



**Verified Carbon
Standard**

DAVIDSON COUNTY LANDFILL

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CONTENTS

1	PROJECT DETAILS	4
1.1	Summary Description of the Project	4
1.2	Sectoral Scope and Project Type	4
1.3	Project Eligibility	4
1.4	Project Design	4
1.5	Project Proponent	5
1.6	Other Entities Involved in the Project	5
1.7	Ownership	5
1.8	Project Start Date	6
1.9	Project Crediting Period	6
1.10	Project Scale and Estimated GHG Emission Reductions or Removals	7
1.11	Description of the Project Activity	7
1.12	Project Location	8
1.13	Conditions Prior to Project Initiation	8
1.14	Compliance with Laws, Statutes and Other Regulatory Frameworks	8
1.15	Participation under Other GHG Programs	8
1.16	Other Forms of Credit	8
1.17	Additional Information Relevant to the Project	9
2	SAFEGUARDS	9
2.1	No Net Harm	9
2.2	Local Stakeholder Consultation	9
2.3	Environmental Impact	10
2.4	Public Comments	10
2.5	AFOLU-Specific Safeguards	10
3	APPLICATION OF METHODOLOGY	10
3.1	Title and Reference of Methodology	10
3.2	Applicability of Methodology	10
3.3	Project Boundary	13
3.4	Baseline Scenario	13
3.5	Additionality	14

3.6	Methodology Deviations.....	15
4	QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS.....	16
4.1	Baseline Emissions.....	16
4.2	Project Emissions.....	16
4.3	Leakage	16
4.4	Net GHG Emission Reductions and Removals.....	16
5	MONITORING.....	16
5.1	Data and Parameters Available at Validation	16
5.2	Data and Parameters Monitored	16
5.3	Monitoring Plan	16

1 PROJECT DETAILS

1.1 Summary Description of the Project

The Davidson County Landfill is a municipal solid waste facility operated by Davidson County in Lexington, North Carolina. At the landfill, landfill gas is collected and routed for combustion at one of two devices: a single open flare or an electricity generator set. Both devices are operated by Davidson Gas Producers using landfill gas collected at the Davidson County Landfill. Since the commissioning of the electricity generator set in November 2010, the flare only operates as a backup methane destruction device. The landfill gas collection system consists of 77 vertical wells between the Holly Grove area, Phase 1, and Phase 2. There is a total of 25 wells connected to the leachate cleanout system for a total of 102 wells. The landfill does not re-circulate leachate back into the landfill and is not considered a Bioreactor as defined by U.S. EPA.

The project is located at 220 Davidson County Landfill Road, Lexington, NC, 27292 in Davidson County.

The project is expected to generate GHG emissions reductions by destroying methane from landfill gas via electricity generator set and open flare.

Prior to project start date, landfill gas was vented to the atmosphere.

Average annual GHG emissions reductions are estimated at 50,000. Project total is estimated at 350,000.

1.2 Sectoral Scope and Project Type

The project's sectoral scope is 1. Energy because of the electricity generation from generator set and 13. Waste Handling and Disposal because the methane is destroyed from landfill gas.

1.3 Project Eligibility

The project is eligible under the VCS program because the project start date is May 20th, 2009, and the project was listed under the Climate Action Reserve (CAR) and verified within 2 years of project start date. The crediting period will be renewed under VCS program but will not exceed the original crediting period of 20 years.

1.4 Project Design

Not applicable

1.5 Project Proponent

Organization name	Element Markets Emissions, LLC
Contact person	Heather Rogers
Title	Associate of Environmental Products
Address	3200 Southwest Freeway, Suite 1310, Houston, Texas, 77027
Telephone	858-774-8686
Email	hrogers@elementmarkets.com

Table 1. Project Proponent Details

1.6 Other Entities Involved in the Project

Organization name	Davidson County Landfill
Role in the project	Landfill owner and operator
Contact person	Charlie Brushwood
Title	Landfill Project Manager
Address	1242 Old Highway 29, Thomasville, NC 27360
Telephone	336-240-0303
Email	Charlie.brushwood@davidsoncountync.gov

Organization name	Davidson Gas Producers
Role in the project	Landfill gas collection system, flare, generator set owner and operator
Contact person	Mokeima Jackson
Title	Biomass Asset Manager
Address	414 S. Main Street Suite 700, Ann Arbor, MI 48104
Telephone	734-913-2052
Email	mokeima.jackson@dteenergy.com

Table 2. Other Entities Details

1.7 Ownership

Contract between Davidson Gas Producers, LLC and Element Markets Emissions, LLC has been uploaded to the VCS project webpage. Element Markets Emissions, LLC has full right and title to the emissions reductions.

Davidson Gas Producers, LLC is a wholly owned subsidiary of DTE Energy.

1.8 Project Start Date

The project start date is May 20th, 2009, which is the day the flare became operational.

1.9 Project Crediting Period

The original crediting period under CAR was 10 years once renewable. The start date for the project is May 20th, 2009. The first crediting period ended on May 19th, 2019, and the project is eligible for crediting until May 19th, 2029.

After transferring the project to VCS, the crediting period will be renewed per the VCS Standard V4.1. The crediting period will be renewed as part of the gap validation. The baseline scenario and regulatory surplus will be demonstrated by the Project Developer (sections 3.4 and 3.5 respectively) and assessed by the Validation Body.

Per the Protocol, the baseline scenario assumes that all uncontrolled methane emissions are released to the atmosphere except for the portion of methane that would be oxidized by bacteria in the soil of uncovered landfills absent the project, or destroyed by a baseline destruction device. Since there was no pre project methane destruction, the original baseline scenario was uncontrolled methane emissions released to the atmosphere. In renewing the crediting period, there were no updates to the methodology in determining baseline scenario. The project maintains that uncontrolled methane emissions is the baseline scenario for the renewed crediting period.

Regulatory surplus has been demonstrated for the crediting period renewal by demonstrating the NMOC emissions are less than 34 Mg/year. Because the site has over 2.5 million cubic meters of waste, it is subject to Federal New Source Performance Standards (NSPS) for MSW landfills. Before 2019, the Davidson Landfill was subject to NSPS 40 CFR 60 subpart WWW, which stipulates the landfill must install a GCCS if the NMOC annual emissions exceeds 50 Mg/year. The facility expanded in 2018 causing NSPS 40 CFR 60 subpart to change to XXX. Starting in 2019, the site must install a GCCS if the NMOC annual emissions exceed 34 Mg/year. At no point in the project crediting period is the facility expected to exceed the NMOC emission rate to require the installation of a GCCS.

The project will renew under the 7 year twice renewable crediting period but will not exceed the total crediting period under the CAR program. The first VCS crediting period will be from January 1st, 2015 until December 31st, 2021. The second VCS crediting period will be from January 1st, 2022 until December 31st, 2028.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
Year 2015	50,000
Year 2016	50,000
Year 2017	50,000
Year 2018	50,000
Year 2019	50,000
Year 2020	50,000
Year 2021	50,000
Total estimated ERs	350,000
Total number of crediting years	7
Average annual ERs	50,000

Table 3. Project Credit Estimation

1.11 Description of the Project Activity

The project consists of two methane destruction devices: a single open flare or an electricity generator set both installed voluntarily. Both devices are operated by Davidson Gas Producers using landfill gas collected at the Davidson County Landfill. In the baseline scenario, all the landfill gas was vented to the atmosphere.

When the flare was voluntarily commissioned in 2009, the project activity began.

In November 2010, an electricity generator set was commissioned, and since then the flare only operates as a backup methane destruction device. The engine is rated at 2,233 HP with an LFG flow rate of 600 SCFM, and the flare is rated with an LFG flow rate of 900 SCFM. The landfill gas to energy (LFGTE) site is located on land leased from Davidson County, and the landfill does not exercise any control over the engine nor the flare.

The landfill gas collection system consists of 77 vertical wells between the Holly Grove area, Phase 1, and Phase 2. There is a total of 25 wells connected to the leachate cleanout system

for a total of 102 wells. The landfill does not re-circulate leachate back into the landfill and is not considered a Bioreactor as defined by U.S. EPA.

1.12 Project Location

The project is located at the Davidson Landfill in Lexington, North Carolina, United States of America. The address is 220 Davidson County Landfill Road, Lexington, North Carolina. The coordinates are 35.836708, -80.173958.

1.13 Conditions Prior to Project Initiation

Prior to project initiation, landfill gas was vented to the atmosphere, and there was no methane destruction.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Not applicable

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project was originally listed and registered under the Climate Action Reserve (CAR) in June of 2009. The full name of the project is “Davidson County Landfill Gas Destruction Project” and the project is registered as CAR468.

The project received credits from June 12th, 2009 until December 31st, 2014. The project will be transferred to the Verra Registry and resume credit generation under the VCS program from January 1st, 2015 until the end of the project’s original crediting period May 19th, 2029.

1.15.2 Projects Rejected by Other GHG Programs

Not applicable

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Not applicable

1.16.2 Other Forms of Environmental Credit

Duke Energy purchases electricity generated from the Project, per the “Renewable Energy Power Purchase Agreement” between Duke Energy Carolinas, LLC and Davidson Gas Producers,

LLC. Duke Energy generates Renewable Energy Credits (RECs) from the electricity generated by the Project.

1.17 Additional Information Relevant to the Project

Leakage Management

Not applicable

Commercially Sensitive Information

Not applicable

Sustainable Development

The Project contributes to SDG 13 – Take urgent action to combat climate change and its impacts. By destroying methane that would have otherwise been leaked to the atmosphere, this project is contributing to limiting global average temperature increase below 2 degrees C above pre-industrial levels.

Further Information

Not applicable

2 SAFEGUARDS

2.1 No Net Harm

No negative environmental and socio-economic impacts are associated with this project. Methane destruction at a municipal solid waste landfill is a community benefit because it eliminates odour and mitigates emissions.

2.2 Local Stakeholder Consultation

The Project obtained a Solid Waste Operating Permit and Title V Air Permit before initiating the project, and the project must renew the Air Permit preceding major modifications. These permits are managed by the North Carolina Department of Environmental Quality and the US EPA. Before obtaining an Air Permit, EPA requires a 30-day public comment period followed by a 45-day EPA review. The North Carolina Division of Air Quality publicises the permit and comment period in the local newspaper and online. The public can submit comments via the website. There were no public comments submitted for the Title V Air Permit at the Davidson County Landfill.

For the most recent Air Permit renewal, the public comment period began on March 6th, 2020 and ended on April 5th, 2020.

2.3 Environmental Impact

Not applicable.

2.4 Public Comments

The project did not receive any public comments.

2.5 AFOLU-Specific Safeguards

Not applicable

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Climate Action Reserve Landfill Project Protocol, Version 6.0, published June 8, 2022.

3.2 Applicability of Methodology

The project meets the applicability/eligibility conditions of the methodology.

Eligibility Rule	Protocol Requirement	Project Activity
1. Location	U.S. and its tribal lands and territories	Lexington, North Carolina, U.S.
2. Project Start Date	No more than 12 months prior to project submission	The project was listed on June 25 th , 2009. The project start date was May 20 th , 2009.
3. Project Crediting Period	Emissions reduction may only be reported during the crediting period; the crediting period may be renewed one time	The original 10-year crediting period began on May 20 th , 2009 and ended on May 19 th , 2019. The total crediting period extends to May 19 th , 2029. The project will not seek emissions reductions beyond the total eligible crediting period of 20 years.

4. Additionality	• Meet performance standard • Avoid limits on credit stacking • Exceed legal requirements	• The project meets the performance standard by installing a landfill gas collection system and qualifying destruction device where landfill gas has not been collected before. • There are no other credits this project is seeking. The project will also not transition to reporting under any of the fuel standards and will instead receive CRTs in the current and future reporting periods. Therefore, the Project is not subject to submitting a Zero-Credit Reporting Period Acknowledgement and Election form. • The Project is not subject to NSPS because the NMOC emission level is below 34 Mg/year.
5. Regulatory Compliance	Project is in compliance with all applicable laws	The Project operates under all necessary permits from USEPA and North Carolina Department of Environmental Quality. The Davidson Landfill has no violations posted on USEPA ECHO database for project period.

Table 4. Project Eligibility Conditions

Davidson Gas Producers, LLC Landfill Gas to Energy Project System Diagram

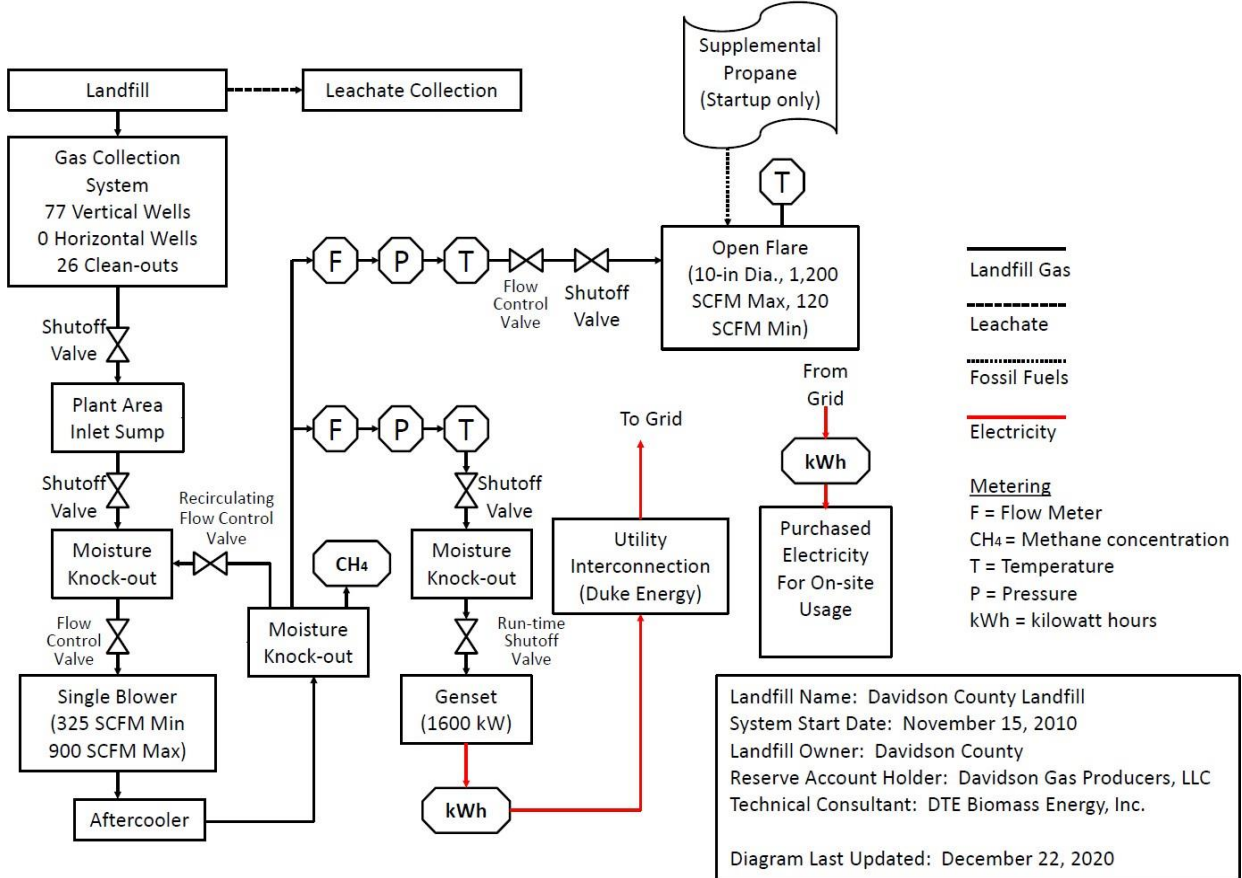


Figure 1. Project Diagram of Davidson Landfill and Gas Destruction Units

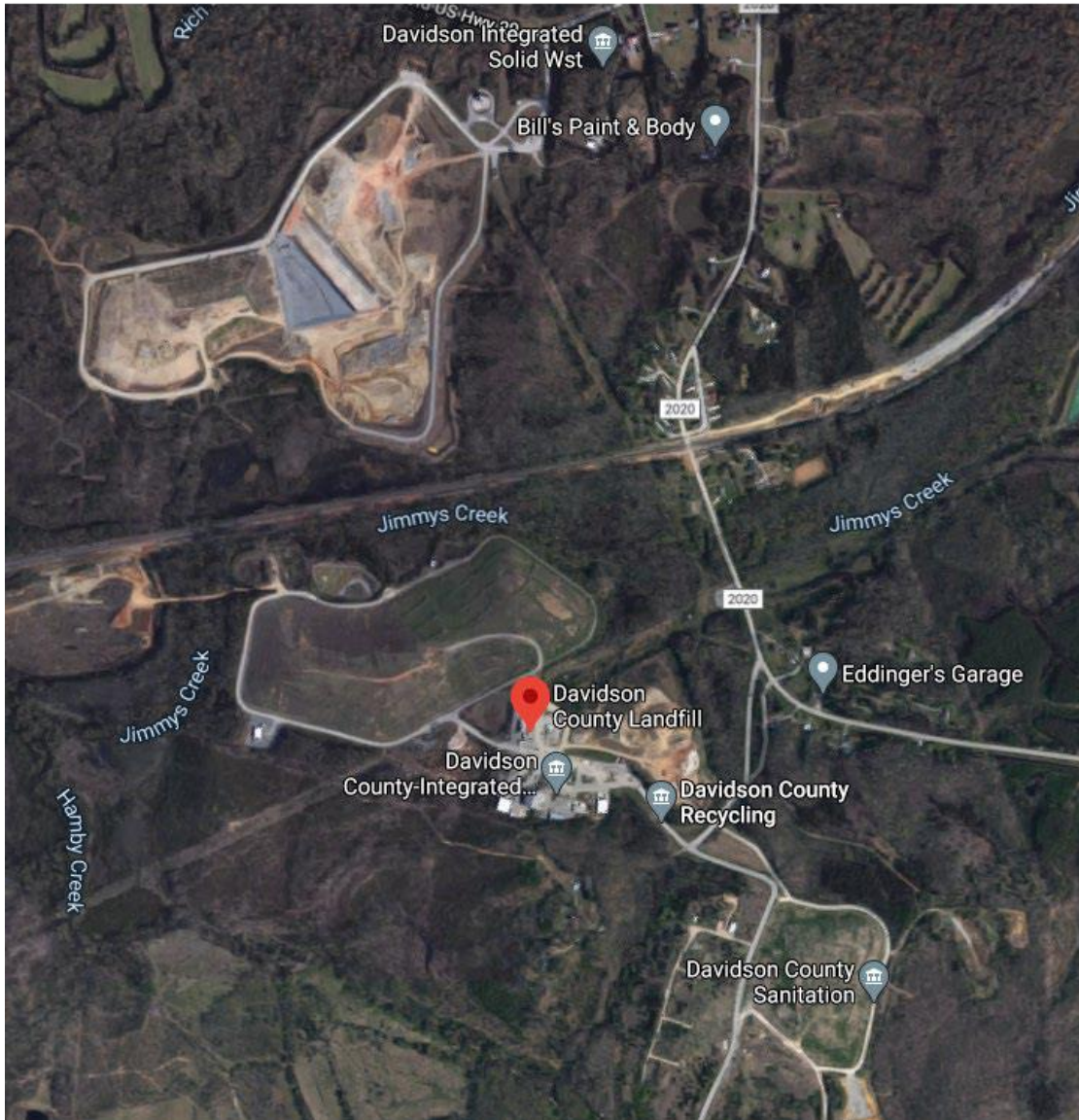


Figure 2. Aerial view of Davidson Landfill Project

3.3 Project Boundary

Not applicable

3.4 Baseline Scenario

Per the Protocol, the baseline scenario assumes that all uncontrolled methane emissions are released to the atmosphere except for the portion of methane that would be oxidized by bacteria in the soil of uncovered landfills absent the project, or destroyed by a baseline destruction device. Since the Project had no previous destruction of landfill gas prior to project start date, baseline emissions are equal to the sum of all methane destroyed by eligible

destruction devices less the amount of methane that would have been oxidized by soil bacteria in the absence of the project – assumed to be 10% outlined in the protocol as the oxidation factor according to the IPCC guidelines.

This ensures that the reductions resulting from the GHG project are only from the landfill gas destroyed beyond what would have been destroyed in the baseline scenario.

3.5 Additionality

The protocol requires projects to satisfy a performance standard test and a legal requirement test to prove additionality.

- The Performance Standard Test
 - Installation of a new qualifying destruction device at an eligible landfill where landfill gas was collected and vented but has never been destroyed in any manner prior to the project start date.
 - The project meets this above performance standard scenario and therefore passes the performance standard test.
 - The landfill's wellfield has expanded since project initiation, which qualifies as a project expansion rather than a new project.
- The Legal Requirement Test
 - All projects are subject to a legal requirement test to ensure that the GHG reductions achieved by a project would not otherwise have occurred due to federal, state, or local regulations, or other legally binding mandates. Projects pass the legal requirement test when there are no laws, statutes, regulations, court orders, environmental mitigation agreements, permitting conditions, or other legally binding mandates requiring the destruction of landfill gas methane at the project site.
 - Because the site has over 2.5 million cubic meters of waste, it is subject to Federal New Source Performance Standards (NSPS) for MSW landfills. Before 2019, the Davidson Landfill was subject to NSPS 40 CFR 60 subpart WWW, which stipulates the landfill must install a GCCS if the NMOC annual emissions exceeds 50 Mg/year. The facility expanded in 2018 causing NSPS 40 CFR 60 subpart to change to XXX. Starting in 2019, the site must install a GCCS if the NMOC annual emissions exceed 34 Mg/year. At no point in the project crediting period is the facility expected to exceed the NMOC emission rate to require the installation of a GCCS. The NMOC emissions for 2015-2021 are estimated below from Tier 2 reports.

Year	NMOC Emissions (Mg/year)
2015	18.14
2016	24.02
2017	29.61
2018	34.92
2019	15.83
2020	16.43
2021	17.00

Table 5. NMOC Emissions by year

3.6 Methodology Deviations

The Project deviates from the methodology in determining the flowrate to the engines.

Per section 6.1 of the Protocol:

If there are any periods when not all destruction devices measured under a single flow meter are operational, methane destruction during these periods will be eligible provided that the verifier can confirm all of the following conditions are met:

1. The destruction efficiency of the least efficient destruction device in operation shall be used as the destruction efficiency for all destruction devices monitored by this meter; and
2. All devices are either equipped with valves on the input gas line that close automatically if the device becomes non-operational (requiring no manual intervention), or designed in such a manner that it is physically impossible for gas to pass through while the device is non-operational; and
3. For any period where one or more destruction devices within this arrangement is not operational, it must be documented that the remaining operational devices have the capacity to destroy the maximum gas flow recorded during the period. For devices other than flares, it must be shown that the output corresponds to the flow of gas.

For the reporting period 2015-2019, flowrate to the engine and flare has been saved as total flow, representing the sum of the measured flowrate to the engines and flare. For this reporting period, there is no historical thermocouple data, and the project will seek emissions reductions from the engine only. The flare is equipped with a safety shut off valve, but for the reporting period it was operated manually. The engine is equipped with an automatic safety shut off valve that is triggered by a power loss or failure. Since only one of the destruction devices is equipped with an automatic safety shut off valve, the Project deviates from the protocol.

To account for this protocol deviation, the project assumes the flare was operating when the kWh output drops below 100kWh. Since the flare only runs as a backup to the engine when the engine is not operational, flowrate corresponding to less than 100kWh operational data is voided, which is a conservative methodology for determining flowrate to the engine. DGP personnel manually open the flare valve when the engine is not operational for a shut-down or maintenance.

3.6.1 Project Description Deviation

In addition, a project description deviation has been applied for the purpose of switching to a new version of the existing methodology. With the new CAR U.S. Landfill Protocol V6.0 being published, the project has updated to apply this version as opposed to the V5.0 listed in the initial project description to remain up to date.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are calculated using Equations 5.3 and 5.4 of the protocol.

Note, the following information aligns with the updated protocol V6.0 per the PD deviation.

Equation 5.3. Calculating Baseline Emissions

$BE = CH_4Dest_{PR} \times GWP \times (1 - OX) \times (1 - DF) - Dest_{base} \times (1 - OX)$		
Where,		
BE	= Baseline emissions during the reporting period	Units tCO ₂ e
CH ₄ Dest _{PR}	= Total methane destroyed by the project landfill gas collection and destruction system during the reporting period (see Equation 5.4)	tCH ₄
GWP	= Global warming potential factor of methane to carbon dioxide equivalent, equal to 25 at the time of publication ²³	tCO ₂ e/tCH ₄
OX	= Factor for the oxidation of methane by soil bacteria. Equal to 0.10 for all landfills except those that incorporate a synthetic liner throughout the entire area of the final cover system, where OX = 0	
DF	= Discount factor to account for uncertainties associated with the monitoring equipment. (See Section 6.1.) Equal to zero if using continuous methane monitoring	
Dest _{base}	= Adjustment to account for baseline LFG destruction device (see Equation 5.5). Equal to zero if no baseline LFG destruction system is in place prior to project implementation	tCO ₂ e

Equation 5.4. Total Methane Emissions Destroyed

$$CH_4Dest_{PR} = \sum_i (CH_4Dest_i) \times (0.0423 \times 0.000454)$$

Where,

	Units
CH_4Dest_{PR} = Total methane destroyed by the project landfill gas collection and destruction system during the reporting period	tCH ₄
CH_4Dest_i = The net quantity of methane destroyed by destruction device i during the reporting period	scf CH ₄
0.0423 = Density of methane	lb CH ₄ /scf CH ₄
0.000454 = Conversion factor from pounds to metric tonnes	tCH ₄ /lb CH ₄

And,

$$CH_4Dest_i = Q_i \times DE_i$$

Where,

	Units
CH_4Dest_i = The net quantity of methane destroyed by device i during the reporting period	scf
Q_i = Total quantity of landfill methane sent to destruction device i during the reporting period	scf
DE_i = Methane destruction efficiency for device i . See Appendix B for guidance	

And,

$$Q_i = \sum_t (LFG_{i,t} \times PR_{CH_4,t})$$

Where,

	Units
Q_i = Total quantity of landfill methane sent to destruction device i during the reporting period	scf
$LFG_{i,t}$ = Adjusted volume of landfill gas fed to the destruction device i , in time interval t	scf
t = Time interval for which LFG flow and concentration measurements are aggregated. See Table 6.1 for guidance	
$PR_{CH_4,t}$ = The average methane fraction of the landfill gas in time interval t	scf CH ₄ / scf LFG

4.2 Project Emissions

Project emissions are calculated using Equations 5.9, 5.10 and 5.11 in the protocol.

Note, the following information aligns with the updated protocol V6.0 per the PD deviation.

Equation 5.9. Calculating Project Emissions

$$PE = FF_{CO_2} + EL_{CO_2} + NG_{emissions}$$

Where,

		Units
PE	= Project emissions during the reporting period	tCO ₂ e
FF _{CO₂}	= Total carbon dioxide emissions from the destruction of fossil fuel during the reporting period	tCO ₂
EL _{CO₂}	= Total carbon dioxide emissions from the consumption of electricity from the grid during the reporting period	tCO ₂
NG _{emissions}	= Total quantity of emissions from supplemental natural gas, including both uncombusted methane and carbon dioxide emissions during the reporting period	tCO ₂ e

Equation 5.10. Calculating Project Emissions from Fossil Fuel Use

$$FF_{CO_2} = \frac{\sum_j (FF_{PR,j} \times EF_{FF,j})}{1000}$$

Where,

		Units
FF _{CO₂}	= Total carbon dioxide emissions from the destruction of fossil fuel during the reporting period	tCO ₂
FF _{PR,j}	= Total fossil fuel consumed by the project landfill gas collection and destruction system during the reporting period, by fuel type <i>j</i>	volume fossil fuel
EF _{FF,j}	= Fuel specific emission factor. See Appendix B	kg CO ₂ /volume fossil fuel
1000	= Conversion factor	kg CO ₂ /tCO ₂

Equation 5.11. Calculating Project Emissions from Electricity Use

$$EL_{CO_2} = \frac{(EL_{PR} \times EF_{EL})}{2204.62}$$

Where,

		Units
EL _{CO₂}	= Total carbon dioxide emissions from the consumption of electricity from the grid during the reporting period	tCO ₂
EL _{PR}	= Total electricity consumed by the project landfill gas collection and destruction system during the reporting period	MWh
EF _{EL}	= CO ₂ emission factor for electricity used ²⁶	lb CO ₂ / MWh
2204.62	= Conversion factor	lb CO ₂ / tCO ₂

4.3 Leakage

Not applicable

4.4 Estimated GHG Emission Reductions and Removals

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated reduction VCU (tCO ₂ e)	Estimated removal VCU (tCO ₂ e)	Estimated total VCUs (tCO ₂ e)

01-Jan-2022 to 31-Dec-2022	50,100	100	0	50,000	0	50,000
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5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	Destruction Efficiency of flare and engines
Data unit	%
Description	Destruction efficiency of the qualifying destruction device
Source of data	Default value outlined in protocol
Value applied	Open flare: 96% / Engine generator set: 93.6%
Justification of choice of data or description of measurement methods and procedures applied	Per the Title V Air Permit, the gas is destroyed in an open flare, so the open flare default value has been applied. The gas is also destroyed in the engine generator, so the lean-burn internal combustion engine default value has been applied.
Purpose of Data	Calculation of baseline scenario
Comments	N/A

5.2 Data and Parameters Monitored

Data / Parameter	Flowrate of landfill gas
Data unit	scfm
Description	Flowrate of landfill gas delivered to qualifying destruction device at 60 degrees F and 1 atm
Source of data	Measured continuously by project flowmeter and recorded
Description of measurement methods and procedures to be applied	Flowrate is measured continuously by 2 flowmeters (one for flare and one for engine) and recorded every 15 minutes or less by an Emerson ROCLINK 809
Frequency of monitoring/recording	Continuously recorded at least every 15 minutes

Value applied	Average flowrate is approximately 135 scfm for the flare, and 500 scfm for the engine.
Monitoring equipment	Engine Flowmeter – Fisher RSP1C – SN: 4691177 Flare Flowmeter - Fisher RSP1C – SN: 4691608
QA/QC procedures to be applied	All flowmeters are calibrated annually by a third party per manufacturer’s guidance. As found, as left and percent drift are measured and recorded.
Purpose of data	Calculation of baseline emissions
Calculation Method	Continuously recorded by flowmeter
Comments	N/A

Data / Parameter	Methane Concentration
Data unit	Scf CH4 / scf LFG (%)
Description	Methane fraction of landfill gas destroyed
Source of data	Continuous gas analyzer
Description of measurement methods and procedures to be applied	Methane concentration is measured continuously using a gas analyzer and recorded every 15 minutes or less by an Emerson ROCLINK 809.
Frequency of monitoring/recording	Continuously recorded at least every 15 minutes
Value applied	Average methane concentration is approximately 50% for the flare, and the engine.
Monitoring equipment	Gas analyzer - Siemens Ultramat 23 - SN:N1-AG-902
QA/QC procedures to be applied	Gas analyzer is calibrated annually by a third party per manufacturer’s guidance. As found, as left and percent drift are measured and recorded.
Purpose of data	Calculation of baseline emissions
Calculation Method	Continuously recorded by gas analyzer
Comments	N/A

Data / Parameter	Thermocouple Temperature
Data unit	Degrees F
Description	Temperature of flare during destruction of methane gas
Source of data	Thermocouple
Description of measurement methods and procedures to be applied	Temperature of the flare is measured continuously using the flare thermocouple and recorded every 15 minutes or less by an Emerson ROCLINK 809.
Frequency of monitoring/recording	Continuously recorded at least every 15 minutes
Value applied	Thermocouple temperature consistently above 500 degrees F
Monitoring equipment	Flare thermocouple
QA/QC procedures to be applied	Thermocouple is monitored and cleaned as necessary.
Purpose of data	Prove operability of the flare
Operational activity	As noted above, the thermocouple temperature confirms the operability of the flare. In addition, the site includes all necessary operable safety shut off valves and procedures in place.
Calculation Method	Continuously recorded by thermocouple
Comments	N/A

Data / Parameter	Power Generation
Data unit	kWh
Description	Power generation from engine generator set
Source of data	Power purchase reports from Duke Energy
Description of measurement methods and procedures to be applied	Methane is destroyed in generator engine located at the Davidson Landfill, and the power is purchased by Duke Energy. Duke records the kWh purchased and provides DTE with report of kWh every 15 minutes.
Frequency of monitoring/recording	kWh recorded every 15 minutes

Value applied	Average kWh output is approximately at 1500 kWh
Monitoring equipment	Power generation is measured from meters at Duke Energy and is also measured with the Emerson ROCLINK 809
QA/QC procedures to be applied	Equipment is subject to Duke's standard operating procedures
Purpose of data	Prove operationality of the engines
Operational activity	As noted above, the recorded power data being generated by the engine indicates the generator set is in fact operational.
Calculation Method	Duke continuously records and reports kWh data
Comments	N/A

Data / Parameter	Fossil Fuel Usage
Data unit	Pounds of propane, gallons of gasoline, and gallons of diesel
Description	Fossil fuel used for project activity
Source of data	Operating records recorded by the operations team
Description of measurement methods and procedures to be applied	DTE maintains records of fossil fuel used for project activity where the usage volumes are logged by the operator
Frequency of monitoring/recording	Summarized once per reporting period but noted throughout the reporting period as equipment is filled
Value applied	Propane = 40 pounds/year Gasoline = 20 gallons/year Diesel = 15 gallons/year
Monitoring equipment	Operator recordings of volumes filled into the equipment
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	Recorded by DTE in their operating records
Comments	N/A

Data / Parameter	All relevant permits and regulatory documents
Data unit	N/A
Description	Tier 2 Reports, Title V permits, operating permits
Source of data	Landfill staff and regulatory agencies
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Annually
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	Review by Anew Environmental
Purpose of data	Demonstrate regulatory compliance
Calculation Method	N/A
Comments	N/A

Data / Parameter	GWP
Data unit	tCO ₂ /tCH ₄
Description	Global Warming Potential for Methane
Source of data	IPCC Fifth Assessment Reports
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	28
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A

Purpose of data	Calculation of baseline emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	OX
Data unit	unitless
Description	Factor for the oxidation of methane by soil bacteria
Source of data	Default value in Landfill Protocol V6.0
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	0.1
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	EF _{FF}
Data unit	kgCO ₂ /gal propane
Description	Emission factor for propane
Source of data	Default value in Landfill Protocol V6.0
Description of measurement methods and procedures to be applied	N/A

Frequency of monitoring/recording	N/A
Value applied	5.72
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	EF _{FF}
Data unit	kgCO ₂ /gal gasoline
Description	Emission factor for gasoline
Source of data	Default value in Landfill Protocol V6.0
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	8.778
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	EF _{FF}
Data unit	kgCO ₂ /gal diesel

Description	Emission factor for diesel
Source of data	Default value in Landfill Protocol V6.0
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	10.206
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	EF _{EL}
Data unit	lbsCO ₂ /MWH
Description	CO ₂ emission factor for electricity used
Source of data	eGRID 2021 database – SRVC region
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	639.67
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

Calculation Method	N/A
Comments	N/A

Data / Parameter	ER
Data unit	tCO2e
Description	Total Emissions Reductions
Source of data	Calculated
Description of measurement methods and procedures to be applied	Calculated using equation 5.1 in protocol
Frequency of monitoring/recording	N/A
Value applied	50,000
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of emissions reductions
Calculation Method	Total baseline emissions less project emissions
Comments	N/A

Data / Parameter	BE
Data unit	tCO2e
Description	Baseline Emissions
Source of data	Calculated
Description of measurement methods and procedures to be applied	Calculated using equation 5.3 in protocol (In the quantification spreadsheet, this is the summation of cells G11 in both flare and engine)
Frequency of	N/A

monitoring/recording	
Value applied	50,100
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation Method	Total emissions associated with what would have occurred in the baseline scenario where the gas is not routed to the project's destruction devices using equation 5.3 in the protocol V6.0
Comments	N/A

Data / Parameter	PE
Data unit	tCO2e
Description	Project Emissions
Source of data	Calculated
Description of measurement methods and procedures to be applied	Calculated using equation 5.9 in protocol
Frequency of monitoring/recording	N/A
Value applied	100
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	Total emissions associated with the project condition using equation 5.9 in the protocol V6.0
Comments	N/A

Data / Parameter	LFG _{adjusted}
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Data unit	scf
Description	Adjusted volume of LFG fed to the flare and engine
Source of data	Calculated from continuous flowrate (scfm)
Description of measurement methods and procedures to be applied	Calculated using equation 5.2 in protocol
Frequency of monitoring/recording	N/A
Value applied	15,500,000 to flare 250,000,000 to engine
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation Method	Adjusted volume of LFG sent to flare and engine using equation 5.2 of the protocol V6.0
Comments	N/A

Data / Parameter	CH ₄ Dest _{PR}
Data unit	tCH ₄
Description	Total methane destroyed by the project LFG gas collection and destruction system during the reporting period
Source of data	Calculated
Description of measurement methods and procedures to be applied	Calculated using equation 5.4 in protocol
Frequency of monitoring/recording	N/A
Value applied	2,400
Monitoring equipment	N/A
QA/QC procedures to be	N/A

applied	
Purpose of data	Calculation of baseline emissions
Calculation Method	The amount of methane is quantified from the LFG gas collection and destruction system using equation 5.4 of the protocol V6.0
Comments	N/A

Data / Parameter	Q
Data unit	Scf CH ₄
Description	Total quantity of landfill methane sent to destruction device during the reporting period
Source of data	Calculated
Description of measurement methods and procedures to be applied	Calculated using equation 5.4 in protocol
Frequency of monitoring/recording	N/A
Value applied	135,000,000
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation Method	Using data of the amount of LFG sent to each destruction device and using equation 5.4 of the protocol V6.0
Comments	N/A

Data / Parameter	FF _{CO2}
Data unit	tCO ₂
Description	Total carbon dioxide emissions from the combustion of fossil fuels during the reporting period
Source of data	Calculated

Description of measurement methods and procedures to be applied	Calculated using equation 5.10 in protocol
Frequency of monitoring/recording	N/A
Value applied	0.50
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	Taking the amount of fossil fuel usage recorded and using equation 5.10 of the protocol V6.0
Comments	N/A

Data / Parameter	EL _{CO2}
Data unit	tCO2
Description	Total carbon dioxide emissions from the consumption of electricity from the grid during the reporting period
Source of data	Calculated from elec consumption records
Description of measurement methods and procedures to be applied	Calculated using equation 5.11 in protocol
Frequency of monitoring/recording	N/A
Value applied	115
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	Using the electricity consumption records and using the equation 5.11 of the protocol V6.0

Comments	N/A
Data / Parameter	EL _{PR}
Data unit	MWh
Description	Total electricity consumed by the project landfill gas collection and destruction system during the reporting period
Source of data	Monthly electricity bills
Description of measurement methods and procedures to be applied	Summed from utility bills provided by landfill operator
Frequency of monitoring/recording	Monthly
Value applied	400
Monitoring equipment	Electricity meter
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation Method	The sum of the monthly utility bills
Comments	N/A

5.3 Monitoring Plan

5.3.1 Monitoring & Reporting

Project data is recorded continuously by two flowmeters (one for flow to engine generator set, one for flow to flare) and a continuous gas analyzer. The operability of the flare and engine are monitored continuously by a thermocouple reading and kWh reading respectively. The engine and flare flow data are measured and recorded by a SCADA system that includes a PLC. The data is then automatically transferred to an Emerson ROCLINK 809 (ROC) along with the power generation data. The flow and other data is saved on a server running Rockwell Software FactoryTalk Historian. After five years, the Historian data storage used will be evaluated. If storage space is a concern, older data files will be moved to file storage servers in DTE data center.

In 2021 until project conclusion, the data will be downloaded monthly and shared with Anew. In 2021 until project conclusion, the Project will seek emissions reductions from the flare and the engines.

Flowmeter data is recorded every 15 minutes, Methane concentration is recorded every 15 minutes, kWh data is provided by Duke Energy or the ROC every 15 minutes, and thermocouple data is recorded every 15 minutes.

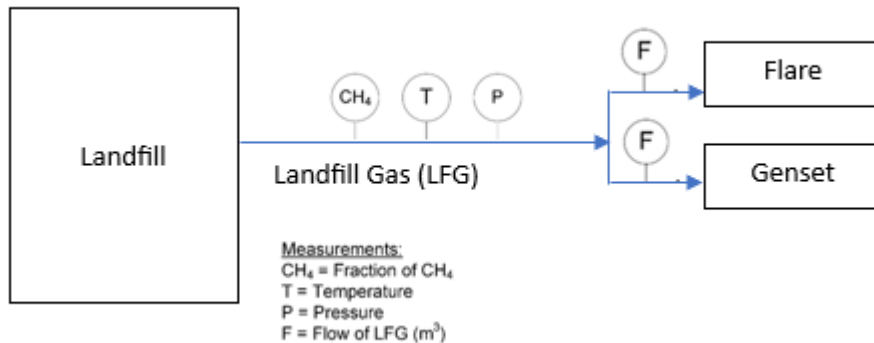


Figure 3: Arrangement of LFG Metering Equipment

5.3.2 Calibration Reporting

Calibration records are provided, as available, for all project equipment requiring calibration checks – this includes the flare flow meter, engine flow meter, as well as the continuous methane analyzer. All project equipment is calibrated annually as there are no calibration or cleaning/inspection requirements specified by the manufacturer. Note, although there are no manufacturer's recommendations for the cleaning and inspection of this project equipment, it should be noted that the cleaning and inspection occurs on a regular basis as it is part of the operational duties at the site. The calibrations are also performed and checked for accuracy by a third party with the as found, as left conditions and percent drift recorded. The end of reporting period field check/third party calibration was conducted for all instruments and the related reports will be provided to the verifier.

5.3.3 Landfill Regulations

DTE personnel monitor all applicable regulations and permit requirements for the landfill on an on-going basis. These actions help to ensure ongoing project eligibility. If any potential issue arises around legal requirements or project eligibility for the landfill, Anew is notified, and the issue is discussed. Regulations that are monitored include:

- NSPS Regulations
 - Requirements around Tier II reporting are checked by DTE to ensure that the report is up to date and that a new report is not required. DTE and EM also check the predicted NMOC levels in the Tier II report to determine if the landfill is expected to exceed the 34 MG/year threshold.

5.3.4 Project Roles

DTE manages operations, maintenance, data collection, and compliance of the destruction facility. DTE is responsible for relevant cleaning and inspection of project equipment and calibrating project equipment per Protocol requirements. DTE is responsible for compiling data and sharing with Anew to facilitate emissions reduction calculation.

Davidson County is responsible for operating and maintenance of the landfill and wellfield and obtaining all relevant permits for the landfill.

Anew is responsible for quantifying emissions reductions, hiring a verification body, sharing data/documentation with the verifier, and submitting the project on VCS.

Anew has been hired by DTE to manage verification and provide guidance and expertise regarding monitoring requirements based on the Protocol. Anew and DTE are in constant communication regarding project compliance and monitoring requirements. Any disruption in monitoring activities will be immediately reported to Anew and remedied as soon as possible.

DTE has internal checks and QA/QC procedures for project data. The IT team constantly monitors and validates data.

5.3.5 Record Keeping

In accordance with the Protocol, DTE and Anew will keep all required information for a period of 10 years after the information is generated or 7 years after the last verification. The following system information will be retained for the given period:

- All data inputs for the calculation of the project emission reductions
- Copies of all solid waste, air, water, and land use permits, Notices of Violations (NOVs), and any administrative or legal consent orders dating back at least 3 years prior to the project start date, and for each subsequent year of project operation
- Project developer attestation of compliance with regulatory requirements relating to the landfill gas project
- Project developer attestation of voluntary implementation of the project
- Collection and control device information (installation dates, equipment list, etc.)
- LFG flow meter information (model number, serial number, manufacturer's calibration procedures)
- Methane monitor information (model number, serial number, calibration procedures)
- Destruction device monitor information (model number, serial number, calibration procedures)
- LFG flow data (for each flow meter)
- LFG flow meter calibration data (for each flow meter)
- Methane monitoring data
- Methane analyzer calibration data
- Destruction device monitoring data (for each destruction device)
- Destruction device calibration data (for each destruction device),
- CO₂e monthly and annual tonnage calculations
- Copies of the results of the NSPS/EG Tier 1 and/or Tier 2 NMOC emission rate estimates and the projected date when system start-up will be required by NSPS
- Initial and annual verification records and results
- All maintenance records relevant to the LFG control system, monitoring equipment, and destruction devices
- Operational records of the landfill relating to the amount of waste placed onsite (scalehouse records, etc.), or most recent documented WIP report accepted by a regulatory agency
- Calibrated portable gas analyzer information that the project developer should retain includes:
 - Date, time, and location of methane measurement
 - Methane content of LFG (% by volume) for each measurement
 - Methane measurement instrument type and serial number
 - Date, time, and results of instrument calibration
 - Corrective measures taken if instrument does not meet performance specifications

5.3.6 Data QA/QC

5.3.6.1 Data Acquisition

The Davidson LFG project is monitored at least monthly as data (flow, generator, methane %) is acquired from DTE, with the data being reviewed for accuracy, completion and periods of unusual flow, generator output and/or methane concentration. Data is also compared to previous data for quality assurance purposes. This review helps to ensure that the appropriate data has been sent, any gaps in data are understood, no erroneous information is utilized, and that all systems are running as expected.

5.3.6.2 Flow Meter Calibration QA/QC

The Protocol requires that all gas flow meters be cleaned and inspected on a regular basis and field checked for calibration accuracy by a third-party technician at the end of – but no more than two months prior to or after – the end date of the reporting period. In addition, flow meters must be calibrated by the manufacturer per manufacturer guidelines. If a stationary meter that was in use for 60 days or more is removed and not reinstalled during a reporting period, that meter shall either be field-checked for calibration accuracy prior to removal or sent in for calibration after it was removed.

This project follows a calendar reporting period and the flow meter has been and will continue to be calibrated with percent drift documented annually within 2 months prior to or after the end of the reporting period.

5.3.6.3 Methane Analyzer Calibration QA/QC

The Protocol requires that all gas analyzers be cleaned and inspected on a regular basis and field checked for calibration accuracy by a third-party technician at the end of – but no more than two months prior to or after – the end date of the reporting period.

This project follows a calendar reporting period and the analyzer has been and will continue to be calibrated with percent drift documented annually within 2 months prior to or after the end of the reporting period.

5.3.7 Davidson Quantification QA/QC

The initial emission reduction calculations are completed by the Project Manager for the Davidson LFG project. EM has internal procedures in place to check the accuracy of the calculations with additional EM staff reviewing all aspects of the calculations including reviewing raw data from EM's internal database, methane readings, excel formulas/functions and electricity/fossil fuel use. After review by EM staff, any errors or changes are noted, and the calculations are then reviewed again for the final time by the Project Manager.

5.3.8 Data Substitution Guidelines

Version 6.0 of the Protocol references data substitution guidelines that are permissible for methane concentration and flow metering parameters but not for destruction monitoring devices. Substitution may only occur when two monitored parameters corroborate proper functioning of the destruction device and system operation within normal ranges. The substitution methodology is as follows:

Duration of Missing Data	Substitution Methodology
Less than six hours	Use the average of the four hours immediately before and following the outage
Six to 24 hours	Use the 90% lower or upper confidence limit of the 24 hours prior to and after the outage, whichever results in greater conservativeness
One to seven days	Use the 95% lower or upper confidence limit of the 72 hours prior to and after the outage, whichever results in greater conservativeness
Greater than one week*	No data may be substituted, and no credits may be generated

Table 6: Data Substitution Methodology

*For weekly measured methane concentration, the lower of the measurement before and the measurement after must be used and only one week missing weekly measurement can substituted.

The lower confidence limit should be used for both methane concentration and flow readings for landfill projects.