



EcoSecurities International Ltd.

CDM Monitoring Report

Embralixo/Araúna - Bragança Landfill Gas Project

Project CDM ID: 1179

Project registration date: 15 October 2007

Monitoring period: 01/01/2008 – 31/10/2009

Date monitoring report and version nr. 18/11/2009 V1

1. Project background

Embralixo/Araúna - Bragança Landfill Gas Project has been registered as CDM project by the UNFCCC on 15 October 2007 under reference 1179.

Further background on this project can be found in the PDD and associated documents, which are available on the UNFCCC website: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1182151832.44/view>

Party involved is Brazil (Host Country). The project participants are Araúna Participações e Investimentos Ltda (Private Entity) and Embralixo - Empresa Bragantina de Varrição e Coleta de Lixo Ltda (Private Entity), and EcoSecurities Group Plc.

The starting date of the crediting period is 1st January 2008. This first monitoring period covers 1st January 2008 0:00 to 31st October 2009 24:00.

2. Project implementation in relation to registered PDD

The project is implemented and operated as per registered PDD.

2.1. Implementation status

The “Embralixo/Araúna - Bragança Landfill Gas Project” is located in the Bragança Paulista municipality, São Paulo State, Brazil. Municipal solid waste has been disposed at the Bragança Paulista landfill since 1990 and the landfill is expected to be closed in 2015.

The project comprises the collection and flaring of landfill gas (LFG). The project generates Certified Emission Reductions (CERs) by flaring LFG that would otherwise be released to the atmosphere.

2.2. Operation of the project

The project was fully operational per 01/01/2008. The project has been operating since this date. “Operational” in this context includes downtime due to maintenance and other technical issues.

During July 2008, the project changed the site operation company. Between 01/01/2008-30/06/2008 the site operator was Brasmetano. Since 01/08/2009 the site operator has been Landtec. No CERs are claimed for July 2008.

2.3. Forecasted emission reductions versus actual emission reductions

The actual emission reductions in this monitoring period [670 days] were 51,541 tCO₂ tCO₂e. This is considerably lower than forecasted in the PDD 121,017 tCO₂ for the same period, due to:

1. The actual monitored LFG flow (456,849.6 Nm³/Month average) is lower than the values estimated in the decay model used in the PDD (908,485 Nm³/Month average).
2. The actual concentration of methane (37.3%CH₄) average of the LFG is lower than the 50% estimated in the registered PDD.

3. Only partial monitoring data were available because downtime due to technical issues.

3. Compliance of the monitoring plan with the monitoring methodology

This project has been registered under methodology ACM0001 ver.5 and ACM0002 ver.6. This is the first monitoring period, and the project has not sought revision or deviation to the monitoring plan. The validated monitoring plan is therefore in accordance with the approved methodology applied to the CDM project activity.

4. Compliance of monitoring with the monitoring plan

Monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD.

4.1. Monitoring period

The monitoring period covers 01/01/2008 00:00 to 31/10/2009 24:00. The starting date is later than the registration date [15/10/2007].

4.2. Monitoring parameters

As per AM-CLA-0023, the parameters Temperature of landfill gas (T) and Pressure of the landfill gas (P) do not need to be measured since the flow measurement technology allows Nm³ measurement directly.

Data/parameter:	$LFG_{total, y} - FV_{RG, h}$
Data unit:	Nm3 (cubic meters)
Description:	Volume of landfill gas captured and flared
Source of data used:	Flow meter measuring LFG flow in Normal conditions.
Value for this monitoring period:	Total 10,050,691.3 Nm3 Average 456,849.6 Nm3/month
Description of measurement methods and procedures applied:	Instantaneous measurements by continuous flow meter. All the data are recorded continuously, on an electronic database. Between 01/01/2008-15/04/2008: 1 minute frequency measurements were performed. Between 15/04/2008-05/05/08: 5 minute frequency measurements were performed. Since 05/05/2008: 2 minute frequency

	<p>measurements have been performed.</p> <p>1-minute-frequency caused data handling problems. After a period of testing, 2-minute-frequency was considered adequate. Data is summarized hourly.</p>
QA/QC procedures applied:	The flow meter is subjected to a regular maintenance and testing regime to ensure accuracy.
Comments:	<p>As there is no other system that uses landfill gas that claims CERs, such as boiler or generator, the only flow meter is the one on the flare system.</p> <p>This parameter is also used for the flare efficiency and project emission determination, according to "Tool to determine project emissions from flaring gases containing methane"</p> <p>No separate monitoring of temperature and pressure is necessary when using flow meters that express LFG volumes in normalized cubic meters according to AM-CLA-0023.</p>
Data/parameter:	$W_{CH_4,y} - V_{f,i,h}$
Data unit:	% (Percentage) - $m^3 CH_4 / m^3 LFG$
Description:	Methane fraction in the landfill gas
Source of data used:	Gas Analyzer measuring LFG.
Value for this monitoring period:	37.3% Average. Note: this parameter is continuously monitored
Description of measurement methods and procedures applied:	<p>All the data are recorded continuously, on an electronic database.</p> <p>Between 01/01/2008-15/04/2008: 1 minute frequency measurements were performed.</p> <p>Between 15/04/2008-05/05/08: 5 minute frequency measurements were performed.</p> <p>Since 05/05/2008: 2 minute frequency measurements have been performed.</p> <p>Data are used as an hourly average.</p>
QA/QC procedures applied:	Gas Analyzer is subjected to a regular maintenance and testing regime to ensure accuracy.

Comments:	This parameter is also used for the flare efficiency and project emission determination, according to “Tool to determine project emissions from flaring gases containing methane”.
Data/parameter:	EL_{IMP}
Data unit:	MWh
Description:	Total amount of electricity imported to meet project requirement.
Source of data used:	Electricity consumption meter
Value for this monitoring period:	Total 82.6 MWh Average 3.8 MWh/month
Description of measurement methods and procedures applied:	A power meter is continuing measuring the electricity consumption of the project. This is monthly recorded. The meter is owned by the electricity supplier.
QA/QC procedures applied:	The meter is under the electricity supplier control.
Comments:	Not Applicable
Data / Parameter:	CEF_{electricity, y}
Data unit:	tCO ₂ e/MWh
Description:	CO2 emission intensity of the electricity.
Source of data to be used:	Information from the grid responsible groups in Brazil
Value for this monitoring period:	0.2636 tCO ₂ e/MWh
Description of measurement methods and procedures to be applied:	This parameter is calculated ex-ante in the registered PDD, as the average for the most recent 3 years for which data are available at the time of the PDD submission, according to ACM 0002 v6. This data will be re assessed at renewal of the credit period.
QA/QC procedures to be applied:	Not Applicable
Any comment:	Not Applicable

Data / Parameter:	Regulatory requirements relating to landfill gas projects
Data unit:	Text
Description:	Regulatory requirements relating to landfill gas projects
Source of data to be used:	Laws
Value for this monitoring period	There is no new requirements relating to landfill gas project that could affect the adjustment factor (AF). There is no legislation in Brazil obliging landfills to flare the collected gas.
Description of measurement methods and procedures to be applied:	Revision of the new requirement for landfills.
QA/QC procedures to be applied:	N/A
Any comment:	This information is used for changes to the adjustment factor (AF) or directly MDreg,y at renewal of the credit period.
Data / Parameter:	t_{O2,h}
Data unit:	-
Description:	Volumetric fraction of O2 in the exhaust gas of the flare in the hour h
Source of data to be used:	Measurements by project participants using a continuous gas analyzer
Value for this monitoring period	15.1% average
Description of measurement methods and procedures to be applied:	All the data are recorded continuously, on an electronic database. Between 01/01/2008-15/04/2008: 1 minute frequency measurements were performed. Between 15/04/2008-05/05/08: 5 minute frequency measurements were performed. Since 05/05/2008: 2 minute frequency

measurements have been performed.

Values are averaged hourly.

QA/QC procedures to be applied: Analyzer is periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check is performed by comparison with a standard gas.

Any comment:

Data / Parameter: $f_{V_{CH_4,FG,h}}$

Data unit: mg/m³

Description: Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h

Source of data to be used: Measured using a continuous gas analyzer

Value for this monitoring period: 6.2 mg/m³ average

Description of measurement methods and procedures to be applied: All the data are recorded continuously, on an electronic database.

Between 01/01/2008-15/04/2008: 1 minute frequency measurements were performed.

Between 15/04/2008-05/05/08: 5 minute frequency measurements were performed.

Since 05/05/2008: 2 minute frequency measurements have been performed.

Values are averaged hourly.

QA/QC procedures to be applied: Analyzer is periodically calibrated according to manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard gas.

Any comment: Measurement instrument reads ppm. To convert from ppm to mg/m³ simply multiply by 0.7168.

Data / Parameter: T_{flare}

Data unit: °C

Description: Temperature on the exhaust gas of the flare

Source of data to be used: Measured

Value for this monitoring period	548°C Average. Note: this parameter is continuously monitored
Description of measurement methods and procedures to be applied:	Measure the temperature of the exhaust gas stream in the flare by thermocouple. A temperature above 500 °C indicates that a significant amount of gases are still being burnt and that the flare is well operating.
QA/QC procedures to be applied:	Thermocouples replaced or calibrated every year
Any comment:	No Applicable

4.3. Management and operational system

The responsibilities and authorities for monitoring and reporting are defined in organization chart in Annex B.

4.3.1. Calibration of monitoring equipment

The site uses meter for the measurement of parameters of the monitoring plan. The meters used for the calculation of emission reduction are controlled by a calibration plan.

The site uses:

[i] a flow meter for the measurement of LFG captured and fed to the flare. The meter used for the calculation of emission reductions was calibrated in accordance with the frequency stipulated in the PDD (12 months).

[ii] a continuous gas analyser for the measurement of the methane content in the LFG. The meter used for the calculation of emission reductions was calibrated every 6 months (a higher frequency than stipulated in the PDD).

[iii] a thermocouple for the measurement of the combustion temperature. The thermocouple used for the calculation of emission reductions was exchanged/calibrated every 12 months.

[iii] a exhaust gas analyzer for the measurement of the methane and oxygen content in the exhaust gas. The meter used for the calculation of project emission was calibrated every 6 months (a higher frequency than stipulated in the PDD).

4.3.2. Monitoring frequency

The parameters to be monitored were read with the frequency indicated in section 4.2 of this document. This corresponds with the requirements from the approved methodology and the validated monitoring plan.

4.3.3. *Monitoring system*

Monitoring organisation

An organizational structure, defining authorities and responsibilities for project management, monitoring, measurement, and reporting has been agreed between the project participants and the following steps were formalized:

- a) Data collection and reporting
- b) CDM data and record keeping arrangements
- c) CDM data checks
- d) ER calculations and subsequent quality control and quality assurance
- e) Equipment maintenance and calibration

Data records and management

Data records are filed electronically each day and kept for 2 years until the end of the crediting period.

Internal audits

The implementation of the monitoring plan is checked regularly by EcoSecurities during field visits and/or the consistency and plausibility of the data.

4.3.4. *Forward Action Requests*

No forward action requests remain from validation process.

5. Calculation of emission reductions

Calculation of emission reductions took place on the basis of a complete set of cross checked data, applying the approved methodology ACM0001 v5, ACM0002 v6, and "Tool to determine project emissions from flaring gases containing methane".

5.1. Data completeness

All data were monitored according to the frequency indicated in the validated monitoring plan. Only complete sets of data were used in the calculation of emission reductions. A data set for the purpose of ER calculation is considered to be complete and eligible with: a record of LFG flow, a record of methane concentration, and temperature of combustion $500^{\circ}\text{C} < T_{\text{comb}}$.

5.2. Cross checks of monitoring data

EcoSecurities is conducting plausibility checks the of ER workbook sent by the project developer on a regular basis.

5.3. Calculation of emission reductions

Emission reductions have been calculated on the basis of the formulas provided by the validated PDD and the approved methodology using the hourly consolidated data.

A summary table of the monthly result of calculations are shown in Annex A of this document.

5.4. Assumptions in emission calculations

For non-compliant data sets no ERs are claimed. Data sets are considered to be non-compliant when recorded data were outside the specified range of design parameters of the flare manufacturer, and the criteria set out in section 5.1.

5.5. Application of emission factors, IPCC default values and other reference values

The emission factor used in the calculation of the emission reductions is the combined margin grid emission factor using the ex-ante option of the ACM 0002 v6. This has been calculated in the PDD and validated (0.2636 tCO₂e/MWh). The value is shown in Annex A and it is valid throughout the crediting period.

A summary of IPCC default data and other reference values required for ER calculation are listed below:

Parameter	Description	Value	SI Unit
AM_C	Atomic mass of carbon	12	kg/kmol
AM_H	Atomic mass of hydrogen	1.01	kg/kmol
AM_N	Atomic mass of nitrogen	14.01	kg/kmol
NA_{C, CH₄}	Number of atoms of carbon in CH ₄	1	
NA_{H, CH₄}	Number of atoms of hydrogen in CH ₄	4	
NA_{N, N₂}	Number of atoms of nitrogen in N ₂	2	
MM_{CH₄}	Molecular mass of methane	16.04	kg/kmol
MM_{N₂}	Molecular mass of nitrogen	28.02	kg/kmol
MF_{O₂}	Volumetric fraction of O ₂ in the air	0.21	
P_n	Atmospheric pressure at normal condition	101325	Pa
T_n	Temperature at normal conditions	273.15	K
R_u	Universal ideal gas constant	8314.472	Pa.m ³ /kmol.K
MV_n	Volume of one mole of any ideal gas at NTP	22.414	m ³ /kmol
r_{CH₄,n}	Density of methane at normal conditions	0.716	kg/m ³
GWP_{CH₄}	Global warming potential of methane	21	tCO ₂ e/tCH ₄
AF	Adjustment factor	10	%
EF_{grid}	Emission factor of the grid	0.2636	tCO ₂ e/MWh

6. Summary

The CDM project activity Embralixo/Araúna - Bragança Landfill Gas Project , CDM reference 1179 has reduced **51,541 tCO₂eq** in the period 01/01/2008 00:00 to 31/10/2009 24:00. The emission reduction has been calculated as set out in the validated PDD and the approved methodology. The project activity is implemented as set out in the validated PDD. The validated monitoring plan is in accordance with the approved methodology. Monitoring has been carried out as per validated monitoring plan.

ANNEX A

Summary: Emission Reduction Calculations

	MD _{project,h} tCH4	AF %	MD _{reg,h} tCH4	ERs tCO2	Power consum MWh	EF _{grid} tCO2e/M Wh	PE Elect tCO2	ERs Final tCO2
Jan-08	153.4	10	15.3	2,899.6	6.143	0.2636	1.62	2,897.9
Feb-08	94.1		9.4	1,778.3	3.170		0.84	1,777.5
Mar-08	105.0		10.5	1,985.0	2.720		0.72	1,984.3
Apr-08	78.7		7.9	1,486.9	2.683		0.71	1,486.2
May-08	86.7		8.7	1,639.4	2.395		0.63	1,638.8
Jun-08	56.4		5.6	1,066.6	3.689		0.97	1,065.7
Jul-08	-		-	-	-		0.00	
Aug-08	58.5		5.8	1,105.3	5.988		1.58	1,103.7
Sep-08	140.9		14.1	2,662.7	2.659		0.70	2,662.0
Oct-08	154.3		15.4	2,916.4	5.155		1.36	2,915.1
Nov-08	144.0		14.4	2,722.3	3.601		0.95	2,721.4
Dec-08	176.2		17.6	3,330.3	4.607		1.21	3,329.1
Jan-09	177.8		17.8	3,361.3	4.090		1.08	3,360.2
Feb-09	154.2		15.4	2,913.6	3.968		1.05	2,912.6
Mar-09	151.5		15.2	2,863.9	4.203		1.11	2,862.8
Apr-09	141.9		14.2	2,681.0	4.202		1.11	2,679.9
May-09	137.8		13.8	2,605.2	4.672		1.23	2,603.9
Jun-09	134.9		13.5	2,549.5	4.123		1.09	2,548.4
Jul-09	96.6		9.7	1,826.2	3.280		0.86	1,825.3
Aug-09	146.8		14.7	2,774.9	4.510		1.19	2,773.7
Sep-09	170.5		17.1	3,222.7	3.976		1.05	3,221.7
Oct-09	167.8		16.8	3,171.6	2.716		0.72	3,170.9
Total	2,728.2		272.8	51,562.9	82.6		21.8	51,541.2

Summary: Monitored Parameters

	FV _{RG,h} Nm3	fv _{CH4,h} %	T _{flare} °C	t _{O2,h} %	fv _{CH4,FG,h} mg/m3
Jan-08	685,228.0	32.2	592.7	14.0	34.8
Feb-08	525,442.2	26.1	593.0	15.1	12.5
Mar-08	552,195.6	29.1	587.0	16.7	6.1
Apr-08	429,854.6	29.3	577.7	16.9	7.7
May-08	451,686.1	28.3	576.9	17.4	3.9
Jun-08	274,117.6	34.9	559.5	17.7	3.0
Jul-08	-	-	-	-	-
Aug-08	225,877.6	39.2	544.3	17.4	0.4
Sep-08	517,090.9	38.6	549.0	18.7	0.4
Oct-08	551,364.5	39.6	568.1	19.2	0.3
Nov-08	483,227.6	42.1	565.4	20.6	0.2
Dec-08	586,283.5	42.3	593.2	12.7	5.9
Jan-09	559,381.5	44.8	582.7	12.3	5.2
Feb-09	471,386.5	46.0	569.2	12.6	18.9
Mar-09	478,948.2	44.4	582.7	14.1	3.5
Apr-09	469,974.7	42.5	573.1	14.1	2.8
May-09	449,816.8	43.5	553.2	15.1	4.9
Jun-09	433,064.3	44.0	548.6	15.8	8.8
Jul-09	303,046.9	44.7	568.7	16.2	4.1
Aug-09	486,246.8	42.7	562.8	16.4	8.4
Sep-09	575,738.4	43.4	592.7	15.1	0.9
Oct-09	540,719.0	44.0	616.8	14.9	2.8
Sum	10,050,691.3				
Average	456,849.6	37.3	548.1	15.1	6.2

ANNEX B: Organization Chart

