MONITORING REPORT

AURÁ LANDFILL GAS PROJECT
AURÁ LANDFILL
CITY OF BELÉM, PARÁ, BRASIL
(CDM REGISTRATION REFERENCE NUMBER 0888)

MONITORING PERIOD FEBRUARY 1, 2009 – AUGUST 31, 2009

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1.0 INTRODUCTION

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, Brasil. This report quantifies the emission reductions achieved at the Aurá landfill for the monitoring period of February 1, 2009 to August 31, 2009.

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.

1.1 PROJECT ACTIVITY

The project was developed at the Aurá Landfill, originally called the Aterro Sanitário do Aurá. The Site received non-hazardous solid municipal, industrial, commercial, institutional, and some agricultural wastes for approximately 15 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.

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.

The purpose of the project activity is to collect 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).

1.2 PROJECT PARTICIPANTS

A list of the parties involved is provided below:

Name of Party Involved	*Private and/or public entities*
Brasil (Host Country)	Prefeitura Municipal de Belém, City of Belém, State of Pará (Public Entity)
Brasil (Host Country)	Conestoga-Rovers & Associados Engenharia S/A (Project Sponsor; Private Entity)
United Kingdom	Grey K Environmental (Europe) Ltd. (Private Entity)

1.3 PROJECT LOCATION

The Aurá Landfill is located 19 kilometers (km) from the centre of the City of Belém, State of Pará, 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.

1.4 PROJECT DESCRIPTION

The technology used to gather the LFG is a grid of vertical 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.

Vertical gas extraction wells are established in the waste material and are connected to the blower system through a network of underground piping installed on and around the perimeter of the landfill.

The extraction wells are connected to the subheader or directly to the header through smaller diameter laterals. As the blower is operated, a vacuum is applied through the piping network, which in turn applied a vacuum to each well and extracts LFG out of the waste. The flow is controlled at each of the individual extraction wells through the

use of a valve located at the top of the well piping. Each well is individually controlled to ensure that the collection system is effectively setup and balanced. The system is manually monitored and controlled at each wellhead and is equipped with a secure monitoring chamber and monitoring ports for gas composition, pressure, and temperature readings.

Non-perforated LFG collection piping will be utilized to convey the LFG from the extraction wells to the gas control plant. The LFG collection piping consists of a perimeter header, subheaders, and laterals. Header piping conveys the LFG collected from subheader collection piping to the gas control plant. Subheader piping conveys LFG from lateral piping to header piping, and lateral piping conveys LFG collected primarily at vertical gas extraction wells to the subheader piping.

The blower system is located in the gas control plant. An additional blower is available to allow for regular down time for maintenance and to provide backup in the event of a component failure. The blower system exerts vacuum through the piping system to the system of vertical wells. Extracted LFG is sent to the high-efficiency enclosed flare for destruction of the methane component of the extracted LFG. The stack height of the flare was selected to provide sufficient residence time for destruction of components in the gas at high temperature and in a controlled environment to destroy extracted methane. Flare temperature is controlled by a system of automatically and manually controlled air inlet dampers and thermocouples located in the stack.

2.0 CONTRIBUTION OF THE PROJECT ACTIVITY TO SUSTAINABLE DEVELOPMENT

The project will make a strong contribution to sustainable development in Brasil. 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)

3.0 BASELINE METHODOLOGY

The approved baseline methodology applied to this project is the approved ACM0001 ver. 4 (dated 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 Brasil.

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.

4.0 MONITORING METHODOLOGY

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 a relatively straightforward program 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 based on the operating hours measure by a run-time meter. The destruction efficiency of the flare is directly correlated to the internal combustion temperature and the retention time of the unit.

A summary of the data collected requirements for the project activity is provided in Table 1.

4.1 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 recording device in this case a datalogger. The flow sensors are calibrated according to a specified temperature, pressure, and composition of the gas; thus the flow actually measured is corrected according to actual temperature, pressure, and composition, in order to provide the actual density of the gas measured. The equipment selected allows for dynamic compensation of these parameters, normalized to a standard temperature, pressure, and gas composition. For reporting purposes, the flows are required to be normalized to 0 degrees Celsius and 1 atm at standard gas composition of 50 percent methane and carbon dioxide each by volume.

Equipment calibration procedures are specified by the equipment manufacturer, and calibration of the sensors is required on a regular basis 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 +/- 2 percent by volume. The measured flow is aggregated approximately once per second.

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.

4.2 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.

Although compensation for temperature and pressure is not required for the methane and oxygen sensors, the sensors are designed to operate within specified temperature and pressure conditions. Equipment calibration procedures are specified by the equipment manufacturer, and calibration of the sensors is required 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 second.

4.3 OPERATIONAL MONITORING

Additional operational monitoring of the LFG collection wellfield is conducted in order to optimize the system and ensure it is operating both correctly and efficiently. Periodic adjustments to the extraction wells will be required to optimize the collection system effectiveness. The collection field adjustments are undertaken based upon a review of the extraction well performance history considered within the context of the overall field operation in order to maximize the collection of methane balanced against the minimization of any oxygen in the system which could introduce unsafe operating conditions. Monitoring at each extraction well consists of using portable measuring devices to measure the following parameters:

- Valve position
- Individual well flow
- Individual well vacuum
- Composition of gas collected (i.e., methane, carbon dioxide, and oxygen)

5.0 EMISSION REDUCTIONS

5.1 OPERATIONAL DATA SOURCES

The operational data for the LFG collection and flaring system were obtained from the system datalogger, the Landtec Field Service Unit (FSU). Flow rate data, the gas composition data, and flare temperature data are all recorded and transmitted via the FSU. Daily volumetric flow rates of LFG are obtained from an average of multiple daily flow rates measured by the on-Site flow meter and recorded by the FSU. The LFG composition is analyzed by the Landtec Field Analytical Unit (FAU). Daily volumetric gas compositions of LFG are obtained from an average of multiple gas compositions measured by the on-Site gas analyzer and recorded by the FSU. Calculation of the operational run time for the flare is based on the number of minute-by-minute temperature readings.

5.2 EMISSION REDUCTION CALCULATIONS

The amount of LFG collected and destroyed by combustion is monitored at a centralized location using a flow meter. Project emissions are comprised of the quantity of methane collected and not flared due to flare inefficiency and the quantity of energy required to operate the system based on the carbon dioxide emission intensity of the power source. This amount is subtracted from the measured quantity of collected methane. The flaring efficiency was measured on March 27, 2009. Based on this stack sampling event, the flaring efficiency of hydrocarbons for the enclosed flare is 99.99 percent.

A summary of the monthly emission reductions achieved at the Site is provided in Table 2.

The following formula was used to estimate emission reductions for the project activity:

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

where:

- ER_y are the emission reductions, measured in tCO_2e
- $MD_{project,y}$ is the amount of methane actually destroyed/combusted during time period T, measured in tCH_4
- $MD_{reg,y}$ is the amount of methane that would have been destroyed/combusted during 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, 21 tCO_2e/tCH_4

The total amount of methane destroyed by the flare in a given period is calculated as:

$$MD_{flared,y} = LFG_{flare,y} \times w_{CH4,y} \times D_{CH4} \times FE$$

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 LFG flared during a given time period t, measure in cubic meters (m^3)
- w_{CH4} is the average methane fraction of the LFG as measured during the given time period t and expressed as a fraction of CH_4 volume per LFG volume (m^3CH_4/m^3 LFG)
- D_{CH4} is the methane density, expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4), and measured at standard pressure (1 atm) and temperature (0°C) conditions, which is 0.0007168 tCH_4/m^3CH_4 (as per consolidated methodology ACM0001 version 4)
- FE is the flare efficiency (the fraction of the methane destroyed, as determined by quarterly flare stack monitoring)

6.0 CER VOLUME CLAIMED

The CER volume claimed for the monitoring period extending from February 1, 2009 to August 31, 2009 is 83,077 tCO_2e.

CALCULATION MEMO

Variable	*Unit*	*Quantity*
CO_2 Equivalent Reduced	tCO_2e	83,128
Total Electricity Consumed	MW	103
CO_2 Emissions Produced	tCO_2	51
Total CO_2 Equivalent Reduced	tCO_2e	83,077

Note:

1. CO_2 Equivalent Reduced includes a reduction for uncombusted methane due to flare destruction efficiency
2. An estimate of the grid emission factor for Brasil is calculated as 489 kg CO_2/MWh based on the default emission factor for the Brazilian North-Northeast interconnected grid

TABLE 1

SUMMARY OF DATA COLLECTION REQUIREMENTS
Aurá Landfill Gas Project
Aurá Landfill
Belém, Pará, Brasil

ID number	*Data Variable*	*Source of data*	*Data Unit*	*Measured (m), calculated ('c), estimated (e)*	*Recording Frequency*	*Proportion of data to be monitored*	*Method of data archival (electronic/paper)*	*Comment*
1. $LFG_{total,y}$	Total amount of landfill gas captured	Online LFG flow meter	m^3	m	Continuous	100%	Daily: electronic Monthly: paper	Measured by a flow meter
2. $LFG_{flare,y}$	Total amount of landfill gas flared	Online LFG flow meter	m^3	m	Continuous	100%	Daily: electronic Monthly: paper	Measured by a flow meter or calculated using flare efficiency from
5. FE	Flare/combustion efficiency determined by the operation hours (1) and the methane content in the exhaust gas (2).	Thermistors, Samples	%	m/c	(1) continuously; (2) quarterly, monthly if unstable	100%	Daily: electronic Monthly: paper	(1) The flare operation shall be continuously monitored by continuous measurement of operation time of flare using a run time meter connected to a flame detector or a flame continuous temperature controller, irrespective of whether the flare efficiency is monitored. (3) The enclosed flares shall be operated and maintained as per the specification prescribed by the manufacturer.
6. $w_{CH4,y}$	Methane fraction in the landfill gas	Online LFG analyzer	$m^3 CH_4 / m^3$ LFG	m	Continuous	100%	Daily: electronic Monthly: paper	Measured by continuous gas quality analyzer
7. T	Temperature of the landfill gas	Temperature Probe	^oC	m	Continuous	100%	Daily: electronic Monthly: paper	Measured to determine the density of methane D_{CH4}. No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.
8. P	Pressure of the landfill gas	Pressure Gauge	Pa	m	Continuous	100%	Daily: electronic Monthly: paper	Measured to determine the density of methane D_{CH4}. No separate monitoring of pressure is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.
10. EL_{IMP}	Total amount of electricity imported to meet project requirements	Electricity Meter	MWh	m	Continuous	100%	Daily: electronic Monthly: paper	Required to determine CO2 emissions from use of electricity
11.	CO_2 emission intensity of the electricity and/or other energy carriers	Calculated	tCO_2/MWh	c	As specified in ACM0002	100%	Daily: electronic Monthly: paper	In case a specific source is displaced or used for imports, the emission factor is estimated for that specific source.
13.	Regulatory requirements relating to landfill gas projects	Test	Test	n/a	At the renewal of crediting period	100%	Periodically	The information, though recorded annually, is used for changes to the adjustment factor (AF) or directly $MD_{reg,y}$ at renewal of the credit period.

TABLE 2

MONTHLY CERTIFIED EMISSION REDUCTIONS SUMMARY
FEBRUARY 1, 2009 TO AUGUST 31, 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

	CO_2 *Equivalent* Reduced (tCO_2 *e/day)*	CO_2 *Emissions* Produced (tCO_2 *e)*	Total CO_2 *Equivalent* Reduced (tCO_2 *e/day)*
Month - 2009			
February	13,366	7	13,359
March	12,556	8	12,548
April	13,651	8	13,643
May	13,058	8	13,050
June	9,801	7	9,794
July	11,257	7	11,250
August	9,439	6	9,433
Total Project Emissions/Reductions:	**83,128**	**51**	**83,077**

APPENDIX A

MONTHLY EMISSION REDUCTION SUMMARIES

TABLE A.1

CERTIFIED EMISSION REDUCTIONS (CER) CALCULATIONS
FEBRUARY 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

Day	*Volume (Nm^3)*	*Flow [1] (Nm^3/h)*	*Methane [2] (%)*	*Net Flare Operational Period [3] (min)*	*Flare Destruction Efficiency [4] (%)*	*CO_2 Equivalent Reduced (tCO_2e)*
1	79,710	3,321	40.8	1,440	99.99	489
2	78,734	3,299	41.2	1,432	99.99	488
3	76,848	3,346	40.2	1,378	99.99	465
4	81,470	3,399	39.7	1,438	99.99	487
5	64,067	3,432	40.4	1,120	99.99	389
6	79,294	3,389	41.2	1,404	99.99	491
7	71,753	3,213	41.8	1,340	99.99	451
8	69,363	3,009	41.3	1,383	99.99	432
9	66,989	3,162	41.8	1,271	99.99	422
10	73,453	3,380	40.7	1,304	99.99	450
11	79,272	3,357	40.4	1,417	99.99	482
12	45,397	3,479	38.4	783	99.99	262
13	65,728	3,417	38.9	1,154	99.99	385
14	80,787	3,376	41.4	1,436	99.99	503
15	78,052	3,386	42.4	1,383	99.99	498
16	75,497	3,360	42.3	1,348	99.99	480
17	80,581	3,358	41.7	1,440	99.99	506
18	81,747	3,406	41.2	1,440	99.99	507
19	82,327	3,430	41.3	1,440	99.99	512
20	82,997	3,458	41.7	1,440	99.99	521
21	83,332	3,472	40.7	1,440	99.99	511
22	84,802	3,541	40.4	1,437	99.99	516
23	83,978	3,514	40.5	1,434	99.99	512
24	81,740	3,425	41.5	1,432	99.99	511
25	83,108	3,463	42.1	1,440	99.99	526
26	82,164	3,438	42.1	1,434	99.99	521
27	82,716	3,447	42.4	1,440	99.99	528
28	80,767	3,365	42.9	1,440	99.99	521

Total CO_2 Equivalent Reduced (tCO_2e)	**13,366**
CO_2 Emission Intensity [5] (tCO_2e/MWh)	**0.489**
Quantity of Electricity Imported (MWh)	**14.6**
CO_2 Emissions Produced (tCO_2e)	**7**
Total CO_2 Equivalent Reduced (tCO_2e)	**13,359**

NOTES:

- System down
(1) Flow data recorded by the flow meter
(2) Methane percentage recorded by the Landtec FAU Gas Analyzer
(3) System up-time
(4) Based on the flare methane destruction efficiency measurement
(5) Default emission factor for the Brazilian North-Northeast interconnected grid

TABLE A.2

CERTIFIED EMISSION REDUCTIONS (CER) CALCULATIONS
MARCH 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

Day	*Volume (Nm^3)*	*Flow [1] (Nm^3/h)*	*Methane [2] (%)*	*Net Flare Operational Period [3] (min)*	*Flare Destruction Efficiency [4] (%)*	*CO_2 Equivalent Reduced (tCO_2e)*
1	81,771	3,407	42.5	1,440	99.99	522
2	81,301	3,388	41.7	1,440	99.99	510
3	82,480	3,444	42.8	1,437	99.99	531
4	67,126	3,442	42.1	1,170	99.99	425
5	61,125	3,520	41.6	1,042	99.99	383
6	53,509	3,505	41.4	916	99.99	334
7	83,189	3,490	41.0	1,430	99.99	513
8	63,429	3,485	41.3	1,092	99.99	394
9	79,792	3,369	39.1	1,421	99.99	470
10	75,386	3,141	39.9	1,440	99.99	453
11	66,807	3,199	40.0	1,253	99.99	402
12	77,085	3,212	39.2	1,440	99.99	455
13	69,252	3,096	41.4	1,342	99.99	432
14	50,064	3,254	42.2	923	99.99	318
15	27,165	3,273	42.6	498	99.99	174
16	25,141	3,315	42.8	455	99.99	162
17	29,150	2,944	39.1	594	99.99	171
18	33,809	3,078	38.9	659	99.99	198
19	78,191	3,262	40.7	1,438	99.99	478
20	79,863	3,346	41.1	1,432	99.99	494
21	73,797	3,500	41.9	1,265	99.99	466
22	68,532	3,476	43.1	1,183	99.99	445
23	55,336	3,521	42.3	943	99.99	352
24	81,787	3,473	41.3	1,413	99.99	509
25	80,631	3,360	43.8	1,440	99.99	531
26	25,594	3,514	45.9	437	99.99	177
27	80,462	3,353	43.7	1,440	99.99	529
28	74,908	3,439	44.2	1,307	99.99	499
29	49,391	3,395	44.2	873	99.99	329
30	70,782	3,339	44.2	1,272	99.99	471
31	71,233	3,347	40.0	1,277	99.99	429

Total CO_2 Equivalent Reduced (tCO_2e)	**12,556**
CO_2 Emission Intensity [5] (tCO2e/MWh)	**0.489**
Quantity of Electricity Imported (MWh)	**15.4**
CO_2 Emissions Produced (tCO_2e)	**8**
Total CO_2 Equivalent Reduced (tCO_2e)	**12,548**

NOTES:

- System down
(1) Flow data recorded by the flow meter
(2) Methane percentage recorded by the Landtec FAU Gas Analyzer
(3) System up-time
(4) Based on the flare methane destruction efficiency measurement
(5) Default emission factor for the Brazilian North-Northeast interconnected grid

TABLE A.3

CERTIFIED EMISSION REDUCTIONS (CER) CALCULATIONS
APRIL 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

Day	*Volume (Nm^3)*	*Flow [1] (Nm^3/h)*	*Methane [2] (%)*	*Net Flare Operational Period [3] (min)*	*Flare Destruction Efficiency [4] (%)*	*CO_2 Equivalent Reduced (tCO_2e)*
1	46,937	3,385	43.5	832	99.99	307
2	53,874	3,191	42.3	1,013	99.99	343
3	77,889	3,245	43.4	1,440	99.99	509
4	75,961	3,172	44.0	1,437	99.99	503
5	77,838	3,243	44.2	1,440	99.99	518
6	78,634	3,276	42.3	1,440	99.99	501
7	76,284	3,178	41.2	1,440	99.99	474
8	49,790	3,312	42.5	902	99.99	319
9	50,982	3,350	42.6	913	99.99	327
10	79,110	3,296	42.7	1,440	99.99	508
11	68,175	3,435	41.4	1,191	99.99	425
12	78,944	3,289	42.3	1,440	99.99	502
13	79,861	3,328	41.7	1,440	99.99	501
14	66,735	3,512	39.7	1,140	99.99	399
15	65,703	3,555	39.8	1,109	99.99	394
16	60,240	3,502	41.3	1,032	99.99	374
17	77,935	3,247	43.5	1,440	99.99	510
18	80,899	3,371	40.7	1,440	99.99	495
19	80,879	3,370	40.4	1,440	99.99	492
20	80,595	3,358	40.6	1,440	99.99	493
21	80,624	3,359	41.1	1,440	99.99	498
22	77,233	3,392	41.1	1,366	99.99	478
23	80,469	3,353	41.6	1,440	99.99	504
24	75,802	3,451	39.9	1,318	99.99	455
25	77,996	3,261	41.6	1,435	99.99	488
26	71,855	3,379	42.4	1,276	99.99	458
27	73,223	3,259	41.8	1,348	99.99	461
28	76,331	3,180	41.3	1,440	99.99	474
29	77,538	3,231	42.1	1,440	99.99	491
30	69,206	3,277	43.2	1,267	99.99	450

Total CO_2 Equivalent Reduced (tCO_2e)	**13,651**
CO_2 Emission Intensity [5] (tCO2e/MWh)	**0.489**
Quantity of Electricity Imported (MWh)	**16.1**
CO_2 Emissions Produced (tCO_2e)	**8**
Total CO_2 Equivalent Reduced (tCO_2e)	**13,643**

NOTES:

- System down
(1) Flow data recorded by the flow meter
(2) Methane percentage recorded by the Landtec FAU Gas Analyzer
(3) System up-time
(4) Based on the flare methane destruction efficiency measurement
(5) Default emission factor for the Brazilian North-Northeast interconnected grid

TABLE A.4

CERTIFIED EMISSION REDUCTIONS (CER) CALCULATIONS
MAY 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

Day	*Volume (Nm^3)*	*Flow [1] (Nm^3/h)*	*Methane [2] (%)*	*Net Flare Operational Period [3] (min)*	*Flare Destruction Efficiency [4] (%)*	*CO_2 Equivalent Reduced (tCO_2e)*
1	69,404	3369	40.4	1,236	99.99	423
2	78,852	3318	40.3	1,426	99.99	479
3	61,760	3393	40.0	1,092	99.99	372
4	81,150	3391	40.9	1,436	99.99	500
5	74,455	3397	40.4	1,315	99.99	452
6	52,717	3480	40.4	909	99.99	321
7	46,436	3369	40.6	827	99.99	284
8	24,351	3555	40.7	411	99.99	149
9	73,076	3388	40.8	1,294	99.99	448
10	79,962	3332	41.0	1,440	99.99	494
11	76,667	3194	42.6	1,440	99.99	492
12	70,915	3380	40.6	1,259	99.99	433
13	80,938	3372	40.3	1,440	99.99	491
14	76,541	3321	46.7	1,383	99.99	538
15	73,806	3322	39.2	1,333	99.99	435
16	76,505	3388	42.3	1,355	99.99	487
17	80,547	3377	34.3	1,431	99.99	415
18	47,615	3349	40.0	853	99.99	286
19	80,105	3338	39.6	1,440	99.99	477
20	79,690	3320	39.7	1,440	99.99	476
21	79,209	3300	39.8	1,440	99.99	475
22	79,243	3302	39.6	1,440	99.99	473
23	78,460	3313	40.5	1,421	99.99	479
24	78,993	3291	42.5	1,440	99.99	506
25	78,084	3272	42.5	1,432	99.99	500
26	77,879	3252	42.6	1,437	99.99	500
27	70,933	3210	41.7	1,326	99.99	446
28	44,985	3019	42.6	894	99.99	289
29	28,357	3317	40.8	513	99.99	174
30	67,481	3400	39.0	1,191	99.99	396
31	62,690	3338	39.0	1,127	99.99	368

Total CO_2 Equivalent Reduced (tCO_2e)	**13,058**
CO_2 Emission Intensity [5] (tCO2e/MWh)	**0.489**
Quantity of Electricity Imported (MWh)	**16.3**
CO_2 Emissions Produced (tCO_2e)	**8**
Total CO_2 Equivalent Reduced (tCO_2e)	**13,050**

NOTES:

- System down
(1) Flow data recorded by the flow meter
(2) Methane percentage recorded by the Landtec FAU Gas Analyzer
(3) System up-time
(4) Based on the flare methane destruction efficiency measurement
(5) Default emission factor for the Brazilian North-Northeast interconnected grid

TABLE A.5

CERTIFIED EMISSION REDUCTIONS (CER) CALCULATIONS
JUNE 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

Day	*Volume (Nm^3)*	*Flow [1] (Nm^3/h)*	*Methane [2] (%)*	*Net Flare Operational Period [3] (min)*	*Flare Destruction Efficiency [4] (%)*	*CO_2 Equivalent Reduced (tCO_2e)*
1	78,279	3266	42.5	1,438	99.99	501
2	70,146	3351	51.2	1,256	99.99	540
3	57,774	3286	45.5	1,055	99.99	396
4	53,605	3466	47.4	928	99.99	383
5	44,553	3583	41.9	746	99.99	281
6	58,502	3528	38.2	995	99.99	336
7	16,610	3257	36.1	306	99.99	90
8	62,528	3350	43.9	1,120	99.99	413
9	76,688	3378	47.0	1,362	99.99	542
10	70,869	3588	45.2	1,185	99.99	482
11	65,566	3596	42.9	1,094	99.99	423
12	53,401	3521	25.7	910	99.99	206
13	78,203	3265	40.3	1,437	99.99	475
14	3,982	3063	40.3	78	99.99	24
15	42,802	3128	41.9	821	99.99	270
16	73,479	3062	41.0	1,440	99.99	454
17	54,280	3283	39.4	992	99.99	322
18	32,866	3490	40.3	565	99.99	199
19	38,823	3156	40.1	738	99.99	234
20	48,003	3169	40.8	909	99.99	295
21	39,440	3548	31.2	667	99.99	185
22	41,657	3382	36.3	739	99.99	227
23	57,213	3073	39.1	1,117	99.99	337
24	42,593	2975	40.8	859	99.99	262
25	35,097	3043	42.5	692	99.99	225
26	72,726	3030	40.9	1,440	99.99	447
27	72,710	3030	40.3	1,440	99.99	441
28	71,555	3030	40.3	1,417	99.99	434
29	62,439	3053	40.1	1,227	99.99	377
30	-	-	-	-	-	-

Total CO_2 Equivalent Reduced (tCO_2e)	**9,801**
CO_2 Emission Intensity [5] (tCO2e/MWh)	**0.489**
Quantity of Electricity Imported (MWh)	**14.2**
CO_2 Emissions Produced (tCO_2e)	**7**
Total CO_2 Equivalent Reduced (tCO_2e)	**9,794**

NOTES:

- System down
(1) Flow data recorded by the flow meter
(2) Methane percentage recorded by the Landtec FAU Gas Analyzer
(3) System up-time
(4) Based on the flare methane destruction efficiency measurement
(5) Default emission factor for the Brazilian North-Northeast interconnected grid

TABLE A.6

CERTIFIED EMISSION REDUCTIONS (CER) CALCULATIONS
JULY 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

Day	*Volume (Nm^3)*	*Flow [1] (Nm^3/h)*	*Methane [2] (%)*	*Net Flare Operational Period [3] (min)*	*Flare Destruction Efficiency [4] (%)*	*CO_2 Equivalent Reduced (tCO_2e)*
1	30,640	3059	41.9	601	99.99	193
2	38,186	2815	41.1	814	99.99	236
3	43,059	2983	41.2	866	99.99	267
4	69,917	2913	40.0	1,440	99.99	421
5	70,640	2964	39.1	1,430	99.99	415
6	42,992	3021	40.4	854	99.99	261
7	67,606	2823	40.8	1,437	99.99	415
8	67,105	2796	40.7	1,440	99.99	411
9	67,916	2848	39.5	1,431	99.99	404
10	67,683	2820	40.3	1,440	99.99	411
11	67,124	2803	40.3	1,437	99.99	407
12	65,864	2744	40.4	1,440	99.99	400
13	56,846	2812	39.5	1,213	99.99	338
14	42,016	2699	39.6	934	99.99	250
15	63,779	2657	40.0	1,440	99.99	384
16	59,843	2816	39.5	1,275	99.99	356
17	67,326	2813	37.8	1,436	99.99	384
18	66,517	2772	39.4	1,440	99.99	395
19	65,419	2737	40.3	1,434	99.99	397
20	64,920	2716	40.7	1,434	99.99	398
21	66,266	2767	39.5	1,437	99.99	394
22	62,604	2859	37.1	1,314	99.99	350
23	66,505	3149	30.1	1,267	99.99	301
24	60,141	2506	39.8	1,440	99.99	360
25	62,261	2594	39.8	1,440	99.99	373
26	65,781	2747	39.8	1,437	99.99	394
27	65,018	2709	40.3	1,440	99.99	394
28	64,478	2687	40.4	1,440	99.99	392
29	63,909	2663	40.4	1,440	99.99	389
30	63,637	2695	40.1	1,417	99.99	384
31	63,852	2681	39.9	1,429	99.99	383

Total CO_2 Equivalent Reduced (tCO_2e)	**11,257**
CO_2 Emission Intensity [5] (tCO2e/MWh)	**0.489**
Quantity of Electricity Imported (MWh)	**13.3**
CO_2 Emissions Produced (tCO_2e)	**7**
Total CO_2 Equivalent Reduced (tCO_2e)	**11,250**

NOTES:

- System down
(1) Flow data recorded by the flow meter
(2) Methane percentage recorded by the Landtec FAU Gas Analyzer
(3) System up-time
(4) Based on the flare methane destruction efficiency measurement
(5) Default emission factor for the Brazilian North-Northeast interconnected grid

TABLE A.7

CERTIFIED EMISSION REDUCTIONS (CER) CALCULATIONS
AUGUST 2009
Aurá Landfill Gas Project
Belém, Pará, Brasil

Day	*Volume (Nm^3)*	*Flow [1] (Nm^3/h)*	*Methane [2] (%)*	*Net Flare Operational Period [3] (min)*	*Flare Destruction Efficiency [4] (%)*	*CO_2 Equivalent Reduced (tCO_2e)*
1	62,872	2620	40.8	1,440	99.99	386
2	63,481	2645	40.2	1,440	99.99	384
3	62,168	2608	40.5	1,430	99.99	379
4	62,207	2736	35.5	1,364	99.99	332
5	58,895	2653	40.4	1,332	99.99	358
6	63,520	2647	40.3	1,440	99.99	385
7	63,134	2631	39.8	1,440	99.99	378
8	61,653	2640	40.1	1,401	99.99	372
9	63,398	2642	40.4	1,440	99.99	385
10	63,309	2638	40.3	1,440	99.99	384
11	63,263	2636	40.0	1,440	99.99	381
12	54,765	2639	40.3	1,245	99.99	332
13	63,667	2653	39.7	1,440	99.99	381
14	63,129	2638	39.6	1,436	99.99	377
15	37,469	2831	40.7	794	99.99	229
16	72,002	3011	39.7	1,435	99.99	430
17	72,613	3026	40.1	1,440	99.99	438
18	73,609	3067	39.6	1,440	99.99	438
19	75,503	3146	38.8	1,440	99.99	441
20	28,387	2932	39.9	581	99.99	170
21	-	-	-	-	-	-
22	-	-	-	-	-	-
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	-	-	-	-	-	-
26	35,348	2765	39.2	767	99.99	208
27	44,670	2939	36.8	912	99.99	248
28	47,040	3136	39.1	900	99.99	277
29	75,600	3150	39.2	1,440	99.99	446
30	74,688	3112	40.4	1,440	99.99	455
31	73,366	3057	40.3	1,440	99.99	445

Total CO_2 Equivalent Reduced (tCO_2e)	**9,439**
CO_2 Emission Intensity [5] (tCO2e/MWh)	**0.489**
Quantity of Electricity Imported (MWh)	**13.0**
CO_2 Emissions Produced (tCO_2e)	**6**
Total CO_2 Equivalent Reduced (tCO_2e)	**9,433**

NOTES:

- System down
(1) Flow data recorded by the flow meter
(2) Methane percentage recorded by the Landtec FAU Gas Analyzer
(3) System up-time
(4) Based on the flare methane destruction efficiency measurement
(5) Default emission factor for the Brazilian North-Northeast interconnected grid