



RUBY CANYON ENGINEERING

Verification Report

CAR475 Gaston County Landfill Gas Destruction Project

Reporting Period: April 1, 2014 – March 31, 2015

Prepared for:

Gaston County Solid Waste and Recycling

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1.0 Introduction

The Gaston County Solid Waste and Recycling (Gaston County) contracted Ruby Canyon Engineering, Inc. (RCE) to perform the verification of the CAR475 Gaston County Landfill Gas Destruction Project (Project) for the reporting period April 1, 2014 through March 31, 2015 to the Climate Action Reserve (Reserve) Landfill Project Protocol Version 3.0 (Protocol). The Project involves greenhouse gas (GHG) emission reductions from the capture and destruction of landfill gas (LFG) via two open flares and three lean-burn internal combustion engines at the Gaston County Landfill located in the town of Dallas, North Carolina.

1.1 Project Background & Site Description

The Gaston County Landfill is owned by Gaston County and is operated by the County Public Works department. The Landfill, which opened in 1988, covers 130.5 acres. The estimated date of landfill closure is 2029. The Gaston County Landfill has an active recycling facility at the site in addition to various administration offices.

A pre-project passive venting system of wells and cut-off trenches was installed in 1995 – 1996 to control migratory and explosive gas. The system consisted of nine wells along the northeastern side of Areas C and D, which closed in 1998. The passive system remained in operation until 2008 when the landfill gas (LFG) capture and destruction project was designed and installed. The current Project consists of seventy eight LFG collection wells, piping and manifolds for transporting the captured gas, a knockout pot, blowers, LFG flow meters and gas concentration analyzer, and destruction devices to combust the LFG. The original Project destruction device was an 8-inch open candlestick flare. New destruction devices were installed to replace the flare with the equipment becoming operational on April 21, 2011. The Project destruction devices now include a 4-inch open candlestick flare, a 10-inch open candlestick flare, and three GE Jenbacher lean burn engines.

Gaston County had previously contracted with EcoSecurities International Limited, who acted as the Reserve project developer. This agreement has ended and Gaston County is now the acting project developer listed in the Reserve.

1.2 Responsible Party

Gaston County Solid Waste and Recycling
3155 Philadelphia Church Road
Dallas, NC 28034

1.3 Verification Team

The RCE verification team consisted of the following individuals who were selected based upon verification experience and knowledge of the landfill methane sector.

Lead Verifier: Zach Eyler

Team Member: Nina Pinette, Peter Browning

Senior Internal Reviewer: Phillip Cunningham

1.4 Objectives

The goal of the verification activities was to ensure that the claimed GHG emission reductions were complete, consistent, accurate, transparent, and permanent and that the Project was in compliance with the Reserve's project additionality, monitoring, and reporting requirements. Furthermore, the verification activities ensure that the data provided to RCE is well documented and free of any material errors or omissions.

1.5 Scope

The scope of the verification consisted of the following independent and objective activities:

- Review the reporting period's Project Monitoring Plan;
- Conduct a site visit to the Project location;
- Review the Project data acquisition and quality control procedures;
- Review the Project's baseline emissions and confirm the baseline and Project boundaries;
- Review the Project's evidence of environmental and regulatory requirements to ensure that the Project is additional;
- Review the Project's emission reduction calculations;
- Review the Project documents and data against the criteria listed in Table 1;
- Issue requests for additional documentation, clarifications, and corrective actions as necessary; and
- Issue a verification report, verification statement, and list of findings to Gaston County and the Reserve.

1.6 Verification Criteria

Table 1 – Summary of Verification Criteria

Criteria	Details
Standard of Verification	• The Reserve Landfill Project Protocol Version 3.0 (December 2, 2009) • Errata and Clarifications to Landfill Project Protocol Version 3.0 (June 18, 2015) • The Reserve Program Manual (October 26, 2011) • The Reserve Verification Program Manual (December 20, 2010)
Verification Process	The Reserve Verification Program Manual and ISO 14064-3 Specification with guidance for the validation and verification of greenhouse gas assertions.
Level of Assurance	Reasonable assurance
Materiality	97% accuracy level (less than 3% error) because total annual emission reductions are greater than 25,000 tCO ₂ e and less than 100,000 tCO ₂ e.

2.0 Verification Activities Summary

The Verification process consisted of the following activities as outlined in the verification plan:

- RCE completed a Notification of Verification Activities/Conflict of Interest (NOVA/COI) form to identify any potential conflict of interest with the Project or Gaston County. The NOVA/COI form was submitted to the Reserve and the COI assessment revealed no conflicts of interest and was approved by the Reserve on March 30, 2015.
- RCE held a verification kick-off meeting with Gaston County on April 14, 2015. During the kick-off meeting RCE reviewed the verification objectives and process, reviewed the verification schedule, and requested the verification background documents.
- RCE performed a strategic review and risk assessment of the received data and support documents in order to understand the scope and areas of potential risk in the GHG emissions reductions.
- RCE developed a risk-based sampling plan based upon the strategic review and risk assessment. The verification plan and sampling plan were used throughout the verification and were revised as needed based upon additional risk assessments.

- RCE conducted a site visit on April 27, 2015. During the site visit RCE performed key personnel interviews; inspected the Project equipment; and observed the onsite GHG management systems and data gathering, monitoring, and handling practices.
- RCE performed a risk-based desktop review of the submitted verification documents. The desktop review included an assessment of the GHG calculation methods and inputs, source data completeness, GHG management and monitoring systems, evidence of regulatory compliance, and record retention practices.
- RCE submitted requests for corrective actions, additional documentation, and clarifications to Gaston County throughout the verification.
- RCE's senior internal reviewer conducted a review of the verification sampling, report, and statement.
- RCE issued a final verification report, verification statement, and list of findings.
- RCE held an exit meeting with Gaston County on August 14, 2015.

3.0 Verification Findings

3.1 *Assessment of the GHG Emission Reductions Project Operations*

The Gaston County Landfill Gas Destruction Project currently collects LFG from the Gaston County Landfill and destroys it via combustion in a 4-inch open candlestick flare, a 10-inch open candlestick flare, and three electricity generating internal combustion engines. The LFG is pulled by a blower located at the flare skid through a gas collection system that consists of 78 wellheads connected by lateral piping to the main header pipe. RCE also confirmed that the landfill is not a bioreactor and does not re-circulate leachate or any other liquid in a controlled fashion to accelerate or enhance the anaerobic biodegradation of the waste.

3.2 *GHG Project Boundary (sources, sinks and/or reservoirs)*

The Protocol designates that CO₂ and CH₄ are the only GHGs included from the baseline and Project activities. The GHG emission sources resulting from the Project activity must be deducted from the Project baseline in order to calculate GHG emission reductions. These GHGs include methane generated from biodegradation of the landfill waste vented to the atmosphere, methane consumed by soil bacteria through natural oxidation, methane destroyed in the Project destruction devices, fossil fuel use, and electricity use. The sources of GHG emissions reviewed during the verification of the Project are listed in Table 2.

Table 2 – Summary of the Project GHG Sources, Sinks and Reservoirs

Activity	GHG Sources, Sinks & Reservoirs
Baseline	• CH₄ vented to the atmosphere • Percent methane oxidized by soil bacteria. The landfill does not incorporate a synthetic cover as part of the final cap system; therefore a 10% oxidation factor is applied.
Project	• CH₄ from the incomplete combustion of LFG sent to the open flares. • CH₄ from the incomplete combustion of LFG sent to the lean-burn internal combustion engines. • CO₂ from the combustion of fossil fuels used during operation and maintenance of the Project activity. • CO₂ resulting from the consumption of imported electricity.

3.3 Project Eligibility Criteria

The Protocol specifies four eligibility rules that a project must meet in order to register emission reductions with the Reserve: Location, Project Start Date, Additionality, and Regulatory Compliance. Below is a summary of the Reserve eligibility requirements and the Project's compliance to each requirement.

- **Eligibility Rule 1: Location**

The Project is a US-based landfill located in the town of Dallas in Gaston County, North Carolina, USA and therefore meets this eligibility requirement.

- **Eligibility Rule 2: Project Start Date**

To be eligible, the project must be submitted to the Reserve no more than six months after the project start date, unless the project is submitted during the first 12 months following the date of adoption of Version 2.0 of the Landfill Project Protocol by the Reserve board (the Effective Date, or November 17, 2008). The project was submitted in July 2009. During RCE's first verification of the Project, RCE reviewed email communications between the Project startup technicians and the design engineering firm stating that the qualifying destruction device began flaring gas on November 18, 2008.

- **Eligibility Rule 3: Additionality**

Performance Standard Test

During the first verification of the Project, RCE confirmed that prior to Project activity, the Gaston County Landfill did not combust any landfill gas and only collected and passively vented the gas through nine passive vents. The current Project involved the installation of a new qualifying destruction device. Thus, the Project passes the Performance Standard Test number 2 since it involves:

"Installation of a new qualifying destruction device at an eligible landfill where landfill gas is currently collected and vented, but has never been destroyed in any manner prior to the project start date."

Legal Requirement Test

During the site visit, RCE interviewed the Project Developer about the procedures to ensure that the Project meets environmental compliance requirements and the Legal Requirement Test. The Project Developer monitors federal, local, and state regulations to ensure that the Project is in environmental compliance and that there is no mandate to collect and combust LFG. RCE also reviewed the Project's Monitoring Manual which defines how the Project continues to exceed the Legal Requirement Test including having an administrator maintain compliance and knowledge of any changes in regulatory requirements.

RCE also reviewed the Attestation of Voluntary Implementation form signed after the end of the reporting period and uploaded to the Reserve website which states that the project was implemented and established voluntarily.

The Gaston County Landfill expanded its operations in 2010 and is now constructed and permitted to operate at a design capacity of 5,748,470 Mg of municipal solid waste. The new design capacity triggered the NSPS Tier II NMOC emissions estimates reporting requirement. According to the Tier II Report from June 2013, the NMOC emission rate for 2014 and 2015 are 39 Mg per year and 40 Mg

per year, respectively, and are below the requirements of the NSPS 50 Mg/yr NMOC threshold. The site is not estimated to exceed the 50 Mg threshold in the next five years.

- **Eligibility Rule 4: Regulatory Compliance**

RCE reviewed the procedures described in the Gaston County Monitoring Manual to ensure that the Project remains in compliance with all applicable local, state, and Federal requirements. RCE reviewed environmental and operating permits including the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Air Quality air permit and the NCDENR Municipal Solid Waste Landfill Facility permit to operate. During RCE's review there was no evidence of non-compliance found, and the procedures for ensuring regulatory compliance in the Monitoring Manual were being properly followed. RCE reviewed the EPA Enforcement and Compliance History Online (ECHO) report for the Gaston County Landfill on June 5, 2015 and no violations or enforcement actions were noted. Finally, RCE confirmed signature of the Attestation of Regulatory Compliance after the end of the reporting period, which was uploaded to the Reserve.

3.4 Ownership of Generated Emission Reductions

RCE reviewed evidence that Gaston County has ownership of the GHG emission reductions. Ownership documentation reviewed includes permits, and the contract agreement between Gaston County and Duke Carolinas—the buyer of the electricity generated by the Project—which states that Gaston County retains all emission reduction credits. Finally, RCE reviewed the completed Attestation of Title which was uploaded to the Reserve website following the end of the reporting period.

3.5 GHG Monitoring and Management Systems

RCE reviewed the data management systems during the site visit and desktop review. RCE completed the majority of the GHG management systems review during the site visit by observing the onsite procedures and interviewing the landfill and Gaston County personnel. The onsite review included an assessment of the Project data collection, processing, and handling procedures; recordkeeping and data storage; quality control and assurance procedures; record retention systems; and a field tour of the Project equipment. The desktop review included a detailed review of the Project monitoring plan and its conformance to Protocol requirements. RCE also confirmed that the Project was implemented according to the Monitoring Plan.

The primary project data includes the LFG flow to the 4-inch flare, the 10-inch flare, and the engines; methane content of the LFG; the flare temperatures; and kilowatt data was recorded every fifteen minutes (to determine operational activity). Three Veris Verabar V100 differential pressure flow meters in conjunction with Rosemount differential pressure transmitters were used to record flow to the two flares and engines at a standard temperature and pressure of 60°F and 1 atm. RCE confirmed that the position of the flow meters are adequate to ensure laminar flow. A Siemens Ultramat 23 continuous methane analyzer is used to measure methane content.

The operation and temperature of the flares are continuously monitored by thermocouples. Operation of the engines is monitored through the power plant's SCADA system which records electricity production data for each engine on a 15-minute basis. The LFG flow, concentration, and temperature data is recorded continuously via a PLC system which sends data to an electronic chart recorder. The data is exported in 10-minute intervals on a weekly basis. The Environmental Analyst at the landfill also records manual measurements in a Project logbook on a daily basis.

During the site visit, RCE reviewed Gaston County's data storage and retention policies and verified they were in conformance with the Protocol requirements and followed the Project monitoring plan.

3.6 Instrument QA/QC

RCE reviewed evidence that the LFG flow meters and methane analyzer met all instrument QA/QC requirements outlined in the Protocol. Gaston County provided quarterly cleaning/inspection documentation by 3rd party technicians for all flow meters and differential pressure transmitters. In addition to the cleaning and inspection, the 3rd party technician also calibrated the flow meters. The documentation indicated that the flow meters did not read outside of the ± 5 percent threshold as required by the Protocol, and the as found/as left conditions of the meters were documented. The Siemens Ultramat analyzer was field checked for accuracy and exceeded the ± 5 percent threshold during the second quarter 2014 check. RCE confirmed that Gaston County correctly adjusted the methane data based on the over-reporting. The analyzer was also calibrated on a quarterly basis by the 3rd party technician, including after the over-reporting during the second quarter of 2014.

The Veris Verabar flow meters cannot be calibrated and are only required to be checked periodically. The Rosemount differential pressure transmitters do not have a manufacturer defined calibration schedule and the user can define their own calibration schedule based on system parameters. Siemens recommends using a calibration gas annually to calibrate the unit. RCE confirmed that all equipment was calibrated at a greater frequency than required by the manufacturer.

The quarterly cleaning/inspections were performed on the flow meters and analyzer on June 17, 2014, September 10, 2014, December 19, 2014, and March 5, 2015. The March 5, 2014 quarterly field check also served as the 3th party calibration accuracy check within the last two months of the reporting period.

3.7 Assessment of GHG Emission Reductions Calculations

RCE reviewed the emission reduction calculations, Project assumptions, raw data inputs, and accuracy of calculations. RCE first assessed the completeness of the raw data and how the data is transferred to the calculation spreadsheet. Next, the team reviewed the formulas and raw data inputs for accuracy and compliance with the Protocol. RCE sampled selections of data and recalculated the methane destroyed by the Project and compared these values to Gaston County's values in the assertion spreadsheet.

RCE reviewed checks built into the spreadsheet that accounts for flow only at times when the destruction devices are operational which is defined as thermocouple reading temperatures greater than 500°F for the open flares. The team also confirmed that destruction of LFG was claimed only when kilowatt readings (evidence of hourly operational activity) were recorded at a minimum on an hourly basis for the engines.

RCE confirmed that the default destruction efficiency of 96 percent was applied to the open flares and 93.6 percent was applied to the lean-burn internal combustion engines. A 10 percent discount was applied for the oxidation of methane by soil bacteria because the landfill does not incorporate a synthetic liner as part of the final cap system throughout the entire landfill. RCE reviewed source documentation for Project emissions from purchased electricity, diesel and propane, confirmed that appropriate emission and conversion factors were used, and reviewed the use of Protocol equations for Project emissions in the GHG assertion.

RCE recalculated LFG total flow, confirmed correct application of percent methane, recalculated project fossil fuel use, and confirmed use of appropriate conversion factors. All calculations were checked against the Gaston County's calculations with percent differences noted. There were no instances of data substitution during this reporting period. The difference between RCE's and Gaston County's emission reductions was non-material.

4.0 Verification Results

Gaston County provided sufficient documentation of its emission reductions, data collection procedures, and monitoring and quality control procedures. The verification process focused on verifying the emission reductions claimed and the source data used by Gaston County to quantify the emission reductions in accordance with the Reserve Landfill Project Protocol Version 3.0. The following is a summary of the verification results.

The Project reported emission reductions of **76,866** metric tons CO₂e for the current reporting period. During the final review, RCE identified no material misstatements in the data or emission reduction calculations. The emission reductions verified are listed in Table 3. During the verification process, RCE made requests for corrective actions and supplemental documentation to complete the verification. Gaston County sufficiently addressed all requests. The details of these requests are documented in RCE's List of Findings provided to the Reserve and Gaston County.

5.0 Conclusion

RCE conducted a risk-based analysis of the CAR475 Gaston County Landfill Gas Destruction Project GHG assertion including a strategic review of the Project data and evidence. Based upon the processes and procedures and the evidence collected, RCE concludes that the GHG assertion is a fair representation of the Project emission reductions resulting from the capture and utilization of landfill gas during the reporting period April 1, 2014 through March 31, 2015 and can be considered:

- In conformance with the Reserve Landfill Project Protocol, Version 3.0,
- Without material discrepancy, and
- Verified to a reasonable level of assurance.

The verified emission reductions are listed in Table 3.

Table 3 - Emission Reductions Verified for April 1, 2014 through March 31, 2015

Year	Baseline Emissions CO ₂ e (mt)	Project Emissions CO ₂ e (mt)	Emission Reductions CO ₂ e (mt)
2014	57,660	412	57,248
2015	19,748	129	19,619
Total	77,408	542	76,866

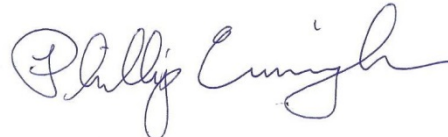
Note: Due to rounding, individual values might not equal totals and values are not representative of raw data used in the emission reductions calculation.

Lead Verifier Signature



Zach Eyler

Independent Reviewer Signature



Phillip Cunningham