

Verification Report for Northeast Mississippi Landfill Walnut, Mississippi

Climate Action Reserve—CAR435

November 2016

Prepared by: First Environment, Inc.
91 Fulton Street
Boonton, New Jersey 07005



TABLE OF CONTENTS

1.	Introduction	1
2.	Objectives	1
3.	Verification Scope	1
4.	Standards Used to Verify Emissions (Criteria).....	1
5.	Overview of the Verification Process	2
5.1	Conflict of Interest Review	2
5.2	Verification Team	2
5.3	Verification Kick-off	2
5.4	Development of the Verification Plan	3
5.5	Site Visit.....	3
5.6	Emissions Reduction Data and Calculation Assessment	3
5.7	Corrective Actions and Supplemental Information.....	3
5.8	Verification Reporting.....	3
6.	Site's Conformance with Verification Criteria.....	3
6.1	Project Description.....	3
6.2	Eligibility.....	4
6.2.1	Ownership and Title	4
6.2.2	Project Start Date	4
6.2.3	Additionality	4
6.2.3.1	Performance Standard Test.....	4
6.2.3.2	Legal Requirements Test.....	4
6.2.4	Regulatory Compliance.....	5
6.3	Project Performance Against CAR Protocol and Project Management System	5
6.3.1	Project Monitoring	5
6.3.2	Instrument Quality Assurance/Quality Control.....	6
6.3.3	Project Emissions	7
6.4	Emissions Reduction Calculation Assessment.....	7
6.5	Approved Variance or Deviations.....	8
7.	Verification Conclusion.....	9
8.	Lead Verifier Signature.....	9
9.	Senior Internal Reviewer Signature	10

TABLES

TABLE 1: Monitoring Equipment	6
TABLE 2: Instrument QA/QC	7
TABLE 3: Project Emissions	7
TABLE 4: Input Parameters	8
TABLE 5: Assessment of Variance Requirements	9

1. Introduction

This report is provided to Waste Services of N.E. Mississippi, Inc. (Waste Services) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the Northeast Mississippi Landfill – CAR435 (the Project) for the period from January 1 through December 31, 2015. First Environment, Inc. (First Environment) conducted the verification from the date of the kickoff meeting through November 18, 2016.

During the verification process Element Markets, LLC (Element Markets) acted as the Project advisors for the Project developer, Waste Services of N.E. Mississippi, Inc. First Environment communicated primarily with Element Markets regarding all verification activities.

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	Northeast Mississippi Landfill, Walnut, MS
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, 2015
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 2.0, November 18, 2008 (CAR Protocol) • Climate Action Reserve Landfill Project Protocol Version 2.0 Errata & Clarification, June 18, 2015 (Errata and Clarification) • Climate Action Reserve Program Manual, September 1, 2015
Verification Process	• Landfill Project Verification Protocol, Version 2.0, November 18, 2008 • 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 and 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 Waste Services and Element Markets;
- development of the verification and sampling plan;
- review of management and data collection system;
- site visit;
- assessment of raw data and calculations for the period under review;
- follow-up interaction with the Waste Services and Element Markets 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 March 18, 2016.

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
Verifier – Luca Nencetti
Senior Internal Reviewer – Michael Carim

5.3 Verification Kick-off

The verification was initiated with a kick-off meeting on April 7, 2016 with Waste Services and Element Markets. 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. Waste Services was afforded the opportunity to comment on the key elements of the plan for verification. Based on items discussed and agreed upon with Waste Services, 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. Jeff Daley conducted a site visit on July 26, 2016 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 and clarification requests during the verification process. Waste Services provided sufficient responses to all of the corrective action and clarification 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 Waste Services, a verification statement, and a list of findings, all to be submitted to the Climate Action Reserve.

6. Site's Conformance with Verification Criteria

6.1 Project Description

The Northeast Mississippi Landfill is located in Walnut, Mississippi and is owned and operated by Waste Services of N.E. Mississippi, Inc., a subsidiary of Waste Connections. The landfill opened in 1998 and currently receives municipal solid waste.

The Project consists of the voluntary collection and destruction of landfill gas in an open flare. Waste Services began installing a landfill gas (LFG) well field and active gas collection and control system in 2008. In 2006, a non-qualifying solar flare was installed to collect gas from a leachate cleanout as a means of odor control. The solar flare was operational until 2008 when the project activity commenced. Prior to the installation of the solar flare, landfill gas was vented to the atmosphere. The baseline scenario is defined as the destruction of landfill gas prior to the Project activity using a non-qualifying destruction device.

6.2 Eligibility

The Project meets the eligibility requirements set forth in the CAR Protocol as described below.

6.2.1 Ownership and Title

The landfill is owned by Northeast Mississippi Solid Waste Management Authority (the Authority), and operated by Waste Services of N.E. Mississippi, Inc. The Authority and Waste Services of N.E. Mississippi, Inc. entered into a landfill operating contract conveying operating authority to Waste Services of N.E. Mississippi, Inc. On June 9, 2008, the operating contract was amended to give Waste Services of N.E. Mississippi, Inc. authority to design, construct, and implement a landfill gas collection system. This addendum explicitly identifies that Waste Services of N.E. Mississippi, Inc. retains all right and title to any and all environmental attributes, including carbon credits. Additionally, purchase records were reviewed which show that Waste Services of N.E. Mississippi, Inc. owns the project equipment (i.e., flare skid). Therefore, Waste Services of N.E. Mississippi, Inc. is the owner of the Project and consequently owns the rights to any emission reduction credits generated by it. The ownership status was also confirmed at the site visit through interviews conducted with project personnel.

Additionally, First Environment relied on the Attestation of Title completed by Waste Services of N.E. Mississippi, Inc. for the current reporting period. 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 November 5, 2008, which was confirmed through review of a service order from the flare installation company (Shaw LFG Specialties), who confirmed that the flare began operation on this date.

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 landfill gas collection and control system and therefore exceeds the performance standard defined by the CAR Protocol, specifically Scenario 2a from the list provided in Section 3.3.1 of the CAR Protocol, because landfill gas had previously been collected and destroyed in a non-qualifying destruction device prior to the project start date. It was also confirmed during the site visit that the landfill is not a bioreactor.

6.2.3.2 Legal Requirements Test

The landfill has a permitted capacity above the 2.5 million cubic meter threshold of municipal solid waste that triggers New Source Performance Standard (NSPS) requirements. As such, Waste Services conducted non-methane organic compounds (NMOC) emissions rate testing on August 20, 2012. The NMOC Emissions Rate calculations indicated that the NMOC emission rate was estimated to be 16.53 megagrams (Mg) per year in 2015, which is below the 50 Mg per year threshold established by the NSPS regulation. Therefore, the landfill is not required to operate an active collection system under NSPS requirements. The NSPS regulation and the NMOC threshold are currently in the process of being updated by the United States Environmental Protection Agency. However, the 50 Mg per year threshold was the applicable standard during the current reporting period.

Additionally, First Environment relied on the Attestation of Voluntary Implementation completed by Waste Services of N.E. Mississippi, Inc. 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 current Title V permit, Solid Waste Operating permit, Pretreatment Permit, NPDES Permit, generated a compliance report on November 8, 2016 using the Environmental Protection Agency's (EPA) Enforcement and Compliance History Online (ECHO) database, reviewed Mississippi Department of Quality (MDEQ) inspection reports, and interviewed site personnel to determine regulatory compliance. This cursory review of permits, the EPA compliance database, site compliance inspection reports, and interviews conducted at the site visit 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 the Waste Services of N.E. Mississippi, Inc. 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. Waste Services 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 is continuously monitored using a Rosemount MultiVariable Mass Flow meter and transmitted to a Yokogawa datalogger that electronically archives all flow data. The landfill owns two identical flow meters to facilitate a quarterly meter calibration schedule. Flow data are measured at a standard temperature and pressure of 68°F and one atmosphere, respectively. The data are exported to Microsoft Excel for review and quantification.

The methane concentration of the landfill gas is continuously measured with a Siemens Ultramat 23 methane analyzer. The continuous methane content of the landfill gas is recorded by the Yokogawa data logger, and data are exported to Microsoft Excel for review and quantification.

Both gas flow rates and methane concentration are measured on the same relative moisture basis.

Flare temperature is continuously monitored by thermocouples and recorded by the Yokogawa datalogger. The data are also exported to Microsoft Excel for review and quantification.

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	Rosemount MultiVariable Mass Flow meter(s)	Continuous	Every 8 minutes	Yokogawa digital chart recorder
Methane Concentration	Siemens Ultramat 23 continuous analyzer	Continuous	Every 8 minutes	Yokogawa digital chart recorder
Hourly Operation of Destruction Device	Thermocouple	Continuous	Every 8 minutes	Yokogawa digital chart recorder

6.3.2 Instrument Quality Assurance/Quality Control

Waste Services' instrument quality assurance/quality control (QA/QC) plan for the Project's monitoring equipment complies with CAR Protocol's requirements, except where noted below.

The flow meter was calibrated on a quarterly basis with as-found/as-left conditions documented. First Environment reviewed all quarterly calibrations performed during the current reporting period, all of which indicated that the flow meters were operating within the required five percent accuracy range. The manufacturer recommends factory calibrations once every three years. The Project flow meters are calibrated more frequently than manufacturer recommendations.

The gas analyzer was cleaned, inspected, field checked, and calibrated on a quarterly basis with as-found/as-left conditions documented, with the exception of the first quarter of 2015. As a result of the missing documentation for the first quarter cleaning/inspection and calibration, Waste Services requested a monitoring variance as discussed in Section 6.5 below. First Environment reviewed all quarterly field checks and calibrations performed during the current reporting period, all of which indicated that the analyzer was operating within the required five percent accuracy range, with the exception of the fourth quarter 2015 check which revealed the analyzer was operating outside of the required accuracy range. The analyzer was successfully calibrated with the resulting as-left drift well within the required five percent accuracy threshold. As a result of the as-found drift, all affected methane concentration data was drift corrected back to the last successful field check/calibration. The manufacturer only recommends an annual field accuracy check and does not recommend a specific interval to perform calibrations. Therefore, the Protocol five-year default calibration interval applies. However, the analyzer is field calibrated on a quarterly basis.

Additionally, First Environment confirmed that the calibration gas used to perform the third-party field calibration and accuracy check of the continuous methane analyzer was valid.

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

TABLE 2: Instrument QA/QC

Monitoring Equipment	In Service	Calibration
Rosemount 3095MF flow meter (s/n 295444)	4/1/2015 - 7/1/2015; 10/1/2015 - 12/31/2015	1/1/2015; 7/1/2015
Rosemount 3095MF flow meter (s/n 33517)	1/1/2015 - 4/1/2015; 7/1/2015 - 10/1/2015	4/1/2015; 12/4/2015
Siemens Ultramat 23 continuous gas analyzer	Entire reporting period	5/20/2015; 9/22/2015; 11/6/2015

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	Purchase Invoices
Propane consumption	Purchase Invoices
Diesel consumption	Purchase Invoices

6.4 Emissions Reduction Calculation Assessment

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

Total landfill gas flow is computed by multiplying the average landfill gas flow rate in a given interval by the length of the interval. Flow totals are aggregated on a daily basis. Metered gas flow volumes were automatically corrected to one atmosphere of pressure and a temperature of 68°F by the flow meters. As such, the standard conditions of the landfill gas flow were corrected in the calculations to standard conditions of one atmosphere of pressure and a temperature of 60°F. The total volume of methane destroyed by the Project was computed in daily intervals by multiplying the daily gas flow to the 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. The pre-project discount was calculated in accordance with Protocol requirements by calculating total flow based on the maximum flow design capacity (scfm) of the destruction device multiplied by the average methane concentration during the current reporting period. The quantity of pre-project methane destroyed was converted to mass flow using the density of methane at 60°F and one atmosphere of pressure. The pre-project discount was subtracted from the total quantity of methane destroyed by the Project during the reporting period. Project emissions were calculated by multiplying activity data by an appropriate emission factor. No data

substitution was performed during the current reporting period. 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 landfill gas sent to the flare	Summed daily from metered data, internally corrected to 68°F and one atmosphere of pressure
LFG _{PP}	Quantity of landfill gas flow destroyed by the non-qualifying pre-project destruction device	Calculated based on the maximum flow capacity of the destruction device in accordance with the Protocol.
PR _{CH₄,t}	Methane content	Averaged daily from continuously recorded data
PP _{CH₄}	Methane concentration of the landfill gas destroyed by the non-qualifying pre-project destruction device	In accordance with Errata & Clarification, PP _{CH₄} is equal to the average monitored methane concentration over the reporting period.
DE _i	Default destruction efficiency	96%
OX	Oxidation Factor	10%
DF	Discount Factor	0%
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 /gallon
EF _{FF}	Diesel emission factor	10.15 kg CO ₂ /gallon
EF _{EL}	Purchased electricity emission factor	1,337.15 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 were 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*

As noted above, Waste Services requested a variance from the CAR Protocol for the current reporting period. Specifically, the first quarter QAQC of the continuous methane analyzer was not documented. The variance request was approved by CAR on November 17, 2016 (2015-VAR-DET-CAR435) for the period of January 1 through December 31, 2015. Table 5 summarizes the specific conditions of the variance approval and First Environment's verification conclusion.

TABLE 5: Assessment of Variance Requirements

Variance Requirement	Verification Conclusion
The verifier confirms that the field check immediately before and after the missing field check indicated that the meter was operating within the +/-5% threshold required by the protocol.	First Environment confirmed through review of calibration and field accuracy check records that the field check immediately before and after the missing field check indicated that the analyzer was operating within the +/-5% threshold required by the Protocol. Specifically, the analyzer was field checked and calibrated on December 2, 2014 which identified a 0.23% drift, and on May 20, 2015 which identified a 0.6% drift.
The verifier confirms that the monitoring plan includes language which describes the quarterly field check requirements, including a process for maintaining verifiable evidence that the field checks occurred.	First Environment confirmed that the Monitoring Plan contains the necessary language identifying the field check requirements and also includes language identifying that all QAQC records must be retained by the Project for verification purposes.

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, 2015 can be considered with a reasonable level of assurance:

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

Verified results show:

January 1 to December 31, 2015	Total
Baseline Emissions (tCO ₂ e)	124,229
Project Emissions (tCO ₂ e)	111
Pre-Project Discount (tCO ₂ e)	4,900
Emissions Reductions (tCO ₂ e)	119,218

8. Lead Verifier Signature



Jeff Daley
Environmental Specialist

9. Senior Internal Reviewer Signature



Michael Carim
Senior Associate