



SPARTANBURG COUNTY LANDFILL GAS COMBUSTION PROJECT



Document Prepared by Anew Environmental, LLC

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Project ID	947
Monitoring period	01-January-2023 to 31-December-2023
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Version	3.0
<i>VCS Standard</i> Version	VCS Standard V4.7
Prepared by	Anew Environmental, LLC

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PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the 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 whilst Phase V includes approximately 35 acres of Subtitle D lined landfill. The Landfill is currently operating in Phase VII.

The Spartanburg County Landfill Gas Combustion Project (“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 103 wells and associated piping, in Phases I through V of the Landfill. The Project now contains more than 103 wells. During this stage, the gas captured from this system is flared, thereby converting methane to biogenic CO₂. As evidenced by the meeting minutes provided by 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. Since the project’s initial crediting period, the physical piping that allows the pre-project gas stream to mix with the project gas stream has been removed; therefore, quantifying pre-project gas in the emission reduction calculations is not possible.

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 commissioning 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. Note that no emission reductions are claimed for offsetting grid connected electricity generation.

Table 1 below provides a summary of the quantification of emission reductions generated by the project activity from January 1, 2023– December 31, 2023. The total emission reductions achieved by the project activity till date is 1,244,665 tCO₂e. The average VCU generated annually till date is 91,833 tCO₂e/year.

Summary of Emission Reductions (tonnes CO₂e)

	Jan 1, 2023 – Dec 31, 2023
Baseline Emissions	76,918
Project Emissions	274
Total Emission Reductions	76,644

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	13-March-2012	VCS	First Environment	1
Joint Validation/Verification	25-June-2021	VCS	First Environment	1
Verification	15-June-2010—31-December-2010	VCS	Perry Johnson Registrars Carbon Emission Services Inc.	0.545205
Verification	01-January-2011—31-December-2011	VCS	Perry Johnson Registrars Carbon Emission Services Inc.	1
Verification	01-January-2012—30-September-2012	VCS	Perry Johnson Registrars Carbon Emission Services Inc.	0.745205
Verification	01-October-2012—31-December-2012	VCS	Perry Johnson Registrars Carbon Emission Services Inc.	0.249315
Verification	01-January-2013—30-September-2013	VCS	SCS GLOBAL SERVICES	0.745205
Verification	01-October-2013—31-December-2013	VCS	SCS GLOBAL SERVICES	0.249315
Verification	01-January-2014—31-December-2014	VCS	Perry Johnson Registrars Carbon Emission Services Inc.	1
Verification	01-January-2015—31-December-2015	VCS	FIRST ENVIRONMENT, INC.	1
Verification	01-January-2016—31-December-2016	VCS	FIRST ENVIRONMENT, INC.	1
Verification	01-January-2017—31-December-2017	VCS	FIRST ENVIRONMENT, INC.	1
Verification	01-January-2018—31-December-2018	VCS	FIRST ENVIRONMENT, INC.	1

Verification	01-January-2019–31-December-2019	VCS	FIRST ENVIRONMENT, INC.	1
Verification	01-January-2020–14-June-2020	VCS	FIRST ENVIRONMENT, INC.	0.452055
Joint Verification/Validation	15-June-2020–31-December-2020	VCS	FIRST ENVIRONMENT, INC.	0.545205
Verification	01-January-2021–31-December-2021	VCS	SCS GLOBAL SERVICES	1
Verification	01-January-2022–31-December-2022	VCS	TUV SUD	1
Verification	01-January-2023–31-December-2023	VCS	TUV SUD	1

1.3 Sectoral Scope and Project Type

Sectoral scope ¹	Sectoral Scope 13
Project activity type	Individual Project, Waste Handling and Disposal

1.4 Project Proponent

Organization name	Lockhart Power
Contact person	Bryan Stone, P.E.
Title	Chief Operating Officer
Address	P.O. Box 10; 420 River St, Lockhart, SC 29364
Telephone	864-545-2575

¹ Projects, activities, or methodologies may be developed under any of the 16 VCS sectoral scopes: <https://verra.org/programs/verified-carbon-standard/vcs-program-details/#sectoral-scopes>

Email	bstone@lockhartpower.com
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Organization name	Milliken & Company
Contact person	Cassidy Carlile
Title	Director of Corporate Environmental
Address	P.O. Box 1926; Spartanburg, SC 29304
Telephone	864.503.1569
Email	Cassidy.Carlile@milliken.com

Organization name	Spartanburg County DPW
Contact person	Travis Brown
Title	Solid Waste Department Head, Wellford Landfill
Address	P.O. Box 5666; Spartanburg, SC 29304
Telephone	864-949-1658
Email	twbrown@spartanburgcounty.org

1.5 Other Entities Involved in the Project

Organization name	Anew Environmental, LLC
Role in the Project	Project Environmental Attribute Developer
Contact person	Sidra Kamal
Title	Technical Climate Solutions Analyst
Address	Suite 1605, 840 7 th Avenue SW Calgary, Alberta, T2P 3G2
Telephone	(780) 710-5413

Email	skamal@anewclimate.com
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1.6 Project Start Date

Project start date	29-April-2010
Justification	This is the date that project system became operational and landfill gas was collected and destructed from the Project collection system. This also corresponds with the date when all metering equipment was installed and operational. This would be the first date on which the project would generate GHG emission reductions which conforms with the VCS program requirements.

1.7 Project Crediting Period

Crediting period	☐ Seven years, twice renewable ☐ Ten years, fixed ☒ Other (15-June-2020 to 14-June-2030. The first crediting period for this project was 15-June-2010 to 14-June-2020 which could be renewed for another 10 years based on the VCS Standard at the time of validation.)
Start and end date of first or fixed crediting period	15-June-2010 to 14-June-2020.

1.8 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 as follows:

595 Little Mountain Road
Wellford, South Carolina 29385

The latitude and longitude of the Landfill are as follows:

- Latitude: 35.001193
- Longitude: -82.13042

1.9 Title and Reference of Methodology

The methodology is the approved consolidated baseline methodology ACM0001: “Flaring or use of landfill gas (Version 19), released in 2019.

The following tools are utilized in the quantification of this monitoring period:

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	ACM0001	Flaring or use of landfill gas	19.0
Methodological Tool	CDM Tool 3	Tool to calculate project or leakage CO2 emissions from fossil fuel combustion	3.0
Methodological Tool	CDM Tool 5	Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation	3.0
Methodological Tool	CDM Tool 6	Project emissions from flaring	3.0
Methodological Tool	CDM Tool 8	Tool to determine the mass flow of a greenhouse gas in a gaseous stream	3.0
Methodological Tool	CDM Tool 9	Determining the baseline efficiency of thermal or electric energy generation systems	3.0
Methodological Tool	CDM Tool 11	Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period.	3.0.1

1.10 Double Counting and Participation under Other GHG Programs

1.10.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

If yes, provide required evidence of no double issuance as outlined by the VCS Standard.

1.10.2 Registration in Other GHG Programs

Was the project registered or seeking registration under any other GHG programs?

☐ Yes ☒ No

If yes, provide the registration number and all relevant details including the date of project inactivity in the other GHG program.²

1.11 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.11.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

If yes, provide all required evidence of no double claiming as outlined by the VCS Standard.

1.11.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system.

☐ Yes ☒ No

If yes, provide all required evidence of no double claiming as outlined by the VCS Standard.

1.11.3 Supply Chain (Scope 3) Emissions

Do the project activities affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

If yes:

Is the project proponent(s) or authorized representative a buyer or seller of the product(s) (goods or services) that are part of a supply chain?

☐ Yes ☐ No

If yes:

² The requirement to provide the date of project inactivity only applies to projects which request registration or crediting period renewal under the VCS Program on or after 1 January 2025.

Has the project proponent(s) or authorized representative posted a public statement on their website saying, “Carbon credits may be issued through the Verified Carbon Standard project [project ID] for the greenhouse gas emission reductions or removals associated with [project proponent or authorized representative organization name(s)] [name of product(s) whose emissions footprint is changed by the project activities].”

☐ Yes

☐ No

If yes to all:

Provide evidence of the public statement. Evidence must be provided in this section or in an appendix.

1.12 Sustainable Development Contributions

This Project is a landfill gas (LFG) capture and combustion project that implements the capture of landfill gas at the solid waste disposal site (SWDS) for combustion in either the flare, electricity generator or the boilers. This results in SD contributions (SDG 13.2) as under the project condition, methane is converted to CO₂ through combustion which results in measurable greenhouse gas emission reductions. Please refer to Appendix A for supporting evidence of quantification.

Additionally, SDG 7.2 focuses on increasing the share of renewable energy in the global energy mix. This project contributes to this SDG indicator by capturing landfill gas (LFG) and converting it into usable energy forms such as electricity and heat for boilers. By utilizing LFG as a renewable energy source, the project reduces reliance on fossil fuels, thereby promoting cleaner energy production. Additionally, flaring LFG ensures the safe management of methane, a potent greenhouse gas, while still contributing to energy recovery. This aligns with the indicator's emphasis on renewable energy generation and its integration into the energy mix. Please refer to Appendix X for additional information.

SDG 12.2 focuses on sustainable management and efficient use of natural resources. By capturing landfill gas and utilizing it for electricity generation and heating in boilers, the project exemplifies resource efficiency. Instead of letting methane escape into the atmosphere, the landfill recovers and repurposes this valuable resource. This Landfill project contributes by reducing the material footprint of waste disposal through resource recovery and energy generation. Please refer to Appendix A for additional information.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.2	13.2.2	Under this project condition, methane is converted to CO ₂ through combustion of captured landfill gas which results in measurable greenhouse gas emission reductions	By implementing the active capture of landfill gas at the solid waste disposal site (SWDS) for combustion in either the flare, Lockhart generator or the Milliken boilers, the Project has prevented the release of 76,644 tonnes of carbon dioxide equivalents into the atmosphere during the monitoring period.	Prevented the release of 1,244,665 tonnes of carbon dioxide equivalents into the atmosphere.

2)	7.2	7.2.1	Under this project condition, biogas is converted into electricity and heat using the Lockhart Generator <u>and the</u> boilers at the Milliken facility, demonstrating the integration of renewable energy sources. This adoption of clean technology contributes to the reduction of overall emissions and aligns with the Sustainable Development 7.2.1 as it involves utilizing LFG for electricity.	By implementing clean and environmentally sound technologies such as the use of the generators at the Lockhart Power Facility to generate electricity during the monitoring period demonstrates innovative and sustainable infrastructure practices to reduce emissions and allows for the use of affordable and clean energy and increasing the share of renewable energy in the global energy mix. The project produced 68.40 TJ of energy to run the boilers and 128.199 MWh of electricity from the generators during the current monitoring period.	Heat generation and Electricity production will occur throughout the lifetime of this project and is expected to produce 1000+ TJ of energy and 1000+ MWh of electricity over its lifetime.
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3)	12.2	12.2.1	Stage two (2) of the Project involves the implementation of a beneficial use project, whereby captured biogas will be transported 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). 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.	By implementing these two stages, Spartanburg has contributed to responsible consumption and production by providing sustainable waste management and utilization practice. This reduces the material footprint during the current RP as biogas is used for generating electricity and as a fuel to run the boilers.	Electricity production and usage of the biogas in the boilers to generate heat energy will occur throughout the lifetime of this project.
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1.13 Commercially Sensitive Information

No commercially sensitive information has been excluded from the Monitoring Report.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification	At validation there was no formal identification of stakeholders and stakeholder consultation was instead conducted through the posting of project documents to the public VCS registry with the monitoring report mentioning that stakeholders can contact Spartanburg or other project proponents through the contact information in the monitoring report. Spartanburg County holds council meetings which are open to the public. Any changes to the landfill or project operation are shared with the public, at which time local stakeholders can submit input and raise concerns as they see fit. Additionally, questions or comments can be submitted directly to the Landfill Manager or Public Works Director through e-mail as listed on the website and are addressed as needed. During the 2023 reporting period, monthly council meetings with stakeholders were held, and all meeting minutes were recorded in PDF documents and uploaded to the website for public viewing: https://www.spartanburgcounty.org/AgendaCenter/Search/?term=&CIDs=all&startDate=01/01/2023&endDate=12/31/2023&dateRange=&dateSelector=
Legal or customary tenure/access rights	The landfill, waste transfer station, and a homeowners drop off area at the landfill is owned and operated by Spartanburg County. There are no conflicting rights over territories and resources.

	https://www.spartanburgcounty.org/DocumentCenter/View/761/ULMO-Amendment-0-11-31
Stakeholder diversity and changes over time	The Stakeholders would be the residents of Spartanburg County. Based on the U.S census, Spartanburg County is 74% white and 20.3% Black, 2.7% Asian and 0.5% American Indian. The median household income is \$61,955 and 87.8% of residents have a high school diploma and 25.2% have a bachelor's degree or higher. The makeup of the stakeholder group is not expected to change over time because of this project. https://www.census.gov/quickfacts/fact/table/spartanburgcountysouthcarolina,US#
Expected changes in well-being	The revenue generated by the project is used to fund the post closure care of the landfill which prevents the release of hazardous constituents to the environment and reduces the burden on the county to fund the post closure care. https://www.spartanburgcounty.org/DocumentCenter/View/14759/Clemson-Economic-Impact-Study
Location of stakeholders	Spartanburg County which consists of the municipalities of Campobello, Chesnee, Cowpens, Duncan, Greer, Inman, Landrum, Lyman, Pacolet, Reidville, Spartanburg, Wellford and Woodruff are all affected by this project. https://www.spartanburgcounty.org/520/Municipalities
Location of resources	Residents of Spartanburg County have access to the landfill to drop off waste but do not own the facility. Spartanburg County owns the facility.

2.1.2 Stakeholder Consultation and Ongoing Communication

Ongoing consultation	Spartanburg County regularly conducts monthly council meetings which are open to the public to provide updates on the project. The monitoring reports are also uploaded to VCS which are public and allow for a period where the public can provide comments.
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Date(s) of stakeholder consultation	12-January-2023
	23-January-2023
	02-February-2023
	20-February-2023
	01-March-2023
	20-March-2023
	17-April-2023
	04-May-2023
	09-May-2023
	15-May-2023
	08-June-2023
	19-June-2023
	17-July-2023
	19-July-2023
	08-August-2023
	21-August-2023
	18-September-2023
	16-October-2023
	20-November-2023
	27-November-2023
	11-December-2023
	https://www.spartanburgcounty.org/AgendaCenter/Search/?term=&CIDs=all&startDate=01/01/2023&endDate=12/31/2023&dateRange=&dateSelector=
Communication of monitored results	The Spartanburg County council meetings encourage the public to submit comments and the VCS monitoring report contains a section that encourages the public to send comments to Spartanburg County. There have been no comments over the course of this crediting period.

Consultation records	Any emails or comments received would be retained by Spartanburg County.
Stakeholder input	Any input from the council members at the meeting was addressed by Spartanburg County and no comments justified needing to update the project design. Comments and questions were mainly about the landfill rather than concerns about the gas collection and control system project.

2.1.3 Free, Prior, and Informed Consent

Consent	The project does not affect IPs, LCs and customary rights holders, rights to land, territories, and resources. There was no formal stakeholder consultation conducted during validation but all Spartanburg County presentations at the council meetings mention how Spartanburg County is the owner of the facilities.
Outcome of FPIC	The project did not encroach on land or relocate people without consent. The installation of a gas collection and control system did not affect the land already owned by Spartanburg County for the landfill.

2.1.4 Grievance Redress Procedure

Grievances received	Resolution and outcome
N/A	Any changes to the landfill or project operation are shared with the public at the Spartanburg County council meeting, at which time local stakeholders can submit input and raise concerns as they see fit. There were no grievances identified during the 10- year crediting period and during the current reporting period. Additionally, questions or comments can be submitted directly to the Landfill Manager or Public Works Director and are addressed as needed.

2.1.5 Public Comments

Summary of comments received	Actions taken
N/A	No ongoing comments or concerns were submitted during this reporting period.

2.2 Risks to Stakeholders and the Environment

2.2.1 Management Experience

The management team at the landfill brings extensive experience in implementing project activities related to gas collection and control systems. Over the years, they have successfully overseen the installation, operation, and maintenance of advanced gas collection infrastructure, ensuring efficient capture and utilization of landfill gas. Their expertise encompasses every aspect of these projects, from initial planning and design to execution and ongoing monitoring. This includes managing regulatory compliance, optimizing system performance, and integrating innovative technologies to enhance environmental protection and energy recovery. Their proven track record in this specialized field underscores their capability to handle complex projects with a high degree of professionalism and technical proficiency. There has been no new entity involved in Project Design and Implementation.

2.2.2 Risk assessment

	Risk identified	Mitigation or preventative measure(s) taken
Natural and human-induced risks to stakeholders' wellbeing	No risk identified.	The project activities have not affected stakeholders' wellbeing, as there are no natural and human associated risks with the project's location in areas where stakeholders have access.
Risks to stakeholder participation	No risk identified.	The project activities have not affected stakeholder participation, as there are no associated risks with the project's location in areas where stakeholders have access. The project poses no risks to the

		social, economic, and cultural diversity among stakeholders.
Working conditions	No risk identified.	The project activities have not raised any concerns or identified risks related to the working conditions.
Safety of women and girls	No risk identified.	No risks have been identified regarding the safety of women and girls due to the implementation of this project.
Safety of minority and marginalized groups, including children	No risk identified.	There are no identified risks concerning the safety of minority and marginalized groups, including children due to the implementation of this project.
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	No risk identified.	This project does not emit any hazardous materials or pollutants into water, land, or air. All the gas produced from landfill waste is captured and flared or employed in electricity generation.

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

	Risks identified ³	Mitigation or preventative measure(s) taken
Discrimination	No risks identified.	All parties participating in this project have implemented comprehensive anti-discrimination policies, training programs and investigation and resolution protocols that prevents any discrimination. The

³ The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor, and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

		Spartanburg County website mentions that Spartanburg County Government does not discriminate on the basis of any class or characteristic protected by law. https://selfservice.spartanburgcounty.org/ess/employmentopportunities/default.aspx
Sexual harassment	No risks identified.	All parties participating in this project have implemented comprehensive policies, training programs and investigation and resolution protocols that prevents any sexual harassment.
Gender equity in labor and work	No risks identified.	Spartanburg County has appointed an Equal Opportunity officer and a Fair Practices officer to ensure compliance with the Governors Code of Fair Employment Practices Executive Order which mentions promoting equal employment opportunity and work force diversification reflective of the availability of women in the relevant labor market.
Forced labor	No risks identified.	This project does not use victims of forced labor. Work related to the project including flare and engine maintenance are conducted by qualified technicians which does not include victims of forced labor.
Child labor	No risks identified.	This project does not use victims of child labor. Work related to the project including flare and engine maintenance are conducted by qualified technicians which does not include children.

Human trafficking	No risks identified.	This project does not use victims of human trafficking. Work related to the project including flare and engine maintenance are conducted by qualified technicians which does not include victims of human trafficking.
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2.3.2 Human Rights

Risks identified	Mitigation or preventative measure(s) taken
No risks identified	The Project occurs on municipal land so it will not affect the rights of IPs, LCs and customary rights holders.

2.3.3 Indigenous Peoples and Cultural Heritage

Risks identified	Mitigation(s) or preventative measure taken
No risks identified	The Project does not impact the cultural heritage of Indigenous Peoples as project activities occur on municipal land.

2.3.4 Property Rights

Risks identified	Mitigation or preventative measure(s) taken
No risks identified.	The project does not affect the property right of stakeholders. The landfill is owned by Spartanburg County. The installation of a gas collection and control system had no effect on property rights. There are no disputes over rights to territories and resources.

2.3.5 Benefit Sharing

Summary of the benefit sharing plan	This section is inapplicable as the Project does not impact property rights, and there have been no contentions concerning entitlements to territories and resources.
Benefit sharing during the monitoring period	N/A

2.4 Ecosystem Health

Risk identified		Mitigation or preventative measure(s) taken during the monitoring period
Impacts on biodiversity and ecosystems	No risks identified.	Capturing and combusting LFG will have no negative impact on biodiversity and ecosystem health.
Soil degradation and soil erosion	No risks identified.	Capturing and combusting LFG will have no negative impact on soils.
Water consumption and stress	No risks identified.	Capturing and combusting LFG will have no negative impact on water consumption.

2.4.1 Rare, Threatened, and Endangered species

Species or habitat	This section is not applicable because the Project is not located in, or adjacent to habitats for rare, threatened, or endangered species.
Areas needed for habitat connectivity	This section is not applicable because the Project is not located in, or adjacent to habitats for rare, threatened, or endangered species and does not affect any area needed for habitat connectivity.

Risks identified		Mitigation or preventative measure(s) taken
Habitats for rare, threatened, and endangered species	No risks identified.	This section is not applicable because the Project is not located in, or adjacent to habitats for rare, threatened, or endangered species.
Areas for habitat connectivity	No risks identified.	This section is not applicable because the Project is not located

		in, or adjacent to habitats for rare, threatened, or endangered species and does not affect any area needed for habitat connectivity.
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2.4.2 Introduction of species

N/A

2.4.3 Ecosystem conversion

This section is not applicable because this is not a ARR, ALM, WRC or ACoGS project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The Project was fully operational throughout the monitoring period (January 1, 2023 – December 31, 2023) and was implemented according to the validated PDD. The distribution of the landfill gas flow going to the different destruction devices during January 1, 2023 – December 31, 2023 is as follows: Flare ~53.687%; Milliken~46.267%; Lockhart~0.0460%.

During the current monitoring period, regular maintenance was performed on all facility equipment, including cleaning and inspecting flow meters and gas analyzers, servicing generator engines at Lockhart Power, and maintaining the boiler at the Milliken Facility. Due to the lack of available landfill gas, the power generation plant at Lockhart Power operated only during peak hours, so there was no shutdown for yearly maintenance. Similarly, there was no shutdown at the Wellford Landfill during this reporting period, as it regularly accepts landfill waste from the local community.

3.2 Deviations

3.2.1 Methodology Deviations

There are no new methodology deviations this monitoring period. There are, however, twelve deviations to the methodology, documented in the Project's PDD, which have been applied to the current monitoring period. These methodology deviations are as follows:

1) Grid Electricity Emission Factor and TDL

Project emissions associated with electricity consumption are calculated in accordance with CDM Tool 5: "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". Following the Tool, a default grid CO₂ emission factor of 1.3 t CO₂/MWh would be applied. As per CDM Tool 5, the emission factor for grid electricity is predetermined and remains unchanged throughout the project, without being monitored, even though it is used to calculate emissions after the project's completion. 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 used and the emission factor for electricity generation is determined by examining the electricity grid in the region through the monitoring of $EF_{EF,y}$.

Similarly, the $TDL_{j,y}$ parameter, representing Transmission and Distribution Losses, has been fixed ex-ante, despite being an annually monitored parameter as per CDM TOOL 05. To improve the accuracy of emissions quantification, a project description deviation will be applied to enable ex-post monitoring of $TDL_{j,y}$ given the generation mix and emission intensity of electricity generation from the applicable regional grid. A deviation from the methodology is used and the emission factor for electricity generation is determined by examining the electricity grid in the region through the monitoring of $TDL_{j,y}$.

The Landfill draws electricity from the SRVC (SERC Virginia/Carolina) region. According to the USEPA's eGRID database, the emission rate of electricity generation from this grid for 2023 is 0.2677 tCO₂/MWh. This emission intensity is representative of the actual emissions associated with the generation of electricity used at the site which increases the accuracy of the quantification. This value will be updated in subsequent reporting period to the most recent value available from the eGRID database.

2) Ex Ante Estimate of Emission Reductions

Following the Methodology, project proponents must provide an ex-ante estimate of emission reductions by projecting the future GHG emissions of the Landfill.

Instead of estimating ex-ante baseline methane emissions using the CDM "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", the USEPA 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 variables to determine the emissions associated with disposal of waste at the solid waste disposal site. For this project, proprietary K and LO values are inputted into the LandGEM model. The use of the LandGEM model is generally accepted as the most accurate way to model landfill gas emissions in the United States and only impacts the estimation of ex-ante emission reductions. It does not impact the conservativeness of emission reduction quantification.

3) Efficiency of the Flare

A deviation from the CDM Tool 6: "Project emissions from flaring" (version 3.0) default value is used as this value is not an accurate representation of the flare efficiencies typically achieved in the United States for flares designed in accordance with 40 CFR 60.18. This deviation from the Tool is necessary to reflect the equipment used and destruction efficiencies commonly observed at the flares located in the United States and to increase the accuracy of the emission reduction claim. A flare efficiency value of 98% will be used in project calculations.

The Landfill operates a PEI candlestick flare to destruct landfill gas. The flare's design limits specify that landfill gas must have a composition of at least 20% methane to maintain a stable flame and a 98% destruction efficiency. The flow range must be between 30 scfm and 1800 scfm. Methane content and monthly landfill gas flow to the flare are monitored on a continuous basis and any flow above and below the specified design limits are voided. Similarly, any methane content below 20% is voided from the calculation worksheet (Jan-Dec 2023 Combined w Calcs).

4) Electricity consumed by the Heat Generation Device

The methodology applied for this Project deviates from the CDM Tool 5: “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 3.0). To determine the amount of electricity consumed by the boilers in the project condition, the power rating of the heat generation equipment in MW is multiplied by the time of operation of said equipment. It is assumed that the heat generation equipment is in operation for 24 hours, which is conservative.

5) Net calorific value of methane

The net calorific value of methane from the NIST Chemistry Webbook will be used instead of the one recommended under Parameter Table 4 of ACM0001. The NIST Chemistry Webbook value represents the most accurate and relevant value for the Project.

6) Emissions factor for stationary combustion of natural gas

The emission factor for stationary combustion of natural gas from the USEPA will be used instead of the 2006 IPCC Guidelines on National GHG Inventories as recommended under Parameter table 5 of AMC0001. The USEPA value represents the most accurate and relevant value for the Project.

7) Reference conditions in the project

The Project uses 60F and 1 atm as standard reference conditions, whereas the Methodology uses 32F and 1 atm as the reference conditions. Flowmeters in the Project correct the gas flow data to the project-specific standard reference conditions. Parameters that are a function of temperature and pressure such as density are taken at the project-specific standard reference conditions.

8) Equation to calculate methane emissions that result from LFG combustion in the flare, heat generation device, and electricity generation device

The method to monitor and measure methane emissions related to the LFG that is destroyed in the project will be modified from its original format as written in CDM Tool 8. This modification is permissible under the VCS standard given that the modification will increase the accuracy of the quantification. For conservativeness, if the amount of eligible project LFG is greater than the amount destroyed, then the destroyed amount is used to multiply by the proportion of LFG that is flared, combusted by electricity generation, and combusted by heat generation. Otherwise, the eligible amount of gas is used to multiply by said proportions. This deviation mitigates the overstatement of emission reductions, which is possible if the eligible LFG project is more than the LFG destroyed.

9) Efficiency of Heat Generation Equipment in Project

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, Given that Milliken uses LFG in three different units, a deviation is applied in monitoring the heat generation equipment efficiency. Because the amount of LFG combusted is not monitored per heat generation equipment, the quantity of thermal energy displaced by LFG-sourced heat is amalgamated.

Moreover, the heat generation efficiency of the Cleaver-Brooks boilers are established by the manufacturer at 82%. The Carotek heater is rarely used, and thus, a deviation is applied to assume that this efficiency is applicable to all equipment used at the Milliken facility.

10) Operation of the Boiler/Air Heater/Heat Generation Equipment

Rather than measuring operation of the boiler/air heater/heat generating equipment in terms of hours of operation (which would not be accurate given Milliken's concurrent use of natural gas in its boilers), to ensure that all LFG sent to the Milliken boilers is burned and not vented to the atmosphere, Milliken has failsafe 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. This deviation pertains to measurement of an operational parameter and does not negatively impact conservativeness in any way.

11) Use of Reference density in the project quantification

Because temperature and pressure are determined to be standard reference values, consequently, density used in the project quantification is the density at the reference temperature and pressure. This is a deviation from CDM Tool 8 which requires project proponents to calculate density based on continuous measurement of temperature and pressure.

12)

In addition, there are two methodology deviation from previous monitoring periods that are applicable to the current monitoring period.

- 1) The PDD states that the equations 6-8 (MDflared,y, MDelectricity,y , and MDthermal, y) are calculated by using an equation format such as MDdestructiondevice,y= LFG Project total,y* wCH4,y* DCH4 *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.
- 2) Engine flow is measured on a dry basis while corresponding methane 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 result 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).

3.2.2 Project Description Deviations

There are no deviations to the Project that impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario.

There are no deviations to how the project was defined that were applicable in previous monitoring periods and apply during this monitoring period. There are, however, two deviations from how the project was defined in the PDD that are applicable to this reporting period.

1) Calibration Frequency of Flowmeter at Location 2 (Flare):

As per the PDD, the set of flowmeters used to record gas flow at location '2' will be calibrated every 12 to 18 months following manufacturer recommendations. The flowmeters in question are SN 21996, 21997 and 21998, all Rosemount 2051 differential pressure flow meters. All three flow meters are still used at the facility. However, there is an additional flow meter that was installed with the new flare, SN 22000. The primary flow meters are currently 21998 and 22000. According to the correspondence from the manufacturer, the Rosemount 2051 differential flow meters need to be calibrated every 3.5 years when considering the effects of temperature variation. The meters listed above are calibrated once every 3 years as an additional accuracy measure. Therefore, the calibration frequency deviates from the original specification of every 12 to 18 months. This does not affect the accuracy of the quantification as meters are still calibrated more frequently than recommended by the manufacturer.

2) Flowmeter Serial ID at Location 4 (Milliken Facility):

The flowmeter listed in the PDD at location 4 'Milliken Facility' is Flowmeter SN 43317. This flowmeter, however, is located at the delivery point between Lockhart and the Milliken Facility and not at gas skid 2. Flowmeter SN 42055 is located at gas skid 2 and thus, the schematic has been updated to reflect this. SN 42055 records at least approximately every 15 minutes and feeds into the SCADA system. This flowmeter will be used in the quantification. This deviation improves accuracy as the serial ID listed in the PDD was not that of the flowmeter used in the quantification. Providing the correct serial ID enables the data to be easily traced back to its source and for the corresponding calibration records to be attached to the correct flowmeter.

3.3 Grouped Projects

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

3.4 Baseline Reassessment

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes

☒ No

4 DATA AND PARAMETERS

4.1 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	OX_{top_layer}
Data unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the Landfill in the baseline
Source of data	Methodology
Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	Value provided in the Methodology
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$F_{CH_4,BL,y}$
Data unit	t CH ₄
Description	Amount of methane in the LFG that would have been flared in the baseline
Source of data	N/A
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	LFG from new extraction wells does not mix with LFG from the old wells. The LFG recovered from the new wells is measured for flow rate and methane concentration separately from pre-project wells. Therefore, no discounting is necessary, and this parameter is set to zero.
Purpose of Data	This is used for baseline emissions
Comments	N/A

Data / Parameter	η_{PJ}
Data unit	Dimensionless

Description	Efficiency of the LFG capture system installed in the project activity
Source of data	Reference
Value applied	50%
Justification of choice of data or description of measurement methods and procedures applied	This is the default value that the methodology prescribes.
Purpose of Data	Calculation of ex-ante emissions
Comments	N/A

Data / Parameter	GWP _{CH4}
Data unit	t CO ₂ e / t CH ₄
Description	Global warming potential of methane
Source of data	Reference
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	IPCC fifth assessment report
Purpose of Data	Calculation of baseline and project emissions
Comments	N/A

Data / Parameter	ρ_{CH4}
Data unit	t CH ₄ / m ³ CH ₄
Description	Density of methane at 60F, 1 atm
Source of data	Reference
Value applied	0.000678
Justification of choice of data or description of	This value is selected as flow meters are calibrated to standard temperature and pressure conditions (60F, 1atm).

measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions
Comments	https://www.epa.gov/sites/production/files/2015-09/nganal.xls

Data / Parameter	η_{flare}
Data unit	%
Description	Efficiency of the flare
Source of data	Reference
Value applied	98%
Justification of choice of data or description of measurement methods and procedures applied	See deviation description in Section 3.6 of the PDD. Value is used based on guidance from the USEPA for flares operated within the requirements for 40 CFR 60.18.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$\eta_{\text{HG,BL,y}}$
Data unit	%
Description	Efficiency of the heat generation equipment used in the baseline
Source of data	Guidance from ACM0001
Value applied	100%
Justification of choice of data or description of measurement methods and procedures applied	Value is taken from Option F of Tool 9: Determining the baseline efficiency of thermal or electric energy generation systems. The efficiency of baseline heat generation equipment is chosen to be 100% for conservativeness.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$\eta_{\text{HG,PJ,y}}$
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Data unit	%
Description	Efficiency of the heat generation equipment used in the project
Source of data	Cleaver-Brooks Efficiency Guide
Value applied	82%
Justification of choice of data or description of measurement methods and procedures applied	Value is taken from manufacturer-specified efficiency for methane
Purpose of Data	Calculation of baseline emissions
Comments	https://cleaverbrooks.com/Product/cble

Data / Parameter	F
Data unit	%
Description	Fraction of methane in the LFG (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories and LandGEM default value.
Value applied	50
Justification of choice of data or description of measurement methods and procedures applied	This is the most accurate estimate available.
Purpose of Data	This is used to conduct ex-ante emissions using LandGEM
Comments	N/A

Data / Parameter	Lo
Data unit	m ³ /Mg
Description	Potential methane generation capacity
Source of data	Clean Air Act default value from LandGEM
Value applied	170

Justification of choice of data or description of measurement methods and procedures applied	This is a default value provided by LandGEM.
Purpose of Data	This is used to conduct ex-ante emissions using LandGEM.
Comments	N/A

Data / Parameter	K
Data unit	year ⁻¹
Description	Decay rate
Source of data	Clean Air Act default value from LandGEM
Value applied	0.05
Justification of choice of data or description of measurement methods and procedures applied	This is a default value provided by LandGEM
Purpose of Data	This is used to conduct ex-ante emissions using LandGEM
Comments	N/A

Data / Parameter	EF _{EF}
Data unit	0.27 tCO ₂ / MWh
Description	Emission factor for the grid electricity
Source of data	Reference
Value applied	0.27
Justification of choice of data or description of measurement methods and procedures applied	Value is obtained using the USEPA eGRID summary tables 2023 Region SRVC. This is the most accurate source of this data.
Purpose of Data	Calculation of project emissions
Comments	This value will be updated to align with the most recent published eGRID values

	https://www.epa.gov/egrid/summary-data
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Data / Parameter	EF _{CO2,BL,HG,NG}
Data unit	tCO ₂ / TJ
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 The value of 0.05306 tCO ₂ /MMBtu was obtained from USEPA.
Source of data	U.S. EPA Emission Factors for Greenhouse Gas Inventories https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf
Value applied	49.34
Justification of choice of data or description of measurement methods and procedures applied	US EPA value represents most accurate public source
Purpose of Data	This is used for baseline emissions
Comments	Values will be reviewed annually to ensure they are appropriate or following any future revision of USEPA guidelines, as applicable.

Data / Parameter	NCV _{CH4} ,
Data unit	TJ / tCH ₄
Description	Energy content of methane
Source of data	National Institute of Standards and Technology Chemistry WebBook
Value applied	0.0555
Justification of choice of data or description of measurement methods and procedures applied	NIST Chemistry WebBook is an accurate, public source.
Purpose of Data	This is used for baseline and project emissions
Comments	Values will be reviewed annually to ensure they are appropriate EF, as applicable.

Data / Parameter	TDL
Data unit	%
Description	Average transmission and distribution losses in the grid
Source of data	Reference
Value applied	4.2 %
Justification of choice of data or description of measurement methods and procedures applied	Value is obtained using the USEPA eGRID summary tables 2023 Region SRVC. This is the most accurate source of this data.
Purpose of Data	Calculation of project emissions
Comments	This value will be updated to align with the most recent published eGRID values. https://www.epa.gov/system/files/documents/2025-01/egrid2023_summary_tables_rev1.pdf

Data / Parameter	COEF _{propane}
Data unit	t CO ₂ / gal
Description	CO ₂ emission coefficient for propane
Source of data	Calculated
Value applied	0.005590 t CO ₂ /gal
Justification of choice of data or description of measurement methods and procedures applied	COEF = NCV * EF which are both reference values
Purpose of Data	Calculation of project emissions
Comments	Values will be reviewed annually to ensure they are appropriate or following any future revision of USEPA guidelines, as applicable.

Data / Parameter	NCV _{propane}
Data unit	MMBtu / gal
Description	Energy content of propane

Source of data	Reference
Value applied	0.09133
Justification of choice of data or description of measurement methods and procedures applied	U.S. EPA Guidelines, Inventory of US Greenhouse Gas Emissions and Sinks, April 2020, Annex 2, Table A-56 https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2018
Purpose of Data	Calculation of project emissions
Comments	Values will be reviewed annually to ensure they are appropriate or following any future revision of USEPA guidelines, as applicable.

Data / Parameter	EF _{CO2,propane}
Data unit	t CO ₂ / MMBtu
Description	CO ₂ emission factor for propane
Source of data	Reference
Value applied	0.06153
Justification of choice of data or description of measurement methods and procedures applied	U.S. EPA Guidelines, Inventory of US Greenhouse Gas Emissions and Sinks, April 2020, Annex 2, Table A-56
Purpose of Data	Calculation of project emissions
Comments	Values will be reviewed annually to ensure they are appropriate or following any future revision of USEPA guidelines, as applicable.

Data / 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
Justification of choice of data or description of measurement methods and procedures applied	Summation of the MW for the three fans based on their rating
Purpose of Data	This is used for project emissions
Comments	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	fd _{CH4,HG,j,default}
Data unit	--
Description	Default value for the fraction of methane destroyed when used for heat generation equipment
Source of data	The value for boilers and air heaters are based on default values provided in the 2006 IPCC Guidelines (Tier 3 approach for Chapter 2: Stationary Combustion of Volume 2: Energy Use).
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	1 is the fraction of CH ₄ destroyed for boilers prescribed in the Methodology.
Purpose of Data	This is used to determine fossil fuel that would have been combusted to generate heat but has been displaced due to the use of LFG in the heat generation equipment.
Comments	N/A

4.2 Data and Parameters Monitored

Data / Parameter	Management of SWDS
Data unit	N/A
Description	Management of SWDS
Source of data	Original design of the landfill Technical specifications for the management of the SWDS Local or national regulations

Description of measurement methods and procedures to be applied	Management practices of SWDS after the implementation of the project activity will be reviewed.
Frequency of monitoring/recording	Annually
Value monitored	There are no practices implemented in this monitoring period that increases methane generation. There are no changes in the management practices of SWDS based on technical or regulatory requirements.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of the data	The purpose of this review is to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS will be justified by referring to technical or regulatory specifications.
Calculation method	N/A
Comments	N/A

Data / Parameter	W _y
Data unit	tonnes
Description	Total amount of waste disposed in year y
Source of data	Measured
Description of measurement methods and procedures to be applied	Measured by the Project Proponent
Frequency of monitoring/recording	Annually
Value applied	167,694.9
Monitoring equipment	Continuous with monthly and annual aggregation of data
QA/QC procedures to be applied	N/A

Purpose of data	This value is used in the ex-ante estimate
Calculation method	N/A
Comments	The quantity of waste disposed is determined based on facility records.

Data / Parameter	$F_{CH_4,PJ,y}$
Data unit	t CH ₄
Description	Total amount of methane in the LFG collected and destroyed by the project system at standard temperature and pressure (60 F, 1 atm)
Source of data	Calculated value
Description of measurement methods and procedures to be applied	Flow rates of methane to the landfill gas flare, electricity generation equipment, and heat generation equipment are calculated based on continuous monitoring. $F_{CH_4,PJ,y}$ is calculated by summing $F_{CH_4,flared,y}$, $F_{CH_4,EL,y}$, and $F_{CH_4,HG,y}$.
Frequency of monitoring/recording	Continuously monitored
Value applied	2,959.73 t CH ₄
Monitoring equipment	See applicable parameters
QA/QC procedures to be applied	See applicable parameters
Purpose of data	Calculation of baseline emissions
Calculation method	Methane content sent to the flare, the heat generation units and electricity generation units is calculated each month. $F_{CH_4,flared,y}$, $F_{CH_4,HG,y}$ and $F_{CH_4,EL,y}$ are summed to calculate the total methane captured and destroyed by the system. See sample calculations in Section 5 for the methodology.
Comments	N/A

Data / Parameter	$F_{CH_4,sent_flare,y}$
Data unit	t CH ₄
Description	Amount of methane in the LFG which is sent to the flare in year y

Source of data	Calculated based on V_{flare} , V_{CH_4} and ρ_{CH_4} as per CDM Tool 8: Tool to determine the mass flow of a greenhouse gas in a gaseous stream.
Description of measurement methods and procedures to be applied	Calculated value
Frequency of monitoring/recording	Continuous
Value applied	1,588.99 t CH ₄
Monitoring equipment	See applicable parameters
QA/QC procedures to be applied	See applicable parameters
Purpose of data	Calculation of baseline emissions
Calculation method	Measured flowrate of landfill gas is multiplied by the measured methane percentage and methane density at standard temperature and pressure. See sample calculations in Section 5 for the methodology.
Comments	N/A

Data / Parameter	$PE_{\text{flare},y}$
Data unit	t CH ₄
Description	Project emissions from flaring of the residual gas stream in year y
Source of data	Calculated based on $F_{\text{CH}_4,\text{sent to flare}}$ and η_{flare} as per CDM Tool 6: "Project emissions from flaring".
Description of measurement methods and procedures to be applied	Calculated value
Frequency of monitoring/recording	Annually
Value applied	31.78 t CH ₄
Monitoring equipment	See applicable parameters

QA/QC procedures to be applied	See applicable parameters
Purpose of data	Calculation of project emissions
Calculation method	Methane sent to the flare is multiplied by the destruction efficiency of the flare. See sample calculations in Section 5 for the methodology.
Comments	N/A

Data / Parameter	BE _{CH4, SWDS, y}
Data unit	tCO ₂ e/year
Description	Modelled methane emissions generated from waste disposal at the Landfill
Source of data	Landfill weight acceptance records
Description of measurement methods and procedures to be applied	Engineering studies and USEPA Default Values
Frequency of monitoring/recording	US EPA LandGem Model (version 3.02)
Value monitored	LandGEM was used to model ex-ante methane emissions
Monitoring equipment	10 years (every crediting period renewal)
QA/QC procedures to be applied	140,742 tCO ₂ e/year
Purpose of the data	Weigh scale to determine landfill weight acceptance and other default values identified in Section 5.1 of this PDD.
Calculation method	N/A
Comments	The purpose of this parameter is to estimate the methane emissions that the landfill can potentially generate in the crediting period using historical landfill acceptance records.

Data / Parameter	V _{project total}
Data unit	m ³
Description	Total volume of methane in LFG collected and destroyed by the project system at standard temperature and pressure (60 F, 1 atm)

Source of data	FCI Thermal Mass Flowmeter
Description of measurement methods and procedures to be applied	Measured and compiled into monthly excel files
Frequency of monitoring/recording	Continuous Monitoring; Recording every 15 minutes
Value monitored	4,365,378.845 m ³
Monitoring equipment	FCI Thermal Mass Flowmeter (Serial No. 324341)
QA/QC procedures to be applied	Consistent with manufacturer recommendations, the flowmeter should have a "Delta R" check to validate the electronics and resistance values of the sensor element and calibration should be performed every 18 months. 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. 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.
Purpose of the data	Calculation of baseline emissions
Calculation method	N/A
Comments	Flowmeter corrects recorded data to 60 degrees F and 1 atm.

Data / Parameter	V _{flare}
Data unit	m ³
Description	Volume of methane in landfill gas sent to flare at standard temperature and pressure.
Source of data	Rosemount 2051 differential pressure flow meters
Description of measurement methods and procedures to be applied	Rosemount 2051 differential pressure flow meters (Serial Nos. 21997, 21998, 21996, 22000) Flow is recorded at 60 degrees F and 1 atm.
Frequency of monitoring/recording	Continuous monitoring. Readings are recorded approximately every 15 minutes.

Value applied	2,343,648.45 m ³
Monitoring equipment	Rosemount 2051 differential pressure flow meters (Serial Nos. 21997, 21998, 21996, 22000)
QA/QC procedures to be applied	SN 21997 was installed May 2019. SN 21998 was installed May 2019. SN 21996 was installed May 2019. SN 22000 was installed May 2019. The flowmeter will be calibrated every 3 years following manufacturer recommendations.
Purpose of data	Calculation of baseline emissions
Calculation method	Measured value
Comments	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.

Data / Parameter	V _{CH4}
Data unit	m ³ CH ₄ /m ³ LFG
Description	Average methane fraction of the LFG
Source of data	Siemens Ultramat 23 Continuous Gas Analyzer
Description of measurement methods and procedures to be applied	Measured and compiled into monthly excel files
Frequency of monitoring/recording	Continuous monitoring. Recorded approximately every 15 minutes.
Value applied	51.7%
Monitoring equipment	Siemens Ultramat 23 Continuous Gas Analyzer (Serial No. N1 A1 664)
QA/QC procedures to be applied	The unit is currently calibrated once a month by Lockhart, although the OEM recommendation is only once every 6-12 months, and the interval between calibrations may be extended to align with this recommendation. In addition, the unit is calibrated externally on an annual basis. The unit automatically recalibrates the zero point by the AUTOCAL function when connecting nitrogen or air. During monthly

	calibrations, calibration is done by at least one reading verification with a standard gas. 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.
Purpose of data	Calculation of baseline emissions
Calculation method	Measured value
Comments	The analyzer is located at the billing gate between Lockhart and the County. Composition is measured on a wet basis.

Data / Parameter	$F_{CH_4, HG, y}$
Data unit	t CH ₄
Description	Amount of methane in the landfill gas which is destroyed by heat generation.
Source of data	Calculated based on V_{Heat} , V_{CH_4} and p_{CH_4} as per CDM Tool 8: Tool to determine the mass flow of a greenhouse gas in a gaseous stream.
Description of measurement methods and procedures to be applied	Calculated value
Frequency of monitoring/recording	Continuous
Value applied	1,369.37 t CH ₄
Monitoring equipment	See applicable parameters
QA/QC procedures to be applied	See applicable parameters
Purpose of data	Calculation of baseline emissions

Calculation method	Measured flowrate of landfill gas is multiplied by the measured methane percentage and methane density at standard temperature and pressure. See sample calculations in Section 5 for the methodology.
Comments	N/A

Data / Parameter	V _{Heat}
Data unit	m ³
Description	Volume of methane in landfill gas sent to the heat generation units at standard temperature and pressure.
Source of data	Rosemount 2051 SFC compact conditioning orifice plate mass flowmeter with integrated pressure and temperature integration.
Description of measurement methods and procedures to be applied	Gas flow and composition of the LFG entering the Milliken facility is measured. Flow is recorded at 60 degrees F and 1 atm.
Frequency of monitoring/recording	Continuous monitoring. Readings are recorded approximately every 15 minutes.
Value applied	2,019,721.67 m ³
Monitoring equipment	Rosemount 2051 SFC Serial Number: 42055
QA/QC procedures to be applied	The meter is calibrated according to manufacturer recommendations, every 3.5-years. If the calibration does not take place within this 3.5 year period, a discount factor of 1% will be applied to account for the possible reading deviation. If an alternate flowmeter is purchased it will be calibrated following manufacturer recommendations.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	Flow is metered 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	$F_{CH_4,EL,y}$
Data unit	t CH ₄
Description	Amount of methane in the landfill gas which is destroyed by electricity generation.
Source of data	Calculated based on $V_{Electricity}$, V_{CH_4} and p_{CH_4} as per CDM Tool 8: Tool to determine the mass flow of a greenhouse gas in a gaseous stream.
Description of measurement methods and procedures to be applied	Calculated value
Frequency of monitoring/recording	Continuous
Value applied	1.36 t CH ₄
Monitoring equipment	See applicable parameters
QA/QC procedures to be applied	See applicable parameters
Purpose of data	Calculation of baseline emissions
Calculation method	Measured flowrate of landfill gas is multiplied by the measured methane percentage and methane density at standard temperature and pressure. See sample calculations in Section 5 for the methodology.
Comments	N/A

Data / Parameter	$V_{Electricity}$
Data unit	m ³
Description	Volume of landfill gas sent to power generation unit at standard temperature and pressure.

Source of data	Rosemount 3051 SFC compact conditioning orifice plate mass flowmeter with integrated pressure and temperature integration.
Description of measurement methods and procedures to be applied	Gas flow and composition to the Lockhart facility is measured for invoicing purposes. This data is compiled into monthly excel files. Flow is recorded at 60 degrees F and 1 atm.
Frequency of monitoring/recording	Continuous monitoring. Readings are recorded approximately every fifteen minutes.
Value applied	2,008.72 m ³
Monitoring equipment	Rosemount 3051 SFC Serial Number: 482561
QA/QC procedures to be applied	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 calibration schedule has been extended to the 3-year interval in accordance with the manufacturer's recommendations. The flow meter was configured by a Rosemount technician. If an alternate flowmeter is purchased it will be calibrated following manufacturer recommendations.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	Flow will be measured at the delivery point between the Landfill and the Lockhart facility.

Data / Parameter	EleC _{flare}
Data unit	MWh
Description	Sum of quantity of electricity consumed by the flare skid
Source of data	Electricity supplier invoices
Description of measurement methods and procedures to be applied	There is a dedicated electricity meter that records the sum of electricity consumed by the flare skid
Frequency of monitoring/recording	Monthly

Value applied	673.67 MWh
Monitoring equipment	Dedicated electricity meter
QA/QC procedures to be applied	3 rd party statements/invoices are used to ensure accuracy of data.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	EleC _{treatment}
Data unit	MWh
Description	Sum of quantity of electricity consumed by the treatment skid
Source of data	Electricity supplier invoices
Description of measurement methods and procedures to be applied	There is a dedicated electricity meter that records the sum of electricity consumed by the treatment skid that treats LFG prior to transportation to be combusted for heat and electricity generation.
Frequency of monitoring/recording	Monthly
Value applied	27.94 MWh
Monitoring equipment	Dedicated electricity meter
QA/QC procedures to be applied	3 rd party statements/invoices are used to ensure accuracy of data.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	EleC _{Heat}
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. The manufacturer's load rating for all 3 fans is 0.03171 MW/hr.
Frequency of monitoring/recording	Monthly
Value applied	277.78 MWh
Monitoring equipment	N/A
QA/QC procedures to be applied	In the case of direct metering, 3 rd 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.
Purpose of data	Calculation of project emissions
Calculation method	See Comments below
Comments	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	PE _{propane}
Data unit	t CO ₂ /yr
Description	CO ₂ emissions from propane combustion
Source of data	Calculated based on FC _{propane} and COEF _{propane} as per the CDM Tool 3: "Tool to determine project or leakage CO ₂ emissions from fossil fuel combustion".
Description of measurement methods and procedures to be applied	Calculated value
Frequency of monitoring/recording	Annually

Value applied	0.39 t CO ₂ /yr
Monitoring equipment	See applicable parameters
QA/QC procedures to be applied	See applicable parameters
Purpose of data	Calculation of project emissions
Calculation method	Quantity of propane combusted is multiplied by an appropriate emission factor to determine total emissions. See sample calculations in Section 5 for the methodology.
Comments	N/A

Data / Parameter	FC _{propane}
Data unit	gal/yr
Description	Volume of propane combusted in the project activity in year y
Source of data	Supplier invoices
Description of measurement methods and procedures to be applied	Monthly supplier invoices demonstrate the amount of propane consumed at the facility which are recorded by commercial fuel meters.
Frequency of monitoring/recording	Invoiced on an as-delivered basis
Value applied	69.50 gal/yr
Monitoring equipment	Commercial fuel meters
QA/QC procedures to be applied	3rd party statements/invoices are used to ensure accuracy of data.
Purpose of data	Calculation of project emissions
Calculation method	Measured Value
Comments	N/A

Data / Parameter	Op _{flare,h}
Data unit	F

Description	This includes data to monitor whether the flare operates within the range of operating conditions specified by the manufacturer.
Source of data	Pyromation thermocouple
Description of measurement methods and procedures to be applied	A Pyromation thermocouple is used to monitor flame temperature and ensure proper operation of the flare. When the flare is not operational no gas is discharged and no flow is recorded.
Frequency of monitoring/recording	Continuous monitoring; Recorded every 15 minutes
Value applied	N/A
Monitoring equipment	Pyromation thermocouple
QA/QC procedures to be applied	Thermocouples are replaced as required and are not calibrated. This will not adversely impact the accuracy of the project as the thermocouples are used to ensure flare operation 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).
Purpose of data	Verification of flare operation
Calculation method	N/A
Comments	N/A

Data / Parameter	Op _{engine,h}
Data unit	kW
Description	Electricity generated by Lockhart Power during the project period. This is used to ensure operation of the energy plant.
Source of data	Records from commercial electricity meters
Description of measurement methods and procedures to be applied	Records from commercial electricity meters
Frequency of monitoring/recording	Every minute
Value applied	N/A

Monitoring equipment	Commercial electricity meter
QA/QC procedures to be applied	If it is determined that electricity is not being generated by Lockhart power, emissions related to LFG destruction by the electricity generating facility is assumed to be zero. Because this is a revenue grade meter, it is assumed that the meter is calibrated and maintained appropriately.
Purpose of data	Verification of operation of Lockhart power electricity generation units
Calculation method	N/A
Comments	Landfill gas destruction is double checked against generation data from the Lockhart units to ensure that destruction is not claimed when engines are not operational. The commercial electricity meters record electricity generated by the minute, which far exceeds the hourly requirement stipulated by Parameter table 12 in AMC0001.

Data / Parameter	†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	N/A
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 applied	8,760 hours
Monitoring equipment	Hour Meter (if applicable)
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	Totalized hourly readings or assumption of 24 hour / 365 day operation

Comments

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.

4.3 Monitoring Plan

The purpose of monitoring is to ensure the accuracy of offset quantification. The estimate of GHG emission reductions claimed for this project relies on data provided by Lockhart Power, the owner and operator of the Project. Lockhart Power has sustainably and reliably served their customers in South Carolina for over 100 years. The Project is overseen by Lockhart Power's General Manager and Chief Operating Officer and the Gas to Energy Site Operator is responsible for the day-to-day operations of this facility.

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. Lockhart Power has personnel located at the landfill, monitoring the gas analyzer and flow data to ensure readings are normal and accurate. If any data is deemed inaccurate, corrective action is taken as necessary to ensure that the data is as complete and accurate as possible.

Baseline Emissions

Monitoring Equipment

The flow rate of LFG is metered at four locations: the main gas stream from the field, at the flare inlet, prior to delivery to the Milliken Facility and prior to delivery to Lockhart.

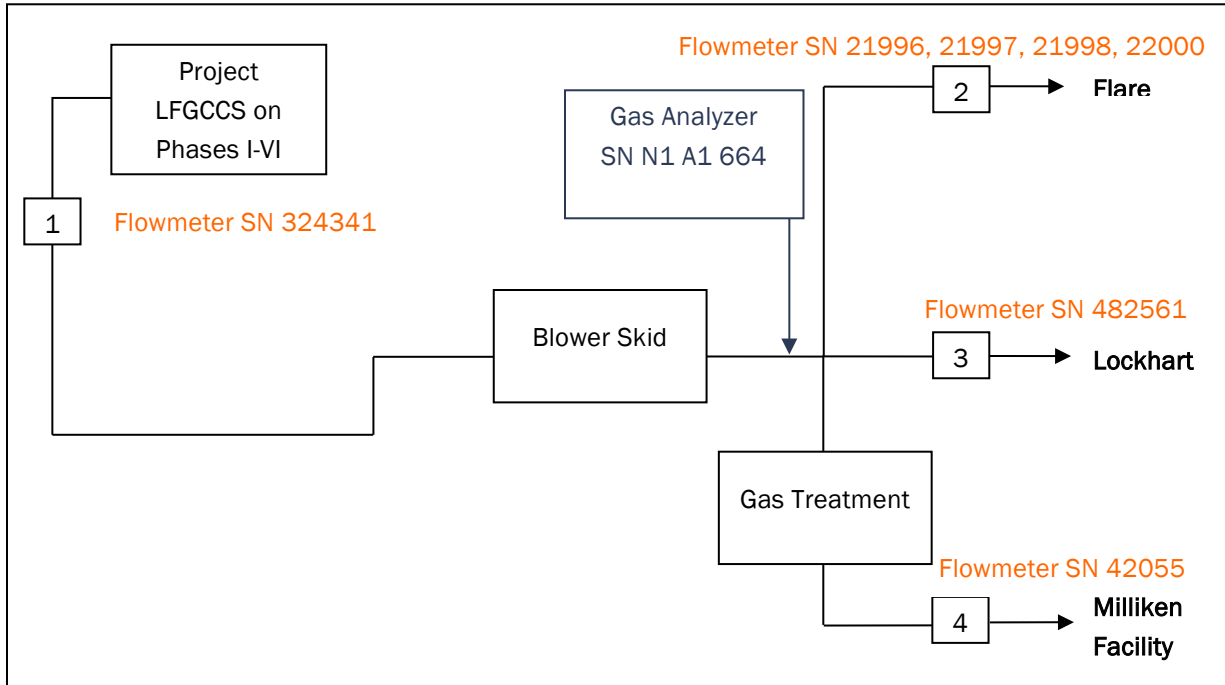
LFG flow from the project system is monitored using an FCI Thermal Mass flowmeter that normalizes flow to standard temperature and pressure conditions. Composition is metered using a Siemens Ultramat 23 continuous gas analyzer at the point prior to where gas flow splits to the three different combustion devices. Gas flow and composition data are recorded continuously and averaged every 15 mins. There is an automatic control valve located after the moisture separator that directs the flow through the 1st stage gas treatment skid. If the skid were to 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 separated into three lines (primary, secondary, and pilot flow) at the flare skid. These three lines are each monitored individually with three Rosemount 2051 differential pressure flow meters. A Pyromation thermocouple is used to ensure the flare is burning. Flow, composition, 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. In addition, when calculating the amount of methane destroyed by the flare, skid minute data is checked against flare operating parameters. If the temperature falls below the minimum of 300 or the

methane content below the minimum of 20%, the quantity of methane destroyed is set to zero and thus, is not quantified.

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. In addition, at the delivery point between the Landfill and the Milliken Facility, both the composition and flow rate of the LFG is recorded every minute.

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 3 years 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 monthly by Lockhart and annually by an external party. 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.

When the Lockhart Facility came online, a supervisory control and data acquisition system (SCADA) system began 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.

The data collected by the original PLC as being stored on an offsite SCS FTP site. Once the SCADA system came online the data began to be stored on site on a separate server in the Lockhart switch gear facility. The data is also backed up on the technician's laptop. The SCADA system uploads data to the on-site server monthly. 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.

Project Emissions

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 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 quantified based on the 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 the Project data (June 2, 2011). Records will be maintained on the County and Lockhart’s on-site server.

The County and Lockhart will submit data to Anew for integration into emission reductions calculations. Anew saves the raw data files and then after applying the appropriate parameters, creates the emission reduction calculations. These undergo an internal QA/QC review.

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.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The following equation is used to determine baseline emissions:

$$BE_y = BE_{CH_4,y} + BE_{HG,y}$$

Where:

BE_y = Baseline emissions in year y (t CO₂e/yr)

$BE_{CH_4,y}$ = Baseline emissions of methane from the SWDS in year y (t CO₂e/yr)

$BE_{HG,y}$ = Baseline emissions associated with heat generation in year y (t CO₂e/yr)

Determination of $BE_{CH_4,y}$

Baseline emissions of methane from the SWDS are determined with the following equation, based on the amount of methane that is captured under the project activity and the amount that would have been captured and destroyed in the baseline. In addition, the effect of methane oxidation that is present in the baseline and absent in the project is considered.

$$BE_{CH_4,y} = \left((1 - OX_{top\ layer}) * F_{CH_4,PJ,y} - F_{CH_4,BL,y} \right) * GWP_{CH_4}$$

$$BE_{CH_4,y} = ((1 - 0.10000) * (2635.15) * 28)$$

$$BE_{CH_4,y} = 66,405.84 \text{ t CO}_2\text{e/yr}$$

Where,

$BE_{CH_4,y}$ = Baseline emissions from the SDWS in year y (t CO₂e/yr)

$OX_{\text{top layer}}$ = Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)

$F_{CH_4,PJ,y}$ = Amount of methane in the LFG which is flared, used to generate heat, and/or used to generate electricity in the project activity in year y (t CH₄/yr)

$F_{CH_4,BL,y}$ = Amount of methane in the LFG that would have been flared in the baseline year y (t CH₄/yr)

GWP_{CH_4} = Global warming potential of methane (t CO₂e / t CH₄)

Determination of $F_{CH_4,PJ,y}$

$F_{CH_4,PJ,y}$ is the sum of quantities of methane flare and used to generate electricity during the reporting period, as follows:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,HG,y} + F_{CH_4,EL,y}$$

$$F_{CH_4,PJ,y} = 1,557.21 \text{ tCH}_4/\text{yr} + 1,369.37 \text{ tCH}_4/\text{yr} + 1.36 \text{ tCH}_4/\text{yr}$$

$$F_{CH_4,PJ,y} = 2927.95 \text{ tCH}_4/\text{yr}$$

Where,

$F_{CH_4,PJ,y}$ = Amount of methane in the LFG which is flared, used to generate heat, and/or used to generate electricity in the project activity in year y (t CH₄/yr)

$F_{CH_4,flared,y}$ = Amount of methane in the LFG which is destroyed by flaring in year y (t CH₄/yr)

$F_{CH_4,HG,y}$ = Amount of methane in the LFG which is destroyed for heat generation in year y (t CH₄/yr)

$F_{CH_4,EL,y}$ = Amount of methane in the LFG which is destroyed for electricity generation in year y (t CH₄/yr)

Determination of $F_{CH_4,flared,y}$

$F_{CH_4,flared,y}$ is determined as the difference between the amount of methane supplied to the flare and any methane emissions from the flare as follows:

$$F_{CH_4,flared,y} = F_{CH_4,sent_flare,y} - \frac{PE_{flare,y}}{GWP_{CH_4}}$$

$$F_{CH_4,flared,y} = 1,588.99t\ CH_4/yr - 31.78tCH_4/yr$$

$$F_{CH_4,flared,y} = 1557.2\ t\ CH_4/yr$$

Where,

$F_{CH_4,flared,y}$ = Amount of methane in the LFG which is destroyed by flaring in year y (t CH₄/yr)

$F_{CH_4,sent_flare,y}$ = Amount of methane in the LFG which is sent to the flare in year y (t CH₄/yr)

$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year y (t CO₂e/yr)

GWP_{CH_4} = Global warming potential of CH₄ (t CO₂e/t CH₄)

Determination of $F_{CH_4,sent\ to\ flare,y}$

The Project meters the volume of LFG sent to the flare and the composition of this gas on a wet basis. As such, $F_{CH_4,sent\ to\ flare,y}$ is determined using option C in the CDM Tool 8: “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”. Option C includes instructions for determining the volume of greenhouse gas sent to the flare under standard temperature and pressure (STP) conditions (60F, 1atm). As the meters automatically record data under STP conditions, methane density can be considered a reference value and conversion of volumetric flow rate is not necessary. Equation 9 is therefore used to calculate the quantity of methane sent to the flare, while equations 10 and 11 are not used.

$$F_{CH_4,sent_flare,y} = V_{flare} * v_{CH_4} * \rho_{CH_4}$$

$$F_{CH_4,sentflare,y} = 2,343,628.45\ m^3CH_4/yr * 0.000678\ \frac{tCH_4}{m^3CH_4}$$

$$F_{CH_4,sentflare,y} = 1588.99\ t\ CH_4/yr$$

Where,

$F_{CH_4,sent_flare,y}$ = Amount of methane in the LFG which is sent to the flare in year y (t CH₄/yr)

V_{flare} = Volume of landfill gas sent to flare, calculated using the proportion of landfill gas flared as shown in **Determination of V_{flare} , V_{Heat} , and $V_{Electricity}$** (m³)

v_{CH_4} = Average methane fraction of the LFG (m³ CH₄ / m³ LFG)

ρ_{CH_4} = Density of methane at 60F and 1atm (t CH₄ / m³ CH₄)

Determination of $PE_{flare,y}$

$PE_{flare,y}$ is determined directly by using the CDM Tool 6: “Project emissions from flaring” (version 3.0). The flare efficiency that will be applied is 98% as discussed in Section 3.6 of the PDD, except in cases when the flare thermocouples detect a flare temperature outside of manufacturer’s recommended settings. In these cases, a flare efficiency of 0% will be used as per section 6.2 of CDM Tool 6. The landfill gas composition is continuously measured at the facility. Therefore, equation 15 from the Tool is used:

$$PE_{flare,y} = \sum (F_{CH4,sent\ flare,y} * (1 - \eta_{flare})) * GWP_{CH4}$$

$$PE_{flare,y} = 1588.99 \frac{tCH4}{yr} * (1 - 0.98) * 28 tCO2e/tCH4$$

$$PE_{flare,y} = 889.83 t CO_2e/yr$$

Where,

$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year y (t CO₂e/yr)

$F_{CH4,sent\ to\ flare,y}$ = Amount of methane in the LFG which is sent to the flare in year y, (t CH₄/yr)

η_{flare} = Efficiency of the flare (%)

GWP_{CH4} = Global warming potential of methane (tCO₂e/tCH₄)

Determination of $F_{CH4,HG,y}$

The Project meters the volume of LFG sent to Milliken and the composition of this gas. As such, $F_{CH4,HG,y}$ is determined using option C in the CDM Tool 8. Option C includes instructions for determining the volume of greenhouse gas sent to the heat generation device under STP conditions. As the meters automatically record data under STP conditions, methane density can be considered a reference value and conversion of volumetric flow rate is not necessary. Equation 9 is therefore used to calculate the quantity of methane sent to the flare, while equations 10 and 11 are not used.

$$F_{CH4,HG,y} = V_{Heat} * v_{CH4} * \rho_{CH4}$$

$$F_{CH4,HG,y} = 2,019,721.67 m^3CH4/yr * 0.000678 \frac{tCH4}{m^3CH4}$$

$$F_{CH4,HG,y} = 1,369.37 tCH4/yr$$

Where,

$F_{CH4,HG,y}$ = Amount of methane in the LFG which is destroyed for heat generation in year y (t CH₄/yr)

V_{Heat}	= Volume of landfill gas sent to heat generation unit, calculated using the proportion of landfill gas destroyed by heat generation as shown in
V_{CH4}	= Average methane fraction of the LFG ($m^3 CH_4 / m^3 LFG$)
ρ_{CH4}	= Density of methane ($t CH_4 / m^3 CH_4$)

Determination of $F_{CH4,EL,y}$

The Project meters the volume of LFG sent to the Lockhart Power and the composition of this gas. As such, $F_{CH4,sent\ to\ flare,y}$ is determined using option C in the CDM Tool 8. Option C includes instructions for determining the volume of greenhouse gas sent to the flare under STP conditions. As the meters automatically record data under STP conditions, methane density can be considered a reference value and conversion of volumetric flow rate is not necessary. Equation 9 is therefore used to calculate the quantity of methane sent to the flare, while equations 10 and 11 are not used.

$$F_{CH4,EL,y} = V_{Electricity} * v_{CH4} * \rho_{CH4}$$

$$F_{CH4,EL,y} = 2008.72 m^3 CH_4 * 0.000678 \frac{tCH_4}{m^3 CH_4 yr}$$

$$F_{CH4,EL,y} = 1.36 t CH_4/yr$$

Where,

$F_{CH4,EL,y}$	= Amount of methane in the LFG which is destroyed by electricity generation in year y ($t CH_4/yr$)
$V_{Electricity}$	= Volume of landfill gas sent to power generation unit, calculated using the proportion of landfill gas destroyed by power generation as shown in Determination of V_{flare}, V_{Heat}, and $V_{Electricity}$ (m^3)
V_{CH4}	= Average methane fraction of the LFG ($m^3 CH_4 / m^3 LFG$)
ρ_{CH4}	= Density of methane ($t CH_4 / m^3 CH_4$)

Determination of V_{flare} , V_{Heat} , and $V_{Electricity}$

The following equations demonstrate how the volume of landfill gas sent to the different destruction devices will be monitored.

For conservativeness, if the amount of eligible project LFG is greater than the amount destroyed, then the destroyed amount is used to multiply by the proportion of LFG that is flared, combusted by electricity generation, and combusted by heat generation. Otherwise, the eligible amount of gas is used to multiply by said proportions. 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:

$$V_{flare} = V_{Project,total} * Proportion_{flare}$$

$$V_{Heat} = V_{Project,total} * Proportion_{Heat}$$

$$V_{Electricity} = V_{Project,total} * Proportion_{Electricity}$$

$$V_{flare} = 154,161,896.80 \text{ ft}^3\text{CH}_4 * 0.02831685 \frac{\text{m}^3}{\text{ft}^3} * 0.53687166$$

$$V_{flare} = 2,343,648.45 \text{ m}^3\text{CH}_4$$

$$V_{Heat} = 154,161,896.80 \text{ ft}^3\text{CH}_4 * 0.028316847 \frac{\text{m}^3}{\text{ft}^3} * 0.462668$$

$$V_{Heat} = 2,019,722.29 \text{ m}^3\text{CH}_4$$

$$V_{Electricity} = 154,161,896.80 \text{ ft}^3\text{CH}_4 * 0.028316847 \frac{\text{m}^3}{\text{ft}^3} * 0.0460$$

$$V_{Electricity} = 2008.72 \text{ m}^3\text{CH}_4$$

Where,

$V_{project, total}$ = lesser of eligible project LFG and destroyed amount of LFG volumes (m^3)

And

$$Proportion_{flare} = \frac{V_{Flare,P} * v_{CH_4,Flare}}{V_{Flare,P} * v_{CH_4,Flare} + V_{Heat,P} * v_{CH_4,Heat} + V_{Electricity,P} * v_{CH_4,Elec}}$$

$$Proportion_{Heat} = \frac{V_{Heat,P} * v_{CH_4,Heat}}{V_{Flare,P} * v_{CH_4,Flare} + V_{Heat,P} * v_{CH_4,Heat} + V_{Electricity,P} * v_{CH_4,Elec}}$$

$$Proportion_{Electricity} = \frac{V_{Electricity,P} * v_{CH_4,Elec}}{V_{Flare,P} * v_{CH_4,Flare} + V_{Heat,P} * v_{CH_4,Heat} + V_{Electricity,P} * v_{CH_4,Elec}}$$

$$Proportion_{flare} = \frac{2,343,648.45}{2,343,648.45 + 2,019,722.29 + 2008.72}$$

$$Proportion_{flare} = 53.687\%$$

$$Proportion_{Heat} = \frac{2,019,722.29}{2,343,628.41 + 2,019,721.67 + 2008.72}$$

$$Proportion_{Heat} = 46.267\%$$

$$Proportion_{Electricity} = \frac{2008.72}{2,343,628.41 + 2,019,721.67 + 2008.72}$$

$$Proportion_{Electricity} = 0.0460\%$$



Where,

Proportion_{flare} = Proportion of methane combusted by the flare over total methane combusted

Proportion_{Heat} = Proportion of methane combusted by heat generation over total methane combusted

Proportion_{Electricity} = Proportion of methane combusted by electricity generation over total methane combusted

V_{Flare,P} = Volume of LFG sent to the flare (m³)

V_{Heat,P} = Volume of LFG sent to the heat generation unit (m³)

V_{Electricity,P} = Volume of LFG sent to the electricity generation unit (m³)

V_{CH4} = Average methane fraction of the LFG (m³ CH₄ / m³ LFG)

Determination of F_{CH4,BL,y}

In order to calculate the BE_{CH4,y} the amount of methane that would have been destroyed in the absence of the project activity, F_{CH4,BL,y}, must be deducted. The new LFG extraction wells were routed to a separate collection system and thus, LFG collected from these new wells does not mix with that of the old wells. The LFG recovered from the new wells is measured for flow rate and methane concentration. Therefore, no discounting is necessary.

$$F_{CH4,BL,y} = 0$$

Where,

F_{CH4,BL,y} = Amount of methane in the LFG that would have been flared in the baseline year y (t CH₄/yr)

Determination of BE_{HG,y}

The baseline emissions associated with heat generation is quantified by calculating fossil fuel emissions that would have been emitted in the absence of the Project. For the Project's baseline condition, natural gas is assumed to be the fossil fuel that is being displaced.

$$BE_{HG,y} = NCV_{CH4} * R_{efficiency} * F_{CH4,HG,dest,j,y} * EF_{CO2,BL,HG,NG,y}$$

$$BE_{HG,y} = \frac{0.0555TJ}{tCH4} * (0.82) * 1369.37 \frac{tCH4}{yr} * 50.29 \frac{tCO2}{TJ}$$

$$BE_{HG,y} = 3134.08 tCO2/yr$$

Where,

$BE_{HG,y}$	= Baseline emissions associated with heat generation in year y (t CO ₂ /yr)
NCV_{CH_4}	= Net calorific value of methane at reference conditions (TJ/t CH ₄)
$R_{efficiency}$	= Ratio of the project and baseline efficiency of heat equipment (dimensionless)
$F_{CH_4,HG,dest,j,y}$	= Amount of methane in the LFG which is destroyed for heat generation by the heat generation equipment in year y (t CH ₄ /yr)
$EF_{CO_2,BL,HG,NG}$	= CO ₂ emissions factor of the natural gas that would have been combusted in the heat generation equipment in the baseline. (tCO ₂ /TJ)

Determination of $R_{efficiency,y}$

Equation 18 from the Methodology is used to determine the ratio of the project and baseline efficiency of the heat generation equipment

$$R_{efficiency,y} = \min \left\{ 1, \frac{\eta_{HG,PJ,y}}{\eta_{HG,BL,y}} \right\}$$

$$R_{efficiency,y} = \min \left\{ 1, \frac{0.82}{1.0} \right\}$$

$$R_{efficiency,y} = 0.82$$

Where,

$R_{efficiency,y}$	= Ratio of the project and baseline efficiency of heat equipment in year y (dimensionless)
$\eta_{HG,PJ,y}$	= Efficiency of the heat generation equipment used in the project activity in year y (dimensionless)
$\eta_{HG,BL,y}$	= Efficiency of the heat generation equipment used in the baseline in year y (dimensionless)

Determination of $F_{CH_4,HG,dest,j,y}$

Equation 19 from the Methodology is used to determine the amount of methane in the LFG destroyed for heat generation by the heat generation equipment.

$$F_{CH_4,HG,dest,j,y} = f_{d_{CH_4,HG,j,default}} * F_{CH_4,HG,j,y}$$

$$F_{CH_4,HG,dest,j,y} = 1 * 1,369.37 \text{ t CH}_4/\text{yr}$$

Where,

$F_{CH_4,HG,dest,j,y}$ = Amount of methane in the LFG which is destroyed for heat generation by the heat generation equipment (t CH₄/yr)

$fd_{CH_4,HG,j,default}$ = Default value for the fraction of methane destroyed when used for heat generation equipment type j (dimensionless)

$F_{CH_4,HG,j,y}$ = Amount of methane in the LFG which is used for heat generation equipment (t CH₄/yr)

During the monitoring period (January 1, 2023 – December 31, 2023) the baseline emissions were:
Baseline Emissions= $BE_{HG,y} + BE_{CH_4,y}$

$$\text{Baseline Emissions} = 3,134.08 \text{ t} \frac{\text{CO}_2\text{e}}{\text{yr}} + 73,783.94 \text{ t} \frac{\text{CO}_2\text{e}}{\text{yr}}$$

	Jan 1 – Dec 31, 2023
Actual Baseline Emissions	76,918 tCO ₂ e

5.2 Project Emissions

Project emissions come from electricity and fossil fuels consumed in the project activity. These emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y}$$

Where,

PE_y = Project emissions in year y (t CO₂e / yr)

$PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year y (t CO₂e/yr)

$PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity in year y (t CO₂e/yr)

Determination of PE_{FC}

Propane is used as a start-up fuel to establish combustion before the residual gas flow begins and the flare is operational and once the flare is operational, the propane supply is discontinued. The equation for $PE_{FC,y}$ is:

$$PE_{FC,y} = PE_{propane}$$

Project emissions from the consumption of fossil fuel in the Project activity are calculated using equation 1 in the CDM Tool 3: “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (version 3.0). It is conservative to assume that the propane purchased will be combusted

during the reporting period and thus, emissions due to propane are only allocated at the point of sale. With this considered, the following equations are used:

$$PE_{propane} = FC_{propane} * COEF_{propane}$$

$$PE_{propane} = 69.50 \text{ gal/yr} * 0.005621 \frac{tCO_2}{gal}$$

$$PE_{propane} = 0.39 \frac{tCO_2}{yr}$$

Where,

$PE_{propane}$ = CO₂ emissions from propane combustion in year y (t CO₂/yr)

$FC_{propane}$ = Volume of propane purchased in the project activity in year y (gal)

$COEF_{propane}$ = CO₂ emission coefficient for propane (t CO₂ / gal)

The CO₂ emission coefficients are calculated based on net calorific value and CO₂ emission factor of the fuel type. This is Option B in Tool 3.

$$COEF_{propane} = NCV_{propane} * EF_{CO_2,propane}$$

$$COEF_{propane} = 0.09133 \frac{MMBtu}{gal} * 0.06153 \frac{tCO_2}{MMBtu}$$

$$COEF_{propane} = 0.005621 \frac{tCO_2}{gal}$$

Where,

$NCV_{propane}$ = Net calorific value of propane (MMBtu / gal)

$EF_{CO_2,propane}$ = Emission factor of propane (tCO₂ / MMBtu)

The Methodology section 5.5(66)(b) states “If in the baseline a proportion of LFG is captured and flared ($F_{CH_4,BL,y} > 0$), then the fossil fuels consumption used in the calculation should refer to the net of that consumed in the baseline.”

There is no historical data for fuel consumed in the baseline. Therefore, it is assumed that the net consumption is only what is consumed in the Project activity. This will increase the Project emissions, a conservative approach.

Determination of PE_{EC}

Project emissions from consumption of electricity by the project activity are calculated using equation 1 (the generic approach) from CDM Tool 5: “Baseline, project and/or leakage emission from electricity consumption and monitoring of electricity generation” (version 3.0).

$$PE_{EC,y} = EC_{PJ,y} * EF_{EF} * (1 + TDL)$$

$$PE_{EC,y} = 979.38 \text{ MWh} * 0.2677 \frac{tCO_2e}{\text{MWh}} * (1 + 0.042)$$

$$PE_{EC,y} = 273.59 \text{ tCO}_2e$$

Where,

- $EC_{PJ,y}$ = Quantity of electricity consumed by the Project in year y (MWh/yr)
- EF_{EF} = Emission factor for the grid that supplies the electricity (t CO₂e/MWh)
- TDL = Average transmission and distribution losses for providing electricity to the source (%)

The parameter EF_{EF} is quantified using the methodology described in Methodology Deviation 1, found in section 3.6 of the PDD. This emission factor will be regularly updated to reflect the most recent value for the region published in the USEPA's eGrid database.

The Methodology section 5.5(65)(b) states “If in the baseline a proportion of LFG is destroyed, then the electricity consumption in the tool should refer to the net quantity of electricity consumption (i.e. the increase due to the project activity).”

There was no historical data for electricity consumed in the baseline. Therefore, it will be assumed that the net consumption is only what is consumed in the Project activity. This will increase the project emissions, a conservative approach.

Determination of $EC_{PJ,y}$

$EC_{PJ,y}$ is determined by aggregating the amount of electricity used at the flare skid, the treatment skid, and Milliken facility as a result of operating the project to support LFG combustion.

$$EC_{PJ,y} = Elec_{flare} + Elec_{Heat} + Elec_{treatment}$$

Where,

- $Elec_{Flare}$ = Amount of electricity consumed by the flare skid (MWh)
- $Elec_{Heat}$ = Amount of electricity consumed by the heat generation device (MWh)
- $Elec_{treatment}$ = Amount of electricity consumed by the treatment skid (MWh)

$Elec_{Flare}$ and $Elec_{Treatment}$ are directly measured whereas the electricity consumed by the boilers to generate heat is calculated as follows:

$$Elec_{Heat} = L_{Milliken} * t_{Milliken}$$

$$Elec_{Heat} = 0.03171 \frac{MW}{hr} * 24hr/day * 365 days/year$$

$$Elec_{Heat} = 277.78 MWh/year$$

Where,

$L_{Milliken}$ = Load rating of the equipment used to operate the boilers/heater at the Milliken facility (MW)

$t_{Milliken}$ = Hours of operation of the equipment used to operate the boilers/heater at the Milliken facility. It is conservative to assume that the equipment is in operation for 24 hours per day during the entire month.

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:

$$L_{Milliken} = Rating (hp) * 0.746 * 0.001$$

Where,

0.746 = Conversion factor from kW to hp

0.001 = Conversion factor from kW to MW

During the monitoring period (January 1, 2023 – December 31, 2023) the project emissions were:

	Jan 1 – Dec 31, 2023
Project Emissions	274 tCO ₂ e

5.3 Leakage Emissions

The Project activity does not anticipate any leakage emissions.

5.4 GHG Emission Reductions and Carbon Dioxide Removals

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:

$$ER_y = BE_y - PE_y$$

Where,

ER_y = Emission reductions in year y (t CO₂e/yr)

BE_y = Baseline emissions in year y (t CO₂e/yr)

PE_y = Project emissions in year y (t CO₂e/yr)

Table 2 provides a summary of the quantification of emission reductions generated by the project activity from June 15, 2010 – December 31, 2023.

Vintage period	Baseline emissions (tCO ₂ e)	Project emissions (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Reduction VCUs (tCO ₂ e)	Removal VCUs (tCO ₂ e)	Total VCUs (tCO ₂ e)
15-Jun-2010 to 31-Dec-2010	32,909	118	0	32,791	0	32,791
01-Jan-2011 to 31-Dec-2011	70,640	391	0	70,249	0	70,249
01-Jan-2012 to 30-Sep-2012	63,973	425	0	63,548	0	63,548
01-Oct-2012–31-Dec-2012	23,730	164	0	23,566	0	23,566
01-Jan-2013–30-Sep-2013	73,464	523	0	72,941	0	72,941
01-Oct-2013–31-Dec-2013	25,868	177	0	25,691	0	25,691
01-Jan-2014–31-Dec-2014	91,885	727	0	91,158	0	91,158
01-Jan-2015–31-Dec-2015	104,577	439	0	104,138	0	104,138
01-Jan-2016–31-Dec-2016	125,890	462	0	125,428	0	125,428
01-Jan-2017–31-Dec-2017	119,544	444	0	119,100	0	119,100
01-Jan-2018–31-Dec-2018	108,096	445	0	107,651	0	107,651

01-Jan-2019–31-Dec-2019	99,338	472	0	98,866	0	98,866
01-Jan-2020–14-Jun-2020	43,017	244	0	42,773	0	42,773
15-Jun-2020–31-Dec-2020	46,390	232	0	46,158	0	46,158
01-Jan-2021–31-Dec-2021	78,851	382	0	78,469	0	78,469
01-Jan-2022–31-Dec-2022	65,862	368	0	65,494	0	65,494
01-Jan-2023–31-Dec-2023	76,918	274	0	76,644	0	76,644
Total	1,250,952	6287	0	1,244,665	0	1,244,665

Vintage period	Ex-ante estimated reductions/removals	Achieved reductions/removals	Percent difference	Explanation for the difference
01-Jan-2023 to 31-Dec-2023	134,858	76,644	-43.2%	The Wellford Landfill produced reduced amounts of landfill gas compared to earlier years. Consequently, there is a decrease in the volumes of landfill gas being flared, utilized in boilers, and employed in generators to produce electricity.
Total	134,858	76,644		

APPENDIX X: EVIDENCE OF SD CONTRIBUTIONS

Project Spartanburg County Landfill Gas Combustion Project
Proponent Anew Canada ULC, Lockhart Power
Crediting Period June 15, 2020 - June 14, 2030
Reporting Period January 1, 2023 - December 31, 2023
System Verified Carbon Standard
Protocol ACM0001: Flaring or use of landfill gas Version 19

OFFSET SUMMARY SHEET

This sheet contains a summary of baseline and project emissions from each SS on the other worksheets, as well as a calculation of the total credits created. Oxidation emissions are calculated in this sheet.

								CO2	CH4	N2O	
								GWP	1	28	265
Baseline Emissions			t CO ₂	t CH ₄	t N ₂ O	PFCs	HFCs	SF6	t CO ₂ e	t CO ₂ e	
SS	BECH4_F	Destruction of LFG via Flare	-	1,401.49	-	-	-	-	-	39,241.79	
	BECH4_HG	Destruction of LFG via Heat Generation	-	1,232.43	-	-	-	-	-	34,508.16	
	BECH4_EL	Destruction of LFG via Electricity Generation	-	1.23	-	-	-	-	-	34.32	
	BEHG	NG Displacement from Heat Generation	3,134.08	-	-	-	-	-	-	3,134.08	
	FCH4BL	Baseline Emission Deduction	-	-	-	-	-	-	-	-	
Total Baseline Emissions:			-	-	-	-	-	-	-	76,918.34	
Project Emissions			t CO ₂	t CH ₄	t N ₂ O	PFCs	HFCs	SF6	t CO ₂ e	t CO ₂ e	
SS	PE_EC	Electricity Consumption	-	-	-	-	-	-	273.20	273.20	
	PE_FC	Fossil Fuel Consumption	-	-	-	-	-	-	0.39	0.39	
Total Project Emissions:			-	-	-	-	-	-	-	273.59	
Emission Offset Credits Created			t CO ₂	t CH ₄	t N ₂ O	PFCs	HFCs	SF6	t CO ₂ e	t CO ₂ e	
ALL			3,134.08	2,635.15	-	-	-	-	273.59	76,644.75	

From Lockhart Power website:

<https://lockhartpower.com/using-renewable-landfill-gas-energy/>

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Lockhart Power is dedicated to environmental sustainability. From our administrative offices to how we produce power, we believe in doing what's right for the environment. That's why we operate four run-of-river hydroelectric projects licensed by the Federal Energy Regulatory Commission.

Lockhart also owns and operates the Wellford Renewable Energy (WREN) Landfill Gas-to-Energy Project in Wellford, S.C. Lockhart Power constructed the WREN facility in 2011 and uses the methane output of the Wellford Landfill to produce power. Lockhart also operates and maintains the gas collection and treatment systems for the landfill owner, Spartanburg County, in addition to a 6-mile pipeline feeding additional gas to an industrial plant.

Landfill gas is a natural byproduct of decomposing organic waste in landfills and is primarily composed of methane and carbon dioxide. Instead of allowing these gases to escape into the atmosphere and contribute to climate change, we capture them and convert the gas into a valuable energy source.

The collected gas can be processed to remove impurities and moisture, producing a cleaner and more efficient fuel source. This purified gas can then be used to fuel generators or other power-generation equipment to produce electricity.

Using landfill gas energy, Lockhart Power effectively turns a waste product into a valuable resource. This approach contributes to environmental sustainability by reducing greenhouse gas emissions, mitigating odor issues associated with landfills, and generating renewable energy.

Calculation Procedure for SDG 07 Indicator:

The energy content of methane is approximately:

- **NCV_{CH4} = 0.0555 TJ/tCH₄**

For heat in boilers (1,232.43 tCH₄ and taking oxidation factor into account):

Convert to TJ: Energy in TJ=1,232.43 tCH₄×0.0555 TJ/tCH₄

Energy = 68.40 TJ

Similarly,

The EF of Grid Electricity is:

- **0.26771022 t CO₂/MWh**

For electricity produced by the Lockhart Generators (1.23 tCH₄ and taking oxidation factor into account):

1.23 tCH₄*28= 34.32 t CO₂

- Convert to MWh: 34.32 t CO₂/0.26771022 t CO₂/MWh= 128.199 MWh

For Lifetime Calculations, as the project has a 10 year crediting period, the project has produced over 100+ TJ of energy and 100+ MWh of electricity.

PROCESS FLOW DIAGRAM:

