Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia

(UNFCCC Registration No. 2467)

CDM MONITORING REPORT (1st Report)

Monitoring Period: 28th August 2009 – 28th February 2010

Doc. Version: Version v1.1

Report Submitted on: 15 April 2010

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Executive Summary

The project "Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia" was registered (no. 2467) with the UNFCCC as a CDM project on 28th August 2009. This first CDM Monitoring report documents the emission reduction activities and monitoring carried out from 28th August 2009 to 28th February 2010 (first 6 months of the crediting period).

Implemented Activities

A CDM monitoring team was set up. Formal training was given to the on-site staff to carry out data collection and recording, documentation storage and operating the monitoring equipments/instruments.

During the first 6-month monitoring period, landfill gas extraction and flaring was implemented in the first cell (Advance Cell) of the sanitary landfill. Gas extraction and flaring of landfill gas (LFG) were monitored continuously by the CDM monitoring team according to the monitoring plan as described in the registered PDD.

During the reporting period, the project developer had also initiated the construction of gas extraction and flaring system at its second cell (referred to as Phase 1 cell). Gas extraction and flaring is expected to initiate in Phase 1 cell in July 2010.

For power generation, the project developer has applied for the license to generate power from renewable energy (landfill gas) under the Small Renewable Energy Power Program (SREP) from the Energy Commission of Malaysia. The approval for SREP for power supply generation to national grid operated by Tenaga Nasional Berhad (TNB) was obtained on 12 January 2010. Negotiation with TNB on interconnection details as well as power purchase agreement initiated end of January 2010.

KBE had also completed a tendering exercise for construction and supply of a LFG power generation system to be located next to the flaring system located at the Advance cell. The contract was yet to be awarded by time of this report and the power generation system is expected to be commissioned only by end of 2010 or first quarter of 2011. The delay in implementation was mainly due to the lengthy delay in authority approval for the SREP application, which is beyond the control of the project owner. The power produced from its recovered LFG will be used to supply the landfill's own electricity demand, while any excess electricity will be sold to the national grid when approved.

Monitoring Activities

The CDM monitoring plan was implemented for the project where parameters were monitored based on the monitoring methodology prescribed by ACM 0001 ver. 8. Automatic recording of data (at the flare system) were performed by the data logger while manual data recording were carried out by the on-site staff using standard forms regularly. Manual records were updated in soft copies every week and stored in the database system.

The calibration of equipments installed and used were valid and according to the manufacturer's requirement during the monitoring period. As part of the QA/QC of the monitoring plan, the format for data/info documentation had been established and formal training had been given to the on-site staff to carry out data collection and recording, documentation storage and operating the monitoring equipments/instruments.

Emission Reduction

Baseline emissions (BE) for the project activity were only related to the capturing of landfill gas that was destroyed in the high temperature enclosed flare. No baseline emission from the grid electricity replaced during this reporting period as power generation plan from landfill gas was delayed.

Project emissions (PE) were resulted from the flaring (PE_{flare}) and emissions from grid electricity consumed by the gas extraction and flaring system (PE_{EC}).

The emission reduction (ER) as a result of the flaring were calculated to be 43,059 tCO_2e for the monitoring period reported in this report.

TABLE OF CONTENTS

CONTENTS

ANNEXES

Introduction

The Bukit Tagar Sanitary Landfill (BTSL) begun its operation in April 2005 and was designed to receive 3,000 mt/day of municipal solid wastes (hereafter referred as solid waste) for up to 40 years. BTSL is one of the very few sanitary landfills in Malaysia that achieves Level 4 (highest level) of the United States Environmental Protection Agency rating for sanitary landfill. BTSL started landfilling waste into the first cell (hereafter referred as Advanced Cell) from 2005 and the Advanced Cell was closed in November 2007. The Advanced Cell accumulated around 1.43 million tonnes of municipal waste. The current operating cell (known as Phase 1 cell) started to receive solid waste in November 2007 and up to date, has received around 1.8 million tonnes of solid waste.

KUB-Berjaya Enviro Sdn. Bhd. (KBE), the operator for BTSL, realised its potential to recover the landfill emitted gas (LFG) and harness its power to produce renewable energy for own use as well as export to the national grid. Not only will this project be able to help reduce greenhouse gas emissions from landfill, but electricity can be produced from utilising the recovered LFG. KBE has initiated the application for a power generation license from the Malaysian Government and to apply this project under the Small Renewable Energy Power Program (SREP) to supply electricity to the national grid. SREP is a national incentive programme to encourage renewable energy development in Malaysia. The project also contributes to the improvement of local environment as well as created employment and business opportunities.

The above undertaking is only feasible with CDM financing. KBE submitted their Project Design Document to the UNFCCC Executive Board for the application for CDM project registration in 9 December 2008 and the project was registered by the UNFCCC on 28th August 2009.

SECTION A. PROJECT BACKGROUND AND IMPLEMENTATION

A.1. Title of the project activity:

Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia.

A.2. UNFCCC registration number:

This project was registered on 28th August 2009 and its UNFCCC registration number is 2467.

The crediting period was decided to be 7 years from 28th August 2009 – 27th August 2016 (renewable).

A.3. Short description of the project activity:

The Bukit Tagar Sanitary Landfill is operated by KUB-Berjaya Enviro Sdn. Bhd. (KBE) and located in Hulu Selangor of Malaysia. The landfill receives municipal solid wastes from the country's capital Kuala Lumpur and Selayang district in Selangor State.

The main objective for the CDM project is to avoid direct emissions of greenhouse gasses from the landfill into the atmosphere through active extraction. The gas collected will be either destructed by high temperature enclosed flare or utilised for power generation using gas engine.

The host country for this project is Malaysia. The project participants are:

1. KUB Berjaya Enviro Sdn. Bhd., Malaysia (Focal point)
2. Japan Carbon Finance, Ltd., Japan.

The main contractor for the landfill gas extraction and flaring for advanced cell is:
Q2 Engineering Sdn. Bhd. (wholly owned by Q2 A/S, Denmark)
Address: Unit 6-09, Block E, Phileo Damansara 1
No. 9, Jalan 16/11, Off Jalan Damansara
46350, Petaling Jaya, Selangor
Tel : +60 3 7665 3788
Fax : +60 3 7665 3799
Email : Q2@Q2.com.my
Contact Person : Mr. Frans Teisen / Mr. Low King Hseng

A.3.1. Project Implementation

For the reporting period of 28th August 2009 to 28th February 2010, the key CDM activities implemented are as follows:

A.3.1.1. Gas Extraction System in Advance Cell

Q2 Engineering Sdn. Bhd., a subsidiary of Q2 A/S of Denmark, was appointed turnkey contractor to construct the gas extraction and flaring system for Advanced Cell. Vertical gas extraction pipes were installed in the landfill to extract the landfill gas (LFG). These wells are connected to 8 units of main gas collection pipes that lead to the LFG Flaring system.


Figure 1. Example of Vertical Well Installed

These vertical wells can be individually regulated and control.

A.3.1.2. High Temperature Enclosed Flaring System for Advance Cell (first cell)

One unit of high temperature enclosed flare system had been installed at the Advanced Cell. The flare system includes a containerised blower and flaring system with a maximum capacity to flare off 2,500 m^3/hr landfill gas.


Figure 2. Enclosed Flare Installed at Advanced Cell

The details of the flare specifications are listed as follows:

Specifications	Details
Manufacturer	Fairyland Environmental Technology, China
Gas Flow	Maximum – 2,500 Nm^3/hr
Retention time	>0.3 seconds at 800-1,000^oC
Gas Blower	Twin-lobe roots blower
Gas analysers	Gas analysers for CH_4, O_2 and CO_2

The gas extraction and flaring was tested and operated since July 2009. Actual implementation of the flaring was initiated in August 2009.

A.3.1.3. Gas Extraction and Flaring in Phase 1 (second cell)

The project tender for gas extraction and flaring for Phase 1 Cell was called in September 2009 and the contract has been awarded to Tai Hoe Engineering Sdn. Bhd. on 15th December 2009. A series of horizontal gas extraction wells will be constructed for the entire Phase 1 Cell. The site possession date was 2nd January 2010 and the physical works started on 22 January 2010.

No flaring activities were implemented at Phase 1 for this reported monitoring period as the flaring system in Phase 1 has not been completed.

A.3.1.4. Power Generation

Power generation and export from the site requires the approval from governmental authorities as well as the power utility company in Malaysia. KBE applied this project already since September 2008 under the Small Renewable Energy Power Program, an incentive programme offered by the Government of Malaysia to encourage renewable energy power generation and sells to the energy grid operated by Tenaga Malaysia Berhad[1] (TNB).

The plan at Bukit Tagar was to install a 1 MW gas engine to generate electricity from the collected LFG. The electricity generated will be utilised for on-site landfill operations while any excess electricity will be sold to the national grid. KBE has called for tender for power generation system for the Project and the contract was yet to be awarded at time this report was prepared. The duration for the construction and commissioning of the power generation system will take approximately 11 months.

For this monitoring period, no power was generated from the landfill gas captured.

The plan for power generation has been delayed primary due to the lengthy and slow approval process from the relevant authorities (detail timeline is shown next page). The approval was officially given to Bukit Tagar project on 24 November 2009. The official notification letter was finally received on 12 January 2010. Negotiation of a Renewable Energy Power Purchase Agreement has been initiated with the power utility Tenaga Nasional Berhad Malaysia. A power generating license has yet to be issued at time of the completion of this report.

A power system study shall be conducted by the Tenaga Nasional Berhad Energy Services (TNBES) to determine the requirements needed to be fulfilled by BTSL power generation system on-site. The study would be completed tentatively on 30 April 2010 and forwarded to Tenaga Nasional Berhad Distribution (TNBD) for review and approval. The Renewable Energy Power Purchase Agreement

[1] TNB is the main power utility company operating the entire grid power distribution in Peninsula Malaysia.

(REPPA) shall be negotiated between KBE and TNB based on the findings of the power system study. The initial plan was to install a 1 MW gas engine to generate electricity from the collected LFG. The electricity generated will be utilised for on-site landfill operations while any excess electricity will be sold to the national grid. KBE has called for tender bidding for power generation system for the Project and the contract is expected to be awarded April 2010. The duration for the construction and commissioning of the power generation system will take approximately 11 months and expected to supply power to TNB by the early 2011.

The timeline for power generation implementation for BTSL project activity is tabulated below:

Date/ Duration	Process Description	Details & Status
25 Sept 2008 – 16 Dec 2008	Application for SREP sent to the Energy Commission Malaysia (EC)	- Submission of technical drawings to EC on 25 Sept 2008. - Submission of main single line diagram to EC on 16 Dec 2008.
16 Dec 2008	Preliminary meeting with TNB	- Preliminary meeting with TNB to discuss about the project
7 Jan 2009	Call for meeting with Tenaga Nasional Berhad (TNB)	- Tenaga Nasional Berhad called for a meeting to discuss the commercial sale of the LFG generated power between KBE and TNB on 7 Jan 2009. - TNB requested for the detail design of the power generation project from KBE on 3 March 2009.
24 Mar 2009	Re-submission of SREP form	- Submitted completed SREP application form and BTSL project design
17 April 2009	Acceptance of SREP application	- Energy Commission accepted the SREP application for the project - EC requested for a preliminary technical study between TNB and KBE for the project
3 June 2009	Meeting with TNB for the preliminary technical study	- Presentation to TNB on the project background - Discussion with TNB on requirements for the project and site visit to the project site with TNB officers.
24 Aug 2009	Reply from EC on outcome of the preliminary technical study	- Received reply from EC based on TNB's comments on the study. - EC proposed that the project is viable to supply 1MW electricity to TNB. - KBE replied to EC on 10 Sept 2009.

Date/ Duration	Process Description	Details & Status
18 Nov 2009	Letter of Undertaking for SREP license conditions	- KBE send in their letter of undertaking for conditions of SREP license to EC.
24 Nov 2009	Special Committee On Renewable Energy (SCORE) Meeting to discuss the project	- Approval for the SREP license from SCORE, but pending their official approval letter. - Prepare for Renewable Energy Power Purchase Agrement (REPPA) between KBE and TNB.
12 January 2010	Received Letter of SREP Approval	- Approval of SREP application - Approval to export 1 MW to TNB received. - Prepare for Renewable Energy Power Purchase Agreement (REPPA) between KBE and TNB.
29 January 2010	Negotiation with Power Utility Tenaga Nasional Berhad Malaysia initiated.	- A kick off meeting with TNB was held on 29 January 2010
24 Feb 2010	Power System Study	- Appointed Tenaga Nasional Berhad Energy Services (TNBES) to conduct the study. - Study expected to be completed by 30 April 2010.

SECTION B. CDM MONITORING

B.1. Monitoring Period

The monitoring period reported in this report is from 28th August 2009 until 28th February 2010.

B.2. Methodology applied to the project activity:

B.2.1. Baseline Methodology

The basis of the baseline calculations were based on the approved methodology *ACM0001 ver. 8 – Consolidated baseline and monitoring methodology for landfill gas project activities.*

B.2.2. Monitoring Methodology

The basis of the monitoring plan was formulated based on the approved methodology *ACM0001 ver. 8 – Consolidated baseline and monitoring methodology for landfill gas project activities.*

Following the project registration, the CDM monitoring plan for the project was further detailed and elaborated in the CDM Monitoring Manual (Version 1.4), March 2009. The manual describes in detail the monitoring plan included in the registered PDD v 5.3, dated 23 August 2009.

B.3. Intended deviations or revisions to the registered PDD:

The only intended deviation would be the timing of the installation of the first 1 MW gas engine (Stage 1). On pg. 7 of the registered PDD, v 5.3, the 1 MW gas engine was planned to be implemented by January 2010. However, due to the delay in authority approval (described in detail in A.3.1. pg 4 above), the commissioning of the power generation will only be realised early 2011.

The deviation above are caused by reasons beyond the control of the project owner. The project owner has demonstrated continuous effort to execute the power generation from landfill gas as described above (A 3.1.4).

B.4. Intended deviations or revisions to the registered monitoring plan

There are no deviations or revisions to the monitoring plan (implemented as described in the registered PDD, version 5.3).

Based on the experiences from the weekly calibration over the monitored period, the deviation of errors of the CH_4 analyser was observed to be very minimal and within the specification by the manufacturer. In view of this, the CDM monitoring team, through the second CDM Management Review meeting held on 21st January 2010, decided to revise the weekly calibration to monthly calibration for the next monitoring period (from 1st March 2010). This is still considered very conservative as the manufacturer's recommendation for calibration is only once a year.

Similarly, based on the data captured from 28th August 2009 to 28th February 2010, it can be observed that the continuous recorded data every five seconds is being too excessive and unnecessary. Therefore, it has been proposed to reduce the continuous data logging interval from the current 5 seconds to per minute. This decision was endorsed at the 2nd CDM Management Committee meeting held on 21st January 2010 and will be effective only for the next monitoring period.

B.5. Changes since last verification

Not applicable. This is the first verification request.

B.6. Person(s) responsible for the preparation and submission of the monitoring report:

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SECTION C. KEY MONITORING ACTIVITIES

C.1.0 Data Monitored

The parameters monitored during the monitoring period are illustrated in the following figure:

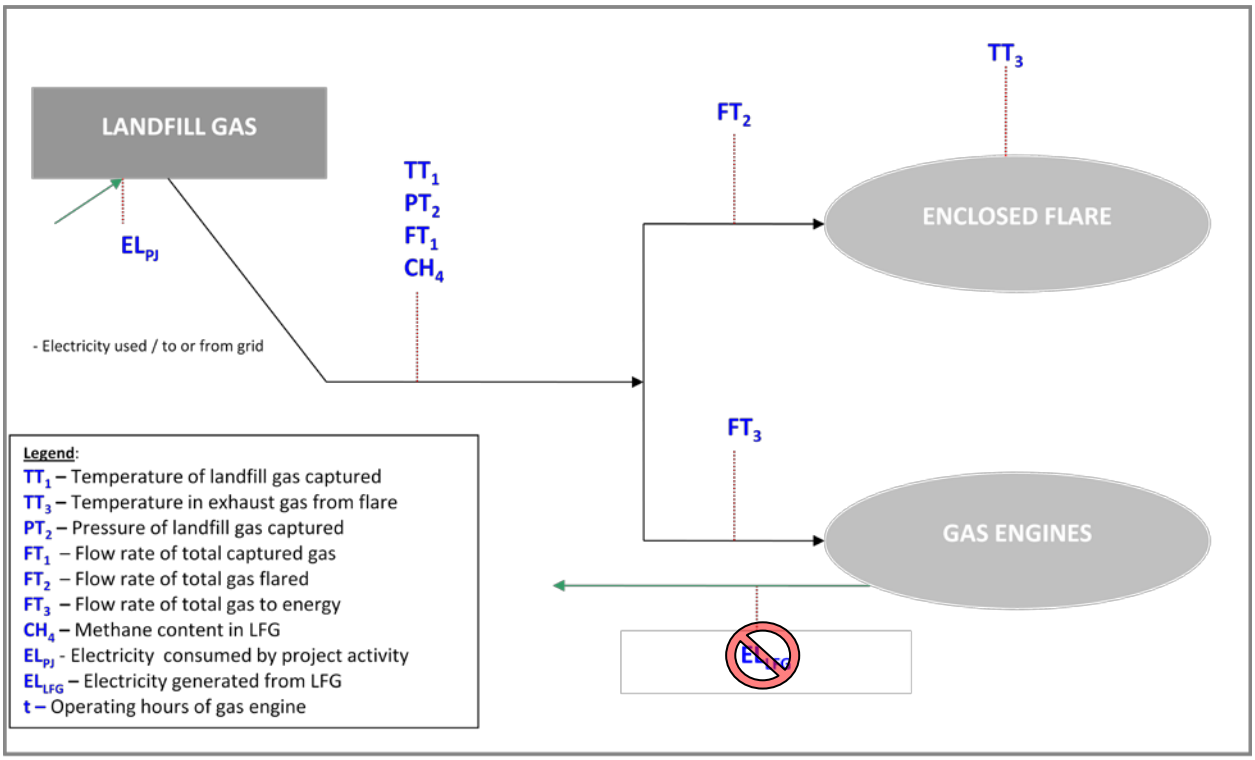


Figure 3. Key Parameters Monitored under CDM Monitoring Plan

As mentioned earlier, no power generation was carried out during the monitoring period and therefore EL_{LFG} (FT_3) was not measured during this monitoring period.

All the other parameters are monitored in accordance to the frequency and method stipulated in the monitoring plan. A summary of the data to be directly monitored are tabulated below:

Table C.1.1. CDM monitoring parameters, frequency and archiving

Parameter	CDM ID	Equipment ID	Monitoring Equipment	Recording frequency	Documentations	Data Archive
Temperature	T	TT_1, TT_3	Thermocouple	Every 5 sec (auto) Daily (manual) – as backup	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet – will be scanned into pdf format for archiving
Pressure	P	PI_3	Pressure Transmitter	Every 5 sec Daily (manual) – as backup	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet – will be scanned for archiving
Flowrate	F	FT_1, FT_2, FT_3	V-Cone Differential Pressure Flowmeter	Every 5 sec Daily (manual) – as backup	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet – will be scanned for archiving
Methane Fraction	W_{CH4}	CH_4	Continuous Infrared Gas Analyser	Every 5 sec Daily (manual) – as backup	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet – will be scanned for archiving

Parameter	CDM ID	Equipment ID	Monitoring Equipment	Recording frequency	Documentations	Data Archive
Electricity consumed by the project	$EL_{PJ,y}$	EL_{PJ}	kWh meter	Daily (manual)	Softcopy Hardcopy	Data recorded will be compiled into MS Excel and aggregated for monthly amount Daily log sheet – will be scanned for archiving

NOTE:
The flow meter used converts the flow automatically to normalised volume (Nm^3), therefore there is no need to convert the measured volume further from the recorded value.

C.2.0. Monitoring equipment

The list of CDM monitoring equipments used is shown below in Table C.2.1.

Figure 4. Flow Meter installed

Figure 5. Gas Analyser for CH_4 fraction measurement

Table C.2.1. Table providing information on the equipment used for CDM monitoring

No.	Item	Equip ID	CDM Monitoring	Brand	Type / Specification	Serial No	Accuracy	Range
1	CH_4 Meter	CH4	$W_{CH_4,y}$	Guardian Plus	Guardian plus, CH_4 0-100%, precision: ± 2% FS	27471	± 2%	0-100%
2	Flow Meter	FT1	$LFG_{total,y}$	Kingsway	KVS10IIKC23FSN, DN250, 304SS	FT119 (8102101)	± 1%	3 - 5000 Nm^3/h
3	Flow Meter	FT2	$LFG_{flare,y}$	Kingsway	KVS10IIKC23FSN, DN250, 304SS	FT120 (8102102)	± 1%	3 - 5000 Nm^3/h
4	Pressure Sensor	PT2	P_{total}	Rosemount	3051TG1A2B21AB4E5Q4, 0-30kPa, Meterage rod+316SS	1873654	± 0.25%	(-10) kPa - 10 kPa
5	Temperature Transmitter	TT1	T_{total}	Honeywell	STT25M-0-EN0 0-100°C, L=150mm, precision: ± 0.025% FS Meterage rod+304SS	b224836437	± 0.5%	0-100°C
6	Temperature Transmitter	TT3	$T_{flare,y}$	Honeywell	STT25M-0-EN0 0-1200°C, L=1000mm, precision: ± 0.025% FS Meterage rod chinaware	b120876837	± 0.5%	0-1200°C
7	Power meter	EL	$EL_{LFG,y}$	Krizik	Type: ET 421 HF612132c - 5(6) A	8383258	± 2%	0-999,999 kWh (x10)

C.2.1. Equipment Calibration

The CDM monitoring equipment (apart from the power or kWh meter) was installed on the 30th April 2009. As the monitoring equipment installed is newly installed, all the equipment certifications were valid and in accordance to the monitoring plan for the monitored period (refer to Table C.2.2 below).

Table C.2.2. Table providing information on calibration record

No	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Last Calibration Date & Cert No.	Recommended Frequency of Calibration
Flare System									
1	Temperature (T)	TT_1	T	^0C	Honeywell	STT25M-0-EN0	b224836437	17/8/2008 (installed on 30 April 09)	Annual
2	Flare Temperature ($T_{flare,y}$)	TT_3	$T_{flare,y}$	^0C	Honeywell	STT25M-0-EN0	b120876437	17/8/2008 (installed on 30 April 09)	Annual
3	Pressure Transmitter (P)	PT_2	P	Pa	Rosemount	3051TG1A	b120876837	Oct 2008 (installed on 30 April 09)	Annual
4	Total Biogas Flow Rate ($LFG_{total,y}$)	FT_1	$LFG_{total,y}$	NM^3/hr	Kingsway VCone	DN250KVS10IIKC23FS NS304	FT119(8102101)	31/10/2008 (installed on 30 April 09)	24 months
5	Flaring Biogas Flow Rate ($LFG_{flare,y}$)	FT_2	$LFG_{flare,y}$	NM^3/hr	Kingsway VCone	DN250KVS10IIKC23FS NS304	FT120(8102102)	3/11/2008 (installed on 30 April 09)	24 months
Gas Analysers									
7	Methane fraction of LFG	CH_4	W_{CH4}	%	Guardian Plus	CH4 0-100%, Precision +/- 2%FS	27471	18/9/2008 (installed on 30 April 09)	Annual
Power									
8	Power generation (MWh)	EL_{LFG}		kWh (to be converte	KRIZIK (Electricity Meter)		8383258	8/4/2009 (installed on 28 May 09)	Annual

The following variations for calibration frequency were implemented by the project:

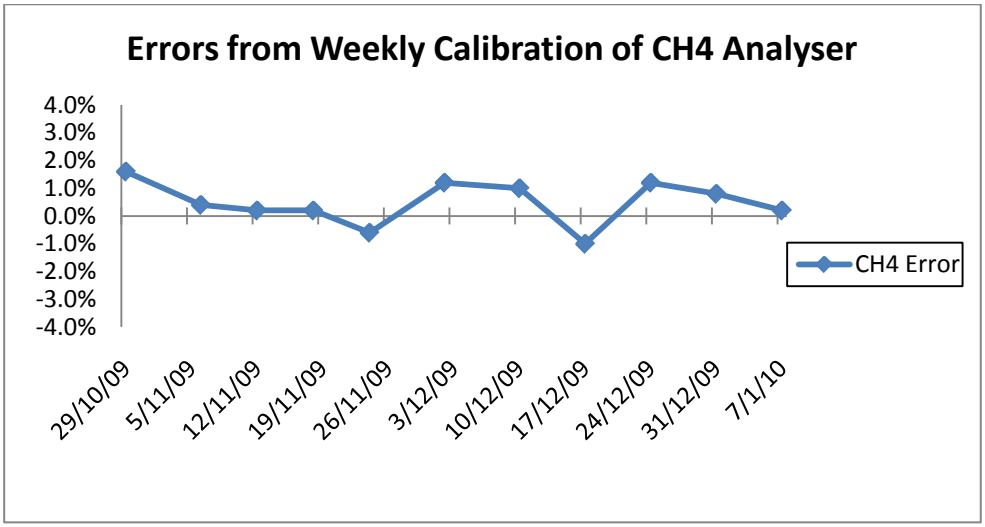
Parameters (CDM ID)	Equipment ID	Recommended Calibration Frequency	Calibration Frequency Adopted as in PDD
Methane fraction of LFG (W_{CH4})	CH4	Annually	Weekly (site staff) Annually (qualified external party)

The adopted calibration frequency, which is more frequent than as recommended by supplier, can be seen as pro-active steps to ensure the accuracy of the meters installed.

The weekly calibration of the methane analyser has shown minimum deviation of the accuracy over the 6 months period monitored.

The errors recorded were all within the error specification of 2% of the manufacturer. The results from the weekly calibration are tabulated below:

Calibration Date	$CH_{4\ Analyser}$ 80% span gas		
	Before	After	Error (%)
29/10/2009	78.4%	80.0%	1.6%
6/11/2009	79.6%	80.0%	0.4%
12/11/2009	79.8%	80.0%	0.2%
18/11/2009	79.8%	80.0%	0.2%
24/11/2009	80.6%	80.0%	-0.6%
2/12/2009	78.8%	80.0%	1.2%
10/12/2009	79.0%	80.0%	1.0%
17/12/2009	81.0%	80.0%	-1.0%
24/12/2009	78.8%	80.0%	1.2%
31/12/2009	79.2%	80.0%	0.8%
7/1/2010	79.8%	80.0%	0.2%



In view of the minimum deviation, it has been decided in the 2nd CDM management review meeting held on 21st January 2010 that the weekly internal calibration shall be revised to monthly for the next monitoring period.

C.2.2. Involvement of Third Parties

During the reported period, KBE has engaged Eco-Ideal Consulting Sdn. Bhd. as their CDM consultant to ensure all the monitoring activities are implemented according to the monitoring plan.

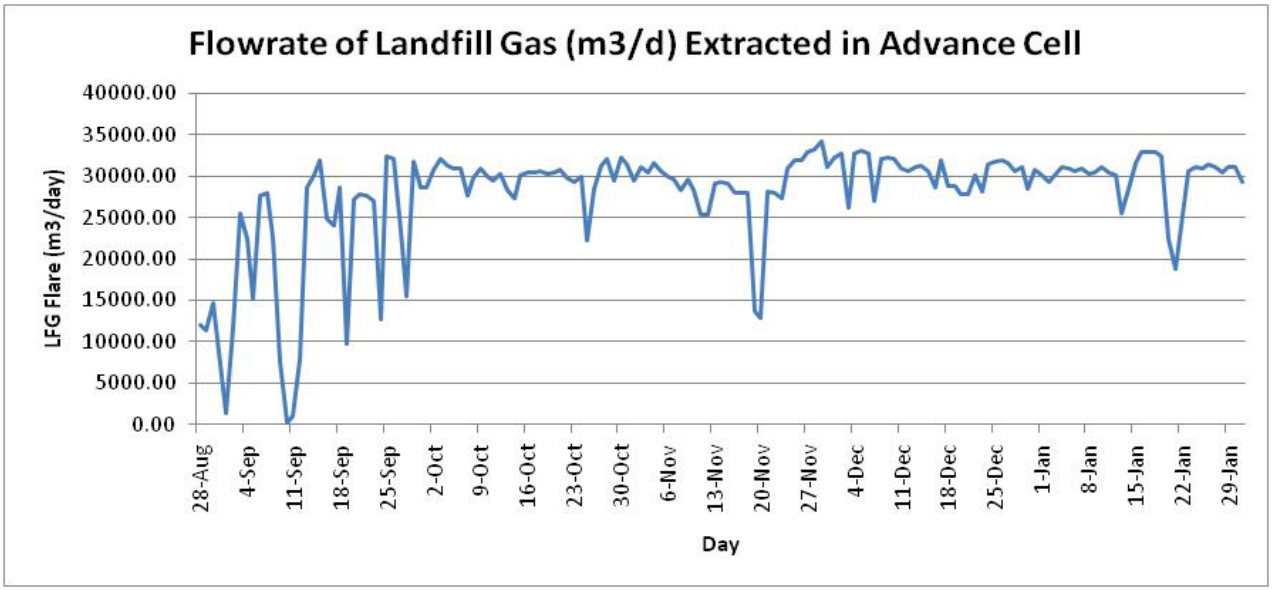
In addition, KBE has also engaged Ismail dan Rakan-Rakan Sdn. Bhd. as their Mechanical and Electrical Engineer, especially for the power generation applications.

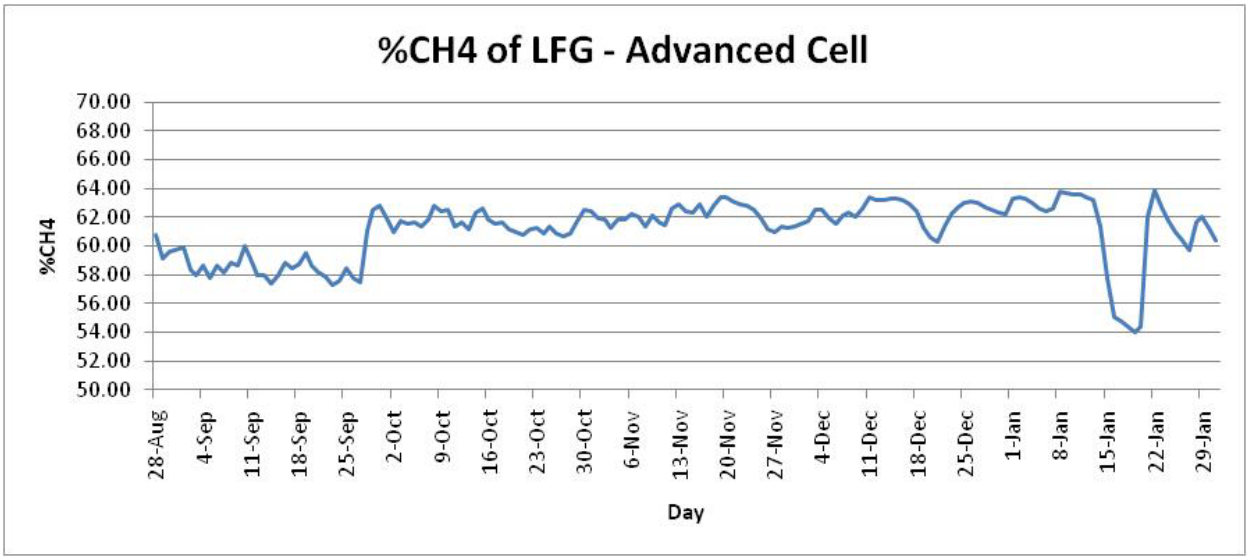
As mentioned earlier, Q2 Engineering Sdn. Bhd. is the main contractor supplying the gas extraction and flaring system.

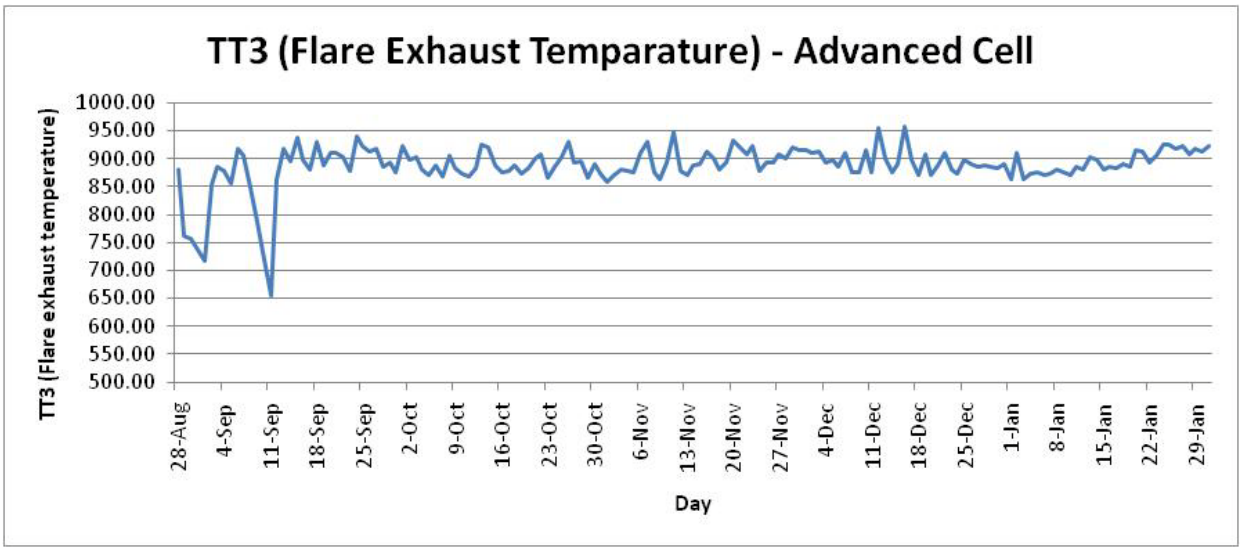
C.3.0 Data collection (for the whole monitoring period)

Based on the monitoring plan, key flaring parameters (temperature, pressure, flow of gas, methane concentration in LFG) were continuously monitored and recorded via the data logger at the flare system control room. Continuous flaring data are logged and archived every 5 minutes in the database file. These raw data was compiled and analysed for the calculation of CERs.

Data recorded for key parameters are compiled and presented below:







As a backup data recording system, the on-site staff also manually recorded certain monitored parameters in the daily manual recording logsheets. These records were scanned into soft copies for electronic filing on a monthly basis.

Data recorded manually (not recorded in the data logger system) i.e. electricity consumed as well as electricity generated, were recorded in specific record sheets on a daily basis and compiled in MS Excel format weekly.

The flaring parameters are displayed online (see Figure 6 below) via the PLC program at the flare control room.

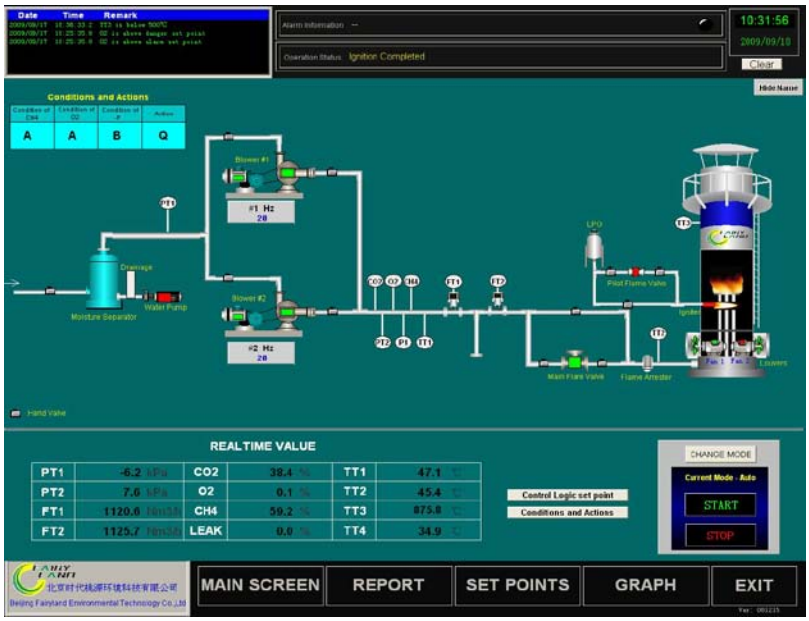


Figure 6. A Screenshot of the PLC in Flare Control Room

C.3.1. List of default values applied:

The following default values were applied according to the registered PDD (v5.3):
Global Warming Potential of methane (GWP_{CH4}) = 21[2] *tCO_2e/tCH_4*
Methane density at standard temperature and pressure (D_{CH4}) = 0.0007168[3] *t_{CH4}/m^3_{CH4}*

Flare efficiency:

For enclosed flare, the default value for the flare efficiency in the hour *h* is:

- 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*.

[2] Available at http://unfccc.int/ghg_emissions_data/information_on_data_sources/global_warming_potentials/items/3825.php , accessed on 30 Jan 2010;

[3] According to ACM 0001 version 8 (pg. 13)

C.3.2. List of fixed values applied:

In the registered PDD (v 5.3), it has been stated that the $CEF_{elec,PR,y}$ will be determined ex-post based on latest available data released by the authority. At completion of this report, the latest available grid data released by the Malaysia Energy Centre (PTM) is for baseline year 2008 (released in March 2010). The $CEF_{elec,PR,y}$ was calculated based on the relevant tool (*Tool to Calculate Emission Factor for an electricity system, v 2*) in accordance to the applied ACM 0001 v. 8 for this project.

The following fixed values were applied:
Carbon Emission Factor for Grid Electricity ($CEF_{elec,PR,y}$) = 0.672 tCO_2e/MWh (latest release by PTM in 2010).

C.3.3. List of Variables:

Variable ID	Unit	Details of variables
$LFG_{total,y}$	m^3	Total of landfill gas captured during the project at normal temperature and pressure
$LFG_{flare,y}$	m^3	Total amount of landfill gas sent to flare at normal temperature and pressure.
W_{CH4}	% volume	Fraction of methane in landfill gas
T	°C	Temperature of the landfill gas
$T_{flare,h}$	°C	Temperature in the exhaust gas of the enclosed flare
P	Pa	Pressure of the landfill gas
$EL_{PJ,y}$	MWh	Quantity of electricity consumption by project activity
$PE_{flare,y}$	tCO_2e	Project emissions from flaring of the residual gas stream

C.3.3. Data concerning GHG emissions by sources of the project activity

Project emissions from the project activity are expected from the incomplete flaring of gas containing methane ($PE_{flare,y}$) and grid electricity consumption by the project ($PE_{EC,y}$).

$PE_{flare,y}$ is determined based on hourly measurement of the temperature in the exhaust gas of the enclosed flare ($T_{flare,h}$) where the default flare efficiency was applied every hour.

For $PE_{EC,y}$, the key data monitored are the actual power consumption of the project activity. This is monitored by the dedicated power meter installed at the flare area where all power consumptions

related to the project were recorded. Daily records were taken and these data was tabulated in MS Excel and the aggregated value for total per week and subsequently by month.

Figure 7. Power meter (kWh meter) installed at Advanced Cell

C.3.4. Data concerning GHG emissions by sources of the baseline

The data monitored for baseline emissions were:

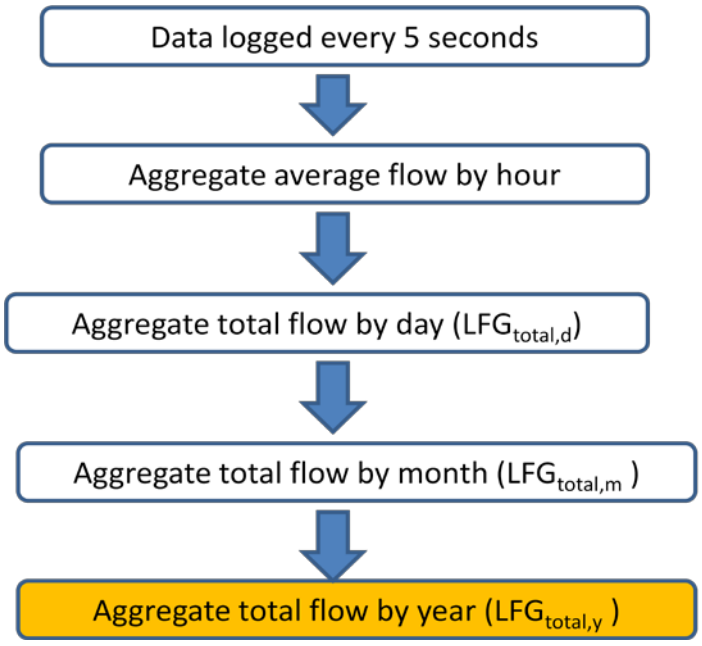
Variable ID	Unit	Details of variables
$LFG_{total,y}$	nm^3	Total of landfill gas captured during the project at normal temperature and pressure
$LFG_{flare,y}$	nm^3	Total amount of landfill gas sent to flare at normal temperature and pressure.
W_{CH4}	% volume	Fraction of methane in landfill gas
T	°C	Temperature of the landfill gas
$T_{flare,y}$	°C	Temperature in the exhaust gas of the enclosed flare
P	Pa	Pressure of the landfill gas
$EL_{PJ,y}$	MWh	Quantity of electricity consumption by project activity
$PE_{flare,y}$	tCO_2e	Project emissions from flaring of the residual gas stream

The data logged are archived in .db file format and compiled (See example in Annex 1).

Data recorded must be further processed to yield the results required. A specific computation programme (in MS Access) has been developed by the CDM Consultant to process continuous monitored data to required format and summary.

An example of data aggregation on site for flowrate of landfill gas at the main pipe is shown as follows:

Parameter : FT1 (Flowrate of LFG at main pipe)



Hour	LFG - Total LFG Flow (m3)
00:00 - 01:00	780
01:01 - 02:00	880
02:01 -03:00	950
....	....
Total (day)	22,000

Figure8 Example of Data Aggregation for Continuous Monitoring

Raw data logged at 5 seconds interval will be used to compute hourly average. Subsequently, daily readings can be computed, followed by aggregation into monthly, finally yearly summaries.

Similar average values will be computed for parameters such as Temperature, Pressure and Methane Content.

In accordance to the *"Tool to determine project emissions from flaring gases containing methane"*, all the operational parameters (temperature, pressure and so forth) required were recorded continuously through the PLC system. This is done since this project is applying the default values for flare efficiency.

The default value for flare efficiency by each hour was determined by accessing the exhaust gas temperature from the flare stack ($T_{flare,h}$). This was done for each of the flaring hour recorded in accordance to the *"Tool to determine project emissions from flaring gases containing methane"*. An example is attached in Annex 2.

C.3.5. Data concerning leakage

No leakage effects were applicable for this project.

C.3.6. Policies and Regulations

No changes to relevant policies and regulatory requirement to flare or utilize landfill gas in landfills within Malaysia within the reported period.

C.3.7. Data concerning environmental impacts

The destruction of methane emissions from landfill gas in the flare had contributed to the reduction of greenhouse gas emissions.

The capturing of landfill gas also leads to the improvement in local environment, especially in terms of air pollution due to landfill gas.

There are no negative environmental impacts identified for this project.

SECTION D. QUALITY ASSURANCE AND QUALITY CONTROL MEASURES

D.1. Documented procedures and quality control measures

Quality assurance and quality control (QA/QC) was applied throughout the monitoring period:

- Daily inspection of landfill gas extraction, flaring and monitoring systems;
- Checking and counter signing of data forms by CDM manager;
- Data security was applied to ensure the integrity of data;
- Inspection, observations, incidents and follow up actions were documented;
- Internal audits carried out by external consultants; and
- Data analysed on a weekly basis to determine any irregularities.

Details of the QA/QC procedures for the CDM monitoring plan are documented in the CDM Monitoring Manual (Version 1.4) March 2010.

D.2. Data Management and Storage

A proper data management and data backup system has been set up to as a security measure to ensure the integrity of the data will not be compromised.

D.2.1. Continuous Monitoring (data logging system)

The data from continuous monitoring (data logger) was primarily stored in the hard disk located in the flare control room. To ensure that all data recorded are safe and properly archived, the following backup system was applied for this project:

Types of backup	Frequency	Back up location
Manual backup using a portable HD (weekly)	Monthly	At the flare
Automatic backup to CDM Manager's PC located in the site office, at Bukit Tagar Sanitary Landfill	Weekly	On-site (site office)
Data server in CDM Consultant's office (Eco-Ideal Consulting C7-2, Wisma Goshen, Plaza Pantai KL)	Weekly	Off-site (consultant's office)

The data stored in the data server located at the CDM Consultant's office will be used as the primary back up data in case of any emergency situation resulting in the lost of data from the flare data recording system.

The automatic data backup system, based on internet data transmission, can be illustrated as follows:

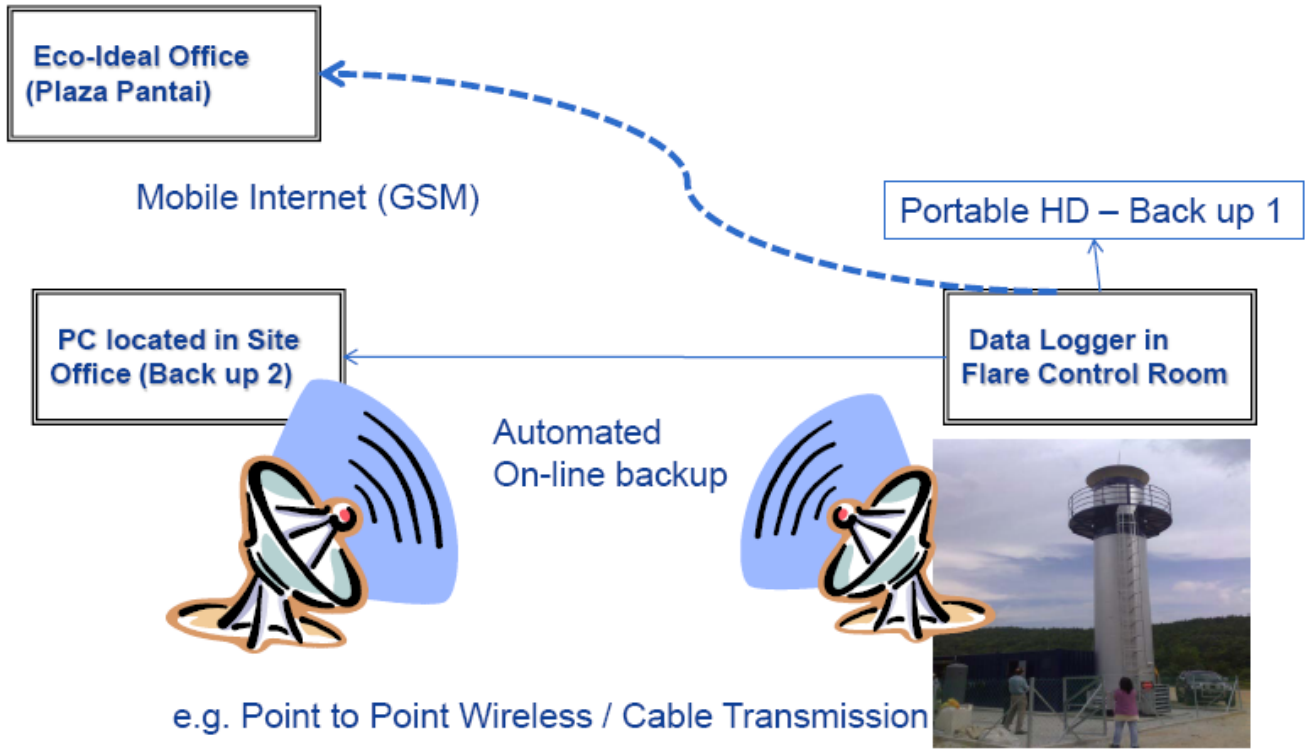


Figure 9. Automatic Data Backup System at Bukit Tagar Sanitary Landfill for Flaring System

D.2.2. Manual Recording

Daily operational data (consisting of CDM parameters monitored) recorded manually was backed up by scanning all the daily log sheets on a weekly basis and these data were primarily stored in the computer at the cabin office next to the flare cabin. A copy of these scanned log sheets were handed to the CDM Consultant on monthly basis for secondary back up.

D.3. Internal audits and control measures:

All procedures for audit and quality control measures are detailed in the CDM Monitoring Audit Plan and Procedures (October 2009). A total of 2 internal audits were conducted during the 1st reporting period, in between

- 1st Internal Audit – 9 November 2009
- 2nd Internal Audit – 14 January 2010

The internal audits served as important quality control measures to ensure all the monitoring required are done in accordance to plan. Through these audits, the project can pre-empt any potential problems, issues as well as identify improvement measures along the monitoring period.

SECTION E. CALCULATION OF GHG EMISSION REDUCTIONS

E.1. Table providing formulas used:

Calculations for Emission Reductions are made by using the following formulas:

ID	Parameters	Formula	Unit
ER	Emission reductions	$ER_y = BE_y - PE_y$	tCO_2e
BEy	Baseline emissions from the project	$BE_y = (MD_{project,y} – MD_{BL,y}) \cdot GWP_{CH4} + EL_{LFG,y} \cdot CEF_{elec,BL,y} + ET_{LFG,y} \cdot CEF_{ther,BL,y}$	tCO_2e
$MD_{project,y}$	Amount of CH_4 that would be destroyed in the project scenario	$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y}$	tCH_4
$MD_{flared,y}$	Amount of CH_4 destroyed by flaring	$MD_{flared,y} = (LFG_{flare,y} \cdot w_{CH4} \cdot D_{CH4}) – (PE_{flare,y} / GWP_{CH4})$	tCH_4
$PE_{flare,y}$	Project emissions from flaring of the residual gas stream	$PE_{flare,y} = \sum TM_{RG,h} \cdot (1-\eta_{flare,h}) . GWP_{CH4}/1000$	tCO_2e
PE_y	Project emissions from the	$PE_y = PE_{EC,y}$	tCO_2e

ID	Parameters	Formula	Unit
	project activity		
$PE_{EC,y}$	Emissions due to electricity consumption of the project implementation	$PE_{EC,y} = EC_{PJ,y} \cdot EF_{grid,y} \cdot (1+TDL_y)$	tCO_2e

E.2. Description and consideration of measurement uncertainties and error propagation:

Baseline Emissions:

In this reporting period, the baseline emissions (BE) are contributed from the LFG extraction from landfill and destroyed through flaring (LFG_{flare}). Methane content of landfill gas captured (w_{CH4}) is also important in the baseline emissions calculations. Measures (such as weekly calibrations of analyser) were taken to minimise the errors due to measurement by the monitoring instruments/equipments (e.g. gas analysers, gas flow meters). In general, the instruments were calibrated within the stipulated calibration period as stated in Table C.2.1 according to the manufacturer's requirements.

In order to minimise, if not eliminate, the erroneous manual recordings for the monitored parameters, the on-site monitoring staff had been given training programs for operating the instruments/ equipments, simple trouble-shooting of the equipments (in case of occasional breakdowns or error measurements).

Internal audit by external consultants (Eco-Ideal) is another mean of quality control to address any significant cases of uncertainties and errors arising from the monitoring programme.

Weekly review of data recorded, and comparison to the data trends established is another mean for the project to identify any critical errors resulting from the data recording.

Project Emissions:

The Project emissions (PE) are contributed from:

- project emissions from the flaring process (PE_{flare});
- emissions from electricity consumption by the flaring system (PE_{EC}).

The project emission from flaring is determined based on the continuous monitoring of exhaust gas temperature of the flare (TT_3). The data is being reviewed on a weekly basis and cross-checked with shut down records as part of the verification process.

The flare system requires electricity for its data logger system, therefore the electricity meter is installed to monitor the electricity consumption (EF_{EC}) at the flare system. Manual recording of electricity consumption is carried daily by the on-site workers. The CDM Consultant will monitor the electricity consumption of the flare system on weekly basis by obtaining the records from the on-site

staff. The electricity consumption results will be used for to calculate the PE for this project (refer to Section E.3.).

E.3. GHG emission reductions

E.3.1. Project emissions:

The $PE_{EC,y}$ during the monitoring period (28 August 2009 to 28 Feb 2010) were calculated as follows:

Project Emissions from Electricity Consumed by the Project Activity

Month	Total Electricity consumed by project activity Advance Cell LFG ECPJ,y (MWh)	Coefficient for grid electricity Advance Cell LFG EF grid,y	Transmission and Distribution Losses Advance Cell LFG TDL,y	Project Emission from project activity Advance Cell LFG (tCO2e)
Aug-09	0.42	0.672	0.1	0.31
Sep-09	6.47	0.672	0.1	4.87
Oct-09	8.23	0.672	0.1	6.19
Nov-09	10.41	0.672	0.1	7.83
Dec-09	10.60	0.672	0.1	7.98
Jan-10	10.18	0.672	0.1	7.66
Feb-10	10.59	0.672	0.1	7.96

PE fc,y is zero as no heat of fossil fuel is used to generate electricity for this project.
The grid connected baseline for Peninsula Malaysia for 2008 (latest available) was applied to this project and the EFBL,EL,y calculated was 0.672 tCO2/MWh

The PE_{flare} was determined by each hour, based on the default values determined by the flare exhaust gas temperature $T_{flare,h}$. See Annex 2 for example of PE_{flare} determination.

E.3.2. Baseline emissions:

The baseline emissions monitored during the monitoring period from 1 Sept 2009 to 31 Oct 2009 are shown as follows:

Emissions from Flared LFG (Advance Cell LFG)

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

Month	Quantity of LFG to flare Advance Cell LFGflare,y (Nm3)	Methane average fraction Advance Cell LFG WCH4 (% wet basis)	Density of Methane Advance Cell LFG DCH4 (t/Nm3)	Total methane flared Advance Cell LFG (tCH4)	Global Warming Potential Advance Cell LFG GWP (tCO2/tCH4)	PE flare Advance Cell LFG (tCO2e)	Quantity of Methane destroyed by flaring MD flared,y (tCH4)
Aug-09	38,124.26	0.59	0.0007168	16.2	21	34.09	14.61
Sep-09	635,364.74	0.59	0.0007168	267.5	21	565.93	240.53
Oct-09	927,346.48	0.62	0.0007168	409.2	21	862.77	368.07
Nov-09	856,818.38	0.62	0.0007168	381.5	21	802.50	343.24
Dec-09	947,814.41	0.62	0.0007168	423.4	21	889.23	381.01
Jan-10	926,144.13	0.61	0.0007168	404.9	21	851.38	364.35
Feb-10	851,782.30	0.62	0.0007168	378.7	21	799.60	340.62

$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$	$MD_{project,y}$	$(MD_{project,y} - MD_{BL,y}) * GWP_{CH4}$	$EL_{LFG,y} \cdot CEF_{elec,BL,y}$				Bey Advance Cell LFG
Total LFG for electricity generation Advance Cell LFG LFG electricity,y (Nm3)	Methane average fraction Advance Cell LFG W_{CH4} (% wet basis)	Electricity Generated Emission Advance Cell LFG MD electricity,y (tCH4)	Quantity of methane that would have been destroyed MD project,y (tCH4)	Emissions from flare Advance Cell LFG (tCO2e)	Total electricity generated from Advance Cell LFG $EL_{LFG,y}$ (MWh)	CoEF for electricity Advance Cell LFG CEF electricity,y	Baseline Emission from electricity generation Advance Cell LFG (tCO2e)	Total Baseline Emissions Advance Cell LFG (tCO2e)
0.00	0.59	0.00	14.61	307	0.00	0.682	0.00	307
0.00	0.59	0.00	240.53	5051	0.00	0.682	0.00	5,051
0.00	0.62	0.00	368.07	7730	0.00	0.682	0.00	7,730
0.00	0.62	0.00	343.24	7208	0.00	0.682	0.00	7,208
0.00	0.62	0.00	381.01	8001	0.00	0.682	0.00	8,001
0.00	0.61	0.00	364.35	7651	0.00	0.682	0.00	7,651
0.00	0.62	0.00	340.62	7153	0.00	0.682	0.00	7,153

For this project, the following applies:

1. $MD_{thermal,y}$ and $MD_{PL,y}$ are not applicable (= 0)to this project since there are no heat generation and feeding to natural gas pipeline; and
2. For this project, $MD_{BL,y}$ is zero since there are no destroy or combustion of methane today due to regulatory and contractual requirements;
3. $ET_{LFG,y}$ and $CEF_{ther,BL,y}$are not applicable (= 0) to this project since there are not thermal energy production.

E.3.3. Leakage:

No leakage applicable to this project.

E.3.4. Summary of the emission reductions during the monitoring period:

The emission reduction for the monitoring period was determined as follows:

$$ER_y = BE_y - PE_y$$

Month	BEy Advance Cell LFG	PEy Advance Cell LFG	ER Advance Cell LFG = BEy - PEy
Aug-09	307	0.3	306
Sep-09	5,051	4.8	5,046
Oct-09	7,730	6.1	7,723
Nov-09	7,208	7.7	7,200
Dec-09	8,001	7.8	7,993
Jan-10	7,651	7.5	7,644
Feb-10	7,153	7.8	7,145
Total			43,059

Note:
MD thermal and MD pl,y is not relevant for this project because the LFG is not used for heat generation or natural gas distribution

PE y is equivalent to PE EC,y only because no fossil fuel or heat is consumed at site.

The total emission reductions calculated from 28th August 2009 to 28th February 2010 is **43,059** tCO_2e.

The calculation of CERs during this monitoring period did not include the baseline emissions due to grid electricity being replaced by electricity generated from landfill gas, as there are no power generation from LFG during this monitoring period. All emissions are destroyed via the flaring unit. The emissions for electricity generation from the project will be calculated when the power generation phase of the project begins.

SECTION F. CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

During the project, the following contribution from the project can be accounted for:

Environment

The capturing and destruction of methane in the landfill gas has contributed to the reduction of Greenhouse Gas emissions to the environment.

As result of the project, the local environment, especially the air quality has been improved.

Social

The improved local environment, especially air quality is a positive impact to the general worker's health and safety at the landfill.

Economic

The project has provided job opportunities for new employee to the company as well as other local contractors and consultants.

Four (4) new employees, consisting of 2 executives and 2 general workers had been employed due to the project.

SECTION G. CONCLUSION

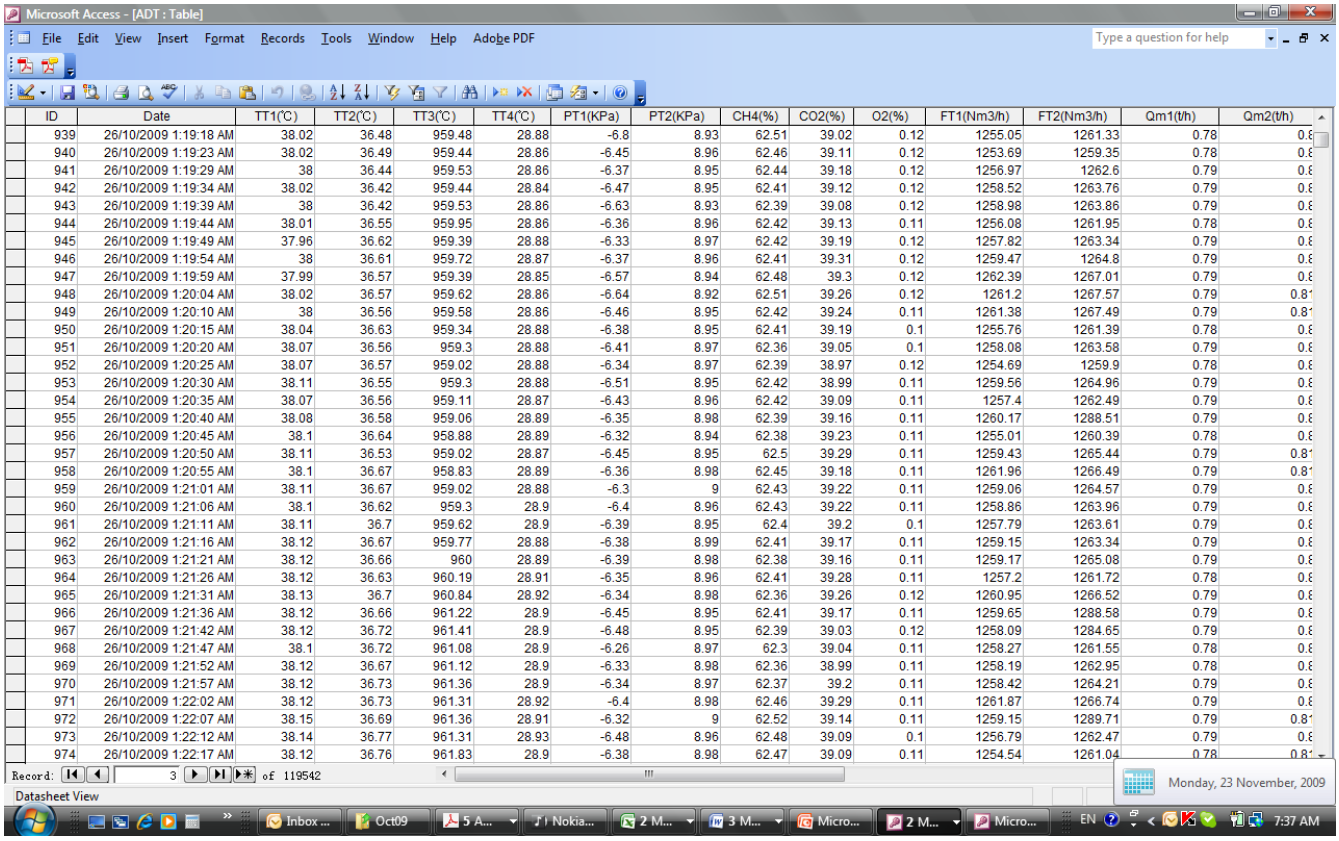
During the first monitoring period (28th August 2009 to 28th February 2010), emissions reductions was realised at the Advanced Cell of the landfill through the implementation of gas extraction and flaring system. The monitoring plan for the project activity has been implemented in accordance to the registered PDD as well as the applicable Approved Methodology and tools.

The only deviation from the PDD is the delay in installation of the gas engine for on-site power generation. The delay was mainly due to the lengthy process for approval by government agency (Energy Commission) for the Small Renewable Energy Power (SREP) program and the acceptance by the key Power Utility Company (TNB).

Based on the results from the monitoring, the calculated ERs from from 28th August 2009 to 28th February 2010 amount to a total of **43,059 tCO_2e**.

ANNEX 1

Sample of Flaring Data Archived in MS Access



Microsoft Access - [ADT : Table]

File Edit View Insert Format Records Tools Window Help Adobe PDF

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ID	Date	TT1(℃)	TT2(℃)	TT3(℃)	TT4(℃)	PT1(KPa)	PT2(KPa)	CH4(%)	CO2(%)	O2(%)	FT1(Nm3/h)	FT2(Nm3/h)	Qm1(t/h)	Qm2(t/h)
939	26/10/2009 1:19:18 AM	38.02	36.48	959.48	28.88	-6.8	8.93	62.51	39.02	0.12	1255.05	1261.33	0.78	0.8
940	26/10/2009 1:19:23 AM	38.02	36.49	959.44	28.86	-6.45	8.96	62.46	39.11	0.12	1253.69	1259.35	0.78	0.8
941	26/10/2009 1:19:29 AM	38	36.44	959.53	28.86	-6.37	8.95	62.44	39.18	0.12	1256.97	1262.6	0.79	0.8
942	26/10/2009 1:19:34 AM	38.02	36.42	959.44	28.84	-6.47	8.95	62.41	39.12	0.12	1258.52	1263.76	0.79	0.8
943	26/10/2009 1:19:39 AM	38	36.42	959.53	28.86	-6.63	8.93	62.39	39.08	0.12	1258.98	1263.86	0.79	0.8
944	26/10/2009 1:19:44 AM	38.01	36.55	959.95	28.86	-6.36	8.96	62.42	39.13	0.11	1256.08	1261.95	0.78	0.8
945	26/10/2009 1:19:49 AM	37.96	36.62	959.39	28.88	-6.33	8.97	62.42	39.19	0.12	1257.82	1263.34	0.79	0.8
946	26/10/2009 1:19:54 AM	38	36.61	959.72	28.87	-6.37	8.96	62.41	39.31	0.12	1259.47	1264.8	0.79	0.8
947	26/10/2009 1:19:59 AM	37.99	36.57	959.39	28.85	-6.57	8.94	62.48	39.3	0.12	1262.39	1267.01	0.79	0.8
948	26/10/2009 1:20:04 AM	38.02	36.57	959.62	28.86	-6.64	8.92	62.51	39.26	0.12	1261.2	1267.57	0.79	0.8
949	26/10/2009 1:20:10 AM	38	36.56	959.58	28.86	-6.46	8.95	62.42	39.24	0.11	1261.38	1267.49	0.79	0.8
950	26/10/2009 1:20:15 AM	38.04	36.63	959.34	28.88	-6.38	8.95	62.41	39.19	0.1	1255.76	1261.39	0.78	0.8
951	26/10/2009 1:20:20 AM	38.07	36.56	959.3	28.88	-6.41	8.97	62.36	39.05	0.1	1258.08	1263.58	0.79	0.8
952	26/10/2009 1:20:25 AM	38.07	36.57	959.02	28.88	-6.34	8.97	62.39	38.97	0.12	1254.69	1259.9	0.78	0.8
953	26/10/2009 1:20:30 AM	38.11	36.55	959.3	28.88	-6.51	8.95	62.42	38.99	0.11	1259.56	1264.96	0.79	0.8
954	26/10/2009 1:20:35 AM	38.07	36.56	959.11	28.87	-6.43	8.96	62.42	39.09	0.11	1257.4	1262.49	0.79	0.8
955	26/10/2009 1:20:40 AM	38.08	36.58	959.06	28.89	-6.35	8.98	62.39	39.16	0.11	1260.17	1288.51	0.79	0.8
956	26/10/2009 1:20:45 AM	38.1	36.64	958.88	28.89	-6.32	8.94	62.38	39.23	0.11	1255.01	1260.39	0.78	0.8
957	26/10/2009 1:20:50 AM	38.11	36.53	959.02	28.87	-6.45	8.95	62.5	39.29	0.11	1259.43	1265.44	0.79	0.8
958	26/10/2009 1:20:55 AM	38.1	36.67	958.83	28.89	-6.36	8.98	62.45	39.18	0.11	1261.96	1266.49	0.79	0.8
959	26/10/2009 1:21:01 AM	38.11	36.67	959.02	28.88	-6.3	9	62.43	39.22	0.11	1259.06	1264.57	0.79	0.8
960	26/10/2009 1:21:06 AM	38.1	36.62	959.3	28.9	-6.4	8.96	62.43	39.22	0.11	1258.86	1263.96	0.79	0.8
961	26/10/2009 1:21:11 AM	38.11	36.7	959.62	28.9	-6.39	8.95	62.4	39.2	0.1	1257.79	1263.61	0.79	0.8
962	26/10/2009 1:21:16 AM	38.12	36.67	959.77	28.88	-6.38	8.99	62.41	39.17	0.11	1259.15	1263.34	0.79	0.8
963	26/10/2009 1:21:21 AM	38.12	36.66	960	28.89	-6.39	8.98	62.38	39.16	0.11	1259.17	1265.08	0.79	0.8
964	26/10/2009 1:21:26 AM	38.12	36.63	960.19	28.91	-6.35	8.96	62.41	39.28	0.11	1257.2	1261.72	0.78	0.8
965	26/10/2009 1:21:31 AM	38.13	36.7	960.84	28.92	-6.34	8.98	62.36	39.26	0.12	1260.95	1266.52	0.79	0.8
966	26/10/2009 1:21:36 AM	38.12	36.66	961.22	28.9	-6.45	8.95	62.41	39.17	0.11	1259.65	1288.58	0.79	0.8
967	26/10/2009 1:21:42 AM	38.12	36.72	961.41	28.9	-6.48	8.95	62.39	39.03	0.12	1258.09	1284.65	0.79	0.8
968	26/10/2009 1:21:47 AM	38.1	36.72	961.08	28.9	-6.26	8.97	62.3	39.04	0.11	1258.27	1261.55	0.78	0.8
969	26/10/2009 1:21:52 AM	38.12	36.67	961.12	28.9	-6.33	8.98	62.36	38.99	0.11	1258.19	1262.95	0.78	0.8
970	26/10/2009 1:21:57 AM	38.12	36.73	961.36	28.9	-6.34	8.97	62.37	39.2	0.11	1258.42	1264.21	0.79	0.8
971	26/10/2009 1:22:02 AM	38.12	36.73	961.31	28.92	-6.4	8.98	62.46	39.29	0.11	1261.87	1266.74	0.79	0.8
972	26/10/2009 1:22:07 AM	38.15	36.69	961.36	28.91	-6.32	9	62.52	39.14	0.11	1259.15	1289.71	0.79	0.8
973	26/10/2009 1:22:12 AM	38.14	36.77	961.31	28.93	-6.48	8.96	62.48	39.09	0.1	1256.79	1262.47	0.79	0.8
974	26/10/2009 1:22:17 AM	38.12	36.76	961.83	28.9	-6.38	8.98	62.47	39.09	0.11	1254.54	1261.04	0.78	0.8

Record: 3 of 119542

Datasheet View

Monday, 23 November, 2009

Inbox ... Oct09 5 A... Nokia... 2 M... 3 M... Micro... 2 M... Micro... EN 7:37 AM

ANNEX 2

Sample of Flaring Efficiency Determination by Hour

Project Emission From Flaring (PE flare, y) October 09

Dat	Hou	Flow rate (M3/hr)	Record	Flow (M3	Density of Landfill Gas (kg/m3)	fv CH4,h	TM (RG,m) - kg/hr	Total running time (mins)	Total running time (hour)	Total Minutes with Flare >500C	Flare Efficiency (%)	PEflare,m (tCO2e)
1-Oct	0:00	1192.31	1.00	1192.31	0.7168	0.62	526.46	59.25	1.00	59.25	90%	1.11
	1:00	1195.62	1.00	1195.62	0.7168	0.62	527.92	59.25	1.00	59.25	90%	1.11
	2:00	1198.02	1.00	1198.02	0.7168	0.62	528.98	59.25	1.00	59.25	90%	1.11
	3:00	1192.89	1.00	1192.89	0.7168	0.62	526.71	59.25	1.00	59.25	90%	1.11
	4:00	1152.87	1.00	1152.87	0.7168	0.62	509.05	59.25	1.00	59.25	90%	1.07
	5:00	1154.49	1.00	1154.49	0.7168	0.62	509.76	59.25	1.00	59.25	90%	1.07
	6:00	1157.56	1.00	1157.56	0.7168	0.62	511.12	59.25	1.00	59.25	90%	1.07
	7:00	1156.13	1.00	1156.13	0.7168	0.62	510.48	59.25	1.00	59.25	90%	1.07
	8:00	1144.62	1.00	1144.62	0.7168	0.62	505.40	59.25	1.00	59.25	90%	1.06
	9:00	1120.09	1.00	1120.09	0.7168	0.62	494.57	59.25	1.00	59.25	90%	1.04
	10:00	1143.48	1.00	1143.48	0.7168	0.62	504.90	59.25	1.00	59.25	90%	1.06
	11:00	1200.71	1.00	1200.71	0.7168	0.62	530.17	59.17	1.00	59.17	90%	1.11
	12:00	1221.44	1.00	1221.44	0.7168	0.62	539.32	59.25	1.00	59.25	90%	1.13
	13:00	1214.53	1.00	1214.53	0.7168	0.62	536.27	59.25	1.00	59.25	90%	1.13
	14:00	1177.69	1.00	1177.69	0.7168	0.62	520.00	59.25	1.00	59.25	90%	1.09
	15:00	1176.08	1.00	1176.08	0.7168	0.62	519.29	59.25	1.00	59.25	90%	1.09
	16:00	1184.13	1.00	1184.13	0.7168	0.62	522.85	59.25	1.00	59.25	90%	1.10
	17:00	1200.44	1.00	1200.44	0.7168	0.62	530.05	59.25	1.00	59.25	90%	1.11
	18:00	1225.55	1.00	1225.55	0.7168	0.62	541.14	59.17	1.00	59.17	90%	1.14
	19:00	1256.54	1.00	1256.54	0.7168	0.62	554.82	59.25	1.00	59.25	90%	1.17
	20:00	1259.03	1.00	1259.03	0.7168	0.62	555.92	59.25	1.00	59.25	90%	1.17
	21:00	1237.64	1.00	1237.64	0.7168	0.62	546.48	59.25	1.00	59.25	90%	1.15
	22:00	1245.74	1.00	1245.74	0.7168	0.62	550.05	59.25	1.00	59.25	90%	1.16
	23:00	1289.06	1.00	1289.06	0.7168	0.62	569.18	59.25	1.00	59.25	90%	1.20
Total		28696.67		28696.67		Average	527.95	1421.83		1421.83		26.61
2-Oct	0:00	1299.88	1.00	1299.88	0.7168	0.62	573.96	59.25	1.00	59.25	90%	1.21
	1:00	1289.80	1.00	1289.80	0.7168	0.62	569.50	59.25	1.00	59.25	90%	1.20
	2:00	1249.37	1.00	1249.37	0.7168	0.62	551.65	59.17	1.00	59.17	90%	1.16
	3:00	1271.82	1.00	1271.82	0.7168	0.62	561.57	59.33	1.00	59.33	90%	1.18
	4:00	1294.57	1.00	1294.57	0.7168	0.62	571.61	59.25	1.00	59.25	90%	1.20
	5:00	1197.57	1.00	1197.57	0.7168	0.62	528.78	59.25	1.00	59.25	90%	1.11
	6:00	1194.92	1.00	1194.92	0.7168	0.62	527.61	59.17	1.00	59.17	90%	1.11
	7:00	1196.24	1.00	1196.24	0.7168	0.62	528.20	59.25	1.00	59.25	90%	1.11
	8:00	1173.65	1.00	1173.65	0.7168	0.62	518.22	59.33	1.00	59.33	90%	1.09
	9:00	1143.55	1.00	1143.55	0.7168	0.62	504.93	59.25	1.00	59.25	90%	1.06
	10:00	1163.21	1.00	1163.21	0.7168	0.62	513.61	59.25	1.00	59.25	90%	1.08
	11:00	1225.07	1.00	1225.07	0.7168	0.62	540.92	59.25	1.00	59.25	90%	1.14
	12:00	1302.53	1.00	1302.53	0.7168	0.62	575.13	59.17	1.00	59.17	90%	1.21
	13:00	1326.31	1.00	1326.31	0.7168	0.62	585.63	59.25	1.00	59.25	90%	1.23
	14:00	1286.28	1.00	1286.28	0.7168	0.62	567.95	59.33	1.00	59.33	90%	1.19
	15:00	1316.14	1.00	1316.14	0.7168	0.62	581.14	59.17	1.00	59.17	90%	1.22
	16:00	1357.17	1.00	1357.17	0.7168	0.62	599.25	59.25	1.00	59.25	90%	1.26
	17:00	1316.85	1.00	1316.85	0.7168	0.62	581.45	59.25	1.00	59.25	90%	1.22
	18:00	1336.70	1.00	1336.70	0.7168	0.62	590.21	59.25	1.00	59.25	90%	1.24
	19:00	1354.65	1.00	1354.65	0.7168	0.62	598.14	59.25	1.00	59.25	90%	1.26
	20:00	1364.65	1.00	1364.65	0.7168	0.62	602.55	59.25	1.00	59.25	90%	1.27
	21:00	1371.62	1.00	1371.62	0.7168	0.62	605.63	59.25	1.00	59.25	90%	1.27
	22:00	1383.65	1.00	1383.65	0.7168	0.62	610.94	59.25	1.00	59.25	90%	1.28
	23:00	1390.05	1.00	1390.05	0.7168	0.62	613.77	59.25	1.00	59.25	90%	1.29
Total		30806.23		30806.23		Average	566.77	1421.92		1421.92		28.56
3-Oct	0:00	1391.15	1.00	1391.15	0.7168	0.62	614.26	59.17	1.00	59.17	90%	1.29
	1:00	1392.80	1.00	1392.80	0.7168	0.62	614.99	59.25	1.00	59.25	90%	1.29
	2:00	1395.69	1.00	1395.69	0.7168	0.62	616.26	59.25	1.00	59.25	90%	1.29
	3:00	1372.56	1.00	1372.56	0.7168	0.62	606.05	59.25	1.00	59.25	90%	1.27
	4:00	1344.37	1.00	1344.37	0.7168	0.62	593.60	59.17	1.00	59.17	90%	1.25
	5:00	1345.08	1.00	1345.08	0.7168	0.62	593.92	59.25	1.00	59.25	90%	1.25
	6:00	1345.01	1.00	1345.01	0.7168	0.62	593.88	59.25	1.00	59.25	90%	1.25
	7:00	1346.07	1.00	1346.07	0.7168	0.62	594.35	59.25	1.00	59.25	90%	1.25
	8:00	1353.54	1.00	1353.54	0.7168	0.62	597.65	59.25	1.00	59.25	90%	1.26
	9:00	1328.86	1.00	1328.86	0.7168	0.62	586.75	59.25	1.00	59.25	90%	1.23
	10:00	1339.56	1.00	1339.56	0.7168	0.62	591.48	59.25	1.00	59.25	90%	1.24
	11:00	1365.17	1.00	1365.17	0.7168	0.62	602.78	59.25	1.00	59.25	90%	1.27
	12:00	1322.69	1.00	1322.69	0.7168	0.62	584.03	59.25	1.00	59.25	90%	1.23
	13:00	1327.69	1.00	1327.69	0.7168	0.62	586.23	59.25	1.00	59.25	90%	1.23
	14:00	1312.22	1.00	1312.22	0.7168	0.62	579.41	59.25	1.00	59.25	90%	1.22
	15:00	1278.77	1.00	1278.77	0.7168	0.62	564.64	59.25	1.00	59.25	90%	1.19
	16:00	1277.81	1.00	1277.81	0.7168	0.62	564.21	59.17	1.00	59.17	90%	1.18
	17:00	1268.68	1.00	1268.68	0.7168	0.62	560.18	59.25	1.00	59.25	90%	1.18
	18:00	1293.44	1.00	1293.44	0.7168	0.62	571.11	59.25	1.00	59.25	90%	1.20
	19:00	1306.91	1.00	1306.91	0.7168	0.62	577.06	59.25	1.00	59.25	90%	1.21
	20:00	1332.69	1.00	1332.69	0.7168	0.62	588.45	59.25	1.00	59.25	90%	1.24
	21:00	1336.94	1.00	1336.94	0.7168	0.62	590.32	59.17	1.00	59.17	90%	1.24
	22:00	1344.25	1.00	1344.25	0.7168	0.62	593.55	59.25	1.00	59.25	90%	1.25
	23:00	1349.29	1.00	1349.29	0.7168	0.62	595.77	59.25	1.00	59.25	90%	1.25

Annex 3
Daily Monitoring Records

Project name	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfil						
Monitored Period	Sep-09						
Month	Sep-09						
Day	TT1 Advance Cell LFG	TT3 Advance Cell LFG	PT2 Advance Cell LFG	LFG flare Advance Cell	LFG electricity Advance Cell	Total Advance Cell LFG	% CH4 Advance Cell LFG
1-Sep	38.38	718.12	3.19	1318.01	0.00	1318.01	59.74
2-Sep	44.91	853.39	6.77	11674.94	0.00	11674.94	58.19
3-Sep	44.13	886.09	8.72	25614.97	0.00	25614.97	57.82
4-Sep	43.27	878.21	8.11	22492.22	0.00	22492.22	58.66
5-Sep	45.82	856.89	6.64	15106.91	0.00	15106.91	57.71
6-Sep	43.28	916.76	8.01	27627.05	0.00	27627.05	58.66
7-Sep	44.59	906.57	8.33	28047.50	0.00	28047.50	58.20
8-Sep	41.32	848.93	6.53	22548.23	0.00	22548.23	58.64
9-Sep	35.77	785.78	3.96	7641.29	0.00	7641.29	57.59
10-Sep	29.07	718.48	2.14	150.90	0.00	150.90	59.79
11-Sep	40.20	655.63	1.44	1103.32	0.00	1103.32	59.09
12-Sep	43.03	864.23	7.03	7872.66	0.00	7872.66	57.86
13-Sep	45.41	918.36	8.81	28738.73	0.00	28738.73	57.94
14-Sep	48.31	896.12	9.91	30203.47	0.00	30203.47	57.35
15-Sep	47.11	936.59	10.79	32008.71	0.00	32008.71	57.98
16-Sep	42.70	897.80	9.81	24860.20	0.00	24860.20	58.45
17-Sep	41.93	880.11	7.68	24004.14	0.00	24004.14	58.65
18-Sep	42.28	931.33	8.47	28698.70	0.00	28698.70	58.74
19-Sep	36.37	889.12	7.11	9680.60	0.00	9680.60	59.44
20-Sep	42.5	911.51	7.87	27161.08	0.00	27161.08	58.67
21-Sep	44.08	910.24	8.05	27798.88	0.00	27798.88	58.14
22-Sep	44.76	903.68	8	27615.67	0.00	27615.67	57.83
23-Sep	46.13	879.33	7.79	26939.43	0.00	26939.43	57.28
24-Sep	52.00	940.76	11.46	12758.22	0.00	12758.22	57.49
25-Sep	48.83	923.04	11.04	32516.18	0.00	32516.18	58.42
26-Sep	49.08	914.03	10.80	32035.08	0.00	32035.08	57.81
27-Sep	48.86	917.78	10.87	23422.25	0.00	23422.25	57.52
28-Sep	45.23	886.15	9.91	15520.08	0.00	15520.08	61.08
29-Sep	45.62	891.93	10.94	31783.37	0.00	31783.37	62.49
30-Sep	44.03	875.77	9.11	28673.06	0.00	28673.06	62.76
Total				635615.9	0.00	635615.85	
Avg.	43.63	873.09					59%

Project name	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfil						
Monitored Period	Oct-09						
Month	Oct-09						
Day	TT1 Advance Cell LFG	TT3 Advance Cell LFG	PT2 Advance Cell LFG	LFG flare Advance Cell	LFG electricity Advance Cell	Total Advance Cell LFG	% CH4 Advance Cell LFG
1-Oct	47.22	923.68	9.34	28696.67	0.00	28696.67	61.94
2-Oct	48.86	898.08	10.80	30806.23	0.00	30806.23	60.97
3-Oct	47.02	902.34	11.25	32071.23	0.00	32071.23	61.72
4-Oct	47.05	881.03	10.78	31301.18	0.00	31301.18	61.58
5-Oct	45.95	871.43	10.52	31039.64	0.00	31039.64	61.63
6-Oct	46.83	888.19	10.57	30938.76	0.00	30938.76	61.36
7-Oct	46.58	869.26	9.44	27667.55	0.00	27667.55	61.68
8-Oct	46.63	905.75	10.28	29739.56	0.00	29739.56	62.83
9-Oct	46.57	883.02	10.05	30918.74	0.00	30918.74	62.42
10-Oct	44.36	873.32	9.39	30041.94	0.00	30041.94	62.49
11-Oct	47.39	867.15	9.40	29556.31	0.00	29556.31	61.34
12-Oct	45.49	883.02	9.68	30332.08	0.00	30332.08	61.60
13-Oct	46.02	925.17	8.61	28371.40	0.00	28371.40	61.16
14-Oct	44.25	919.37	8.11	27297.89	0.00	27297.89	62.48
15-Oct	45.09	888.50	9.43	30213.97	0.00	30213.97	62.65
16-Oct	46.09	875.26	9.71	30463.03	0.00	30463.03	61.85
17-Oct	46.36	877.83	9.79	30525.16	0.00	30525.16	61.55
18-Oct	45.24	887.18	9.79	30655.84	0.00	30655.84	61.67
19-Oct	46.62	872.97	9.72	30320.71	0.00	30320.71	61.17
20-Oct	47.22	883.17	10.01	30549.61	0.00	30549.61	60.95
21-Oct	48.16	900.44	10.20	30745.01	0.00	30745.01	60.78
22-Oct	46.28	907.92	9.44	29828.13	0.00	29828.13	61.13
23-Oct	45.01	866.51	9.10	29378.52	0.00	29378.52	61.22
24-Oct	46.75	885.45	9.64	30008.72	0.00	30008.72	60.90
25-Oct	46.28	902.00	9.54	22283.09	0.00	22283.09	61.38
26-Oct	46.26	931.02	9.07	28457.32	0.00	28457.32	61.01
27-Oct	47.15	892.49	10.43	31299.53	0.00	31299.53	60.70
28-Oct	46.33	895.57	10.90	32181.48	0.00	32181.48	60.89
29-Oct	45.29	866.91	9.74	29533.04	0.00	29533.04	60.06
30-Oct	46.46	890.69	10.76	32200.34	0.00	32200.34	62.53
31-Oct	45.10	872.90	10.28	31423.26	0.00	31423.26	62.38
Total				**928845.9**	**0.00**	**928845.93**	
Avg.	**46.32**	**889.92**					**62%**

Project name	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfi						
Monitored Period	Nov-09						
Month	Nov-09						
Day	TT1 Advance Cell LFG	TT3 Advance Cell LFG	PT2 Advance Cell LFG	LFG flare Advance Cell	LFG electricity Advance Cell	Total Advance Cell LFG	% CH4 Advance Cell LFG
1-Nov	45.16	858.54	9.96	29459.99	0.00	29459.99	61.97
2-Nov	45.63	870.86	10.33	31090.79	0.00	31090.79	61.81
3-Nov	47.38	879.78	10.16	30415.72	0.00	30415.72	61.28
4-Nov	44.85	877.83	10.30	31623.56	0.00	31623.56	61.86
5-Nov	44.39	874.96	9.67	30603.41	0.00	30603.41	61.80
6-Nov	43.43	910.66	9.37	29976.72	0.00	29976.72	62.21
7-Nov	45.00	931.16	9.66	29638.99	0.00	29638.99	62.04
8-Nov	46.30	876.93	9.05	28339.22	0.00	28339.22	61.36
9-Nov	43.76	863.72	9.66	29686.14	0.00	29686.14	62.12
10-Nov	43.84	892.73	8.89	28321.67	0.00	28321.67	61.69
11-Nov	44.46	948.45	8.70	25363.62	0.00	25363.62	61.41
12-Nov	44.19	877.00	9.50	25435.00	0.00	25435.00	62.49
13-Nov	44.50	870.80	9.33	29130.63	0.00	29130.63	62.89
14-Nov	44.29	887.06	9.52	29308.08	0.00	29308.08	62.46
15-Nov	43.71	890.84	9.35	29137.25	0.00	29137.25	62.29
16-Nov	39.97	913.12	8.47	27984.37	0.00	27984.37	62.88
17-Nov	43.74	899.36	8.77	27946.37	0.00	27946.37	62.04
18-Nov	41.71	880.56	8.80	27978.65	0.00	27978.65	62.74
19-Nov	38.16	892.85	7.17	13637.37	0.00	13637.37	63.40
20-Nov	40.81	931.90	8.96	12954.08	0.00	12954.08	63.42
21-Nov	42.43	920.04	9.29	28116.30	0.00	28116.30	63.13
22-Nov	41.58	907.25	9.09	28038.55	0.00	28038.55	62.94
23-Nov	42.53	923.27	9.19	27330.95	0.00	27330.95	62.84
24-Nov	44.95	877.74	10.67	31044.80	0.00	31044.80	62.38
25-Nov	46.86	893.34	11.08	31979.46	0.00	31979.46	61.90
26-Nov	48.43	893.08	11.00	31898.39	0.00	31898.39	61.13
27-Nov	47.82	907.72	11.32	32866.11	0.00	32866.11	60.98
28-Nov	46.32	900.35	11.20	33324.17	0.00	33324.17	61.33
29-Nov	47.24	920.73	11.74	34326.56	0.00	34326.56	61.25
30-Nov	45.63	916.22	10.57	31108.55	0.00	31108.55	61.58
Total				858065.5		858065.5	
Avg.	44.30	896.29					62%

Project name	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfi						
Monitored Period	Dec-09						
Month	Dec-09						
Day	TT1 Advance Cell LFG	TT3 Advance Cell LFG	PT2 Advance Cell LFG	LFG flare Advance Cell	LFG electricity Advance Cell	Total Advance Cell LFG	% CH4 Advance Cell LFG
1-Dec	44.84	915.02	11.06	32294.93	0.00	32294.93	61.55
2-Dec	46.56	909.51	11.33	32823.57	0.00	32823.57	61.66
3-Dec	44.46	911.82	10.14	26241.79	0.00	26241.79	62.62
4-Dec	42.80	894.13	10.54	32810.66	0.00	32810.66	62.54
5-Dec	45.03	897.73	10.80	33156.47	0.00	33156.47	61.90
6-Dec	46.33	884.63	10.56	32799.73	0.00	32799.73	61.50
7-Dec	42.76	910.48	8.72	27017.19	0.00	27017.19	62.18
8-Dec	43.96	874.92	10.25	32174.47	0.00	32174.47	62.32
9-Dec	45.87	874.56	10.36	32256.87	0.00	32256.87	61.98
10-Dec	46.54	915.86	10.36	32122.87	0.00	32122.87	62.42
11-Dec	44.49	876.07	9.71	31034.47	0.00	31034.47	63.41
12-Dec	44.27	955.90	9.32	30576.00	0.00	30576.00	63.23
13-Dec	44.27	900.31	9.65	31171.19	0.00	31171.19	63.23
14-Dec	43.55	876.06	9.73	31350.43	0.00	31350.43	63.28
15-Dec	43.34	889.91	9.30	30603.28	0.00	30603.28	63.24
16-Dec	41.12	958.68	8.92	28718.60	0.00	28718.60	63.16
17-Dec	42.94	897.15	10.10	31974.03	0.00	31974.03	62.52
18-Dec	38.61	869.82	8.27	28900.77	0.00	28900.77	62.38
19-Dec	38.20	907.02	8.33	28814.01	0.00	28814.01	61.22
20-Dec	39.04	871.49	7.89	27838.69	0.00	27838.69	60.61
21-Dec	42.15	889.15	8.17	27791.25	0.00	27791.25	60.16
22-Dec	43.12	909.57	9.06	30187.42	0.00	30187.42	61.39
23-Dec	42.32	880.21	8.62	27526.67	0.00	27526.67	62.20
24-Dec	44.02	872.30	9.66	31407.90	0.00	31407.90	62.08
25-Dec	43.19	897.80	9.80	31716.28	0.00	31716.28	63.02
26-Dec	41.27	890.69	9.88	31992.59	0.00	31992.59	63.10
27-Dec	41.57	886.15	9.77	31683.03	0.00	31683.03	63.02
28-Dec	42.81	887.37	9.24	30645.69	0.00	30645.69	62.67
29-Dec	42.42	885.93	9.51	31145.70	0.00	31145.70	62.49
30-Dec	42.56	882.80	9.33	28462.47	0.00	28462.47	62.36
31-Dec	44.04	890.78	9.38	30857.46	0.00	30857.46	62.21
Total				948096.5		948096.5	
Avg.	43.18	895.61					62%

Project name	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill,						
Monitored Period	Jan-10						
Month	Jan-10						
Day	TT1 Advance Cell LFG	TT3 Advance Cell LFG	PT2 Advance Cell LFG	LFG flare Advance Cell	LFG electricity Advance Cell	Total Advance Cell LFG	% CH4 Advance Cell LFG
1-Jan	41.26	863.69	8.90	30067.81	0.00	30067.81	63.29
2-Jan	40.47	910.76	8.47	29247.22	0.00	29247.22	63.42
3-Jan	41.35	864.55	9.01	30140.84	0.00	30140.84	63.27
4-Jan	41.59	874.21	9.56	31160.78	0.00	31160.78	62.96
5-Jan	42.23	874.75	9.61	30934.25	0.00	30934.25	62.59
6-Jan	43.44	869.92	9.49	30608.93	0.00	30608.93	62.43
7-Jan	43.53	873.16	9.67	30926.71	0.00	30926.71	62.65
8-Jan	39.85	879.57	9.05	30323.98	0.00	30323.98	63.73
9-Jan	42.23	876.12	9.33	30411.46	0.00	30411.46	63.64
10-Jan	42.09	869.80	9.55	31053.88	0.00	31053.88	63.56
11-Jan	41.82	885.81	9.26	30534.50	0.00	30534.50	63.54
12-Jan	42.17	880.40	9.08	30157.88	0.00	30157.88	63.39
13-Jan	40.54	901.95	9.74	25472.21	0.00	25472.21	63.21
14-Jan	42.14	897.41	8.92	28542.37	0.00	28542.37	61.37
15-Jan	42.99	880.86	9.39	31665.52	0.00	31665.52	57.74
16-Jan	45.47	885.26	9.98	33000.06	0.00	33000.06	55.04
17-Jan	45.59	883.39	9.99	32876.92	0.00	32876.92	54.76
18-Jan	46.43	890.52	10.20	32996.91	0.00	32996.91	54.41
19-Jan	44.79	884.60	9.94	32461.47	0.00	32461.47	54.00
20-Jan	40.16	915.19	7.34	22407.72	0.00	22407.72	54.38
21-Jan	37.74	911.77	7.27	18781.74	0.00	18781.74	62.06
22-Jan	44.94	892.30	9.65	25387.22	0.00	25387.22	63.86
23-Jan	45.44	906.63	10.51	30617.95	0.00	30617.95	62.70
24-Jan	45.77	924.44	10.90	31071.83	0.00	31071.83	61.77
25-Jan	46.09	926.19	10.81	31018.20	0.00	31018.20	60.99
26-Jan	45.25	919.04	10.73	31456.16	0.00	31456.16	60.35
27-Jan	46.63	923.36	10.81	31189.65	0.00	31189.65	59.70
28-Jan	46.14	907.16	10.42	30405.99	0.00	30405.99	61.66
29-Jan	45.84	917.91	10.77	31153.77	0.00	31153.77	62.01
30-Jan	46.83	913.09	10.75	31196.01	0.00	31196.01	61.23
31-Jan	46.18	922.47	10.14	29302.16	0.00	29302.16	60.42
Total				**926572.10**		**926572.10**	
Avg.	**43.45**	**894.40**	**Total**	**926572.10**		**Avg.**	**61%**

BUKIT TAGAR LANDFILL GAS RECOVERY & UTILISATION

CDM Monitoring Data

Project name	**Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hu**
Monitored Period	**Feb-10**
Month	**Feb-10**

Day	TT1 Advance Cell LFG	TT3 Advance Cell LFG	PT2 Advance Cell LFG	LFG flare Advance Cell	LFG electricity Advance Cell	Total Advance Cell LFG	% CH4 Advance Cell LFG
1-Feb	47.49	927.55	11.14	32009.91	0.00	32009.91	59.71
2-Feb	48.14	931.50	11.24	32071.79	0.00	32071.79	58.96
3-Feb	45.26	895.82	9.07	27433.10	0.00	27433.10	60.34
4-Feb	43.18	863.12	7.91	25443.58	0.00	25443.58	62.16
5-Feb	43.82	893.18	10.08	30523.36	0.00	30523.36	62.67
6-Feb	45.66	885.99	10.06	30344.85	0.00	30344.85	61.59
7-Feb	45.08	896.60	10.24	30709.57	0.00	30709.57	60.97
8-Feb	45.09	890.26	9.39	28180.46	0.00	28180.46	60.82
9-Feb	46.83	883.26	10.01	30068.46	0.00	30068.46	62.52
10-Feb	45.56	910.85	9.85	25912.61	0.00	25912.61	63.12
11-Feb	49.36	929.95	11.14	31651.30	0.00	31651.30	63.76
12-Feb	49.07	934.51	11.33	32031.62	0.00	32031.62	62.74
13-Feb	49.78	935.31	11.41	32100.55	0.00	32100.55	62.01
14-Feb	49.62	926.83	11.18	31755.42	0.00	31755.42	61.56
15-Feb	49.83	925.72	11.23	31814.40	0.00	31814.40	61.48
16-Feb	48.82	907.40	10.45	30426.89	0.00	30426.89	61.33
17-Feb	44.83	892.60	10.03	30322.86	0.00	30322.86	61.60
18-Feb	46.64	921.62	10.86	31524.45	0.00	31524.45	61.47
19-Feb	47.83	909.73	10.38	29431.28	0.00	29431.28	59.21
20-Feb	49.18	919.27	10.84	26967.73	0.00	26967.73	61.91
21-Feb	47.45	926.68	11.10	31855.20	0.00	31855.20	60.80
22-Feb	47.94	914.20	10.89	31420.30	0.00	31420.30	60.04
23-Feb	47.00	914.89	10.47	28131.56	0.00	28131.56	61.39
24-Feb	49.74	924.40	11.20	32245.15	0.00	32245.15	65.23
25-Feb	48.91	926.32	11.15	32049.03	0.00	32049.03	64.82
26-Feb	46.70	914.61	10.74	31641.08	0.00	31641.08	64.84
27-Feb	48.25	920.08	11.00	31866.99	0.00	31866.99	64.83
28-Feb	48.29	921.26	11.02	31848.82	0.00	31848.82	64.81
Total				**851,782.30**		**851,782.30**	
Avg.	**47.33**	**912.27**				**Avg.**	**62%**