

Verification Report for the Central Sanitary Landfill Pierson, Michigan

Climate Action Reserve—CAR502

May 2018

**Prepared for: Element Markets, LLC
3555 Timmons Lane, Suite 900
Houston, Texas 77027**

**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	3
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	6
6.3.2	Instrument Quality Assurance/Quality Control.....	6
6.3.3	Project Emissions	8
6.4	Emissions Reduction Calculation Assessment.....	8
6.5	Approved Variance or Deviations.....	9
7.	Verification Conclusion.....	9
8.	Lead Verifier Signature.....	10
9.	Senior Internal Reviewer Signature	10

TABLES

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

1. Introduction

This report is provided to Central Sanitary Landfill, Inc. (CSL) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the Central Sanitary Landfill – CAR502 (the Project) for the reporting period from January 1 through December 31, 2017. The Project is in its second crediting period. First Environment, Inc. (First Environment) conducted the verification from the date of the kickoff meeting through May 10, 2018.

During the verification process, Element Markets, LLC (Element Markets) acted as the Project advisors for the Project developer, Central Sanitary Landfill, 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	Central Sanitary Landfill, Pierson, Michigan
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, 2017
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 4.0, June 29, 2011 (CAR Protocol) • Climate Action Reserve Landfill Project Protocol Version 4.0 Errata & Clarification, June 18, 2015 (Errata and Clarification) • Climate Action Reserve Program Manual, September 1, 2015
---------------------------------	---

Verification Process	• Section 8 of the CAR Protocol • Errata and Clarification • Climate Action Reserve Verification Program Manual, February 8, 2017 • 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 three 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 CSL 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 period under review;
- follow-up interaction with the CSL 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 January 23, 2018.

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
Senior Internal Reviewer – Michael Carim

5.3 Verification Kick-off

The verification was initiated with a kick-off meeting on January 26, 2018 with CSL. 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. CSL was afforded the opportunity to comment on the key elements of the plan for verification. Based on items discussed and agreed upon with CSL, 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 February 13, 2018 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. CSL 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 the CSL, 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 Central Sanitary Landfill is located in Pierson, Michigan and is owned by Central Sanitary Landfill, Inc. and operated by Republic Services, Inc. The landfill opened in 1959 and currently receives municipal solid waste.

The Project consists of the voluntary collection and destruction of landfill gas in an open flare. CSL began installing a landfill gas (LFG) well field and active gas collection and control system in 2006. Prior to this system, LFG was not collected at the landfill. The Project destroys landfill gas that otherwise would be vented to the atmosphere, resulting in a net reduction of CO₂-equivalents. No combustion devices existed on site prior to the implementation of the Project activity. The baseline scenario is defined as the total release of landfill gas to the atmosphere.

6.2 Eligibility

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

6.2.1 Ownership and Title

Central Sanitary Landfill, Inc. is the owner of the landfill and, as such, holds title to the associated emission reduction credits. First Environment reviewed several documents to confirm ownership status, including the Solid Waste Operating permit, the Renewable Operating Permit, permitting applications, and the associated surety bonds which identify Central Sanitary Landfill, Inc. as the property and mineral rights owner. 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 the CSL 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 October 6, 2006, which was confirmed through review of site documentation and review of the Shaw LFG Specialties, LLC (flare skid installer) commissioning report. The commissioning report identifies that the flare skid was commissioned on October 6, 2006, which is the date that methane was first destroyed in the flare.

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 (A)1 from the list provided in Section 3.4.1 of the CAR Protocol, because no collection or control system existed prior to the Project start date. The Project does not involve the generation of electricity and therefore the size threshold requirement of the Performance Standard Test does not apply. It was also confirmed at 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, CLS conducts non-methane organic compounds (NMOC) emissions rate testing. The most recent Tier II testing event occurred on March 31, 2016, as documented in the most recent NMOC Emissions Rate Report dated May 18, 2016. The results of this test indicated that the NMOC emission rate was estimated to be 59.44 megagrams (Mg) per year in 2017, which is above the 50 Mg per year threshold established by the NSPS regulation. Because the landfill has exceeded the NMOC threshold, per 40CFR 60.752, the landfill is required to operate a gas collection and control system within 30 months of the date of the NMOC emissions rate report. Therefore, the last date this Project will be eligible to receive credits is November 18, 2018. Because the Project is still within the 30-month time period, landfill gas collection and destruction is not required by regulation and the Project is still eligible under the Landfill Protocol for the current reporting period. The NSPS regulation and associated NMOC threshold limit 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 CSL 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 renewable operating permit, solid waste operating permit, and generated a compliance report on January 23, 2018 using the Environmental Protection Agency's (EPA) Enforcement and Compliance History Online (ECHO) database and interviewed site personnel to determine regulatory compliance. The ECHO database identifies a violation issued on September 13, 2017 and a "TV ACC Receipt/Review Facility Deviations" issue on March 14, 2017. Both of these items on the ECHO report were confirmed to be for the same issue. Specifically, the facility submitted their semi-annual Title V deviation report to MI DEQ on September 11, 2017 (for the period ending March 2017) which identified that due to Yokogawa data logger issues, some flare temperature data had not been recorded. On September 13, 2017, the MI DEQ issued a Notice of Violation (NOV) for this issue. CSL submitted a response letter to the MI DEQ on October 4, 2017. Ultimately, a new Yokogawa data logger was purchased and installed on September 26, 2017 to resolve the issue. There has been no additional follow-up from the MI DEQ regarding the NOV. Because this issue is a reporting issue and not in recurrent non-compliance or due to negligence or intent, it was determined to not have an effect on crediting for the current reporting period. Further, since flare temperature data was not recorded from April 17 to May 4, 2017 by the data logger, emission reduction credits are not being claimed during this period.

The Michigan Department of Environmental Quality conducted routine site inspections during the reporting period on: February 9, April 14, May 11, July 19, and September 19, 2017, all of which indicated that the site was in compliance. Aside from the issue identified above, the cursory review of permits, compliance reports, state inspection reports, and interviews conducted at the site visit indicated that there was no evidence of non-compliance during the reporting period.

Additionally, First Environment relied on the Attestation of Regulatory Compliance completed by the CSL 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. CSL 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 FCI-ST98 mass flow meter and transmitted to a Yokogawa data logger that electronically archives all flow data. Flow data are automatically corrected from ambient conditions to a standard temperature and pressure of 60°F and one atmosphere, respectively. The data are exported to Microsoft Excel for review and quantification. An identical rental flow meter was used during the reporting period while the primary meter was sent to the manufacturer for calibration.

The methane concentration of the landfill gas is continuously measured with a Siemens Ultramat 23 methane analyzer. Methane content of the landfill gas is recorded by the Yokogawa data logger. The data are exported to Microsoft Excel for review and quantification. Methane concentration was also measured using portable Landtec GEM-5000 analyzers during the reporting period when the continuous analyzer was not functioning properly.

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

Flare temperature is continuously monitored by a thermocouple and recorded by the Yokogawa data logger. 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	FCI-ST98 flow meter	Continuous	At least once every 15 minutes	Yokogawa digital chart recorder
Methane Concentration	Siemens Ultramat 23	Continuous	At least once every 15 minutes	Yokogawa digital chart recorder
	GEM-5000 handheld analyzers	Weekly	As measured	Field logs
Hourly Operation of Destruction Device	Thermocouple	Continuous	At least once every 15 minutes	Yokogawa digital chart recorder

6.3.2 Instrument Quality Assurance/Quality Control

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

The flow meter is cleaned and inspected on a regular basis as specified in the Project's Monitoring Plan with as-found / as-left conditions documented and is also field checked for calibration accuracy on a regular basis by a third party (SCS Field Services), including one field check within two months of the end of the reporting period. First Environment reviewed all third-party field calibration checks performed during the current reporting period. The March, June, and August field checks indicated that the flow meter was under reporting flow outside of the five percent threshold. As such, flow data is applied "as is" without any drift corrections. The

meter was removed from the field in September for a manufacturer calibration, and a rental meter was installed. The manufacturer's documented as-found conditions of the flow meter were within the five percent threshold; therefore no drift corrections were necessary. The manufacturer recommends factory calibrations once every 18 months, as such; the instrument is calibrated per the manufacturer's requirements. The manufacturer calibration certificate of the flow meter documents that the meter was calibrated to a range of flow rates inclusive of flow rates typically observed at the landfill.

The gas analyzer is cleaned and inspected on a regular basis as specified in the Project's Monitoring Plan with as-found / as-left conditions documented and is also field checked for calibration accuracy on a regular basis by a third party (SCS Field Services), including one field check within two months of the end of the reporting period. The manufacturer does not recommend a specific interval to perform calibrations on an ongoing basis. Therefore, the Protocol's default calibration interval of once every five years applies. However, the project developer has the instrument calibrated quarterly by a third party according to the manufacturer's procedure. The quarterly calibrations are performed in-situ and therefore were carried out corresponding to conditions (temperature and pressure) at the landfill. First Environment reviewed all inspection and calibration records which indicated the analyzer was operating accurately.

During the reporting period, portable Landtec GEM-5000 analyzers were used to take weekly methane concentration readings. The manufacturer requires the portable analyzers be calibrated on an annual basis. All portable analyzers used during the reporting period were within the manufacturer's recommended calibration service interval.

Additionally, First Environment confirmed that the Landtec GEM-5000 instrument used to perform the third-party field calibration accuracy checks of the Project flow meter and continuous gas analyzer was calibrated and maintained per manufacturer's requirements. It was also confirmed that the calibration gas used to field check and calibrate the continuous methane analyzer was not expired.

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	Field Checked	Inspected/Cleaned
FCI-ST98 flow meter (s/n 270839) - Primary	1/1/2017 – 9/22/2017	4/19/2016; 12/26/2017	3/23/2017; 6/23/2017; 8/29/2017	3/23/2017; 6/23/2017; 8/29/2017
FCI-ST98 flow meter (s/n 631083) - Rental	9/22/2017 – 12/31/2017	9/6/2017	12/22/2017	12/22/2017
Siemens Ultramat 23 gas analyzer	3/29/2017 – 4/17/2017; 5/6/2017 – 9/17/2017	6/23/2017; 8/29/2017; 11/29/2017; 12/22/2017	6/23/2017; 8/29/2017; 11/29/2017; 12/22/2017	1/5/2017; 1/26/2017; 6/23/2017; 8/29/2017; 11/29/2017; 12/22/2017

Monitoring Equipment	In Service	Calibration	Field Checked	Inspected/Cleaned
Landtec GEM 501388	1/26/2017; 2/3/2017; 2/8/2017; 2/14/2017; 8/3/2017; 9/18/2017; 10/4/2017; 10/11/2017; 10/16/2017; 10/27/2017; 12/19/2017	3/3/2016; 3/23/2017; 12/5/2017	Field calibrated prior to each use	Prior to each use
Landtec GEM 501638	3/3/2017; 3/10/2017; 3/14/2017; 3/23/2017; 11/4/2017; 11/11/2017; 11/13/2017; 11/21/2017; 11/30/2017	12/29/2016	Field calibrated prior to each use	Prior to each use

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	Estimated based on maximum possible electricity consumption of the project blowers
Propane consumption	Estimated based on tank gauge volume

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 standard conditions at one atmosphere of pressure and a temperature of 60°F by the FCI flow meters. 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 or weekly 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. No data substitution was applied during the reporting period.

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 60°F and one atmosphere of pressure
$PR_{CH_4,t}$	Methane content	Averaged daily from continuously recorded data or weekly from portable readings
DE_i	Default destruction efficiency	96%
OX	Oxidation Factor	10%
DF	Discount Factor	0% -or 10% when weekly methane readings are applied
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_{EL}	Purchased electricity emission factor	1,272.045 lbs. CO ₂ /MWh (RFCM Sub region)
GWP_{CH_4}	Global Warming Potential of Methane	25 (AR4)

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*

No variances or deviations were obtained for the Project in this verification 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, 2017 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, 2017	Total
Baseline Emissions (tCO ₂ e)	51,147
Project Emissions (tCO ₂ e)	377
Emissions Reductions (tCO ₂ e)	50,770

8. Lead Verifier Signature



Jeff Daley
Environmental Specialist

9. Senior Internal Reviewer Signature



Michael Carim
Senior Associate