Monitoring report form
(Version 04.0)

MONITORING REPORT	
Title of the project activity	Aurá Landfill Gas Project
Reference number of the project activity	0888
Version number of the monitoring report	1
Completion date of the monitoring report	07/01/2015
Registration date of the project activity	30/04/2007
Monitoring period number and duration of this monitoring period	Monitoring Period Number 9 From 01/01/2014 to 31/12/2014 (both days included)
Project participant(s)	Brazil: Conestoga-Rovers & Associados Engenharia S/A Norway: Nordic Environment Finance Corporation
Host Party(ies)	Brazil
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	Scope 13: Waste handling and disposal ACM0001- Consolidated methodology for landfill gas project activities- ver 4
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	312,248 tCO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	470,218 tCO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	-
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	470,218 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The Aurá Landfill Gas Project has been developed at the Aurá Landfill (Site), originally called the Aterro Sanitário do Aurá. The Site has received non-hazardous solid municipal, industrial, commercial, institutional, and some agricultural wastes for approximately 16 years. Carbon dioxide (CO_2) and methane (CH_4) are generated by the anaerobic decomposition of the above-noted wastes placed at the Site. These compounds are then passively emitted to the atmosphere.

Purpose of the Project Activity

The purpose of the project activity is to collect landfill gas (LFG) at the Aurá Landfill and combust the extracted LFG over a ten year-period, utilizing a high efficiency enclosed flare, thereby reducing greenhouse gas emissions (GHG) and generating Certified Emission Reductions (CERs).

Installed Technology and Equipment

The project involved the construction of a LFG collection system consisting of horizontal trenches and vertical LFG extraction wells, centrifugal blower(s), and all other supporting mechanical and electrical subsystems and appurtenances necessary to collect the LFG.

The LFG collected from the Site is combusted in an enclosed LFG flare with full process controls and instrumentation installed and operating. The state-of-the-art flare is capable of providing sufficient temperature and retention time of the extracted LFG for complete destruction of hydrocarbons.

Relevant dates for the project activity

Conestoga-Rovers & Associates (CRA) started design activities in late 2005 and construction a year later in 2006. Constructed by February 2007 and ready for commissioning, the first monitoring period was from April 30, 2007 to September 30, 2008.

Total GHG emission reductions achieved in this monitoring report

The Certified Emission Reductions (CERs) volume claimed for the monitoring period extending from January 01, 2014 to December 31, 2014 is 470,218 tCO_2e.

A.2. Location of project activity

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The project activity is located at:
Host country: Brazil
State: Pará
Municipality: Belém
Physical location:

> The Aurá Landfill is located 19 kilometers (km) from the centre of the City of Belém, State of Pará, Brazil, and is 8 km from the centre of the City of Ananindeua. The entire Site covers an area of 120 hectares (ha) and the waste fill area of the Site is approximately 30 ha in size. The Site is located west of Curuperé Creek and east of the Parque Ambiental de Belém.

UTM Coordinates: 22 M 790853 mE and 9843207 mS.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Conestoga Rovers e Associados Engenharia Ltda. (Private Entity)	No
Norway	Nordic Environment Finance Corporation	No

A.4. Reference of applied methodology and standardized baseline

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The approved baseline and monitoring methodology applied to this project is the approved ACM0001 – Consolidated Baseline Methodology for Landfill Gas Project Activities- Version 4.0[1].

This methodology also refers to the following tools:

- "Tool to calculate the emission factor for an electricity system", version 4.0, EB75 annex 15; https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

- Standard for application of the global warming potentials to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto protocol, version 01.0, EB69 annex 3;
https://cdm.unfccc.int/faq/Reference/Standards/meth/reg_stan02.pdf

A.5. Crediting period of project activity

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The crediting period for this project is from April 30, 2007 to April 29, 2017 (fixed). This is the 9th consecutive monitoring period corresponding to January 01, 2014 to December 31, 2014.

A.6. Contact information of responsible persons/ entities

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Conestoga Rovers e Associados Engenharia Ltda.
Av. Maria Coelho Aguiar, 215, Bloco F, 6º andar. Zip Code: 05805-000
Email: fpileggi@craengenharia.com.br
Contact Person: Flavia Pileggi
+55 11 3741-5225

[1] Available at: https://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_TX29WGSXE4781NKGQGCDPTHM2F3V3D/ACM0001%20_ver4.pdf?t=S0R8bmdiZ2MwfDB7cVPH2pPsqYrA5MN_FjlO.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The technology used to gather the LFG is a grid of horizontal gas extraction wells within the landfill, connected to a centralized blower system used to induce vacuum. Upon collection of the LFG, the methane component of the LFG is combusted in a state-of-the-art high-efficiency enclosed flare. The Global Warming Potential (GWP) of the LFG is reduced by the destruction of the methane portion of the LFG.

The LFG management system is comprised of the following three major components:

1. LFG management facility - houses mechanical and electrical components required for the extraction and delivery of LFG for disposal by flaring
2. LFG collection field - removes LFG from the wastes within the limit of waste and includes trenches and collection piping to convey LFG from the field to the LFG management facility
3. Condensate management system - removes liquid condensate from the LFG collection system and directs the condensate to the leachate collection system

The design for the overall landfill gas (LFG) management system for the Site was completed by Conestoga-Rovers & Associates (CRA) from late 2005 to mid 2006. Construction of the LFG management system commenced in early 2006, and the facility was commissioned in the spring of 2007. The start date of the project activity is September 1, 2007.

To date there have been seven issuances of CERs, as follows:

Verification N	Monitoring Period	CERs	Date of Issuance
First	Apr 30, 2007 to Sep 30, 2008	32,265 tCO_2e	Aug 12, 2009
Second	Oct 1, 2008 to Jan 31, 2009	51,524 tCO_2e	Aug 13, 2009
Third	Feb 1, 2009 to Aug 31, 2009	83,077 tCO_2e	Mar 4, 2010
Fourth	Sep 1, 2009 to Feb 28, 2010	87,595 tCO_2e	Oct 27, 2010
Fifth	Mar 1, 2010 to Dec 31, 2010	234,835 tCO_2e	Nov 16, 2011
Sixth	Jan 1, 2011 to Oct 31, 2011	286,399 tCO_2e	January 14, 2013
Seventh	Nov 1, 2011 to Dec 31,2012	482,110 tCO2e	May 17, 2013
Eighteenth	Jan 1,2013 to Dec 31,2013	429,046 tCO2e	May 28, 2014
TOTAL CERs ISSUED TO DATE		**1,686,851 tCO_2e**	

During the current monitoring period January 01, 2014 to December 31, 2014, there have been the following major maintenance activities:

Description	Date of maintenance activity
John Zink Panel maintenance	August 18,2014
Solenoid Valve was changed	February 14, 2014
Solenoid Valve was changed	June 21, 2014

There is no major deviation of project monitoring activities from applied methodology and all monitoring activities are being done in accordance with the said methodology as well as with the approved monitoring plan.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

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There are no temporary deviations from the registered monitoring plan or the applied methodology.

B.2.2. Corrections

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There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

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The monitoring plan was revised and approved before the period of this monitoring report on October 4, 2009.

B.2.4. Changes to project design of registered project activity

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There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

B.2.5. Changes to start date of crediting period

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There are no changes to the start date of the crediting period that have been approved during this period or submitted with this monitoring report.

B.2.6. Types of changes specific to afforestation or reforestation project activity

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Not applicable.

SECTION C. Description of monitoring system

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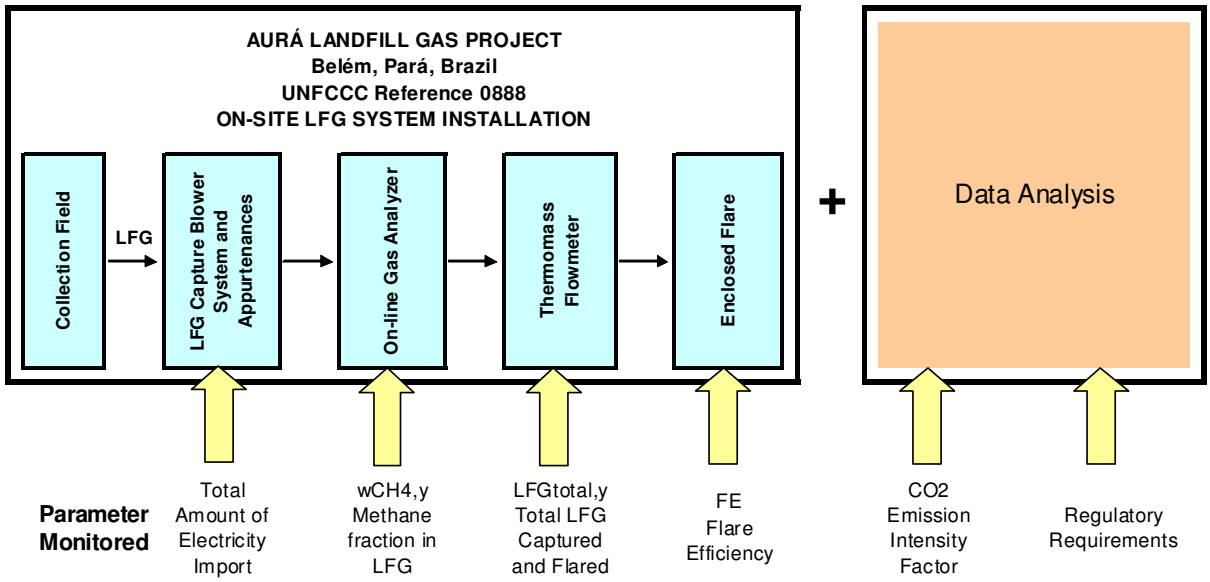
The LFG monitoring program is designed to collect system operating data required to safely and effectively operate the system as required for the verification of CERs. This data is collected in real time, and provides a continuous record that is easy to monitor, review, and verify.

The monitoring methodology is based on the direct measurement of the quantity of LFG captured and destroyed by the LFG management system. The actual tonnage of methane emissions reduced by the project is calculated based on the flow rate of the LFG, methane concentration, and destruction/conversion efficiency of the combustion equipment. The monitoring plan provides for the continuous measurement of both LFG quantity and quality using a continuous flow meter and online LFG analyzer. The methane emissions reduced by the flare are determined on the flow, methane content, flare temperature and time.

Monitoring Points



Flow measurement

LFG collected by the System and subsequently flared is measured via a flow measuring device suitable for measuring the velocity and volumetric flow of a gas. The flow measurements are taken within the piping itself, and the flow sensors are connected to a transmitter that is capable of collecting and sending continuous data to the Landtec recording system. The equipment selected allows for measurement of flow parameters, normalized to a standard temperature, pressure, and gas composition.

The thermal mass flow meter must be calibrated every 18 months as per manufacturer specifications. Equipment calibration procedures are specified by the equipment manufacturer, and calibration of the sensors is required on this schedule to ensure the quality and validity of the data. The accuracy of a flow meter is dependent on the design of the equipment, and the specific type of sensor used. The equipment selected provides a minimum accuracy of +/- 1 percent by volume. The measured flow is aggregated approximately once per two minutes.

All data that is collected is recorded for the permanent record. Both electronic and hard copies of the data are maintained for auditing purposes and for use in the calculation of CERs.

Gas quality

The two parameters that are most pertinent to the verification of CERs, as well as the safe and efficient operation of the system, are the concentrations of methane and oxygen in the gas stream. These two parameters are measured via a common sample line that is run to the main collection system piping, and measured in real time by two separate sensors, one each for methane and oxygen.

Compensation for temperature and pressure is not required for the methane and oxygen sensors and the sensors are designed to operate within specified temperature and pressure conditions. Equipment calibration is automatic as specified by the equipment manufacturer. Calibration of the sensors is conducted on a regular basis to ensure the quality and validity of the data. Regular calibration of the equipment is especially important, as the accuracy of the methane and oxygen sensors is greatest within the expected calibration range of the gas stream to be measured. The equipment selected provides an accuracy of at least +/- 1 percent by volume. Gas compositions are aggregated approximately once per two minutes.

Emission reduction calculations

Guidelines and directives in order to standardize the data acquisition and handling processes are in place for calculating the generation of Certified Emission Reductions (CERs) for the project. The Site uses a Landtec™ data acquisition device [Field Analytical Unit – (FAU)], which measures parameters such as methane (CH_4) concentration, flare temperature, and landfill gas flow on a continuous-basis. The data is collected and stored on-site using a Field Server Unit (FSU), which also sends the data to a Landtec server in California (USA) for off-site storage and back-up. Through the EnviroComp Report Service (ECRS), the data is viewed and downloaded to a spreadsheet file for further analysis.

A series of procedures are in place to retrieve and store the data, and set up tables and reports for the verification events. Based on operational data and the applicable monitoring methodology, the emission reductions are calculated on a monthly basis and compiled in a monitoring report during a verification exercise.

Data collection and record keeping

The monitoring methodology requires the continuous measurement of the quantity and quality of the LFG being flared. A summary of all data collection and reporting requirements, as listed in the UNFCCC ACM0001 (version 4) monitoring methodology, and a summary of on-site monitoring responsibilities and frequencies are provided below.

SUMMARY OF SITE MONITORING RESPONSIBILITIES
Landfill Gas Development Project
Aurá Landfill
Belém, Pará, Brazil

Project Activity	***Equipment***	***Personnel***	***Responsibilities***	***Frequency***
Quantity of LFG Captured	Flow Meter	Site Operator	* Verify the flow meter and FSU are operating correctly and collecting gas flow rate data continuously	Daily
Methane Fraction in LFG	Gas Analyzer	Site Operator	* Verify the FAU and FSU are operating correctly and collecting gas composition data continuously	Daily
Flare Efficiency	Flare Stack	Site Operator	* Arrange for qualified technician to perform stack testing	Annually
Flare Operation Time	Flare Stack	Site Operator	* Verify the FSU is recording the flare temperature on a continual basis * Follow operation and maintenance requirements as outlined in the Operation and Maintenance Report	Daily
Amount of Electricity Used	n/a	Site Operator	* Collect all Electricity bills and file on-Site and to office.	Monthly

In addition to the previous monitoring practices, the Project Participant keeps records of sustainable development parameters to monitor benefits the project activity is having in the area. Amongst these
monitored parameters are:

- record keeping of job creation: includes number of employees hired and definition of responsibilities of employees working at the LFG collection system plant;
- income generation: includes incomes of all employees working at LFG collection system plant;
- tracking of odour complaints (dealt with by landfill operator): for this monitoring period there were no odour complaints during April 2014, May 2014, June 2014, September 2014 and December 2015. For the rest of the period, the complaints were addressed by the City of Belém by taking the appropriate action;
- landfill safety: subsurface migration of LFG is monitored on a monthly basis through monitoring rounds of the applied vacuum on the collection field. Negative pressure readings indicate the gas is being collected by the combustion system avoiding LFG migrating to the surroundings. Furthermore, Aura Landfill Gas Project has an Environment and Safety Plan for Capture and Flare
- technology transfer and communication of results have been presented in papers submitted to conferences held in North America;
- training records of personnel: meetings are performed on site for training and communication purposes, attendees include field, administrative and technical personnel from CRA.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	GWP_{CH4}
Unit:	tCO_2e/tCH_4
Description:	Global warming Potential (GWP) value for methane
Source of data:	Decisions under UNFCCC and the Kyoto Protocol As described in the CDM standard "Application of the global warming potentials to clean development mechanism project activities and programme of activities for the second commitment period of the Kyoto Protocol", emission reductions of CDM projects occurring from 1 January 2013 onwards shall be determined using the GWP adopted at the CMP in Durban (IPCC Table 2.14 Errata, i.e. 25 for methane, 298 for N2O, 14 800 for HFC 23 and 22 800 for SF6).
Value(s) applied):	25
Purpose of data:	Baseline emission calculations
Additional comment:	-

Data / Parameter:	D_{CH4}
Unit:	tCH_4/m^3CH_4
Description:	Methane density
Source of data:	ACM0001- Consolidated Baseline Methodology for Landfill Gas Project Activities - version 04
Value(s) applied):	0.0007168
Purpose of data:	Baseline emission calculations
Additional comment:	-

D.2. Data and parameters monitored

Data / Parameter:	$LFG_{total,y}$
Unit:	Nm^3
Description:	Total amount of landfill gas captured and flared
Measured/ Calculated / Default:	Measured
Source of data:	On-Line LFG flow meter (thermo mass)
Value(s) of monitored parameter:	Multiple, continuously measured. Values submitted in excel tables with this report.
Monitoring equipment:	Type: Thermal Instrument Co Model 62-9/9500 thermal flowmeter Serial # 2012383 Flowrate Readout Accuracy: ± 1 % Full Scale Calibration frequency: 18 months Date of last calibration: September 21, 2012 Validity: March 21, 2014 Type: Thermal Instrument Co Model 62-9/9500 thermal flowmeter Serial # 2012001 Flowrate Readout Accuracy: ± 1 % Full Scale Calibration frequency: 18 months Date of last calibration: February 28, 2014 Validity: August 28, 2015 Flowmeter serial # 2012383 was replaced by serial # 2012001 on March 10, 2014
Measuring/ Reading/ Recording frequency:	Continuously every two minutes
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The flowmeter is recalibrated as per manufacturer's recommendation.
Purpose of data:	Baseline emission calculations
Additional comment:	-

Data / Parameter:	FE
Unit:	%
Description:	Flare/combustion efficiency determined by the operation hours (1) and the methane content in the exhaust gas (2)
Measured/ Calculated / Default:	Measured/calculated

Source of data:	(1) The temperature of the flare is continuously recorded within the Field Service Unit (FSU) (2) Flare stack samplings by certified laboratories: EcoSampling Ambiental flare sampled on January 4, 2012 EcoSampling Ambiental flare sampled on February 07, 2013
Value(s) of monitored parameter:	(1) Multiple, continuously measured (2) From January 1, 2014 to July 31, 2014: FE= 99.9954% From August 1, 2014 to December 31, 2014: FE= 99.9964%
Monitoring equipment:	Type K. calibrated by PAKARI Identification Number: 250 Accuracy: +/- 2.2℃ Date of last calibration: March 31, 2014 Validity: Not applicable Identification Number: 251 Accuracy: +/- 2.2℃ Date of last calibration: March 31, 2014 Validity: Not applicable Identification Number: 252 Accuracy: +/- 2.2℃ Date of last calibration: March 31, 2014 Validity: Not applicable Identification Number: 253 Accuracy: +/- 2.2℃ Date of last calibration: March 31, 2014 Validity: Not applicable (2) EcoSampling Flare sampled on November 29, 2013: FID chromatograph equipment CAI - California Analytical Instruments Model 600 HFID EcoSampling Flare sampled on July 31, 2014: FID chromatograph equipment CAI - California Analytical Instruments Model 600 HFID
Measuring/ Reading/ Recording frequency:	Measuring frequency: (1) continuously every two minutes and (2) monitored annually
Calculation method (if applicable):	(1) Operation hours according to temperature of the flare (2) EcoSampling tests already include the calculation on FE = (1-(mass flow out of fare/mass flow into flare))*100
QA/QC procedures:	Regular maintenance to ensure optimal operation of controlled combustion environment.
Purpose of data:	Baseline emissions calculations
Additional comment:	Determined by (1) measurement of operation time of flare (with temperature); (2) measurement of methane content in the exhaust gas.

Data / Parameter:	$wCH_{4,y}$
Unit:	m^3 CH_4/m^3 LFG
Description:	Methane fraction in the landfill gas
Measured/ Calculated / Default:	Measured
Source of data:	Measured by continuous gas quality analyzer
Value(s) of monitored parameter:	Multiple, continuously measured. Values submitted in excel tables with this report.

Monitoring equipment:	Landtec Field Analytical Unit (FAU), calibration automatically checked. Type: FAU Serial Number: GA 08798 Calibration frequency: 12 months Accuracy:+/- 1% Date of last calibration: March 13, 2013 Validity: March 13, 2014 Type: FAU Serial Number GA 08676 Calibration frequency: 12 months Accuracy: :+/- 1% Date of last calibration: April 11, 2013 Validity: April 11, 2014 Type: FAU Serial Number: GA 08798 Calibration frequency: 12 months Accuracy:+/- 1% Date of last calibration: July 12, 2014 Validity: July 12, 2015 Type: FAU Serial Number GA 08676 Calibration frequency: 12 months Accuracy: :+/- 1% Date of last calibration: January 27, 2014 Validity: January 27, 2015 FAU # 8676 was replaced by FAU #8798 on January 16,2014 FAU #8798 was replaced by FAU #8676 on February 03, 2014 Type: Gas Cylinder Serial Number 161954 Composition: CH_4 50%; CO_2 35% Date of last calibration: March 30, 2012 Validity: 36 months Type: Gas Cylinder Serial Number EFH5153 Composition: O_2 -4% Date of last calibration: March 26, 2012 Validity: 36 months
Measuring/ Reading/ Recording frequency:	Continuously every two minutes
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Calibration of equipment as per manufacturer specifications to ensure validity of data measured

Purpose of data:	Baseline emission calculations
Additional comment:	-

Data / Parameter:	EL_{IMP}
Unit:	MWh
Description:	Total amount of electricity import to meet project requirements
Measured/ Calculated / Default:	Measured
Source of data:	Electric meter – Centrais Elétricas do Pará- CELPA
Value(s) of monitored parameter:	

January 2014	11.336MWh
February 2014	10.924MWh
March 2014	11.650MWh
April 2014	13.012MWh
May 2014	12.035MWh
June 2014	11.092MWh
July 2014	12.043MWh
August 2014	10.159MWh
September 2014	10.674MWh
October 2014	10.109MWh
November 2014	9.506MWh
December 2014	10.334MWh
January 01, 2014 to December 31, 2014	132.874MWh

Monitoring equipment:	Energy measurement meters. These meters are installed by the local electric provider Centrais Elétricas do Pará S.A. (CELPA), are sealed and tamper proof LANDIS+GYR Model: SAGA 1000-1681-B Accuracy: 0.5% Serial number: 362496 Last Calibration: February 25, 2013 LANDIS+GYR Model: SAGA 1000-1681-B Accuracy: 0.5% Serial number: 362496 Last Calibration: April 22, 2014
Measuring/ Reading/ Recording frequency:	Measuring frequency: monthly meter reading by the electricity distribution company (CELPA) representative and billing to the company
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Calibration of equipment as per manufactures specifications to ensure validity of data measured
Purpose of data:	Project emission calculations
Additional comment:	-

Data / Parameter:	EF_{grid}
Unit:	tCO_2e/MWh
Description:	CO_2 emission intensity of electricity used in the project activity
Measured/ Calculated / Default:	Calculated
Source of data:	Most recent data for the build margin and operating margin (2013) found on the Brazilian Governments Ministry of Science and Technology website: (http://www.mct.gov.br/index.php/content/view/346665.html#ancora)
Value(s) of monitored parameter:	For 2013 (http://www.mct.gov.br/index.php/content/view/346665.html#ancora) 0.432 tCO_2e/MWh Average Operating Margin: 0.5931 tCO_2e/MWh Build Margin*: 0.2713 tCO_2e/MWh Calculation of Grid Emission Factor Emission Factor = (OM*0.5) + (BM*0.5) = (0.5931*0,5) + (0.27130*0,5) = 0.432 tCO_2e/MWh
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Annually ex-post
Calculation method (if applicable):	The build margin and operation margin are weighted as 50 percent and 50 percent respectively, in accordance with "Tool to Calculate the Emission Factor for an Electricity System "– version 4.0.0 (EB 75)
QA/QC procedures:	Not applicable
Purpose of data:	Project emissions calculations
Additional comment:	-

Data / Parameter:	AF
Unit:	None
Description:	Regulatory requirements relating to landfill gas projects
Measured/ Calculated / Default:	Test
Source of data:	The information though recorded annually, is used for changes to the adjustment factor (AF) or directly MDreg.y at renewal of the credit period
Value(s) of monitored parameter:	Zero
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Annually

Calculation method (if applicable):	Not applicable
QA/QC procedures:	Not applicable
Purpose of data:	Baseline emission calculations
Additional comment:	-

D.3. Implementation of sampling plan

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Not applicable.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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The approved baseline methodology applied to this project is the approved ACM0001 ver. 4 (dated 28 July 2006) – Consolidated Baseline Methodology for Landfill Gas Project Activities.

Baseline emissions are determined according to equation (1) and comprise the following sources:

(a) Methane emissions from the SWDS in the absence of the project activity;

(b) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;

(c) Heat generation using fossil fuels in the absence of the project activity; and

(d) Natural gas used from the natural gas network in the absence of the project activity.

Baseline emissions of methane from the SWDS are determined as follows, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (such as due to regulations). In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account:

$$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y}\right) \times GWP_{CH4}$$

Where:

BE_{CH4} = Baseline emissions of methane from the SWDS in year y (t CO2e/yr)

OX_{top_layer} =Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH4/yr)

$F_{CH,BL,y}$= Amount of methane in the LFG that would be flared in the baseline in year y (t CH4/yr)

GWP_{CH4} = Global warming potential of CH4 (t CO2e/t CH4)

E.2. Calculation of project emissions or actual net GHG removals by sinks

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Methodology ACM0001 ver. 4 clearly states that the CO2 emission intensity of the electricity consumed by the project activity must be taken into account. In the project activity, electrical consumption is associated with the blower system used to draw landfill gas to the enclosed drum flare.

An estimate of the grid emission factor for Brazil is calculated based on the calculation for the combined margin emission factor for the Brazilian interconnected grid, weighting the build margin and operating margin 50 percent and 50 percent respectively in accordance with the Tool to Calculate the Emission Factor for an Electricity System-Version 4.0.0The most recent data for the build margin and operating margin is for 2013 and is found on the Brazilian Governments Ministry of Science and Technology website (http://www.mct.gov.br/index.php/content/view/346665.html#ancora).

TOTAL EMISSIONS RESULTING FROM ELECTRICAL CONSUMPTION
AURÁ LANDFILL GAS PROJECT
AURÁ LANDFILL
BELÉM, PARÁ, BRAZIL

Period	***Quantity of Electricity Imported (MWh)*** ***EC***	***CO_2 Emission Intensity (tCO2e/MWh)*** ***EFgrid, CM***	***CO_2 Emissions Produced (tCO_2e)*** ***PEEC***
January 2013	11.336	0.432	4.9
February 2013	10.924	0.432	4.7
March 2013	11.650	0.432	5.0
April 2013	13.012	0.432	5.6
May 2013	12.035	0.432	5.2
June 2013	11.092	0.432	4.8
July 2013	12.043	0.432	5.2
August 2013	10.159	0.432	4.4
September 2013	10.674	0.432	4.6
October 2013	10.109	0.432	4.4
November 2013	9.506	0.432	4.1

December 2013	10.334	0.432	4.5
Total	132.874	0.432	57.4

E.3. Calculation of leakage

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No leakage effects need to be accounted under methodology ACM0001 ver. 4 (E.2=0).

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

The following formulae were used to estimate emission reductions for the project activity:

$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_y * CEF_{electricity,y} - ET * CEF_{thermal,y}$

Where:

- ER_y are the emission reductions, measured in tCO_2e
- $MD_{project,y}$ is the amount of methane actually destroyed/combusted during the time period t, measured in tCH_4
- $MD_{reg,y}$ is the amount of methane that would have been destroyed/combusted during the time period t in the absence of the project activity, measured in tCH_4
- GWP_{CH4} is the approved Global Warming Potential value for methane, 25 tCO_2e/tCH_4
- EL_y is net quantity of electricity displaced during a given period t, measured in MWh
- $CEF_{electricity,y}$ is the CO_2 emissions intensity of the electricity displaced, measured in tCO_2e/MWh
- ET is the quantity of thermal energy displaced, measured in TeraJoules (TJ)
- $CEF_{thermal,y}$ is the CO_2 emissions intensity of the thermal energy displaced, measured in tCO_2e/TJ

It is noted that while the terms for electricity and thermal energy have been included to be consistent with the overall formulation stated in ACM0001 ver.4, energy displacement is not a component of the proposed project activity. As a result, the above equation reduces to the following form for the project activity:

$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4}$

Considering that there is no regulatory or contractual requirement determining MDreg, an adjustment factor (AF) is used:

$MD_{reg} = MD_{project} * AF$

Based on the project context, an "Adjustment Factor" of 0 percent is used for the project.

$MD_{reg,y} = MD_{project,y} \times AF$
$MD_{reg,y} = MD_{project,y} \times 0$

And $ER_y = MD_{project,y} * GWP_{CH4}$

The methane destroyed by the project activity during a given time period t can be determined by the following: monitoring the quantity of methane actually flared and LFG used to generate electricity and to produce thermal energy, and is given by:

$MD_{project} = MD_{flared} + MD_{electricity} + MD_{thermal}$

For the proposed project activity, $MD_{electricity} = MD_{thermal} = 0$, as there is no energy displacement component of the project. As a result, the total actual quantity of methane captured and destroyed will be metered ex post once the project activity is operational, and:

$MD_{project} = MD_{flared}$

and,

$MD_{flared,y} = LFG_{flare,y} * wCH_4,y * DCH_4 * FE$

Where:

- $MD_{flared,y}$ is the quantity of methane destroyed by flaring in a given time period t, measured in tCH_4
- LFG_{flare} is the quantity of landfill gas flared during the time period t, measured in cubic meters (m^3)
- wCH_4 is the average methane fraction of the landfill gas as measured during the given time period t and expressed as a fraction of CH_4 volume per LFG volume (m^3 CH_4/m^3 of LFG)
- FE is the flare efficiency (the fraction of the methane destroyed, in percent)
- DCH_4 is the methane density, expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4), and measured at STP (0 degree Celsius and 1.013 bar), which is 0.0007168 tCH_4/m^3CH_4 (as per consolidated methodology ACM0001 Ver. 4)

As a result, the formula to estimate emission reductions for the project activity is the following:

$ER_y = (LFG_{flare,y} * wCH_4,y * DCH_4 * FE) * GWP_{CH4}$

The following table summarizes the baseline emissions of the project activity. Electronic spread sheets are attached to present full calculations of the monitoring report.

CERTIFIED EMISSION REDUCTIONS SUMMARY

Monitoring Period	*CO_2 Equivalent Reduced (tCO_2e) BEy*	*CO2 Emissions Produced (tCO_2e) PEy*	*Emissions reductions (tCO_2e/month) ERy*
January/2014	35,186	4.9	35,181
February/2014	36,750	4.7	36,745
March/2014	44,510	5.0	44,505
April/2014	44,767	5.6	44,761
May/2014	45,621	5.2	45,616
June/2014	42,284	4.8	42,279
July/2014	42,141	5.2	42,136
August/2014	33,407	4.4	33,402
September/2014	37,198	4.6	37,194
October/2014	39,983	4.4	39,979
November/ 2014	34,995	4.1	34,990
December/ 2014	33,435	4.5	33,430
Total	470,275	57,4	470,218

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total	470,275	57,4	-	470,218

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

As recorded in the PDD, it was estimated that for Aurá Landfill Project 312,248 tCO_2e would be claimed throughout the full 2014 reporting year. The amount of estimated emission reductions is approximately 470,218 tCO_2e.

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	312,248	470,218

E.6. Remarks on difference from estimated value in registered PDD

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The actual quantity of CERs achieved in this Project is higher (approximately 50%) than the quantity of CERs estimated in the PDD.

Conditions for project development have been generally maintained as steady expansion of the LFG collection field to improve the performance of the LFG recovery project at the Aura landfill. Included in this development was the increased total length of trenches, improving the LFG collection efficiency, which resulted in an increased CERs generation for this monitoring period.

Additional to this, there are external factors outside of the Project Participant's control that have resulted in
higher total of CERs claimed during the current monitoring period in relation to what was estimated in the registered PDD. These factors are: (1) the registered PDD included estimation of CERs based on Site assumptions as per the Site Owner observations. One of these assumptions was the Site receiving waste up to 2010 inclusive. However, the Site owner received waste on 2011, 2012, 2013 and 2014 and continues to do so.

Furthermore, the Site owner has increased the amount of waste received overtime; and (2) there have been some improvements like the optimization of waste disposal (more localized), better drainage systems, daily cover implementation (including covering all areas of previous disposal), availability of equipment and labour, and better housekeeping of the Site.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	-	470,218

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Conestoga Rovers e Associados Engenharia Ltda.
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Document information

Version	*Date*	*Description*
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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