



Verification Report

CAR512 Rio Grande Valley Landfill

Reporting Period: December 12, 2015 – December 11, 2016

Prepared for:

BFI Waste Systems of North America, LLC

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1.0 Introduction

Element Markets contracted Ruby Canyon Engineering, Inc. (RCE) to perform the verification of the CAR512 Rio Grande Valley Landfill (Project) for the reporting period December 12, 2015 through December 11, 2016 to the Climate Action Reserve (Reserve) Landfill Project Protocol Version 4.0 (Protocol). The Project involves greenhouse gas (GHG) emission reductions from the capture and destruction of landfill gas (LFG) via an open flare at the Rio Grande Valley Landfill located near Donna, Texas.

1.1 *Project Background & Site Description*

The Rio Grande Valley Landfill (Landfill) began operation in 1994. The Landfill consists of 134.5 acres with a total permitted footprint of 92.1 acres, and has a maximum design capacity of 11.7 million cubic yards. The landfill comprises eight constructed cells. The Landfill controls leachate via a collection system that uses collection piping to drain leachate into sumps located in each landfill cell. Leachate is collected and stored in a 150,000 gallon storage tank and all leachate collected at the site is re-circulated under the Landfill's municipal solid waste permit. The landfill is not considered a bioreactor according to the EPA definition because no additional liquids are added to the waste mass.

The Landfill stopped accepting waste on September 21, 2013. While at the end of the current verification period (December 2016) the landfill was not yet officially registered as closed, finalization of final cap placement and official closure was in process.

An active landfill gas control and collection system (LFGCCS) was constructed between May 26, 2004 and June 1, 2004 and became operational on February 21, 2005. The initial LFGCCS involved the following components: (1) installation of gas collection piping system including fifteen active landfill gas extraction wells, (2) channel crossing, (3) leachate collection system (LCS), (4) clean-out riser connections, (5) condensate management system, and (6) installation of a blower/flare skid. The majority of these components were installed and completed by December 2004, with exception of the utility flare. The flare was installed by Shaw EMCON/OWT, Inc., in February 2005. The LFGCCS was expanded in the fall of 2005 to include the installation of eleven new vertical gas extraction wells. In 2006, ten additional landfill gas extraction wells were installed and in 2008, eight vertical gas extraction wells as well as a U-trap connection to the existing leachate cleanout riser were installed. From April to September of 2013, twenty-seven vertical extraction wells installed to the LFGCCS. The current system has a total of eighty-eight vertical extraction wells.

The LFG wells were installed through refuse above the landfill liner system, and the total depths of the LFG wells vary according to their respective locations in the landfill. The main header pipe conveys the LFG to the blower/flare compound where the LFG is destroyed via combustion by the flare system manufactured by LFG Specialties. Four leachate collection system clean-out risers were installed at the perimeter to increase landfill gas extraction capacity.

Negative pressure (vacuum) is created on the well field by an electrically driven reciprocating air compressor located on the blower/flare skid. The LFG passes through the blowers to the flare where it is combusted. The LFG flow rate is measured with a Thermal Instruments (TI) flow meter which automatically adjusts for temperature and pressure. Methane content is currently measured with a Siemens Ultramat 23 Non-dispersive Infrared (NDIR) continuous gas analyzer that was installed on March 30, 2010. A thermocouple measures the combustion temperature of the flare.

The Project Developer and landfill owner is BFI Waste Systems of North America, LLC, a subsidiary of Republic Services. BFI owns the rights to all of the GHG credits that result from the Project activity.

Element Markets serves as the technical consultant to the Project Developer.

1.2 Responsible Parties

Project Developer: BFI Waste Systems of North America, LLC

Technical Consultant: Element Markets

Landfill Owner: BFI Waste Systems of North America, LLC

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

Senior Internal Reviewer: Samantha Phillips

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 consists 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, list of findings, and verification statement to the Project Developer and the Reserve.

1.6 Verification Criteria

Table 1 – Summary of Verification Criteria

Criteria	Details
Standard of Verification	• The Reserve Landfill Project Protocol Version 4.0 (June 29, 2011) • Errata and Clarifications to Landfill Project Protocol Version 4.0 (June 18, 2015) • The Reserve Program Manual (September 1, 2015) • The Reserve Verification Program Manual (February 8, 2017)
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

As the first step in verification activities, RCE developed a verification plan to be followed throughout the verification. The verification plan consisted of the following activities:

- RCE completed the Notification of Verification Activities/Conflict of Interest (NOVA/COI) form to identify any potential conflict of interest with the Project or Project Developer. RCE submitted the NOVA/COI form to the Reserve and the COI assessment revealed no conflicts of interest and was approved on January 17, 2017.
- RCE held a verification kickoff meeting with Element Markets on January 24, 2017. During the kickoff 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 calculations.
- 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 May 2, 2017. During the site visit RCE performed key personnel interviews; inspected the Project equipment; reviewed source documents, Project data, and calculations; 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 including 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 clarifications, corrective actions, and additional documentation to the Project Developer throughout the verification.
- RCE's Senior Internal Reviewer conducted a review of the verification sampling, verification report, and verification statement.
- RCE issued a final verification report, verification statement, and list of findings.
- RCE held an exit meeting with Element Markets on August 11, 2017.

3.0 Verification Findings

3.1 Assessment of the GHG Reduction Project Operations

The Project currently collects landfill gas from the Landfill and destroys it via combustion through an open flare mounted on a flare skid adjacent to the Landfill. The LFG is pulled from a total of 88 wells and is sent to the open flare for destruction. There was no pre-project collection or destruction of LFG. RCE

confirmed that the project is not a bioreactor and does not add any liquid, including leachate, in a controlled manner to the landfill.

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

According to the Protocol, carbon dioxide and methane are the only GHGs included in the Project boundary from both the baseline and Project activities. The emissions resulting from the Project activity must be deducted from the Project baseline emissions in order to calculate total emission reductions. These Project emissions include the carbon dioxide resulting from the consumption of grid electricity related to Project activities. The calculation of baseline emissions takes into account the total methane destroyed based on the destruction efficiency of the Project destruction devices and the oxidation of methane by soil bacteria in the landfill cover. Table 2 lists the sources of GHG emissions reviewed during the verification of the Project.

Table 2. Project GHG Sources, Sinks, and Reservoirs

Activity	GHG Sources, Sinks & Reservoirs
Baseline	• CH₄ vented to the atmosphere. • Percent methane oxidized by soil bacteria. As the landfill is not covered with a synthetic liner, a 10% oxidation factor resulting from natural oxidation by soil bacteria was applied to the baseline emissions.
Project	• CH₄ from the incomplete combustion of LFG sent to the flare. • 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 near Donna, Texas USA. The Project therefore meets this eligibility requirement. RCE confirmed this during the site visit.

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

The initial Project submittal form was uploaded to the Reserve on October 28, 2009. The Project began gas destruction by flaring on February 21, 2005. RCE reviewed an email from Practical Controls (third party engineering firm who provides monitoring services for the Project) in support of this start date. The Project began a second crediting period with the upload on February 19, 2015 of the second Project Submittal Form for the crediting period February 21, 2015 to February 20, 2025.

- **Eligibility Rule 3: Additionality**

Performance Standard Test – Practice Threshold

The Project passes the Performance Standard Test number (A)1. since it involves:

“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.”

Performance Standard Test – Size Threshold

The size threshold test is only applicable to landfill gas energy projects. Because the only destruction device used in the project is a flare the size threshold test was not applied during this verification.

Legal Requirement Test

RCE examined the procedures outlined in the Project Monitoring Plan that BFI will follow to ascertain and demonstrate that the Project at all times passes the Legal Requirement Test. These procedures include adherence to guidance in the landfill operating permits, and participation in Republic Service’s environmental risk management policies and procedures. In addition, the landfill follows all guidelines related to the Occupational Safety and Health Administration (OSHA), to include regularly scheduled on-site safety meetings and trainings.

During the review of the supporting evidence, RCE did not observe any indication that the landfill was mandated to collect and combust their LFG. Additionally, there are no local, state or Federal mandatory requirements for the installation of a gas collection and combustion system. The landfill is subject to the NSPS rule because it has a design capacity greater than 2.5 million Mg. The landfill closed in 2013; the December 2013 Tier II test was >50 Mg/year. The EPA allows a landfill to retest and recalculate the NMOC emission rate up to the date that the BCCS is required (30 months after the >50 result). The December 2014 Tier II test found the NMOC emission rate to be 31.45 Mg/year, which is below the 50 Mg threshold; the rate will continue to decline as the landfill is closed. Therefore, the results of the review indicated that the Rio Grande Valley Landfill is following their Monitoring Plan procedures to assure they pass the Legal Requirement Test.

RCE reviewed the signed Attestation of Voluntary Implementation form and verified that it was uploaded to the Reserve after the end of the reporting period.

- **Eligibility Rule 4: Regulatory Compliance**

RCE reviewed the procedures described in the Monitoring Plan to ensure that the Project remains in compliance with all applicable local, state, and federal regulatory requirements. RCE confirmed that the procedures were being properly followed. RCE reviewed solid waste permits for evidence that the Project was in compliance with all environmental and regulatory requirements.

RCE reviewed the EPA Enforcement & Compliance History Online database (ECHO) to confirm that there were no issued notices of violation (NOVs) to the Landfill during the reporting period. RCE also reviewed the Texas Commission on Environmental Quality (TCEQ) database of municipal solid waste permits. There were no violations noted under any of the regulations, and the landfill has a high compliance history with the TCEQ based on the landfill’s adherence to various TCEQ recommended practices.

Finally, RCE reviewed the signed Attestation of Regulatory Compliance and verified that it was uploaded to the Reserve after the end of the reporting period.

3.4 Ownership of GHG reductions

RCE reviewed the signed Attestation of Title which states that BFI owns the emission reduction credits generated by the Project. RCE also reviewed the Master Agreement between BFI and Element Markets which confirms that BFI owns any emission reduction credits generated by the Project.

3.5 GHG Monitoring and Management Systems

RCE reviewed the data management systems during the site visit and desktop review. The onsite review included an assessment of the Project data collection, processing, and handling procedures, 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, a thorough assessment of recordkeeping and data storage, quality control and assurance procedures, record retention systems, as well as a complete review and recalculation of the baseline and project emissions. RCE also confirmed that the Project was implemented according to the Monitoring Plan.

The primary project data includes the LFG flow to the open flare, thermocouple temperature of the flare, and methane content of the LFG. A Yokogawa data logger records data for LFG flow, methane content and thermocouple temperature every four minutes. The LFG flow rate is measured continuously by a Thermal Instruments (TI) flow meter located after the blower. During the site visit RCE observed that the flow meter is installed correctly to allow for laminar flow of LFG. The flow meter is configured to the Protocol standard conditions of 60°F and 1 atm. Methane content of the LFG was measured continuously by a Siemens Ultramat 23 gas analyzer. No data substitution occurred during the reporting period.

3.6 Instrument QA/QC

RCE confirmed that the continuous monitoring equipment was cleaned and inspected on a regular basis, with the activities and results documented by site personnel. All inspections were performed by a third party, Practical Controls. The flow meter was cleaned, inspected, and field checked for calibration accuracy on March 31, 2016, June 29, 2016, September 30, 2016, and December 14, 2016. The December field check was performed within two months of the end of the reporting period.

The flow meter was factory calibrated on December 22, 2016. The previous factory calibration was performed on December 31, 2015. This schedule adheres to the manufacturer's guidance of 12 to 18 months.

The analyzer was cleaned, inspected, and calibrated on March 31, 2016, September 30, 2016, and December 14, 2016. The December calibration was performed within two months of the end of the reporting period. All of the field checks had a documented percent drift of less than 0.2%, well within the Protocol-required +/- 5% threshold.

Siemens recommends that the Ultramat 23 be calibrated with calibration gas every 12 months. The Project far exceeds this recommendation with the regular calibrations. The December field check and calibration was performed within two months of the end of the reporting period.

3.7 Assessment of GHG Emissions 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 are transferred to the calculation spreadsheet. RCE reviewed the formulas and raw data inputs for accuracy and

compliance with the Protocol. RCE recalculated the methane destroyed by the Project and compared these values to BFI's values in the assertion spreadsheet.

RCE reviewed checks built into the spreadsheet that account for flow only at times when the destruction device is operational; this is defined as thermocouple temperatures greater than 500°F for the open flare.

RCE confirmed that the default destruction efficiency of 96 percent was applied to the open flare. A ten percent discount was applied for the oxidation of methane by soil bacteria because the landfill does not incorporate a complete synthetic liner as part of the final cap system throughout the entire landfill. RCE reviewed source documentation for Project emissions from purchased electricity 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 confirmed that Project did not include any pre-Project destruction devices.

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 BFI's calculations with percent differences noted. The difference between RCE's and BFI's emission reductions was non-material.

Due to a failure of the data recorder, there are no data from December 12, 2015 through midnight December 31, 2015. Therefore, all emission reductions were calculated from data generated from January 1, 2016 through December 11, 2016.

4.0 Verification Results

BFI 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 BFI to quantify the emission reductions in accordance with the Reserve Landfill Project Protocol Version 4.0. The following is a summary of the verification results.

The Project reported emission reductions of 94,661 metric tons CO₂e from December 12, 2015 – December 11, 2016. 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. BFI sufficiently addressed all requests. The details of these requests are documented in RCE's List of Findings provided to the Reserve and BFI.

5.0 Verification Statement

RCE conducted a risk-based analysis of the CAR512 Rio Grande Valley Landfill 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 LFG during the reporting period December 12, 2015 through December 11, 2016 and can be considered:

- In conformance with the Reserve Landfill Project Protocol Version 4.0,
- 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 December 12, 2015 through December 11, 2016

Year	Baseline Emissions CO ₂ e (tonnes)	Project Emissions CO ₂ e (tonnes)	Emission Reductions CO ₂ e (tonnes)
2015	0	0	0
2016	94,774	113	94,661
Total	94,774	113	94,661

Lead Verifier Signature



Bonny Crews

Senior Internal Reviewer Signature



Samantha Phillips