

Verification Report for

Greenville County Landfill Gas
Utilization Project
Greer, South Carolina
USA

Climate Action Reserve
Project ID CAR495

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Report Prepared for

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Summary

Greenville Gas Producers, LLC (GGP) engaged NSF International (NSF) to verify its methane emission reductions from the Greenville County Landfill to the Climate Action Reserve for the reporting period of 1 January through 31 December 2015.

Greenville County's Enoree Landfill is a municipal landfill as described by NAICS code 562212. The "Greenville County Landfill Gas Utilization Project" (the Project) is listed in the Reserve's database with the identification number CAR495. The Project's methane emission reductions during the cited project reporting period resulted from the collection and destruction of landfill gas in a electric generation power plant and an open flare at the Greenville County Enoree landfill facility located at 1311 Anderson Ridge Road, Greer, SC 29651. The Project reduced emissions into the atmosphere by 74,718 metric tons CO₂-e for 2015.

1. Introduction

1.1 Objective

The objective of this verification audit was to determine, with reasonable assurance, that the Project had met eligibility requirements and had quantified, monitored, and fairly reported to the Climate Action Reserve its landfill gas emission reductions at the Greenville County, SC Enoree landfill in accordance with all applicable requirements of the Climate Action Reserve Landfill Project Verification 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 Greenville County landfill for the reporting period of 1 January through 31 December 2015. 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

GGP 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, 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 (December 20, 2010), 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 GGP project documentation submitted to the Climate Action Reserve and documentation prepared for the Project 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 GGP's collection and destruction operation in Greer, SC on April 8, 2016. 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 GGP'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 GGP 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 GGP's monitoring of key operational parameters of its landfill gas collection and destruction project;
- Determination GGP'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 GGP'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

Greenville County manages a closed municipal solid waste facility in Greer, SC. The Enoree landfill was closed in 2007 and accepts no more waste. During the project reporting period covered by this report, landfill gas was collected and routed for combustion to two identical Caterpillar engine sets and a single open flare located at the landfill by the Project.

The Project is equipped with a condensate knockout pot, instrumentation and controls including thermocouple at the flare tip, Rosemont 1151 and Yokogawa EJA110A pressure differential measurement devices and data loggers and a Siemens Ultramat 23 methane analyzer. The LFG engines are Caterpillar G3520C engine generator sets, each with a nameplate capacity of approximately 1.6 MWh each. 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.

Location: The project is located in Greer, SC – located entirely within the U.S. and was eligible as a landfill project under the Climate Action Reserve Protocol. NSF confirmed the location on April 8, 2016.

Project Start Date: The Project was submitted with the Climate Action Reserve on September 1, 2009, which was within 12 months after the publication date of version 2.0 of the Landfill Project Protocol under which the project was originally verified within the CAR data base. The project start date occurred after 1 January 2001, on August 1, 2007, the day the open flare became operational on a continuous basis. NSF confirmed the start date of the project from records reporting start up of the flare to the SC Bureau of Air Quality. The Greenville County Landfill Gas Utilization project had been validated, verified, and registered as a VCS project and as of September 2009, listed on the Climate Action Reserve as CAR495. The baseline & monitoring methodology for this reporting period is CAR Landfill Project Protocol, Version 3.0, December 2009. The first CAR verification period from March 20th, 2008 to September 19th, 2009 was verified to Version 2.0.

Engine start date documentation included letters of source start up to the South Carolina Bureau of Air Quality and were reviewed by NSF during this verification.

Crediting Period: The crediting period for landfill projects is 10 years from the project start date. The crediting period for the Project extends to July 31, 2017. NSF has concluded that the reporting period verified in this report is within this first crediting period of the Project.

Legal Requirement Test: NSF reviewed an attestation of voluntary implementation signed by the GGP dated June 1, 2016 for the project reporting period of January 1, 2015, through December 31, 2015. NSF, concluded that the project was subject to NSPS regulation because it had a solid waste design capacity greater than 2.5 million Mg., was required to hold a Title V Permit (No 21397), and was required to conduct Non-Organic Compound (“NMOC”) emission rate testing. Documentation reviewed for this verification report found that estimated NMOC emissions to be 11.69 Mg/year for 2014, well under the 50 Mg./year threshold where landfills are required to install a gas collection system. Since the landfill is closed this rate was not expected to exceed the regulatory threshold of 50 Mg/year in 2015, which would trigger mandatory emissions control.

NSF verified the implementation of the project developer’s monitoring plan with respect to changes in regulations that could affect the continued eligibility of the landfill gas destruction project. NSF reviewed evidence obtained from the the Project concerning knowledge of any changes to regulations that would affect the voluntary nature of the project’s implementation. NSF reviewed GGP’s Title V Operating Permit specific conditions, annual Title V compliance certification, the NESHAP engine test report for the reporting period, and conformance with its Title V recordkeeping requirements for opacity observations and restriction from use of any engine fuel except LFG. From this review, NSF has concluded that the project implementation continued to be voluntary.

Performance Standard Test: NSF determined during the site visit that the landfill had not previously collected and destroyed landfill gas prior to the implementation of the project. This conforms to the description in the Landfill Project Protocol, Version 3.0 to Scenario 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.” The project therefore has met the performance standard test described in the Landfill Project Protocol Version 3.0. According to the Protocol, the project developer who has once passed the performance standard test is eligible to register reductions for the lifetime of the project crediting period, as long as a project is not otherwise determined ineligible due to the regulatory changes that impacted project’s voluntary implementation. NSF has concluded from these facts the project has met the performance standard test.

3.3 Regulatory Compliance

NSF reviewed an Attestation of Regulatory Compliance signed by the Executive Director of GGP dated June 1, 2016 that was supported by evidence of implementation of regulatory monitoring of the project. NSF examined regulatory compliance by an interview with GGP management. In addition, NSF reviewed permits and reports which only included the Title V Operating Permit – and an inspection report by the South Carolina Bureau of Air Quality. There were no violations observed.

As a cross-check, NSF reviewed the EPA’s publicly available Office of Enforcement and Compliance History database (ECHO) on April 23, 2016. No Notices of Violation had been recorded in the database in this reporting

period for the landfill itself or the Project under the Clean Air Act, National Pollution Discharge Elimination System, or Resources Recovery and Reclamation Act.

Results of the Project's ongoing regulatory review indicated that the landfill was in compliance with federal, state and local regulations during the reporting period January 1, 2015 through December 31, 2015. From this evidence, NSF has concluded that the project had remained in material compliance with applicable laws and regulations during the reporting period January 1 through December 31, 2015.

3.4 Ownership

NSF reviewed the Attestation of Title dated June 1, 2016 concerning ownership of landfill gas emission reduction credits for the period of January 1 through December 31, 2015. This document asserts that the project applicant had legal rights to any emission reduction credits to be issued by the Climate Action Reserve.

NSF confirmed the information in the attestation of title documents by reviewing contract documents, including the contractual scope of work statement that the GGP executed with Enerdyne. NSF reviewed prior evidence that GGP retains sole ownership of the GHG emission reductions. Ownership documentation consisted of a redacted contract agreement between GGP and Greenville County, South Carolina that states GGP is entitled to any emission reduction credits or offsets from the destruction of LFG. NSF also reviewed evidence of the purchase power agreement between GGP and the third party contracted to buy electricity generated at the Landfill. The presented evidence demonstrates that GGP holds the legal title and exclusive ownership rights of the emission reductions associated with the Project.

From this evidence, NSF has concluded that the project developer, GGP, is entitled to receive the emission reduction credits that may be issued by the Climate Action Reserve for methane destroyed during this project period.

3.5 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:

- 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.
- CH₄ vented to the atmosphere.

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.

3.6 Performance Against Project Protocol/Methodology

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

Conditions Affecting Landfill Gas Collection. There were no destruction device operations issues for the reporting period. The emission reductions were relatively in line with the previous reporting period. A review of the raw data and a tour of the Project landfill and flare skid showed that the landfill continues to operate without major problems and that the collection system, electric generation plant and flare were operating smoothly.

Monitoring and Measurement Equipment. The project required the development and implementation the project monitoring and quarterly inspections cleaning and calibration of landfill gas flow metering devices.

NSF reviewed flow meter calibration and maintenance records that indicated that the flow measurement and analyzer equipment was cleaned and inspected on a quarterly basis on March 1, 2015, June 1, 2015, September 1, 2015, and December 1, 2015. Quarterly inspections, cleanings and calibrations were performed for all the flow meters with “as found,” “as left” conditions documented with each inspection and cleaning done by a qualified third-party contractor.

For all flow meters, NSF confirmed that the meters were field checked for calibration accuracy within two months of the end of the reporting period by a certified third party, per protocol requirements and that factory calibration schedules adhere to the manufacturer’s guidance. For the Verabar flare flow meter and Lamda Square flow meters for total flow and engine flow, calibration is not required, but annual inspection for any clogging is recommended. For the Rosemont and Yokogawa differential pressure transmitters, calibration is recommended annually. The Rosemount and Yokogawa Transmitter components of the flow meters were calibrated June 6, 2015 and last calibrated November 23, 2015 by a certified calibration service within two months of the end of the reporting period. Calibration records indicated that accuracy on these checks were well within the protocol guidelines of $\pm 5\%$.

For the Siemens Ultramat 23 methane analyzer, the manufacturer requires calibration to certified gases annually. The Project’s analyzer was calibrated June 9, 2015 and laboratory calibrated November 5, 2015, within two months of the end of the reporting period.

The landfill owns and maintains a portable gas analyzer used to measure daily landfill gas data for comparison to the Siemens for operational checks. A Landtec GEM -12445 is used for this purpose, and during this reporting period the GEM was not used for Project emission reduction calculations. However, since the GEM is used to monitor the Siemens analyzer performance, it is daily calibrated prior to use and factory calibrated semiannually. Semiannual factory calibration certificates showed the GEM to be within acceptable tolerances.

NSF concludes that the flow metering and gas analyzer in use conformed to protocol requirements and to the manufacturer-recommended factory calibration intervals.

The Monitoring Plan and Missing Data calculation procedures were reviewed for consistency with the Landfill Project Protocol requirements and the application Errata and Clarifications document. No discrepancies with requirements were found. There were no instances of missing data substitution during the reporting period.

The project utilized a paperless chart recorder (“data logger”) with remote operations capability to collect flow and temperature with readings taken continuously and averaged every four minutes. The project did not count methane destroyed in the flare when the flare’s temperature sensor recorded temperatures lower than 500 degrees F. NSF also confirmed that data was corrected on Excel spreadsheets to 60 deg F and 14.7 psia per protocol requirements.

The Project maintains two separate metered electrical services recording engine operational status hourly in kWh. NSF reviewed reports from the utility company showing hourly engine operation for the entire year. In addition, NSF reviewed selected on site electronic engine operator logs showing hourly engine operations. From these records NSF determined the appropriate hourly destruction device monitoring was performed during the reporting period.

3.7 Project Management System

NSF verified the project's management system in the site visit conducted on April 8, 2016. 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 – ISR found the continued adequate control environment existed for the project.

3.8 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

Baseline emissions were calculated using protocol equations found in Section 5 of the protocol. Default emission factors were used in all cases except an engine destruction efficiency of 99.5% was applied during the reporting period. The specific engine destruction efficiency was used because the Project performed emission destruction testing in 2014 and 2015, which included inlet, and outlet methane concentrations demonstrating the destruction efficiency used in baseline emission calculations. For this reporting period, NSF examined a data set of four months of Excel files and a number of aggregated Excel data files to verify that spreadsheet formulas were consistent with the Landfill Gas Project Protocol and that operating parameters (flare temperatures and flow, in particular) have been met. Raw data from the chart recorder were compared to CRT calculation for the same periods.

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 EPA eGRID emission factors for electricity for the SRVC region and found the correct 2012 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.

3.9 Corrective Action Requests/Recommendations

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

3.10 Approved Variances or Deviations

CAR issued a variance for this Project on December 11, 2015 regarding use of single flow metering to measure LFG destructed by two identical engines. The variance required:

- The project developer to be able to demonstrate that electricity produced by the engines is proportional to the volume of flow as confirmed by the verifier,
- The verifier confirm it is physically impossible for LFG to vent from the engines while not in operation, and
- The verifier to confirm the monitoring plan is updated to reflect that each engine's operational status will be monitored independently moving forward.

While on site NSF, verified through visual observation each engine is of the same design and capacity, that there is an automatic cut off valve installed on each engine that prevents flow of LFG to the engine when it is not operational or when LFG flow is insufficient, and that the SCADA system on each engine automatically tracks the amount of gas consumed, kWhs being generated and MMBTUs being consumed by each engine during operation of both or one engine. Further, NSF verified the Monitoring Plan had been revised to indicate hourly monitoring of each engine's operational status by the site operator and data system, and that this data is to be submitted weekly to the Project's data coordinator for QA/QC. Evidence was produced that each engine's electrical output is measured independently by the local utility purchasing the Project's electrical kWhs. Such reports were produced by the Project to the verifier for the report period. As such, NSF concluded the Project met the requirements outlined in the Variance.

4. Verification Results

4.1 Verification Team Recommendation

Reductions/Removals from January 1, 2015 to December 31, 2015		Metric tons CO ₂ -e
Project baseline		74,968
- Project emissions		250

- Project adjustments (Two Pre-project non-qualifying destruction devices (e.g. passive flares) used for odor control.	0
= Net project emission reductions/removals	74,718

4.2 Verification Audit Summary

Project Developer	Greenville County Landfill Gas Utilization Project LLC
Project Location	Greer, South Carolina, USA
Project Type	Collecting and Destroying Methane from Landfills
Project Period	January 1, 2015 through December 31, 2015
Protocol/Methodology	Climate Action Reserve, Landfill Project Protocol, Version 3.0
Emissions/Removals Verified	Vintage 2015: 74,718 metric tons of CO ₂ -e
Verification Conclusion	Based upon the above, NSF has concluded that the Greenville County Landfill Gas Utilization Project 2015 vintage methane emission reductions of 74,718 metric tons (CO ₂ -e) reported to the Climate Action Reserve are, in all material respects, fairly stated.
Lead Verifier	 Michael DeBusschere, 06-14-2016
Internal Reviewer	 Tina Sentner, June 14, 2016
<i>This verification statement is valid when signed and dated by an NSF internal reviewer.</i>	