MONITORING REPORT

REGIONAL LANDFILL PROJECTS IN CHILE

CDM registration reference number 1435

Monitoring period: 1 October 2008 to 30 September 2009

Date of report: 1 October 2009

Version 1

INDEX

Preamble

Format: Values are presented in International System of Units
Dates are presented in format dd/mm/yyyy

Abbreviations:

CDM	Clean Development Mechanism
CER	Certified Emission Reductions
LFG	Landfill gas

1. General project activity information

1.1. CDM background

Title:	Regional landfill projects in Chile
UNFCCC Ref:	1435
Registration date:	4 July 2008
Crediting period:	4 July 2008 – 3 July 2018
Monitoring period:	1 October 2008 – 30 September 2009
Methodology:	ACM0001 version 5 *Consolidated baseline and monitoring methodology for landfill gas project activities*

1.2. Description of the project activity

The project activity is to build, operate and maintain a landfill gas collection and flaring system on the landfills of Leña Dura in Punta Arenas (Region XII), Lajarilla in Viña del Mar (Region V) and Viñita Azul in Copiapo (Region III), all located in Chile.

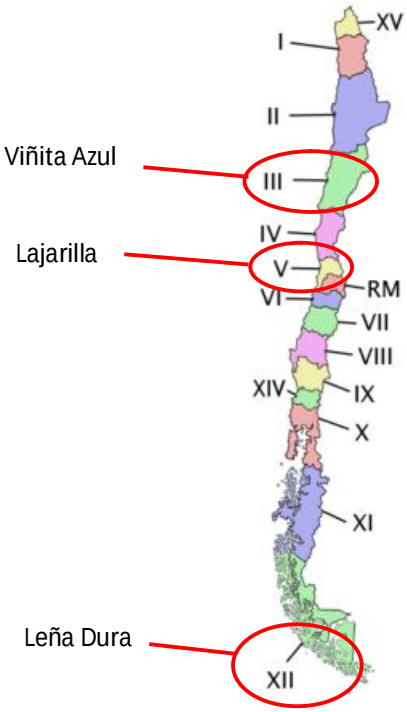

Figure 1.1 – Location of the project activity

1.3. Implementation status

The project activity has been implemented on two landfills:

- on Leña Dura landfill, the plant has been operating since 15/12/2007,
- on Lajarilla landfill, the plant has been operating since 11/12/2007.

The project of Viñita Azul was not implemented.
The Lajarilla degassing plant entered testing in December 2007; following the testing phase, the production proved much lower than expected. For this reason, the CER resulting from LFG destruction at Lajarilla were not considered during the first monitoring period (04/07/2008-30/09/2008). For the monitoring period considered in this report, the Lajarilla degassing plant is included and emissions reductions are accounted.

The equipment installed on site is as described in the registered PDD.

1.4. Compliance with the registered PDD

The project has been carried out in accordance with the registered PDD: the monitoring is compliant with the monitoring plan as exposed in the registered PDD, as such project proponents do not seek deviation or revision of the monitoring plan.

2. MONITORING OF THE PROJECT ACTIVITY

2.1. Monitoring equipment

The flare unit is equipped with the following instruments to capture the required monitoring data:

Instrument	Data monitored	Manufacturer and model	Serial number Leña Dura	Serial number Lajarilla
Flowmeter	**$LFG_{flare,y}$** Amount of LFG flared	Instromet SM-RI-X-K G650	10509860	10509858
Gas analyzer	**$w_{CH4,y}$** Fraction of methane in LFG	NUK GAE	4005.64-5	4005.64-4
Thermocouple	**T_{flare}** Temperature of the flare	Jumo Type S	4012-00	5294-00

Flare efficiency has not been monitored during the monitoring period under consideration. The default flare efficiency ratios have been applied to CER calculations, as described in the PDD, according to step 6 of the *Tool to determine project emissions from flaring gases containing methane*.

In addition to the monitoring instruments mentioned above, the plants are equipped with an electricity meter (manufactured by Landis + Gyr, serial number 88.991.093 at Leña Dura and 94.287.761 at Lajarilla) in order to monitor the electricity consumed by the project activity (parameter EC_{PJ}).
During the monitoring period, electricity was provided by an on-site diesel fired captive power plant at Leña Dura and by the grid at Lajarilla.

2.2. Calibration and maintenance of monitoring instruments

Maintenance includes all preventive and corrective actions necessary for the good functioning of the equipment, such as:

- Visual control of the equipment and real-time check of displayed parameters,
- Cleaning up the equipment and the sensors,
- Adding lubricant,
- Replacement and change of defective parts, etc.

Calibration of equipment consists in verifying, by comparison with a standard, the accuracy of a measuring instrument.
The following table summarizes information on calibration of monitoring instruments as specified by the monitoring methodology and the monitoring plan and as performed during the period:

Instrument	Calibration as specified by the monitoring methodology/tool	Calibration as specified by the monitoring plan	Calibration performed
Flowmeter	Periodically calibrated by an officially accredited entity	Calibrated once a year by an external certified company	Calibrated in November 2008 by an external certified company (TGS Laboratorios)
Gas analyzer	Not specified	Calibrated every month by a qualified operator	Calibrated every month either by an external certified company (High Solutions) or by qualified operators (trained by High Solutions)
Thermocouple	Replaced or calibrated every year	Replaced or calibrated every year	Calibrated in October 2008 (Leña Dura) and November 2008 (Lajarilla) by an external certified company (Asistek)
Electricity meter	Calibrated according to the equipment manufacturer instructions and in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO)	Calibrated every 5 years	Not calibrated during the monitoring period

2.3.Monitoring systems and procedures

2.3.1. Data logging, transmission, processing and storage

Data logging, transmission, processing and storage are as described in the monitoring plan, pp 36-37.

2.3.2. Managerial responsibilities

- The CDM aspects of the project are managed by the Director of Carbon Finance. The Director of Carbon Finance supervises the CDM Project Manager who is in charge of validation and verification activities (PDD writing and preparing the monitoring report).
- The monitoring plan is the responsibility of the Monitoring Director of the project, who reports to the Director of Carbon Finance for CDM matters (collection and storage of monitoring data) and to the Chief of Operations for operational matters. The Monitoring Director is accountable for the monitoring activities, the logging and record keeping of all monitored data.
- The Maintenance Director supervises the calibration and maintenance procedures.
- Maintenance programs are carried out on site by the Field Technician, who also ensures that the monitoring tools operate correctly.

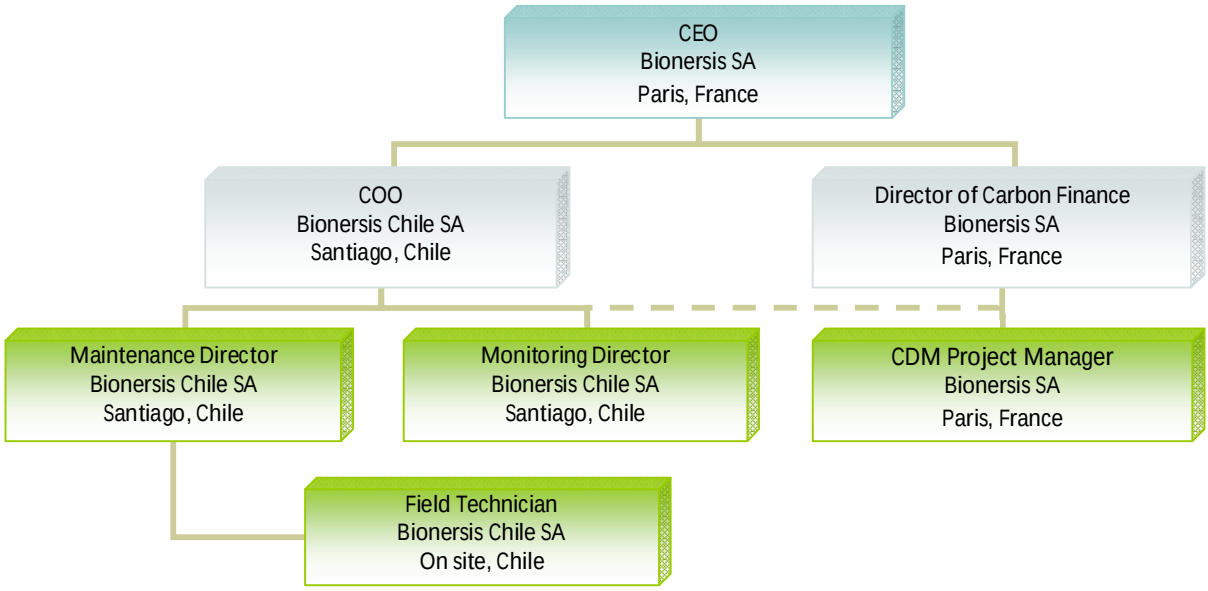

Figure 2.1 – Managerial organization

2.3.3. Quality assurance and quality control

Monitored parameters

The values recorded by the monitoring instruments are controlled at 3 stages:

- A first control happens on site, when collecting data and reporting events
- Then a second check takes place at the time of uploading values to the server machine and to the on-line database
- The final validation is the responsibility of the Monitoring Director who analyses the events, cross-check the consistency of data and eventually takes action if necessary

Monitoring report

The Director of Carbon Finance is responsible for the monitoring report. As such, he is empowered to control consistency of monitored data by any means, such as on-site audit, visual control of data on the server, cross-checking of data on the server with data provided by the Field Technician and/or the Maintenance Director and/or the Monitoring Director.

Training

Employees involved in the monitoring were trained externally and internally on the following topics:

- Review of equipment and captors
- Configuration of monitoring equipment
- Calibration requirement
- Maintenance requirement

3. FORMULAS AND PARAMETERS USED FOR CALCULATIONS

3.1.Formulas

Emissions reduction (ER)

As specified by the methodology ACM0001 version 5, and taking into account that there is no methane destroyed for electricity or thermal energy generation, the CO_2e emissions reductions shall be calculated as follows:

$$\mathbf{ER = (MD_{flare} - MD_{reg}) * GWP_{CH4}}$$

Where:

ER	Emissions reductions, in tonnes of CO_2 equivalent (tCO_2e)
MD_{flare}	Amount of methane destroyed by LFG flaring, in tonnes of methane (tCH_4)
MD_{reg}	Amount of methane that would have been destroyed/combusted in the absence of the project, in tonnes of methane (tCH_4)
GWP_{CH4}	Global Warming Potential value for methane in tCO_2e/tCH_4

Methane destroyed by LFG flaring (MD_{flare})

$$\mathbf{MD_{flare} = (LFG_{flare} * w_{CH4} * D_{CH4}) - (PE_{flare} / GWP_{CH4})}$$

Where:

LFG_{flare}	Quantity of LFG flared during the monitoring period measured in cubic meter (Nm^3)
w_{CH4}	Average methane fraction of the LFG (m^3CH_4/m^3LFG)
D_{CH4}	Methane density in tCH_4/m^3CH_4
PE_{flare}	Project emissions resulting from flaring of the residual gas stream (tCO_2)
GWP_{CH4}	Global warming potential of methane (tCO_2/tCH_4)

Methane destroyed in the absence of the project (MD_{reg})

$$\mathbf{MD_{reg} = MD_{flare} * AF}$$

Where AF is an adjustment factor set in the PDD to 4% for Leña Dura and to 0% for Lajarilla.

Project emissions resulting from flaring (PE_{flare})

During the considered monitoring period, continuous monitoring of the methane destruction efficiency of the flare (flare efficiency $\eta_{flare,h}$) was not available; hence we have applied the following default values, in accordance with the *Tool to determine project emissions from flaring gases containing methane*:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500°C for more than 20 minutes during the hour *h*.
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour *h,* but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*.
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour *h* and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*.

Project emissions resulting from electricity consumption (PE_{EC})

As specified in the PDD, project emissions resulting from electricity consumption will be calculated as follows:

$$PE_{EC} = EL_{PR} * CEF_{electricity}$$

Where:

EL_{PR}	Quantity of electricity consumed by the project activity during year *y* (in MWh)
$CEF_{electricity}$	CO_2 emissions intensity of the electricity consumed (tCO_2/MWh). Two cases: At Lajarilla, electricity is imported from the grid: $CEF_{electricity}$ = 1.3 tCO_2/MWh At Leña Dura, electricity is supplied by a diesel generator: $CEF_{electricity}$ = 0.8 tCO_2/MWh

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Leakage

No leakage effects need to be accounted under methodology ACM0001 version 5.

3.2.Parameters

Fixed parameters applied

Parameter	Description	Value	Unit	Source
GWP_{CH4}	Global warming potential of CH_4	21	tCO_2e / tCH_4	IPCC 2006 guidelines
$CEF_{electricity}$	CO_2 emissions intensity of the electricity consumed by the project activity	1.3 @ Lajarilla	tCO_2e/MWh	Methodology AMS-I.A
		0.8 @ Leña Dura		Methodology AMS-I.D
D_{CH4}	Density of methane	0.0007168	t_{CH4}/m^3_{CH4}	Default
AF	Adjustment factor Lajarilla	0	%	Legal report on regulatory requirements and on-site inspection
	Adjustment factor Leña Dura	4		

Monitored parameters included into emission reductions calculations

Parameter	Description	Unit	Source	Recording frequency
LFG_{flare}	Amount of LFG flared measured in normalized cubic meter	Nm^3	Flow meter	Continuously
w_{CH4}	Average methane fraction in LFG	% (m^3CH_4/m^3LFG)	Gas analyzer	Continuously
$\eta_{flare,h}$	Flare efficiency	%	Thermocouple	Continuously
EL_{PR}	Quantity of electricity consumed by the project activity during the monitoring period	MWh	Electricity meter	Continuously

Other monitored parameters (not required by the methodology)

Parameter	Description	Unit	Source	Recording frequency
T_{gas}	Temperature of the LFG	C°	Thermometer	Continuously
P	Pressure of the LFG	mBar	Pressure sensor	Continuously
O_2	Concentration of oxygen in LFG	% (m^3O_2/m^3LFG)	Gas analyzer	Continuously
-	Regulatory requirements relating to landfill gas projects	-	Laws and regulations	Every 6 months

4. MONITORED AND CALCULATED DATA

4.1. Monitored data

The data collected by the MemoGraph are recorded via ReadWin2000 every minute.
The number of records for the monitoring period exceeds 600,000 lines and can therefore not be displayed in this monitoring report. We display below the Memograph output for a 2-minute recording period:

Table 4.1 - Example: Leña Dura, 1st August 2009 00:00:00 and 00:01:00

Date	Time	State	Flow (Nm^3/h)	Tgas (°C)	Pressure (mbar)	CH_4 (%)	O_2 (%)	Tflare (°C)
01/08/09	00:00:00	OK	358.9	28	30	41.9	0.7	1,110
01/08/09	00:01:00	OK	358.6	28	29	41.9	0.7	1,117

The data are logged in .RSD files in the Memograph.
The data are then extracted to an .XLS file (raw data file).
The data in the .XLS file are then directly used for calculating the emission reductions.

4.2. Calculated data

The raw data file is used to calculate monthly MD_{flare} and MD_{reg}.
The monthly MD_{flare} and MD_{reg} are consolidated in a final monitoring spreadsheet.
Project emissions for the monitoring period are then computed on the final monitoring spreadsheet, in accordance with the registered PDD and the methodology.

4.3. Calculation results

Period		From	01-10-2008 00:00	To	30-09-2009 23:59
Parameter	$MD_{project}$ (tCH_4)	MD_{reg} (tCH_4)	PE_{EC} (tCO_2e)	Leakage	Emissions reductions (tCO_2e)
Formula	$MD_{project} = MD_{flare}$	$MD_{reg} = MD_{project} * AF$	$PE_{EC} = EL_{PR} * CEF_{electricity}$	N/A	$ER = (MD_{project} - MD_{reg}) * GWP_{CH4} - PE_{EC}$
Leña Dura	765.99	30.64	47.85	-	15,394
Lajarilla	136.61	00.00	33.54	-	2,835

Summary - Emission reductions (tCO_2e)	Leña Dura	Lajarilla	Viñita Azul	Total
Claimed emissions reduction monitoring period	15,394	2,835	0	18,229
Emissions reductions forecasted in the PDD	23,599	38,264	15,259	77,122