

Verification Report for IESI-Trinity Timber Ridge Landfill Carbon Project – CAR838

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**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	5
6.3.2	Instrument Quality Assurance/Quality Control.....	7
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.....	9
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.....	8

1. Introduction

This report is provided to IESI MO Landfill Corporation (IESI) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the IESI-Trinity Timber Ridge Landfill Carbon Project – CAR838 (the Project) for the period from October 15, 2015 through October 10, 2016. First Environment, Inc. (First Environment) conducted the verification from the date of the kickoff meeting through September 26, 2017.

During the verification process, Trinity Carbon Management, LLC acted as the Project advisor for the project developer, IESI. As such, First Environment communicated directly with Trinity Carbon Management, LLC regarding most 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	Timber Ridge Landfill, Richwoods, MO
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	October 15, 2015 through October 10, 2016
Data Sources	Metered Data and Emissions Reduction Calculations

4. Standards Used to Verify Emissions (Criteria)

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

Standard of Verification	• Climate Action Reserve U.S. Landfill Project Protocol, Version 3.0, December 2, 2009 (CAR Protocol) • Climate Action Reserve U.S. Landfill Project Protocol Version 3.0 Errata & Clarification, June 18, 2015 (Errata and Clarification) • Climate Action Reserve Program Manual, September 1, 2015
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Verification Process	• Section 8 of the CAR Protocol, Version 3.0, December 2, 2009 • 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 for the current reporting period • 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 IESI and Trinity Carbon Management, LLC;
- 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 IESI and Trinity Carbon Management, LLC 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 for the project developer from CAR in a notification dated August 24, 2017.

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 August 29, 2017 with the project developer. The meeting focused on confirming the scope, schedule, and data required for verification.

5.4 Development of the Verification Plan

The Verification Team formally documented its verification plan as well as determined the data-sampling plan. The verification plan was developed based on the discussion of key elements of the project verification process during the kick-off meeting. IESI was afforded the opportunity to comment on the key elements of the plan for verification. Based on items discussed and agreed upon with IESI, 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 September 19, 2017 to assess the Project's data management systems and interview personnel relevant to the Project for the verification period.

5.6 Emissions Reduction Data and Calculation Assessment

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

5.7 Corrective Actions and Supplemental Information

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

5.8 Verification Reporting

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

6. Site's Conformance with Verification Criteria

6.1 Project Description

The Timber Ridge Landfill is located in Richwoods, Missouri. The landfill, which opened in 2003, accepts municipal solid waste and has a design capacity of approximately 20.5 million cubic yards. The landfill is owned and operated by IESI.

The active landfill gas (LFG) collection and control system consists of a surficial gas collection system over a synthetically lined and capped area, vertical gas extraction wells outside of the synthetically capped area, condensate removal equipment, blowers, monitoring equipment, an open flare, and a boiler used to evaporate leachate.

The Project achieves a net reduction in CO₂-equivalent (CO₂e) emissions through the destruction of landfill gas, which would have otherwise been released to the atmosphere. The baseline scenario, defined as the total release of landfill gas to the atmosphere, was verified during the Project's initial reporting period.

6.2 Eligibility

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

6.2.1 Ownership and Title

IESI is the owner and developer of the landfill, and as such holds title to the associated emission reduction credits. The landfill was originally developed by Waco Landholding, Inc. IESI then subsequently purchased the landfill through acquisition of Waco Landholding, Inc. First Environment reviewed the original land deeds and evidence of the landfill sale to IESI, as well as the facility's Title V, Water Discharge and Solid Waste Permit, and the facility's Permit to Construct in order to confirm that IESI is the owner of the project and consequently owns the right to any emission reduction credits generated by it.

Additionally, First Environment relied on the Attestation of Title completed by IESI 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 during the initial verification through review of flare installation and start up records.

6.2.3 Additionality

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

6.2.3.1 Performance Standard Test

The Project consists of the installation of a 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 landfill gas had never been collected or destroyed prior to the Project. 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 that triggers New Source Performance Standard (NSPS) requirements. As such, the landfill is required to conduct Tier II testing to determine non-methane organic compound (NMOC) emissions. The most recent Tier II testing event occurred in December 2012, a subsequent testing event is scheduled to occur later this year. First Environment reviewed the most recent Tier II emissions rate calculations which were updated in March 2017 and identified NMOC emission rates of 37.01 Mg/yr. for 2015 and 39.61 Mg/yr. for 2016. These results are below the 50 Mg/yr. threshold that would require the active collection and control of landfill gas. 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/yr. threshold was the applicable standard during the current reporting period. First Environment also confirmed, through

interviews with project personnel, that no additional state or local requirements mandate the active LFG collection and control system. 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 IESI 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 operating permit, solid waste permit, Title V permit, water discharge permit, quarterly Missouri Department of Natural Resources (MDNR) compliance inspection reports, and generated a compliance report on August 29, 2017 using the Environmental Protection Agency's (EPA) Enforcement and Compliance History Online (ECHO) database, as well as conducted interviews with site personnel to determine regulatory compliance.

The EPA ECHO database report indicated that the site had stormwater discharge exceedances during the current reporting period. The exceedances listed in the U.S. EPA ECHO report are related to iron level exceedances as a result of the naturally occurring iron levels in the soil. IESI did not receive any violations from the MDNR for the items listed in the EPA ECHO report. The MDNR has issued a revised National Pollution Discharge Elimination System (NPDES) permit raising the total recoverable iron limit permit levels to help eliminate this issue in the future. Additionally, First Environment reviewed the December 2015, March 2016, and June 2016 Effluent Limitation Exceedance Reports that were submitted to the state to confirm that the stormwater exceedances were not related to the Project activity and/or any Project equipment, and therefore it was determined that this issue does not impact the Project's eligibility under the CAR Landfill Protocol. No other compliance issues were identified during the reporting period.

Additionally, First Environment relied on the Attestation of Regulatory Compliance completed by the IESI 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. IESI and Trinity Carbon Management 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

The Project's monitoring conforms to the requirements of the CAR Protocol, as discussed below.

A Thermal Instruments TI-9500 mass flow meter continuously measures landfill gas flow to both the open flare and boiler. This metering arrangement is permissible per Errata and Clarification No.12, June 18, 2015. As a result, First Environment confirmed during the site visit that all destruction devices are equipped with automatic shut-off valves that prevent landfill gas from

passing through the devices if they become non-operational. Additionally, the boiler is designed in such a manner that it is physically impossible for gas to pass through while the device is non-operational. It was confirmed through review of raw data records that during periods when the boiler was not operational, the flare was operating and destroying landfill gas. As identified in Table 4 below, the destruction efficiency of the least efficient destruction device is applied to all gas flow during the reporting period. The site installed a new flare skid in April 2016. A new Thermal Instruments TI-9500 flow meter was installed as a result of the new flare skid installation. The original open flare had a design capacity of 500scfm, while the new open flare has a design capacity of 1,300scfm. As a conservative measure, any landfill gas flow that was recorded in excess of the old and new flare design capacity (500scfm and 1,300scfm, respectively) was excluded from emission reduction calculations. Prior to the new flare skid installation, the data were transmitted to a Yokogawa data logger that electronically archives all flow data. After the new flare skid was installed, the data are transmitted to a Honeywell data logger that electronically archives all flow data. Both of the flow meters used during the reporting period standardize flow readings to a pressure of one atmosphere and a temperature of 60°F.

The methane concentration of the landfill gas is measured weekly with either a Landtec GEM-5000 or Landtec GEM-2000 portable gas analyzer.

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 data or Honeywell data logger. Boiler temperature is continuously monitored by thermocouples and recorded by the PLC system integrated within the boiler. This data is also exported to Microsoft Excel for review and quantification.

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

TABLE 1: Monitoring Equipment

Parameter	Monitoring Equipment	Frequency of Measurement	Frequency of Recording	Recording Device
Landfill gas flow	TI-9500 mass flow meter(s)	Continuous	Once per minute	Yokogawa and Honeywell Data Recorder
Methane Concentration	LandTec GEM-2000 portable gas analyzer LandTec GEM-5000 portable gas analyzer	At least weekly	As measured	Field Logs
Flare Operation	Thermocouple	Continuous	Once per minute	Yokogawa and Honeywell Data Recorder
Boiler Operation	Thermocouple	Continuous	Every ten minutes	PLC system

6.3.2 Instrument Quality Assurance/Quality Control

IESI and Trinity Carbon Management's instrument quality assurance/quality control (QA/QC) plan for the Project's monitoring equipment complies with CAR's requirements.

The Thermal Instruments Model TI 9500 flow meter is inspected and cleaned on a quarterly basis with as-found/as-left conditions documented, and undergoes quarterly field checks for calibration accuracy performed by a third-party technician with the last field check occurring within two months prior to the end of the reporting period. Each field check performed during the current reporting period indicated the instruments were within the five percent accuracy range required by the CAR Protocol. The manufacturer of the flow meter recommends calibrations every 18 months. The Project flow meter is calibrated at intervals more frequent than manufacturer recommendations.

The Project used a Landtec GEM-5000 and a Landtec GEM-2000 to measure methane concentration of the landfill gas during the entire reporting period. The manufacturer requires annual calibration of the GEM-5000 gas analyzer and six-month calibrations of the GEM-2000 gas analyzer. First Environment reviewed all calibration records to confirm that calibrations occurred at the required frequency specified by the manufacturer. The calibration records indicated that the analyzers were operating accurately, with the exception of the January 20, 2016 calibration of the GEM-2000 analyzer which indicated "as-found" condition that was over reporting outside of the required five percent accuracy threshold. As a result, all affected methane concentration readings taken with this analyzer prior to this calibration event were adjusted according to Protocol requirements.

Additionally, First Environment confirmed that the Thermo-anemometer straight probe and VelociCalc Handheld Digital Air Velocity meter used to perform the third-party field calibration accuracy checks of the flow meter were calibrated and maintained per the manufacturers' requirements.

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

TABLE 2: Instrument QA/QC

Monitoring Equipment	Dates Used	Calibration	Field Checked	Inspected/Cleaned
TI 62-9500 Flow Meter S/N2010368	10/15/2015 – 4/12/2016	10/8/2015	10/8/2015; 3/14/2016	10/8/2015; 3/14/2016
TI 62-9500 Flow Meter S/N2013293	4/12/2016 – 10/10/2016	4/1/2016; 10/30/2016	6/9/2016; 8/11/2016	6/9/2016; 8/11/2016
GEM 5000 (S/N GM501576)	12/27/2015 – 1/30/2016; 3/6/2016 – 3/19/2016; 6/5/2016 – 6/25/2016	11/13/2014; 11/2/2015	Prior to use	Prior to use
GEM 2000 (S/N GM10447)	10/15/2015 – 12/26/2015; 1/31/2016 – 3/5/2016; 3/20/2016 – 6/4/2016; 6/26/2016 – 10/10/2016	7/16/2015; 1/20/2016; 6/18/2016	Prior to use	Prior to 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	Monthly electric utility invoices
Propane consumption	Purchase records

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 in a given interval was computed by multiplying the flow rate by the length of the interval. Because the flow meters automatically corrected the flow to 60°F and one atmosphere of pressure, no temperature and pressure correction was required. Project data recorded when flare temperature was below 500°F and when boiler temperature was below 125°F were excluded from emissions reduction calculations. The total volume of methane destroyed by the Project was computed in daily intervals by multiplying the daily landfill gas flow by the weekly average of methane concentration measurements, and 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. Project emissions sources consisted of purchased electricity to power Project equipment and stationary combustion of propane for the flare's pilot light and for the flare skid backup generator. 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 LFG	Summed daily from metered data, internally corrected to 60°F and one atmosphere of pressure.
$PR_{CH_4,t}$	Methane content	Averaged weekly from periodic handheld readings.
DE_i	Default destruction efficiency	96% (open flare, least efficient destruction device)
OX	Oxidation Factor	10%
DF	Discount Factor	10% for use of weekly measurements of methane concentration
Flare Temperature Cut-off	Metered data below corresponding temperature cut-off are excluded from calculations	500°F (Flare)

Input Parameter	Name	Description/ Value
Boiler Temperature Cut-off		125°F (Boiler)
EF _{FF}	Propane emission factor	5.74 kg CO ₂ /gallon
EF _{EL}	Purchased electricity emission factor	1772.005 lb. CO ₂ /MWh (SRMW Region)

Copies of the raw data used in the calculations, including flow data, and methane concentration 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 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 applied 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 October 15, 2015 through October 10, 2016 can be considered with a reasonable level of assurance:

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

Verified results show:

October 15 to December 31, 2015	Total
Baseline Emissions (tCO ₂ e)	6,819
Project Emissions (tCO ₂ e)	28
Emissions Reductions (tCO ₂ e)	6,791

January 1 to October 10, 2016	Total
Baseline Emissions (tCO ₂ e)	32,336
Project Emissions (tCO ₂ e)	83
Emissions Reductions (tCO ₂ e)	32,253

8. Lead Verifier Signature



Jeff Daley
Environmental Specialist

9. Senior Internal Reviewer Signature



Michael Carim
Senior Associate