



Verification Report for

Bi-County Landfill Gas
Destruction Project
Woodlawn, Tennessee
USA

Climate Action Reserve
Project ID CAR790

08 May 2018

Report Prepared for

Bi-County Gas Producers, LLC
10600 Nations Ford Road, Suite 150
Charlotte, North Carolina 28273

Report Prepared by

NSF International
789 N. Dixboro Road
Ann Arbor, MI 48105
USA

Summary

Bi-County Gas Producers, LLC (BCGP) engaged NSF International (NSF) to verify its methane emission reductions from the Bi-County Landfill to the Climate Action Reserve for the reporting period of 1 January through 31 December 2017.

The Bi-County Landfill is a municipal landfill as described by NAICS code 562212. The “Bi-County Landfill Gas Destruction Project” (the Project or BGDG) is listed in the Reserve’s database with the identification number CAR790. The BGDG’s methane emission reductions during the project reporting period resulted from the collection and destruction of landfill gas in an electric generation power plant and an open flare at the Bi-County Solid Waste Authority landfill facility located at 3212 Dover Road, Woodlawn, Tennessee 37191. The Project reduced emissions into the atmosphere by 61,562 metric tons CO₂-e for 2017.

1. Introduction

1.1 Objective

The objective of this verification audit was to determine, with reasonable assurance, that BGDG had met eligibility requirements and had quantified, monitored, and fairly reported to the Climate Action Reserve its landfill gas emission reductions at the Bi-County landfill in accordance with all applicable requirements of the Climate Action Reserve Landfill Project Protocol, version 3.0, December 2, 2009.

1.2 Scope

The scope of the engagement included verification of the quantification, monitoring and reporting of greenhouse gas emission reductions from the project at the Bi-County landfill for the reporting period of 1 January through 31 December 2017. The scope included verification of the calculated project emissions associated with emissions connected to the combustion of fossil fuel in an electricity-generation plant and in a single flare; and indirect emissions attributed to electricity consumption from project-related activities and propane use. Finally, the scope of this verification covered a review of all eligibility rules for this project per the requirements in the CAR Landfill Project Protocol.

1.3 Criteria

BGDG implemented its methane reduction in accordance with the requirements of the Climate Action Reserve’s Landfill Project Protocol, Version 3.0 (December 2, 2009), Errata and Clarifications, Version 3.0 dated June 18, 2015 and the Climate Action Reserve Program Manual, (September 1, 2015). NSF conducted its verification of the reported emission reductions in accordance with the Climate Action Reserve Verification Program Manual (February 8, 2017), and ISO 14064:2006 Part 3, Greenhouse gases – Specification with guidance for the validation and verification of greenhouse gas assertions.

1.4 Materiality

In accordance with the Climate Action Reserve Verification Program Manual, emission reduction reports were considered fairly stated if they varied by no more than 3% from a complete statement of the project’s methane emission reductions for projects registering more than 25,000 Climate Reserve Tons (CRTs) but less than 100,000 CRTs in a 12 month period. In addition, qualitative misstatements, where the emission reduction project implementation does not conform to the requirements of the CAR program and protocols were also considered material. For this reporting period, emission reductions were demonstrated for a 12-month period to determine the appropriate materiality threshold of 3%.

1.5 Level of Assurance

This engagement was performed at the reasonable level of assurance.

2. Verification Approach

1.1 Team Appointment and COI Review

This verification was performed by Michael DeBusschere, P.E., NSF Lead Verifier and reviewed by Tina Sentner, NSF Senior Internal Reviewer. Conflict of Interest inquiries were completed for NSF, the Lead Verifier and the Senior Internal Reviewer. A finding of low COI risk was confirmed by the Climate Action Reserve.

1.2 Document Review

The Lead Verifier conducted a document review to inform the planning process in advance of performing onsite verification activities. Documents reviewed included project documentation submitted to the Climate Action Reserve and documentation prepared for BGDG by the project developer, including the following:

- Project design document
- Project monitoring plan
- Summary Excel emission reduction calculation spreadsheets
- Data logger raw data output to Excel spreadsheets
- Project emissions data (electricity invoices, natural gas & propane use)
- Meter calibration records for flow meters and methane analyzer
- Monitoring and Reporting Procedures used for monitoring/calculations/reporting
- Evidence of project start date
- Regulatory reviews/ audits, Relative Permits associated with project equipment and landfill
- CAR Landfill Project Submittal Form
- The quantity of CRTs the project is claiming for the reporting period
- Project Developer's Attestation of Title
- Project Developer's Attestation of Voluntary Implementation for the reporting period
- Project Developer's Attestation of Regulatory Compliance for the reporting period
- Project Design diagram as required in the CAR Policy memo dated February 13, 2012

1.3 Planning

NSF's verification approach is risk-based. It draws upon our understanding of risks to fair statement of reported emissions and the operation of controls to reduce such risks. As a result of the document review and preliminary conversations with developer personnel a verification plan and a sampling plan were developed for this engagement.

1.4 Verification Activities

NSF conducted a site visit of the BGDG's collection and destruction operation in Woodlawn, Tennessee on February 15, 2018. The purpose of the site visit was to confirm the project equipment and collection system associated with two electric generation engines and an open flare and assesses the capability of BGDG's management system and procedures to produce accurate, reliable, and reproducible data and information from project activities. In addition to a site visit, verification activities included a desk review and phone interviews. The nature of verification activities conducted included:

- Confirmation of continuing eligibility, ownership of the project, and quantification of project emission reductions in accordance with the Climate Action Reserve Landfill Project Protocol Version 3.0;
- Verification of evidence presented by BGDG to demonstrate its knowledge of and assertion of compliance with applicable air, waste and water regulations;
- Verification of applicable methane and carbon dioxide emission sources within the project boundary and their quantification as defined by the Climate Action Reserve Landfill Project Protocol Version 3.0;
- Verification of BGDG's monitoring of key operational parameters of its landfill gas collection and destruction project;
- Determination BGDG's conformity in all material respects with the requirements of the Climate Action Reserve Landfill Project Protocol Version 3.0;
- Selecting locations and processes within the scope of BGDG's landfill gas project to visit based upon an assessment of risks to fair reporting; and
- Reviewing the basis for and results achieved from the calculated methane emission reductions from its landfill gas collection and destruction project.

3. Verification Findings

3.1 Project Description

Bi-County manages a closed municipal solid waste facility in Woodlawn, Tennessee. During the project reporting period covered by this report, landfill gas was collected and routed for combustion to two Caterpillar engine sets and a single open flare located at the landfill by the Project.

BGDG is equipped with a condensate knockout pot, instrumentation and controls including thermocouple at the flare tip, Endress & Hauser Deltabar pressure differential measurement devices, a data logger, a Siemens Ultramat 23 methane analyzer and two back up portable hand held gas analyzers. The LFG engines are Caterpillar 3520C and 3516+ engine generator sets, with a nameplate capacity of approximately 3.0 MWh. The landfill is not considered a bioreactor, is not fully capped, and only recirculates leachate as needed.

3.2 Eligibility

NSF considered evidence to establish the eligibility of the Project under the Landfill Project Protocol Version 3.0. The project continues to meet the eligibility requirements.

Location: The project is located within the United States of America in Woodlawn, Tennessee. The location was confirmed after the first BCDP reporting period and again by a site visit by NSF on February 15, 2018.

Project Start Date: The project start date was listed as October 7, 2010, the day the open flare became operational. The start date was previously verified in the first reporting period in 2011 and re-reviewed during the site visit. BCDG provided various documents to support the evidence of construction of the landfill gas project such as the third party construction reports for the installation of the gas collection and conveyance system, the BCDP design drawings, and a start up service order for the installation of the flare skid. NSF concluded these documents confirmed the project start date of October 7, 2010. In late 2011 and again in late 2013 engine sets were added to the site for purposes of generating electricity from landfill gas destruction. Flare and engine start

date documentation included letters of source start up to the Tennessee Department of Environment and Conservation (TDEC).

Crediting Period: The crediting period for landfill projects is 10 years from the project start date. The crediting period for BGDG extends to October 6, 2020. NSF has concluded that the reporting period verified in this report is within this first crediting period of the Project.

3.3 Additionality

Legal Requirement Test: During the site visit, BCGP affirmed that the project continued to be implemented voluntarily. The Bi-County Landfill design mass of 2.45 MT does not exceed 2.5 million MT of Municipal Solid Waste and was therefore, not subject to NSPS regulation requiring the facility to conduct Non-Methane Organic Compound (NMOC) emission rate testing. However, Tier II testing has been performed and the NMOC Emission Rate Report for Bi-County Landfill was published on April 2012 with a 2017 result of 28.9 Mg/yr NMOC. In addition, NSF reviewed the Solid Waste Permit, Title V Permit exemption, and the engine sets and flare registrations from the TDEC. There was no evidence observed requiring a mandatory installation of a gas collection and conveyance system. NSF reviewed the legal and regulatory review of the Bi-County Landfill as conducted by the project proponent. NSF confirmed the results of the review indicated the landfill is 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. Lastly, NSF reviewed an attestation of voluntary implementation signed by Bi-County Gas Producers, LLC on February 1, 2018 for the period from January 1 through December 31, 2017. From this review NSF has concluded that the project implementation remains voluntary.

Performance Standard Test: NSF determined during the site visit that the Bi-County Landfill had not collected and destroyed any landfill gas prior to the implementation of the Project. Interviews with the site operator and review of design drawings of the site prior to the Project confirmed there were no solar flares devices connected to any leachate riser system or previous qualifying destruction devices installed onsite. In addition, NSF reviewed the Solid Waste Permit and the Title V Permit for Bi-County Landfill and no evidence of a pre-existing destruction device was observed or required of the site. 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." According to the Protocol, a project developer who has once passed the performance standard test remains eligible to register reductions for the lifetime of the project crediting period, as long as the project is not otherwise determined ineligible due to regulatory changes that impact the project's voluntary implementation. NSF has concluded from these facts that the project has met the performance standard test.

3.4 Regulatory Compliance

NSF reviewed the Attestation of Regulatory Compliance signed by Bi-County Gas Producers, LLC affirming the project's compliance status throughout the project-reporting period of January 1 through December 31, 2017. During the site visit and desk review activities, NSF reviewed the regulatory review of the Bi-County Landfill conducted by the project proponent. NSF interviewed the landfill and project managers regarding legal and regulatory compliance tracking systems and reviewed inspections from the last two years for the landfill. There were no notices of violation in 2017. In addition, the Project's monitoring plan was observed to contain procedures for maintaining and monitoring ongoing legal and regulatory compliance. As a cross-check, NSF reviewed the EPA's publicly available Office of Enforcement and Compliance History database (ECHO) and found no Notices of Violation had been recorded in the database in this reporting period or for two prior years under the CAA, National Pollution Discharge Elimination System, or Resources Recovery and Reclamation Act. From this evidence, NSF has concluded that the Project and the Bi-County Landfill remain in material compliance with applicable laws and regulations during the reporting period.

3.5 Ownership

The Bi-County Solid Waste Authority owns the Bi-County Landfill. Ownership was confirmed through review of organizational documents and various regulatory permits issued from TDEC such as the Solid Waste and air emission exemption permits. NSF also reviewed the Environmental Services Agreement between the Bi-County Solid Waste Authority and BCGP dated October 10, 2009, which transfers all rights to landfill gas reductions, energy production and green house gas reductions to BCGP. During the current reporting period, NSF confirmed there were no changes to ownership and reviewed the Attestation of Title dated February 1, 2018 concerning ownership of landfill gas emission reduction credits for the period January 1 through December 31, 2017. This document asserts that the project applicant had legal rights to any emission reduction credits to be issued. From this evidence, NSF has concluded that the project developer, Bi-County Gas Producers, LLC, is entitled to receive the emission reduction credits that may be issued by the Climate Action Reserve for methane destroyed during the project period.

3.6 Project Boundaries and Emission Sources

The Project included all emission sources from the operation of the landfill gas collection system to the ultimate destruction of the landfill gas in an open flare and combustion engine sets.

GHG Sources, Sinks and Reservoirs associated with the baseline scenario:

- CH₄ vented to the atmosphere.
- CO₂ from the oxidation of CH₄ by soil bacteria. As the landfill is only partially covered by a synthetic liner, the Landfill Project Protocol assumption that 10 percent of the methane produced would be naturally oxidized by soil bacteria has been applied.

GHG sources, sinks and reservoirs associated with the project:

- Un-combusted CH₄ from landfill gas in the internal combustion engines and the landfill 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 and CH₄. All gases have been converted to CO₂ equivalents.

3.7 Performance Against Project Protocol/Methodology

The project was implemented in conformity with the Landfill Project Protocol version 3.0.

Monitoring and Operations Plan. In accordance with the Landfill Project Protocol requirements, Bi-County Gas Producers, LLC established a monitoring manual and operations plan, which is described in a document entitled “Monitoring Manual for the Bi-County Landfill Gas Destruction Project 7.0”. This document addresses flow and methane concentration monitoring, facility, and data management system operations and describes how relevant parameters required by the Landfill Project Protocol Table 6.1 are to be collected and reported. In addition, Missing Data calculation procedures were reviewed for consistency with the Landfill Project Protocol requirements and the protocol’s Errata and Clarifications document. No discrepancies with requirements were found. The monitoring plan records are kept for a minimum of ten years when the information is first generated. NSF concluded that the project met the monitoring requirements in version 3.0 of the Landfill Project Protocol.

Monitoring and Measurement Equipment: Engine sets and flare layout and related monitoring equipment were reviewed for conformity with the LF Protocol requirements during the on-site visit of February 15, 2018. The primary data gathered for the project was landfill gas flow, pressure, temperature, and methane content of the landfill gas. Three Endress & Hauser mass flow meters were utilized for the project to ensure uninterrupted metering during calibration events. The flow meters continuously monitored flow after the blower, a knockout and a demister prior to combustion in the engines and the flare. In addition to flow meters, temperature was continuously monitored by a thermocouple to the flare. Flow measurement devices are configured to measure flow at actual conditions and is corrected to 59 deg F and 1 atmosphere. However the project has appropriately adjusted flow to 60 degrees and 1 ATM in the emission reduction calculations. The position of the flow meters was adequate to ensure laminar flow for both the engines and the flare. The flow meters were inspected and cleaned on a quarterly basis by BCGP and calibration checked on-site semi-annually by a third party. Third party inspections/calibrations occurred on June 14 and December 11, 2017 within two months of the end of the reporting period. Field inspection and cleaning occurred on March 16, June 14, September 21 and December 11, 2017 showing the activities performed and the as left/as found condition of the instrument documented. The calibrations conducted showed all flow meters to be within required tolerances. Flow meter equipment manufacturer maintenance manual states third party calibrations are required no more than five years apart. The calibrations conducted showed all flow meters to be within required tolerances and exceeded OEM minimum calibration intervals. Based on this review, NSF concludes the project reported accurate flow data.

Methane concentration was measured continuously with a Siemens Ultramat 23 methane concentration analyzer. The Siemens Ultramat 23 instrument was factory calibrated prior to installation in October 2010. The manufacturer recommends annual calibrations, which the Project has exceeded. The Ultramat 23 was inspected, cleaned, and calibrated in the field by a third party and found to be within tolerance thresholds on June 14, 2017. The Ultramat was also field checked quarterly by on-site BCGP personnel on March 16, June 14 and September 21. In addition, self-calibration checks to a cylinder of mixed nitrogen, carbon dioxide, and methane were performed automatically on a periodic basis. Periodic methane reading checks on the Ultramat are conducted using a portable GEM gas analyzer monitor.

On September 1, 2017 field check, the Siemens analyzer was found to be out of specification and was removed from service due to moisture accumulation. The Project sought and obtained a variance for methane measurements for the Siemens for a period slightly beyond two months after its latest calibration, until September 1, 2017. Subsequently the GEM2000 handheld analyzer was used between September 1 and 18, 2017 to measure methane. The GEM was sent for factory calibration on October 3, 2017. From September 18 through October 13, 2017 an Envision ENV100 handheld gas analyzer was used to measure methane. The GEM2000 was returned on site October 13 and was used thereafter for methane measurement for the rest of the reporting period.

Calibration procedures and logs for the flow meters and gas analyzer demonstrated consistency with the requirements of the Protocol calibration requirements, with the exception to the GEM2000 which had not been factory calibrated since the fall of 2016. A variance was issued by CAR that allowed for the continued use of the GEM2000 until the factory calibration was completed October 3, 2017 under condition that the drift did not exceed 1.2%, which was met. As noted above, an Envision ENV100 was used to measure methane between September 18 and October 13, 2017 when both the Siemens and the GEM2000 were out of service. The Envision ENV100 was factory calibrated on January 12 and December 11, 2017 and met the protocol requirements for methane measurement during the time it was used on site. See additional details regarding the variance in section 3.11 of the report.

Flare temperature was continuously monitored via a thermocouple mounted after the blower and within the shroud of the flare. The flare operations are programmed to automatically alert project individuals via phone if the flare system goes down. The system will shutdown automatically eliminating flow to the flare if flare temperature drops below 500 deg F. Hours of operation for the engines were monitored by revenue electric meters owned and operated by the local electric cooperatives Generation Partners and Renewable Standard Offer. The engine sets are also monitored for operation continuously for flow to each cylinder and compared to total

flow to the engines. In addition to the 30 minute monitoring of electricity produced and sent offsite, an engine down time log is kept and reviewed weekly and reported by the site operator to the Project. A site wide PLC (programmable logic controller) system records whether the flare or engines were operating. When there is no kW output from the engine, a sensor automatically closes the feed valve so that no gas may flow through the gas train to the engine affected.

Raw data from the flow meters, Ultramat 23 gas analyzer and temperature thermocouples is continuously collected every five minutes automatically onsite by a Eurotherm Chessle 6100A chart recorder which downloads data to the site operator's computer data acquisition device. Measurement by the GEM2000 and Envision ENV100 hand held analyzers were conducted daily and recorded by the site operator and in the raw data workbooks used to calculate CRTs. Once a week, raw data was downloaded from the computer and transmitted to Bi-County Gas Producers, LLC. The raw data was stored for recordkeeping retention and emission reduction calculations. Data is generally stored indefinitely by the project; 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. In addition the site operator reviews daily system operation as shown by a PLC screen display for anomalies, and makes weekly reports of operations to the BCGP carbon manager.

3.8 Project Management System

NSF verified the project's management system in the site visit conducted on February 15, 2018. In particular, our verification looked to confirm continued adequacy of the following elements:

- Definition and maintenance of an appropriate control environment by management and personnel, including the electric generation plant;
- Training and competence of landfill project managers and operating/data management personnel;
- Identification and management of legal requirements related to the landfill operations;
- Identification and maintenance of records required by the landfill project;
- Landfill site and gas collection, combustion equipment and gen-set specifications;
- Quantification methods and calculations for project emissions; and
- Checking and corrective action mechanisms.

Based on this review, NSF found the continued adequate control environment existed for the project.

3.9 Calculation of GHG Emission Reductions

The Project emission reductions were calculated per the formula defined in the Climate Action Reserve Landfill Project Protocol, Version 3.0. The basic formula was:

Landfill gas destroyed

- the portion of methane oxidized in the baseline scenario,
- carbon dioxide emissions from fossil fuel consumption (propane),
- methane emissions from incomplete destruction of natural gas, (not applicable),
- indirect carbon dioxide emissions resulting from the use of electricity from the grid,
- pre-project adjustment for methane destruction in the baseline scenario (not applicable),
- discount factor to account for uncertainties associated with the project monitoring equipment (a 10% discount for weekly methane concentration readings),

= Project Emission Reductions

NSF verified the calculated project emission reductions on a sampling basis from information derived from raw data for the reporting period. The verification team reviewed data downloaded into excel spreadsheets for monthly destruction periods. NSF 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 independently 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. BCDP emission reductions were calculated per the formula defined in the Climate Action Reserve Landfill Project Protocol Version 3.0. Specific engine destruction efficiency was used because the Project performed emission destruction testing in 2015, which included inlet, and outlet methane concentrations demonstrating the destruction efficiency used in baseline emission calculations. For this reporting period, NSF examined a set of raw data Excel files and a number of aggregated Excel data files to verify that spreadsheet formulas were consistent with the Landfill Project Protocol and that operating parameters (flare temperatures and flow, in particular) had been met. Raw data from the chart recorder were compared to CRT calculation for the same periods. NSF confirmed emission reductions were calculated per the formula defined in the Climate Action Reserve Landfill Project Protocol Version 3.0.

Propane delivery records were used to calculate the average monthly amount of propane to fuel the flare pilot ignition system. The Project correctly applied the propane combustion default emission factor from the Protocol. Monthly utility billing records were used to document the amount of electricity used by the Project. NSF checked that the Project used the latest available EPA eGRID emission factors for electricity for the SRTV region and found the correct 2016 CO₂ emission factors were applied to the Project's electricity usage. NSF found that the calculations of the CO₂ emissions from usage of both electricity and propane were correctly applied in the Project emissions. There was no substituted data for the reporting period.

3.10 Corrective Action Requests/Recommendations

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

3.11 Approved Variances or Deviations

There was a variance issued by the Climate Action Reserve April 27, 2018. The variance required verification of three conditions:

- *The verification body confirms that there are no apparent issues with the continuous gas analyzer measurements until September 1, 2017 when issues with the analyzer were discovered onsite.* During verification activities NSF reviewed the calibration record of the Siemens from June 14, 2017, reviewed the field inspections of June 14 and September 1, 2017 and reviewed the raw data collected and entered into the CRT calculations. NSF has concluded the Siemens analyzer appeared to be working within acceptable operational boundaries up until September 1, 2017 when it was removed from service, and that the methane concentrations in all respects were within acceptable range.
- *The verification body confirms that the maximum calibration drift of the GEM2000 handheld gas analyzer was only 1.2%; measurements can then be used as is from September 1, 2017 to September 18, 2017.* NSF examined the GEM2000 factory calibration record of October 3, 2017, reviewed site GEM2000 daily calibration checks and verified site GEM2000 calibration gases were current. The factory calibration results were within the required parameters of the variance as was the field accuracy of the GEM2000 daily measurements.
- *The verifier confirms that QA/QC requirements are accurately stated in the monitoring plan and all other requirements have been met by the project.* The Project revised its Monitoring Plan to address use of the GEM2000 and Envirovision ENV100 hand held analyzers and their required calibration and data handling



QA/QC requirements per the Protocol. NSF verified version 7.0 of the Monitoring Plan did address this requirement of the variance.

4. Verification Results

4.1 Verification Team Recommendation

Reductions/Removals from January 1, 2017 to December 31, 2017	Metric tons CO ₂ -e
Project baseline	62,143
- Project emissions	581
- Project adjustments (Two Pre-project non-qualifying destruction devices (e.g. passive flares) used for odor control.	0
= Net project emission reductions/removals	61,562

4.2 Verification Audit Summary

Project Developer	Bi-County Landfill Gas Producers LLC
Project Location	Woodlawn, Tennessee, USA
Project Type	Collecting and Destroying Methane from Landfills
Project Period	January 1, 2017 through December 31, 2017
Protocol/Methodology	Climate Action Reserve, Landfill Project Protocol, Version 3.0
Emissions/Removals Verified	Vintage 2017: 61,562 metric tons of CO ₂ -e
Verification Conclusion	Based upon the above, NSF has concluded that the Bi-County Landfill Gas Destruction Project 2017 vintage methane emission reductions of 61,562 metric tons (CO ₂ -e) reported to the Climate Action Reserve are, in all material respects, fairly stated.
Lead Verifier	 Michael DeBusschere, 08 May 2018
Internal Reviewer	 Tina Sentner, 23 May 2018

This verification statement is valid when signed and dated by an NSF internal reviewer.

End of Report