

Verification Report for Sustainable Energy Solutions, LLC Wolf Creek Landfill—CAR 498 Dry Branch, Georgia

Climate Action Reserve

February 2015

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1. Introduction

This report is provided to Sustainable Energy Solutions, LLC (SES) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the Wolf Creek Landfill – CAR498 (the Project) for the period from January 1 through December 31, 2014. First Environment, Inc. (First Environment) conducted the verification from the date of the kick-off meeting until February 13, 2015.

2. Objectives

The purpose of this verification was, through review of appropriate evidence, to establish that:

- the Project conforms to the requirements of the verification criteria, including all eligibility requirements, discussed in Section 4 of this report; and
- the data reported are accurate, complete, consistent, transparent, and free of material error or omission.

3. Verification Scope

Specific scope metrics for the verification are outlined in the table below:

Geographic Boundaries	Wolf Creek Landfill operation, Dry Branch, Georgia
Emission Reduction Sources, Project Emissions, and Greenhouse Gases	Emissions reductions (expressed in units of Carbon Dioxide equivalents (CO ₂ e)) resulting from methane destruction; Project emissions of CO ₂ from fossil fuel combustion and purchased electricity.
Reporting Period	January 1 through December 31, 2014
Data Sources	Metered Data and Emissions Reduction Calculations

4. Standards Used to Verify Emissions (Criteria)

The following table outlines the guidance and protocols used to conduct this verification:

Standard of Verification	• Climate Action Reserve U.S. Landfill Project Protocol, Version 3.0, December 2, 2009 (CAR Protocol) • Climate Action Reserve Landfill Project Protocol Version 3.0 Errata & Clarification, January 14, 2015 (Errata and Clarification) • Climate Action Reserve Program Manual, October 26, 2011
Verification Process	• Section 8 of the CAR Protocol • Errata and Clarification • Climate Action Reserve Verification Program Manual, December 20, 2010 • ISO 14064-3: Specification with guidance for the validation and verification of greenhouse gas assertions, 2006

Level of Assurance	• Reasonable assurance
Materiality	• Misstatements greater than one percent of the Project's emission reductions assertion are considered material • Qualitative non-conformities with the CAR Protocol are also considered material

5. Overview of the Verification Process

The verification process was utilized to gain an understanding of the Project's emission sources and reductions, to evaluate and verify the collection and handling of data, the calculations that lead to the results, and the means for reporting the associated data and results.

The following verification process was used:

- conflict of interest review;
- selection of Verification Team;
- initial interaction and kickoff meeting with SES;
- development of the verification and sampling plans;
- review of management and data collection system;
- site visit;
- assessment of raw data and calculations for period under review;
- follow-up interaction with SES for corrective action, clarification, or supplemental data as needed; and
- final statement and report submittal.

5.1 Conflict of Interest Review

Prior to beginning any verification project, First Environment conducts an evaluation to identify any potential conflicts of interest associated with the Project. No potential conflicts were found for this Project. First Environment also received authorization to proceed with verification activities for the project developer from CAR in a notification dated November 6, 2014.

5.2 Verification Team

First Environment's Verification Team consisted of the following individuals who were selected based on their verification experience, as well as familiarity with landfill operations.

Lead Verifier – Jeff Daley
Verifiers – Luca Nencetti
Senior Internal Reviewer – Michael Carim

5.3 Verification Kick-off

The verification was initiated with a kick-off meeting on November 17, 2014 with the project developer. The meeting focused on confirming the scope, schedule, and data required for verification.

5.4 Development of the Verification Plan

The Verification Team formally documented its verification plan as well as determined the data-sampling plan. The verification plan was developed based on the discussion of key elements of the Project verification process during the kick-off meeting. SES was afforded the opportunity to comment on the key elements of the plan for verification. Based on items discussed and agreed upon with SES, the plan identified the First Environment project team members, project level of assurance, materiality threshold, and standards of evaluation and reporting for the verification. It also provided an outline of the verification process and established project deliverables. A separate data-sampling plan was designed to review all project elements in areas of potentially high risk of inaccuracy or non-conformance.

5.5 Site Visit

Mr. Luca Nencetti conducted a site visit on December 11, 2014 to assess the Project's data management systems and interview personnel relevant to the Project for the verification period.

5.6 Emissions Reduction Data and Calculation Assessment

This assessment used information and insights gained during the previous steps to evaluate the collected data and the reported emissions reduction quantities, and identify if either contained material or immaterial misstatements.

5.7 Corrective Actions and Supplemental Information

The team issued corrective action requests during the verification process. SES provided sufficient responses to all corrective action requests.

5.8 Verification Reporting

Verification reporting, represented by this report, documents the verification process and identifies its findings and results. Verification reporting consists of this report for SES, a verification statement, and a list of findings, all of which are submitted to the Climate Action Reserve.

6. Site's Conformance with Verification Criteria

6.1 Project Description

The Wolf Creek Landfill, located in Dry Branch, Georgia, is owned and operated by Wolf Creek Landfill, LLC, a subsidiary of Advanced Disposal Services, Inc. The landfill opened in 1992 and currently receives municipal solid waste, construction and demolition debris, and other non-hazardous wastes.

SES installed a landfill gas (LFG) collection and control system, including an open flare and a LFG well field, in January 2010. In November 2011, installation of two electric generators was completed and both generators came online November 23, 2011. Power is generated from two Jenbacher Type 420 GS-B82 spark ignition internal combustion engines rated at 1426KW each. In August 2012, an enclosed flare was installed and came online September 2012. Prior to these systems, LFG was not collected at the landfill. The Project consists of the voluntary collection and destruction of landfill gas in the open flare, enclosed flare, or engines. The

Project destroys landfill gas that otherwise would be vented to the atmosphere, resulting in a net reduction of CO₂-equivalents. The baseline scenario, defined as the total release of landfill gas to the atmosphere, was confirmed during the initial verification for the Project.

6.2 Eligibility

SES meets the eligibility requirements set forth in the CAR Protocol, as described below.

6.2.1 Ownership and Title

Ownership of the emission reductions was demonstrated through the Landfill Gas Collection and Combustion Agreement between SES and Wolf Creek Landfill, LLC establishing SES' exclusive ownership rights to Environmental Attributes of any sort arising from landfill gas captured and destroyed at the Wolf Creek Landfill, including any credits generated. With the addition of the energy plant, a Power Purchase Agreement (PPA) was entered into between Walton Electric Membership Corporation (power purchaser) and Wolf Creek Landfill, LLC. The PPA indicates the power purchaser obtains no rights, title, or other interests in any GHG emission reduction attributes associated with power production and that these are retained by SES. First Environment also reviewed the landfill's Title V Permit and Solid Waste Handling Permit to confirm that Wolf Creek is the owner, in the first instance, of the emission reduction credits associated with the landfill gas.

Additionally, First Environment relied on the Attestation of Title completed by SES for the current reporting period to establish ownership of GHG emission reductions. The Attestation is on file with CAR and was reviewed to confirm that it was completed correctly.

6.2.2 Project Start Date

First Environment confirmed that the Project meets CAR's start date requirements. The Project start date is January 28, 2010, which was confirmed during the initial verification through review of flare start-up records.

6.2.3 Additionality

The Project passes both the Performance Standard Test and the Legal Requirements Test, as described below.

6.2.3.1 Performance Standard Test

The Project consists of the installation of a new landfill gas collection and control system and therefore exceeds the performance standard defined by the CAR protocol, specifically Scenario 1 from the list provided in Section 3.4.1 of the CAR Protocol. It was also confirmed during the site visit that the landfill is not a bioreactor.

6.2.3.2 Legal Requirements Test

The Title V permit for the landfill, the Title V permit for the internal combustion engines, the Solid Waste Handling Permit, and Tier II test results were reviewed during this verification period to confirm conformance with the Legal Requirement test. The Wolf Creek Landfill is subject to New Source Performance Standard (NSPS) rules requiring the facility to conduct Non-Methane Organic Compound (NMOC) emission rate testing. The most recent Tier II emissions rate

testing occurred in February 2012. Tier II testing is not required to occur again until February 2017. The most recent emission Tier I rate estimates were calculated in February 2014, projecting an NMOC emissions rate of 38.17 Mg/yr in 2014, below the 50 Mg/yr threshold that would require installation of a gas collection and combustion system.

To further inform the assessment of regulatory additionality, First Environment performed a cursory review of the landfill's operating permits and relevant Georgia Department of Natural Resources regulations for municipal solid waste landfills. This cursory review indicated that the project is not required by regulation; therefore, the Project passes the CAR Protocol's Legal Requirements Test.

Additionally, First Environment relied on the Attestation of Voluntary Implementation completed by the SES for the current reporting period. The Attestation is on file with CAR and was reviewed to confirm that it was completed correctly.

6.2.4 Regulatory Compliance

First Environment reviewed the landfill's original solid waste permit, Title V permits for the landfill and the LFG power station, and generated a compliance report on February 6, 2015 using the Environmental Protection Agency's (EPA) Enforcement and Compliance History Online (ECHO) database to determine regulatory compliance. The cursory review indicated that the site was in compliance and no violations of permits occurred during the reporting period.

Additionally, First Environment relied on the Attestation of Regulatory Compliance completed by SES for the current reporting period. The Attestation is on file with CAR and was reviewed to confirm that it was completed correctly.

6.3 Project Performance Against CAR Protocol and Project Management System

The Project was implemented in conformity with the CAR Protocol. SES developed and implemented a Monitoring Plan to track relevant project parameters and data sources. The Monitoring Plan, including the Project Diagram, was reviewed to determine compliance with the protocol requirements. Based on observations made during the site visit and review of relevant project documentation, First Environment found the Monitoring Plan and Project Diagram to meet the requirements set forth by the CAR Protocol and the Project to be implemented in accordance with the Monitoring Plan.

6.3.1 Project Monitoring

Landfill gas flow sent to the open flare is continuously monitored using a Rosemount Mass ProBar flow meter (s/n 0037537) measuring differential pressure, temperature, and pressure of the gas stream. The meter standardizes flow readings to a pressure of one atmosphere and a temperature of 60°F.

Landfill gas flow sent to the engines is continuously monitored using a Rosemount Mass ProBar flow meter (s/n 0020710) measuring differential pressure, temperature, and pressure of the gas stream. The meter standardizes flow readings to a pressure of one atmosphere and a temperature of 60°F.

Landfill gas sent to the enclosed flare is continuously monitored using a FCI ST75 Mass flow meter (s/n 427800). The meter standardizes flow readings to a pressure of one atmosphere and a temperature of 60°F.

A Siemens Ultramat 23 Continuous Gas Analyzer measures gas composition for methane, oxygen, and carbon dioxide content. A GEM2000 portable gas analyzer is also used to take periodic methane measurements, although only continuously monitored methane data was used for the purposes of emission reduction quantification over this reporting period.

Gas flows to all combustion devices and the methane content of LFG are measured on the same relative moisture basis.

The open flare and enclosed flare both incorporate a Pyromation thermocouple to monitor operation of the combustion devices. Operating hours of engines are monitored through hourly records of electricity production.

A PLC system continuously records gas flow, continuous methane concentration, and flare temperature data on a Yokogawa digital chart recorder.

Table 1 summarizes the Project monitoring system parameters and monitoring equipment employed by the Project.

TABLE 1: Monitoring Equipment

Parameter	Monitoring Equipment	Frequency of Measurement	Frequency of Recording	Recording Device
Landfill gas flow	Two Rosemount Mass ProBar flow meters One FCI ST75 flow meter	Continuous	Every 30 seconds	Yokogawa digital chart recorder
Methane Concentration	Siemens Ultramat 23 Continuous Gas Analyzer	Continuous	Every 30 seconds	Yokogawa digital chart recorder
Hourly Operation of open flare	Pyromation thermocouple	Continuous	Every 30 seconds	Yokogawa digital chart recorder
Hourly Operation of enclosed flare	Pyromation thermocouple	Continuous	Every 30 seconds	Yokogawa digital chart recorder
Hourly Operation of engine generators	Utility Meter	Continuous	Hourly	Recorded by local utility

6.3.2 Instrument Quality Assurance/Quality Control

SES' instrument quality assurance/quality control (QA/QC) plan for the Project's monitoring equipment complies with CAR's requirements. .

The Rosemount Mass ProBar flow meters and FCI ST75 Mass flow meter are cleaned and inspected quarterly by site personnel with as found/as left conditions documented. The flow

meters are field checked for calibration accuracy by a third-party technician within two months prior to the end of the reporting period. First Environment reviewed evidence of quarterly inspections and cleanings with as-found/as-left conditions documented, and third-party field checks for accuracy of all flow meters, all of which indicated that the flow meters were operating accurately within the required five percent accuracy range. The manufacturer of the Rosemount flow meters does not recommend a specific interval to perform calibrations on an ongoing basis so the instruments are calibrated at a minimum of every five years. The manufacturer of the FCI flow meter recommends calibration every 18 months and as such, the FCI flow meter is calibrated according to manufacture recommendations.

The Siemens Ultramat gas analyzer is field checked by a third party at least once per reporting period, but no more than two months prior to the end of the reporting period, and is inspected/cleaned and calibration accuracy checked on a monthly basis by SES personnel with as found/as left conditions documented. The manufacturer does not recommend a specific interval to perform calibrations on an ongoing basis; however, the instrument is calibrated annually according to the manufacturer's procedure by a third party. First Environment reviewed evidence of all gas analyzer field checks, and the calibration performed during the current reporting period which indicated the analyzer was operating accurately within the five percent threshold established by the CAR Protocol.

In accordance with the Project's monitoring plan, if the Ultramat 23 gas analyzer is not functioning properly, a GEM2000 portable gas analyzer will be used to take manual methane readings during these periods of down time. The Ultramat 23 gas analyzer was found to be functioning properly for the entire length of the verification period; thus, this alternate source of methane concentration data was not needed.

Additionally, First Environment confirmed that the portable Landtec GEM-2000 used to perform the third-party field calibration accuracy check of the flow meter and continuous methane analyzer was calibrated and maintained per the manufacturer's requirements.

Table 2 shows the dates during the current reporting period when instrument QA/QC was performed.

TABLE 2: Instrument QA/QC

Monitoring Equipment	Calibration	Third Party Field Checked for Accuracy	Inspected/Cleaned
Rosemount flow meter (Open flare meter, s/n 0037537)	1/16/2013; 11/18/2014	11/20/2014	1/20/2014; 4/22/2014; 7/7/2014; 9/25/2014; 12/16/2014
Rosemount flow meter (Engine meter, s/n 0020710)	1/16/2013; 11/18/2014	11/20/2014	1/20/2014; 4/22/2014; 7/7/2014; 9/25/2014; 12/16/2014
FCI ST75 flow meter (Enclosed flare meter s/n 427800)	1/28/2014	11/20/2014	1/13/2014; 4/22/2014; 7/7/2014; 9/25/2014; 12/16/2014
Siemens Ultramat 23 gas analyzer	11/20/2014	11/20/2014	1/21/2014; 2/6/2014; 3/11/2014; 4/28/2014; 5/24/2014; 6/16/2014; 7/7/2014; 8/11/2014; 9/2/2014; 10/6/2014; 11/10/2014; 12/16/2014

6.3.3 Project Emissions

Project emissions sources and the associated monitoring methodology are summarized in Table 3.

TABLE 3: Project Emissions

Project Emissions Source	Monitoring
Consumption of Purchased Electricity	Monthly utility invoices
Propane consumption	Fuel purchase records

6.4 Emissions Reduction Calculation Assessment

The emission reduction calculations were reviewed to ensure accuracy in the formulas applied and the raw data used as inputs. The formulas were tested to ensure consistency with the calculation methodology described in the CAR Protocol.

Total LFG flow in a given day was computed by averaging the continuous readings and then multiplying the average by the total length of time included in the interval. Metered gas flow volumes were automatically corrected to standard conditions at one atmosphere of pressure and a temperature of 60°F by the flow meters. The total volume of methane destroyed by the Project was computed in daily intervals by multiplying the daily LFG flow to the open flare, the engine generators, and the enclosed flare by the daily average of methane concentration measurements and is converted to a mass flow using the density of methane at 60°F and one atmosphere of pressure. The total quantity of methane destroyed by the Project is aggregated monthly and summed over the reporting period to obtain the total baseline emissions.

Project emissions were calculated by multiplying activity data by an appropriate emission factor. The total emission reductions were determined by subtracting the Project emissions from the baseline emissions.

Table 4 summarizes the input parameters used in the emission reduction calculations.

TABLE 4: Input parameters

Input Parameter	Name	Description/ Value
$LFG_{i,t}$	Total quantity of LFG	Summed daily from metered data, internally corrected to 60°F and one atmosphere of pressure
$PR_{CH_4,t}$	Methane content	Averaged daily from continuously recorded data
DE_i	Default destruction efficiency	93.6% (engines) 96% (open flare) 99.5% (enclosed flare)
OX	Oxidation Factor	10%
DF	Discount Factor	0

Input Parameter	Name	Description/ Value
Open flare and enclosed flare Temperature Cut-off	Metered data below corresponding temperature cut-off are excluded from calculations.	500°F
EF _{FF}	Propane emission factor	5.74 kg CO ₂ /gal
EF _{EL}	Purchased electricity emission factor	1,354.09 lb CO ₂ /MWh

Copies of the raw data used in the calculations, including flow data, and methane content data were compared with the data used in the final calculations and tested for transcription or mathematical errors. A representative sample of raw data sources and calculations over the entire verification period was reviewed. First Environment performed recalculations of emission reductions for the entire reporting period to assess whether they were free of material misstatement. First Environment found the emission reduction calculations to be free of material misstatement.

6.5 Approved Variance or Deviations

No variances or deviations were requested for the Project in this reporting period.

7. Verification Conclusion

Based on the evidence collected and the assessments performed, First Environment concludes that the Project's GHG emissions reductions achieved through the collection and combustion of landfill gas for the period January 1 through December 31, 2014 can be considered with a reasonable level of assurance:

- in conformance with the verification criteria, and
- without material discrepancy.

Verified results show:

Reporting Period: January 1 to December 31, 2014	Total
Baseline Emissions (tCO ₂ e)	110,404
Project Emissions (tCO ₂ e)	842
Emissions Reductions (tCO ₂ e)	109,562

8. Lead Verifier Signature



Jeff Daley
Environmental Specialist

9. Senior Internal Reviewer Signature



Michael Carim
Senior Associate