

Verification Report for Moccasin Mike Landfill Gas Project Superior, Wisconsin

Climate Action Reserve—CAR406

April 2016

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1. Introduction

This report is provided to the City of Superior, Wisconsin (City of Superior) as a deliverable of the Climate Action Reserve (CAR) project verification process. This report covers the verification of the Moccasin Mike Landfill Gas Project – CAR406 (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 April 13, 2016.

During the verification process, Short Elliott Hendrickson, Inc. (SEH) and Element Markets, LLC (Element Markets) acted as the Project advisors for the Project developer, City of Superior. First Environment communicated primarily with SEH 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	Moccasin Mike Landfill, Superior, Wisconsin
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 Protocol, Version 3.0, December 2, 2009 (CAR Protocol) • Climate Action Reserve Landfill Project Protocol Version 3.0 Errata & Clarification, June 18, 2015 (Errata and Clarification) • Climate Action Reserve Program Manual, September 1, 2015
Verification Process	• Section 8 of the CAR Protocol, Version 3.0, December 2, 2009 • 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 City of Superior;
- 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 City of Superior for corrective action, clarification, or supplemental data as needed; and
- final statement and report submittal.

5.1 Conflict of Interest Review

Prior to beginning any verification project, First Environment conducts an evaluation to identify any potential conflicts of interest associated with the Project. No potential conflicts were found for this Project. First Environment also received authorization to proceed with verification activities for the Project developer from CAR in a notification dated January 19, 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
Senior Internal Reviewer – Jay Wintergreen

5.3 Verification Kick-off

The verification was initiated with a kick-off meeting on February 16, 2016 with the City of Superior, SEH, 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. The City of Superior was afforded the opportunity to comment on the key elements of the plan for verification. Based on items discussed and agreed upon with the City of Superior, 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 March 22, 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 clarification requests during the verification process. The City of Superior provided sufficient responses to the 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 City of Superior, 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 Moccasin Mike Landfill is located in Superior, Wisconsin and is owned and operated by the City of Superior. The landfill has actively received municipal solid waste since 1976 and consists of Cells 1 through 5.

In 2004, the City of Superior installed five passive vents to help prevent the migration of landfill gas. These passive vents were converted to active gas collection wells in 2008. The gas collection system consists of vertical and horizontal wells. The Project consists of the voluntary collection of landfill gas from Cells 1 through 5 and its subsequent destruction in an open flare. No combustion devices existed on site prior to the initiation of the Project activity. 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

The City of Superior meets the eligibility requirements set forth in the CAR Protocol as described below.

6.2.1 Ownership and Title

The City of Superior is the owner and operator of the landfill and as such, holds title to the associated emission reduction credits. First Environment reviewed several permits held by the City of Superior, including the air pollution control construction permit, to confirm that the City of Superior 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.

Additionally, First Environment relied on the Attestation of Title completed by the City of Superior 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 April 28, 2009, which was confirmed during the initial verification through review of site documentation and official notifications sent to local and state environmental agencies notifying the agencies of flare start up.

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 2 from the list provided in Section 3.4.1 of the CAR Protocol, because gas has been previously collected but never destroyed 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, the City of Superior conducted non-methane organic compounds (NMOC) emissions rate testing on June 19, 2014, as documented in the most recent NMOC Emissions Rate Report dated July 31, 2014. The results of this test indicated that the NMOC emission rate was estimated to be 11.0 megagrams (Mg) per year in 2015, and the rate is anticipated to remain below the 50 Mg per year threshold established by the NSPS regulation for the remainder of the crediting period. Therefore, the landfill is not required to operate an active collection system under NSPS requirements. First Environment reviewed the preliminary determination document issued by the Wisconsin (WI) Department of Natural Resources (DNR) and the current air pollution control operating permit to confirm that the Project is not required under local or state regulations. The NMOC emission rate report was reviewed in order to confirm that the Project is not required under federal NSPS regulations.

Furthermore, the landfill is required to comply with Wisconsin Administrative Code NR 445 which regulates hazardous air contaminants. In order to demonstrate compliance with NR 445,

the landfill was required to install an active gas collection system and monitor hazardous air contaminants. In their preliminary determination document, the Wisconsin DNR confirmed that, based on estimated maximum theoretical emission rates, the landfill does not have to operate the open flare as a means of meeting the NR 445 limits. First Environment reviewed the preliminary determination document issued by the Wisconsin DNR, current and past air pollution control operating permits, current hazardous air modeling results, and copies of correspondence with the Wisconsin DNR in order to confirm the voluntary nature of the landfill gas destruction under state regulations. Similarly, based on a cursory review of the landfill's permits and compliance history, First Environment is reasonably assured that no additional local requirements for the installation of the landfill gas collection and control system exist, as stated in the Project's Monitoring Plan. Based on First Environment's review described above, the Project passes the Legal Requirements Test defined by the CAR Protocol.

Additionally, First Environment relied on the Attestation of Voluntary Implementation completed by the City of Superior 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 air permit and generated a compliance report on March 4, 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 Wisconsin Department of Natural Resources performed three site inspections during the reporting period (May 18, 2015, September 9, 2015, and December 1, 2015). All three inspection reports showed that the site was in compliance and no non-compliance issues were identified during any of the inspections.

Additionally, First Environment relied on the Attestation of Regulatory Compliance completed by the City of Superior 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 of Superior 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 model 3051SMV 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 is continuously measured with a Siemens Ultramat 23 methane analyzer. Methane content of the landfill gas is recorded by the Yokogawa datalogger. The data are exported 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 dual 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 mass flow meter	Continuous	Every 8 minutes	Yokogawa digital chart recorder
Methane Concentration	Siemens Ultramat 23	Continuous	Every 8 minutes	Yokogawa digital chart recorder
Hourly Operation of Destruction Device	Thermocouple	Continuous	Every 8 minutes	Yokogawa digital chart recorder

6.3.2 Instrument Quality Assurance/Quality Control

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

The flow meter is cleaned and inspected on a monthly basis by landfill personnel and on a quarterly basis by a third party with as-found/as-left conditions documented. It is also field checked for calibration accuracy on a quarterly basis by a third party, including one field check within two months prior to the end of the reporting period. First Environment reviewed all third-party field calibration checks performed during the current reporting period, which indicated that the flow meter was operating within the required five percent accuracy range. The manufacturer recommends factory calibrations once every three years, as such, the instrument is factory calibrated per the manufacturers requirements.

The gas analyzer is inspected and cleaned on a monthly basis by landfill personnel with as-found/as-left conditions documented. It is also field checked for calibration accuracy on a quarterly basis by a third party, including one field check within two months prior to the end of the reporting period. First Environment reviewed all field checks of the methane analyzer performed during the current reporting period, which indicated that the gas 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 other than annual field checks with calibration gas; however, the instrument is calibrated quarterly by a third party

according to the manufacturer's procedure. First Environment reviewed all inspection and calibration records which indicated the analyzer was operating accurately.

Additionally, First Environment confirmed that the instruments used to perform the third-party field calibration accuracy check of the flow meter and continuous methane analyzer were calibrated and maintained per manufacturer's requirements.

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 3051SMV flow meter (s/n 434191)	January 1, 2015 – December 31, 2015	12/12/2013	3/6/2015; 6/12/2015; 9/11/2015; 12/11/2015	1/28/2015; 2/26/2015; 3/6/2015; 3/30/2015; 4/9/2015; 5/11/2015; 6/12/2015; 6/25/2015; 7/28/2015; 8/4/2015; 9/11/2015; 10/23/2015; 11/18/2015; 12/11/2015; 12/17/2015
Siemens Ultramat 23 gas analyzer	January 1, 2015 – December 31, 2015	7/29/2015; 12/11/2015	3/6/2015; 6/12/2015; 9/11/2015; 12/11/2015	1/28/2015; 2/26/2015; 3/6/2015; 3/30/2015; 4/9/2015; 5/11/2015; 6/12/2015; 6/25/2015; 7/28/2015; 8/4/2015; 9/11/2015; 10/23/2015; 11/18/2015; 12/11/2015; 12/17/2015

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 electricity readings from Project sub-meter.
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 instrument. 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 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
$PR_{CH_4,t}$	Methane content	Averaged daily from continuously recorded data
DE_i	Default destruction efficiency	96%
OX	Oxidation Factor	10%
DF	Discount Factor	0
Flare Temperature Cut-off	Metered data below corresponding temperature cut-off are excluded from calculations.	510°F
EF_{FF}	Propane emission factor	5.74 kg CO ₂ /gallon
EF_{EL}	Purchased electricity emission factor	1,425.15 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 (tCO ₂ e)	47,574
Project Emissions (tCO ₂ e)	57
Emissions Reductions (tCO ₂ e)	47,517

8. Lead Verifier Signature



Jeff Daley
Environmental Specialist

9. Senior Internal Reviewer Signature



Jay Wintergreen
Senior Associate