

# VERIFICATION REPORT FOR THE HENRICO COUNTY LANDFILL GAS COMBUSTION PROJECT



Document Prepared By First Environment, Inc.

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**Summary:**

This report is provided to Blue Source, LLC (Blue Source), the County of Henrico (Henrico County), and Ingenco as a deliverable of the Verified Carbon Standard (VCS) project verification process for the Henrico County Landfill Gas Combustion Project (the Project) located in Glen Allen, Virginia.

The landfill is divided into three separate and distinct areas: East Fill, West Fill and the Expansion. Prior to the Project activity, landfill gas was collected from the East Fill area and destroyed in an open flare. The Project consists of gas collection from the Expansion area and was implemented in two stages. Stage One of the project involved expansion of the pre-existing wellfield and installation of an open flare. Stage Two consists of a beneficial use application where landfill gas is collected and sent to an on-site power generating facility for destruction in engines used to generate electricity. Both stages of the Project are currently active and each achieves a net reduction in CO<sub>2</sub>-equivalents through the avoidance of methane emissions that otherwise would have been released to the atmosphere.

The verification process and scope consists of the independent third-party assessment of the implementation of the project and emission reduction assertion against the criteria stated in the Verified Carbon Standard (VCS) Standard, 21 June 2017, v3.7; the approved Clean Development Mechanism (CDM) Methodology ACM0001 "Consolidated baseline and monitoring methodology for landfill gas project activities," Version 10.0 and the validated VCS Project Description (VCS PD). The purpose of the verification is to ensure the project was implemented and monitored in accordance with the validated Project Description and underlying CDM Methodology.

During the verification process, First Environment, Inc. (First Environment) issued eleven corrective action requests and four clarification requests, all of which were addressed sufficiently by Blue Source. No uncertainties were identified during the verification process. The Project claims emission reductions of 302,550 tonnes CO<sub>2</sub>e for the period of January 1, 2015 through December 31, 2018. First Environment is reasonably assured that the Project meets all relevant VCS program requirements and correctly applies the CDM methodology ACM0001 (Version 10.0) and the validated PD.

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## 1 INTRODUCTION

### 1.1 Objective

This report is provided to Blue Source, LLC (Blue Source), the County of Henrico (Henrico County), and Ingenco as a deliverable of the Verified Carbon Standard (VCS) project verification process for the Henrico County Landfill Gas Combustion Project (the Project) located in Glen Allen, Virginia. This report covers the verification of greenhouse gas (GHG) emission reductions from the avoidance of methane emissions from decomposing waste during the period from January 1, 2015 through December 31, 2018. First Environment, Inc. (First Environment) conducted the verification from January through April 2019.

During the verification process, Blue Source acted as the Project advisor for the Project Proponents. As such, First Environment communicated directly with Blue Source regarding most verification activities.

### 1.2 Scope and Criteria

The specific scope metrics for the verification are outlined in the table below:

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reporting Period</b>          | <ul style="list-style-type: none"> <li>January 1, 2015 – December 31, 2018</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Emission Sources Verified</b> | <p><i>Baseline Sources</i></p> <ul style="list-style-type: none"> <li>CH<sub>4</sub> emission reductions resulting from the destruction of landfill gas.</li> <li>CH<sub>4</sub> emission reductions resulting from the pre-project destruction of landfill gas</li> </ul> <p><i>Project Sources</i></p> <ul style="list-style-type: none"> <li>CO<sub>2</sub> emissions from on-site fossil fuel consumption in support of the project activity.</li> <li>CO<sub>2</sub> emissions from electricity consumption by the project activity</li> <li>CH<sub>4</sub> emissions from uncombusted methane</li> </ul> |
| <b>Definition of Materiality</b> | <ul style="list-style-type: none"> <li>Misstatements of greater than five percent of the Project's GHG assertion. The Project activity generated less than 300,000 tonnes of CO<sub>2</sub>e per year and is therefore falls under the "Project" scale.</li> <li>Qualitative non-conformities with Standards of Verification described below</li> </ul>                                                                                                                                                                                                                                                        |

The following table outlines the guidance and protocols used to conduct this verification:

|                                  |                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Standards of Verification</b> | <ul style="list-style-type: none"> <li>VCS Standard: VCS Version 3, 21 June 2017, v3.7 (VCS Standard)</li> <li>Validated VCS Project Description (VCS PD), November 19, 2009</li> <li>Approved CDM Methodology ACM0001 "Consolidated baseline and monitoring methodology for landfill gas project activities", Version 10</li> </ul> |
| <b>Verification Process</b>      | <ul style="list-style-type: none"> <li>VCS Standard</li> <li>VCS Program Guide, Version 3, 21 June 2017, v3.7</li> <li>ISO 14064-3: Specification with guidance for the validation and verification of greenhouse gas assertions, 2006</li> </ul>                                                                                    |

The Monitoring Report dated 1 April 2019; Version 2.5 titled "*Blue Source Henrico County Landfill Gas Combustion Project*" was also reviewed to inform the verification assessment.

### 1.3 Level of Assurance

First Environment and Blue Source have agreed that a reasonable level of assurance be applied for the Project.

### 1.4 Summary Description of the Project

The Project is located at the Springfield Road Landfill (the Landfill) at 10600 Fords Country Lane (Latitude: 37°40'45", Longitude: 77°33'58"). Henrico County is the owner and operator of the landfill and flare, Ingenco is the owner and operator of the power plant. The Project consists of two stages: (1) expansion of the existing landfill gas collection system and destruction of landfill gas in an open flare; (2) implementation of a beneficial use project by which landfill gas is destroyed in a series of engine-generator units at the Ingenco power facility with a total capacity of four megawatts. These activities result in a net reduction of CO<sub>2</sub>e emissions.

The VCS PD provides additional details regarding the project activity.

## 2 VERIFICATION PROCESS

The verification process consisted of an assessment of the Project's implementation, as described in the Monitoring Report, against the verification criteria described above, as well as an assessment of the GHG emission reduction assertion. Discrepancies between project documentation and the verification criteria were considered material and identified for corrective action. Deviations were evaluated on the basis of the requirements in ACM0001 and the VCS Standard and required appropriate justification from Blue Source.

### 2.1 Method and Criteria

To review the Project's GHG information, the following verification process was used:

- conflict of interest review;
- selection of Audit Team;
- kick-off meeting with Blue Source;
- review of the validated VCS PD;
- development of the verification plan and sampling plan;
- site visit;
- desktop review and evaluation of raw data, calculations, and supporting documentation for the period under review;
- follow-up interaction with Blue Source for corrective action or supplemental data as needed; and
- final statement and report development.

The verification process was utilized to gain an understanding of the Project's GHG emission sources and reductions and to evaluate and verify the collection and handling of data, the calculations that lead to the results, and the means for reporting the associated data and results.

#### ***Conflict of Interest Review***

Prior to beginning any verification project, First Environment conducts an evaluation to identify any potential conflicts of interest associated with the project. No potential conflicts were found for this Project.

#### ***Audit Team***

First Environment's Audit Team consisted of the following individuals who were selected based on their verification experience, as well as familiarity with landfill operations:

Jeff Daley – Lead Verifier  
Luca Nencetti - Verifier  
Jay Wintergreen – Internal Reviewer

### ***Audit Kick-off***

The verification audit was initiated with a kick-off conference call on January 10, 2019 between First Environment and Blue Source. The communication focused on confirming the verification scope, objectives, criteria, schedule, and the data required for the verification.

### ***Project Description Review***

The Audit Team reviewed the VCS PD as a basis for developing the verification plan.

### ***Development of the Verification Plan***

The Audit Team formally documented its verification plan as well as determined the data-sampling plan. The verification plan was developed based on discussion of key elements of the verification process during the kick-off meeting. Blue Source was given the opportunity to comment on key elements of the plan for verification. Based on items discussed and agreed upon with Blue Source, the plan identified the First Environment team members, project level of assurance, materiality threshold, and standards of evaluation and reporting for the verification. It also provided an outline of the verification process and established project deliverables. A separate sampling plan was designed to review all project elements in areas of high risk of inaccuracy or non-conformance.

### ***Site Visit***

First Environment performed a site visit on February 13, 2019. The site visit included interviews with relevant site personnel and project stakeholders; review of the Project's operations; data collection procedures and information management systems; as well as assessments of the Project's controls for sources of potential errors and omissions. The site inspection included a tour of the landfill, all destruction devices, and all associated ancillary equipment (i.e., metering and data recording systems).

### ***Desktop Review***

The Audit Team performed a desktop review of the Monitoring Report, GHG emission reduction assertion, and supporting documentation, as further described in Section 2.2 below.

### ***Corrective Actions and Supplemental Information***

The Audit Team issued requests for supplemental information, corrective action, and clarification during the verification process. The corrective action and clarification requests and the responses provided by Blue Source are summarized in Section 2.5.

### ***Verification Reporting***

Verification reporting documents the verification process and identifies its findings and results. Verification reporting consists of this report and a separate Deed of Representation to be submitted to the VCS Association.

## 2.2 Document Review

During the verification process, First Environment reviewed the Project's Monitoring Report, GHG emission reduction assertion, and supporting documentation for the current verification period to ensure consistency with the VCS Standard, ACM0001, and the VCS PD. Discrepancies between project documentation and the verification criteria were considered material and identified for corrective action. Deviations required appropriate justification from Blue Source. Additionally, First Environment assessed the GHG emission reduction assertion and underlying monitoring data to determine if either contained material or immaterial misstatements. The results of these reviews are discussed in greater detail below.

## 2.3 Interviews

Through the course of verification activities, First Environment interviewed the following project personnel to inform the verification process:

- Will Overly – Blue Source; Vice President of Business Development;
- Sarah Johnson – Blue Source; Director of RNG Projects;
- Don Marickovich – Draper Aden Associates, Senior Design Engineer;
- Sayem Zaman – Draper Aden Associates, Design Engineer;
- Derek Berry - Draper Aden Associates;
- Josh Barley – Henrico County;
- David Moore – Ingenco.

Additionally, VCS representative Christopher Chapman was present to observe site visit activities.

## 2.4 Site Inspections

As described above, a site visit was performed on February 13, 2019 for the current verification process.

## 2.5 Resolution of Findings

The Audit Team issued eleven requests for corrective action and four requests for clarification during the verification process. Blue Source's responses were sufficient to resolve all requests. The corrective action and clarification requests and the responses provided are summarized in the tables found in Appendix A.

### 2.5.1 Forward Action Requests

No forward action requests were issued during the verification process.

## 2.6 Eligibility for Validation Activities

First Environment is accredited to perform validation activities as described in Section 3 below for activities in Sectoral Scope 13 – Waste Handling and Disposal, which is the applicable scope for the approved CDM methodology ACM0001.

## 3 VALIDATION FINDINGS

As described in Sections 3.2 and 3.3 below, one new methodology deviation and six new Project Description deviations were validated during the current reporting period. First Environment reviewed justification for each deviation, including supporting documentation, in order to confirm they were consistent with the underlying methodology and did not negatively impact the conservativeness or

accuracy of the emission reductions. The validation process for the deviations consisted of an assessment of the Project's implementation, as described in the Monitoring Report and from discussions with Blue Source, against the validation criteria. The validation criteria considered in the assessment of any deviations included the approved CDM methodology ACM0001,v10 and the VCS standard.

### 3.1 Participation Under Other GHG Programs

During the verification process, First Environment reviewed written confirmation from Blue Source confirming that GHG emission reduction credits from the Project have not been registered under another GHG program.

First Environment concluded that the Project is eligible to participate under the VCS program.

### 3.2 Methodology Deviations

Section 4.1 identifies methodology deviations previously validated for the Project. One methodology deviation was identified during the current reporting period.

The VCS PD identifies that methane concentration will be measured quarterly or weekly, with the potential of implementing a continuous methane analyzer in the future. During the current reporting period, methane concentration is measured using a continuous methane analyzer. Due to issues with the data logger and analyzer itself, there are several discrete and limited instances throughout the reporting period where methane concentration data contains gaps. As a result, data substitution was applied to the affected methane concentration data to fill the gaps. The substitution method applied is consistent with data substitution guidelines found in the U.S. EPA GHG Reporting Regulation (40 CFR 98.345). In addition, and to ensure conservativeness of the GHG assertion, a five percent discount is applied to all substitute methane concentration values. First Environment approved this deviation because it meets the criteria for permitted methodology deviations. Specifically, this deviation is related to the criteria and procedures pertaining to monitoring or measurement set out in the methodology. The deviation results in a more accurate representation of methane concentration recorded by ensuring that the gaps in methane concentration data are addressed and not overlooked. Additionally, the application of a five percent discount to all substituted methane concentration values ensures that the deviation does not negatively impact the conservativeness of the emission reduction assertion.

### 3.3 Project Description Deviations

The following project description deviations were identified in the Monitoring Report and approved for the Project during prior verifications and remain relevant to the current reporting period:

- The VCS PD identifies in the Schedule Table in Section 7 that verification will occur annually. Verification has not always occurred on an annual basis, and the current reporting period verification is covering a time period of four years.
- The VCS PD states in Section 1.4, page 2 that the Landfill's non-methane organic compound (NMOC) emissions will be assessed annually to ensure that the landfill is not required to install a collection system. While the NMOC emissions rates are reviewed annually, the regulatory requirement dictates a five year assessment/review of the NMOC emissions rates which entails a Tier II sampling and testing event followed by a recalculation of the NMOC emissions.
- Section 4.4 of the VCS PD states that "emission reductions are calculated as the difference between the baseline methane emission rate and project emissions from electricity and fuel consumption at the site." but no equation was given therefore Equation 17 was included in Section 4.4 of the Monitoring Report for clarification.
- The VCS PD identified an incorrect value for the density of methane. The correct methane density has been identified in the Monitoring Report and applied in the emission reduction calculations.

The following new project description deviations are proposed in the Monitoring Report for the current reporting period:

- The global warming potential (GWP) of methane has been updated to the value reported in the IPCC's Fourth Assessment Report. This reflects policies allowed in accordance with the most recent version of the VCS Standard. First Environment approved this deviation because it is consistent with the most recent VCS Standard guidance.
- The VCS PD does not indicate that the Ingenco plant consumes diesel fuel, which is a source of project emissions. Diesel fuel is accounted for in the current emission reduction calculations and is identified in the Monitoring Report for the current reporting period. First Environment approved this deviation because it accurately reflects and accounts for a source of CO<sub>2</sub> emissions from on-site fossil fuel consumption in support of the project activity.
- The VCS PD requires that the flare flow meter, flare thermocouple, and engine flow meter undergo annual calibrations. During the current reporting period, the flare flow meter and flare thermocouple were past due for their respective calibrations in 2018. The engine flow meter was past due for its annual calibration in both 2015 and 2017. This issue has been identified as a deviation in the Monitoring Report. First Environment approved this deviation because each flow meter and the thermocouple were subsequently field checked and calibrated within days after the missed annual calibrations. The as-found and as-left conditions for each flow meter and the thermocouple identified that all of the instruments were operating accurately and well within allowable accuracy specifications. Therefore, the data monitored by each instrument was not adversely affected by the calibration frequency exceedance.
- The VCS PD identified that the standard temperature and pressure settings for the engine flow meter were 68°F and one atmosphere of pressure. During the course of verification activities it was found that the standard temperature setting is actually 60°F. Flows are correctly adjusted in the emission reduction calculations to correspond to the value of methane density applied.
- Methane data that was recorded using a handheld gas analyzer was applied in the emission reduction calculations by calculating the lower bound 95 percent confidence interval of the available data as specified in ACM0001. The calculation of the lower bound 95 percent confidence interval was not specified in the VCS PD. First Environment approved this deviation because the use of non-continuous methane data is allowed per ACM0001.
- The VCS PD identifies that the portable gas analyzer will be field checked prior to each use and calibrated by the manufacturer every six months. It is standard practice by facility personnel to field calibrate the portable analyzer prior to each use. However, these field checks/calibrations were not documented. Additionally, the portable analyzer was not manufacturer calibrated at six month intervals during the 2015 to 2017 period. First Environment approved this deviation because portable methane readings were only relied upon in 2015 and 2018 during limited instances. Additionally, the manufacturer calibrations of the analyzer indicated it was functioning properly. Therefore, First Environment is reasonably assured that the data recorded by the portable analyzer was not adversely affected by the calibration frequency exceedances or lack of documenting the field calibrations prior to use.
- The ECOTEC FAU-TDL continuous gas analyzer is field checked for calibration accuracy monthly throughout the reporting period. The August 1, 2016, September 2, 2016, September 8, 2016, September 19, 2016, and June 6, 2018 field checks identified drift in excess of five percent. The affected methane concentration data is drift corrected based on the drift recorded during the field checks. In instances where the field checks identified the analyzer was under reporting, methane concentration data is used "as is" with no drift correction as this results in greater conservativeness. First Environment approved this deviation because it results in greater accuracy and conservativeness in the final emission reduction assertion.

The project deviations described above did not impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario, and the Project remained in conformance with all other ACM0001 and VCS requirements. In addition, Blue Source provided appropriate descriptions and justifications for all relevant deviations. All project deviations were deemed to be valid.

### 3.4 Grouped Project

Not Applicable – the Project is not a grouped project.

## 4 VERIFICATION FINDINGS

### 4.1 Project Implementation Status

The Project is implemented according to the description provided in the VCS PD, except where noted in Section 3 above, and relative to previously validated deviations identified below. The Project became operational on June 3, 2005. The 10-year Project crediting period began on January 1, 2009 and ends on December 31, 2018. First Environment previously confirmed the Project's start date during validation. Emission reductions are claimed for landfill gas from the expanded gas collection system installed at the Landfill. The Project consists of two stages. Collected eligible landfill gas is destroyed in an open flare (Stage 1), or in a series of engine generators to produce electricity (Stage 2). Additionally, collection and destruction of landfill gas in a pre-existing open flare prior to the Project's start date occurred at the facility. As a result, methane destroyed in the pre-existing gas collection system is accounted for in the emission reduction assertion consistent with the VCS PD.

No data and/or variables presented in the Monitoring Report differ from those stated in the VCS PD, except where noted in Sections 3.2 and 3.3 above or as described below. Similarly, the data collection and recordkeeping procedures were found to be consistent with those outlined in the monitoring plan described by the VCS PD and meet the requirements of ACM0001. The Project has adequate management and operational systems in place with respect to monitoring and reporting, as determined through observation during the site visit and the desktop review of project documentation.

During the verification process, First Environment reviewed written confirmation from Blue Source confirming that GHG emission reduction credits for the current reporting period have not been registered under another GHG program.

The Project activity does not claim emission reduction credits for the displacement of fossil generated electricity. Therefore, no double counting of environmental attributes associated with electricity production and carbon credits has occurred.

The following topics were discussed with project personnel during the site visit:

- the data collection process used to generate reports, and
- internal documents and protocols that set guidelines for the data collection process.

The information gathered during these discussions was used to assess the Project's data management systems and its controls for sources of potential errors and omissions. The primary aspects of the Project's monitoring plan are described below.

The quantity of LFG sent to the flare is continuously measured using a Rosemount Orifice Plate flow meter. The quantity of LFG sent to the engine is continuously measured using a Rosemount Orifice Plate flow meter. All flow data are recorded by the Project's Red Lion data logger every five minutes. Additionally, as a backup, engine totalized engine flow data is recorded daily by Ingenco. Flow data is also uploaded and stored on remote servers by Draper Aden Associates, the County's third-party engineering consultant.

Methane concentration data are recorded by the Project's Red Lion data logger every five minutes. Methane data is also uploaded and stored on remote servers by Draper Aden Associates, the County's third party engineering consultant. Additionally, as a backup, Ingenco takes methane readings with a portable gas analyzer daily.

The flow meters and continuous methane analyzer were calibrated in accordance with the requirements of the VCS PD, except as previously identified. Table 1 below identifies the dates each meter was calibrated:

**TABLE 1: Meter QAQC**

| Meter                                                | Location                                                                  | Dates of Use                                                                                                                                | Calibration Date                                                      | VCS PD calibration frequency                                           |
|------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------|
| Rosemount (s/n: 135079)                              | Flare (LFG flare,y)                                                       | Entire reporting period                                                                                                                     | 12/12/2014;<br>11/23/2015;<br>11/22/2016;<br>11/8/2017;<br>11/14/2018 | Annual                                                                 |
| Rosemount (s/n: 306661)                              | Engine (LFG electricity,y)                                                | Entire reporting period                                                                                                                     | 10/10/2014<br>10/19/2015;<br>10/4/2016;<br>10/25/2017<br>10/7/2018    | Annual                                                                 |
| Thermocouple (K-type)                                | Flare                                                                     | Entire reporting period                                                                                                                     | 12/12/2014<br>11/23/2015;<br>11/22/2016;<br>11/8/2017;<br>11/14/2018  | Annual                                                                 |
| ECOTEC FAU – TDL (s/n: 1037)                         | Header Line (w CH <sub>4</sub> flare,y / w CH <sub>4</sub> electricity,y) | 1/1/2015 - 7/23/2015;<br>8/24/2015 – 9/19/2016;<br>10/20/2016 - 4/12/2018;<br>5/2/2018 - 6/18/2018;<br>7/25/2018 - 12/31/2018               | 12/12/2013;<br>8/19/2015;<br>10/12/2016;<br>4/27/2018                 | 24 Months                                                              |
| Rental Unit: ECOTEC FAU – TDL (s/n: 1002)            | Header Line (w CH <sub>4</sub> flare,y / w CH <sub>4</sub> electricity,y) | 7/23/2015 - 8/24/2015;<br>6/18/2018 - 7/25/2018                                                                                             | 7/20/2015;<br>4/25/2018                                               | 24 Months                                                              |
| Rental Unit: ECOTEC FAU – TDL (s/n: 1006)            | Header Line (w CH <sub>4</sub> flare,y / w CH <sub>4</sub> electricity,y) | 9/19/2016 - 10/20/2016;<br>4/12/2018 - 5/2/2018                                                                                             | 5/2/2016;<br>4/6/2018                                                 | 24 Months                                                              |
| Landtec GEM-2000 Portable Gas Analyzer (s/n:GM12536) | Header Line (w CH <sub>4</sub> flare,y / w CH <sub>4</sub> electricity,y) | 2/17/2015; 3/1/2015 –<br>4/14/2015; 7/15/2015 –<br>7/23/2015; 4/1/2018 –<br>4/11/2018; 8/26/2018 -<br>10/23/2018; 11/6/2018 –<br>12/31/2018 | 10/25/2014;<br>2/20/2017;<br>11/17/2017;<br>4/30/2018;<br>10/11/2018  | Calibrated prior to use, and manufacturer calibrated every six months. |

First Environment reviewed the calibration records for all flow meters identified in Table 1 to confirm that each meter was operating within the five percent accuracy threshold established by the Standard. All flow meters are calibrated in-situ.

In addition to the continuous gas analyzer calibration identified in Table 1 above, the methane analyzer is field checked for calibration accuracy on a monthly basis by facility personnel. First Environment reviewed the results of all third-party calibrations and monthly calibrations, all of which identified the gas analyzer was operating accurately and within the five percent accuracy threshold established by the Standard with the exception of the August 1, 2016, September 2, 2016, September 8, 2016, September 19, 2016, and June 6, 2018 field checks which identified drift in excess of five percent. As discussed in Section 3.3 above, the affected methane concentration data is drift corrected based on the drift recorded during the field checks. In instances where the field checks identified the analyzer was under reporting, methane concentration data is used “as is” with no drift correction as this results in greater conservativeness.

The open flare uses a series of Type K thermocouples to continuously monitor flare temperature as well as a UV sensor to monitor the presence of a flame. The temperature is recorded by the Red Lion data logger every five minutes. The flare is set to operate above a minimum temperature of 400°F. The flare system alarms at 400°F and automatically shuts down the blowers and flare if the temperature drops below 400°F or if the UV eye does not detect a flame. First Environment confirmed that no flow was recorded when the flare temperature was below this threshold.

The operation of the power plant is demonstrated by engine run time recorded every five minutes, and kilowatt production data which monitored continuously and recorded daily by a SCADA system.

The Project imports electricity from the grid. Electricity consumption is monitored using monthly utility invoices. The Project also consumes propane for the flare pilot light system and diesel fuel by the power plant. Propane and diesel usage are determined from purchase invoices.

The data collection and recordkeeping procedures were found to be consistent with those outlined in the monitoring plan described by the PD and meet the requirements of the ACM0001.

The following methodology deviations were previously validated for the Project during the Project’s initial validation:

- The default flare efficiency of the open flare was assigned a value of 98 percent as opposed to the 50 percent default efficiency for open flare as found in the “Tool to determine project emissions from flaring gases containing methane,” Version 1.0. First Environment previously approved this methodology deviation during the validation process because the 98 percent flare efficiency is representative of the typical flare efficiency for an open flare operated under United States (US) Environmental Protection Agency (EPA) 40CFR60.18, as is the case for the project flare. Furthermore, the applied flare efficiency yields a more accurate representation of emission reductions.
- Project emissions resulting from purchased grid electricity are quantified by using a electricity emission factor sourced from the U.S. EPA eGRID database for the sub region in which the Project is located, as opposed to quantifying a grid electricity emission factor by using Tool to calculate the emission factor for an electricity system, or by applying a default electricity emission factor. First Environment previously approved this methodology deviation during the validation process because the U.S. EPA eGRID electricity factor more accurately represents the electricity grid in which the Project activity resides.
- The ex-ante emission reduction estimates were not estimated using the CDM “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site.” Instead, ex-ante emission reductions were estimated by using the US EPA LandGEM Landfill Gas Emissions model, which is the industry accepted standard for developing landfill gas curves in the United States. First Environment previously approved this deviation during the validation process because it does not impact the conservativeness of the future reporting period emission reductions.

The data collection and recordkeeping procedures utilized were found to be consistent with those outlined in the monitoring plan described in the VCS PD and meet the requirements of ACM0001, except where noted above.

The Project contributes to sustainable development objectives by creating energy while preventing the release of methane to the atmosphere.

Overall, the Project is implemented according to the description provided in the VCS PD (except where deviations are noted above), and the monitoring system implemented was found appropriate to the task of obtaining, recording, and compiling the monitored data and parameters.

## 4.2 Accuracy of GHG Emission Reduction and Removal Calculations

Emission reductions are calculated ex-post using the approach indicated in ACM0001 and the VCS PD. First Environment reviewed the emission reduction calculations for the verification period to ensure accuracy in the formulas applied and the raw data and default factors used as inputs. First Environment's review assessed whether emission reductions were free of material misstatement. The formulas were tested and found to be consistent with the calculations described in ACM0001 and the VCS PD.

Landfill gas flow sent to the flare (LFGflare,y), engine (LFGengine,y), and total landfill gas (LFGproject total,y) are measured continuously, and the methane fraction of the landfill gas (WCH4,y) measured by either the continuous gas analyzer or a portable Landtec GEM analyzer, and are used to calculate the total amount of methane destroyed by the Project (MDproject,y).

Landfill gas combusted by the flare (LFGflare,y) is measured continuously, and the methane fraction of the landfill gas (WCH4,y) measured by the continuous or portable gas analyzer are used to calculate the total amount of methane destroyed by the flare (MDflare,y). The total monthly quantities of landfill gas are determined by taking the continuous flow readings and summing them over the reporting period. The flare flow meter automatically corrects flow data to standard conditions of 68°F and 14.70 psi. Flare flow data is adjusted in the emission reduction calculations to standard conditions of 70°F and 14.40 psi. Methane density consistent with the metered flow standard conditions (0.664321412 kg/m<sup>3</sup> at 70°F and 14.70psi) is multiplied by total methane flow to convert the methane destroyed from a volumetric flow to a mass flow. A thermocouple measures flare temperature to ensure methane destruction. Any flow data with associated flare temperatures below 400°F are excluded from emission reduction calculations.

Landfill gas combusted by the engine (LFGengine,y) is measured continuously, and the methane fraction of the landfill gas (WCH4,y) measured by the continuous or portable gas analyzer are used to calculate the total amount of methane destroyed by the engine (MDelectricity,y). The total monthly quantities of landfill gas are determined by taking the continuous flow readings and summing them over the reporting period. The engine flow meter automatically correct flow data to standard conditions of 60°F and 14.70 psi. Engine flow data is adjusted in the emission reduction calculations to standard conditions of 70°F and 14.40 psi. Methane density consistent with the metered flow standard conditions (0.664321412 kg /m<sup>3</sup> at 70°F and 14.70psi) is multiplied by total methane flow to convert the methane destroyed from a volumetric flow to a mass flow.

Project emissions from uncombusted methane during flaring, fossil fuel usage, and grid purchased electricity consumption are deducted from the overall emission reductions created by the Project. Project emissions from uncombusted methane are calculated in accordance with the VCS PD. Project emissions from fossil fuel usage are quantified by multiplying the activity data by the appropriate emission factor. Project emissions from electricity consumption are quantified by multiplying the activity data by the appropriate emission factor and transmission and distribution loss factor.

As required by ACM0001, MDproject is determined by comparing the amount of methane destroyed against the amount of methane generated as calculated by the EPA LandGEM model. For emission year 2016 the quantity of methane generated was the lesser of the two values and was therefore applied in the

baseline emissions quantification. For emissions years 2015, 2017, and 2018, the quantity of methane destroyed was the lesser of the two values and was therefore applied in the baseline emissions quantification. Because landfill gas was collected and destroyed prior to the project activity, this amount of methane destroyed is (MDBL,y) subtracted from baseline emissions in accordance with the VCS PD.

The verification process focused on the evaluation of quantification spreadsheets to ensure that they were consistent with the formulas and equations described in ACM0001 and the VCS PD. Copies of the raw data used in the calculations, including flow and methane concentration data, and utility and other fossil fuel invoices, were compared with the values used in the final calculations and tested for transcription or mathematical errors. The calculations for the entire period were reviewed as well to determine whether they were free of material misstatement. All calculation methods and emission factors used to determine emission reductions were consistent with those outlined in the validated PD.

The Audit Team performed an independent recalculation of the emission reductions from the verification period using the available raw data. Material misstatements were identified for correction by Blue Source as described in Section 2.5.

No material misstatements were observed in the final GHG assertion.

Overall, the GHG emission reductions were quantified correctly in accordance with the VCS PD and the ACM0001 methodology.

### 4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

Blue Source provided adequate documentation for the emission reduction calculations as well as its management systems around the data collection process. Specifically, First Environment was provided a Monitoring Report prepared in accordance with the VCS program template, transparent calculation spreadsheets, calibration records, and data records associated with LFG flow, methane concentration, electricity consumption, and fossil fuel consumption. Data was reviewed beginning from its original source of generation to confirm the accuracy of the information flow.

The evidence provided was consistent with the requirements of ACM0001 and the validated VCS PD and meets generally accepted evidentiary standards for best practice in GHG accounting.

### 4.4 Non-Permanence Risk Analysis

Not applicable.

## 5 SAFEGUARDS

### 5.1 No Net Harm

The Project creates no negative environmental or socio-economic impacts.

### 5.2 Local Stakeholder Consultation

The Project operates in accordance with several permits to ensure protection of the environment. The landfill is owned by a public entity and therefore local stakeholders can submit input at any time to the Landfill Manager or Public Works Department. No ongoing comments or concerns were submitted during the reporting period.

## 6 VERIFICATION CONCLUSION

First Environment was retained to provide verification services for the Project's GHG emission reductions assertion based on the following fundamentals:

- *Level of assurance:* Reasonable assurance.
- *Objectives of verification:* To assure project conformance with the VCS Standard, the CDM methodology ACM0001 and the VCS PD.
- *Verification criteria:* VCS Standard, the CDM methodology ACM0001 and the VCS PD.
- *Definition of materiality:* Misstatements of greater than five percent of the GHG assertion and qualitative non-conformities with the validated VCS PD are considered material.
- *Scope, including:*
  - *Boundaries of the assertion:* Operations at the Springfield Road Landfill, and Ingenco Plant;
  - *The physical infrastructure, facilities, and activities within the assertion:* LFG collection and destruction operations, including the flare located at the Springfield Road Landfill, and engines at the Ingenco Plant; and
  - *GHG sources, sinks, and reservoirs included within the assertion:* Methane and carbon dioxide emission reductions expressed as carbon dioxide-equivalents and carbon dioxide emissions from the operation of project equipment; and.

Based on the assessments performed and the historical evidence collected, First Environment concludes, with a reasonable level of assurance, that the emissions reductions of the Project resulting from the capture and combustion of methane gas are:

- consistent with the VCS PD of November 19, 2009;
- in conformance with the VCS Standard, the CDM methodology ACM0001 (Version 10);
- without material discrepancy; and meeting the minimum level of accuracy of at least 95 percent.

Additionally, the deviations reviewed and approved during the current audit process are consistent with the VCS Standard and ACM0001 methodology, including all validation criteria therein.

Verification period: From 1-January-2015 to 31-December-2018

Verified GHG emission reductions and removals in the above verification period:

| Year         | Baseline emissions or removals (tCO <sub>2</sub> e) | Project emissions or removals (tCO <sub>2</sub> e) | Leakage emissions (tCO <sub>2</sub> e) | Net GHG emission reductions or removals (tCO <sub>2</sub> e) |
|--------------|-----------------------------------------------------|----------------------------------------------------|----------------------------------------|--------------------------------------------------------------|
| 2015         | 57,185                                              | 830                                                | 0                                      | 56,355                                                       |
| 2016         | 90,773                                              | 1,091                                              | 0                                      | 89,682                                                       |
| 2017         | 85,958                                              | 933                                                | 0                                      | 85,025                                                       |
| 2018         | 72,122                                              | 633                                                | 0                                      | 71,489                                                       |
| <b>Total</b> | <b>306,037</b>                                      | <b>3,487</b>                                       | <b>0</b>                               | <b>302,550</b>                                               |

## APPENDIX A: DETAILED RESOLUTION OF FINDINGS

| ID | Corrective Action Request                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Participant Response                                                                                                                                 | Verification Conclusion |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 1  | <p>The following issues were identified in Section 2.2.2 of the Monitoring Report:</p> <ul style="list-style-type: none"> <li>The data substitution deviation is incorrectly identified as a project description deviation. Additionally, please further justify this deviation and clarify the regulations from which the data substitution procedure is adopted.</li> <li>The Methane Density deviation does not identify any units of measurement. Additionally, in Section 3.1, the "Value of data applied" row does not identify any units of measurement for methane density.</li> <li>The verification schedule deviation contains outdated information.</li> </ul> | The Monitoring Report has been revised to address each of the identified issues.                                                                     | Response is acceptable. |
| 2  | <p>The following Monitoring Report issues were identified:</p> <ul style="list-style-type: none"> <li>Section 3.1 does not identify contact information for Ingenco.</li> <li>Section 2.1 contains outdated information that is not relevant to the current reporting period.</li> <li>Section 2.4 is missing, and subsequent sub-sections are mislabeled.</li> <li>Section 3.2, the LFG total parameter box contains several empty rows.</li> <li>Section 3.3 "Monitoring Plan" does not identify procedures used for handling any internal auditing performed and any non-conformities.</li> </ul>                                                                       | The Monitoring Report has been revised to address each of the identified issues.                                                                     | Response is acceptable. |
| 3  | The Monitoring Report does not identify and justify the use of the IPCC's Fourth Assessment Report GWP for methane as a project description deviation as required per the VCS Standard v3.7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | The use of IPCC's Fourth Assessment Report GWP values has been identified and justified in the Monitoring Report as a project description deviation. | Response is acceptable. |
| 4  | There are several instances throughout the reporting period where methane data substitution is being applied to what appears to be valid methane data (for example, see: October 5, 2016 at 10:45am).                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The data analysis has been revised to address this issue.                                                                                            | Response is acceptable. |
| 5  | Methane data applied in the flow calculations for the month of August 2015 is inconsistent with the raw data records provided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The August 2015 data analysis has been revised and is now consistent with the raw data records provided.                                             | Response is acceptable. |

| ID | Corrective Action Request                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Participant Response                                                                                                                                                                                                                                                                                                 | Verification Conclusion |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 6  | The consumption of diesel fuel by the Ingenco plant is not identified in the Monitoring Report as a project description deviation.                                                                                                                                                                                                                                                                                                                                                       | The use of diesel fuel by the Ingenco plant has been identified and justified in the Monitoring Report as a project description deviation.                                                                                                                                                                           | Response is acceptable. |
| 7  | The EcoTec FAU-TDL analyzer (s/n: 1037) was due for manufacturer calibration in October 2018. No manufacturer calibration records have been provided to demonstrate calibration occurred in 2018.                                                                                                                                                                                                                                                                                        | The EcoTec FAU-TDL analyzer was calibrated by the manufacturer on April 27, 2018 which is within the two-year calibration frequency identified in the Project Description. A copy of the calibration certificate has been provided for review.                                                                       | Response is acceptable. |
| 8  | The monthly flare skid field checks identified that the continuous methane analyzer as found drift conditions were in excess of ten percent on the following dates: 8/1/2016; 9/2/2016; 9/8/2016; 9/19/2016; 6/6/2018.                                                                                                                                                                                                                                                                   | The emission reduction calculations have been revised to apply the appropriate drift corrections. Additionally, this issue has been identified as a project description deviation.                                                                                                                                   | Response is acceptable. |
| 9  | In 2018, the flare flow meter (s/n 135079) was in use past the annual calibration frequency identified in the Project Description. Additionally, in 2018, the flare thermocouple was past due for its annual calibration.                                                                                                                                                                                                                                                                | Section 2.2.2 of the Monitoring Report has been revised to identify the missed annual calibrations as a project description deviation.                                                                                                                                                                               | Response is acceptable. |
| 10 | In 2015, and 2017, the engine flow meter (s/n 306661) was in use past the annual calibration frequency identified in the Project Description.                                                                                                                                                                                                                                                                                                                                            | Section 2.2.2 of the Monitoring Report has been revised to identify the missed annual calibrations as a project description deviation.                                                                                                                                                                               | Response is acceptable. |
| 11 | Relevant to the determination of methane destroyed by the project ( $MD_{project,y}$ ), the sum of the total amount of methane destroyed by each destruction device and the projections of methane generated ( $MG_{PR,y}$ ) are not being compared consistently, and the results of this comparison are not being applied in the emission reduction calculations. Additionally, Section 3.2 of the Monitoring Report does not identify the methane generated parameter ( $MG_{PR,y}$ ). | The comparison of the sum of the total amount of methane destroyed by each destruction device and the projections of methane generated ( $MG_{PR,y}$ ) has been revised. Additionally, Section 3.2 of the Monitoring Report has been revised and now identifies the parameter for methane generated ( $MG_{PR,y}$ ). | Response is acceptable. |

| ID | Clarification Request                                                                                                                                                                                                                                                                                                                                           | Participant Response                                                                                                                                                                                                                                                                              | Verification Conclusion                                                                                                                                                                          |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Please clarify (and provide documentation to demonstrate) the standard temperature and pressure settings of both the flare and engine flow meter.                                                                                                                                                                                                               | Evidence has been provided to demonstrate that the flare flow meter standard conditions are 68°F and 1Atm. The engine flow meter calculation data sheet has been provided which identifies that the engine flow meter standard conditions are 60°F and 1Atm.                                      | Response is acceptable.                                                                                                                                                                          |
| 2  | There are instances where both methane concentration and engine flow are identified in the data analysis as being provided from Ingenco. Please clarify the source of this data (i.e. which meters this data is coming from), and provide the associated raw data files (for example see, July 15, 2015 at 16:00 for methane, and March - April 2015 for flow). | The alternate data applied is sourced from Ingenco data records which record project data from the same metering instruments as the primary data source. Additionally, the Ingenco data records include a daily portable gas analyzer reading which is recorded near the continuous gas analyzer. | Response is acceptable.<br><br>First Environment verified the Ingenco data records and confirmed that data was applied in the calculations according to the VCS PD and Methodology requirements. |
| 3  | Please clarify the source of, and provide documentation to demonstrate, the diesel emission factor.                                                                                                                                                                                                                                                             | Evidence has been provided to support the diesel emission factor applied and identifying the source of data.                                                                                                                                                                                      | Response is acceptable.                                                                                                                                                                          |
| 4  | Please clarify why the baseline destruction discount (MD <sub>BL</sub> ) values that are applied in the emission reduction calculations are different from the values identified in the validated Project Description.                                                                                                                                          | The baseline destruction discount (MD <sub>BL</sub> ) value that is applied in the emission reduction calculations is different than the value identified in the VCS PD because the density of methane has been revised and updated from the original value identified in the VCS PD.             | Response is acceptable.                                                                                                                                                                          |