MONITORING REPORT
EL PANUL – ECOMETHANE LANDFILL GAS PROJECT

ECO SECURITIES

Document Prepared By EcoSecurities International Limited

Project Title	El Panul – EcoMethane Landfill Gas Project
Version	4.0
Date of Issue	15-March-2012
Project ID	Not available
Monitoring Period	01-March-2008 to 05-October-2009 (both days are included)
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1 PROJECT DETAILS

1.1 Summary Description of Project

The El Panul – EcoMethane Landfill Gas is a landfill gas (LFG) collection and flaring project in the city of Coquimbo, Chile.

The objective of the Project is to replace the ineffective passive venting system with an active gas collection system so as to destroy the LFG, thus minimising gaseous emissions and improving overall landfill operation. Indeed, the landfill gas was previously released to the atmosphere, or partially burnt via low efficiency combustion passive flaring systems.

The project activity involves the installation of an active LFG collection system using vertical gas wells drilled into the waste to extract the LFG and the installation of a modular enclosed gas flare consisting of piping, valves, blower, stack with burners, instrumentation, and control panel. By collecting and efficiently destroying the landfill gas via a proper flaring system, the project activity results in considerable methane emission reductions.

1.2 Sectoral Scope and Project Type

The project activity falls into Sectoral Scope 13 – Waste Handling and Disposal. The project meets the criteria of a landfill gas project activity as defined in the CDM Approved Consolidated Baseline Methodology ACM0001 Version 8, “Consolidated baseline and monitoring methodology for landfill gas project activities.” The project is not a grouped project.

1.3 Project Proponent

The Project Proponent is EcoSecurities International Limited, 40/41 Park End Street, Oxford OX1 1JD, United Kingdom.

Summary Workbook Emission Reductions and Monitoring Report, as well as collecting and summarizing information related to the CDM project activity is the responsibility of EcoSecurities’ Project Manager.

1.4 Other Entities Involved in the Project

Other entities involved in the Project are:

Project Developer - Biogas Technology Ltd. [UK]

A Carbon Credit Data Controller has been appointed and trained, who is responsible for the CDM monitoring system. Operation of the plant and maintenance of facilities, fall under responsibility of the Site Technician and Operation Assistant. Monthly recording of parameters and QAQC of the data, fall under the responsibility of the Carbon Credits Data Controller and Carbon Operation Manager.

1.5 Project Start Date

The project start date is March 1, 2008, the day on which the Project's enclosed flare was commissioned and began flaring landfill gas.

1.6 Project Crediting Period

The crediting period began on March 1, 2008 and ended on October 5, 2009 (both days are included); it became registered with the UNFCCC as a CDM Project on October 6, 2009, for a total crediting period of 19 months and 5 days.

1.7 Project Location

The Project is located south of Coquimbo in the "Altas de Panul" region, 3 km east of the main road Ruta 5 Norte" (Route 5 North), and 18 km from the city of La Serena. The geographical coordinates are: 30° 01' 10'' S and 71° 21' 31'' E.

Address: Relleno Sanitario el Panul: Parcela 11- Comunidad La Herradura Etapa E

1.8 Title and Reference of Methodology

The approved methodology applied for this project is the CDM Approved Consolidated Baseline Methodology ACM0001 Version 8, *Consolidated baseline and monitoring methodology for landfill gas project activities*.

The following tools are referenced in the methodology, and are also applied in the calculation of VERs generated during the reporting period:

- *Tool to determine project emissions from flaring gases containing methane*, adopted at EB28;
- *Tool to calculate baseline, project and/or leakage emissions from electricity consumption*, Version 01, adopted at EB39;
- *Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*, Version 5.1, adopted at EB 61
- *Tool to calculate the emission factor for an electricity system*, Version 1.1, adopted at EB35

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project was implemented and has been operational since March 1, 2008. During the reporting period, LFG has been sent to the enclosed flare.

The project had numerous interruptions in operations during the monitoring period, but also had long periods of normal operations. Normal operations include downtimes due to maintenance, failures and stoppages (e.g. electricity supply, quantity of LFG). Main failures are described below and are reflected in the ER workbook:

Date	Description of Failure
01/03/2008 – 15/09/2008	Netrix, transmission system, CH_4 card exchanged 15/09/2008 to solve on-going issues with data transmission (since April)
18/06/2008 – 15/09/2008	Problem with analyser CH_4 card, resolved when card was replaced on 15/09/2008
07/072008 – 04/08/2008	Flow meter failure, resolved when meter was replaced on 04/08/2008
04/09/2008 – 15/09/2008	Flare shutdown due to several operational problems
13/10/2008 – 14/10/2008	Flare off to reset Netrix
26/02/2009 – 24/03/2009	Main LFG pipeline broken
26/03/2009 – 20/05/2009	Problems with PLC and Netrix; Netrix server replaced on 20/05/2009
22/05/2009 – 09/06/2009	Flare shutdowns but lack of portable gas analyser onsite prevented well-field balancing; portable analyser arrives on 09/06/2009, able to get flare running again
15/07/2009	Flare off due to unpaid electricity invoice

2.2 Deviations from the Monitoring Plan

The project did not deviate from the monitoring plan during the monitoring period.

2.3 Grouped Project

Not applicable.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

The following parameters were available at validation:

Data Unit / Parameter:	GWP_{CH4}

Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of CH_4
Source of data:	IPCC
Value applied:	21
Justification of choice of data or description of measurement methods and procedures applied:	Default value per the methodology
Any comment:	-

Data Unit / Parameter:	D_{CH4}
Data unit:	tCH_4/m^3CH_4
Description:	Methane density
Source of data:	Methodology
Value applied:	0.0007168
Justification of choice of data or description of measurement methods and procedures applied:	Default value per the methodology
Any comment:	At standard temperature and pressure (0 degrees Celsius and 1,013 bars), the density of methane is 0.0007168 t/m^3.

Data Unit / Parameter:	φ
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data:	According to the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, Version 2.
Value applied:	0.9
Justification of choice of data or description of measurement methods and procedures applied:	Default value per the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, Version 2.
Any comment:	This parameter is used to determine $MG_{PR,1}$,(included in the AF estimation). $MG_{PR,1}$, is to be determined once (first year of the project activity) and remains fixed for the entire crediting period. According to

	ACM0001 v8 page 7 (Step 2, Option 1)

Data Unit / Parameter:	OX
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data:	According to the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site* and IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Using 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost.
Value applied:	0.1
Justification of choice of data or description of measurement methods and procedures applied:	Default value for managed solid waste disposal sites per the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, Version 2.
Any comment:	This parameter is used to determine $MG_{PR,1}$,(included in the AF estimation). $MG_{PR,1}$, is to be determined once (first year of the project activity) and remains fixed for the entire crediting period. According to ACM0001 v8 page 7 (Step 2, Option 1)

Data Unit / Parameter:	DOC_f
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data:	According to the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site* and IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.5
Justification of choice of data or description of measurement methods and procedures applied:	Default value per the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, Version 2.
Any comment:	This parameter is used to determine $MG_{PR,1}$,(included in the AF estimation). $MG_{PR,1}$, is to be determined once (first year of the project activity) and remains fixed for the entire crediting period. According to ACM0001 v8 page 7 (Step 2, Option 1)

Data Unit / Parameter:	MCF
Data unit:	-
Description:	Methane correction factor
Source of data:	MCF was determined on page 17 of the registered PDD according to the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site* and IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.5
Justification of choice of data or description of measurement methods and procedures applied:	Default value for semi-aerobic managed solid waste disposal sites per the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, Version 2.
Any comment:	This parameter is used to determine $MG_{PR,1}$,(included in the AF estimation). $MG_{PR,1}$, is to be determined once (first year of the project activity) and remains fixed for the entire crediting period. According to ACM0001 v8 page 7 (Step 2, Option 1)

Data Unit / Parameter:	DOC_j
Data unit:	%
Description:	Fraction of degradable organic carbon (by weight) in the waste type *j*.
Source of data:	According to the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site* and IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value applied:	The following values for the different waste types *j* are applied:

Waste type *j*	**DOC_j**
Wood and wood products	43%
Pulp, paper and cardboard (other than sludge)	40%
Food, food waste, beverages and tobacco (other than sludge)	15%
Textiles	24%
Garden, yard and park waste	20%
Glass, plastic, metal, other inert material	0%

Justification of choice	Default value for wet waste per the *Tool to determine methane*

of data or description of measurement methods and procedures applied:	*emissions avoided from disposal of waste at a solid waste disposal site*, Version 2
Any comment:	The values applied are for wet waste. This parameter is used to determine $MG_{PR,1}$,(included in the AF estimation). $MG_{PR,1}$, is to be determined once (first year of the project activity) and remains fixed for the entire crediting period. According to ACM0001 v8 page 7 (Step 2, Option 1)

Data Unit / Parameter:	k_j
Data unit:	-
Description:	Decay rate for the waste type *j*.
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value applied:	The following values for the different waste types *j* are applied:

Waste type *j*	**k_j**
Wood and wood products	0.02
Pulp, paper and cardboard (other than sludge)	0.04
Food, food waste, beverages and tobacco (other than sludge)	0.06
Textiles	0.04
Garden, yard and park waste	0.05
Glass, plastic, metal, other inert material	0.00

Justification of choice of data or description of measurement methods and procedures applied:	Default value for Temperate (MAT≤20°C) and Dry (MAP/PET<1) per the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, Version 2.
Any comment:	This parameter is used to determine $MG_{PR,1}$,(included in the AF estimation). $MG_{PR,1}$, is to be determined once (first year of the project activity) and remains fixed for the entire crediting period. According to ACM0001 v8 page 7 (Step 2, Option 1)

Data Unit / Parameter:	$EF_{grid,y}$

Data unit:	tCO_2/MWh
Description:	Emission factor for the grid in year *y*
Source of data:	Calculated *ex-ante* in CDM Registered PDD
Value applied:	0.5230
Justification of choice of data or description of measurement methods and procedures applied:	Calculated as per the *Tool to calculate the emission factor for an electricity system*, based on fuel consumption and electricity generation data for plants connected to the grid, provided by CDEC-SIC. Detailed information can be found in registered PDD, B.6.2.. Simple Adjusted Operating Margin 2005-2007 0.6319 Average Build Margin 2007 0.4141 Carbon Emission Factor 0.5230 Refer to the CDM Registered PDD for a more detailed explanation of the calculation.
Any comment:	Used to calculate project emissions from electricity consumption.

Data Unit / Parameter:	Regulatory requirements relating to landfill gas projects
Data unit:	Not applicable
Description:	Regulatory requirements relating to landfill gas projects
Source of data:	CONAMA (Chilean-DNA) web site: www.mma.gob.cl
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Annually
Value applied:	DS189/2008 Minsal, *Normative for safety conditions of landfills*, remains unchanged since the validation of the project. No specific requirement for LFG capture/flaring is stated, so no requirements for AF or $MD_{reg,y}$ is defined.
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Not applicable
Any comment:	It is used for changes to the adjustment factor (AF) or directly $MD_{BL,y}$ at renewal of the credit period. Relevant regulations for LFG project activities shall be updated at renewal of each credit period.

3.2 Data and Parameters Monitored

The following parameters are monitored:

<table>
<tr><td>Data Unit / Parameter:</td><td>$LFG_{total,y}$</td></tr>
<tr><td>Data unit:</td><td>Nm^3</td></tr>
<tr><td>Description:</td><td>Total amount of landfill gas captured at Normal Temperature and Pressure</td></tr>
<tr><td>Source of data:</td><td>Flow meter</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Data will be measured with a flow meter and monitored continuously by the Project Developer. The flow meter will be maintained and calibrated periodically in line with the manufacturer (officially accredited entity) requirements .This will ensure that the accuracy of the measurement instrument is maintained. The accuracy will be ±1.5 % of reading plus ±0.5 % of full scale. Monitoring data and/or back-up data will be gathered regularly on site and aggregated monthly by the Project Developer.</td></tr>
<tr><td>Frequency of monitoring/recording:</td><td>Continuously measured, recorded every 30 minutes (changed to 15 minutes on 9/24/2009)</td></tr>
<tr><td>Value applied:</td><td>2,857,507
Aggregated values only referential. 30-minutes values are used for the VER calculations.</td></tr>
<tr><td>Monitoring equipment:</td><td>Thermal mass flow meter
Manufacturer: Endress+Hausser
Model: t-mass AT65
Accuracy: ±(1.5 % of reading + 0.5 % of full scale)
Calibration frequency: Manufacturer recommends 3-5 year calibration frequency after the installation. 3 year calibration is adopted conservatively.
<table>
<tr><th>Serial No.</th><th>In Use From/To</th><th>Calibration Date</th><th>Valid Until</th></tr>
<tr><td>89011D02000</td><td>01/03/08 – 04/08/08</td><td>18/09/2006</td><td>28/02/2011</td></tr>
<tr><td>A4131602000</td><td>04/08/08 – 03/08/11</td><td>15/05/2008</td><td>03/08/2011</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The flow meter is maintained and calibrated (by an accredited entity) periodically in line with the manufacturer requirements.
Monitoring data are gathered regularly on site and aggregated monthly by the Project Developer.</td></tr>
<tr><td>Calculation method:</td><td>An adjustment regarding the composition of the LFG (Methane content) is performed according manufacturer direction. This calculation is performed in ERs workbook.
The flow meter expresses gas flow in normalized cubic meters, therefore</td></tr>
</table>

	no separate monitoring of pressure (P) and temperature (T) of LFG is necessary to determine density.
Any comment:	$LFG_{total,y}$ will equal $LFG_{flared,y}$ in case the project does not generate electricity, and no separate flow meter will be installed. Furthermore, $LFG_{flared,y}$ will equal $LFG_{total,y}$ in case the project does not generate electricity.

Data Unit / Parameter:	$LFG_{flared,y}$
Data unit:	Nm^3
Description:	Amount of landfill gas flared at Normal Temperature and Pressure
Source of data:	Flow meter
Description of measurement methods and procedures to be applied:	Please refer to $LFG_{total,y}$
Frequency of monitoring/recording:	Please refer to $LFG_{total,y}$
Value applied:	Please refer to $LFG_{total,y}$
Monitoring equipment:	Please refer to $LFG_{total,y}$
QA/QC procedures to be applied:	Please refer to $LFG_{total,y}$
Calculation method:	$LFG_{flared,y}$ is equal to $LFG_{total,y}$ because the project does not generate electricity. Please also refer to AM-CLA-0028.
Any comment:	Please refer to $LFG_{total,y}$ $LFG_{flared,y}$ is considered to be equivalent to the variable $FV_{RG,h}$ (volumetric flow rate of the residual gas) as described in the *Tool to determine project emissions from flaring gases containing methane* to determine the project emissions from the flaring process.

Data Unit / Parameter:	$PE_{flare,y}$
Data unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream in year *y*
Source of data:	Calculated using parameter $LFG_{total,y}$, w_{CH4}, T_{flare}, T_{comb} and default values of flare efficiency as per the *Tool to determine project emissions from flaring gases containing Methane*.
Description of measurement	Please see parameters: $LFG_{total,y}$, w_{CH4}, T_{flare}, T_{comb}

methods and procedures to be applied:	
Frequency of monitoring/recording:	Please see parameters: $LFG_{total,y}$, w_{CH4}, T_{flare}, T_{comb}
Value applied:	2,605 Aggregated values only referential. 30-minutes values are used for the VER calculations.
Monitoring equipment:	Please see parameters: $LFG_{total,y}$, w_{CH4}, T_{flare}, T_{comb}
QA/QC procedures to be applied:	Please see parameters: $LFG_{total,y}$, w_{CH4}, T_{flare}, T_{comb}
Calculation method:	As per the *Tool to determine project emissions from flaring gases containing methane*. Also refer to section 4.2. As default values for flare efficiency in the hour h ($\eta_{flare,h}$) the following criteria were used: • 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 manufactures specifications on proper operation of the flare are met continuously during the hour h. The manufacturer specifications on proper operation are:

Parameters	**Conditions**
T_{comb} *available in VERs calculation workbook*	700 – 1200ºC
T_{flare}	500 - 1200°C
w_{CH4}	>20 (% vol)

To determine flare efficiency, 30 minute-frequency set of data are used. The flare is considered to meet the tool requirement regarding the 40 minute duration as long as all 30 minute measurements within an hour (there are 2 of them each hour) are above 500ºC. Should any of the measurements be below 500ºC, it is considered that the tool requirement with regards to the 40 minute rule (STEP 6 of the

	tool) is not met for that hour. Following a shutdown, the flare at El Panul is designed to remain off for a 30-minute period before an automatic restart is initiated; as a result of this design feature, any shutdown in the system is reflected in the monitored data. The Tool to determine project emissions from flaring gases containing Methane states "An excessively high temperature at the sampling point (above 700 ºC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.". In the case of El Panul, the flare installed is designed to operate at a temperature in the upper section of the flare (sampling point) ranging from 500ºC to 1200ºC. It is not an indication of malfunctioning for the flare installed at El Panul to reach temperatures above 700ºC in its upper section, as it is designed to reach temperatures between 500ºC to 1200ºC in that section during normal operation.
Any comment:	-

Data Unit / Parameter:	w_{CH4}
Data unit:	% (m^3CH_4 / m^3LFG)
Description:	Methane fraction in the landfill gas
Source of data:	Fixed Gas Analyser
Description of measurement methods and procedures to be applied:	Methane content will be measured continuously with a fixed gas analyser by the Project Developer. The gas analyser will be maintained and calibrated regularly in line with the manufacturer's requirements. The Methane fraction of the landfill gas will be measured according to the methodology requirement.
Frequency of monitoring/recording:	Continuously measured, recorded every 30 minutes (changed to 15 minutes on 24/09/2009)
Value applied:	46.9 Averaged values only referential. 30-minutes values are used for the VER calculations.
Monitoring equipment:	Fixed Infrared Gas Analyser, Edinburg Instruments. Accuracy: 2% Calibration frequency 12 months (after the installation date) is applied, as per manufacturer indications. Calibration is performed on- site.

Serial No.	In Use From/To	Calibration Date	Valid Until
24614	01/03/08 – 15/09/08	27/03/2007	28/02/2009
27061	15/09/08 – 05/10/09	25/04/2008	14/09/2009

			14/09/2009	13/09/2010
QA/QC procedures to be applied:	Methane content is measured continuously with a fixed gas analyser by the Project Developer. The gas analyser is maintained and calibrated regularly in line with the manufacturer's requirements to ensure accuracy. Calibration is carried out using a standard certified gas. A zero check is performed.			
Calculation method:	Not applicable			
Any comment:	w_{CH4} is considered to be equivalent to the variable $fv_{CH4,h}$ (Volumetric fraction of the component CH_4 in the landfill gas in hour *h*) as described in the *Tool to determine project emissions from flaring gases containing methane*.			

Data Unit / Parameter:	T_{flare}
Data unit:	°C
Description:	Temperature in the exhaust gas of the flare
Source of data:	Thermocouple Type N
Description of measurement methods and procedures to be applied:	The temperature in the exhaust gas will be measured with a type N thermocouple and continuously monitored as described in the *Tool to determine project emissions from flaring gases containing methane*.
Frequency of monitoring/recording:	Continuously measured, recorded every 30 minutes (changed to 15 minutes on 24/09/2009)
Value applied:	766 Averaged values only referential. 30-minutes values are used for the VER calculations.
Monitoring equipment:	Thermocouple Type N Accuracy for 333°C to 1200°C: ±0.75 % Calibration: Yearly calibration or exchange (considered from the installation date) is adopted as per manufacturer indications.
QA/QC procedures to be applied:	According to a manufacturer´s statement: *It is not a requirement for thermocouples to be calibration checked whilst they are in storage.* Therefore, the 12-month calibration frequency is applied since the installation date of the meter. The thermocouple is replaced or calibrated every year.

Serial No.	In Use From/To	Calibration Date	Valid Until
70439-3	01/03/08 – 13/01/09	18/04/2007	28/02/2009
686675-24	13/01/09 – 25/11/09	14/05/2008	12/01/2010

Calculation method:	Not applicable
Any comment:	Required to determine adequate operation of the flare, per the *Tool to determine project emissions from flaring gases containing methane*.

Data Unit / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	Onsite consumption of electricity provided by the grid and/or captive power plant(s) and attributable to the project activity during year *y*
Source of data:	Electricity meter
Description of measurement methods and procedures to be applied:	Electricity is measured continuously with an electricity meter. Data is aggregated at least annually as stated in the *Tool to calculate project emissions from electricity consumption*.
Frequency of monitoring/recording:	Continuously measured, aggregated at least annually.
Value applied:	74
Monitoring equipment:	Manufacturer: Landis & Gyr Model: ML240 Accuracy: 2% Calibration frequency as per manufacturer recommendations 8 years. Serial number: 66824216 Calibrated on: 25/07/2008* Valid Until: 24/07/2016 * the first documented calibration of this meter occurred after the start of operations, therefore, to be conservative, an additional 2% of electricity consumption is applied in the VER calculations for March-July, 2008 to compensate.
QA/QC procedures to be applied:	Electricity meter is subject to regular maintenance and testing in accordance with stipulation of the meter supplier to ensure accuracy.
Calculation method:	Not applicable
Any comment:	Required to determine CO_2 emissions from use of electricity or other energy carriers to operate the project activity.

Data Unit / Parameter:	TDL_y
Data unit:	%
Description:	Average technical transmission and distribution losses in the grid in

	year *y* for the voltage level at which electricity is obtained from the grid at the project site.
Source of data:	Calculated from CDEC-SIC (Grid company) public information for 2008-2009, Comisión Nacional de Energia (National Energy Commission), as per *Tool to calculate baseline, project and/ or leakage emissions from electricity consumption.*
Description of measurement methods and procedures to be applied:	Per *Tool to calculate baseline, project and/ or leakage emissions from electricity consumption*
Frequency of monitoring/recording:	Annually
Value applied:	2008: 11, 2009: 10
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Per *Tool to calculate baseline, project and/ or leakage emissions from electricity consumption*
Any comment:	Used to calculate project emissions from consumption of electricity. Data obtained from CDEC-SIC (Grid company) public information for 2008-2009; Year book Operation Statistic 2001-2010 (http://www.cdec-sic.cl) and the Distribution companies annual performance information (www.cne.cl).

Data Unit / Parameter:	$MG_{PR,1}$
Data unit:	tCH_4
Description:	Amount of methane generated during year 1 of the project activity
Source of data:	Calculated using the actual amount of waste disposed in the landfill as per the latest version of the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Once and fixed during the crediting period.
Value applied:	1572
Monitoring equipment:	Not applicable

QA/QC procedures to be applied:	Not applicable
Calculation method:	The project activity started on March 1, 2008 (commissioning date), however, during 2008 the monitoring system had several periods of downtimes, and the monitoring system was not working in a continuous basis. Thus, the yearly aggregated results (from 1 March 2008) are not reliable. Thus, for calculation of $MG_{PR,1}$, the period July 2009-June 2010 has been taken, when the monitoring system is considered fully implemented with minor downtime periods.
Any comment:	-

3.3 Description of the Monitoring Plan

Data collection procedures

Data generation and recording: The landfill gas flow ($LFG_{flare,y}$), temperature of flare (T_{flare}), temperature of combustion (T_{comb}) and the fraction of methane in the landfill gas ($w_{CH4,y}$) are measured continuously and sent via telemetry system to the Netrix server. The telemetry system is the default gathering and submission system. It consists of automatic readings for the parameters indicated above which are used for the calculations of the emissions reductions. This data is stored on a server and available through a protected web interface; it can be downloaded at any time by connecting to the server through a secure internet connection. Electricity consumption ($EC_{PJ,y}$) is measured continuously and recorded at least monthly from the electricity meter.

Data Aggregation: Data are downloaded monthly. The raw data is considered eligible for inclusion in ERs calculations when they are complete. The 30 minute data is used for calculation (see Section 4), where BE, PE, and ERs are summarised annually. Since 24/09/2009, 15 minute data has been recorded and used for calculation.

Calculation: Calculations are performed as per the methodology ACM0001 v8. See Section 4. $PE_{flare,y}$ calculation is performed using default values as per the *Tool to determine project emissions from flaring gases containing methane*, according to the tool conditions (T_{flare}) and manufacturer conditions (T_{comb} and w_{CH4}%).

AF has been recalculated as per ACM0001 v8 page 7, using Option 1 (Step 2); "the destruction efficiency of the system used in the project activity is estimated once (the first year of the project activity) and remains fixed for the whole crediting period"(ε_{PR}), and also the latest version of *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*.

Reporting: The calculated values are included in an Excel sheet and reported in the VCS-MR.

Organizational structure, roles and responsibilities

The Carbon Credit Data Controller is responsible for the carbon monitoring system.

Operation of the plant and maintenance of facilities, fall under responsibility of the Site Technician and Operation Assistant.

Monthly recording of parameters and QAQC of the data, fall under the responsibility of the Carbon Credits Data Controller and Carbon Operation Manager.

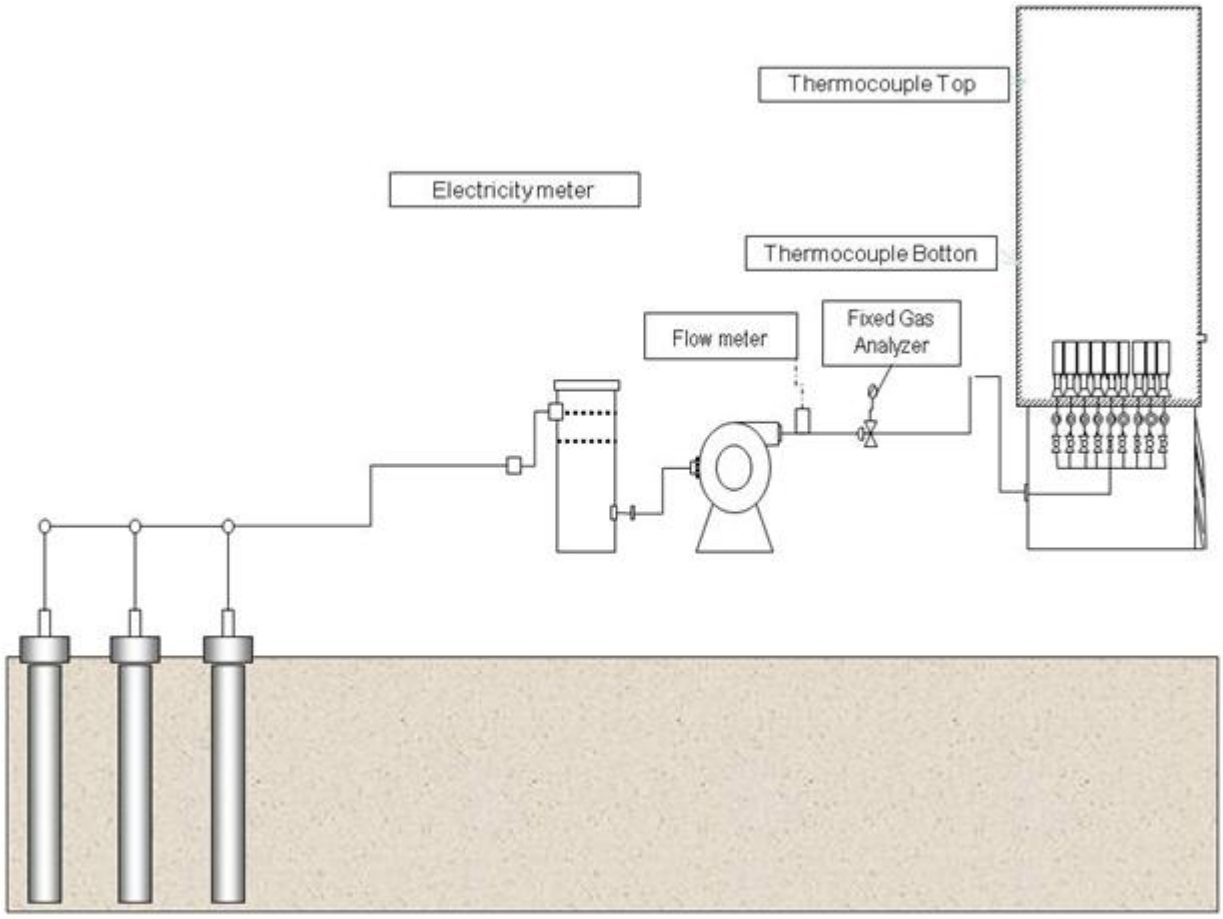
Summary Workbook Emission Reductions and Monitoring Report, as collecting and summarizing information related to the CDM project activity is responsibility of EcoSecurities' Project Manager.

Emergency procedures for the monitoring system

The Site Technician and Operation Assistant will notify the Carbon Credits Data Controller and Carbon Operation Manager in case there is doubt about the correct functioning of the meters mentioned in the monitoring plan. In that case, the Operation Manager will check and where necessary replace the meters. No VERs are claimed for the period during which the meters were not functioning correctly.

If the flare is off or readings of $LFG_{flared,y}$, T_{flare}, T_{comb} and $w_{CH4,y}$ were not recorded in the telemetry system (in this case, a 0 or a blank space is reported in the Workbook), this set of data is identified as "N/A" in the field "Operational Check" (column H) in the Emission Reductions Workbooks. No ERs are claimed from this set of data. If no data is recorded by the system for a period of time, a single line is inserted in the Workbook denoting the data gap, and the "Flow per Interval" field (column J) is set to zero and highlighted in yellow. No ERs are claimed during such periods.

Line diagram



4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

According to PDD B.6.1 equation (1*), and considering the project activity does not include either electricity or a thermal energy component:

$BE_y = (MD_{project,y} – MD_{BL,y}) \times GWP_{CH4}$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2e)
$MD_{project,y}$	=	The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4) in project scenario
$MD_{BL,y}$	=	The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH_4)
GWP_{CH4}	=	Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4

As the LFG is only feed to the flare, $MD_{project,y}$ can be expressed as below:

$MD_{project,y} = MD_{flared,y}$

Where:

$MD_{flared,y}$ = Quantity of methane destroyed by flaring (tCH_4)

$MD_{flared,y} = (LFG_{flare,y} \times w_{CH4,y} \times D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$

Where:

$LFG_{flare,y}$ = Quantity of landfill gas fed to the flare(s) during the year (Nm^3)

$w_{CH4,y}$ = Average methane fraction of the landfill gas as measured during the year (m^3 CH4/m^3 LFG)

D_{CH4} = Methane density (tCH_4/m^3CH_4). At standard temperature and pressure (0° Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4/m^3 CH_4.

$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year y (tCO_2e) determined following the procedure described in the Tool to determine project emissions from flaring gases containing methane.

GWP_{CH4} = Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4

Flow meter readings are adjusted using an error calculation procedure *Plot error curve showing the effects of gas composition change in flow meter t-mass 65 using the Applicator*, following manufacturer indications to adjust the flow considering the gas composition.

Error(%)= A*(%CH4)2 + B*(%CH4) + C

Adjusted $LFG_{flare,y}$ = $LFG_{flare,y}$ * (1 + Error(%))

Where:

A= 2,70, B=-2,08, C=0,35

For the amount of methane destroyed in the baseline scenario, the following equation is used:

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

AF = % Adjustment factor expressed as a percentage.

The adjustment factor (AF) was recalculated according ACM0001 v8 and the latest version of *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site* available at the time of submission of the Monitoring Report version 1.

As per ACM0001 v8 page 7. Using Option 1 (Step 2)

AF= ε_{BL} / ε_{PR} = 2.3% / 52% = 4.4% ~= 5% conservatively

ε_{PR}= $MD_{project1}/MG_{PR,1}$ = 814.1 / 1572=52%

Where:

ε_{PR} = Destruction efficiency of the system used in the project activity that will remain fixed for the whole crediting period (fraction)

$MD_{project,1}$ = Amount of methane destroyed by the project activity during the first year of the project activity (tCH_4)

$MG_{PR,1}$ = Amount of methane generated during the first year of the project activity estimated using the actual amount of waste disposed in the landfill as per the latest version of the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site,* (tCH_4).

ε_{PR} is monitored during the first year of the project activity and remains fixed for the crediting period. The project activity started on March 2008 (commissioning date, see A.1) and the crediting period started on October 2009. However, during 2008 the monitoring system had several periods of downtimes, and the monitoring system was not working on a continuous basis. Thus, the yearly aggregated results (until July 2009) are not reliable. Thus, for calculation of AF, the period July2009-June2010 has been used, when the monitoring system is considered fully implemented with minor downtime periods.

ε_{BL}=2.3% Destruction efficiency of the baseline system (fraction), calculated as per the CDM registered PDD page 18 and 19 (see also parameter: Regulatory requirements relating to landfill gas projects).

The calculation of baseline emissions applying actual values and including formulae used is included in the VER Workbook.

4.2 Project Emissions

Project emissions of the flare were calculated as per *Tool to determine project emissions from flaring gases containing methane.*

$$PE_{flare,y} = \sum_{i=1}^{8760} TM_{RG,h} \times (1-\eta_{flare,h}) \times \frac{GWP_{CH4}}{1000}$$

Where:

$PE_{flare,y}$	=	Project emissions from flaring of the residual gas stream in a year y (tCO_2e)
$TM_{RG,h}$	=	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$/_{flare,h}$	=	Flare efficiency in hour *h* (fraction or %), 0%, 50% or 90% according to the Tool conditions.

The mass flow rate of methane in the residual gas is calculated as follows:

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n}$$

Where:

$FV_{RG,h}$	=	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h* (Nm^3/h)
$fv_{CH4,RG,h}$	=	Volumetric fraction of methane in the residual gas on dry basis in hour *h* (fraction or m^3 CH_4/m^3 LFG)
$\rho_{CH4,n}$	=	Density of methane at normal conditions kg/Nm^3 (0.7168).

Please notice that project emission from flaring methane are not included in the PE of the project. They are used in the BE calculation as per the applicable methodology.

Project emissions of Electricity Consumption were calculated as follows:

$PE_y = PE_{EC,y}$

Where:

PE_y	=	Project emissions in year *y*;
$PE_{EC,y}$	=	Emissions from consumption of electricity in the project case. The project emissions from electricity consumption ($PE_{EC,y}$) are calculated following the latest version of *Tool to calculate baseline, project and/or leakage emissions from electricity consumption*.

$PE_{EC,y} = EC_{PJ,y} \times EF_{grid,y} \times (1 + TDL_y)$

$PE_{EC,y}$	=	Project emissions from electricity consumption by the project activity in year *y* (tCO_2/yr)
$EC_{PJ,y}$	=	Quantity of electricity consumed by the project activity in year *y* (MWh)
$EF_{grid,y}$	=	Emission factor for the grid in year *y*; (0.523 tCO_2/MWh)
TDL_y	=	Average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site (10%).

The calculation of project emissions applying actual values and including formulae used is included in the VER Workbook.

4.3 Leakage

No leakage effects need to be accounted under this methodology.

4.4 Summary of GHG Emission Reductions and Removals

Emission reductions generated during the VCS monitoring period (01 March 2008 – 05 October 2009) are equal to the difference in the Baseline Emissions and the Project Emissions, or:

$ER_y = BE_y – PE_{EC,y}$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)
BE_y = Baseline emissions in year *y* (tCO_2e/yr)
$PE_{EC,y}$ = Project emissions from electricity consumption in year *y* (tCO_2/yr)

2008 Emission Reductions	Symbol	Amount	Unit	Remarks
Baseline Emissions	BE_y	7,989	tCO_{2e}	1
Project Emissions	PE_y	22	tCO_{2e}	2
Leakage Emissions	LE_v	-	tCO_{2e}	3
Total emission reductions	ERs	7,967	tCO_{2e}	4

2009 Emission Reductions	Symbol	Amount	Unit	Remarks
Baseline Emissions	BE_y	10,027	tCO_{2e}	1
Project Emissions	PE_y	21	tCO_{2e}	2
Leakage Emissions	LE_v	-	tCO_{2e}	3
Total emission reductions	ERs	10,006	tCO_{2e}	4

Remarks

1. $BE_y = (MD_{project,y}-MD_{bl,y})*GWP_{CH4}$
2. $PE_y = PE_{EC,y} = EC_{PJ,y}*CEF_{grid}*(1+TDL_y)$
3. $LE_y=0$
4. $ERs=BE_y-PE_y$

with y=2008 or 2009

5 ADDITIONAL INFORMATION

Not applicable.