

Verification Report for Erie County Sanitary Landfill Milan, Ohio

Climate Action Reserve—CAR444

November 2011

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1. Introduction

This report is provided to Element Markets, LLC (Element Markets) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the Erie County Landfill – CAR444 (the Project) for the period from April 8, 2010 through April 7, 2011. First Environment, Inc. (First Environment) conducted the verification from September through November 2011.

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	Erie County Sanitary Landfill, Milan, Ohio
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 supplemental fuel use.
Reporting Period	April 8, 2010 through April 7, 2011
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 3.0, December 2, 2009 (CAR Protocol). • Climate Action Reserve Landfill Project Protocol Version 3.0 Errata & Clarification, October 26, 2011 (Errata and Clarification). • Climate Action Reserve Program Manual, October 26, 2011.
Verification Process	• Section 8 of the CAR Protocol. • 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 three percent, of the Project's emission reductions assertion are considered material (for each vintage 2010 and vintage 2011). • 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 project developer;
- 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 project developer 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 received authorization to proceed with verification activities from CAR in a notification dated July 12, 2011.

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 – Iris Caldwell
Verifiers – Jeff Daley, Natali Ganfer
Senior Internal Reviewer – James Wintergreen

5.3 Verification Kick-off

The verification was initiated with a kick-off meeting on September 2, 2011 with the project developer, Element Markets. The meeting focused on confirming the scope, schedule, and data required for verification.

5.4 Development of the Verification Plan

The 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. Element Markets was afforded the opportunity to comment on the key elements of the plan for verification. Based on items discussed and agreed upon with Element Markets, 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, established project deliverables, and presented a data-sampling plan designed to review all project elements in areas of potentially high risk of inaccuracy or non-conformance.

5.5 Site Visit

Jeff Daley conducted a site visit on September 21, 2011 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 actions and clarification requests during the verification process. Element Markets provided sufficient responses to all corrective actions 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 Element Markets, a verification statement, and a list of findings to be submitted to CAR.

6. Site's Conformance with Verification Criteria

6.1 Project Description

The Erie County Sanitary Landfill is located in Milan, Ohio. The landfill opened in 1986 and is owned and operated by the Erie County Board of Commissioners.

The active landfill gas collection and control system became operational on June 9, 2008. The gas collection system consists of 17 vertical gas extraction wells, 21 spur wells, 4 connections to leachate cleanout laterals, and connecting gas piping. Prior to this system, a passive gas collection system was installed in September of 2003. Initial flow tests were performed at the landfill prior to the project activity using a gas blower and flare skid, which was rented and subsequently purchased from LFG Specialties, a subsidiary of The Shaw Group. In 2010 an electric generation system was installed as the primary destruction device for the Project. The flare system was shutdown and disconnected from the landfill gas collection system in April 2010. On April 7, 2010 the electric generator was installed and commissioned with all landfill gas being diverted to the generator from that point forward. The on-site generator is a Caterpillar (CAT) G3520C gas engine with a CAT SR4B generator, rated at 1600 ekW. The project achieves a net reduction in CO₂-equivalent emissions through the destruction of landfill gas, which would have otherwise been released to the atmosphere.

6.2 Eligibility

Element Markets meets the eligibility requirements set forth in the CAR Protocol as described below.

6.2.1 Ownership and Title

In December 2007, the Erie County Board of Commissioners entered into a Landfill Gas Purchase Agreement with Renewable Energy Services of Ohio, LLC (RESO). The agreement identifies that RESO retains all rights to all environmental credits associated with the landfill gas, including carbon credits. Subsequently, RESO and Element Markets signed a Verified Emission Reduction Purchase Agreement which established Element Market's exclusive ownership rights to environmental attributes of any sort arising from landfill gas captured and destroyed at the Erie County Sanitary Landfill, including any credits generated. First Environment reviewed the agreements as well as Erie County's original deed to the land in order to confirm the rightful transfer of all environmental attributes associated with the Project to Element Market.

Additionally, First Environment relied on the Attestation of Title completed by Element Markets for the current reporting period. The Attestation of Title 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 January 1, 2001 start date requirement. The project start date is June 9, 2008, which was confirmed through review of field notes.

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 qualifying destruction device at an eligible landfill where landfill gas was being collected and passively vented but not destroyed prior to the project activity. This exceeds the performance standard defined by the CAR Protocol, specifically Scenario 2 from the list provided in Section 3.4.1 of the CAR Protocol. No destruction devices were installed or utilized in the passive collection system, with the exception of two short pump tests that were performed using rental flares and associated equipment in order to determine the capacity and limitations of the well field. The CAR Protocol allows for destruction devices to be temporarily installed for this purpose. The first flow test was conducted from February 4 through February 27, 2004. The second flow test was conducted from October 25 through December 11, 2007. First Environment reviewed the rental agreements in order to confirm the temporary nature of the flare installations. Other than these two short test periods, the system was passively venting with no combustion occurring until the active gas collection and combustion system came online in June 2008. First Environment further confirmed that the baseline scenario is correctly defined as the total release of landfill gas to the atmosphere through interviews with site personnel at the site visit.

6.2.3.2 Legal Requirements Test

The landfill has a permitted capacity of approximately 8.53 million megagrams (Mg) and is therefore subject to the New Source Performance Standard (NSPS) requirements. First Environment reviewed the landfill's Title V permit and the Tier II report to confirm the voluntary nature of the Project. The latest Tier II report, completed in July 2008, indicated NMOC

emissions at 5.77 Mg and 5.88 Mg in 2010 and 2011, respectively. These results are well below the 50 Mg threshold that would require a landfill gas collection and control to be installed. First Environment also reviewed RESO's Final Air Pollution Permit to Install from the State of Ohio Environmental Protection Agency (OhioEPA) permitting the installation of the project generator. First Environment also confirmed through interviews with project personnel that no additional state and local requirements mandated the active landfill gas collection and control system. This cursory review of permits, laws, and regulations corroborated the voluntary nature of the Project.

Additionally, First Environment relied on the Attestation of Voluntary Implementation completed by Element Markets for the current reporting period. The Attestation of Voluntary Implementation 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 authorization to discharge, the Title V permit, and the Environmental Protection Agency's (EPA) Enforcement and Compliance History Online (ECHO) database, as well as interviewed site personnel to determine regulatory compliance. The cursory document review 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 Element Markets for the current reporting period. The Attestation of Regulatory Compliance 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. Element Markets developed and implemented a Monitoring Plan to track relevant project parameters and data sources. The Monitoring Plan was reviewed to determine compliance with the CAR Protocol requirements. Based on observations made during the site visit and review of relevant project documentation, First Environment found the Monitoring Plan 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 Sage Meter (Model SRP-05-18-AC115-LFG) and transmitted to a digital recorder system with Advanced Power Technologies software (APT) that electronically archives all flow data and generator output every minute. Flow data are automatically corrected from ambient conditions to a standard temperature and pressure of 60°F and one atmosphere. During the time period from April 8 to July 19, 2010 (prior to installation of the digital recorder), flow data were recorded using a Honeywell circular paper chart recorder.

During the time period from April 8 to July 19, 2010, methane content readings were recorded on a weekly basis using a portable GEM-2000 analyzer. On July 20, 2010, an ABB Eazyline Series (Model EL3040) continuous gas analyzer was installed on site, and all associated data is recorded by the digital 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 (July 19, 2010 through April 7, 2011)	Sage Meter Model SRP-05-18-AC115-LFG	Continuous	Acquired every minute and recorded every eight minutes	DataTracker digital recorder
Landfill gas flow (April 8, 2010 through July 19, 2010)	Sage Meter Model SRP-05-18-AC115-LFG	Continuous	Continuous	Honeywell chart recorder
Methane Concentration (July 19, 2010 through April 7, 2011)	ABB Eazyline Series Model EL3040	Continuous	Acquired every minute and recorded every eight minutes	DataTracker digital recorder
Methane Concentration (April 8, 2010 through July 19, 2010)	GEM-2000	At least weekly	At least weekly	Manual log
Electricity output	Meter	Continuous	Acquired every minute and recorded every eight minutes	DataTracker digital recorder

6.3.2 Instrument Quality Assurance/Quality Control

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

The Sage flow meter is field checked for accuracy by a third-party technician within two months prior to the end of the reporting period, inspected/cleaned on a quarterly basis, and factory calibrated every five years. First Environment reviewed records of these activities during the current reporting period. The field check indicated the flow meter was operating within the required five percent accuracy range.

The ABB gas analyzer is field checked for accuracy by a third-party technician within two months prior to the end of the reporting period, inspected/cleaned on a quarterly basis, and is factory calibrated every five years. First Environment reviewed records of these activities during the current reporting period. The field check indicated the gas analyzer was operating within the required five percent accuracy range.

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

TABLE 2: Instrument QA/QC

Monitoring Equipment	Factory Calibration	Field Checked	Inspected/Cleaned
Sage Flow Meter	5/26/2010	3/16/2011	4/26/2010, 9/2/2010, 9/13/2010, 10/2/2010, 10/21/2010, 11/2/2010, 12/15/2010, 1/14/2011, 2/16/2011
ABB gas analyzer	12/5/2010	3/16/2011	9/13/2010, 9/30/2010, 10/20/2010, 11/9/2010, 11/16/2010, 11/29/2010, 12/2/2010, 12/15/2010, 1/14/2011, 1/25/2011, 2/9/2011, 2/14/2011, 3/2/2011
GEM-2000	3/2/2010	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
Natural gas consumption	Monthly invoices

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.

Baseline emissions were calculated from monitored data. Total landfill gas flow in a given interval was computed by multiplying the landfill gas flow rate by the length of the time in the interval. Metered gas flow volumes were measured at standard conditions of one atmosphere of pressure and a temperature of 60°F, and therefore, no correction for temperature or pressure was needed. When methane was measured with the ABB continuous gas analyzer, the total volume of methane destroyed by the Project was computed in daily intervals by multiplying the daily landfill gas flow to the engine by the daily average of methane concentration measurements. When the portable gas analyzer was used to measure methane concentration, the total volume of methane destroyed by the Project was computed in weekly intervals by multiplying the weekly landfill gas flow to the flare by the weekly average of all methane concentration measurements. The applicable discount factor for non-continuous methane monitoring was applied when weekly methane readings were used. The volume of methane destroyed was then 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 vintage year to obtain the total baseline emissions.

The Project consumes supplemental natural gas. 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	Continuous flow meter readings every 15 minutes if from circle chart recorder or every 8 minutes if from APT, corrected to 60°F and 1 atm.
$PR_{CH_4,t}$	Methane content	Weekly readings from portable gas analyzer or continuous gas analyzer readings every 8 minutes.
DE_i	Default destruction efficiency	93.6%
OX	Oxidation Factor	10%
DF	Discount Factor	0% if continuous methane data 10% if non-continuous methane data
FFG_{CH_4}	Average methane fraction of the supplemental natural gas as provided for by fuel vendor	100% (conservative assumption)

Copies of the raw data used in the calculations, including flow data, methane content data, and utility and other fossil fuel invoices, were compared with the data used in the final calculations and tested for transcription or mathematical errors. 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.

6.6 Changes Due to Errata & Clarifications Issued by CAR

The issuance of the Errata and Clarification dated October 26, 2011 were addressed during the verification as follows:

- The Errata and Clarification resulted in a change to the attestation forms that the project developer must submit to CAR. First Environment reviewed the Attestation of Voluntary Implementation and the Attestation of Regulatory Compliance forms and confirmed that these forms were completed correctly by Element Markets and are on file with the CAR.
- The Errata and Clarification confirmed that destruction devices installed temporarily prior to the project are not considered in the quantification of emission reductions. As described in Section 6.2.3.1, First Environment reviewed the rental agreements for the flare skid in order to confirm that its operation was temporary. Methane destroyed by the temporary flare was not included in the emission reduction calculations.

- The Errata and Clarification resulted in a change to Equation 5.12. First Environment confirmed that Element Markets applied the correct equation to calculation project emissions from supplemental fuels.
- The Errata and Clarification confirmed that field checks may be performed by project personnel at other times besides the field check performed within two months of the end of the reporting period. While landfill personnel did perform periodic field checks during the reporting period, these were considered outside the scope of verification.

The Errata and Clarification did not result in any other changes to the verification process.

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 April 8, 2010 through April 7, 2011 can be considered with a reasonable level of assurance:

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

Verified results show:

Reporting Period: April 8, 2010 to December 31, 2010	Total
Baseline Emissions (tCO ₂ e)	30,416
Project Emissions (tCO ₂ e)	5
Emissions Reductions (tCO ₂ e)	30,411

Reporting Period: January 1, 2011 to April 7, 2011	Total
Baseline Emissions (tCO ₂ e)	13,027
Project Emissions (tCO ₂ e)	2
Emissions Reductions (tCO ₂ e)	13,025

8. Lead Verifier Signature



Iris Caldwell
Senior Engineer

9. Senior Internal Reviewer Signature

A handwritten signature in black ink, appearing to read "James Wintergreen", with a stylized, flowing script.

James Wintergreen
Senior Associate