

PERRY JOHNSON REGISTRARS



Carbon Emissions Services, Inc.

**Verification Report for
Hancock County Landfill Gas Collection Project
CAR#635
TerraPass, Inc.**

Climate Action Reserve

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1. Introduction

PJRCES was commissioned by TerraPass, Inc. to undertake the initial project verification of the Hancock County Landfill Gas Collection Project (The project). The project consisted of the collection of landfill gas (LFG) from the Hancock County Sanitary Landfill located in Hancock County, Ohio and subsequent destruction through combustion in an open candlestick flare. This report covers the verification period of June 29, 2010 to June 30, 2011 as a project deliverable into the Climate Action Reserve.

2. Objectives

The goal of the verification was to determine with reasonable assurance the project conformance with verification criteria as defined by Climate Action Reserve protocols, to ensure the data reported is accurate, complete, consistent, transparent, and free of material errors or omissions, and to assess the likelihood that the project has resulted in GHG emissions reductions as stated in the supporting documentation.

3. Scope

The scope of the engagement included project eligibility, quantification, monitoring, and reporting of greenhouse gas project emission reductions associated with the operation of a flare at the Hancock County Landfill from June 29, 2010 to June 30, 2011.

4. Criteria

Standard of Verification	CAR Landfill Project Reporting Protocol Version 3.0 (December 2, 2009) Errata and Clarification for LPP Ver. 3.0 (October 26, 2011) CAR Program Manual (October 26, 2011)
Verification Process	CAR Verification Program Manual (December 20, 2010) ISO 14064-3:2006
Level of Assurance	Reasonable
Materiality	Quantitative misstatements greater than 1% and non-conformances with the requirements of the Landfill Protocol will be considered material.

5. Verification Process

5.1 Summary Overview

The verification process consisted of the following:

1. Project listed with the Climate Action Reserve:

The Hancock County Landfill Gas Project was listed on the Climate Action Reserve (CAR) website. TerraPass, Inc. selected PJRCES as their verification body.

2. Conflict of Interest Review.

A conflict of interest and notification of verification activities was submitted to CAR. The COI assessment was conducted to identify any potential conflict of interests with the verification/project. No conflicts were identified and a determination of low potential for conflict of interest was received from the Climate Action Reserve on October 4, 2011, prior to the commencement of verification activities.

3. Introductory Meeting:

A kick off meeting was conducted between the verification team and TerraPass, Inc. on October 6, 2011. The purpose of the kick off meeting was to introduce the verification team, review the verification process and timeline of audit; confirm verification criteria; determine the site visit date, and to initiate documentation transfer.

4. Desk Review



PJRCES received and reviewed the Project document/ monitoring plan, CAR submittals, and supporting documentation to assess initial conformance with the data requirements of the CAR Landfill Project Protocol. A risk assessment was conducted to identify key factors that impact the reported emission reductions and removals. A Verification Plan was created to focus on the critical elements presenting potential risk for errors with the project. The verification plan with an audit agenda was submitted prior to the site visit.

5. Site Visit

Following the desk review, the verifiers conducted an on-site audit of the project area on October 18, 2011. The purpose of the site visit was to verify the project equipment, location and eligibility, to review and evaluate the project GHG management systems, data collection and handling, emission reduction calculations, and to finalize the risk assessment and sampling plan.

6. Quantitative Review

An assessment of the emission reduction calculation inputs and procedures was performed to review the quantitative analyses undertaken by the Project Developer to convert the raw inventory data into emission reduction estimates.

7. Findings

Throughout the verification, there was an iterative exchange between PJRCES and the Project Developer to gather additional information for review and examination. This exchange included Findings—New Information Requests (NIR), Corrective Action Requests (CARS)/Non-Conformity Reports (NCR) and Opportunities for Improvement (OFI)—that were issued by PJRCES to the Project Developer. The Project Developer responded to all NIRs and CARS/NCRs and subsequently all issues were closed by PJRCES.

8. Final Report and Opinion

A draft report was presented to an internal PJRCES Technical Reviewer who determined the Verification Opinion to be justified given the evidence presented. Once completed, the Verification Report and Verification Opinion were presented to TerraPass, Inc. for approval and subsequent submittal to the Climate Action Reserve.

9. Exit meeting with client:

An exit meeting was held to review the verification process, provide a summary of the verification findings and to initiate scheduling for the next verification period.

6. Verification Team

The Verification Team consisted of the following individuals, who were selected based on their experience, knowledge, and competency in the Landfill Gas sector.

Team Leader: Tina Sentner

Technical Reviewer: Mike DeBusschere

7. Verification Findings

7.1 Project Description

The Project collected landfill gas (LFG) from the Hancock County Sanitary Landfill and destroyed it via combustion through an open candlestick flare. The Project was located in Hancock County, Ohio. The landfill is an active solid waste sanitary landfill owned and operated by Hancock County. The landfill began accepting wastes in 1969 and consists of approximately 52 acres. Final closure of the landfill is estimated to take place in 2036. The Gas Collection and Conveyance System consist of approximately 89 wellheads. The gas from the wellheads was routed via a main header line into the flare skid. The landfill gas was pulled by a blower and passed through a knockout vessel to remove moisture prior to passing through the flow meter in route to the candlestick flare.



7.2 Project Eligibility

There are three eligibility rules the project must meet in order to register reductions with the Climate Action Reserve.

Location:

The Project is a US based landfill located in Hancock County, Ohio, USA and therefore meets the location eligibility requirement.

Project Start Date:

The project start date was verified as June 29, 2010, the day the open flare became operational. TerraPass, Inc. provided various documents to support the evidence of construction of the landfill gas project such as the invoice for the flare purchase, third party construction reports for the installation of the well field, initial data logger reports and a start up service order from SHAW LFG Specialties for the installation of the flare skid. PJRCES concluded from these documents the project start date of June 29, 2010.

Project Crediting Period:

The Project ten-year crediting period is June 29, 2010 to June 28, 2020. It is important to note the Hancock County Landfill Gas Collection Project is claiming credits starting July 1, 2010 when the project began recording continuous monitoring data. This is reflected in the various attestations for the verification period. PJRCES has confirmed the reporting period has been accurately reported to the Reserve software.

7.3 Additionality

Legal Requirement Test

PJRCES reviewed the Attestation of Voluntary Implementation, signed on October 26, 2011 by an eligible signatory to attest for the project. TerraPass, Inc. has affirmed that the Project was established and implemented voluntarily and continues to operate as such. PJRCES reviewed the Solid Waste Permit, Title V Permit and Flare Permit letter from the Ohio Environmental Protection Agency dated November 9, 2009. Based on our review, PJRCES found no evidence of legal requirements to collect and destroy methane at the Hancock County Sanitary Landfill.

The Hancock County Sanitary Landfill is subject to NSPS regulation requiring the facility to conduct Non-Methane Organic Compound (NMOC) emission rate testing. The most recent Tier II NMOC Emission Rate Report for the landfill was conducted on April 23, 2010 with a result of 26 Mg/yr NMOC. The test results indicate that the Landfill is not expected to reach an NMOC level of 50 MG/year until beyond the project crediting period.

Lastly, PJRCES verified the Project had developed a procedure in the monitoring plan to ascertain and demonstrate that the project passes the legal requirements test at all times. Based on the evidence provided above, PJRCES concluded that the project passed the Legal Requirement Test for the report period.

Performance Standard Test

PJRCES determined during the site visit that the Hancock County Sanitary Landfill had not collected and destroyed any landfill gas prior to the implementation of the Project. Interviews with the site environmental manager confirmed there were no solar flares devices connected to the leachate riser system or previous qualifying destruction devices installed onsite. PJRCES did not observe evidence of



a solar flare or pre-existing destruction devices or identify pre-existing destruction devices on historical project drawings. In addition, PJRCES reviewed the Solid Waste Permit and the Title V Permit for the landfill and no evidence of a pre-existing destruction device was observed or required of the site. Therefore PJRCES concludes the project proponent meets the performance standard threshold under option 1: "Installation of a landfill gas collection system and a new qualifying destruction device at an eligible landfill where landfill gas has never been collected and destroyed prior to the project start date."

Regulatory Compliance

PJRCES reviewed the Attestation of Regulatory Compliance signed by the CEO of TerraPass Inc. dated October 26, 2011 affirming the project's compliance status throughout the project reporting period. A regulatory review of the Hancock County Sanitary Landfill was conducted by the project proponent. The results of the regulatory review indicated the landfill was in compliance with Federal, State and Local regulations and that there are no laws, statutes, regulations, court orders, environmental mitigation agreements, permitting conditions, or other legally binding mandates requiring the destruction of landfill gas. During the site visit and desk review activities, PJRCES reviewed the regulatory review of the Hancock County Sanitary Landfill conducted by the project proponent. In addition, PJRCES interviewed the landfill and project managers regarding legal and regulatory compliance tracking systems and reviewed recent inspections for the landfill. From a sample of inspections reports reviewed over the reporting period of the project, there was no material notices of violations observed. In addition, the Project's monitoring plan was observed to contain procedures for maintaining and monitoring ongoing legal and regulatory compliance. From this evidence, PJRCES concluded that the Project and the Hancock County Sanitary Landfill were in material compliance with applicable laws and regulations during the reporting period.

Ownership

Hancock County owns Hancock County Sanitary Landfill. Evidence of ownership was observed through various regulatory permits issued by the Ohio Environmental Protection Agency. Hancock County assigned the title of the emission reduction credits to Granger Electric who is the owner of the project equipment. Granger Electric sold the rights to the emission reduction credits for the project to TerraPass Inc. PJRCES reviewed the agreement between Hancock County Landfill and Granger Electric for the assignment of emission reduction credits, and further the sales contract between Granger Electric and TerraPass, Inc. for the rights to the emission reduction credits. PJRCES also reviewed the Attestation of Title dated October 3, 2011 concerning ownership of landfill gas emission reduction credits for the period June 29, 2010 to June 30, 2011. This document asserts that the project developer had legal rights to any emission reduction credits to be issued by the Climate Action Reserve. From this evidence, PJRCES has concluded that the project developer, TerraPass Inc. is entitled to receive the emission reduction credits that may be issued by the Climate Action Reserve for methane destroyed during the project period.

7.4 The GHG Assessment Boundary

The project includes all emission sources from the operation of the landfill gas collection system to the ultimate destruction of the landfill gas. The sources of GHG emissions reviewed include:

The GHG sources, sinks, and reservoirs associated with the baseline scenario are:

- CH₄ vented to the atmosphere.
- CO₂ from the oxidation of CH₄ by soil bacteria. As the landfill is not covered with a synthetic liner, the CAR Landfill Project Reporting Protocol assumption that 10 percent of the methane produced would be naturally oxidized by soil bacteria has been applied.

The GHG sources, sinks, and reservoirs associated with the project are:



- CH₄ from incomplete combustion of Landfill gas in the flare.
- CO₂ from the combustion of fossil fuels used during operation and maintenance activities for the project activity.
- CO₂ resulting from the consumption of imported electricity.

The gases reviewed include CO₂, CH₄. All gases are converted to CO₂ equivalents.

7.5 *Review of Project GHG Management Systems*

During the site visit, a review of project greenhouse gas management systems was reviewed with the project proponent. This review included a detailed look at the project data handling and processing procedures, recordkeeping and data storage, and review of the quality control and assurance procedures.

The primary data gathered for the project is landfill gas flow, pressure, temperature and methane content of the landfill gas. During the reporting period of the project, three Fluid Components Intl (FCI) thermal mass flow meters were used in rotation to continuously monitor flow after the blower and a knockout prior to combustion in to the destruction device. The FCI Thermal Instrument measurement device automatically adjusts to compensate for the temperature and pressure of the gas stream and was configured originally to measure flow at 70 deg F and 1 ATM. In February of 2011, the flow meter in rotation was factory configured to measure flow at 60 deg F and 1 ATM. The position of the flow meter was observed adequate to ensure laminar flow. The flow meters were all factory calibrated prior to installation. The flow meter instruments were rotationally removed for calibration by a certified third party on a quarterly basis and confirmed that the flow meter readings were within a $\pm 5\%$ margin of error. The instruments were also observed to be quarterly cleaned and inspected in the field with the activities performed and as found/as left condition of the equipment documented. In addition, the gas flow meter was confirmed to be field checked for calibration accuracy at the end of – but no more than two months prior to – the end date of the reporting period. Based on the calibration, inspection and cleaning results for this verification period, PJRCES concludes the instruments were reporting accurate data.

Methane concentration is measured continuously with a Siemens Ultramat 23 methane concentration analyzer. Evidence of the Siemens Ultramat 23 instrument factory calibrated was observed. The Ultramat 23 was quarterly inspected, cleaned, and field checked by a third party and found to be within tolerance thresholds. In addition, self-calibration checks to a cylinder of mixed nitrogen, carbon dioxide, and methane were performed automatically on a daily basis. Calibration procedures and logs for the flow meter and gas analyzer demonstrated consistency with the requirements of the Protocol calibration requirements

Temperature and hours of operation are continuously monitored via two thermocouples mounted within the shroud of the candlestick flare; one for the pilot and one for the flare temperature. The flare operations are monitored by a UV sensor which will automatically alert three separate individuals via phone if the flare system goes down. It will automatically initiate a re-start of the system three times and if unsuccessful, the system will shutdown automatically eliminating flow to the flare if the flame is extinguished. .

Raw data from the FCI Thermal Mass flow meter instrument, temperature thermocouples and gas analyzer were continuously collected every 4 minutes automatically onsite by a Yokogawa data acquisition device. Once a week, raw data is downloaded from the Yokogawa recorder by a third party consultant. The raw data is sent to the TerraPass, Inc. and Granger Electric for recordkeeping retention and emission reduction calculations. Data is generally stored indefinitely by both companies; however



at a minimum the data is stored for a period of 10 years after the information is generated or 7 years after the last verification.

A project design document and monitoring plan have been created for the project. The contents of monitoring plan were thoroughly reviewed and observed to meet the requirements of the Landfill Gas Protocol. The monitoring plan records are kept for a minimum of ten years when the information is first generated or seven years after the last verification.

7.6 *Review of Emission Reduction Calculations*

PJRCES verified the calculated project emission reductions on a sampling basis from information derived from the Yokogawa data acquisition device for the reporting period. The verification team reviewed a sample of data downloaded and compared it to data supplied in excel spreadsheets for the two vintage years. PJRCES verified data for completeness, scanned the data for data gaps and for out-of-range values, reviewed spreadsheet formulas for consistency with protocol equations, and recalculated emission reductions. The verification team also verified the correct calculation of project emissions based upon evidence of fossil fuel consumption, and indirect CO₂ emissions from the use of electricity from the grid. The Project emission reductions were calculated per the formula defined in the Climate Action Reserve Landfill Gas Protocol. The main parameters of formula 5.2 were verified as follows

Total annual methane emissions destroyed by the project landfill gas collection and destruction system (CH₄ Dest_{PR})

The amount of methane destroyed is calculated from the continuously metered landfill gas flow and methane concentration data. For the verification period, data was aggregated on intervals of 4 minutes and totaled on a daily basis for the purpose of the calculations of emissions reductions. The main monitored parameters needed to calculate the amount of methane destroyed are:

LFG_{i,t} = total quantity of landfill gas fed to the destruction device and
 PR_{CH₄ i,t} = the average methane fraction of the landfill gas in time interval t as measured

For the verification period, destruction data was calculated on time interval t=daily. Incremental flare flow is voided if for any given 4 minute period the flare temperature is below the threshold temperature of 500 deg F. Total destroyed methane is carried forward into further calculations for the flare to determine emission reductions for the project.

Adjustment for landfill gas flow metering equipment for temperature and pressure

The project was required to correct for the temperature and pressure of the landfill gas as the FCI flow meters corrected to 70 degrees and 1 atmosphere of pressure. On February 16, 2011, the FCI flow meter installed corrected flow to 60 degrees and 1 atmosphere.

Default methane destruction efficiency for device (DE_i)

The value applied was 0.960 for Open flares, as prescribed by the protocol. The project developer has taken an approach of applying a 500 deg F temperature minimum to emission reduction calculations to ensure 96% destruction efficiency of the flare.

Factor for the oxidation of methane by soil bacteria (OX)

The project does not incorporate a synthetic liner in its cover system; therefore a 10% methane soil oxidation factor was applied to the baseline scenario.



Discount factor to account for uncertainties associated with the project monitoring equipment (DF)

There was no discount factor applied to the total quantity of methane collected and destroyed for the period.

Adjustment to account for pre-project LFG destruction device ($PRE_{discount}$)

An adjustment to the project baseline was not necessary because there was no pre-project destruction device.

Total annual indirect carbon dioxide emissions from the consumption of electricity from the grid (EL_{CO_2}) and total annual carbon dioxide emissions from the destruction of fossil fuel (FF_{CO_2})

CO₂ emissions resulting from consumption of electricity to power project equipment and activity data for this source was tracked by reviewing utility invoices from the power supplier. Direct CO₂ emissions resulted from propane used to assist the ignition of the flare. This activity data was taken from purchase invoices and estimates from propane used. The Emission Factors for electricity and propane were verified.

Missing Data Procedures

Missing Data calculation procedures were reviewed for consistency with the Landfill Gas Protocol requirements as part of this verification. Missing Data procedures were applied in two instances in this report period.

7.7 Corrective Action Requests

All requests for corrective action raised by PJRCES during this reporting period were addressed to PJRCES satisfaction and closed. These findings are detailed in our Summary of Findings, a private document.

7.8 Approved Variances or Deviations

No variances were requested or deviations approved for the Project.

8. Verification Results

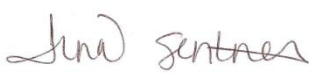
Based on the verification activities described above, the verification team has concluded that the project has achieved the following emission reductions:

Reductions/Removals during the current reporting period in Metric tons CO₂-e	June 29, 2010 to December 31, 2010	January 1, 2011 to June 30, 2011
Landfill gas destroyed	51,025	54,737
- Project emissions	75	82
= Net project emission reductions/removals	50,950	54,655

Note: The project start date is listed as June 29, 2010. There were no emission reductions eligible from June 29 through June 30 of 2010.



9. Verification Conclusions and Opinion

Project Developer Name and address:	TerraPass, Inc. 527 Howard Street, 4th Floor San Francisco, CA 94105
Project Name	The Hancock County Landfill Gas Collection Project
Project Location	Hancock County Sanitary Landfill 10400 Township Road 107, Findlay, Hancock County, OH 45840 USA
Total GHG emissions verified	June 29 to Dec. 31, 2010= 50,950 metric tonnes [CO ₂ e] January 1 to June 30, 2011= 54,655 metric tonnes [CO ₂ e]
GHG protocol(s) used for Verification	Climate Action Reserve's • Landfill Project Protocol, Ver. 3.0 (December, 2009), • Landfill Project Protocol Version 3.0, Errata And Clarifications (October 26, 2011) • CAR Program Manual (October 26, 2011) • Verification Program Manual (December 20, 2010)
Verification opinion with regard to data quality and materiality	The data are considered to be complete, transparent and free of material error or omission.
Verification Period	The emissions have been calculated from data collected during the period: June 29, 2010 to June 30, 2011
Date of verification	The Verification Statement is to be dated when the technical reviewer accepts the recommendation to issue the statement.
Dated and signed on behalf of the verification body by authorized signatory	 Tina Sentner; November 17, 2011
Dated and signed on behalf of the verification body Technical Reviewer	 Mike DeBusschere, November 23, 2011