CER MONITORING REPORT

REGIONAL LANDFILL PROJECTS IN CHILE

CDM registration reference number 1435

Monitoring period: 4 July 2008 to 30 September 2008

Date of report: 1 October 2008

Version 1

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Objectives

The purpose of this Monitoring Report is to quantify the amount of Greenhouse Gas Emission Reductions (ER) achieved, in tons of carbon dioxide equivalent (tCO_2eq), to be certified by the Designated Operational Entity (DOE) as per the Kyoto Protocol and CDM Modalities Procedures requirements (decision 17.CP7).

1. General project activity information

1.1. Title of the project activity

Project 1435: Regional landfill projects in Chile

1.2. CDM registration date, crediting period and monitoring period

Registration date: 4 July 2008
Crediting period: 4 July 2008 – 3 July 2018
Monitoring period: 4 July 2008 – 30 September 2008

1.3. Contact details

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1.4. Description of the project activity

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

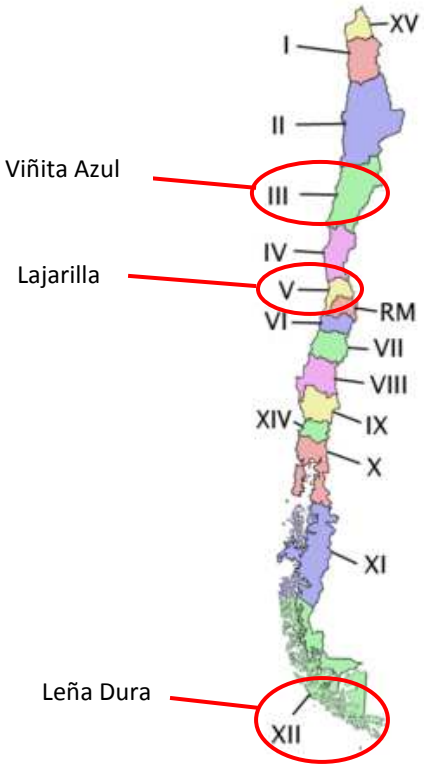

Figure 1 – Location of the project activity

The project activity is based on a landfill gas ("LFG") collection and flaring system, compliant with EU and local regulations. The equipment used in the project activity includes, inter alia:

- a gas collection network, permeable pipes, and vertical gas wells and/or horizontal trenches
- a high temperature enclosed flare (temperature = 1 000°- 1 200°C, retention time > 0.3 s)
- monitoring and control systems to measure the actual flow and composition of the LFG
- civil works

The LFG collection system is composed of a network of vertical wells and/or horizontal trenches and interconnected pipes, and a low pressure is created in the system producing suction for the extraction of the LFG. The LFG extracted is fed into a high temperature flare which enables the methane contained in the LFG to be completely oxidized by the flaring process. The sites are equipped with a monitoring system to measure the flow, the pressure and the temperature. The equipments are connected to the public electricity grid to satisfy their energy needs.

The technology used in the project activity us the HOF*GAS®* extracting and flaring station that has been developed by the Swiss Hofstetter Umwelttechnik company, which is regarded commonly as one of the world's leading companies in landfill gas flaring solutions.
We use the complete extracting + flaring unit with the following particulars:

- the complete degassing unit is built in a ventilated container, providing securities against any weather or burglary risks and which would prove beneficial for noise reduction;

- safe and low emission combustion is guaranteed by a high temperature flare;
- safety devices:
    - EEX motor;
    - flame arrester;
    - slam shut valve;
    - burner control with UV detector.
- gas flow rate could be anything between 40 and 2 500 Nm^3/h, with associated burners between 200 and 12 500 kW.

1.5.Methodology and tools applied to the project activity

Methodology ACM0001 version 05, "*Consolidated baseline and monitoring methodology for landfill gas project activities*", has been applied to this project.
The other methodological tools used are:

- Tool for the demonstration and assessment of additionality (version 3)
- Tool to determine project emissions from flaring gases containing methane (version 1)
- Tool to calculate project emissions from electricity consumption (version 1)
- Tool to calculate project or leakage CO_2 emissions from fossil fuel consumption (version 1)

2. MONITORING PLAN

2.1.Gas extraction and flaring equipment

The degassing system consists in one unit of type HofGas – Ready 600, n° K10017, built in 2007. Provider of the unit is the company Hofstetter Umwelttechnick AG, Munchringgenstrasse 12, 3324 Hindelbank, Switzerland (www.hofstetter.ch).

This model is a proven technology according to the EU and Chilean requirements. Certificate of Conformity of the unit was signed on 10/08/2007.

The main elements of the unit are: (see Figure 2 - Flare Unit)

- a flare station
- a pump station
- a monitoring unit

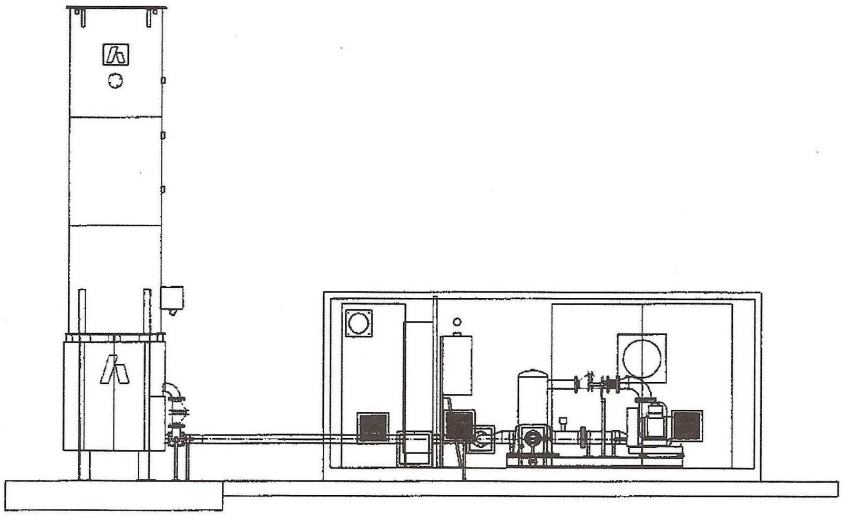

Figure 2 - Flare Unit

2.2.Monitoring approach

The parameters used for determining the project emissions from flaring ($PE_{flare,y}$) will be monitored as per the *Tool to determine project emissions from flaring gases containing methane*:

- $fv_{i,h}$: volumetric fraction of component *i* in the residual gas in the hour *h* where *i* = CH_4 (already considered as $w_{CH4,y}$, above – as a simplified approach the CH_4 will be measured and the remaining part will be considered N_2);

- $t_{O2,h}$: volumetric fraction of O_2 in the exhaust gas of the flare in the hour h, continuous measurements will be done in the future;
- $fv_{CH4,FG,h}$: concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h, continuous measurements will be done in the future.

If it proves technically or financially not possible to monitor flare efficiency, a default Flare Efficiency (FE) of 90% will be used when the compliance with manufacturer's specification will be achieved and a Flare efficiency of 50% will be used if the flare temperature is out of the specified limits. In order to monitor the compliance with the manufacturer's specifications the combustion temperature of the flare will be measured continuously.

2.3.Monitoring equipment

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

N°	Instrument	Data monitored
1	Flowmeter	**$LFG_{flare,y}$** Volume of gas sent to the flare **T** Temperature of the LFG **P** Pressure of the LFG
2	LFG Gas analyzer	**$w_{CH4,y}$** Fraction of methane in LFG
3	Thermocouple	**T_{flare}** Temperature of the flare
4	Electricity meter	**EC_y** Electricity consumed by the equipment
5	Exhaust gas analyzer (when feasible)	**$fv_{CH4,FG}$** concentration of methane in the exhaust gas

The different instruments send their data to the data logging device (the MemoGraph).

2.4.Data logging technology

The data from the instruments will be collected in MemoGraph (type: Visual Data Manager, Provider: Endress+Hauser), equipped with a Compact Flash card of 256 MB for the archive. The unit comes also with a preinstalled copy of software ReadWin2000 (from Endress+Hauser), that is used for the configuration and display of the MemoGraph.
The system also offers 2 different ways of communication for output:

- USB Interface
- Modem transmission, using either protocol RS232, protocol RS485 or Ethernet Interface

The MemoGraph is secured by means of a seal so the displayed value is true and protected against manipulation.

The Monitoring unit collects the following parameters from the flare unit every minute: (see Table 1 - Example of Monitoring Output)

- Date & Hour:Min of the measure
- Status validity of the measure
- Average Gas Pressure in degree in mbar.
- Average Gas concentration in Methane (CH_4).
- Normalized gas Flow in Nm^3/h.
- Gas concentration in Oxygen (O_2).
- Average Gas Temperature in degree Celsius.
- Average Flare Temperature in degree Celsius.

Date/Time	Status	Pression Average mbar	CH4 Average %	FLUJO Average NM3/h	O2 Average VOL%	T Antorcha Average °C	T Gas Average °C
17/12/2007 13:32	OK	80	49	500.1	2.5	1223	37
17/12/2007 13:33	OK	80	49	499.8	2.5	1196	37
17/12/2007 13:34	OK	80	49	499.6	2.5	1165	38
17/12/2007 13:35	OK	80	49.1	499.5	2.5	1114	38
17/12/2007 13:36	OK	80	49	499.5	2.5	1170	38
17/12/2007 13:37	OK	80	49	499.5	2.5	1137	38
17/12/2007 13:38	OK	80	49	499.4	2.5	1141	38
17/12/2007 13:39	OK	80	48.9	499.3	2.5	1129	38

Table 1 - Example of Monitoring Output

The data are recorded on spreadsheet file with a predefined format. The file is then directly used for the monitoring report.

2.5.Data transmission & processing

All parameters mentioned above are processed according to the following methodology:

a) Automatic transmission:

The MemoGraph is configured to communicate data by modem once a day. The results are sent using a direct dedicated phone line to a dedicated server machine that is physically installed in the office of Bionersis in Santiago. The Monitoring Director is controlling that process is functional.

b) Manual transmission:

If automatic transmission failed, the Monitoring Director will contact directly the monitoring unit from the server to collect the data.

c) Physical Logging:

If manual transmission, the Monitoring Director will send a technician physically at site location to output data using the USB interface. These data will be then be sent back to the office and recorded on the server.

d) If all options above do not work, the following procedures will be used:

1. If data can be retrieved subsequently, they will be reintegrated on the server.
2. If data cannot be retrieved, no emissions reductions will be claimed for the period of data failure.

2.6.Data storage

- All data will be stored physically on the disk of the server machine.
- A daily backup of the server will be done.
- A copy of the backup on a portable electronic storage device will be held securely at the Bionersis office in Santiago.

Copies of the files will be stored up to two years after the end of the crediting period of the project.

2.7.Calibration and maintenance procedures

Instrumentation will be calibrated as recommended by manufacturers.
The critical calibration frequency and procedures are detailed below:

A) Flow Meter
The flow meter will be subject to a regular maintenance and verified once a year by an external certified company, recommended by the meter manufacturer.

B) Gas Analyzer
The gas analyzer is calibrated every month according to its calibration protocol by a qualified operator. The calibration gases will be purchased from certified gas suppliers. All gas cylinders will be provided with a quality certificate.

C) Temperature and Pressure of the LFG
The temperature and pressure meters will be calibrated annually by an independent third-party.

D) Temperature of the flare
The thermocouple will be checked annually by an independent third-party

E) Electricity meters
The reading from electricity meters will be cross-checked annually with the invoices from and to the national grid company. Electricity meter will measure inflow from the grid (energy imported for the plant consumption) and outflow to the grid (electricity delivered to the grid)

F) General malfunction of equipment
If the equipment (flow meter, gas analyzer, gauge, controller, MemoGraph, etc.) fails, the equipment supplier will be immediately notified. If possible, repairs will be carried out. If the damaged equipment cannot be repaired, it will be replaced at the earliest by the same or an equivalent unit. In some cases, portable tools will be used in order to carry out daily monitoring of the missing parameter(s). This data will be recorded on paper.

G) Fuel consumption

The degassing unit of Leña Dura will use a diesel generator, hence fuel consumption will be checked at the end of each monitoring period with the invoices.

ID Number	Data Variable	Source of Data	Data Unit	Recording Frequency	Calibration Method and Frequency	Alternative procedure in case of failure
LFG flare,y	Total amount of landfill gas flared	Flowmeter	m3	every minute	Annualy by external expert	N/A (data lost)
Wch4,y and Fvi,y	Fraction of the component i in measured gas	Gas Analyzer	m3 of i / m3 of gas	every minute	Monthly	Manual measurements will be taken using and infrared portable device
T	Temperature of the landfill gas	Temperature Gauge	Celsius	every minute	Annualy	N/A (data lost)
P	Pressure of the landfil gas	Pressure Gauge	Pa	every minute	Annually	N/A (data lost)
Tflare	Temperature of the flare	Thermocouple	Celsius	every minute	Annually	N/A (data lost)
EC	Electricity consumed	Electricity meter	MWh	monthly	Annually	Manual reading and logging
FC	Fuel consumption (diesel)	Provider invoice	Liter	end of each monitoring period	Annually	N/A

Table 2 – Instrumentation calibration

2.8.Managerial responsibilities

The CDM aspects of the project are managed by the Director of Carbon Finance of LA Global Carbon Trading Company Limited, based in Cyprus.
The monitoring plan is the responsibility of the Monitoring Director of the project, who reports to the Director of Carbon Finance for CDM matters (preparation of monitoring report) and to the COO for operational matters.
The Maintenance Director supervises the calibration procedure.

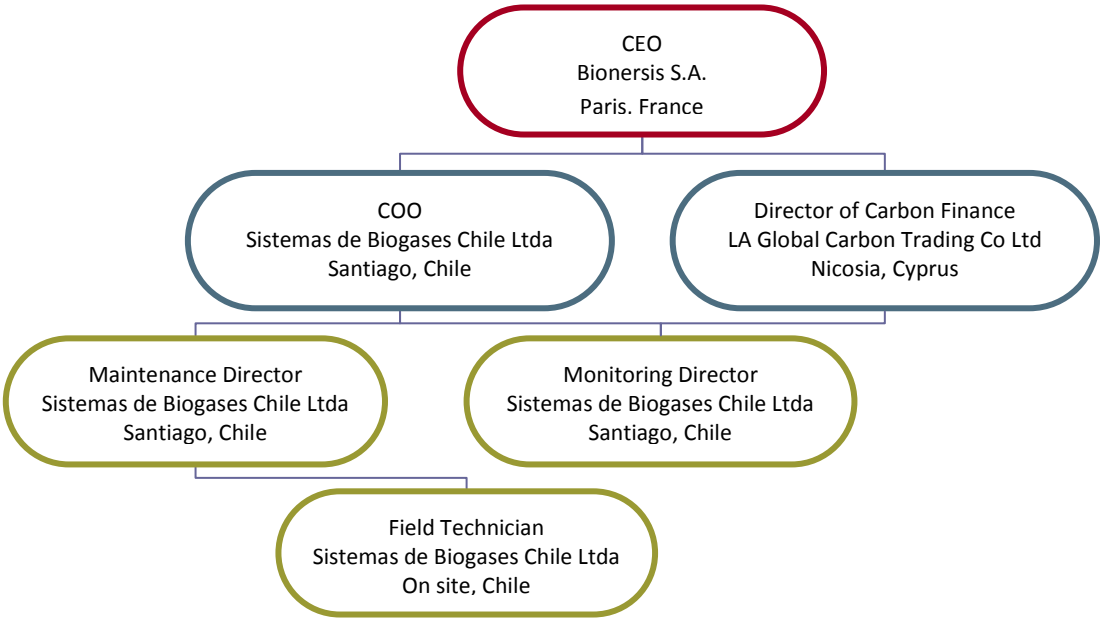

Figure 3 – Managerial organization

2.9. Quality assurance & quality control

- The monitoring director of the project will be in charge of and accountable for the generation of the monitoring, logging and record keeping of all monitoring data.
- The monitoring director will officially sign off on all worksheets used for the recording of monitoring data.
- The director of carbon finance will be in charge of compiling the monitoring report. As such, he will be allowed to control consistency of monitored data by any means, such as on-site audit, visual control of data existence 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.
- Proper management processes and systems records will be kept by the monitoring director. The auditors can require copies of such records to judge compliance with the required management systems.

2.10. Training of monitoring personnel

Employees involved in the monitoring will be trained internally and/or externally. Training will include:

a) Review of equipment and captors
b) Calibration requirement
c) Configuration of monitoring equipment
d) Maintenance requirement

3. FORMULAS AND PARAMETERS USED FOR CALCULATIONS

3.1.Formulas

Emissions reduction (ER_y)

As specified by the methodology ACM0001 version 5, the CO_2e emissions reduction shall be calculated as follows:

$$\mathbf{ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_y * CEF_{electricitry,y} - ET_y * CEF_{thermal,y}}$$

Where:

ER_y	Emission reduction in a given year y, in tonnes of CO_2 equivalent (tCO_2e)
$MD_{project,y}$	Amount of methane that would have been destroyed/combusted by the project activity during the year, in tonnes of methane (tCH_4)
$MD_{reg,y}$	Amount of methane that would have been destroyed/combusted during the year in the absence of the project, 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
EL_y	Net quantity of electricity exported during year y, in megawatt hours, in MWh
$CEF_{electricity,y}$	CO_2 emissions intensity of the electricity displaced, in tCO_2e/MWh
ET_y	Incremental quantity of fossil fuel, defined as difference of fossil fuel used in the baseline and fossil fuel used during project, for energy requirement on site under project activity during the year y, in TJ
$CEF_{thermal,y}$	CO_2 emissions intensity of the fuel used to generate thermal/mechanical energy, in tCO_2e/TJ

No energy is produced in the project activity, and since there is no methane destroyed for electricity or thermal energy generation, all the methane destroyed is the one destroyed by flaring, the above formulae can be simplified as follows:

$$\mathbf{ER_y = (MD_{flare,y} - MD_{reg,y}) * GWP_{CH4}}$$

Methane destroyed by flaring (MD_{flare})

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

Where:

$LFG_{flare,y}$	Quantity of landfill gas flared during the year measured in cubic meter (m^3)
w_{CH4}	Average methane fraction of the landfill gas
D_{CH4}	Methane density in CH_4/m^3CH_4
$PE_{flare,y}$	Project emissions resulting form flaring in year *y*

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

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

Where AF is an adjustment factor set to 4%.

Project emissions resulting from energy consumption ($PE_{PR,y}$)

In the case of Lajarilla and Viñita Azul, project activity will use electricity from the grid, hence project emissions resulting from energy consumption will be calculated as per the *Tool to calculate project emissions from electricity consumption*:

$$\mathbf{PE_{PR,y} = EC_y * CEF_{electricity,y}}$$

Where:

$EC_{,y}$	Electricity consumed by the project activity

In the case of Leña Dura, project activity will use a diesel generator, hence project emissions resulting from energy consumption will be calculated as per the *Tool to calculate project or leakage CO_2 emissions from fossil fuel consumption*:

$$\mathbf{PE_{PR,y} = FC_{diesel,y} * NCV_{diesel} * EF_{diesel}}$$

Where:

$FC_{,diesel,y}$	Fuel (diesel) consumed by the project activity during year *y* (in liter)
$NCV_{,diesel}$	Net calorific value of diesel (in MJ/liter): IPCC default value 43 MJ/liter
$EF_{,diesel}$	CO_2 emission factor of diesel (in tCO_2/TJ): IPCC default values 74.1 tCO_2/TJ

Project emissions resulting from flaring ($PE_{flare,y}= \eta_{flare,h}$)

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*.

The manufacturer's specifications that is applied is the condition on LFG flow: $LFG_{flare,h}$ > 40 m3/h

3.2.Parameters

Fixed parameters applied

GWP_{CH4}	Global warming potential of CH_4	21	tCO_2e / tCH_4
$CEF_{electricity,y}$	CO_2 emissions intensity of the electricity consumed by the project activity – electricity imported from the grid	1.3	tCO_2e/MWh
EF_{diesel}	CO_2 emissions factor of diesel (Leña Dura)	74.1	tCO_2/TJ
NCV_{diesel}	Net calorific value of diesel (Leña Dura)	43	MJ/l
AF	Adjustment factor	4	%

Input LFG / output LFG

The data collected by the MemoGraph are displayed via ReadWin2000, with a precision of a minute (see paragraph 2.4).

Table 3 - Example: Leña Dura, 1st August 2008 00:00:00 and 00:00:01

Date	Time	State	Pressure (mbar)	CH_4 (%)	Flow (Nm^3/h)	O_2 (%)	Tflare (°C)	Tgas (°C)
01/08/08	00:00:00	OK	31	36.1	367.2	1.2	1109	28
01/08/08	00:01:00	OK	31	36.1	366.6	1.2	1107	28

The average methane fraction of the landfill gas in the hour h ($w_{CH4,h}$) is calculated from the average methane fraction of the landfill gas every minute compounded with the LFG flow in the same minute. $LFG_{flare,h}$ is the average flow of LFG in the hour *h*.

Table 4 - Example: Leña Dura, 1st August 2008 0:00 and 1:00

Date/Time	$w_{CH4,h}$ (%)	$LFG_{flare,h}$ (m3)	$\eta_{flare,h}$	$MD_{flare,h}$ (tCH_4) = $LFG_{flare,h}$*$W_{CH4,h}$*$\eta_{flare,h}$ *D_{CH4}
8/1/2008 0:00	36.1	365.1	0.9	0.085
8/1/2008 1:00	36.2	361.0	0.9	0.084

Input FC_{diesel}

Diesel consumption (FC_{diesel}) on the considered period is calculated from the provider invoices.

Output CER

As stated in the above formulae in paragraph 3.1, the emission reductions are calculated as follows:

Table 5 - Example: Leña Dura, August 2008

$MD_{project}$ (tCH4)	**MD_{reg} (tCH4)**	**PE_{PR} (tCO2e)**	**Leakage**	**Total emission reductions (tCO_2e)**
$MD_{project} = MD_{flare}$	$MD_{reg} = MD_{project} * AF$	$PE_{PR} = FC_{diesel} * NCV_{diesel} * EF_{diesel}$	N/A	$ER_y = (MD_{project} - MD_{reg}) * GWP_{CH4} - PE_{PR}$
54.81	2.19	22.20	0.00	**1082.82**

4. CER VOLUMES REQUESTED FOR THE MONITORING PERIOD

Calculation results

	Emission reductions (tCO_2e)		
	Leña Dura	Lajarilla	Viñita Azul
04/07/2008 – 31/07/2008	994	0	0
01/08/2008 – 31/08/2008	1 083	0	0
01/09/2009 – 30/09/2009	1 242	0	0
Total emissions reduction monitoring period	**3 319**	**0**	0

ANNEX 1 – MONITORING SHEETS

Site of leñadura

From 04-07-2008 00:00 to 31-07-2008 23:59				
$MD_{project}$ (tCH4)	**MD_{reg} (tCH4)**	**PE_{PR} (tCO2e)**	**Estimation of leakage (tCO_2e)**	**Total emission reductions (tCO_2e)**
$MD_{project} = MD_{flare}$	$MD_{reg} = MD_{project} * AF$	$PE_{PR} = FC_{diesel} * NCV_{diesel} * EF_{diesel}$	N/A	$ER = (MD_{project} - MD_{reg}) * GWP_{CH4} - PE_{PR}$
50.33	2.01	20.05	0.00	**994.60**

From 01-08-2008 00:00 to 31-08-2008 23:59				
$MD_{project}$ (tCH4)	**MD_{reg} (tCH4)**	**PE_{PR} (tCO2e)**	**Estimation of leakage (tCO_2e)**	**Total emission reductions (tCO_2e)**
$MD_{project} = MD_{flare}$	$MD_{reg} = MD_{project} * AF$	$PE_{PR} = FC_{diesel} * NCV_{diesel} * EF_{diesel}$	N/A	$ER = (MD_{project} - MD_{reg}) * GWP_{CH4} - PE_{PR}$
54.81	2.19	22.20	0.00	**1082.82**

From 01-09-2008 00:00 to 30-09-2008 23:59				
$MD_{project}$ (tCH4)	**MD_{reg} (tCH4)**	**PE_{PR} (tCO2e)**	**Estimation of leakage (tCO_2e)**	**Total emission reductions (tCO_2e)**
$MD_{project} = MD_{flare}$	$MD_{reg} = MD_{project} * AF$	$PE_{PR} = FC_{diesel} * NCV_{diesel} * EF_{diesel}$	N/A	$ER = (MD_{project} - MD_{reg}) * GWP_{CH4} - PE_{PR}$
62.67	2.51	21.48	0.00	**1241.88**