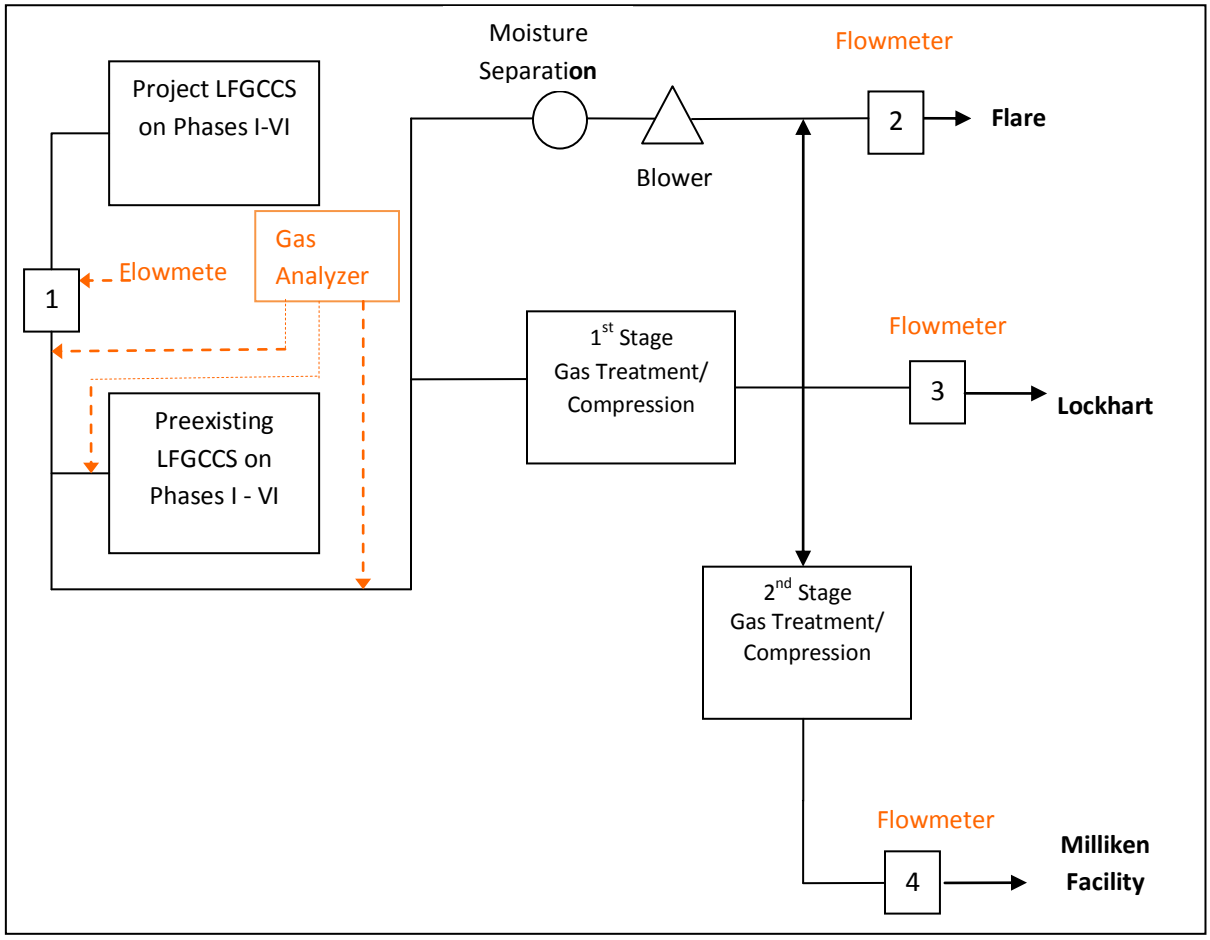
The flow rate of LFG will be metered at four locations; in the field prior to comingling with the pre-project gas stream, at the flare inlet, prior to delivery to the Milliken Facility and prior to delivery to Lockhart.

Gas flow and composition of the project gas stream are measured continuously on a wet basis prior to comingling with the pre-project gas stream (location '1'). Composition is again measured after comingling. LFG flow from the project system is monitored using an FCI Thermal Mass flowmeter that measures flow on a wet basis and normalizes flow to standard temperature and pressure conditions. Composition is metered using a Siemens Ultramat 23 continuous gas analyzer. Gas flow and composition data are recorded at least once every fifteen minutes. There is an automatic control value located after the moisture separator that directs the flow through the 1st stage gas treatment skid. If the skid would shut down, the landfill gas would be directed through the moisture separator, blower and directly to the flare to be destroyed. Otherwise any gas that goes to the flare goes through the 1st stage gas treatment skid.

Landfill gas flow is measured continuously at the blower / flare station (location '2') using a TI 62/9 thermal mass flowmeter. A Pyromation thermocouple is used to ensure the flare is burning. Flow and temperature data from the flare is recorded at least once every fifteen minutes. Additionally, an ultraviolet flame detector is in place to monitor the presence of a flame and activate the safety interlock system.

For the LFG to electricity phase of the Project, the gas flow to Lockhart (location '3') is metered continuously using a Rosemount 3051 SFC compact conditioning orifice plate mass flowmeter with integrated pressure and temperature integration. Flow data from location '3' is recorded at least once every fifteen minutes.

A schematic diagram showing each metering location is provided below:



For the LFG to heat phase of the Project, the gas flow to the Milliken Facility (location '4') is metered continuously using a Rosemount 2051 SFC compact conditioning orifice plate mass flowmeter with integrated pressure and temperature integration. Flow data from location '4' is recorded at least once every fifteen minutes. There is also a methane analyzer at location 4. It is not anticipated that data from this analyzer will be used in the calculation of emission reductions; however, in the event back-up data is needed during an outage of the main analyzer, data from this secondary analyzer could be used to demonstrate methane concentration. Back-up data from this unit may be used provided that during any such periods, methane concentration is monitored continuously and recorded at least every 15 minutes and manufacturer's recommendations for calibration frequency have been followed during the relevant time period.

It should be noted that LFG flow to the Milliken facility is measured on a dry basis, while the applicable methane content is measured on a wet basis. Measuring methane content (along with temperature and pressure) on a wet basis and flow rate on a dry basis results in a conservative calculation of the fraction of methane in the landfill gas. This is because after the gas is de-watered, the methane fraction will be larger, while the overall volume of gas will be smaller. If methane fraction is measured on a wet basis and flow is measured on a dry basis, the resulting figures for methane volume will always be lower than if both measurements were taken on the same basis (both wet or both dry).[2]

[2] http://www.climateactionreserve.org/wp-content/uploads/2011/10/Errata_and_Clarifications_LFPP_V3.0_102611.pdf

The flowmeter used to record gas flow at location '1' will be calibrated every 12 to 24 months following manufacturer recommendations. The flowmeter used to record gas flow at location '2' will be calibrated every 12 to 18 months following manufacturer recommendations. The flowmeters used to record gas at locations '3' and '4' will be calibrated following manufacturer recommendations.

The gas analyzer is currently calibrated once a month, although the OEM recommendation is every 6-12 months, and the interval between calibrations may be extended to align with this recommendation. If the unit malfunctions, Lockhart will attempt to repair it on site, calling out an OEM representative if necessary. If a malfunction occurs, the unit will indicate "malfunction" on the screen, and it will be the responsibility of Lockhart personnel to review the malfunction code and correct if applicable. If the unit cannot be repaired on site, Lockhart would either send it to the OEM to repair off-site or order a replacement unit, depending on the cost of repairs versus replacement.

Record Keeping

The flow rate and methane concentration of project LFG, the flow rate of LFG delivered to the flare, flare temperature, the flow rate of LFG delivered to the Lockhart Power facility, Lockhart Power facility electricity generation, and the flow rate of LFG to the Milliken Facility are documented in the SCADA system. Before the SCADA system data from the flow meters, methane meters, and thermocouples was recorded using an Automation Direct DL-250 process logic controller (PLC). The PLC on the gas analyzer started 6/15/2010 and ran until the SCADA took over. A PLC on the skid also captured data from 6/8/2011 until the SCADA became fully operational on July 11, 2011.

When the Lockhart Facility came online, a supervisory control and data acquisition system (SCADA) system began to be used to record data. The SCADA operates Wonderware, Historian In-Touch, Active Factory, and Microsoft Terminal Server 2003 software on a Dell Power Edge server located at the Lockhart facility.

A solenoid switch has been installed to transfer between methane sampling locations and readings are taken at least once every 15 minutes from each location. The switch is currently setup to take readings from locations (1) and (2). In the raw data, there is a column that indicates which location readings are being taken from. For example, '1' means that the system is monitoring project gas and '0' means that the system is monitoring the quantity of gas being flared. This changed when the energy projects came online. The SCADA is programmed to control the solenoids which transfer methane sampling locations and will tag each data point with the appropriate sample source (e.g., project gas, comingled gas to flare, comingled gas to energy projects).

The data collected by the original PLC as being stored on an offsite SCS FTP site. Once the SCADA system came online the data is stored on site on a separate server in the Lockhart switch gear facility. The data is also backed up on the technician's laptop. At least once per week, data from the PLC is uploaded to the server. The SCADA system uploads data to the on site server on a monthly basis and data will also be aggregated on a monthly and yearly basis.

Lockhart and the County will conduct a detailed data review to identify any data gaps or data sets that are outside expected operating ranges at least once per week. Suspect data will be flagged and causes for suspect data will be investigated to correct any future data issues.

<u>Project Emissions</u>

Project emissions associated with flaring LFG, electricity consumption and fuel usage are estimated using both measured and default values.

Flaring Emissions

The emissions associated with methane destruction by flaring are determined based on the flare's destruction efficiency and the mass flow rate of methane in the gas stream (determined from the volumetric flow rate of LFG and the volumetric fraction of methane in the LFG being flared). The composition and flow rate of LFG gas that is flared are determined as outlined above.

Following ACM0001, the flare's operating parameters are to be continuously monitored to ensure compliance with manufacturer specifications. Accordingly, the temperature of the flare is monitored using

a thermocouple and ultraviolet flame detector. However, only the temperature measured by the thermocouple is recorded.

Electricity and Fossil Fuel Combustion Emissions
Project emissions related to electricity consumption and fossil fuel usage are estimated based on the quantity of electricity and fossil fuels consumed to operate the Project, according to direct metering or supplier invoices.

Monitoring Roles and Responsibilities
County and Lockhart staff will oversee monitoring activities at monitoring locations '1', '2', '3' and '4'. Initially, electronic data was recorded by the PLC and records were maintained on the County and Lockhart's off-site servers. When the Lockhart facility came online, Lockhart began to manage the monitoring system / data, and the SCADA system for its engines began collecting all of the project data beginning on June 2, 2011. Records will be maintained on the County and Lockhart's on-site server.

The County, Lockhart and / or SCS will submit data to Blue Source for integration into emission reductions calculations. Blue Source saves the raw data files and then after applying the appropriate emission reduction parameters creates the emission reduction calculations that undergoes an internal QA/QC checklist.

Note that all relevant documents and records will be retained for a period of at least two years following the end of the Project's crediting period. All records will be available for review by a verification body.

A listing of the variables that will be monitored, including the source of data and a description of measurement methods and QA/QC calibration procedures are provided in Section 3.2 above.. It will be the responsibility of County and Lockhart staff to measure all variables and retain records for verification.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The following equation is used to determine baseline emissions:

$$BE_y = (MD_{project,\,y} - MD_{BL,y}) * GWP_{CH4} + ET_{LFG,y} * CEF_{ther,BL,y} \quad (1)$$

Where:

BE_y	= Baseline emissions in year y (tCO_2e)
$MD_{project,\,y}$	= The amount of methane that would have been destroyed/combusted during the year, in in project scenario (tCH_4)
$MD_{BL,y}$	= The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirements (tCH_4)
GWP_{CH4}	= Global Warming Potential value for methane (tCO_2e / tCH_4)
$CEF_{ther,BL,y}$	= CO_2 emissions intensity of the fuel used by boiler to generate thermal energy which is displaced by LFG based thermal energy generation (tCO_2e/GJ).
$ET_{LFG,y}$	= The quantity of thermal energy produced utilizing LFG, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler, during the year y (GJ)

For this project, the flow of methane from the project system is metered prior to comingling with the pre-project collection system and the baseline deduction ($MD_{BL,y}$) is equal to zero.

Calculation of Quantity of Methane Destroyed
The methane destroyed by the Project ($MD_{project,y}$) is then calculated based on the quantity of methane flared, used to generate electricity or used to generate thermal energy as follows:

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,\ y} \quad (2)$$

Where:

$MD_{flared,y}$ = Quantity of methane destroyed by flaring (tCH_4)
$MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity (tCH_4)
$MD_{thermal,y}$ = Quantity of methane destroyed for the generation of thermal energy (tCH_4)

The proportion of methane collected by the project system and flared, combusted at the Lockhart Facility and Combusted at the Milliken facility will be calculated as follows:

$$Proportion_{\ Flared,y} = (LFG_{flare,y} * w_{CH4\ flare,y}) / ((LFG_{flare,y} * w_{CH4\ flare,y}) + (LFG_{thermal,y} * w_{CH4\ thermal,y}) + (LFG_{electricity,y} * w_{CH4\ electricity,y})) \quad (3)$$

$$Proportion_{\ Electricity,y} = (LFG_{electricity,y} * w_{CH4\ electricity,y}) / ((LFG_{flare,y} * w_{CH4\ flare,y}) + (LFG_{thermal,y} * w_{CH4\ thermal,y}) + (LFG_{electricity,y} * w_{CH4\ electricity,y})) \quad (4)$$

$$Proportion_{\ Thermal,y} = (LFG_{thermal,y} * w_{CH4\ thermal,y}) / ((LFG_{flare,y} * w_{CH4\ flare,y}) + (LFG_{thermal,y} * w_{CH4\ thermal,y}) + (LFG_{electricity,y} * w_{CH4\ electricity,y})) \quad (5)$$

Where:

$LFG_{\ flare,y}$ = Quantity of LFG fed to the flare(s) during the year (ft^3)
$w_{CH4\ flare,y}$ = Average methane fraction of LFG delivered to the flare during the year (ft^3 CH_4/ ft^3 LFG)
$LFG_{\ electricity,\ y}$ = Quantity of LFG fed into Lockhart's generator during the year (ft^3)
$w_{CH4\ electricity,y}$ = Average methane fraction of LFG fed into Lockhart's generator during the year (ft^3 CH_4/ ft^3 LFG)
$LFG_{\ thermal,\ y}$ = Quantity of LFG fed into Milliken's boilers during the year (ft^3)
$w_{CH4\ thermal,y}$ = Average methane fraction of LFG fed into Milliken's boilers during the year (ft^3 CH_4/ ft^3 LFG)

The equations below (6-8:$MD_{flared,y}$, $MD_{electricity,y}$, and $MD_{thermal,\ y}$) have been changed from their original format in the PDD. This is because the equation format (below) could result in overstating emission reductions. Therefore a change to the equation is necessary. This overstatement is possible if the LFG eligible project is more than LFG destroyed. Therefore for conservativeness a comparison of eligible methane vs methane destroyed is taken into consideration so that emission reductions cannot be overstated. This is taken into consideration in the calculations. An excel "IF statement" is used to determine: If the eligible gas is greater than the amount destroyed:- if true, then the destroyed amount (which is the lesser of the two) is used to multiply against the % proportion.- if eligible gas is less than the amount destroyed (false) then the eligible amount of gas (which is less than destroyed) is used to multiply the % proportion.

The quantity of methane captured by the project system and destroyed by flaring ($MD_{flared,y}$) is calculated as:

$$MD_{flared,y} = LFG_{\ Project\ total,y} * w_{CH4,y} * D_{CH4} * Proportion_{\ Flared,y} - PE_{\ flare,y} / GWP_{CH4} \quad (6)$$

Where:

$LFG_{\ Project\ total,y}$ = Quantity of LFG collected from the project system during the year (ft^3)
$w_{CH4,y}$ = Average methane fraction of the LFG as measured during the year (in ft^3 CH_4 / ft^3 LFG)
D_{CH4} = Methane density expressed in tonnes of methane (tCH_4 / ft^3 CH_4)
$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year y (tCO_2e) determined following the procedure described in the "Tool to determine project emissions from flaring gases containing Methane"

Following commissioning of the Lockhart Project the quantity of methane destroyed for electricity generation ($MD_{electricity,y}$) that consists of project gas will be calculated as:

$$MD_{electricity,y} = LFG_{\ Project\ total,y} * w_{CH4,y} * D_{CH4} * Proportion_{\ Electricity,y} \quad (7)$$

Following commissioning of the Milliken Project the quantity of methane destroyed for thermal energy generation ($MD_{thermal,y}$) that consists of project gas will be calculated as:

$$MD_{thermal,\ y} = LFG_{\ Project\ total,y} * w_{CH4,y} * D_{CH4} * Proportion_{\ Thermal,y} \quad (8)$$

Project Emissions from Flaring

The project emissions from flaring ($PE_{flare,y}$) are calculated following the methodology outlined in the CDM Annex 13 "Tool to determine project emissions from flaring gases containing methane".

Flare Efficiency
Following the options outlined in the CDM tool, a default flare efficiency is used. The CDM "Tool to determine project emissions from flaring gases containing methane" specifies a default flare efficiency of 50% for open flares.

However, a flare efficiency of 98% is applied instead. This represents the flare efficiencies typically achieved in the United States for flares designed in accordance with 40 CFR 60.18. This standard specifies requirements for flare operating variables (i.e. Btu content, exit velocity) that must be met in order to achieve 98% or higher flare destruction efficiencies, and are applicable if the flare is operated in accordance with design limits.

The flare's design limits specify that the flare is designed in accordance with 40 CFR 60.18. The flare will achieve 98% destruction efficiency if operated within design limits of 100 scfm to 1,000 scfm and a gas methane content of at least 20%. To ensure the flare is operated within these limits, the flow rate of gas to the flare and methane content of the LFG will be monitored to ensure that they are within design limits. The flare will shut-off if the thermocouple indicates a temperature of less than 300F, but this value may be adjusted according to changing conditions. There is also a UV scanner (flame detection system) and thermocouple to make sure the flare stays lit, and to shut it down when it is not. For visual emissions, Lockhart has historically made visual observations of any visible emissions and recorded any instances of such. Effective March 1, 2012, a checklist requiring the on-site operator to visually check stack emissions each day that the operator is on site and report any unusual visual emissions for follow-up maintenance will be instituted. Currently the operator is on site 4 days per week. This will ensure that the flare is operated according to the specifications required to ensure a destruction efficiency of 98%.

To calculate project emissions from flaring, the mass flow rate in the residual gas on a wet basis is calculated as follows:

$$TM_{RG} = LFG_{\ Project\ total,y} * w_{CH4,y} * D_{CH4} * Proportion_{\ Flared,y} \quad (9)$$

Where:

TM_{RG}	= Mass of methane in the residual gas (tCH_4)
$LFG_{\ Project\ total,y}$	= Quantity of LFG collected from the project system during the year (ft^3)
$w_{CH4,y}$	= Average methane fraction of the LFG as measured during the year ($ft^3\ CH_4$ / ft^3 LFG)
D_{CH4}	= Methane density (tCH_4 / $ft^3\ CH_4$)

Emissions are then calculated as follows:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG} * (1 - \eta_{flare}) * GWP_{CH4} \quad (10)$$

Where:

$PE_{flare,y}$	= Project emissions from flaring of the residual gas stream in year y
TM_{RG}	= Mass flow rate of methane in the residual gas
η_{flare}	= Flare efficiency
GWP_{CH4}	= Global Warming Potential of methane valid for the commitment period

Baseline Emissions from Thermal Energy Generation

The baseline emissions from thermal energy produced by Milliken's boilers/heater from project gas is calculated as follows:

$$ET_{LFG,y} = LFG_{Project\ total,y} * Proportion_{Thermal,y} * w_{CH4,y} * \epsilon_{boiler,BL} * NCV_{methane} \quad (11)$$

Where:

$w_{CH4,y}$ = Average methane fraction of the LFG as measured during the year and expressed as a fraction (m^3 CH_4 / m^3 LFG)

$\epsilon_{boiler,BL}$ = The energy efficiency of the boilers used in the project activity to generate thermal energy

$NCV_{methane}$ = Net calorific value of LFG used in the boilers to generate thermal energy (GJ per scfm)

The emission intensity of baseline thermal energy generation is then calculated as follows:

$$CEF_{ther,BL,y} = EF_{natural\ gas,BL} / (NCV_{natural\ gas,BL} * \epsilon_{boiler}) \quad (12)$$

Where:

$NCV_{natural\ gas,BL}$ = Net calorific value of fuel used in the boilers to generate the thermal energy in the absence of the project activity (GJ per unit of volume or mass)

$EF_{natural\ gas,BL}$ = Emission factor of the fuel used in the boilers to generate the thermal energy in the absence of the project activity (tCO_2 / unit of volume or mass of the fuel)

To estimate boiler efficiency, project participants may choose between two options: Option A involves using the highest of the following three values as a conservative approach; the measured efficiency prior to project implementation, the measured efficiency during monitoring or manufacturer's information on the boiler efficiency. Alternatively, Option B includes assuming a boiler efficiency of 100% as a conservative approach.

For this project, Option B will be applied to be conservative.

To ensure that all LFG sent to the Milliken boilers is burned and not vented to the atmosphere, Milliken has fail-safes built into the control system on each boiler gas train that include two automatic valves that shut anytime the landfill gas line is switched off or the boiler goes down. This stops the flow of gas to the boiler.

During the monitoring period (June 15th 2010- Sept 30th 2012) the baseline emissions were:

	2010 Total	2011 Total	Jan- Sept 2012 Total
Baseline Emissions	32,909	70,646	63,973

4.2 Project Emissions

According to ACM0001 project emissions are defined by the following equation:

$$PE_y = PE_{EC,y} + PE_{FC,j,y} \quad (13)$$

Where:

$PE_{EC,y}$ = Emissions from consumption of electricity in the project case.

$PE_{FC,j,y}$ = Emissions from consumption of fossil fuels in the project case.

Electricity Emissions

The project emissions from electricity consumption ($PE_{EC,y}$) are calculated following the methodology outlined in the CDM Annex 7 "Tool to calculate baseline, project or leakage emissions from electricity consumption" Version, 01 as follows:

$$PE_{EC,y} = \sum_{j} EC_{PJ,Grid,y} * EF_{EL,Grid,y} * (1 + TDL_{Grid,y}) \quad (14)$$

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption in year y (tCO2/yr)
$EC_{PJ,Grid,y}$ = Quantity of electricity consumed by the project from the regional grid in year y (MWh/yr)
$EF_{ELGrid,y}$ = Emission factor for electricity generation from the regional grid in year y (tCO2/MWh)
$TDL_{Grid,y}$ = Average technical transmission and distribution losses for the regional grid in year y

During Phase one (1) of the Project, electricity is consumed to operate the blower used to transport gas to the flare and an automatic valve that prevents passive flow of LFG to the flare following system shut down. The blower is equipped with a 25 hp motor.

Electricity will also be used in Phase two (2) and three (3) of the Project, to further process and compress gas for transportation to the Lockhart and Milliken facilities and to operate auxiliary equipment required to operate the boilers at the Milliken facility.

Electricity consumption from these sources is calculated as follows:

$$EC_{PJ,Grid,y} = EC_{flare\ and\ transport,y} + EC_{Milliken,y} \quad (15)$$

Where:

$EC_{flare\ and\ transport,y}$ = Sum of the quantity of electricity consumed by the blowers used to transport gas to the flare and the quantity of electricity consumed to treat and compress gas for transportation to the Milliken and Lockhart facilities in year y (MWh/yr)
$EC_{Milliken,y}$ = Quantity of electricity consumed to operate auxiliary equipment required to operate the boilers and destruct LFG in year y (MWh/yr)

Calculation of Electricity Usage

A dedicated meter is used to monitor electricity usage at the flare and treatment skids ($EC_{flare\ and\ transport,y}$). Electricity usage at the Milliken facility ($EC_{Milliken,y}$) is not metered independently and will be calculated based on the rated capacity of the equipment used as follows:

$$EC_{Milliken,y} = L_{Milliken} \times t_{Milliken,m} \quad (16)$$

Where:

$L_{Milliken}$ = Load ratings of the equipment used to operate the boilers/heater at the Milliken facility (MW);
$t_{Milliken,m}$ = Hours of operation of the equipment used to equipment used to operate the boilers/heater at the Milliken facility in month m

Load ratings are calculated based on the nameplate horsepower for each piece of equipment. Electricity consumption is calculated based on full load (minus any outages) for conservativeness as follows:

$$L_{equipment,j} = Rating\ (hp) \times 0.746 \times 0.001 \quad (17)$$

Where:

0.746 = kW/hp & 0.001= kW/MW

Determination of $EF_{EL,j,y}$

For determination of the emission factor for grid connected electricity generation ($EF_{EL,j,y}$), ACM0001 indicates that the 'Tool to calculate the emission factor for an electricity system', Version 01.1 should be

used. For determination of the emission factor for electricity generation ($EF_{EL,j,y}$) the methodology presents a number of options. In this case the electricity consumed is purchased from the regional grid and the applicable options are Option A1 and Option A2.

Option A1 is the calculation of a grid emission intensity factor following the methodology outlined in the CDM Annex 12 "Tool to calculate the emission factor for an electricity system" Version 01.1 (Option A1). However, calculation of an emission factor is data intensive and not administratively simple. Given that the project does not consume or generate a significant quantity of electricity and electricity consumption does not represent a large emission source for the project, this approach is not reasonable.

Under Option A2 a conservative default value may be used instead. Following ACM001 only project emissions from electricity consumption are calculated, therefore a default value of 1.3 tonnes CO_2 per MWh would be applied. However given the generation mix and emission intensity of electricity generation from the applicable regional grid, this value is not representative of the emissions associated with electricity generation for the Landfill. A deviation from the methodology is proposed and the emission factor for electricity generation ($EF_{EL,j,y}$) is determined as outlined below:

The grid average emission intensity of electricity generation in the region was examined to define a value to the CO_2 emissions intensity of the project source of grid-connected electricity. The electricity grid from which the Landfill draws electricity is part of the SRVC region. The emission rate of electricity generation from this EPA eGRID 2012, 2009 data was 0.46999 tonnes CO_2 per MWh. The emission factor for electricity generation ($EF_{EL,j,y}$) is assigned this value.

<u>Fossil Fuel Emissions</u>
For project Phases one (1), two (2) and three (3) flare pilot fuel represents the sole fossil fuel emission.

The project emissions from fuel consumption ($PE_{FC,j,y}$) are calculated following the methodology outlined in the CDM Annex 19 "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" Version 01, using Option B as follows:

$$PE_{FC,j,y} = PE_{Propane,y} = FC_{flare,propane,,y} * COEF_{Propane,y} \quad (18)$$

Where:
$PE_{Propane,y}$ = are the CO_2 emissions from propane combustion during the year y (tCO_2/yr)
$FC_{flare,propane,,y}$ = quantity of propane used during the year y (gallons/yr)
$COEF_{Propane,y}$ = CO_2 emission coefficient of propane in the year y (tCO_2/gallon)

The CDM "Tool to Calculate Project or Leakage CO_2 Emissions from Fossil Fuel Combustion recommends calculating emission coefficients based on IPCC factors; however, no such IPCC factors exist for propane. As such, USEPA factors are used instead[3]. It is possible to use the IPCC factors for Liquefied Petroleum Gas, a mixture of Propane and Butane, but the EPA factor is higher and therefore more conservative.
The CO_2 emission coefficient is calculated based on the net calorific value and CO_2 emission factor of propane (Option B), as follows:

$$COEF_{Propane,y} = NCV_{Propane,y} * EF_{CO2,Propane,y} \quad (19)$$

Where:
$COEF_{Propane,y}$ = the CO_2 emission coefficient of propane used (tCO_2/gallon);
$NCV_{Propane,y}$ = the weighted average net calorific value of propane (MMBtu/gallon)
$EF_{CO2,Propane,y}$ = the weighted average CO_2 emission factor of propane (tCO_2/MMBtu)

[3] U.S. EPA, Inventory of Greenhouse Gas Emissions and Sinks: 1990 – 2005 (2007), Annex 2.1, Table A-40

Before the Milliken project started accepting landfill gas, the three boilers were started by a natural gas pilot light. The boilers are still started with a natural gas pilot light, thus not using any additional natural gas because of the landfill gas. Milliken does not have a dedicated landfill gas boiler as the company desired to maintain flexibility to use the methane in any of the three boilers. Thus the boilers used to produce steam or hot oil is not considered a source of project emissions.

Propane Usage
For conservativeness the agreement between Freeman Gas & Electric Co., Inc & Spartanburg Co. Landfill states that "Customer guarantees to purchase 175 gallons of propane per heating year. Thus for 2010, 2011 & 2012 it is assumed that 175 gallons of propane were used each year.

During the monitoring period (June 15th 2010- Sept 30th 2012) the project emissions were:

	2010 Total	2011 Total	Jan- Sept 2012 Total
Project Emissions	118	391	425

4.3 Leakage

The project activity does not anticipate any leakage emissions.

4.4 Summary of GHG Emission Reductions and Removals

Ex Ante Estimate of Emission Reductions

Following ACM0001, for comparison with the calculation of GHG emissions destroyed by the Project, Project Proponents must provide an ex ante estimate of emission reductions by projecting the future GHG emissions of the Landfill.

Instead of estimating baseline methane emissions using the CDM "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", the US EPA LandGEM Landfill Gas Emissions model is used. This is the accepted standard for developing LFG curves in the United States. The LandGEM model requires the user to input the following variables to determine the emissions associated with disposal of waste at the solid waste disposal site:

$$MD_{project,\,y} = f\,(W_x, F, k, Lo) \qquad (20)$$

Where:

$MD_{project,\,y}$ = Methane emissions generated during the year y from waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e)
F = Fraction of methane in the LFG (volume fraction) (0.5)
W_x = Amount of waste disposed in the landfill in each year x from the year the landfill / landfill cell began accepting waste to present (tons)
k = Decay constant (1/yr)
Lo = Methane potential generation capacity (ft^3/Mg)

The table below shows the estimated emission reductions from the project for 2010, 2011 and 2012.

Table 1. Ex Ante Estimate of Emission Reductions for 2010, 2011, 2012

Year	Estimated Baseline Emission (tCO2E)	Estimated Project Emission (tCO2E)	Estimated Leakage Emissions (tCO2E)	Potential Emission Reductions (tCO2E)
2010	34,485	431	0	34,055
2011	81,816	1,025	0	80,791
2012	86,444	586	0	85,858

Following ACM0001 the sum of the quantities fed to the flare, Milliken and Lockhart facilities will be compared annually with the total quantity of methane generated. The lowest value of the two will be adopted as $MD_{project,y}$.

Emission reductions are calculated as the difference between the baseline methane emissions and project emissions from electricity and fuel consumption at the site as follows:

$$ER_y = BE_y - PE_y \quad (21)$$

Where:

ER_y = Emission reductions in year y (tCO_2e)
PE_y = Project emissions in year y (tCO_2e)
BE_y = Baseline emissions in year y (tCO_2e)

Table 2 provides a summary of the quantification of emission reductions generated by the project activity from June 2010- September 30, 2012.

Table 2: Summary of Emission Reductions (tonnes CO_2e)

	2010 Total	2011 Total	Jan- Sept 2012 Total
Baseline Emissions	32,909	70,646	63,973
Project Emissions	118	391	425
Total Emission Reductions	**32,791 (tCO2E)**	**70,255 (tCO2E)**	**63,548 (tCO2E)**

5 ADDITIONAL INFORMATION

There is no additional information.