

**MONITORING REPORT FORM (CDM-MR) \***  
**Version 01 - in effect as of: 28/09/2010**

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\* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

## **MONITORING REPORT**

**Version 1 - 24/11/2011**

### **AURÁ LANDFILL GAS PROJECT CDM REGISTRATION REFERENCE NUMBER 0888 MONITORING PERIOD 6 (01/01/2011 - 31/10/2011)**

#### **SECTION A. General description of the project activity**

##### **A.1. Brief description of the 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 15 years. Carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) are generated by the anaerobic decomposition of the above-noted wastes placed at the Site. These compounds are then passively emitted to the atmosphere.

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).

#### **Contribution of the Project Activity to Sustainable Development**

The project makes a strong contribution to sustainable development in Brazil. Over and above reducing emissions of GHGs, there are other benefits to sustainable development such as:

- Contribution to recycling activities (help organize the wastepickers in a formal co operative, improving work conditions and reducing health and safety hazards while increasing recycling rates)
- Contribution to human health and the environment (cleaner and healthier environment, improved air quality, reduced risk of landfill gas subsurface migration, minimized landfill fire, diminished potential for groundwater contamination)
- Contribution to the improvement of working conditions and employment creation (local employment during construction and operational phases)
- Contribution to income generation (generation of royalty revenue for local government entities throughout the ten year crediting period of the project)
- Contribution to technological capacity building (local personnel training and information sharing)
- Contribution to regional integration and cooperation with other sectors (reference for other municipalities to implement similar projects at their landfill sites)

#### **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.

### **Project Timelines**

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.

### **Project Emission Reductions Achieved**

The Certified Emission Reductions (CERs) volume claimed for the monitoring period extending from January 1, 2011 to October 31, 2011 is 302,896tCO<sub>2</sub>e.

#### **A.2. Project Participants**

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A list of the parties involved is provided below:

<i>Name of Party Involved</i>	<i>Private and/or public entities</i>
Brazil (Host Country)	Prefeitura Municipal de Belém, City of Belém, State of Pará (Public Entity)
Brazil (Host Country)	Conestoga-Rovers & Associados Engenharia S/A (Project Sponsor; Private Entity)
United Kingdom of Great Britain and Northern Ireland	Thunder Road Environmental Limited (Private Entity)

#### **A.3. Location of the project activity:**

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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 Curupeté Creek and east of the Parque Ambiental de Belém.

UTM Coordinates: 22 M 790853 m E and 9843207 m S

#### **A.4. Technical description of the project**

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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

**A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:**

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

**A.6. Registration date of the project activity:**

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The *Aurá Landfill Gas Project* (herein called Project) is being implemented by CRA according to the Project Design Document Version 4 of October 22, 2006. The project is registered at the UNFCCC's web site as of April 30, 2007 with the CDM Registration Reference Number 0888.

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

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The crediting period for this project is from April 30, 2007 to April 29, 2017 (fixed).

**A.8. Name of responsible person(s)/entity(ies):**

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This Monitoring Report has been prepared by Conestoga-Rovers & Associates (CRA) for the landfill gas (LFG) collection and flaring system (System) constructed at the Aurá Landfill Site (Site) located in Belém, Pará, Brazil.

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**SECTION B. Implementation of the project activity**

**B.1. Implementation status of the project activity**

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The project has been implemented according to PDD. The crediting period of the project activity is from April 30, 2007 to April 29, 2017 (fixed).

The registration date of the project activity (UNFCCC reference 0888) is April 30, 2007

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 four issuances of CERs, as follows:

<b>Issuance</b>	<b>Monitoring Period</b>	<b>CERs Issued</b>	<b>Date of Issuance</b>
First Issuance	Apr 30, 2007 to Sep 30, 2008	32,265 tCO <sub>2</sub> e	Aug 12, 2009
Second Issuance	Oct 1, 2008 to Jan 31, 2009	51,524 tCO <sub>2</sub> e	Aug 13, 2009
Third Issuance	Feb 1, 2009 to Aug 31, 2009	83,077 tCO <sub>2</sub> e	Mar 4, 2010
Fourth Issuance	Sep 1, 2009 to Feb 28, 2010	87,595 tCO <sub>2</sub> e	Oct 27, 2010
Fifth Issuance	Mar 1, 2010 to Dec 31, 2010	234,835 tCO <sub>2</sub> e	Nov 16, 2011
<b>TOTAL CERs ISSUED TO DATE</b>		<b>489,296 t C O<sub>2</sub> e</b>	

During the current monitoring period January 1, 2011 to October 31, 2011, there have been the following major maintenance activities:

<b>Description</b>	<b>Date of maintenance activity</b>
Flare panel update	February 07, 2011
Blower BL105 repair	August 28, 2011
Landtec system maintenance	October 1, 2011
Blower BL104 bearing was changed	October 12, 2011

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. Revision of the monitoring plan**

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

#### **B.3. Request for deviation applied to this monitoring period**

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Not applicable.

#### **B.4. Notification or request of approval of changes**

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Not applicable.

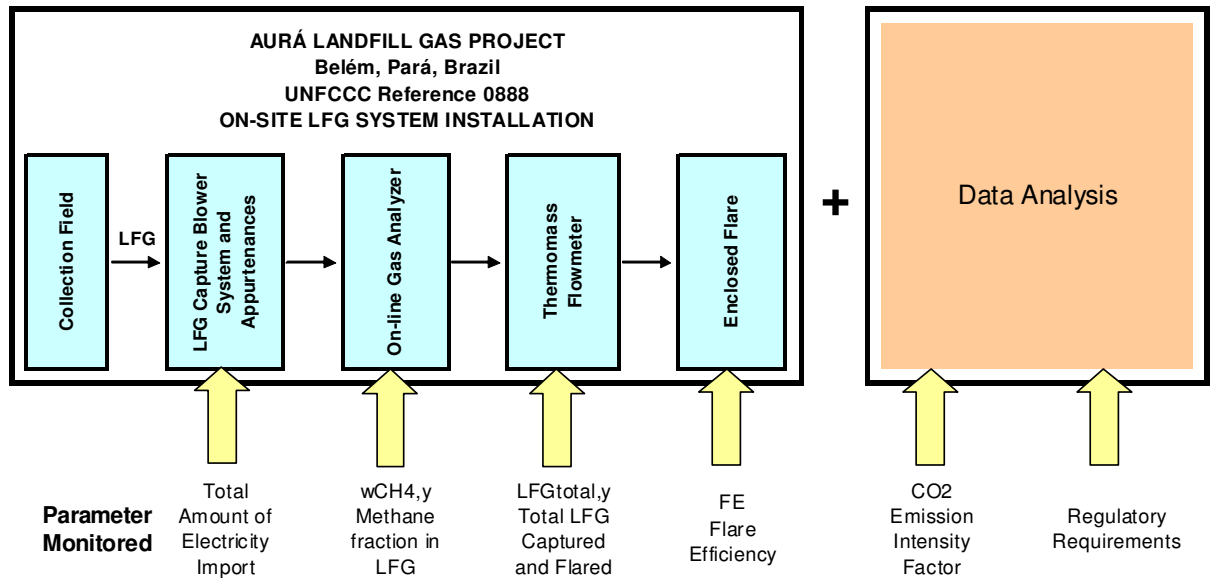
### **SECTION C. Description of the monitoring system**

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The approved monitoring methodology applied to this project activity is the ACM0001 version 4 – Consolidated Monitoring Methodology for Landfill Gas Project Activities. 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<sub>4</sub>) 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**

<i>Project Activity</i>	<i>Equipment</i>	<i>Personnel</i>	<i>Responsibilities</i>	<i>Frequency</i>
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  Daily
Amount of Electricity Used	n/a	Site Operator	* Collect all Electricity bills and file on-Site and to office.	Monthly

### **SECTION D. Data and parameters**

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#### **D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors**

<b>Data / Parameter:</b>
Data unit:
Description:
Source of data used:
Value(s) :

**Not Applicable**

Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	
Additional comment:	

## **D.2. Data and parameters monitored**

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<b>Data / Parameter:</b>	<b>LFG<sub>total,y</sub></b>
Data unit:	<b>Nm<sup>3</sup></b>
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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Thermal Instrument Co Model 62-9/9500 thermal flowmeter serial # 2011010 Flowrate Readout Accuracy: $\pm 1\%$ Full Scale Calibration frequency: 18 months Date of last calibration: January 19, 2011 Validity: July 19, 2012
Measuring/ Reading/ Recording frequency:	Recording Frequency: every two minutes
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	The flowmeter is recalibrated as per manufacturer's recommendation.

<b>Data / Parameter:</b>	<b>FE</b>
Data unit:	<b>%</b>
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 FSU (2) Flare stack samplings by certified laboratories: EcoSampling flare sampled on March 5, 2010 EcoSampling flare sampled on January 11, 2011
Value(s) of monitored parameter:	(1) Multiple, continuously measured (2) From January 1, 2011 to January 10, 2011: FE=99.9978% From January 11, 2011 to October 31, 2011: FE=99.9955%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last	(1) Temperature from thermocouples Field Service Unit (FSU) (2) EcoSampling flare sampled on March 5, 2010: FID chromatograph equipment CAI - California Analytical Instruments Model 300 HFID EcoSampling Flare sampled on January 11, 2011: : FID



calibration, validity)	chromatograph equipment CAI - California Analytical Instruments Model 600 HFID
Measuring/ Reading/ Recording frequency:	Measuring frequency: (1) continuously 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
QA/QC procedures applied:	Regular maintenance to ensure optimal operation of controlled combustion environment.

<b>Data / Parameter:</b>	<b>wCH<sub>4,v</sub></b>
Data unit:	<b>m<sup>3</sup> CH<sub>4</sub>/m<sup>3</sup> LFG</b>
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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Landtec Field Analytical Unit (FAU), calibration automatically checked approximately once every three hours and re-calibrated as necessary
Measuring/ Reading/ Recording frequency:	Measuring frequency: continuously
Calculation method (if applicable):	Not Applicable
QA/QC procedures applied:	Calibration of equipment as per manufacturer specifications to ensure validity of data measured

<b>Data / Parameter:</b>	<b>EL<sub>IMP</sub></b>																				
Data unit:	<b>MWh</b>																				
Description:	Total amount of electricity import to meet project requirements																				
Measured /Calculated /Default:	Measured																				
Source of data:	Electric meter																				
Value(s) of monitored parameter:	<table> <tr><td>January 2011</td><td>18.1 MWh</td></tr> <tr><td>February 2011</td><td>13.0 MWh</td></tr> <tr><td>March 2011</td><td>16.7 MWh</td></tr> <tr><td>April 2011</td><td>16.3 MWh</td></tr> <tr><td>May 2011</td><td>17.0 MWh</td></tr> <tr><td>June 2011</td><td>16.7 MWh</td></tr> <tr><td>July 2011</td><td>17.7 MWh</td></tr> <tr><td>August 2011</td><td>21.8 MWh</td></tr> <tr><td>September 2011</td><td>19.3 MWh</td></tr> <tr><td>October 2011</td><td>17.1 MWh</td></tr> </table>	January 2011	18.1 MWh	February 2011	13.0 MWh	March 2011	16.7 MWh	April 2011	16.3 MWh	May 2011	17.0 MWh	June 2011	16.7 MWh	July 2011	17.7 MWh	August 2011	21.8 MWh	September 2011	19.3 MWh	October 2011	17.1 MWh
January 2011	18.1 MWh																				
February 2011	13.0 MWh																				
March 2011	16.7 MWh																				
April 2011	16.3 MWh																				
May 2011	17.0 MWh																				
June 2011	16.7 MWh																				
July 2011	17.7 MWh																				
August 2011	21.8 MWh																				
September 2011	19.3 MWh																				
October 2011	17.1 MWh																				
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations																				

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Energy measurement meters. These meters are installed by the local electric provider Centrais Elétricas do Pará S.A. (CELPA), are sealed and tamper proof
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 applied:	The energy meters are installed at the site by CELPA. The meters are sealed and tempering with the meter is a criminal offence

<b>Data / Parameter:</b>	<b>EF<sub>grid</sub></b>
Data unit:	<b>tCO<sub>2</sub>e/MWh</b>
Description:	Carbon emission factor for the production of electricity used in the project activity
Measured /Calculated /Default:	Calculated
Source of data:	Most recent data for the build margin and operating margin (2010) found on the Brazilian Governments Ministry of Science and Technology website ( <a href="http://www.mct.gov.br/index.php/content/view/307492.html">http://www.mct.gov.br/index.php/content/view/307492.html</a> ) and the “Tool to Calculate the Emission Factor for an Electricity System - Version 2.2.0” has been used to work out the national grid emission factor, since electricity is being taken from the Brazilian interconnected grid for onsite consumption
Value(s) of monitored parameter:	EF <sub>grid</sub> = 310 kilograms CO <sub>2</sub> /MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Not applicable
Measuring/ Reading/ Recording frequency:	Annually ex-post
Calculation method (if applicable):	Tool to Calculate the Emission Factor for an Electricity System - Version 2.2.0
QA/QC procedures applied:	Not applicable

<b>Data / Parameter:</b>	<b>AF</b>
Data unit:	<b>None</b>
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:	None
Indicate what the data are	Project emission calculations

used for (Baseline/ Project/ Leakage emission calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Not applicable
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Not applicable

## **SECTION E. Emission reductions calculation**

### **E.1. Baseline emissions calculation**

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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.

All greenhouse gas (GHG) emission reductions generated by the implementation of the project activity are considered fully additional based on the lack of previous LFG management activities and the current environmental regulations in Brazil.

There are no existing or pending regulatory requirements requiring the Site to implement any form of LFG emission reductions program. There was no LFG recovery and combustion system in place at the Site prior to the project implementation. Therefore, the project baseline is the uncontrolled release of LFG to the atmosphere.

### **E.2. Project emissions calculation**

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Methodology ACM0001 ver. 4 clearly states that the CO<sub>2</sub> 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 as 310 kilograms CO<sub>2</sub>/MWh 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 (EB 61 Annex 12). The most recent data for the build margin and operating margin is for 2010 and is found on the Brazilian Governments Ministry of Science and Technology website (<http://www.mct.gov.br/index.php/content/view/307492.html>).

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

<i>Period</i>	<i>Quantity of Electricity Imported</i>	<i>CO<sub>2</sub> Emission Intensity</i>	<i>CO<sub>2</sub> Emissions Produced</i>
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	(MWh)	(tCO <sub>2</sub> e/MWh)	(tCO <sub>2</sub> e)
January 1, 2011 to October 31, 2011	174	0.310	54

### E.3. Leakage calculation

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

### E.4. Emission reductions calculation / table

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The Methodology ACM0001 – Version 4 states that the greenhouse gas emissions reductions achieved by the project activity during a given period is the difference between the amount of methane actually destroyed/combusted and the amount of methane that would have been destroyed/combusted in the absence of the project activity, times the GWP of methane.

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

$$ER_y = (MD_{\text{project},y} - MD_{\text{reg},y}) * GWP_{\text{CH}_4} + EL_y * CEF_{\text{electricity},y} + ET * CEF_{\text{thermal},y}$$

Where:

- $ER_y$  are the emission reductions, measured in tCO<sub>2</sub>e
- $MD_{\text{project},y}$  is the amount of methane actually destroyed/combusted during the time period t, measured in tCH<sub>4</sub>
- $MD_{\text{reg},y}$  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<sub>4</sub>
- $GWP_{\text{CH}_4}$  is the approved Global Warming Potential value for methane, 21 tCO<sub>2</sub>e/tCH<sub>4</sub>
- $EL_y$  is net quantity of electricity displaced during a given period t, measured in MWh
- $CEF_{\text{electricity},y}$  is the CO<sub>2</sub> emissions intensity of the electricity displaced, measured in tCO<sub>2</sub>e/MWh
- $ET$  is the quantity of thermal energy displaced, measured in TeraJoules (TJ)
- $CEF_{\text{thermal},y}$  is the CO<sub>2</sub> emissions intensity of the thermal energy displaced, measured in tCO<sub>2</sub>e/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:

$$ER_y = (MD_{\text{project},y} - MD_{\text{reg},y}) * GWP_{\text{CH}_4}$$

Considering that there is no regulatory or contractual requirement determining MD<sub>reg</sub>, an adjustment factor (AF) is used:

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

An "Adjustment Factor" needs to be considered to monitor the regulatory requirements relating to landfill gas projects. The situation regarding Aurá Landfill is described as follow:

- Based on the current LFG management practices at the Site and the current environmental regulations in Brazil, the GHG emission reductions generated by the implementation of the project activity are considered fully additional
- There are no existing or pending regulatory requirements requiring the landfill site to implement any form of LFG emission reductions program

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

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

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

$$\text{And } ER_y = MD_{project,y} * GWP_{CH_4}$$

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)

The actual value of CERs reached during the monitoring period is 302,896.

**CERTIFIED EMISSION REDUCTIONS SUMMARY**  
**AURÁ LANDFILL GAS PROJECT**  
**AURÁ LANDFILL**  
**BELÉM, PARÁ, BRAZIL**

<i>Monitoring Period</i>	<i>CO<sub>2</sub> Equivalent Reduced (tCO<sub>2</sub>e)</i>	<i>CO<sub>2</sub> Emissions Produced (tCO<sub>2</sub>e)</i>	<i>Total CO<sub>2</sub> Equivalent Reduced (tCO<sub>2</sub>e)</i>
January 1, 2011 to October 31, 2011	302,950	54	302,896

**E.5. Comparison of actual emission reductions with estimates in the CDM-PDD**

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The crediting period for this project is from April 30, 2007 to April 29, 2017 (fixed). The CER volume claimed for the monitoring period extending from January 1, 2011 to October 31, 2011 is 302,896. As recorded in the PDD, it was estimated that 362,807 tCO<sub>2</sub>e would be claimed throughout the full 2011 reporting year. As this reporting period covers 10 months of the 2011 reporting year, the amount of estimated emission reductions as reported in the PDD for the monitoring period of January, 2011 through October 31, 2011 is approximately 302,339 tCO<sub>2</sub>e.

<b>Item</b>	<b>Values applied in ex-ante calculation of the registered CDM-PDD</b>	<b>Actual values reached during the monitoring period</b>
<b>Emission reductions (tCO<sub>2</sub>e)</b>	<b>302,339</b>	<b>302,896</b>

**E.6. Remarks on difference from estimated value in the PDD**

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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.

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**History of the document**

<b>Version</b>	<b>Date</b>	<b>Nature of revision</b>
01	EB 54, Annex 34 28 May 2010	Initial adoption.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Guideline, Form <b>Business Function:</b> Issuance		