



**Verified Carbon
Standard**

DAVIDSON COUNTY LANDFILL

2015-2019 MONITORING PLAN

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status 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.

From 01-01-2015 to 31-12-2019, the project has generated 241,002 emissions reductions.

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 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

1.4 Other Entities Involved in the Project

Organization name	Davidson County Landfill
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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

1.5 Project Start Date

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

1.6 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. 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.

The crediting period was renewed during the gap validation, where the baseline scenario and additionality were demonstrated but the Project Proponent and assessed by the Validation Body according to the VCS Standard, V4.1. The Gap Validation Report and validated Project

Description were submitted to Verra on May 14th, 2021, which meets the two-year deadline to renew the crediting period after the initial crediting period has expired.

1.7 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.

1.8 Title and Reference of Methodology

Climate Action Reserve Landfill Project Protocol, Version 5.0, published April 24, 2019.

1.9 Participation under other GHG Programs

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 was transferred to the Verra Registry and will resume credit generation under the VCS program from January 1st, 2015 until the end of the project’s original crediting period May 19th, 2029.

1.10 Other Forms of 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.

1.11 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.

2 SAFEGUARDS

2.1 No Net Harm

3. 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.

3.1 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.

3.2 AFOLU-Specific Safeguards

Not applicable

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

During the reporting period, landfill gas was collected and destroyed at a flare or two engine generator sets. For this reporting period, only emissions reductions from the engines are reported. Flowrate and methane concentration are measured continuously and used to calculate the emissions reductions. Power output readings from the engine is used to prove operability of the destruction device.

There have been no changes to the project entities.

3.2 Deviations

3.2.1 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.

The project deviates from the methodology requirement in section 6.2, "All gas flow meters must be: field checked for calibration accuracy by a third-party technician with the percent drift documented, using either a portable instrument (such as a pitot tube) or manufacturer specified guidance, at the end of – but no more than two months prior to or after – the end date of the reporting period."

For the 2015 reporting period, the flowmeter was calibrated on March 24th, 2015, which does not comply with the end of the reporting period requirement. The meter was calibrated again on November 10th, 2016. The meter passed calibration in both 2015 and 2016, so it can be assumed that the meter was reading within 5% drift for the entire 20-month period between calibrations. No discount will be taken.

3.2.2 Project Description Deviations

Not applicable

3.3 Grouped Projects

Not applicable

4 DATA AND PARAMETERS

4.1 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.
Purpose of Data	Calculation of baseline scenario
Comments	N/A

4.2 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 estimated at 500 scfm

Monitoring equipment	Engine Flowmeter – Fisher RSP1C – SN: 4691178 Flare Flowmeter - Fisher RSP1C – SN: 4691177
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

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 estimated at 50%
Monitoring equipment	Gas analyzer - Siemens Ultramat 23 - SN:F-Nr-TD-0637
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

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	Temperature of the flare is measured continuously using the flare thermocouple and recorded every 15 minutes or less by an Emerson ROCLINK 809.

and procedures to be applied	
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 operationality of the flare
Notes	Flare data will not be used from 2015-2020

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 30 minutes.
Frequency of monitoring/recording	kWh recorded every 30 minutes
Value applied	Average kWh output is estimated at 1500
Monitoring equipment	Power generation is measured from meters at Duke Energy
QA/QC procedures to be applied	Equipment is subject to Duke's standard operating procedures
Purpose of data	Prove operationality of the engines

Data / Parameter	Fossil Fuel Usage
Data unit	Varies – gallons of propane, gallons of gasoline, dekatherms of natural gas purchased
Description	Fossil fuel used for project activity

Source of data	Operating records
Description of measurement methods and procedures to be applied	DTE maintains records of fossil fuel used for project activity
Frequency of monitoring/recording	Once per reporting period
Value applied	2015-2019 propane = 40 lbs/year 2015-2019 gasoline = 60 gallons/year
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

Data / Parameter	Electricity Purchased
Data unit	kWh
Description	Amount of electricity purchased for project activities
Source of data	Monthly electricity bills
Description of measurement methods and procedures to be applied	DTE purchases electricity to operate project activity and provides monthly bills
Frequency of monitoring/recording	Monthly
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

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 Element Markets
Purpose of data	Demonstrate regulatory compliance

Data / Parameter	GWP
Data unit	tCO ₂ /tCH ₄
Description	Global Warming Potential for Methane
Source of data	IPCC Fourth Assessment Reports
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	25
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions

Data / Parameter	OX
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Data unit	unitless
Description	Factor for the oxidation of methane by soil bacteria
Source of data	Default value in Landfill Protocol V5.0
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

Data / Parameter	EF _{FF}
Data unit	kgCO ₂ /gal propane
Description	Emission factor for propane
Source of data	Default value in Landfill Protocol V5.0
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

Data / Parameter	EF _{FF}
Data unit	kgCO ₂ /gal gasoline
Description	Emission factor for propane
Source of data	Default value in Landfill Protocol V5.0
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

Data / Parameter	EF _{EL}
Data unit	lbsCO ₂ /MWH
Description	CO ₂ emission factor for electricity used
Source of data	eGRID 2019 database – SRVC region
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	675.42
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

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	2015-36,159 2016-54,493 2017-43,711 2018-51,590 2019-55,049
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of emissions reductions

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
Frequency of monitoring/recording	N/A
Value applied	2015-36,269 2016-54,611

	2017-43,823 2018-51,699 2019-55,155
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions

Data / Parameter	PE
Data unit	tCO ₂ e
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	2015-110 2016-118 2017-112 2018-109 2019-106
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

Data / Parameter	LFG _{adjusted}
Data unit	scf
Description	Adjusted volume of LFG fed to the flare

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	Yearly Totals 2015-182,224,617 2016-264,212,016 2017-218,062,884 2018-242,914,610 2019-262,364,495
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions

Data / Parameter	CH ₄ Dest _{PR}
Data unit	tCH ₄
Description	Total methane destroyed by the project LFC 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	Yearly Totals 2015-1,612 2016-2,427 2017-1,948 2018-2,297

	2019-2,451
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions

Data / Parameter	CH ₄ Dest _{flare}
Data unit	Scf CH ₄
Description	Net quantity of methane destroyed by the flare 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	Yearly Totals 2015-83,939,470 2016-126,387,764 2017-101,420,869 2018-119,647,473 2019-127,646,914
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions

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	Yearly Totals 2015-89,678,920 2016-135,029,663 2017-108,355,629 2018-127,828,497 2019-136,347,909
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions

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	Yearly Totals 2015-0.58 2016-0.58 2017-0.58 2018-0.58

	2019-0.58
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

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 volume of propane and gasoline
Description of measurement methods and procedures to be applied	Calculated using equation 5.11 in protocol
Frequency of monitoring/recording	N/A
Value applied	Yearly Totals 2015-109.97 2016-117.58 2017-112.05 2018-108.02 2019-106.20
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

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	Yearly Totals 2015-359 2016-384 2017-366 2018-353 2019-347
Monitoring equipment	Electricity meter
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions

4.3 Monitoring Plan

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 is measured and recorded by a SCADA system that includes a PLC. The data is then automatically transferred to an Emerson ROCLINK 809 (ROC). 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.

For 2015, the data has been recovered from the DTE server. From 2016 until 2020, the data has been downloaded from the ROC. From 2015-2020, the Project will seek emissions reductions from the engines only. Starting in 2021 until project conclusion, the data will be downloaded monthly and shared with Element Markets. Starting 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 every 30 minutes, and thermocouple data is recorded every 15 minutes.

All project equipment is calibrated annually. The calibrations are performed by a third party with the as found, as left conditions and percent drift recorded. Annual calibration reports will be provided to the verifier.

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 Element Markets 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.

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

Element Markets has been hired by DTE to manage verification and provide guidance and expertise regarding monitoring requirements based on the Protocol. Element Markets and DTE are in constant communication regarding project compliance and monitoring requirements. Any disruption in monitoring activities will be immediately reported to Element Markets 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 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The 2015-2019 baseline emissions are 241,557 MTCO₂e. Detailed calculations can be found in “Davidson ER Calcs” spreadsheet provided to Verification Body.

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

Equation 5.3. Calculating Baseline Emissions

$$BE = CH_4Dest_{PR} \times GWP \times (1 - OX) \times (1 - DF) - Dest_{base} \times (1 - OX)$$

Where,

		<u>Units</u>
BE	= Baseline emissions during the reporting period	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,

CH_4Dest_{PR} = Total methane destroyed by the project landfill gas collection and destruction system during the reporting period

Units

tCH₄

CH_4Dest_i = The net quantity of methane destroyed by destruction device i during the reporting period

scf CH₄

0.0423 = Density of methane

lb CH₄/scf CH₄

0.000454 = Conversion factor from pounds to metric tonnes

tCH₄/lb CH₄

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 CH₄/ scf LFG

For the project specific measurements, the annual totals are as follows:

Year	Q_{Flare}	CH_4Dest_{Flare}	CH_4Dest_{PR}	BE
2015	89,678,920	83,939,470	1,612	36,269
2016	135,029,663	126,387,764	2,427	54,611
2017	108,355,629	101,420,869	1,948	43,823
2018	127,828,497	119,647,473	2,297	51,699
2019	136,347,909	127,646,914	2,451	55,155

5.2 Project Emissions

The 2015-2019 project emissions are 555 MTCO₂e. Detailed calculations can be found in “Davidson ER Calcs” spreadsheet provided to Verification Body.

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

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

For the project specific measurements, the annual totals are as follows:

Year	FF _{CO2}	EL _{CO2}	PE
2015	0.58	109.97	110
2016	0.58	117.58	118
2017	0.58	112.05	112
2018	0.58	108.02	109
2019	0.58	106.20	106

5.3 Leakage

Not applicable

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2015	36,269	110	0	36,159
2016	54,611	118	0	54,493
2017	43,823	112	0	43,711
2018	51,699	109	0	51,590
2019	55,155	106	0	55,049
Total	241,557	555	0	241,002

APPENDIX A: ER CALCULATIONS

2015 Davidson ER Calcs V1.0.xlsx

2016 Davidson ER Calcs V1.0.xlsx

2017 Davidson ER Calcs V1.0.xlsx

2018 Davidson ER Calcs V1.0.xlsx

2019 Davidson ER Calcs V1.0.xlsx