

Verification Report for the Scott Solid Waste Disposal Company Volunteer Regional Landfill – CAR436 Oneida, Tennessee

Climate Action Reserve

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**Prepared for: Scott Solid Waste Disposal Company
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TABLE OF CONTENTS

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

TABLES

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

1. Introduction

This report is provided to Scott Solid Waste Disposal Company (SSWDC) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the Volunteer Regional Landfill – CAR436 (the Project) for the period from January 1 through December 31, 2015. First Environment, Inc. (First Environment) conducted the verification from the date of the kickoff meeting through August 2, 2016.

During the verification process Element Markets, LLC (Element Markets) acted as the Project advisors for the Project developer, Scott Solid Waste Disposal Company. 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	Volunteer Regional Landfill, Oneida, TN
Emission Reduction Sources, Project Emissions, and Greenhouse Gases	Emissions reductions (expressed in units of Carbon Dioxide equivalents (CO ₂ e)) resulting from methane destruction; Project emissions of CO ₂ from fossil fuel combustion and purchased electricity.
Reporting Period	January 1 through December 31, 2015
Data Sources	Metered Data and Emissions Reduction Calculations

4. Standards Used to Verify Emissions (Criteria)

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

Standard of Verification	• Climate Action Reserve U.S. Landfill Project Reporting Protocol, Version 2.0, November 18, 2008 (CAR Protocol) • Climate Action Reserve Landfill Project Reporting Protocol Version 2.0 Errata & Clarification, June 18, 2015 (Errata and Clarification) • Climate Action Reserve Program Manual, September 1, 2015
Verification Process	• Landfill Project Verification Protocol, Version 2.0, November 18, 2008 • Errata and Clarification • Climate Action Reserve Verification Program Manual, December 20, 2010 • ISO 14064-3: Specification with guidance for the validation and verification of greenhouse gas assertions, 2006

Level of Assurance	• Reasonable assurance
Materiality	• Misstatements greater than 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 SSWDC and Element Markets;
- development of the verification and sampling plan;
- review of management and data collection system;
- site visit;
- assessment of raw data and calculations for the period under review;
- follow-up interaction with the SSWDC and Element Markets for corrective action, clarification, or supplemental data as needed; and
- final statement and report submittal.

5.1 Conflict of Interest Review

Prior to beginning any verification project, First Environment conducts an evaluation to identify any potential conflicts of interest associated with the Project. No potential conflicts were found for this Project. First Environment also received authorization to proceed with verification activities for the Project developer from CAR in a notification dated March 16, 2016.

5.2 Verification Team

First Environment's Verification Team consisted of the following individuals who were selected based on their verification experience, as well as familiarity with landfill operations.

Lead Verifier – Jeff Daley
Verifier – Luca Nencetti
Senior Internal Reviewer – Michael Carim

5.3 Verification Kick-off

The verification was initiated with a kick-off meeting on April 5, 2016 with SSWDC and Element Markets. The meeting focused on confirming the scope, schedule, and data required for verification.

5.4 Development of the Verification Plan

The Verification Team formally documented its verification plan as well as determined the data-sampling plan. The verification plan was developed based on the discussion of key elements of the project verification process during the kick-off meeting. SSWDC was afforded the opportunity to comment on the key elements of the plan for verification. Based on items discussed and agreed upon with SSWDC, 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 May 18, 2016 to assess the Project's data management systems and interview personnel relevant to the Project for the verification period.

5.6 Emissions Reduction Data and Calculation Assessment

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

5.7 Corrective Actions and Supplemental Information

The team issued corrective action and clarification requests during the verification process. SSWDC 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 SSWDC, 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 Volunteer Regional Landfill is located in Oneida, Tennessee and is owned and operated by Scott Solid Waste Disposal Company, a subsidiary of Waste Connections. The landfill opened in 1999 and currently receives municipal solid waste.

The Project consists of the voluntary collection and destruction of landfill gas in an open flare. SSWDC began installing a landfill gas (LFG) well field and active gas collection and control system in 2008. 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

Scott Solid Waste Disposal Company is the owner of the landfill and, as such, holds title to the associated emission reduction credits. First Environment reviewed several permits held by the Scott Solid Waste Disposal Company, including the Solid Waste Operating permit and the Title V Air Permit both of which identify Scott Solid Waste Disposal Company as the owner/operator of the landfill. Therefore, Scott Solid Waste Disposal Company is the owner of the Project and consequently owns the rights to any emission reduction credits generated by it. The ownership status was also confirmed at the site visit through interviews conducted with project personnel.

Additionally, First Environment relied on the Attestation of Title completed by SSWDC for the current reporting period. The Attestation is on file with CAR and was reviewed to confirm that it was completed correctly.

6.2.2 Project Start Date

First Environment confirmed that the Project meets CAR's start date requirements. The Project start date is November 5, 2008, which was confirmed through review of a service order from the flare installation company (Shaw LFG Specialties), which confirmed that the flare began operation on this date.

6.2.3 Additionality

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

6.2.3.1 Performance Standard Test

The Project consists of the installation of a landfill gas collection and control system and therefore exceeds the performance standard defined by the CAR protocol, specifically Scenario 1 from the list provided in Section 3.3.1 of the CAR Protocol, because no collection or control system existed prior to the Project start date. 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, SSWDC conducted non-methane organic compounds (NMOC) emissions rate testing on August 23, 2012. The most recent NMOC Emissions Rate calculations were updated on August 18, 2015 which indicated that the NMOC emission rate was estimated to be 7.644 megagrams (Mg) per year in 2015, which is below the 50 Mg per year threshold established by the NSPS regulation. Therefore, the landfill is not required to operate an active collection system under NSPS requirements. First Environment also reviewed the Renewable Operating Permit to confirm that the LFG collection and destruction is voluntary.

Additionally, First Environment relied on the Attestation of Voluntary Implementation completed by SSWDC 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, generated a compliance report on May 10, 2016 using the Environmental Protection Agency's (EPA) Enforcement and Compliance History Online (ECHO) database, and interviewed site

personnel to determine regulatory compliance. Additionally, the Tennessee Department of Environment and Conservation conducted monthly site inspections during the reporting period, all of which indicated that the site was in compliance. The cursory review of permits, the EPA compliance database, site compliance inspection reports, and interviews conducted at the site visit indicated that the site was in compliance and no violations of permits occurred during the reporting period.

Additionally, First Environment relied on the Attestation of Regulatory Compliance completed by the SSWDC 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. SSWDC developed and implemented a Monitoring Plan to track relevant Project parameters and data sources. The Monitoring Plan, including the Project Diagram, was reviewed to determine compliance with the protocol requirements. Based on observations made during the site visit and review of relevant Project documentation, First Environment found the Monitoring Plan and Project Diagram to meet the requirements set forth by the CAR Protocol and the Project to be implemented in accordance with the Monitoring Plan.

6.3.1 Project Monitoring

Landfill gas flow is continuously monitored using a Rosemount MultiVariable Mass Flow meter and transmitted to a Yokogawa datalogger that electronically archives all flow data. 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.

The methane concentration of the landfill gas was continuously measured with a NOVA 902C-CW methane analyzer from the beginning of the reporting period through September 6, 2015. The continuous analyzer stopped functioning correctly because of water in the analyzer sample lines. The continuous methane content of the landfill gas is recorded by the Yokogawa data logger, and data are exported to Microsoft Excel for review and quantification. Beginning on September 7, 2015 methane concentration of the landfill gas was measured with a portable Landtec GEM-2000 methane analyzer. The methane concentration of the landfill gas measured by the GEM-2000 is recorded in field logs.

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

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

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

TABLE 1: Monitoring Equipment

Parameter	Monitoring Equipment	Frequency of Measurement	Frequency of Recording	Recording Device
Landfill gas flow	Rosemount MultiVariable Mass Flow meter	Continuous	Every 10 minutes	Yokogawa digital chart recorder
Methane Concentration	NOVA continuous analyzer	Continuous	Every 10 minutes	Yokogawa digital chart recorder
	Landtec GEM gas analyzer(s)	Weekly	As measured	Field Logs
Hourly Operation of Destruction Device	Thermocouple	Continuous	Every 10 minutes	Yokogawa digital chart recorder

6.3.2 Instrument Quality Assurance/Quality Control

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

The gas analyzer is cleaned, inspected, field checked, and calibrated on a quarterly basis by a landfill technician with as-found / as-left conditions documented. First Environment reviewed all quarterly field checks and calibrations performed during the current reporting period, all of which indicated that the analyzer was operating within the required five percent accuracy range. The manufacturer does not recommend a specific interval to perform calibrations on an ongoing basis. However, the analyzer is field calibrated on a quarterly basis. Beginning in September 2015 the Project relied on portable methane concentration readings using a Landtec GEM-2000. The manufacturer requires six month calibrations of the GEM-2000 gas analyzer. First Environment reviewed all manufacturer calibrations which indicated the analyzer was operating accurately and that calibrations occurred at the required frequency specified by the manufacturer.

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
Rosemount 3095MF flow meter (s/n 33494)	Entire reporting period	3/25/2015; 6/24/2015; 9/24/2015; 12/29/2015	3/25/2015; 6/24/2015; 9/24/2015; 12/29/2015	3/25/2015; 6/24/2015; 9/24/2015; 12/29/2015
NOVA 902C-CW Continious gas analyzer	January 1, 2015 – September 6, 2015	1/21/2015; 4/6/2015; 8/31/2015	1/21/2015; 4/6/2015; 8/31/2015	1/21/2015; 4/6/2015; 8/31/2015
GEM 2000 (SN: GM11161)	September 7, 2015 – December 31, 2015	7/15/2015	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	Utility Invoices
Propane consumption	Purchase Invoices

6.4 Emissions Reduction Calculation Assessment

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

Total landfill gas flow is computed by multiplying the average landfill gas flow rate in a given interval by the length of the interval. Flow totals are aggregated on a daily basis. Metered gas flow volumes were automatically corrected to standard conditions at one atmosphere of pressure and a temperature of 60°F by the Rosemount flow meter. 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.

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 _{CH4,t}	Methane content	Averaged daily from continuously recorded data and weekly when portable GEM readings are used
DE _i	Default destruction efficiency	96%
OX	Oxidation Factor	10%
DF	Discount Factor	10% when weekly measurements of methane concentration 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	1,337.15 lb CO ₂ /MWh

Copies of the raw data used in the calculations, including flow data and methane content data, were compared with the data used in the final calculations and tested for transcription or mathematical errors. A representative sample of raw data sources and calculations over the entire verification period were reviewed. First Environment performed recalculations of emission reductions for the entire reporting period to assess whether they were free of material misstatement. First Environment found the emission reduction calculations to be free of material misstatement.

6.5 Approved Variance or Deviations

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

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

Verified results show:

January 1 to December 31, 2015	Total
Baseline Emissions (tCO₂e)	36,002
Project Emissions (tCO₂e)	65
Emissions Reductions (tCO₂e)	35,937

8. Lead Verifier Signature

A handwritten signature in black ink, appearing to read 'Jeff Daley', written in a cursive style.

Jeff Daley
Environmental Specialist

9. Senior Internal Reviewer Signature

A handwritten signature in blue ink, appearing to read 'Michael Carim', written in a cursive style.

Michael Carim
Senior Associate