

Verification Report for the City of Thomasville MSW Landfill Thomasville, Georgia

Climate Action Reserve-CAR887

November 2023

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1. Introduction

This report is provided to the City of Thomasville, Georgia (the City) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the City of Thomasville MSW Landfill – CAR887 (the Project) for the period of January 1 through December 31, 2022.

During the verification process Element Markets Emissions, LLC (Element Markets) acted as the Project advisor for the Project developer, the City of Thomasville, Georgia. First Environment, 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	Thomasville Municipal Solid Waste Landfill, Thomasville, 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, 2022
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 Landfill Project Protocol, Version 5.0, April 2019 (CAR Protocol) • Reserve Offset Program Manual, September 6, 2023 • Applicable Climate Action Reserve Policy Memos
Verification Process	• Section 8 of the CAR Protocol, Version 5.0 • Climate Action Reserve Verification Program Manual, February 3, 2021 • ISO 14064-3: Specification with guidance for the verification and validation of greenhouse gas statements, 2019
Level of Assurance	• Reasonable assurance

Materiality	• Misstatements greater than five percent of the Project's emission reductions assertion are considered material. • Qualitative non-conformities with the CAR Protocol are also considered material.
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5. Overview of the Verification Process

To review the Project's GHG information, the following verification process was used:

- conflict of interest review;
- selection of Audit Team;
- initial interaction and kickoff meeting with Element Markets;
- verification preparations;
- development of the verification plan and evidence gathering plan;
- verification execution;
- site visit;
- review and evaluation of GHG information systems and data;
- follow-up interaction with the project developer for corrective action, clarification, or supplemental data as needed;
- Independent review; and
- final opinion and report submittal.

The 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.

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 April 5, 2023.

5.2 *Audit 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 – Logan Simpson
Senior Internal Reviewer – Michael Carim

5.3 *Strategic Analysis and Verification Preparations*

First Environment performed pre-engagement activities to confirm the type of engagement, level of assurance, materiality thresholds, the objectives, criteria, and scope for verification activities.

First Environment also performed a strategic analysis to understand the activities and complexity of the project and to determine the nature and extent of the verification activities required. The

strategic analysis was also used to develop sufficient understanding of the GHG-related activity and its relevant sector information to plan and conduct the verification.

5.4 Audit Kick-off

The verification was initiated with a kick-off meeting on May 17, 2023 with Element Markets. The meeting focused on confirming the scope, schedule, and data required for verification.

5.5 Development of the Verification and Evidence-Gathering Plans

The Audit Team formally documented the verification plan as well as determined the evidence gathering plan. The verification plan was informed by the kick-off meeting where key elements of the verification scope were discussed including project team members, project level of assurance, materiality threshold, and standards of reporting and evaluation. It also provided an outline of the verification processes and established project deliverables. Element Markets was afforded the opportunity to comment on the key elements of the plan for verification. A separate evidence gathering plan was designed to review all project elements in areas of potentially high risk of inaccuracy or non-conformance.

5.6 Execution of Verification

The Audit Team executed the evidence-gathering activities. The verification was conducted according to the verification plan and the evidence-gathering activities according to the evidence-gathering plan.

5.7 Site Visit

Mr. Jeff Daley conducted a site visit on October 7, 2022 as part of the verification process for the previous reporting period. During the previous site visit the Project's data management systems, and monitoring processes were reviewed. Interviews were conducted with personnel relevant to Project implementation. Consistent with the requirements of Section 7.3.3 of the Protocol and because it was confirmed that no significant changes in data management, equipment or personnel have occurred since the October 7, 2022 site visit, a site visit for the current reporting period was not conducted.

5.8 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.

5.9 Corrective Actions and Supplemental Information

The team issued corrective action and clarification requests during the verification process. Element Markets provided sufficient responses to all of the corrective action and clarification requests.

5.10 Independent Review

Before verification reporting is released to the client, a First Environment lead verifier, who has not participated in the verification activities, conducts an independent review to confirm that all verification activities have been completed and provide the agreed upon level of assurance.

5.11 Verification Reporting and Opinion Issuance

Verification reporting, represented by this report, documents the verification processes and identifies their findings and results. Verification reporting consists of this report for Element Markets and the Project Developer, along with a verification opinion. Both the report and opinion are submitted to CAR as part of the verification reporting process.

6. Site's Conformance with Verification Criteria

6.1 Project Description

The Thomasville Municipal Solid Waste Landfill is located in Thomasville, Georgia and is owned by Thomas County and operated by the City of Thomasville. The landfill opened in 1975 and currently receives municipal solid waste.

The Project consists of the voluntary collection and destruction of landfill gas in an open flare. The City began installing a landfill gas (LFG) well field and active gas collection and control system in the fall of 2010. Prior to this system, LFG was not collected or destroyed 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

Thomas County owns the land on which the landfill operates. An agreement, dated March 25, 2002, was provided which establishes that the City of Thomasville and Thomas County will operate the landfill as equal partners until the point at which all disposal activities are terminated, the expiration of post-monitoring requirements, or the intergovernmental contracts time limit of 50 years, whichever occurs first. First Environment was provided with a written statement signed by the Thomas County Board of Commissioners, which clearly identifies and states that the City of Thomasville, Georgia has full, legal, and beneficial title to any and all emission reductions generated by the Project.

Additionally, First Environment relied on the Attestation of Title completed by the City 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 March 1, 2011, which was confirmed through review of a flare start up report and construction timeline, which confirmed that the flare began operation on this date.

The Project's first crediting period was from March 1, 2011 through February 28, 2021. The City of Thomasville, Georgia submitted a request for a crediting period renewal for the Project's second crediting period which will span from March 1, 2021 through February 28, 2031. The reporting period identified in Section 3 above falls within the Project's second crediting period.

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 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 baseline scenario was confirmed through site visit interviews with Project personnel. It was also confirmed during the previous 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, the most recent non-methane organic compounds (NMOC) emissions rate testing occurred from February 17 - 20, 2020. The landfill has not been modified or re-constructed since July 17, 2014; therefore, the most recent emissions rate report dated February 10, 2021 was prepared in accordance with 40CFR63, Subpart WWW. The report identifies that the NMOC emission rate is estimated to be 47.08 Megagrams (Mg) per year in 2022, which is below the 50 Mg per year threshold established by the NSPS regulation. However, as a result of the promulgation of 40CFR62 Subpart OOO in 2021, the landfill was required to submit an initial NMOC report which met the requirements of Subpart OOO. The Initial NMOC Emissions Rate Report, dated September 7, 2021, identified NMOC emissions to be 46.80 for 2022, which is above the 34 Mg/year threshold established by Subpart OOO. Because the landfill has exceeded the NMOC threshold, per Subpart OOO, the landfill is required to operate a gas collection and control system within 30 months of the date of the first emissions report which identifies the threshold has been exceeded. Therefore, the last date this Project will be eligible to receive credits is March 6, 2024. Because the Project is still within the 30-month time period, landfill gas collection and destruction is not required at this time, and the Project is still eligible under the Landfill Protocol for the current reporting period.

First Environment reviewed the facility's solid waste operating permit and Title V permit to confirm that no other requirements for an active landfill gas collection and control system existed. This cursory review of permits, laws, and regulations indicated the voluntary nature of the Project.

Additionally, First Environment relied on the Attestation of Voluntary Implementation completed by the City 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, NPDES Permit, and generated compliance reports on May 17, 2023 from the Environmental Protection Agency's (EPA) Enforcement and Compliance History Online (ECHO) database, and the Georgia Environmental Protection Division (GA EPD) database. The ECHO, and GA EPD database searches did not identify any issues during the current reporting period.

The Georgia Department of Natural Resources (GA DNR) conducted routine site inspection on August 23, 2022. No violations or non-compliances were noted during the inspection.

Additionally, First Environment relied on the Attestation of Regulatory Compliance completed by the City 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. The City 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 previous 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 an Endress + Hauser flow meter and transmitted to a Eurotherm data logger that electronically archives all flow data. Flow data are automatically corrected from ambient conditions to a standard temperature and pressure of 32°F and one atmosphere, respectively. In October 2022, the Endress + Hauser flow meter was replaced with a Kurz Flow meter. The new Kurz flow meter records flow at standard conditions of 77°F and one atmosphere of pressure. The flow data is exported to Microsoft Excel for review and quantification.

During the reporting period limited instances of flow spiking were identified which are caused by landfill gas moisture. As a result of this issue, a variance was requested and subsequently approved by CAR as discussed in Section 6.5 below.

The methane concentration of the landfill gas is continuously measured with a Siemens Ultramat 23 continuous gas analyzer and transmitted to a Eurotherm data logger that electronically archives all methane concentration data for export 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 Eurotherm 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	Endress + Hauser Flow Meter, and Kurz Flow Meter	Continuous	At least every 15 minutes	Eurotherm data logger
Methane Concentration	Siemens Ultramat 23 continuous analyzer	Continuous	At least every 15 minutes	Eurotherm data logger
Operation of Destruction Device	Thermocouple	Continuous	At least every 15 minutes	Eurotherm data logger

6.3.2 Instrument Quality Assurance/Quality Control

The City'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, inspected, and field checked for calibration accuracy by a third party (Carlson Environmental Consultants) on a quarterly basis with as-found/as-left conditions documented, including one check within the last two months of the end of the reporting period. First Environment reviewed documentation of all quarterly QA/QC performed during the current reporting period, all of which indicated that the flow meter was operating within the required five percent accuracy range. The manufacturer (of both the old E+H flow meter, and the new Kurz flow meter) does not publish a specific calibration interval for the flow meter. Therefore, the CAR five-year default applies. The E+H flow meter was in use past the Protocol default five year calibration frequency. As a result, a variance was requested and subsequently approved by CAR as discussed in Section 6.5 below. Both flow meters were calibrated to the range of conditions expected at the site as confirmed through a review of manufacturer calibration certificates.

The gas analyzer is cleaned, inspected, and calibrated in-situ on a quarterly basis by a third party (Carlson Environmental Consultants) with as-found/as-left conditions documented, including one check within the last two months of the end of the reporting period. First Environment reviewed documentation of all calibrations performed during the current reporting period, all of which indicated that the analyzer was operating within the required five percent accuracy threshold. The manufacturer does not recommend a specific interval to perform calibrations on an ongoing basis. However, the analyzer is field calibrated by a third party (Carlson Environmental Consultants) on a quarterly basis.

Additionally, First Environment confirmed that the Landtec GEM-5000 portable gas analyzers used to perform the third-party field calibration accuracy checks of the flow meter were maintained per the manufacturer's requirements, and that the calibration gas used to check the gas analyzer was still within its useful life span.

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	Inspected/Cleaned	Calibration Accuracy Check	Calibration
Endress + Hauser Flow Meter (s/n F9087502000)	1/1/2022 – 10/04/2022	3/3/2022; 6/2/2022; 9/8/2022	3/3/2022; 6/2/2022; 9/8/2022	7/13/2017
Kurz Instruments Flow Meter (s/n: FD45921A)	10/04/2022 – 12/31/2022	12/16/2022	12/16/2022	7/7/2022
Siemens Ultramat 23 (s/n: N1-AD-547)	1/1/2022 – 12/31/2022	3/14/2022; 6/2/2022; 9/8/2022; 12/16/2022	3/14/2022; 6/2/2022; 9/8/2022; 12/16/2022	3/14/2022; 6/2/2022; 9/8/2022; 12/16/2022

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	Utility Invoices
Propane consumption *	Purchase Invoices

* No propane purchases occurred during the current reporting period.

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 are recorded at standard conditions of one atmosphere of pressure and a temperature of 32°F by the E+H flow meter and are recorded at standard conditions of one atmosphere of pressure and a temperature of 77°F by the Kurz flow meter. All recorded landfill gas flow was adjusted in the emission reduction calculations to a standard condition 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 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 performed during the current reporting period.

No sources of leakage emissions are relevant under the Landfill Protocol.

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 and recorded at 32°F and one atmosphere of pressure (E+H Meter); and internally corrected and recorded at 77°F and one atmosphere of pressure (Kurz Meter)
$PR_{CH_4,t}$	Methane content	Averaged daily from continuously recorded data
DE_i	Default destruction efficiency	96%

Input Parameter	Name	Description/ Value
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 _{EL}	Purchased electricity emission factor	891.9 lb CO ₂ /MWh (SRSO, SERC South eGrid Subregion)
GWP _{CH4}	Global Warming Potential of Methane	28 (IPCC 5 th Assessment Report)

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 reporting 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*

Element Markets requested two variances from the CAR Protocol for the current reporting period. The variance requests were approved by CAR on October 24, 2023 for the reporting period of January 1, 2022 through December 31, 2022. Table 5 summarizes the specific conditions of the variance approval and First Environment's verification conclusion.

TABLE 5: Assessment of Variance Requirements

Variance #1 Requirements	Verification Conclusion
The verifier confirms that the flow meter data that exceeds the 99th percentile is appropriately removed from quantification.	First Environment confirmed that the 99th-percentile is correctly calculated. Additionally, it was confirmed that any flow readings that fell above the 99-percentile range were removed from quantification.
The verifier confirms the flow meter spikes are discrete events that occur as Element Markets Emissions, LLC described.	First Environment confirmed that the percentage of data points exceeding the 99th percentile threshold was 0.97% of all data points recorded during the reporting period. Therefore, it was reasonably concluded that the flow meter spikes were discrete events.
Variance #2 Requirements	Verification Conclusion
The verifier confirms that the third-party field checks for the E+H meter were within the +/- 5% threshold	First Environment confirmed that all third-party field calibration accuracy checks identified that the E&H Meter was operating within the five percent accuracy threshold.
The verifier confirms that the Kurz meter was factory calibrated before installation	The Kurz meter was manufacturer calibrated on July 7, 2022 and was installed at the site on October 04, 2022.

Variance #1 Requirements	Verification Conclusion
The verifier confirms that all other QA/QC requirements were met	First Environment confirmed that all other QAQC conditions were met.

7. Verification Conclusion

Based on the historical 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 of January 1 through December 31, 2022 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, 2022	Total
Baseline Emissions (tCO ₂ e)	21,452
Project Emissions (tCO ₂ e)	11
Emissions Reductions (tCO ₂ e)	21,441

8. Lead Verifier Signature



Jeff Daley
Senior Associate

9. Senior Internal Reviewer Signature



Michael Carim
Senior Associate