



March 20, 2011 – September 19, 2011 Reporting Period
Verification Report for CAR 495 - Greenville County Landfill Gas Utilization
Project

Prepared for:
Greenville Gas Producers, LLC

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Ruby Canyon Engineering
743 Horizon Ct. Suite 385
Grand Junction, Colorado 81506
(970) 241-9298

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1.0 Introduction

Ruby Canyon Engineering (RCE) was contracted to perform the periodic verification of the Greenville County Landfill Gas Utilization Project ("Project") for the reporting period March 20, 2011 through September 19, 2011 to the Climate Action Reserve Landfill Project Protocol 3.0. The Project involves GHG emission reductions from the capture and use of methane from the municipal solid waste (MSW) landfill located in Greer, South Carolina, at the Enoree Landfill.

1.1 *Project Background & Site Description*

The Enoree Landfill is owned and operated by Greenville County. There are two waste-containing cells at the Enoree Landfill, referred to as Phase I and Phase II. Phase I of the landfill was operational for three years (1991 – 1994). Detailed waste acceptance records were not required during Phase I operation, but the amount of waste in place upon closure is estimated to be 750,000 – 1,000,000 tons (680,000 – 907,000 tonnes). Phase II of the landfill is about 71 acres in area, with an average depth of 40 feet, and a design capacity of approximately 2,600,000 Mg (2.86 million tons). Phase II began accepting MSW in 1996 and continued until early 2007 when the landfill was closed and subsequently capped with a high-density polyethylene material cover. The amount of waste in place at the time of closure was 2,573,786 tons (2,334,899 tonnes). The landfill was constructed with a liner and leachate drainage system designed in compliance with Subtitle D of the Resource Conservation and Recovery Act (RCRA).

The current project includes an open flare component and an electricity component with an installed capacity of 3.2 MW. The flare began operating in August, 2007, and the electricity generation plant was completed in August, 2008. Greenville Gas Producers, LLC (GGP) is the Project Developer, owner, and operator. EcoSecurities International Ltd, GGP's Carbon Advisor, provided technical assistance during the development of the project.

1.2 *Responsible Party*

Greenville Gas Producers, LLC
10600 Nations Ford Rd., Suite 150
Charlotte, NC 28273

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: Bonny Crews
Team Member: Nina Pinette
Senior Internal Reviewer: Sally Phipps

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 Climate Action Reserve's (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 periodic verification consists of the following independent and objective activities:

- Review the reporting period's Project Monitoring Manual, v6.2, and the Project Monitoring Report
- Review the Project Data Acquisition & Quality Control Procedures
- Review the Project's baseline emission reductions and check that the baseline and Project boundaries have not changed
- Review the project's evidence of environmental and regulatory requirements to ensure the project is additional
- Review the Project's emission reduction calculations
- Review of the Project documents and data against the requirements listed in Table 1
- Issue requests for clarifications and corrective actions as necessary
- Issue a verification report, list of findings and opinion to GGP and the Reserve

1.6 Verification Criteria

Table 1 – Summary of Verification Criteria

Standard of Verification	• Climate Action Reserve Landfill Project Protocol 3.0, • Errata and Clarifications to Landfill Project Protocol 3.0 (October 26, 2011), • Climate Action Reserve Program Manual (October 26, 2011), • Climate Action Reserve Verification Program Manual (December 20, 2010), and the • International Standards Organization (ISO) 14064-3 Specification with guidance for the validation and verification of greenhouse gas assertions
Verification Process	Climate Action Reserve and ISO 14064-3
Level of Assurance	Reasonable assurance
Materiality	+/- 3 percent materiality threshold: (97% materially correct) – accuracy level for projects registering >25,000 but ≤100,000 CRTs

2.0 Verification Activities Summary

The verification of the emission reductions for the March 20, 2011 through September 19, 2011 reporting period is a repeat, desktop verification of the Project. The Project was already listed with the Reserve, and the previous three verifications, two with site visits and one desktop, were performed by RCE.

The verification of the sub-annual March 20, 2011 through September 19, 2011 reporting period began with GGP selecting RCE as the verification body.

Prior to starting the verification, RCE developed a verification plan that was followed throughout the verification. The verification plan consisted of the following activities:

- Completion of a Project COI/NOVA form by RCE to identify any potential conflict of interest with the Project or Project Developer. The COI/NOVA form was submitted to the Reserve's online website and the COI assessment revealed no conflicts of interest and was approved by the Reserve on October 25, 2011.
- A teleconference verification kick-off meeting was held with GGP's Carbon Advisor, EcoSecurities, and RCE on November 9, 2011. During the kick-off meeting RCE reviewed the verification objectives and process, reviewed the verification schedule, and requested the verification background documents.
- RCE began receiving the background verification documents by email from GGP's Carbon Advisor on December 2, 2011.
- 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.
- A verification plan and a risk-based desktop sampling plan were developed based upon the strategic review and risk assessment. The verification plan and desktop sampling plan were used throughout the verification and were revised as needed based upon additional risk assessments.
- A risk-based desktop review of the submitted verification documents was performed. 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.
- Requests for corrective action, additional documentation, and clarifications were submitted to GGP's Carbon Advisor throughout the verification.
- A senior review of the verification sampling, report and statement was conducted.
- A final verification report, verification statement and list of findings were developed.
- An exit meeting was held with the client on January 13, 2012.

3.0 Verification Findings

3.1 Assessment of the GHG Reduction Project Operations

The Greenville County Landfill Gas Utilization Project currently collects landfill gas (LFG) from the Enoree Landfill and destroys it via combustion in a pair of Caterpillar G3520C gas generator sets (low energy fuel, continuous, 1600 kW, 60 Hz, 1200 rpm, 4160 volts) housed in a container adjacent to the flare skid. An open candlestick flare is available to handle destruction of excess LFG, or for gas diversion when one or both gensets is offline. The LFG is pulled by a blower located at the flare skid through a gas collection system that consists of 51 wellheads connected by lateral piping to the main header pipe.

During the two previous site visits and the current desktop review, RCE did not observe any evidence that Project design or operational boundaries had changed from the previous verification. The landfill remains closed and there were no new wells added to the Project.

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

The Climate Action Reserve 3.0 Landfill Project 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 destroyed in the Project destruction device, fossil fuel use and electricity use. The sources of GHG emissions reviewed during the verification of the Greenville County Landfill 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 is capped with a synthetic cover, therefore no oxidation factor is applied.
Project	• CH₄ from the incomplete combustion of LFG sent to the gensets. • CH₄ from the incomplete combustion of LFG sent to 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.

3.3 Project Eligibility Criteria

The Reserve Landfill Project Protocol 3.0 specifies four eligibility rules that a GHG Project Developer must meet in order to register reductions with the Reserve: Location, Project Start Date, Additionality, and Regulatory Compliance. During a previous reporting period, RCE verified the Project's Location, Start Date, Additionality, and Regulatory Compliance. RCE was not required to re-verify the Project Start Date, Location, and Performance Standard Test requirement for Additionality in this repeat verification. RCE observed no changes in project regulatory compliance from the last verification cycle.

RCE performed an additionality assessment to ensure that the Project met the Legal Requirement Test. In addition, the Project Developer provided evidence that the Project is in compliance with all applicable local, state and Federal requirements. RCE reviewed the Attestation of Voluntary Implementation and Regulatory Compliance as well as all permits, and regulatory documents, to determine that the project was in compliance with all applicable regulations. The Project Developer must also demonstrate that they have exclusive ownership rights to the generated GHG emission reductions. RCE reviewed the Attestation of Title and other evidence provided by the Project Developer of their exclusive ownership rights to the GHG reductions.

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 Greer in Greenville County, South Carolina, USA and therefore meets this eligibility requirement. RCE

reconfirmed this through the site visit April 13, 2011 during the previous verification cycle.

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

The Landfill Project Protocol 3.0 states that pre-existing projects must have a start date on or after January 1, 2001. The start date is defined as the date on which a qualifying destruction device becomes operational. According to the Air Permit, the South Carolina Office of Environmental Quality Control Construction Permit and the Temporary Operating Permit, the Greenville County Project began flaring gas on August 1, 2007 and began generating power from LFG combustion on September 1, 2008.

- **Eligibility 3: Additionality**

According to the Reserve additionality requirements, a Project Developer must pass a Performance Standard Test and a Legal Requirement Test in order to show that the Project reductions are above and beyond business as usual.

Performance Standard Test

Prior to the Project activity, the Enoree Landfill in Greenville County neither collected nor destroyed any LFG. Thus the installation of the LFG collection system and destruction devices serves to meet the Performance Standard Test.

Legal Requirement Test

A project passes the Legal Requirement Test when there are no laws, statutes, regulations, court orders, environmental mitigation agreements, permitting conditions or other legally binding mandates requiring the destruction of LFG methane at the project site. The Project satisfies the Legal Requirement Test through signature of the Attestation of Voluntary Implementation form. RCE confirmed signature of this form by the Project Developer after the end of the reporting period. RCE examined the procedures outlined in the Project Monitoring Manual that the Project Developer will follow to ascertain and demonstrate that the project at all times passes the Legal Requirement Test. These procedures include the Operations Manager keeping abreast of any changes in regulatory requirements and ensuring legal compliance is maintained at all times.

The design capacity of the Landfill exceeds the 2.5 million Mg threshold, therefore it is subject to the New Source Performance Standards (NSPS) for MSW Landfills codified in 40 CFR 60 subpart WWW. These regulations require that landfills above the threshold size calculate their annual NMOC emissions. The projected NMOC rate for 2010 in the Tier II test for Greenville is 12.28 Mg/year. Since the landfill is closed that rate is not expected to exceed the regulatory threshold of 50 Mg/year which would trigger mandatory emissions control.

During the review of the supporting evidence RCE did not observe any indication that Greenville County was mandated to collect and combust LFG from the Enoree Landfill. Additionally, there are no local, state or Federal mandatory requirements for the installation of a gas collection and conveyance system. Therefore the results of the regulatory review indicated that GGP is following their Monitoring Manual procedures to ensure they pass the legal requirements test and the Project is in compliance with all Federal, State and local regulations.

- **Eligibility 4: Regulatory Compliance**
RCE reviewed the procedures described in the Project Monitoring Manual v6.2, the submitted Attestation of Regulatory Compliance, air permit, and the closure construction certificate for evidence that the project was in compliance with all environmental and regulatory requirements. 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.
- **Ownership of Generated Reductions**
RCE reviewed both the completed Attestation of Title and the redacted contract agreement between GGP and County of Greenville, South Carolina for evidence of ownership of the generated emission reductions. The presented evidence clearly demonstrated that GGP holds the legal title and exclusive ownership rights of the emission reductions associated with the Project.

3.4 GHG Monitoring and Management Systems

During the previous verification period site visit, RCE reviewed the GHG management systems through observations of onsite procedures and interviews with the GGP Project personnel. The onsite review included an assessment of the Project data collection, processing and handling procedures, recordkeeping and data storage, the quality control and assurance procedures, project maintenance procedures, personnel competency evaluations, and a field tour of the Project.

The primary project data includes the total LFG flow, the LFG flow to the flare, LFG flow to the gensets, temperature of the flare, and methane content of the LFG. There are three points of LFG flow measurement in the Project system: the total LFG drawn from the Enoree Landfill is measured downstream of the last knockout with a Lambda Square Venturi flowmeter at 60°F and 1 atm, coupled with a pressure transmitter; the LFG flared is measured downstream of the blowers and methane measurement with a Veris Verabar flow meter at 59°F and 1 atm, coupled with a pressure transmitter; the amount of LFG sent to the generators is measured downstream of the blowers and methane measurement (after a split that sends LFG to the flare and the gensets) with a Lambda Square Venturi flowmeter at 60°F and 1 atm, coupled with a pressure transmitter. The position of all three of the flow meters is adequate to ensure laminar flow.

The methane fraction in the LFG is measured downstream of the blowers with a Siemens Ultramat 23. All data are measured continuously and recorded every 5 minutes and compiled into a database by the SCADA system. The SCADA data files are transferred weekly by the Site Operator to the Operations Manager, who reviews and transfers the data to GGP's Carbon Advisor. The Carbon Advisor conducts quality checks and incorporates the data into the emission reduction workbook. An electronic chart recorder records 2-second data that is maintained as a backup in the event of SCADA failure.

The Site Operator maintains a weekly report of site operations that includes engine run hours, electricity sent to the grid (kWh), electricity consumed by the project (kWh), methane content (measured by portable handheld analyzer), and other information relevant to maintaining project operations. These weekly reports are sent to the Operations Manager and Regional Manager for quality checks, and to the Carbon Advisor on an as needed basis. This weekly report was observed onsite by RCE during the previous verification period site visit and digital files were sent to RCE for additional comparison.

During the course of this verification, RCE observed that all monitoring equipment was calibrated, cleaned, and inspected according to the manufacturer's specifications and according to the requirements of the Reserve Landfill Protocol 3.0. In addition to meeting the quarterly inspection and cleaning requirement, quarterly calibration field checks were performed to increase the level of assurance of the data. The inspection, cleaning, and calibration field check was performed on July 21, 2011 by PASS II, who reported the flow meters and the methane analyzer met the calibration requirements of the protocol. This check was performed within two months of the end of the reporting period as required by the Reserve.

Table 1 of the Project Monitoring Manual provides specific information on the Details of the Monitoring Equipment to include model and serial numbers, calibration and maintenance procedures, and procedures in event of failure, that are in compliance with the Reserve Landfill Project Protocol 3.0. Also, the operational procedures and responsibilities as outlined in Table 2 of the Project Monitoring Manual were observed by RCE to be accurately portrayed. Table 3 of the Project Monitoring Manual outlines record management in compliance with the protocol.

3.5 Assessment of GHG Emissions Reductions Calculations

The emission reduction calculation assessment included a review of 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 formulas and raw data inputs were reviewed for accuracy and compliance with the Landfill Project Protocol 3.0. Lastly, RCE recalculated the GHG emissions and reductions and compared the results to the Project Developer's calculations to determine if the GHG emissions were materially correct.

The electricity use raw data from the invoices and receipts were also compared to the numbers used in the GHG emissions calculations. RCE sampled 100% percent of the raw Project data, and the selected samples review consisted of data transcription tests, data completeness and accuracy.

The Project's GHG emission reduction calculations were correctly implemented and were in compliance with the Reserve Landfill Project Protocol 3.0 calculation methodologies. Per the guidelines in Table C.3 of Appendix C of the Landfill Project Protocol 3.0, a 96 percent destruction efficiency was assigned to the Project's flare combustion device, and a 93.6 percent destruction efficiency was assigned to the Project's electricity generation devices, and applied accordingly in the emission reduction calculations. RCE examined 100 percent of the Project calculation methods in the Project Workbooks, and compared them to the protocol. The calculation methods were determined to be as described in the Project Monitoring Manual and were complete and transparent.

The monthly CH₄ destroyed by the Project was recalculated for four of the seven months of the reporting period. The samples chosen were 5-minute readings that were checked against the Project calculations. Quality checks on the data ensure that emission reductions are claimed only when proper combustion at the flare is achieved; anomalies outside the normal operating range are removed (flare temperature below 500 °F, LFG_{flare} above the flare capacity).

Since the volume of gas flow to the flare metered by the Veris Verabar flow meter is recorded at a temperature of 59 °F and 1 atm, the flow readings were appropriately

adjusted to a standard temperature and pressure of 60 °F and 1 atm per the Protocol's requirement using Equation 5.2.

The volume of gas flow to the electricity generators and the total LFG flow metered by the Lambda Square Venturi flow meters is measured at 60 °F and 1 atm and therefore does not require adjustment. The gas flows for each 5-minute reading are totalized using the recorded time per interval to determine the gas flow rate per interval. This volume is converted to a mass flow using the density of methane at 60 °F and 1 atm of pressure.

As a conservative check on flow measurements and calculations, the sum of LFG_{flare} and $LFG_{electricity}$ are compared with LFG_{total} and the lower of the two values is used for the emission reductions calculations. These data manipulations are carefully explained in the Monitoring Report and appear consistent and transparent in the Workbook.

The net amount of methane destroyed by the Project was calculated per month, then summed for the reporting period total and converted into CO₂ equivalents (CO₂e). Project emissions consisted of indirect emissions of CO₂ from electricity consumption and from propane use. While the Project emissions were a small percentage of the Baseline emissions in this project, the electricity consumption was an extremely conservative measurement. The correct eGRID emission factor for the appropriate subregion was used for the calculation. The most recent propane purchase was 23.7 gallons on February 11, 2011; all of that propane was accounted for in the previous verification period. There was no propane purchased for the current verification period, thus the propane emissions reported were zero. This project accounts for propane as it is purchased as the usage is not metered; this is a conservative method.

The Project emissions were calculated from the product of activity data multiplied by an appropriate emission factor. The total GHG reductions in CO₂e were calculated by subtracting the Project emissions from the net amount of methane destroyed in the baseline in CO₂e. RCE found no material misstatements in the final Project GHG reductions calculations and results.

4.0 Verification Results

GGP provided excellent documentation of their emission estimates, data collection procedures and their monitoring and quality control procedures. The verification process focused on verifying the emissions estimates and the source data used by the Project Developer to quantify the emissions reductions in accordance with the CAR Landfill Project Protocol 3.0. The following is a summary of the verification results.

The Project proponents reported 49,636 metric tons CO₂e for the current reporting period as per the information provided in the Project calculation spreadsheet dated November 30, 2011. During the verification, RCE identified no material misstatements in the data or emissions calculations. The amounts of emission reductions verified are listed in Table 3.

Table 3 - Emission Reductions Verified for March 20, 2011 through September 19, 2011

Emissions Verified	CO₂e (metric tons)
	2011
Baseline Emissions	49,869
Project Emissions	233
Emission Reductions	49,636

4.1 Findings Overview

During the verification process, RCE made several requests for clarification, corrective action, and supplemental documentation to complete the verification. According to RCE's verification procedures all material corrective actions must be addressed by the Project Developer before a positive verification statement will be submitted. The details of the requests for corrective action and clarification are documented in the RCE List of Findings provided to the Reserve and the Project Developer.

5.0 Verification Statement

RCE conducted a risk-based analysis of the CAR495 - Greenville County Landfill Gas Utilization Project assertion where RCE performed a strategic review of the Project data and evidence. Based upon the processes and procedures and the evidence collected, RCE concludes with a reasonable level of assurance that the emission reductions at the Project resulting from the capture and utilization of landfill gas during the reporting period March 20, 2011 through September 19, 2011 can be considered:

- in conformance with the Climate Action Reserve Landfill Project Protocol 3.0 standards
- without material discrepancy, and
- verified to a reasonable level of assurance.

The verified emission reduction CRT(s) are listed in Table 4.

Table 4 - Emission Reductions Verified for March 20, 2011 through September 19, 2011

Emissions Verified	CO ₂ e (metric tons)
	2011
Emission Reductions	49,636

Lead Verifier Signature



Bonny Crews

Independent Internal Reviewer Signature



Sally Phipps