



**Verified Carbon
Standard**

HENRICO COUNTY LANDFILL GAS COMBUSTION PROJECT



RUBY CANYON ENVIRONMENTAL

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Summary:

The Project consists of a landfill gas (LFG) capture and combustion project located at the Springfield Road Landfill (the “Landfill”). The Landfill was permanently closed in 2016. LFG is destroyed via an open flare or twelve dual-fuel combustion engines with a total capacity of 4 megawatts. There are no regulatory mandates to destroy LFG at the site.

In February of 2020, Blue Source, LLC (Blue Source) contracted with Ruby Canyon Environmental, Inc. (RCE) to perform the validation of the renewal of the crediting and the verification of the first reporting period under the renewed crediting period for the Henrico County Landfill Gas Combustion Project (the “Project”). The new crediting period is 1 January 2019 – 31 December 2028. The verified reporting period is 1 January 2019 – 31 December 2019. RCE performed a site visit to the Landfill and completed a detailed document review of relevant Project information.

The purpose of the validation is to ensure that the original baseline scenario is valid, that the Project complies with the latest version of the CDM Tool to assess the validity of the original baseline, that the project plan and GHG calculation methods are materially correct and meet the most recent CDM methodology tool requirements, that the Project meets the requirements of the Verified Carbon Standard (VCS), and that the planned project could reasonably be expected to achieve the claimed emission reductions. The Purpose of the verification is to ensure that the GHG assertion is materially correct, that the data provided to RCE can be documented and if errors or omissions are detected, they be corrected by Bluesource.

The scope of the validation includes the assessment of the updated Project Description (PD). The Scope of the verification includes emission reductions from methane destruction for LFG that would have been released in the baseline scenario.

The Project was assessed against the requirements of the Clean Development Mechanism (CDM) methodology ACM0001 (version 19.0) and associated CDM Tools, the VCS Standard (Version 4.0), and the updated Project Description dated 28 August 2020. As part of the validation and verification activities, RCE reviewed the completeness, conservativeness, and accuracy of the underlying evidence for the Project’s assumptions and data sources used.

During the verification/validation process, RCE issued a total of 81 findings which include:

- 33 Corrective Action Requests
- 1 Non-material Finding
- 22 Additional Document Requests
- 24 Clarification Requests
- 1 Forward Action Request

Based on documentation and explanations provided by the Project Proponent, RCE closed out all findings in a clear and transparent manner. RCE is reasonably assured that the Project meets all relevant VCS requirements and correctly applies the CDM Methodology and Tools. All uncertainties

associated with inherent data collection and analysis are properly managed through data controls and quality assurance checks.

RCE states, to a reasonable level of assurance that the Project as described in the Project Description dated 28 August 2020 and the monitoring report dated 28 August 2020 meets all relevant VCS requirements and correctly applies the baseline and monitoring methodology ACM0001 (version 19.0) with noted deviations.

RCE confirms, to a reasonable level of assurance, that the Project's GHG assertion of 56,152 metric tonnes of CO₂ equivalent emissions for the period of January 1, 2019 – December 31, 2019 is fairly stated.

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1 INTRODUCTION

1.1 Objective

The purpose of the validation is to ensure that the original baseline scenario is valid, that the Project complies with the latest version of the CDM Tool to assess the validity of the original baseline, that the project plan and GHG calculation methods are materially correct and meet the most recent CDM methodology tool requirements, that the Project meets the requirements of the VCS program, and that the planned project could reasonably be expected to achieve the claimed emission reductions.

The Purpose of the verification is to ensure that the GHG assertion is materially correct, that the data provided to RCE can be documented and if errors or omissions are detected, they be corrected by Bluesource.

1.2 Scope and Criteria

This is the re-validation of the Project's second crediting period. The first crediting period was from 1 January 2009 to 31 December 2018. The second crediting period is from 1 January 2019 to 31 December 2028. The validation scope is defined as an independent and objective review of the LFG capture and destruction project at the Landfill including the review of the Project Description (PD) v4.1, dated 28 August 2020. The PD was reviewed against the following criteria:

- VCS standard version 4.0, 19 September 2019,
- Approved CDM methodology ACM0001 Large-scale Consolidated Methodology: Flaring or use of landfill gas (version 19.0) and all associated CDM tools, and
- ISO 14064-3:2006 "Greenhouse gases – Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions"

This is the verification of the Project's first reporting period from 1 January 2019 to 31 December 2019 for the second crediting period. The verification scope includes the organizational boundaries of LFG collection and destruction system and associated processes. The GHG emission sources included are reductions associated with combustion of LFG that would have been vented to the atmosphere in the baseline scenario and Project emissions from fossil fuel use, purchased electricity, and methane from flaring of LFG. CO₂ and CH₄ are the only GHGs included in the scope of the project.

RCE conducted the verification based upon the following criteria:

- Verified Carbon Standard version 4.0, 19 September 2019,
- Approved CDM methodology ACM0001 Large-scale Consolidated Methodology: Flaring or use of landfill gas (version 19.0) and all associated CDM tools,

- Validated VCS PD, 28 August 2020,
- VCS monitoring report, 28 August 2020, and
- ISO 14064-3:2006 “Greenhouse gases – Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions”

1.3 Level of Assurance

RCE conducted the validation and verification activities to a reasonable level of assurance.

1.4 Summary Description of the Project

This Project is an LFG capture and destruction project located near Richmond, VA involving three stages. The first stage was the installation of 14 wells and a small flare at the landfill that first destroyed LFG in March 2002 that represents the baseline situation. The second stage involved the decommissioning of this small flare and subsequent installation of the current Project flare including an expansion of the well field that added 87 collection wells across three areas of the Landfill. The third stage of the Project involved Ingenco Distributed Energy (“Ingenco”) installing a 4-megawatt power generation facility at the site. Henrico added eighteen additional wells across the landfill as part of this stage. Finally, Henrico added five additional wells in 2016.

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

RCE used a risk-based assessment approach for the validation and verification process to develop the validation and verification sampling plan as part of the validation and verification activities.

The validation process and sampling plan involved the following independent and objective activities:

- Select a validation team;
- Perform a Conflict of Interest Review;
- Conduct a kick-off meeting with Bluesource;
- Review the PD;
- Develop a validation plan and risk-based sampling plan;
- Review the previous crediting period PD, validation report and verification reports;
- Review the validity of the original baseline scenario;
- Conduct a site visit;

- Review the accuracy of the emission reduction projections for the crediting period;
- Review whether project activities are subject to regulatory compliance;
- Confirm project ownership is accurately described in the PD;
- Confirm the application of CDM methodologies;
- Review the monitoring plan;
- Issue CARs, ADRs and CRs.
- Issue a joint validation/verification report and representation; and
- Conduct an exit meeting with Bluesource.

The validation/verification team was selected according to RCE's GHG Verification Policies & Procedures to ensure team members are qualified to perform validation/verification activities pertaining to the Project. The validation/verification team consisted of the following individuals

Lead Validator: Phillip Cunningham

Senior Internal Reviewer: Michael Coté

Prior to validation/verification project activities, RCE performed a Conflict of Interest Assessment to determine whether any potential conflicts exist with the project developer. No issues were discovered that would affect the impartiality or independence of the validation/verification team.

A kick-off conference call was held with Bluesource on 18 February 2020. The purpose of the kick-off conference call was to introduce the Bluesource personnel and the RCE validation/verification team, review the validation/verification objectives, process, and VCS requirements, and to confirm the schedule.

RCE reviewed the PD and developed a validation plan and sampling plan that was used throughout the validation of the Project. A risk-assessment was performed based upon the criteria listed above and evidence provided to RCE by Bluesource that pertained to the current reporting period.

Information in the PD were the primary focus of the validation and sampling plan. RCE reviewed the PD for completeness and accuracy and used the PD to determine other relevant documents to review and personnel to interview. RCE developed a sampling plan checklist based on the requirements of the VCS standard and CDM Tools.

After a preliminary assessment of the Project, RCE performed a site visit to the Project location. The Lead Verifier interviewed key personnel, reviewed GHG sources, sinks and reservoirs (SSRs) and view relevant monitoring and metering equipment. Following its initial review of all Project documents and the site visit, RCE delivered an Issues Log to Bluesource with findings that included CARs, ADRs, and CRs. Bluesource provided responses to all identified issues.

RCE completed the site visit to the Landfill on 4 March 2020.

The verification process and sampling plan involved the following independent and objective activities:

- Select a Verification Team;
- Perform a Conflict of Interest Review;

- Conduct a kick-off meeting with Bluesource;
- Review the validated Project Description;
- Review the current Monitoring Report;
- Develop a verification plan and risk-based sampling plan;
- Conduct a site visit;
- Review the project information control systems and quality control procedures;
- Review the Project's emission reduction calculations;
- Issue CARs, NMs, ADRs, CRs and FARs;
- Conduct independent review
- Issue a joint validation/verification report and representation; and
- Conduct an exit meeting with Blue Source.

RCE developed a verification plan and sampling plan that were used throughout the verification of the Project. A sampling plan was created after reviewing the Project Monitoring Report (MR), validated PD, and the VCS Standard. A risk-assessment was performed based upon the criteria listed above and evidence provided to RCE by Bluesource that pertained to the current reporting period.

The verification plan was used throughout the reporting period as a basis for assessing the completeness, consistency, accuracy and transparency of the Project's GHG emission reductions.

Following the close-out of all open items, RCE completed a joint validation/verification report, and submitted the validation/verification for independent review.

2.2 Document Review

The validation/verification activities relied heavily on document review. RCE reviewed several versions of the PD and MR as well as copies of underlying evidence, data, records, and supporting documents.

RCE performed a risk-based analysis of the Project and document sampling to validate that the Project proponent was in conformance with all criteria requirements. RCE also performed a risk-based analysis of the Project and document sampling to verify that the Project proponent is in conformance with all criteria requirements and that the stated emission reductions are materially correct. These documents are listed in Appendix A.

2.3 Interviews

RCE held numerous discussions with the following personnel throughout the verification process:

- Amy Zell, Manager – Carbon Solutions, Bluesource
- Tooraj Moulai, Director – Engineering and Technical Services, Bluesource
- Isaac Smith, Manager, Carbon Solutions, Bluesource

Topics discussed included:

- Bluesource's process for updating the PD to meet the most recent version of the VCS standard and CDM methodology including associated tools
- Process for determining that the project was still voluntary
- Methods for including relevant SSRs in the Project boundary
- Ownership structure of the Project
- Review of documents provided in support of the PD

RCE interviewed the following personnel during the site visit:

- Sayem Zaman, Design Engineer, Draper Aden Associates
- Derek Berry, Environmental Scientist, Draper Aden Associates
- Wayne Crawley, Plant Manager, Ingenco

Topics discussed during the site visit included:

- Methods for data collection
- Placement of meters
- QA/QC procedures for monitoring equipment
- Operation of the LFG collection system
- Calibration procedures for the handheld methane analyzer

2.4 Site Inspections

RCE conducted a site visit at the Project location in Richmond, VA on 4 March 2020. The objective of the site inspection was to confirm the location of relevant Project flow meters and the methane analyzer (including backup handheld analyzers), confirm that all relevant GHG SSRs were included in the PD and GHG calculations, and confirm that Project personnel were qualified to carry out their respective roles and responsibilities. The site visit activities included a physical inspection of the project operations and a review of the Project's information control systems, data handling, QA/QC activities, and equipment calibration records. RCE interviewed key personnel (see section 2.3) responsible for the day-to-day operation of equipment, data aggregation and compilation, and overall maintenance of the Project.

2.5 Resolution of Findings

Using an Issues Log, RCE requested CARs, NMFs, ADRs, CRs, and FARs during the validation/verification process. Bluesource responded to all requests, which were subsequently closed out.

During the verification/validation process, RCE issued a total of 81 findings which include:

- 33 Corrective Action Requests¹
- 1 Non-material Finding

- 22 Additional Document Requests
- 24 Clarification Requests
- 1 Forward Action Request

The resolution of findings is summarized in the table found in Appendix B and C.

2.5.1 Forward Action Requests

RCE issued one forward action request regarding missing data substitution. There are errors in missing data substitution that result in a non-material difference. Consider updating the calculation spreadsheets to include a check or formula to correctly calculate missing data substitution.

3 VALIDATION FINDINGS

3.1 Project Details

The Project is an individual project under sectoral scope 13 (Waste Handling and Disposal) and Sectoral Scope 1 (Energy).

The Project is a single installation of an activity and is not a grouped project.

The Project proponents include the County of Henrico – Department of Public Utilities, Ingenco Distributed Energy and Bluesource, LLC.

RCE confirmed ownership by reviewing contract between all proponents. The County owns emission reductions from the LFG destroyed in the open flare. The County has transferred the rights to environmental attributes to Ingenco for LFG destroyed in the engines. Both the County and Ingenco have transferred the rights the verified emission reductions to Bluesource.

The Project start date is 3 June 2005 when the project began generation GHG emission reductions. This date coincides with the start-up of the flare after the expansion to the baseline LFG collection system.

This is the second crediting period for the Project starting on 1 January 2019 to 31 December 2028. This project was original registered with a ten-year twice renewable crediting period.

The scale is a Project and the estimated GHG emission reductions are roughly 50,000 tonnes CO_{2e} per year.

The Landfill is located at 10600 Fords Country Lane in Glen Allen Virginia.

Prior to the project start date, the Landfill had voluntarily installed a small LFG collection system in order to divert methane gas detected at subsurface wells. The Virginia Department of Environmental Quality required the Landfill to control subsurface migration of gas but did not

specify that an active LFG collection and destruction system be installed. Bluesource correctly accounted for LFG destroyed in the baseline scenario.

The landfill was permanently closed in 2016. All permits have been revoked and there is no longer disposal of municipal solid waste at the landfill. RCE confirmed that there are no open faces at the landfill during the site inspection.

The Project has not sought or received any form of GHG-related environmental credit other than offsets under VCS. Nor has the Project been registered nor is seeking registration under any other GHG program than VCS. The Project has not been rejected by any GHG program.

The project activity is not an AFOLU project and therefore leakage management is not applicable. There is no commercially sensitive information related to the Project. The Project contributes to the sustainable development of the region by reducing methane venting and flaring, thereby improving regional air quality.

RCE concludes that the Project description included in the PD is accurate, complete, and provides an understanding of the nature of the Project. The Project has been implemented as described in the PD.

3.2 Participation under Other GHG Programs

The Project does not participate under other GHG programs.

3.3 Safeguards

3.3.1 No Net Harm

There are no potential negative environmental or socio-economic impacts as a result of the Project. The landfill is closed and does not hold any permits relevant to the Project activity. The destruction of LFG provides benefits to air quality in the surrounding areas.

3.3.2 Local Stakeholder Consultation

This is the first renewal of the projects three allowed crediting periods. No comments or concerns from local stakeholders have been brought forward during this renewal, or during the original 10-year crediting period. Information regarding the Project is available on Henrico County and Ingenco's web pages.

3.3.3 Environmental Impact

No Environmental Impact Assessment was required by the federal or state authority prior to the implementation of the Project. The destruction of LFG has no adverse internal or external environmental impacts.

3.3.4 Public Comments

No comments or concerns from local stakeholders have been brought forward since the Project initiation.

3.3.5 AFOLU-Specific Safeguards

Not applicable; this is not an AFOLU project.

3.4 Application of Methodology

3.4.1 Title and Reference

Approved CDM methodology ACM0001 Large-scale Consolidated Methodology: Flaring or use of landfill gas (version 19.0) and all associated CDM tools.

3.4.2 Applicability

This is a re-validation of the Project. Bluesource correctly re-assessed whether the baseline scenario is still valid based on the methodological tool for “The assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”. Specifically, the current baseline still complies with all relevant mandatory national and/or sectoral policies which have come into effect since the previous validation. The conditions used to determine the baseline emissions in the previous crediting period are still valid. Namely, there is no requirement at the local, state or federal level to destroy LFG at the Landfill. Bluesource also updated data and parameters that were available at the last validation (including IPCC default factors).

The project meets the applicability criteria specified in section 2.2 3.(b) of ACM0001 as follows:

Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG and/or flare the LFG and/or use the captured LFG for generating electricity. The amount of organic waste recycled was not affected by the project activity.

The methodology is applicable as the most likely baseline scenario was the atmospheric release of LFG not captured by the baseline LFG collection system. There is no evidence that the management of the solid waste disposal site was changed in order to increase methane generation. As of 2016, the landfill no longer accepted municipal solid waste.

The project scenario includes the collection and destruction of LFG (beyond the amount collected and destroyed in the baseline LFG collection system) in order to generate electricity and flaring. The data requirements of the methodology have been fulfilled.

Based on the applicability criteria, RCE confirmed through discussions with site personnel and review of historical data that the Project Activity is applicable under the second scenario under the applicability section of the chosen methodology.

3.4.3 Project Boundary

The physical boundaries of the Project consist of the Landfill and the physical components associated with collecting, transporting and destroying LFG. RCE validated the boundaries at the site inspection by viewing equipment and interviewing site personnel.

The Lead Verifier viewed the open-flare, internal combustion engines, diesel tank for supplying diesel to the engines to supplemental LFG, blowers that consume electricity to physically move the LFG from the well-field to the destruction devices, and propane used for the open flare ignitor. Initially, emissions from diesel consumption were not included in the project boundary. However, Bluesource updated the calculations to include this SSR.

RCE confirmed that all relevant SSRs were selected and included in the Project boundary and are described in the PD.

3.4.4 Baseline Scenario

The baseline scenario for the Project is the release of LFG minus the LFG captured and destroyed in the baseline collection system. In the absence of the Project the most likely scenario would be the release of LFG to the atmosphere beyond what is captured by the baseline collection system. During this renewal of the project crediting period, RCE determined that the original baseline is still valid and justified. This was confirmed through discussion with site personnel and inspection of the site facilities.

3.4.5 Additionality

According to Section 3.8.9 of the VCS Standard, a renewal of the project crediting period does not require a full reassessment of additionality but does require an assessment of regulatory surplus be demonstrated. Bluesource submitted an attestation of regulatory surplus confirming that the Project is not mandated by any local, state, or federal statute. RCE confirmed there are no federal or state laws in Virginia requiring the destruction of LFG at closed landfills.

3.4.6 Quantification of GHG Emission Reductions and Removals

The Project GHG emission reductions and removals are quantified according to the steps and equations presented in the Methodology. RCE validated these quantification methods through a complete review of all data collection and analysis procedures employed by Bluesource. During this validation of the renewal of the project crediting period, RCE compared all the quantification methods to those presented in the Methodology and found them to be appropriate and correct. The project activity is not known to create any leakage emissions. The methodology does associate any uncertainties with the calculation of emission reductions.

Baseline Emissions

Baseline emissions are calculated using the equation:

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

Where:

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

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

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

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

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

Project Emissions

Project emissions are calculated using the equation:

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

Where,

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

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

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

3.4.7 Methodology Deviations

Parameter	ACM0001 Requirement	Deviation from Requirement	Validation Conclusion
$EF_{grid,CM,y}$	Calculate the combined margin emission factor, using the procedures in the latest approved version of the “Tool to calculate the emission factor for an electricity system”.	A deviation from the methodology is used and the emission factor for electricity generation is determined by examining the electricity grid in the region.	The value is more representative based on the site location. Deviation is acceptable and valid.

Ex ante estimation of $F_{CH_4,PJ,y}$	An ex ante estimate of $F_{CH_4,PJ,y}$ is required to estimate baseline emission of methane from the SWDS (according to equation (2)) in order to estimate the emission reductions of the proposed project activity.	Historical data has been used as this reflects 10 years' worth of 3 rd party verified monitoring. This should provide a more accurate statement of emissions compared to an estimation model.	The value is more representative based on-site specific data and does not impact the verified emission reductions. Deviation is acceptable and valid.
$\eta_{flare,m}$	In the case of open flares, the flare efficiency in the minute m ($\eta_{flare,m}$) is 50% when the flame is detected in the minute m ($Flame_m$), otherwise $\eta_{flare,m}$ is 0%.	The Landfill operates an LFG Specialties candlestick flare to destruct landfill gas. The flare's design limits specify that landfill gas must have a composition of at least 30% methane to maintain a stable flame and a 98% destruction efficiency. The flow range must be between 135 scfm and 1350 scfm. The average monthly methane content and average monthly flow of landfill gas to the flare will be monitored to ensure they are within design limits.	Based on the manufacturer specifications, they destruction efficiency of the flare is at least 98%. This value is more accurate than the default value of 50%. Deviation is acceptable and valid.

3.4.8 Monitoring Plan

RCE concludes the monitoring plan adheres to all requirements of the Methodology. The tables below contain the data and parameters that are monitored and/or measured during the project crediting period and reporting period.

DATA AND PARAMETERS AVAILABLE AT VALIDATION

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
Measurement Procedures (if any)	None; default value
Any Comment	Value provided in methodology
Validation	Confirmed

Data/Parameter	$F_{CH_4, BL, y}$
Data Unit	Metric tonnes CH_4
Description	Amount of methane in the LFG that would have been flared in the baseline
Source of Data	Calculated
Value applied	375.82 t CH_4 / year
Measurement Procedures (if any)	Three years of historical flare data between 2002-2004 is used to determine this value as per equations 13 & 14 of ACM0001.
Any Comment	Calculation of baseline emissions
Validation	Confirmed

Data/Parameter	LFG_{BL}
Data Unit	m^3
Description	Historic volume of landfill gas sent to the flare in the baseline
Source of Data	Measured
Value applied	43,704,080 m^3 / year
Measurement Procedures (if any)	Three years of historical flare data between 2002-2004 is used to determine this value. This value was measured continuously using a Fluid Components International ST98 Thermal Gas Flow Meter and corrected to standard temperature and pressure conditions of 68 degrees F and 1 atm.
Any Comment	Calculation of baseline emissions
Validation	Confirmed

Data/Parameter	$W_{CH_4, BL}$
Data Unit	$m^3 CH_4$ / m^3 LFG
Description	Historic average methane fraction of the LFG in the baseline
Source of Data	Measured
Value applied	45.14%
Measurement Procedures (if any)	Three years of historical flare data between 2002-2004 is used to determine this value. This value was measured by Henrico County personal approximately monthly with a Landtec Gem 500 gas analyzer.
Any Comment	Part of the calculation of baseline emissions.
Validation	Confirmed

Data/Parameter	GWP_{CH_4}
Data Unit	Metric tonnes CO_2e / metric tonne CH_4

Description	Global warming potential of methane
Source of Data	Reference
Value applied	25
Measurement Procedures (if any)	IPCC fourth assessment report
Any Comment	Part of the calculation of baseline and project emissions.
Validation	Confirmed

Data/Parameter	ρ_{CH_4}
Data Unit	Metric tonnes CH_4 / m^3 CH_4
Description	Density of methane at 68degrees F and 1 atmosphere
Source of Data	Reference
Value applied	0.000667
Measurement Procedures (if any)	This value is selected as flow meters on the Henrico site are calibrated to standard temperature and pressure conditions (68F, 1atm). Value is reference from the UNFCCC inputs received on consolidated methodologies.
Any Comment	Calculation of baseline and project emissions.
Validation	Confirmed

Data/Parameter	η_{flare}
Data Unit	%
Description	Efficiency of the flare
Source of Data	Reference
Value applied	98%
Measurement Procedures (if any)	See deviation description in Section 3.4.7. Value is used based on guidance from the US EPA for flares operated within the requirements for 40 CFR 60.18.
Any Comment	Calculation of project emissions.
Validation	Confirmed

Data/Parameter	η_{EL}
Data Unit	%
Description	Efficiency of the electricity generation engines
Source of Data	Reference
Value applied	100%
Measurement Procedures (if any)	Engines are continuously maintained and operated under lean burn conditions, Destruction is cross referenced against electricity generation data to ensure operation.
Any Comment	Calculation of baseline emissions.
Validation	Confirmed

Data/Parameter	EF _{EF}
Data Unit	Pounds CO ₂ / MWh
Description	Emission factor for the grid that supplies electricity
Source of Data	Reference
Value applied	743.3
Measurement Procedures (if any)	Value is obtained using the US EPA eGRID summary tables for SRVC Region
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	TDL
Data Unit	%
Description	Average transmission and distribution losses in the grid
Source of Data	Reference
Value applied	4.88%
Measurement Procedures (if any)	Value is obtained using the US EPA eGRID summary tables for SRVC Region
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	COEF _{propane}
Data Unit	Metric tonnes CO ₂ e/gallon
Description	CO ₂ emission coefficient for propane
Source of Data	Calculated
Value applied	0.005297 t CO ₂ e/gal
Measurement Procedures (if any)	Calculated from reference values
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	COEF _{diesel}
Data Unit	Metric tonnes CO ₂ e / gallon
Description	CO ₂ emission coefficient for diesel
Source of Data	Calculated
Value applied	0.010210 t CO ₂ e/gal
Measurement Procedures (if any)	Calculated from reference values
Any Comment	Calculation of project emissions

Validation	Confirmed
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Data/Parameter	NCV _{propane}
Data Unit	MMBtu / gallon
Description	Energy content of propane
Source of Data	Reference
Value applied	0.084250
Measurement Procedures (if any)	U.S. EPA Guidelines
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	NCV _{diesel}
Data Unit	MMBtu / gallon
Description	Energy content of diesel
Source of Data	Reference
Value applied	0.128488
Measurement Procedures (if any)	U.S. EPA Guidelines
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	EF _{CO₂,propane}
Data Unit	Metric tonnes CO ₂ e / MMBtu
Description	CO ₂ emission factor for propane
Source of Data	Reference
Value applied	0.06287
Measurement Procedures (if any)	US EPA Emission Factors for Greenhouse Gas Inventories
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	EF _{CO₂,diesel}
Data Unit	Metric tonnes CO ₂ e / MMBtu
Description	CO ₂ emission factor for diesel
Source of Data	Reference
Value applied	0.07946

Measurement Procedures (if any)	US EPA Emission Factors for Greenhouse Gas Inventories
Any Comment	Calculation of project emissions
Validation	Confirmed

DATA AND PARAMETERS MONITORED

Data/Parameter	$F_{CH_4,PJ,y}$
Data Unit	Metric tonnes CH_4 /year
Description	Total amount of methane in the LFG collected and destroyed by the project system at standard temperature and pressure (68 F, 1 atm)
Source of Data	Calculated value
Value applied	Approximately 2,800 Metric tonnes CH_4 /year
Measurement Procedures (if any)	Flow rates of methane to the landfill gas flare and electricity generating engines are calculated based on continuous monitoring. $F_{CH_4,PJ,y}$ is calculated by summing $F_{CH_4,flared,y}$ and $F_{CH_4,EL,y}$.
Any Comment	Calculation of baseline and project emissions
Validation	Confirmed

Data/Parameter	$F_{CH_4,flared,y}$
Data Unit	Metric tonnes CH_4 /year
Description	Amount of methane in captured LFG which is destroyed by flaring.
Source of Data	Calculated value
Value applied	110 t CH_4 /year
Measurement Procedures (if any)	The amount of methane sent to the flare is calculated based on continuous monitoring. Project emissions from the flare are calculated using continuous monitoring and a flare efficiency factor. $F_{CH_4,flared,y}$ is calculated as the difference between $F_{CH_4,sent\ to\ flare,y}$ and $PE_{flare,y}$.
Any Comment	Calculation of baseline and project emissions
Validation	Confirmed

Data/Parameter	$F_{CH_4,sent\ to\ flare,y}$
Data Unit	Metric tonnes CH_4 /year
Description	Amount of methane in the LFG which is sent to the flare

Source of Data	Calculated based on LFG_{flare} , W_{CH4} and ρ_{CH4} as per CDM Tool 8: Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value applied	Approximately 112 metric tonnes CH_4 /year
Measurement Procedures (if any)	Measured flowrate of landfill gas is multiplied by the measured methane percentage and methane density at standard temperature and pressure
Any Comment	Calculation of project emissions.
Validation	Confirmed

Data/Parameter	$PE_{flare,y}$
Data Unit	Metric tonnes CO_2e /year
Description	Project emissions from flaring of the residual gas stream in year y
Source of Data	Calculated based on $F_{CH4, sent\ to\ flare}$ and η_{flare} as per CDM Tool 6: "Project emissions from flaring"
Value applied	Approximately 55 metric tonnes CO_2e /year
Measurement Procedures (if any)	Methane sent to the flare is multiplied by the destruction efficiency of the flare and the global warming potential of methane to determine project emissions.
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	LFG_{flare}
Data Unit	m^3
Description	Volume of landfill gas sent to flare at standard temperature and pressure
Source of Data	Measured
Value applied	Approximately 345,000 m^3 /year
Measurement Procedures (if any)	Volume of landfill gas to the flare is measured by an orifice plate flowmeter. Data is continuously monitored and recorded by Henrico data collection software. Readings are recorded every five minutes.
Any Comment	Calculation of baseline emissions
Validation	Confirmed

Data/Parameter	W_{CH4}
Data Unit	$m^3\ CH_4/m^3\ LFG$
Description	Average methane fraction of the LFG
Source of Data	Measured

Value applied	Approximately 50%
Measurement Procedures (if any)	Measured continuously by either the primary or backup meter Primary meter: FAU-TDL Gas Analyzer SN: 1037 Backup meter: Landtec GEM 2000 SN: GM12536
Any Comment	Calculation of baseline and project emissions
Validation	Confirmed

Data/Parameter	$F_{CH_4,EL,y}$
Data Unit	t CH ₄ /yr
Description	Amount of methane in the landfill gas which is destroyed by electricity generation
Source of Data	Calculated based on $LFG_{Electricity}$, w_{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
Value applied	2,700 metric tonnes CH ₄ /year
Measurement Procedures (if any)	Calculate value
Any Comment	Calculation of baseline emissions
Validation	Confirmed

Data/Parameter	$LFG_{Electricity}$
Data Unit	m ³
Description	Volume of landfill gas sent to power generation unit at standard temperature and pressure
Source of Data	Measured
Value applied	Approximately 8,500,000 m ³ /year
Measurement Procedures (if any)	Volume of landfill gas to the Ingenco power generation unit is measured by a flowmeter. Data is continuously monitored and recorded by Ingenco data collection software
Any Comment	Calculation of baseline emissions
Validation	Confirmed

Data/Parameter	$EC_{PJ,y}$
Data Unit	MWh/year

Description	Quantity of electricity consumed by the Project
Source of Data	Utility invoices
Value applied	Approximately 45 MWh/year
Measurement Procedures (if any)	Third-party utility meter
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	PE _{propane}
Data Unit	t CO ₂ e/year
Description	CO ₂ emissions from propane combustion in the flare in year y
Source of Data	Supplier invoices
Value applied	Approximately 1 metric tonne CO ₂ e/year
Measurement Procedures (if any)	Fuel supplier meters
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	PE _{diesel}
Data Unit	t CO ₂ e/year
Description	CO ₂ emissions from diesel combustion at the Ingenco facility in year y
Source of Data	Calculated based on FC _{diesel} and COEF _{diesel} as per the CDM "Tool to determine project or leakage CO ₂ emissions from fossil fuel combustion".
Value applied	450 t CO ₂ e/year
Measurement Procedures (if any)	Calculated value
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	FC _{propane}
Data Unit	Gallons/year
Description	Volume of propane combusted by the flare in the project activity
Source of Data	Measured
Value applied	35 gallons/year
Measurement Procedures (if any)	Supplier invoices

Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	FC _{diesel}
Data Unit	Gallons/year
Description	Volume of diesel combusted by Ingenco engines in the project activity in year y
Source of Data	Measured
Value applied	45,000 gallons/year
Measurement Procedures (if any)	Measured continuously by a Micromotion Coriolis flowmeter
Any Comment	Calculation of project emissions
Validation	Confirmed

Data/Parameter	T _{Flare}
Data Unit	Degrees F
Description	Temperature of landfill gas flare tip
Source of Data	Measured
Value applied	1,400 F
Measurement Procedures (if any)	Thermocouple
Any Comment	Verification of landfill gas flare operation
Validation	Confirmed

Data/Parameter	E _{Gen} _{Ingenco}
Data Unit	MWh/year
Description	Electricity generated by the Ingenco engines during the project period
Source of Data	Measured
Value applied	Approximately 95,000 MWh/year
Measurement Procedures (if any)	Records from commercial electricity meters
Any Comment	Verification of operation of Ingenco engines
Validation	Confirmed

3.5 Non-Permanence Risk Analysis

The section is not applicable for this Project type.

4 VERIFICATION FINDINGS

4.1 Accuracy of GHG Emission Reduction and Removal Calculations

Bluesource calculates the Project's emission reductions in accordance with the equations described in ACM0001 and the validated PD. RCE sampled the Project's raw data collected via a red lion data recorder, hourly flare temperatures, hourly engine kilo-watt generation, daily methane readings taken by Ingenco, and the assertion spreadsheet to ensure the accuracy of reported data and to ensure that there were no material transcription errors between data sets.

RCE reviewed the Bluesource GHG assertion spreadsheet to ensure the accuracy of the formulas, emission factors applied, and functionality of the spreadsheet. Bluesource applied the correct default values from the PD to the equations in the assertion spreadsheet. RCE found the GHG emission reduction calculations to be in conformance with ACM0001 and the validated PD, and free of material misstatement.

Baseline emissions are calculated by subtracting LFG destroyed in the baseline system from LFG destroyed in the Project flare and electricity generating engines considering the operational activity of each destruction device. Project emissions were quantified accurately for the reporting period. RCE reviewed all utility invoices and diesel flow data to the engines.

RCE concludes the Project GHG emission reductions and removals have been quantified correctly in accordance with ACM0001 and the validated PD.

4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

Bluesource provided adequate documentation for the emission reduction calculations as well as its information control systems and data management processes. RCE reviewed the Project's Monitoring Report, raw data from the data collection system, instrumentation calibration reports, daily LFG methane measurements, and all emission reduction calculations.

As described in section 4.1, RCE performed sample recalculations of emission reductions from raw data, checked all functionality of the Project workbooks, and traced daily methane readings through input to the Project workbooks. RCE found the information provided to be transparently documented and in accordance with the validated PD and requirements of the CDM ACM0001.

RCE interviewed Bluesource, Draper and Associates, and Ingenco staff members, and reviewed data collection processes and operational systems used to collect and report data. RCE found the systems employed result in adequate data collection and presentation with reliable controls. Quality assurance activities are present through data review techniques conducted by Draper and Associates and Henrico personnel and, subsequently, by Bluesource personnel. RCE confirmed the Project's management and staff to be highly qualified and competent and determined that the GHG management system is sufficient to generate accurate and reliable raw data values.

RCE concludes the Project data used to determine the GHG reductions and removals to be of sufficient quantity and appropriateness of quality in all instances.

5 VALIDATION AND VERIFICATION CONCLUSION

RCE confirms that the validation was performed in accordance with the VCS Program Guide, Version 4.0, and VCS Standard, Version 4.0 in addition to CDM methodologies and tools. Through destruction of LFG in the flare and engines, the Project Activity will result in a reduction of GHG emissions that is relevant, complete, consistent, accurate, transparent and conservative.

Upon completion of the renewal of crediting period validation process RCE concludes that that all relevant VCS validation criteria have been satisfied and the Project Activity properly applies the criteria of ACM0001 Version 19.0. RCE concludes that the original baseline remains valid and that the emission reductions attributable to the Project Activity are additional to any emission reductions that would occur in the absence of the Project.

All CARs, ADRs, and CRs raised by RCE have been satisfactorily resolved by the Project Proponent. The *ex-ante* emission reductions from the Project Activity are estimated to be 500,000 tonnes of CO₂e over a 10-year crediting period from 1 January 2019 to 31 December 2028, resulting in an average of 50,000 tonnes of CO₂e annually throughout the crediting period. RCE considers it likely that the estimated quantity of emission reductions may be achieved by the Project Activity should the assumptions and operational conditions remain the same.

RCE conducted a risk-based analysis of the Henrico County Landfill Gas Combustion Project including a strategic review of the Project data, documentation, and emission reduction calculations. RCE concludes to a reasonable level of assurance that the GHG assertion is free of material misstatement. The emission reductions resulting from methane avoided from LFG combustion for the reporting period 1 January 2019 to 31 December 2019 can be considered in conformance with the:

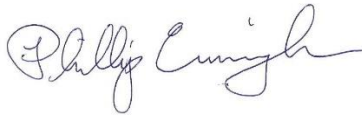
- Verified Carbon Standard version 4.0 (19 September 2019),
- Clean Development Mechanism methodology ACM0001, Large-scale Consolidated Methodology, Flaring or use of landfill gas, Version 19.0, and
- Validated VCS Project Description, 28 August 2020.

Verification period: From 1-January-2019 to 31-December-2019

Verified GHG emission reductions and removals in the above verification period (values in the table may not add up exactly due to rounding errors):

Year	Baseline emissions or removals (tCO2e)	Project emissions or removals (tCO2e)	Leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)
2019	56,628	476	0	56,152
Total	56,628	476	0	56,152

Lead Validator Signature



Phillip Cunningham

Environmental Scientist

Independent Reviewer Signature



Michael Coté

President

APPENDIX A: DOCUMENTS REVIEWED

#	Document
1	Ownership contracts between Bluesource and all responsible parties
2	Relevant environmental permits including closure documents
3	Evidence of voluntary implementation of the LFG collection system
4	Construction drawings
5	Equipment manuals
6	Baseline LFG flow and methane data
7	Maps of the project area
8	Previous crediting period validation and verification reports
9	Monitoring plan
10	Raw landfill gas flow data
11	Operational activity data for each destruction device
12	Daily handheld methane readings
13	Utility bills for electricity usage
14	Invoices for propane usage
15	Diesel fuel consumption readings
16	GHG assertion spreadsheet
17	Validated PD
18	Calculation spreadsheets and underlying raw data
19	Fuel receipts
20	Calibration reports/records
21	Relevant environmental permits
22	Monitoring report

APPENDIX B: RESOLUTION OF VALIDATION FINDINGS

Finding	Description	Project Proponent Response & Action	Status
CAR 1	In the PD under Section 1.1, the second paragraph under the heading "Stage 2 (2010 - present)" states, "Prior to project implementation, gas from the Landfill was passively vented to the atmosphere". However, this was not the baseline scenario for this Project.	Moved sentence under "Pre-Project" header and changed to say 'prior to this phase, gas from the landfill was passively vented to atmosphere'.	Accepted.
CAR 2	In the PD under Section 1.3 Project Eligibility, the Project Proponent states that the Project meets all the requirements set out in Section 3.1. Update this paragraph and describe how the Project meets each requirement.	Updated with table in Appendix A.	Accepted.
CAR 3	In the PD under Section 1.9 Crediting Period, there is a reference to "...the Standard". Please update to reference the Standard that allows a second 10-year crediting period. VCS Standard 4.0 allows, "For non-AFOLU projects, the project crediting	The Project is eligible for 2x 10-year crediting period renewals as confirmed in the email from Matt Borden at Verra. Email from Verra forwarded to RCE April 29, 2020.	Accepted.

	period shall be either seven years twice renewable for a total of 21 years, or ten years fixed”.		
CAR 4	Please refer to the instructions in the PD template. The following items are not addressed or need additional information / clarification in Section 1.11 Description of the Project Activity: 1. The technology and measures are employed is listed but there is no description of how it/they will achieve net GHG emission reductions or removals. 2. The arrangement of the main technologies is not shown. 3. The age and average lifetime of the equipment including load factors and efficiencies is not described. 4. The manufacturer's recommendation for calibration for each piece of monitoring equipment is not stated.	These items have been updated in section 1.11.	Accepted.
CAR 5	Please refer to the instructions in the PD template. The following items are not addressed or need additional information / clarification in Section 2.2 Local Stakeholder Consultation: 1. The procedures or methods used for engaging local stakeholders (e.g., dates of announcements or meetings, periods during which input was sought). 2. The procedures or methods used for documenting the outcomes of the local stakeholder consultation. 3. The mechanism for on-going communication with local stakeholders. 4. How due account of all and any input received during the consultation has been taken. Include details on any updates to the project design or justify why updates are not appropriate.	These items have been updated in section 2.2.	Accepted.
CAR 6	There is no mention of the engines in Section 3.3 Project Boundary. ACM0001 states that: “The project boundary of the project activity shall include the site where the LFG is captured and, as applicable: (a) Sites where the LFG is flared or used (e.g. flare, power plant, boiler, air heater, glass melting furnace, kiln, natural gas distribution network, dedicated pipeline or biogas processing facility)”	Table 3 has been updated to include emissions from the Ingenco engines.	Accepted.
CAR 7	There is no map of the physical boundary of the Project in Appendix A.	Map sent via email April 29, 2020.	Accepted.
CAR 8	When re-assessing the baseline scenario, the PD states: “As such, the financial barriers used to determine the baseline scenario in the previous crediting period are still valid and are now actually much higher due to these three aforementioned factors.” However, no consideration is mentioned of financial revenue from electricity generation. Update the PD to include an assessment of the impact of revenue from electricity production.	The updated project description includes a description of new technologies. No additional assessment is required as per communication from Andrew Beauchamp, 06/04/2020.	Accepted.
CAR 9	The engines are not accurately described in the PD. The PD states that there are “Two 2 MW dual (sic) fuelled (sic) compression ignition engines...”. This is not correct. Further, the calculations assume that all LFG sent to the engines is destroyed. The engines viewed on-site were modified truck engines. RCE disagrees that these engines	After confirmation from Ingenco, Section 1.11 updated to say “12 recycled Detroit Diesel dual-fuel compression ignition engines capable of producing a combined 4 MW of power”. Bluesource refutes RCE's opinion the engines do not have a 100% destruction efficiency on the grounds of the following engineering principals:	Accepted.

	are 100% efficient. Provide an alternative destruction efficiency for these devices with supporting evidence.	1. Ingenco has confirmed the engines are operated at lean burn conditions. Lean burn means excess air is injected into the engine to ensure there is adequate oxygen available to react with all fuel molecules. This is opposed to operating the engine at stoichiometric or rich burn conditions where it is more likely to see incomplete combustion. This is the most important factor in understanding destruction efficiency of an IC engine. 2. If there is incomplete combustion of methane in the engine, the resulting byproducts would be carbon (soot), CO, and H₂O. These compounds are not greenhouse gases so they do not affect the conservativeness of the offset quantification. 3. Diesel is not considered in this argument because 100% of the diesel used in the engines is counted as project emissions based on an accepted emission factor which assumes complete combustion. Un-combusted diesel is not a GHG.	
CAR 10	Update the monitoring table in Section 5.1 to include all relevant values for parameters.	The Project Developer updated Section 5.1.	Accepted.
CAR 11	Step 1.2 of the tool for the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" has not been completed. Specifically, as the situation where the baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is required for the renewal of the crediting period. This has not been performed. Also, no assessment of the impact of electricity or fuel prices in the identification of the current practice for the baseline emissions has been undertaken. What does the impact of revenue from electricity have on the barriers originally assessed during the crediting period?	Full reassessment of the baseline is not necessary, as per email from Andrew Beauchamp.	Accepted.
CAR 12	Section 3.3 Project Boundary Table 3 does not include emissions from fossil fuel for the generation of electricity. During the site visit, Ingenco stated that diesel is burned in the engines to generate electricity. Update the PD to include this SSR.	Table 3 updated to broaden the project emission to just say "Emissions from fossil fuel consumption in the project activity".	Accepted.
CAR 13	The appendix in the PD is blank. Update the appendixes to reflect information in the PD.	Map sent to RCE in email on April 29, 2020. Will be appended when the PD is converted to pdf.	Accepted.
CAR 14	Under the heading "Determination of $F_{CH_4, sent to flare, y}$, $F_{CH_4, EL, y}$, and $F_{CH_4, BL, y}$" in Section 4.1 in the PD, it states "As such, $F_{CH_4, sent to flare, y} / F_{CH_4, EL, y} / F_{CH_4, BL, y}$ is determined per equation 5 in the CDM Tool 8: 'Tool to determine the mass flow of a greenhouse gas in a gaseous stream'". However, the equations listed in the PD do not list: 1. The parameters measured to determine the density of the greenhouse gas i in the gaseous stream. 2. Whether the gas is measured on a wet or dry basis and how the measurement of moisture is applied to the gaseous stream if measured on a wet basis. 3. Pressure and temperature of the gaseous stream(s). 4. Whether equations 1 through 4 are applicable to the calculation(s). If they are not applicable, provide an explanation and corresponding evidence.	Temperature and pressure are measured but not used in the project calculations. As an orifice plate is used, only differential pressure is recorded at the specific meter. Orifice plates are based upon the Bernoulli principle (https://www.engineeringtoolbox.com/orifice-nozzle-venturi-d_590.html) which does not require temperature data to compute volumetric flow. The meter is designed to output volumetric flow in scfm, which dictates that when converting to mass flow rate it should be done at conditions of 70F, 1atm. Update: the meter records flow at 68F and 1atm. The density of methane was updated accordingly.	Accepted.

CAR 15	The PD states that equation 5 from Tool 8 is used. However, the PD also states that the flow meters measure the gaseous stream on a mass basis. Equation 5 is for measuring a gaseous stream based on a volumetric flow basis. Update the PD and calculations to use the correct equations from Tool 08 for each gaseous stream.	Flow is measured using orifice plate meters, which measure differential pressure across a flow constriction (the orifice plate). This pressure reading is converted to scf by the meter's data acquisition software is therefore reported on a volumetric basis. The only mention of a mass flow meter within the PD relates to historical records of landfill gas capture from 2002-2004.	Accepted.
CAR 16	The PD has omitted the operational status of the engines (a biogas destruction device). Tool 08 under Data / Parameter table 19 states, "Monitoring and documenting may be undertaken by recording the energy production from methane captured...to demonstrate the actual destruction of methane, unless a different method is specified in the underlying methodology/tool. Emission reductions will not accrue for periods in which the destruction device is not operational."	PD has been updated to reference electricity generation data from the Ingenco engines in section 5.2/5.3.	Accepted.
CAR 17	The PD has omitted the method to be undertaken for data substitution as outlined in the Appendix of Tool 08.	An explanation of data substitution has been added in section 4.1.	Accepted.
CAR 18	For the data / parameter 'W _{CH4} ' in Table 5.2 it states, "Tool 8 specifies continuous metering of this parameter is required. If the portable gas analyzer is used to record measurements on a weekly basis, a 5% discount factor will be applied to reflect uncertainty in weekly sampling". However, this is not in conformance with '3. Use of a sampling method for methane content of landfill gas' in Tool 08. Update the PD so that the requirement in the Tool is met.	Table 5.2 has been updated to reflect the requirements of Tool 08.	Accepted.
CAR 19	For an open flare, the PD does not include the flare efficiency when a flame is not detected. Update the PD to meet section 6.2.1 of Tool 06 Project Emissions from Flaring.	Section 4.1/5.3 have been updated to describe treatment when the thermocouple does not detect a flame.	Accepted.
CAR 20	Under the heading 'Determination of PE _{flare, y} ' the PD has the parameter 'F _{CH4, sent to flare} = Mass flow of methane in the gas sent to flare'. This parameter is not in Tool 06. Update the PD to include a relevant parameter from Tool 06 including requirements for measuring said parameter.	This term is in section 6.3 of CDM tool 6 and is equivalent.	Accepted.
CAR 21	Under the heading 'Determination of PE _{EC} ' the PD states, "Project emissions from consumption of electricity by the project activity are calculated using Option 1 in the CDM Tool 5: 'Baseline, project and/or leakage emission from electricity consumption and monitoring of electricity generation (version 3.0)'. However, there is no "Option 1" in this tool. Update the PD to include a relevant option from the tool including corresponding parameters. Also, provide justification for the emission factor used.	This section has been updated to more accurately reflect the fact that the equation 2 from CDM tool 5 is used. Additionally, this section now references the fact that the emission factor will be used as described in section 3.6.	Accepted.
CAR 22	The VCS PD template states "Justify the choice of data source, providing references where applicable. Where values are based on measurement, include a description of the measurement methods and procedures applied (e.g., what standards or protocols have been followed), indicate the responsible person/entity that undertook the measurement, the date of the measurement and the measurement results. More detailed information may be provided in an appendix." in the instructions for 'Justification of choice of data or description of measurement methods and procedures applied'. This requirement has not been met for the following parameters:	The referenced parameters have been updated.	Accepted.

	1. $F_{CH_4, BL, y}$ 2. LFG_{BL} 3. $W_{CH_4, BL}$ 4. ρ_{CH_4}		
CAR 23	Please refer to the VCS PD template instructions for Data and Parameters monitored. Many of the instructions for the parameters have not been met.	Section 5.2 has been updated as per the template.	Accepted.
CAR 24	Please refer to the VCS PD template instructions under Section 5.3 Monitoring Plan. Many of the instructions for the parameters have not been met including: 1. The methods for measuring, recording, storing, aggregating, collating and reporting data and parameters. Where relevant, include the procedures for calibrating monitoring equipment. 2. The organizational structure, responsibilities and competencies of the personnel that will be carrying out monitoring activities. 3. The policies for oversight and accountability of monitoring activities. 4. The procedures for internal auditing and QA/QC. 5. The procedures for handling non-conformances with the validated monitoring plan. 6. Any sampling approaches used, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures. 7. Where appropriate, include line diagrams to display the GHG data collection and management system.	Section 5.3 has been updated as per the template.	Accepted.
CAR 25	Update the Project Description section 1.10 based on the new calculation of emission reductions.	The Project Developer updated the estimation based on the most recent assertion.	Accepted.
CAR 26	Update the Project Description to include a description of the meter measuring the consumption of diesel including manufacturer's recommendation for calibration and maintenance.	The Coriolis meter description has been added to the table in section 5.2 and the description in 5.3. The Coriolis meter is equipped with Emerson Smart Meter Verification. From the Emerson website: "Smart Meter Verification establishes an audit trail for each meter and captures data for visual analysis and reporting on demand. Agencies including EPA, IEC (SIS), FDA, AGA, API, ISO 9001, Russian VNiIMS, Alberta Energy Regulator, and other third parties recognize Smart Meter Verification as a valid work practice in lieu of some or all calibrations".	Accepted.
ADR 1	Please provide the justification/calculation of estimated annual average emission reductions as 73,000 tonnes per year.	Since this project has been operating for 10-years, historic values will provide the most accurate estimate of ERs to be expected in this crediting period renewal. Historic values have been provided to RCE along with the previous MR on April 30, 2020.	Received.
ADR 2	Section 1.7 describes the ownership of the Project. Provide evidence of each party's ownership in the Project.	Project ownership is defined in the VCS Project Definitions as: The legal right to control and operate project activities. Distinct from proof of right. Project ownership belongs to both Henrico County and Ingenco as outlined in the document "Henrico - Ingenco LFG Agreement_Redacted.pdf".	Received.

		Both of these entities have the right to control and operate their respective facilities at the Landfill. The redacted agreement emailed to RCE April 30, 2020.	
ADR 3	Provide the evidence cited in Section 1.13 Conditions Prior to the Project Initiation that, "While the Virginia Department of Environmental Quality (DEQ) required Henrico to control the subsurface migration of gas detected in these wells, the installation of an active gas collection system is above and beyond that requirement".	Bluesource provided the document.	Received.
ADR 4	Provide any and all relevant permits for the landfill.	Upon closure of the landfill, the requirement for an operating permit was revoked by the VADEQ. Evidence of this has been provided to RCE April 30, 2020.	Received.
ADR 5	Provide the most recent relevant NMOC Tier II report completed in December 2014.	Provided to RCE April 30, 2020.	Received.
ADR 6	Provide evidence / calculations of the amount of methane captured in the Pre-Project existing LFG capture system.	2002-2004 Flare Operating Reports were sent to RCE April 30, 2020.	Received.
ADR 7	Please provide the attestation of regulatory surplus from the County of Henrico mentioned in Section 3.5.	Attestation sent to RCE April 29, 2020.	Received.
ADR 8	Regarding Section 3.6 Methodology Deviations 2. Ex Ante Estimate of Emission Reductions: provide evidence in the form of calculations to support the statement that, "The use of this (LandGEM) model does not negatively impact the conservativeness of the emission reduction quantification."	The use of the LandGEM model does not negatively impact the conservativeness of the emission reduction quantification as outputs from the LandGEM model are not used in association with the emission reduction quantification. Please refer to Section 4 of the PD to see what inputs and calculations will be used to complete the quantification.	Received.
ADR 9	Provide a reference for using a default flare destruction efficiency of 98%.	Source is referenced in the deviation description.	Received.
ADR 10	Please provide all agreements between Bluesource, Henrico County and Ingenco (redacted as necessary) clearly showing who owns the GHG benefits / credits.	The redacted contract and agreement between Henrico and Ingenco were sent to RCE April 30, 2020.	Received.
ADR 11	Please provide calibration documents for all Project equipment including evidence of manufacturer's recommendation for maintenance and calibration.	Bluesource provided the documents.	Received.
ADR 12	Please provide a diagram showing the exact placement of all Project equipment. It is unclear where each piece of equipment is located with relation to the project destruction devices.	Map sent in email April 29, 2020.	Received.
ADR 13	Please provide the ex-ante estimate of $F_{CH_4,PJ,y}$ referenced in Section 5.4.1.2 of ACM0001 including calculations.	LandGEM model sent in email April 29, 2020.	Received.
ADR 14	Please provide a reference and calculation of the density of methane including how this meets the requirements of the Tool 08.	Reference has been updated.	Received.
ADR 15	Please provide a photo of the flow meter to the Ingenco plant with serial number 306661.	Bluesource provided the photo.	Received.
ADR 16	Please provide evidence that the Rosemount flow meters record LFG at 70 degrees F and 1 atm.	Bluesource updated the density of methane corrected to 68 degrees F because this is the default setting of the flow meter.	Received.
CR 1	Please clarify whether the closing of the landfill has been considered when estimating annual average emission reductions.	The closing is factored into the LandGEM model.	Accepted.

CR 2	Please clarify whether there are any relevant local, regional or national laws regarding methane mitigation at closed landfills. Provide evidence of efforts taken by the Project Developer to confirm that project activities are not required by law.	Attestation sent to RCE April 29, 2020.	Accepted.
CR 3	Please clarify how it was determined that “An environmental impact assessment was not required by the federal or state authority prior to the implementation of the Project”.	The wording has been changed to: The installation of an LFG gas capture and combustion system is not known to have any negative environmental impacts. The Project reduces greenhouse gases entering the atmosphere and improves local air quality by reducing methane odors from the capture of LFG at the Landfill.	Accepted.
CR 4	Please clarify why a public comment period was not required for the development of the Project (specifying references as applicable).	Wording updated to say: No comments or concerns from local stakeholders have been brought forward since the Project initiation.	Accepted.
CR 5	Please clarify why the Project Developer considers the original baseline scenario to still be plausible even though an additional revenue stream from electricity generation was added to the Project after the initial validation.	As per email from Andrew Beauchamp (June 4), the changes made to the project do not fall under the four scenarios set out in Paragraph 5 of the tool that require a reassessment of additionality. As such, the updated project description should include a description of the change in the engine technology(s) but no further assessment is required.	Accepted.
CR 6	Please clarify the exact situation in which gas is sent to Ingenco. When is gas sent? What determines how much gas is sent?	From Ingenco: “Typically, the power generation facility runs around the clock and when it is running, all gas is directed to the facility. There are outages (utility, communication, water system, etc.) that necessitate sending gas to the flare.”	Accepted.
CR 7	Please clarify how the electricity plant is operated. During the site visit, Ingenco described day-ahead scheduling of electricity and how it influenced how much LFG was combusted in the engines.	From Ingenco: “Electricity production is predominantly based on the amount of landfill gas available while also considering the projected day-ahead scheduling of electricity. There are rare times when power prices increase significantly which dictates a higher demand. This is when the facility supplements fuel with diesel to produce higher outputs. LFG is only sent to the flare when it cannot be combusted at the facility.”	Accepted.
CR 8	Please clarify why the engines were changed during the reporting period. The PD states that “The average lifespan of the installed wellheads, piping, flares, blowers, <u>engines</u> and other industrial equipment is longer than the crediting period of the Project”. However, the engines were apparently switched out in the middle of the initial crediting period.	All engines were rebuilt and constantly maintained by the INGenco team. Maintenance was becoming significant on the older engines, resulting in down periods. The change to 12 smaller engines allows for maintenance to be rotated through the equipment, increasing reliability.	Accepted.
CR 9	Please clarify who owns the environmental attributes mentioned in the first paragraph of Section 4.1 Baseline Emissions.	Ingenco does produce and sell RECs using electricity generation at the Henrico site. However, this is separate from the project and does not conflict with the creation of offset credits. Our project boundary cuts off following the combustion chamber of the Ingenco engines and does not touch the electricity generation portion (except to verify that engine activity is taking place). This is why emissions reductions are not quantified for the elimination of grid electricity by Ingenco.	Accepted.

CR 10	The data parameter 'LFG_{flare}' in Table 5.1 states "Flow is measured on a wet basis and the flow meter is located at the blower / flare station. In particular, it is located after the condensate knockout pot and after the blowers." How can the flow of landfill gas be measured on a wet basis if it is measured after the condensate knockout pot? If the flow is measured on a dry basis, provide evidence of how the moisture content was determined.	Flow measurement is measured at a point where the flow could likely be assumed dry. However, according to CDM Tool 8 it is necessary to demonstrate that the gas stream is either below 60C or 0.05 kg H₂O/m³ dry gas in order to calculate flow rates on a dry basis. As there is no metering in place to measure moisture content or gas temperature, and as the flow meters in place automatically record flow rate at normal conditions, it was determined that option C (wet basis) was the most accurate way to determine LFG_{flare}.	Accepted.
CR 11	The PD states that the parameter 'LFG_{flare}' in Table 5.1 is measured on a wet basis. Why doesn't the PD include an equation to account for moisture in the gaseous stream?	Option C of Tool 8 is used to calculate flow rate. This option does not require a calculation for moisture in the gaseous stream.	Accepted.
CR 12	Please clarify what equation is used to convert flow measured to standard conditions as specified by the methodology.	Flow is measured at standard conditions using the orifice plate flow meter methodology. All flowrates reported by Henrico/Ingenco are reported in units of standard cubic feet per minute.	Accepted.
CR 13	Please clarify whether all flow meters measure the gaseous stream as mass and provide evidence corroborating this.	As mentioned previously, all flow meters are orifice plates measuring differential pressure. This data is provided to us as scf, with all conversions performed automatically by the logic system within the meter programmed by the manufacturer. Thus, the gaseous stream is effectively measured on a volumetric basis.	Accepted.
CR 14	Under the heading 'Determination of F_{CH₄,BL,y}' in the PD it states, "The calculation of methane that would have been flared in the absence of the project activity is done by using historical values for the flared methane volumes and average methane fraction. It follows equation 5 in CDM Tool 8." Equation 5 is based on volumetric flow rates. Please clarify if the baseline flow meter measured a gaseous stream based on volume or mass and provide corroborating evidence	As mentioned previously, all flow meters are orifice plates measuring differential pressure. This data is provided to us as scf, with all conversions performed automatically by the logic system within the meter programmed by the manufacturer. Thus, the gaseous stream is effectively measured on a volumetric basis.	Accepted.
CR 15	Regarding section 5.10. Data and parameters not monitored of ACM0001, please clarify the following: 1. Data / Parameter table 4 NCV_{CH₄}.	This parameter is used in the calculation of BE_{HG} which is not an SSR in the Project; therefore, it is not included in the PD.	Accepted.
CR 16	The second paragraph under the heading 'Gas Composition' in Section 5.3 states, "The gas analyzer was sent to the manufacturer in 2018 and was replaced by a Landtec FAU-TDL continuous gas analyzer (SN# 1002)." This is not the serial number on the FAU-TDL that RCE observed during the site visit. Please clarify why the serial numbers are different.	PD has been updated to reference the correct analyzers.	Accepted.
CR 17	The PD under the heading 'Determination of PE_{flare, y}', it states, "...except in cases when the flare thermocouples detect a flare temperature outside of manufacturer's recommended settings". Please clarify what the manufacturer's recommended settings are and provide corresponding evidence.	Manufacturer's spec sheet references 40 CFR 60 regulation. This was meant to reference these requirements. PD has been updated to only mention the applicable regulation.	Accepted.

APPENDIX C: RESOLUTION OF VERIFICATION FINDINGS

Finding	Description	Project Proponent Response & Action	Status
CAR 1	Ingenco is not listed as a party in the Monitoring Report.	Bluesource updated the monitoring report to include Ingenco as a party.	Accepted.
CAR 2	The missing data substitution for the plant flow landfill gas is not calculated correctly. The Project Developer averaged all values instead of following the missing data substitution methodology outlined in the Project Design Document.	The missing data substitution is not being followed for all time periods. The missing data substitution employed does not follow the PDD.	Accepted.
CAR 3	The methane fraction is not applied to the landfill gas flow from the flare and engines. Results in a material misstatement.	Bluesource updated the assertion spreadsheet.	Accepted.
CAR 4	There is no mention of the current types of engines in the monitoring report.	Bluesource updated the monitoring report to include the twelve dual-fuel combustion engines.	Accepted.
CAR 5	Regarding section 4 Data and Parameters: A. This section needs updated to match what is reported in the Project Design Document. B. This section contains references that don't exist. As an example, the efficiency of the flare references "deviation description in Section 3.6(3)" but this section does not exist.	1. Value for FC_{diesel} in the monitoring report states that the volume is measured by a Coriolis meter; however the PDD states that this is calculated based on invoices.	Accepted.
CAR 6	The value for the density of methane used in the file 'Henrico_calc_v5.0_08052020' on the 'Data_Entry' tab does not match the value listed in the Monitoring Report.	Bluesource updated the methane density based on the meter reading at 68 degrees F.	Accepted.
CAR 7	Under the data parameter W_{CH4} it states "Landtec's recommended maintenance practices are to have the meter inspected and calibration once annually". However, this is not the recommendation for the handheld methane analyzer.	Bluesource updated the monitoring report and project description to include the correct maintenance practices.	Accepted.
NMF 1	There are typos for electricity consumption in May and October for the Ingenco electricity usage. Results in a non-material difference (less than 0.01%).	Bluesource updated the calculations to address this finding.	
ADR 1	Please provide the monthly raw flow data for the reporting period that has not been modified in any way.	Bluesource clarified that the 'Raw' data tabs are data that have not been modified.	Received.
ADR 2	Please provide data showing operational activity of the engines.	Bluesource provided the engine run hours for the reporting period.	Received.
ADR 3	Please provide handheld methane readings used during the reporting period.	Bluesource provided handheld methane readings that Ingenco measured during the periods when the continuous methane analyzer was not functioning properly.	Received.
ADR 4	Please provide calibration reports for Ingenco's handheld methane analyzer used during the reporting period.	The requirement for this equipment is to be calibrated every six months. Provide the calibration document covering the time period January 1, 2019 to August 29, 2019. Provide the same documentation for the handheld methane analyzer with serial number GM12536 if this piece of equipment was used.	Received.

ADR 5	Please provide the factory calibration for the flow meter to the Ingenco Plant (SN 306661) mentioned under the section header 'Baseline Emissions' in the monitoring report.	Please provide the calibration sheet for this meter from 11/17/18.	Received.
ADR 6	Please provide documentation of what the manufacturer's recommended settings are for the flare.	Documentation provided 8/19/2020 with response to PDD comments. As mentioned there, the flare manual only references meeting the requirements for 40 CFR 60.18.	Received.
CL 1	Bluesource provided a calibration sheet for a FAU-TDL with serial number 1037. However, when the Lead Verifier was on site, the FAU-TDL serial number at Henrico was 1006. Please clarify why the serial numbers are different or provide the correct calibration sheet.	Bluesource responded that FAU-TDL SN 1037 has been in place for the entirety of 2019 monitoring. However, this meter has been unreliable and not used in any quantification	Accepted.
CL 2	Provide the exact timeline of when the continuous analyzer(s) broke during the reporting period including when data is considered valid from the analyzer(s) and when data was used from Ingenco's handheld analyzer because the continuous analyzer(s) was (were) failing. Which analyzer was in place at the beginning of the reporting period and when did it start failing? When was a new continuous analyzer in place?	Bluesource responded that the Gem2000 meter used for entirety of monitoring period due to unreliability of continuous meter.	Accepted.
CL 3	Please clarify whether there is a flow meter that measures diesel. The Monitoring Report states that diesel consumption is based on "...supplier invoices for diesel consumed at the facility. Invoices are based upon commercial fuel meters.". If fuel volumes used to calculate emissions are based on invoices, please provide the invoices. If volume is based on a meter, please provide evidence that the meter was reading accurately during the reporting period.	Bluesource responded that diesel is metered by a Micromotion Coriolis Flowmeter. MR updated to reference this meter.	Accepted.
CL 4	The serial number on the certification of calibration provided is GM10769. The Lead Verifier took a picture of Ingenco's GEM2000 during the site visit and it was GM12536. Please clarify if Ingenco has more than one GEM2000 and provide evidence showing factory calibrations every six months.	Bluesource responded that Ingenco uses the meter GM12536 for composition monitoring. As the meter needs to be removed on days it is calibrated, the meter GM10769 is used on those days as a replacement.	Accepted.
CL 5	The Monitoring report states that "Rosemount's recommended maintenance practices are to have the meter inspected and calibrated once every 3 years." Further down in Section 4.3, the same three-year reference is mentioned regarding the manufacturer's recommendation. However, the lead verifier could not find a reference to the 3-year schedule in the documentation that was provided and was under the impression that the 3-year schedule was the Project Developer's internal policy. Please clarify.	Bluesource responded that the 3-year period is due to internal policies. Language has been updated.	Accepted.
CL 6	Under the heading 'Gas Composition', it states, "...was measured during the reporting period by a Landtec Gem 2000 continuous gas analyzer." Please clarify what is meant by this wording.	Bluesource updated the language in the monitoring report.	Accepted.
CL 7	Under the heading 'Gas Composition' there is only one handheld methane analyzer mentioned. Please clarify whether there were two handheld analyzers used during the reporting period.	Bluesource clarified that Ingenco uses the meter GM12536 for composition monitoring. As the meter needs to be removed on days it is calibrated, the meter GM10769 is used on those days as a replacement.	Accepted.

FAR 1	There are errors in missing data substitution causing a non-material finding. Update the calculation spreadsheets to include a check or formula to correctly calculate missing data substitution.	No response needed.	