



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

**CONTENTS**

- A. General description of the project activity
  - A.1. Brief description of the project activity
  - A.2. Project participants
  - A.3. Location of the project activity
  - A.4. Technical description of the project
  - A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity
  - A.6. Registration date of the project activity
  - A.7. Crediting period of the project activity and related information
  - A.8. Name of responsible person(s)/entity(ies)
- B. Implementation of the project activity
  - B.1. Implementation status of the project activity
  - B.2. Revision of the monitoring plan
  - B.3. Request for deviation applied to this monitoring period
  - B.4. Notification or request of approval of changes
- C. Description of the monitoring system
- D. Data and parameters monitored
  - D.1. Data and parameters used to calculate baseline emissions
  - D.2. Data and parameters used to calculate project emissions
  - D.3. Data and parameters used to calculate leakage emissions
  - D.4. Other relevant data and parameters
- E. Emission reductions calculation
  - E.1. Baseline emissions calculation
  - E.2. Project emissions calculation
  - E.3. Leakage calculation
  - E.4. Emission reductions calculation
  - E.5. Comparison of actual emission reductions with estimates in the registered CDM-PDD
  - E.6. Remarks on difference from estimated value

**MONITORING REPORT**

Version 1 09/06/2011

**Regional landfill projects in Chile**

1435

Monitoring period 4 – 01/08/2010 – 08/06/2011

**SECTION A. General description of the project activity****A.1. Brief description of the project activity:**

The current project activity is a landfill gas collection and flaring system.

1. the project activity aims at recovering and flaring the landfill gas (LFG) produced by the landfills of Lajarilla in Viña del Mar and Leña Dura in Punta Arenas; by flaring the LFG, the methane contained in the LFG is destroyed and indeed greenhouse gas emissions are reduced;
2. the technology and equipments installed on site are:
  - a gas collection network, permeable pipes and vertical gas wells
  - a high temperature enclosed flare
  - monitoring and control system
3. the project of Leña Dura was commissioned on 15 December 2007 and has been continuously been operating since then; the project of Lajarilla was commissioned on 11 December 2007 and has been temporarily stopped since 3 November 2010; the project of Viñita Azul has not yet been implemented;
4. total emission reductions achieved in this monitoring period: 16,977 tCO<sub>2</sub>e

**A.2. Project Participants**

Party	Project Participant
Chile (host country)	Bionersis Chile SA
France	Bionersis SA
United Kingdom and Northern Ireland	Climate Change Investment I S.A. SICAR

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

The project activity is located on 3 landfills in Chile: Leña Dura in Punta Arenas (Region XII), Lajarilla in Viña del Mar (Region V) and Viñita Azul in Copiapo (Region III).

Geographic coordinates Leña Dura: 53°13'10"S, 70°57'20"W or -53.219, -70.956.

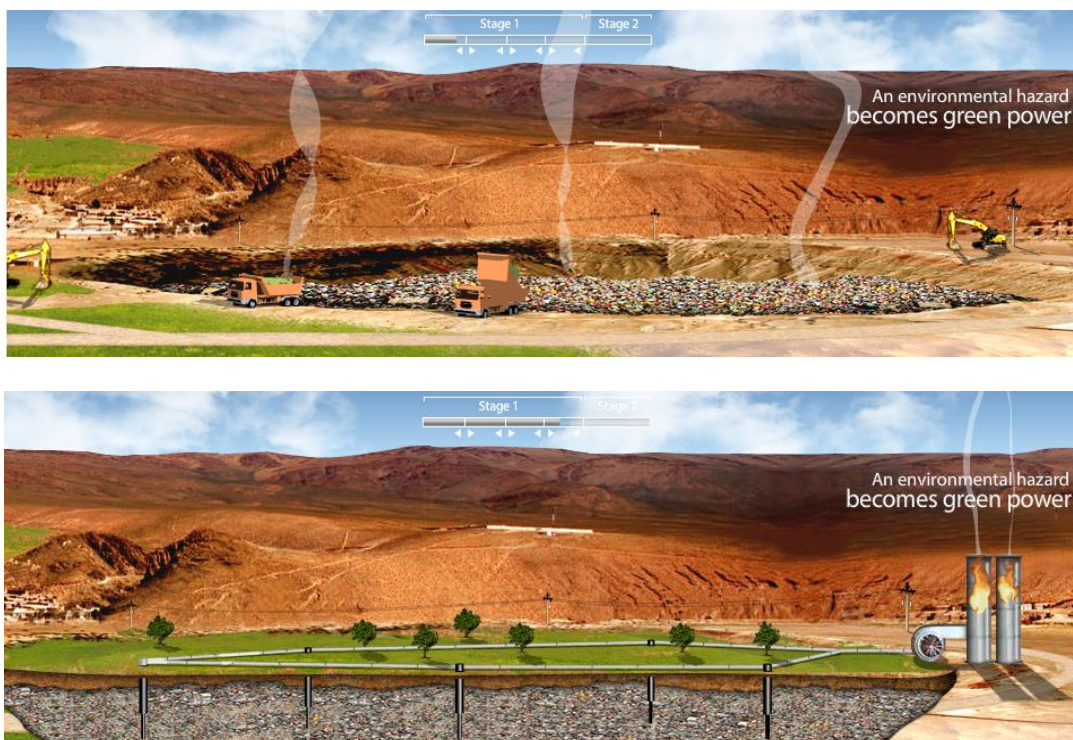
Geographic coordinates Lajarilla: 32°58'20"S, 71°29'00"W or -32.72, -71.483

Geographic coordinates Viñita Azul: 27°27'30"S, 70°20'00"W or -27.458, -70.333.

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

The technology applied in the project activity is a landfill gas collection and flaring system.

The two pictures below schematize the situation of the landfill before and after implementation of the project activity:



The equipment installed includes:

1. a gas collection network consisting of vertical gas wells and a main collector
2. a high temperature enclosed flare manufactured by Hofstetter of 600 Nm<sup>3</sup>/h capacity.
3. measuring equipments and control system: see details in section C

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

Large-scale methodology ACM0001 ver. 5 – “Consolidated baseline and monitoring methodology for landfill gas project activities” has been applied to the project.

The other methodological tools used are:

“Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” (version 4, EB41)

“Tool to determine project emissions from flaring gases containing methane” (version 1, EB28)

“Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 1, EB39)

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

04/07/2008

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

Fixed crediting period: 04/07/2008 - 03/07/2018

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

Bionersis S.A. : 149, rue Montmartre, 75002 Paris, France

Telephone: +33 960088849 Fax: +33 140289663 Email: [anne-sophie.zirah@bionersis.com](mailto:anne-sophie.zirah@bionersis.com)

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

1. The starting dates of operation of the project activity are 11 December 2007 at Lajarilla and 15 December 2007 at Leña Dura.
2. There was no particular event in Leña Dura during the period: no overhaul, no downtimes or exchange of equipment, etc. The project of Lajarilla was temporarily stopped on 3 November 2010 due to a low volume of landfill gas that caused frequent flare stops.
3. No event or situation which may impact the applicability of the methodology occurred during the monitoring period.

**B.2. Revision of the monitoring plan**

NA

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

NA

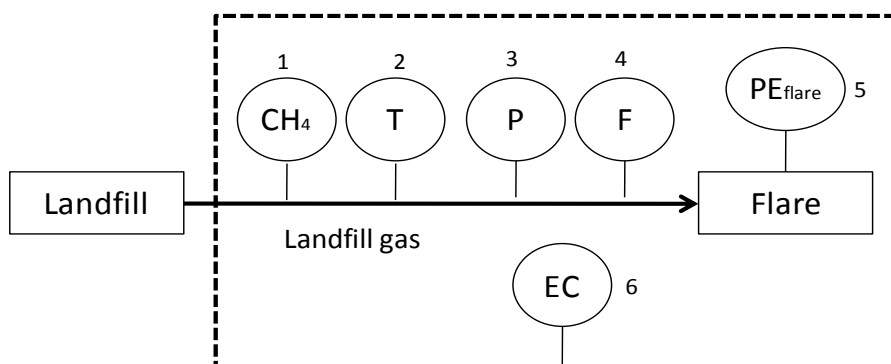
**B.4. Notification or request of approval of changes**

NA

**SECTION C. Description of the monitoring system****C.1.MONITORING EQUIPMENT*****C.1.1.Measuring equipment***

1. gas analyzer
2. temperature sensor
3. pressure sensor
4. flow meter
5. thermocouple
6. electricity meter

The following diagram shows the relevant monitoring points:



### C.1.2.Data acquisition and storage system

The data measured by the instruments are collected in a data acquisition system called “Memograph” manufactured by Endress+Hauser. The Memograph is equipped with an ATA flash memory card of 256 MB for data storage (capacity of the memory card for a 1-min memory cycle receiving 8 analogue inputs per minute is 7,584 days).

The data is transmitted by modem using either protocol RS232, protocol RS485 or Ethernet Interface. The data can also be retrieved via USB

Manufacturer and model: Endress+Hauser Memograph Visual data Manager

Serial number Leña Dura: 9700ZE04040A1

Serial number Lajarilla: 97002F040A1

## C.2.MONITORING SYSTEMS AND PROCEDURES

### C.2.1.Data logging, transmission, processing and storage

The data trail from monitored parameters to emissions reductions calculations is a semi-automated process, designed to prevent tempering of the raw data and to allow transparent control of the results.

#### 1.Downloading the monitored data (raw data .RSD format)

The monitored data are recorded by the data logger system every minute under the encrypted .RSD format, which is a binary program that only the ReadWin2000 program can read.

At regular interval (weekly, monthly or on demand) data are downloaded via modem to the central server. The downloaded .RSD files are stored in the central server.

#### 2.Extracting the data (raw data .XLS format)

An extraction to .XLS of monitored data is used as input by the CER calculator program.

#### 3.Calculating the data (CER calculations)

The input .XLS file extracted from Readwin is processed into a CER calculator program<sup>1</sup> that takes into account formulas and parameters applicable as per the PDD/methodology.

The CER output file is encrypted: the calculator includes a program that generates a random password. Indeed, no one can unprotect it.

### C.2.2.Managerial responsibilities

<sup>1</sup> Disclaimer: note that the CER calculator program works with MS Excel 2007 but not with anterior versions of MS Excel. Also note that macro must be enabled.

- The CDM aspects of the project are managed by the Director of CDM & Carbon Finance. The Director of CDM & 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 and maintenance manager of the project, who reports to the Director of CDM & Carbon Finance for CDM matters (collection and storage of monitoring data) and to the Chief of Operations for operational matters. The Monitoring and Maintenance Manager is accountable for the monitoring activities, the logging and record keeping of all monitored data. He supervises the calibration and maintenance procedures.
- Maintenance programs are carried out on site by the Field Technician, who also ensures that the monitoring equipment operates correctly.

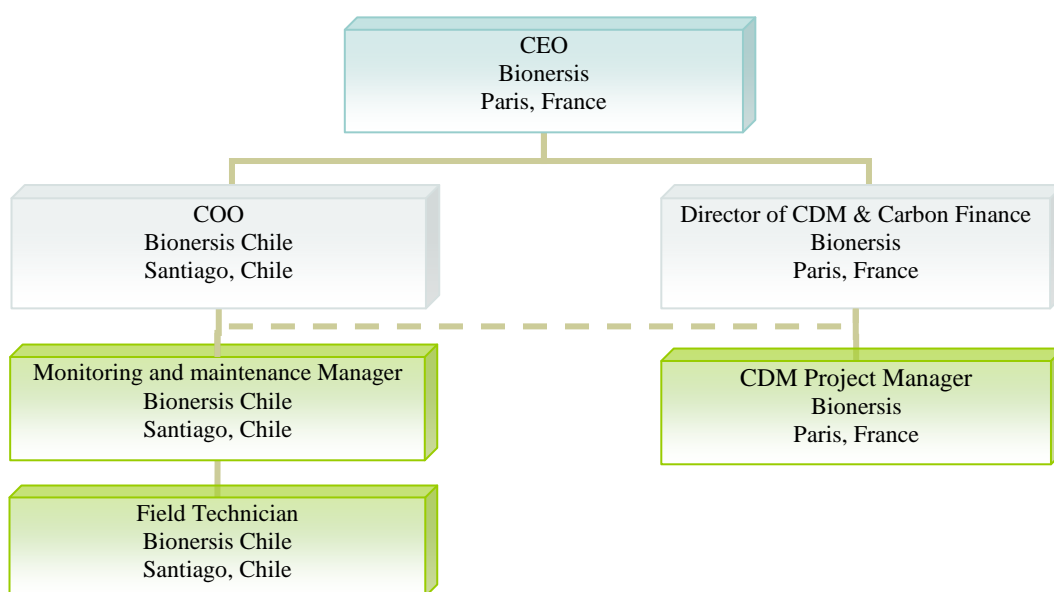


Figure – Managerial organization

### *C.2.3. Quality assurance and quality control*

#### **1. Control of the 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 and maintenance manager who analyses the events, cross-check the consistency of data and eventually takes action if necessary

#### **2. Quality control**

On a monthly basis, the CDM team based in France checks the quality of information provided by local teams on site. This remote internal audit ensures the compliance of operations with CDM requirements.

#### **3. 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 and maintenance requirements

#### 4. Emergency procedures

Emergency procedures are described in an internal document which includes role and responsibilities of personnel, definition of risks, description of emergency equipment, risk assessment, emergency plan in case of fires, explosion, accident etc.

### SECTION D. Data and parameters

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

<b>Data / Parameter:</b>	<b>GWP<sub>CH4</sub></b>
Data unit:	tCO <sub>2</sub> /tCH <sub>4</sub>
Description:	Global warming potential of CH <sub>4</sub>
Source of data used:	Defined by the IPCC methodology
Value :	21
Indicate what the data are used for:	Baseline emissions calculations
Additional comment:	

<b>Data / Parameter:</b>	<b>D<sub>CH4</sub></b>
Data unit:	t <sub>CH4</sub> /m <sup>3</sup> <sub>CH4</sub>
Description:	Density of methane
Source of data used:	Methodology
Value :	0.0007168
Indicate what the data are used for :	Baseline emissions calculations
Additional comment:	

<b>Data / Parameter:</b>	<b>AF</b>
Data unit:	%
Description:	Adjustment factor
Source of data used:	Common practice, on-site assessment
Value :	4%
Indicate what the data are used for:	Baseline emissions calculations
Additional comment:	

<b>Data / Parameter:</b>	<b>CEF<sub>Electricity</sub></b>
Data unit:	tCO <sub>2</sub> e/MWh
Description:	CO <sub>2</sub> emission factor of the electricity consumed
Source of data used:	Tool to calculate project emissions from electricity consumption Methodology AMS-IA
Value :	1.3 tCO <sub>2</sub> /MWh at Lajarilla 0.8 tCO <sub>2</sub> /MWh at Leña Dura
Indicate what the data are used for:	Project emissions calculations
Additional comment:	Calculated ex-ante in the registered PDD and fixed during the



	crediting period
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## D.2. Data and parameters monitored

<b>Data / Parameter:</b>	<b>LFG<sub>flare</sub></b>
Data unit:	Nm <sup>3</sup>
Description:	Amount of landfill gas captured and flared at normal temperature and pressure
Measured /Calculated /Default:	Measured
Source of data:	Data logger
Value(s) of monitored parameter:	Values are provided in spreadsheets aggregated every month
Indicate what the data are used for:	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<p>Flow meter  Manufacturer: Elster Instromet  Type: turbine gas flow meter  Model: SM-RI-X-K G650  Accuracy: ±1%  Serial number: 10509860 Leña Dura; 10509858 Lajarilla  Calibration frequency: every year as per PDD / every 4 years as per manufacturer  Last calibration:  Leña Dura: calibrated on 28/11/2008 by TGS  calibrated on 25/08/2010 by Industria &amp; Metrologia  Lajarilla: calibrated on 20/11/2008 by TGS  calibrated on 28/08/2010 by Industria &amp; Metrologia  Validity:  Leña Dura : 28/11/2008-27/11/2009 and 25/08/2010-24/08/2011  Lajarilla: : 20/11/2008-19/11/2009 and 28/08/2010-27/08/2011</p> <p>No calibration valid from 01/08/2010 to 25/08/2010 at Leña Dura and from 01/08/2010 to 28/08/2010 at Lajarilla.</p> <p>The reason for the calibration delay is the difficulty to find an accredited laboratory in the region. For instance, in Chile there is no manufacturer accredited agent able to perform the calibration of flow meters. TGS (Transportadora de Gas del Sur) is based in Argentina and Industria &amp; Metrologia is based in Colombia.</p> <p>In addition, the manufacturer recommendation on calibration frequency is every 4 years.</p> <p>Since the PDD mentions a calibration frequency of every year, in accordance with EB52 Annex 60, the measured values of the flow have been deviated for the mentioned periods when no calibration was valid, applying the maximum accuracy limit (±1%) of the equipment as the result of the delayed calibration showed an error within the maximum accuracy limit</p>
Measuring/ Reading/ Recording frequency:	Measured and recorded every minute





Calculation method (if applicable):	Normalized flow is calculated automatically by the data logger (Memograph) which processes the flow, temperature and pressure to output the gas flow in Nm <sup>3</sup> /h (see more information on the Memograph section C.1.2).
QA/QC procedures applied:	Regular maintenance

<b>Data / Parameter:</b>	<b>T</b>
Data unit:	°C
Description:	Temperature of the landfill gas
Measured /Calculated /Default:	Measured
Source of data:	Data logger
Value(s) of monitored parameter:	Values are provided in spreadsheets aggregated every month
Indicate what the data are used for:	Baseline emission calculations (normalization of flow)
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<p>Temperature sensor  Manufacturer: Wika  Model: EBL 160 AF  Accuracy: +/-0.55°C  Serial number: Leña Dura 67002013858; Lajarilla 67002013859  Calibration frequency: every year  Last calibration:  Leña Dura: calibrated on 22/03/2010 by Industria y Metrologia  calibrated on 21/03/2011 by Industria &amp; Metrologia  Lajarilla: calibrated on 25/03/2010 by Industria y Metrologia  calibrated on 22/03/2011 by Industria &amp; Metrologia</p> <p>Validity:  Leña Dura : 22/03/2010-22/03/2011 and 21/03/2011-21/03/2012  Lajarilla: : 25/03/2010-25/03/2011 and 22/03/2011-22/03/2012</p>
Measuring/ Reading/ Recording frequency:	Measured and recorded every minute
Calculation method (if applicable):	Normalized flow is calculated automatically by the data logger which processes the flow, temperature and pressure to output the gas flow in Nm <sup>3</sup> /h. See more information in LFG <sub>flared</sub> table.
QA/QC procedures applied:	Regular maintenance

<b>Data / Parameter:</b>	<b>P</b>
Data unit:	mbar
Description:	Pressure of the landfill gas
Measured /Calculated /Default:	Measured
Source of data:	Data logger
Value(s) of monitored parameter:	Values are provided in spreadsheets aggregated every month
Indicate what the data are used for:	Baseline emission calculations
Monitoring equipment (type,	Pressure sensor



accuracy class, serial number, calibration frequency, date of last calibration, validity)	<p>Manufacturer: Wika  Model: IS-20  Accuracy: &lt; 0.5%  Serial number: Leña Dura &amp; Lajarilla 7495645 (batch number)  Calibration frequency: every year  Last calibration:  Leña Dura: calibrated on 22/03/2010 by Industria y Metrologia  calibrated on 21/03/2011 by Industria &amp; Metrologia  Lajarilla: calibrated on 25/03/2010 by Industria y Metrologia  calibrated on 22/03/2011 by Industria &amp; Metrologia</p> <p>Validity:  Leña Dura : 22/03/2010-22/03/2011 and 21/03/2011-21/03/2012  Lajarilla: 22/03/2010-25/03/2011 and 22/03/2011-22/03/2012</p>
Measuring/ Reading/ Recording frequency:	Measured and recorded every minute
Calculation method (if applicable):	Normalized flow is calculated automatically by the data logger which processes the flow, temperature and pressure to output the gas flow in Nm <sup>3</sup> /h. See more information in LFG <sub>flared</sub> table.
QA/QC procedures applied:	Regular maintenance

<b>Data / Parameter:</b>	<b>w<sub>CH4</sub></b>
Data unit:	% (m <sup>3</sup> CH <sub>4</sub> /m <sup>3</sup> LFG)
Description:	Methane fraction in the landfill gas
Measured /Calculated /Default:	Measured
Source of data:	Data logger
Value(s) of monitored parameter:	Values are provided in spreadsheets aggregated every month
Indicate what the data are used for:	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<p>Gas analyzer  Manufacturer: NUK  Model: NGA5  Accuracy: ±1%  Serial number: Leña Dura 4005.64-5; Lajarilla 4005.64-4  Calibration frequency and validity: see calibration dates in appendix 1</p>
Measuring/ Reading/ Recording frequency:	Measured and recorded every minute
Calculation method (if applicable):	Not calculated
QA/QC procedures applied:	<p>Regular maintenance.  The gas analyzer is calibrated by comparison with certified gas cylinders. Canisters used for the calibration of the gas analyzer during the monitoring period:  Leña Dura:  Cylinder 44.3% CH<sub>4</sub> n° 179D-328 (supplied by Linde)  Cylinder 44.0% CH<sub>4</sub> n° 39571 (supplied by Linde)  Cylinder 20.0% O<sub>2</sub> n° 253194 (supplied by Linde)</p>



	<p>Cylinder 19.9% O<sub>2</sub> n° 926344 (supplied by Linde)</p> <p>Lajarilla:</p> <p>Cylinder 44.82% CH<sub>4</sub> n° 672288A (supplied by Linde)</p> <p>Cylinder 19.93% O<sub>2</sub> n° 300072 (supplied by Linde)</p>
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<b>Data / Parameter:</b>	<b>EL<sub>PR</sub></b>
Data unit:	MWh
Description:	Quantity of electricity consumed by the project activity during the monitoring period
Measured /Calculated /Default:	Measured
Source of data:	Continuously measured by electricity meter. Daily manual records
Value(s) of monitored parameter:	Leña Dura: 50.18 MWh Lajarilla: 5.08MWh
Indicate what the data are used for:	Project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<p>Electricity meter</p> <p>Manufacturer: Landis + Gyr</p> <p>Model: ZMD</p> <p>Accuracy: (class 2)</p> <p>Serial number: Leña Dura 88991093; Lajarilla 94287761</p> <p>Calibration frequency:</p> <p>PDD: every 5 years according to PDD;</p> <p>National standards: in Chile, authorized electricity meters are calibrated according to a national standard NCh 2024/1-1993 (replaced by NCh 2024/1-2001 and NCh 2024/2-2001), the recommendation for calibration frequency of electricity meter (mechanical or electronic) is 16 years</p> <p>Last calibrations: tested and calibrated by the manufacturer prior to the installation in the plant on 04/07/2007 at Leña Dura and on 17/10/2007 at Lajarilla</p> <p>Validity: Leña Dura 17/12/2007-16/12/2012 and Lajarilla 11/12/2007-10/12/2012 (5 years from commissioning)</p>
Measuring/ Reading/ Recording frequency:	Measuring every second. Reading and recording every day.
Calculation method (if applicable):	Not calculated
QA/QC procedures applied:	Cross check with the electricity purchase invoices

<b>Data / Parameter:</b>	<b>PE<sub>flare,y</sub></b>
Data unit:	tCO <sub>2</sub> e
Description:	Project emissions from flaring of the residual gas stream in the year y
Measured /Calculated /Default:	Calculated
Source of data:	Calculated according to <i>Tool to determine project emissions from flaring gases containing methane</i>



Value(s) of monitored parameter:	Values of monitored parameters are provided in spreadsheets aggregated every month.
Indicate what the data are used for:	Project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Calculated
Measuring/ Reading/ Recording frequency:	PE <sub>flare</sub> calculated for the monitoring period.
Calculation method (if applicable):	Calculated according to <i>Tool to determine project emissions from flaring gases containing methane</i>
QA/QC procedures applied:	NA

<b>Data / Parameter:</b>	<b><math>\eta_{\text{flare},h}</math></b>
Data unit:	%
Description:	Flare efficiency in hour $h$
Measured /Calculated /Default:	Default values (0% 50% 90%) depending on the conditions of operations of the flare (temperature and status)
Source of data:	Data logger
Value(s) of monitored parameter:	Use of default values: 0% 50% 90%
Indicate what the data are used for:	Baseline calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Thermocouple (see below)
Measuring/ Reading/ Recording frequency:	Calculated for each hour of the monitoring period.
Calculation method (if applicable):	<p>Use of the following default values:</p> <ul style="list-style-type: none"> <li>• 0% if the temperature in the exhaust gas of the flare (<math>T_{\text{flare}}</math>) is below 500°C for more than 20 minutes during the hour <math>h</math>.</li> <li>• 50%, if the temperature in the exhaust gas of the flare (<math>T_{\text{flare}}</math>) is above 500°C for more than 40 minutes during the hour <math>h</math>, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour <math>h</math>.</li> <li>• 90%, if the temperature in the exhaust gas of the flare (<math>T_{\text{flare}}</math>) is above 500°C for more than 40 minutes during the hour <math>h</math> and the manufacturer's specifications on proper operation of the flare are met continuously during the hour <math>h</math>.</li> </ul> <p>The proper operation of the flare is verified by the status "OK"</p>
QA/QC procedures applied:	NA

<b>Data / Parameter:</b>	<b><math>T_{\text{flare}}</math></b>
Data unit:	°C
Description:	Temperature in the exhaust gas of the flare
Measured /Calculated /Default:	Measured



Source of data:	Data logger
Value(s) of monitored parameter:	Values of monitored parameters are provided in spreadsheets aggregated every month
Indicate what the data are used for:	Project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<p>Thermocouple  Manufacturer: Jumo  Type S  Accuracy: Class 1  Serial number: Leña Dura &amp; Lajarilla 4012-00 (batch number)  Calibration frequency: calibrated or replaced every year  Last calibration:  Leña Dura: calibrated on 22/03/2010 by Industria y Metrologia  calibrated on 21/03/2011 by Industria &amp; Metrologia  Lajarilla: calibrated on 25/03/2010 by Industria y Metrologia  calibrated on 22/03/2011 by Industria &amp; Metrologia</p> <p>Validity:  Leña Dura : 22/03/2010-22/03/2011 and 21/03/2011-21/03/2012  Lajarilla: 25/03/2010-25/03/2011 and 22/03/2011-22/03/2012</p>
Measuring/ Reading/ Recording frequency:	Measuring and recording every minute
Calculation method (if applicable):	Not calculated
QA/QC procedures applied:	Calibrated or replaced every year

<b>Data / Parameter:</b>	<b>Regulatory requirements relating to landfill gas projects</b>
Data unit:	Text
Description:	Regulatory requirements relating to landfill gas projects
Measured /Calculated /Default:	NA
Source of data:	Laws and regulations
Value(s) of monitored parameter:	NA
Indicate what the data are used for:	Informative only
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Review every 6 months
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA

## SECTION E. Emission reductions calculation

**E.1. Baseline emissions calculation**

The monitoring methodology is based on direct measurement of the amount of landfill gas captured and destroyed at the flare.

**Emissions reduction ( $ER_y$ )**

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH_4} - PE_y$$

Where:

$MD_{project,y}$  Amount of methane that would have been destroyed/combusted during the year  $y$ , in tons of methane ( $tCH_4$ ) in project scenario

$MD_{reg,y}$  Amount of methane that would have been destroyed/combusted during the year  $y$  in the absence of the project due to regulatory and/or contractual requirement, in tons of methane ( $tCH_4$ )

$GWP_{CH_4}$  Global Warming Potential value for methane

$PE_y$  Project emissions consist of  $CO_2$  emissions related to the power used by the project activity facilities. Project emissions result from electricity consumption,  $PE_y = PE_{EC,y}$

**Methane destroyed by LFG flaring ( $MD_{flared,y}$ )**

During the considered monitoring period, all LFG captured was flared, thus  $MD_{project} = MD_{flared}$

$$MD_{flared,y} = (LFG_{flare,y} * w_{CH_4} * D_{CH_4}) - (PE_{flare,y} / GWP_{CH_4})$$

Where:

$LFG_{flare,y}$  landfill gas flared in the year  $y$  ( $m^3$ )

$w_{CH_4}$  methane content in landfill gas in the year  $y$  (mass fraction)

$D_{CH_4}$  Methane density expressed in  $t_{CH_4}/m^3_{CH_4}$

$PE_{flare,y}$  Emissions from flaring of the residual gas stream in year  $y$  ( $tCO_2$ )

$GWP_{CH_4}$  Global Warming Potential value for methane

**Methane destroyed in the absence of the project ( $MD_{BL,y}$ )**

As per the PDD,  $MD_{reg,y} = MD_{project,y} * AF$ , where  $AF$  is ex-ante fixed as 4%

**Flare efficiency ( $PE_{flare}$  or  $\eta_{flare,h}$ )**

During the considered monitoring period, continuous monitoring of the methane destruction efficiency of the flare (flare efficiency  $PE_{flare}$  or  $\eta_{flare,h}$ ) was not available. The following default values were applied for  $\eta_{flare,h}$ , 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 ( $T_{\text{flare}}$ ) 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  $h$ .

According to the manufacturer's specifications, the correct operation of the flare is verified by the status 'OK' output by the Memograph every minute. The parameters checked in order to obtain the 'flare OK' status are:

- Burner pressure between 2 mbar and 60 mbar
- Combustion temperature between 800°C and 1300°C

The burner pressure and the combustion temperature are checked by the Data Control Software continuously.

Formula used for  $PE_{\text{flare}}$  :

$$PE_{\text{flare},y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{\text{flare},h}) \times \frac{GWP_{CH_4}}{1000}$$

Where:

$TM_{RG,h}$  Mass flow rate of methane in the residual gas in the hour  $h$  (kg/h)

## E.2. Project emissions calculation

Project emissions resulting from electricity consumption are calculated as:

$$PE_{EC,y} = EL_{PR,y} * CEF_{\text{electricity},y}$$

Where:

$EL_{PR,y}$  Quantity of electricity consumed by the project activity during year  $y$  (in MWh)

$CEF_{\text{electricity},y}$  CO<sub>2</sub> emissions intensity of the electricity consumed by the project activity

At Lajarilla, electricity is imported from the grid:  $CEF_{\text{electricity}} = 1.3 \text{ tCO}_2/\text{MWh}$

At Leña Dura, electricity is supplied by a diesel generator:  $CEF_{\text{electricity}} = 0.8 \text{ tCO}_2/\text{MWh}$

## E.3. Leakage calculation

Not applicable.

## E.4. Emission reductions calculation / table

Total of the emission reductions achieved during the monitoring period:

MD <sub>project</sub> (tCH <sub>4</sub> )		MD <sub>reg</sub> (tCH <sub>4</sub> )	PE <sub>EC</sub> (tCO <sub>2</sub> e)	Leakage	Emissions reductions (tCO <sub>2</sub> e)
MD <sub>project,y</sub> = LFG <sub>flare,y</sub> * w <sub>CH4</sub> * D <sub>CH4</sub> – (PE <sub>flare</sub> /GWP <sub>CH4</sub> )		MD <sub>reg</sub> = MD <sub>project</sub> * AF	PE <sub>EC</sub> = EL <sub>PR</sub> * CEF <sub>electricity</sub>	N/A	ER = (MD <sub>project</sub> - MD <sub>reg</sub> ) * GWP <sub>CH4</sub> - PE <sub>EC</sub>
Leña Dura	821.08	32.84	40.14	-	16,512.84
Lajarilla	23.40	0.94	6.60	-	465.10

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

Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
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Leña Dura	23,545	Leña Dura	16,512
Lajarilla	30,041	Lajarilla	465
Viñita Azul	12,188	Viñita Azul	0
<b>Total</b>	<b>65,773</b>	<b>Total</b>	<b>16,977</b>

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

The actual emission reductions achieved during the current monitoring period are much lower than the values calculated ex-ante in the registered CDM-PDD. This is mainly due to the following reasons:

- only 2 sites have been implemented to date
- the site of Lajarilla has a very low level of LFG emissions, regardless of the project operations
- the recovery rate of 75% as set in the PDD was too optimistic
- the values in the PDD were calculated with the EPA/Mex Model which is not the most conservative model to calculate potential methane emissions from a landfill



**Appendix 1**

Calibration dates gas analyzer:

Leña Dura	Lajarilla
21 Jul 10	28 Jul 10
04 Aug 10	12 Aug 10
18 Aug 10	23 Aug 10
02 Sep 10	10 Sep 10
15 Sep 10	21 Sep 10
01 Oct 10	05 Oct 10
15 Oct 10	18 Oct 10
27 Oct 10	03 Nov 10
11 Nov 10	
24 Nov 10	
10 Dec 10	
21 Dec 10	
07 Jan 11	
20 Jan 11	
18 Feb 11	
02 Mar 11	
15 Mar 11	
31 Mar 11	
14 Apr 11	
27 Apr 11	
11 May 11	
24 May 11	
08 Jun 11	