MONITORING REPORT FORM (CDM-MR) *
Version 01

CONTENTS

MONITORING REPORT
Version 1.0- 11th January 2011
Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia
Project 2467
Monitoring period and dates (01/03/2010 to 31/12/2010)

SECTION A. General description of the project activity

A.1. Brief description of the project activity

The Bukit Tagar Sanitary Landfill (BTSL) is operated by KUB-Berjaya Enviro Sdn. Bhd. (KBE) and located in Hulu Selangor in 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 Clean Development Mechanism (CDM) project is to avoid direct emissions of greenhouse gases from the landfill into the atmosphere through active extraction. The gas collected will be destructed by high temperature enclosed flares as well as to be utilised for power generation using high efficiency gas engine.

Carbon emissions are reduced through two major activities:

Emission Reduction Aspects	How will emissions be reduced?
Landfill gas (LFG) Extraction and Destruction (CH_4 avoidance)	Instead of releasing LFG (consisting CH_4) to the atmosphere, the gas will be collected and destroyed in Enclosed Flare and Gas Engine
Power Generation (Fuel replacement)	Less CO_2 will be emitted by replacing electricity generated by grid power with electricity from LFG (considered as renewable)

The LFG extraction from the Advance Cell and first flaring system (Flare No.1) have already been implemented since mid-2009. The gas extraction and flaring system were monitored according to the CDM monitoring plan starting from the project registration date, i.e. 28th August 2009.

The construction works for LFG extraction at Phase 1 cell and setting up of second flaring system (Flare No.2) have started in January 2010 and completed in August 2010.

The power generation works started in April 2010 and grid connection is targeted to be completed first quarter of 2011. A 1 MW high efficiency gas engine will be installed.

The second monitoring period is from 1st March 2010 to 31st December 2010. The total emission reductions achieved in this monitoring period is **113,633** tCO_2eq.

A.2. Project Participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)
Malaysia (Host)	KUB-Berjaya Enviro Sdn. Bhd. (KBE) (Private)
Japan	Japan Carbon Finance, Ltd. (JCF) (Private)

A.3. Location of the project activity

The project location is situated approximately 5km to the west of the Bukit Tagar Interchange along the North-South Expressway and 40km from central Kuala Lumpur. The landfill is easily accessible via expressway and a dedicated Bukit Tagar Interchange has been developed for the access from the North-South Expressway. The landfill is situated in a leased agricultural land, surrounded by hectares of oil palm plantations and rubber trees.

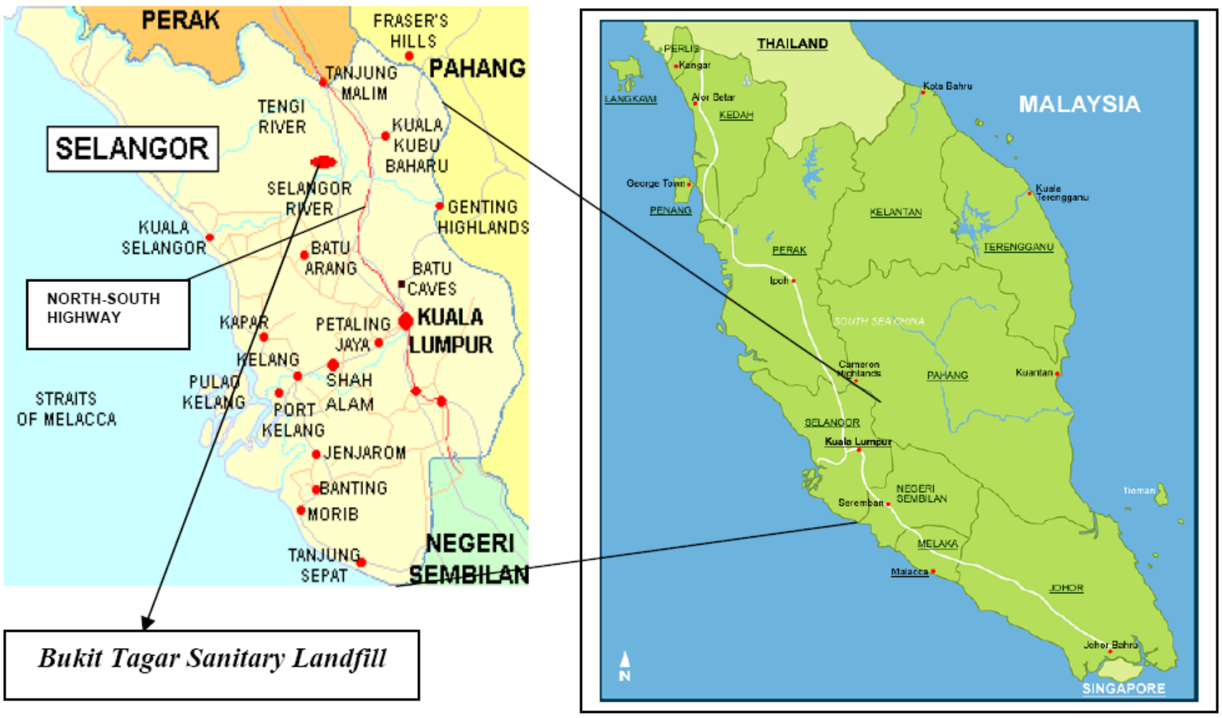

Figure 1: Location of Selangor State and BTSL

The specific geographical coordinates of the landfill are:

Latitude	Longitude	Description
3^0 30' 168''	101^0 28' 428''	North
3^0 29' 07''	101^0 28' 452''	South
3^0 29' 46''	101^0 28' 20''	West
3^0 29' 69''	101^0 29' 268''	East

A.4. Technical description of the project

The landfill gas recovery, flaring and power generation system can be illustrated below:

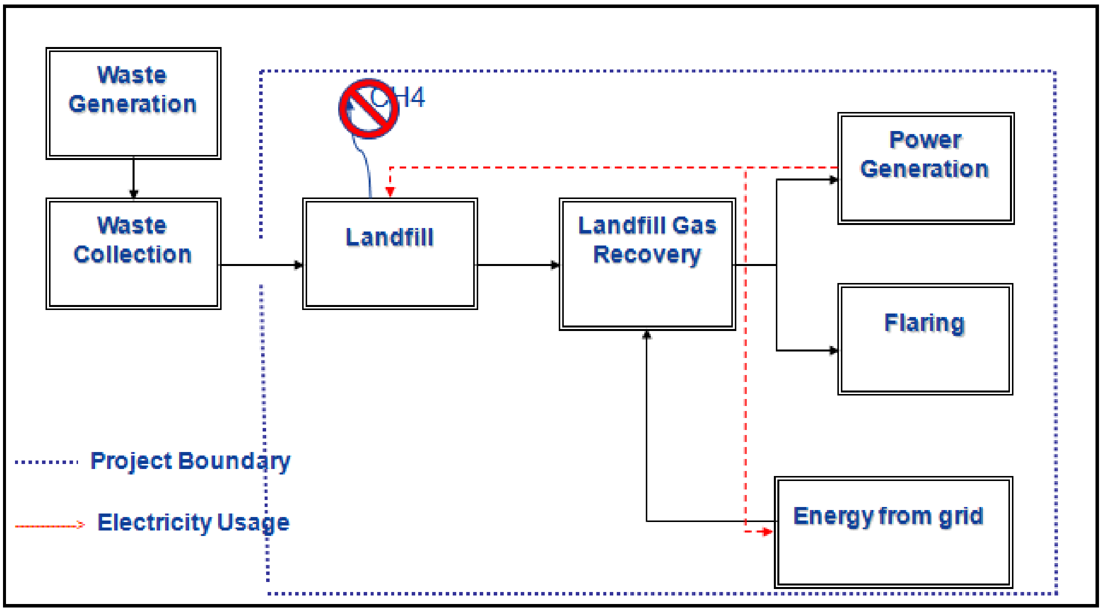

Figure 2: Overall LFG Recovery, Flaring and Power Generation Design

Overall, the LFG technology and design were sourced from developed countries since it was not readily available locally. The technology applied and transferred into this project has been implemented and proven in Europe (Denmark, Germany) as well as China (flaring system).

Gas Extraction System in Advance Cell

Q2 Engineering Sdn. Bhd., a subsidiary of Q2 A/S of Denmark, was appointed as the turnkey contractor to construct the gas extraction and flaring system for Advance Cell. 42 vertical gas extraction pipes were installed in the landfill to extract the LFG. These wells were connected to 8 units of main gas collection pipes that led to the LFG flaring system.

Figure 3: An Example of Vertical Well Installed in Advance Cell

These vertical wells can be individually regulated and controlled.

First High Temperature Enclosed Flaring System (Flare No.1)

One unit of high temperature enclosed flare system had been installed to flare off the LFG extracted. The flare system included a containerised blower and flaring system with a maximum capacity to flare off 2,500Nm^3/hr LFG.

Figure 4: Enclosed Flare Installed at Advanced Cell (Flare No.1)

The details of the flare specifications are listed below:

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

Gas Analyser and Data Logging

Monitoring of the correct functioning of the flaring system was provided by a continuous logging system which examines the operational parameters of the flare. The gas analyzing system is a multi-functional environmental monitoring equipment that can monitor up to 14 different measurement and data logging channels. Data from the logging system was presented on a local screen (on-line data) and stored in a local personal computer (PC) unit with external communication via Global System for Mobile Communications (GSM).

Data were downloaded directly from the in-built data logger to a PC and also transmitted via GSM modem to external server and PC as backup.

Gas Extraction System in Phase 1 Cell

As Phase 1 cell is still an operational cell (to be filled to completion level at later stage), the design of the gas extraction wells is different from Advance cell. A series of horizontal gas extraction wells was constructed for the entire Phase 1 Cell.

Figure 5: Horizontal Gas Extraction Wells in Phase 1 Cell

Second High Temperature Enclosed Flaring System (Flare No.2)

The second unit of high temperature enclosed flare system was installed to cater for the extra LFG extracted from Phase 1 cell. The flare system included a containerised blower and flaring system with a maximum capacity to flare off 2,500Nm^3/hr LFG.

Figure 6: High Temperature Enclosed Flare (Flare No.2)

The flare was supplied by the same manufacturer for Flare No. 1. Details of the flare specifications are listed below:

Specifications	Details
Manufacturer	Fairyland Environmental Technology, China
Gas flow	Maximum – 2,500Nm^3/hr
Retention time	>0.3 seconds at 800-1,000^{o}C
Gas blower	Two roots blower
Gas analysers	Gas analysers for CH_4 and O_2

The analyser and data logging system is similar to Flare No.1 (described above).

Gas Engine Energy Power Plants

A high efficiency (electrical efficiency > 43%) gas engine (1MW) was chosen for the generation of electricity from LFG.

Figure 7: High Efficiency Landfill Gas Engine in Bukit Tagar

The detail of the gas engine specifications are listed below:

Specifications	Details
Manufacturer (Origin)	MWM (Germany)
Model	TCG 2020V12
Electric power output (gross)	1,190kW
Voltage	11kV
Frequency	50Hz
Minimum heating value (LHV)	5.9kWh/m^3

This gas engine has been customised to burn LFG.

To ensure good quality LFG arrives the gas engine, a LFG pre-treatment system comprising of a chiller (made in Germany) and activated carbon filter was also set up to remove moisture and impurities such as H_2S and siloxanes before the gas engine.

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

The project has applied the following approved methodology and tools:

Approved Methodology:

ACM0001 – Consolidated baseline and monitoring methodology for landfill gas project activities *(Version 8)*

Methodological Tools referred to include:

- "Tool for the demonstration and assessment of additionality" *(Version 5.2, EB 39, Annex 10)*;

- “Tool to determine project emissions from flaring gases containing methane” *(Version 1, EB 28, Annex 13)*;
- “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” *(Version 5, EB 55, Annex 18)*;
- “Tool to calculate the emission factor for an electricity system” *(Version 2, EB 50, Annex 14)*; *and*
- “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” *(Version 1, EB 39, Annex 7).*

A.6. Registration date of the project activity:

The registration date of Landfill Gas Recovery and Utilization at Bukit Tagar Landfill, Hulu Selangor in Malaysia is 28th August 2009.

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

Crediting period of 7 years (renewable) was selected. The start date of first crediting period is 28th August 2009 and the last date of the 7 years will be 27th August 2016.

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

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SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

For the reporting period of 1st March 2010 to 31st December 2010, the key CDM activities implemented are as follow:

<u>Gas Extraction System in Advance Cell and Flare No.1</u>

The actual implementation of the flaring system was initiated in August 2009 and has continued through this monitoring period.

The table below shows the details on the downtime of the system due to break down, replacement of equipment used for CDM monitoring and gas integration of the cells.

Date	Reason
5th March 2010 (10:40pm – 11:16pm)	CH_4 analyser breakdown as low flow was detected.

7th March 2010 (4:04am – 5:32am and 10:44am – 11:42am)	CH_4 analyser breakdown as low flow was detected.
9th March 2010 (8:34am – 3:42pm)	CH_4 analyser breakdown as low flow was detected.
9th April 2010 (12:28pm – 4:42pm on 15th April 2010)	TT_3 transmitter has exceeded the danger set point. The transmitter and probe were replaced on 15th April 2010 (refer to page 17, table 3, item 2 for new meter specification).
17th May 2010 (10:38am – 10:46am)	CH_4 reading has exceeded the set point limit.
26th September 2010 (9:02pm – 10:08am on 27th September 2010)	CH_4 analyser shown faulty error.
12th December 2010	TT_3 transmitter has malfunctioned and was replaced on the same day (refer to page 18, table 3, item 2 for new meter specification).
17th December 2010	Integration of gas from Phase 1 Cell to Advance Cell

The total running up time for Flare No. 1 is 96% during this monitoring period.

Gas Extraction System in Phase 1 Cell and Flare No.2

The project tender for gas extraction and flaring for Phase 1 Cell was called in September 2009 and the contract was awarded to Tai Hoe Engineering Sdn. Bhd. on 15th December 2009. The physical works started on 22nd January 2010.

The flaring system in Phase 1 was completed in the 2nd monitoring period and started its operation on 7th August 2010. Flare No. 2 is located next to Flare No. 1 where the LFG extracted from Phase 1 cell is transferred via a transfer pipe and fed to Flare No. 2.

An integration of piping system was implemented to allow the landfill gas from Phase 1 cell can be flared off in Flare No. 1. Similarly, LFG extracted from advanced cell can be flared in Flare No. 2 if necessary.

The table below shows the details on the downtime of the system due to the replacement of CH_4 analyzer during the monitoring period.

Date	Reason
8th November, 2010	CH_4 analyser breakdown on 08th November, 2010. A new analyzer has been replaced on the day (refer to page 19, table 4, item 6 for new meter specification).

The operation up time of Flare No. 2 is 91% during this monitoring period.

Power Generation

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

The power generation works started in April 2010 and grid connection is targeted to be completed first quarter of 2011. A 1 MW high efficiency gas engine will be installed.

The generation of power and uploading to the grid requires licensing and approvals from the Energy Commission as well as the grid operator Tenaga Nasional Berhad (TNB). On-site utilisation of power was originally planned in 2010 using partial of the power generated from the first 1 MW gas engine. An integrated electricity cabling design has been proposed to simultaneously supply on-site requirement and uploading to grid. However, during a meeting with TNB on 22nd June 2010, the proposed design was disapproved by TNB due to technical reason. Simultaneous internal consumption and export was not accepted as an acceptable practice, although technically it is possible.

Due to the above reason, the management of KBE has decided on a meeting on 23rd June 2010 to proceed with the uploading to grid first in 2010 (completed in 2011) and will proceed with the on-site utilisation with a separate gas engine and internal cabling works in 2011. The delay is due to the need to secure adequate funding for this purpose which is not budgeted in 2010.

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

Date/Duration	Process Description	Details & Status
23th Apr 2010	Power system study	- Presentation of the result by TNBES - No issue encountered from the study
27th Apr 2010	Power system study report	- Report submitted by TNBES
11th May 2010	Submission of documents for Renewable Energy Power Purchase Agreement (REPPA) approval	- Compilation and submission of acceptance letter, financial model, power system study and forms 24 & 49 of KBE to TNB for REPPA approval
Mid-May 10	Gas engine	- Ordered 1st gas engine
21th July 2010	Letter of approval (LoA) on terms and conditions for REPPA	- Received LoA from TNB on terms and conditions for REPPA
6th Sept 2010	Draft REPPA	- Draft REPPA was received from TNB for review
3rd Nov 2010	Signing of REPPA	- Final REPPA was signed by KBE

Date/Duration	Process Description	Details & Status
2nd Dec 2010	Announcement of REPPA	- TNB announced to buy the power from Bukit Tagar
03rd Jan 2011	Gas engine delivery	- Delivery of containerised gas engine to Bukit Tagar site

B.2. Revision of the monitoring plan

There was no deviation or revision to the monitoring plan (implemented as described in the registered PDD, Version 5.3).

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

No deviation during this monitoring period.

B.4. Notification or request of approval of changes

No permanent changes were applicable during this monitoring period.

SECTION C. Description of the monitoring system

Monitoring Methodology

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

Operation and Management Structure for Monitoring

The organization structure for the Bukit Tagar CDM monitoring team is shown below:

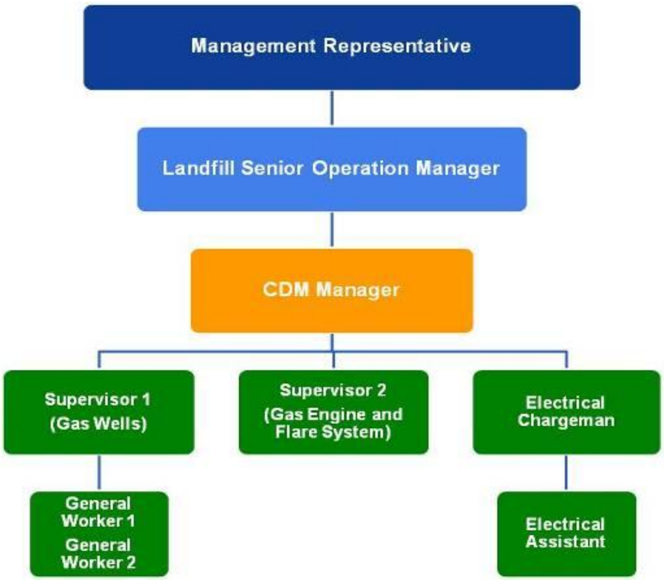


Figure 8: Organisational Structure for CDM Monitoring for BTSL LFG Recovery and Utilisation Project

The roles and responsibilities of the monitoring team in carrying out the monitoring plan are detailed as follow:

Table 1: Responsibilities of the CDM Monitoring Team

Role	Responsibility in CDM monitoring
Management Representative	• Reports to and obtain decisions from management on CDM-related matters • Chairs internal meetings on CDM matters • Signs off official correspondence for external parties
Senior Landfill Operation Manager	• Reports to the management representative • Oversees entire operation of landfills (including LFG management system) • Covers responsibility of CDM Manager when he is not available
CDM Manager	• Reports to the Senior Landfill Operation Manager • Oversees and coordinates the entire CDM monitoring plan • Verifies and signs off all relevant monitoring records • Ensures Quality Control / Quality Assurance (QC/QA) is carried out • Ensures all data are recorded and necessary documentations are prepared according to the requirements of CDM monitoring • Responsible in optimising the LFG extraction and utilisation system
CDM Consultant	• Provides advice on all CDM-related matters • Prepares monitoring reports for verifications • Liaises with the verifier on verification process • Conducts regular audits on CDM monitoring
Supervisors	• Report to the CDM Manager on CDM monitoring issues • Check and ensure that the flaring system is functional • Ensure all data recording devices are functioning and calibrated as planned (including performing QA/QC) • Check and sign the daily monitoring log sheets for CDM monitoring • Supervise general workers in maintenance work and record monitored parameters for CDM monitoring • Identify maintenance requirement and contact the supplier if maintenance and support are needed • Optimise the flare operation together with the CDM Manager • Responsible with the security of locked PLC control room. The supervisor will hold the door key for the PLC control room
Electrical Chargeman	• Conducts regular checks on the electrical components of the flaring system • Ensures continuous power supply to flaring system • Identifies and fixes all electrical and electronic faults detected

Role	Responsibility in CDM monitoring
	• Ensures all electrical meters are functioning and calibrated as per the supplier requirement / industrial standards • Records the electricity consumption for the flare system in the daily monitoring log sheets
General Workers	• Perform regular operational and maintenance tasks • Record necessary readings in daily monitoring log sheets and request verification from the supervisors on the log sheets • Report any fault to supervisor-in-charge or the electrical chargeman

The team was overall headed by the management representative (MR) who oversees the entire CDM monitoring implementation. The MR received direct updates and support from the site staff headed by the Senior Landfill Operation Manager. The Senior Landfill Operation Manager was supported by the CDM Manager whom was the key coordinator to all CDM monitoring matters on site. The CDM Manager was assisted by a group of technicians and workers who will perform the daily recording and check tasks.

The CDM consultant (Eco-Ideal Consulting Sdn. Bhd.) was appointed to assist KBE in ensuring that the monitoring plan and requirement were done according to monitoring plan. The consultant played the role as a trainer as well as conducting independent audits as part of the QA/QC procedures set up for this project.

During this monitoring period, a CDM Management Meeting was held on the 27th September 2010.

Relevant Monitoring Points

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

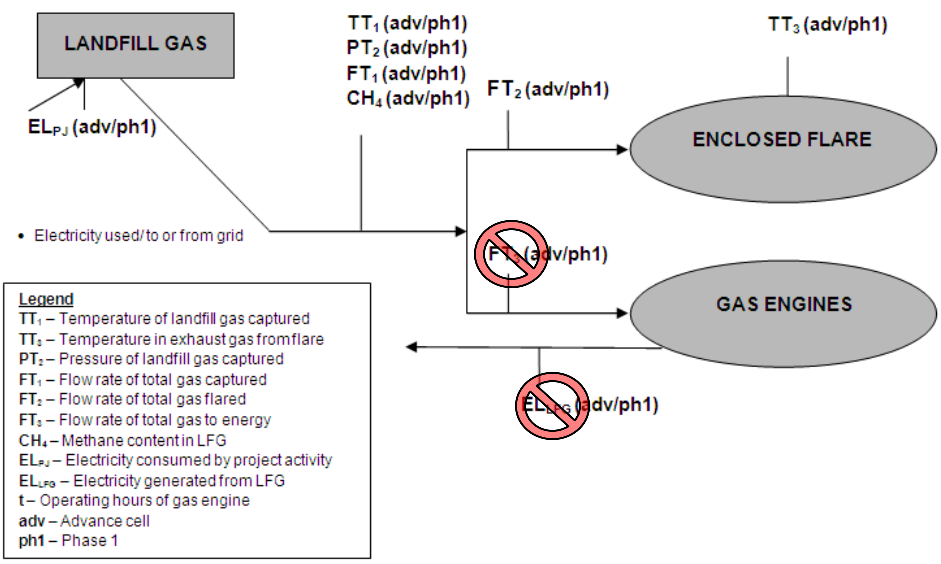


Figure 9: Key Parameters Monitored under the CDM Monitoring Plan

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

Data Recording and Documentation

All relevant data/measurements of the parameters taken were recorded and kept in an appropriate format and archived after the crediting period to ensure that the data are accessible especially during the monitoring and verification process of the project.

Data was recorded in the following way:

Continuous Monitoring – Data in Softcopy:

Data logger (automatic recording in computer)

Manual Recording – Data in Hardcopy:

- Daily log-sheets and record books (manual recording)

Based on the monitoring plan, key parameters (temperature, pressure, flow of gas, CH_4 concentration in biogas) were continuously monitored and recorded via the data logger at the control room.

As a back-up data recording system, the on-site staff was required to manually record certain monitored parameters in daily monitoring log sheets. These records were kept in a safe place which can be accessible by the CDM Manager and technicians whenever necessary. These log sheets (in hard copies) were scanned for electronic filing on a monthly basis.

A summary of the data directly monitored is tabulated below:

Table 2: CDM Monitoring Parameters, Frequency and Archiving

Parameter	CDM ID	Equipment ID	Monitoring equipment	Recording frequency	Documentations	Data archive
Temperature	T	TT_1 (adv/ph1), TT_3 (adv/ph1)	Thermocouple	Every 5 sec (from 01st March 10 to 5th March 10) Every 1 min (from 5th March 10 – on-going) (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into pdf format for archiving
Pressure	P	PT_2 (adv/ph1)	Pressure Gauge	Every 5 sec (from 01st	Softcopy	(.MDB MS Access

Parameter	CDM ID	Equipment ID	Monitoring equipment	Recording frequency	Documentations	Data archive
				March 10 to 5th March 10) Every 1 min (from 5th March 10 – on-going) (auto) Daily (manual) – as back-up	 Hardcopy	database) Daily log sheet will be scanned into pdf format for archiving
Flowrate	F	FT_1 (adv/ph1), FT_2 (adv/ph1), FT_3 (adv/ph1)	V-Cone Differential Pressure Flowmeter	Every 5 sec (from 01st March 10 to 5th March 10) Every 1 min (from 5th March 10 – on-going) (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into pdf format for archiving
Methane Fraction	W_{CH4}	CH_4 (adv/ph1)	Continuous Infrared Gas Analyser	Every 5 sec (from 01st March 10 to 5th March 10) Every 1 min (from 5th March 10 – on-going) (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into pdf format for archiving

Parameter	CDM ID	Equipment ID	Monitoring equipment	Recording frequency	Documentations	Data archive
Electricity consumed by the project	$EL_{PJ,y}$	EL_{PJ} (adv/ph1)	kWh meter	Daily (manual)	Softcopy	Data recorded will be compiled into MS Excel and aggregated for monthly amount
					Hardcopy	Daily log sheet will be scanned into pdf format for archiving

NOTE:
Data recorded by the flow meter were normalised to Nm^3 with the temperature and pressure monitored automatically via the software. Thus, there was no need to normalise the recorded flow further.

LFG electricity not implemented yet in this monitoring period.

Monitoring Equipment and Equipment Calibration

The list of CDM monitoring equipments used is shown below in Table 3 & Table 4 below:

Table 3: List of CDM Monitoring Equipments and Calibration for Flare No.1

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Frequency of Calibration
Flare System												
1	Temperature Transmitter	Temperature (T)	TT_1	T_{total}	°C	Honeywell	STT25M-0-EN0-000-000-000-00-3D	B224836437	±0.5%	0-100°C	28/4/2010 & SB 100601	Annually
2	Temperature Transmitter	Flare Temperature ($T_{flare,y}$)	TT_3	$T_{flare,y}$	°C	1. Honeywell (from 1 Mac - 15 Apr 10)	STT25M-0-EN0-000-000-000-00-3D	b120876837	+0.5%	0-1200°C	17/8/2008 & 03180834	Annually
						2. Pretop (from 15 Apr - 8 Dec 10)	5334B	090564565	±0.5%	0-1200°C	14/4/2010 & SB 100541	Annually
						3. Honeywell (from 8 Dec 10 onwards)	STT25M-0-EN0-000-000-000-00-3D	B123070037	±0.5%	0-1200°C	15/6/2010 & 03244118	Annually
3	Pressure Sensor	Pressure Transmitter (P)	PT_2	P	kPa	Rosemount	3051TG1A2B21AB4E5Q4	01873654	±0.25%	0-2 to 0-207 kPa	28/4/2010 & SB 100605	Annually
4	Flow Meter	Total Biogas Flow Rate ($LFG_{total,y}$)	FT_1	$LFG_{total,y}$	NM^3/hr	Kingsway Vcone	KVS10IIKC23FSNS304	FT119(8102101)	±1%	3-5000Nm^3/h	28/4/2010 & SB 100606	24 months
5	Flow Meter	Flaring Biogas Flow Rate	FT_2	$LFG_{flare,y}$	NM^3/hr	Kingsway Vcone	KVS10IIKC23FSNS304	FT120(8102102)	±1%	3-5000Nm^3/h	28/4/2010 & SB 100607	24 months
Gas Analysers												
6	CH_4 Meter	Methane fraction of LFG	CH_4	$W_{CH4,y}$	%	Guardian Plus	97460	28931	±2%	0-100%	28/4/2010 & SB 100608	Annually
Power Generation and Electricity Consumption												
7	Power meter	Power consumed	EL	$EL_{FL,y}$	kWh	Krizik Slovakia	ET 421 HF612132C	8383258	Class 2	0-999,999kWh	25/4/2010 & SP/RA/2010/134/001-001	Annually

Note:

In accordance to Annex 60, EB52, the maximum permissible error was applied to the period where the calibration was not valid during this crediting period (1 March 2010-27 April 2010) as follows:

- *Item 1 (TT_1) & 3 (PT_2) were measured for the normalisation of the gas flow, which is processed by the software directly. The maximum permissible error for TT_1 & PT_2 is 0.5% and 0.25% respectively. The impact of applying these errors for the flow normalisation from 1 March to 27 Apr 2010 is negligible as demonstrated to the verifier.*
- *Item 2 (TT_3) - The maximum permissible error of +0.5% was applied to the flare temperature reading starting from 01 March 2010 – 13 April 2010 as a conservative approach. The maximum permissible error of +0.5% was applied to all the raw data recorded every 5 seconds (from 1 March until 5 March at 13:59:59) and I minute (started from 5 March 14:00:00) with any records identified below 502.5^oC (500 ^oC x 1.005) will be considered to be below 500 ^oC.*
- *Item 7 - The maximum permissible error of +2% was applied to the power meter reading starting from 01 March – 24 April 2010 as a conservative approach, in accordance to Annex 60, EB52.*

Table 4: List of CDM Monitoring Equipments and Calibration for Flare No.2

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Frequency of Calibration
Flare System												
1	Temperature Transmitter	Temperature (T)	TT_1	T_{total}	^oC	Honeywell	STT25M-0-EN0-000-000-000-00-3D	B839917437	±0.5% of span	0-100°C	18/5/2010 & RGct2010-0478	Annually
2	Temperature Transmitter	Flare Temperature ($T_{flare,y}$)	TT_3	$T_{flare,y}$	^oC	Honeywell	STT25M-0-EN0-000-000-000-00-3D	B838901937	±0.5% of span	0-1200°C	18/5/2010 & RGcc2010-0057	Annually
3	Pressure Sensor	Pressure Transmitter (P)	PT_2	P	kPa	Rosemount	3051TG1A2B21AB4E5Q4	5584784	±0.25%	0-2 to 0-207 kPa	17/5/2010 & RGpc2010-0110	Annually
4	Flow Meter	Total Biogas Flow Rate ($LFG_{total,y}$)	FT_1	$LFG_{total,y}$	NM^3/hr	Kingways	KVS10IIKC23FSN	FT140 (10031701)	±0.5%	3-5000Nm^3/h	7/4/2010 & D10-292-JG-01	24 months
5	Flow Meter	Flaring Biogas Flow Rate ($LFG_{flare,y}$)	FT_2	$LFG_{flare,y}$	NM^3/hr	Kingways	KVS10IIKC23FSN	FT141 (10031702)	±0.5%	3-5000Nm^3/h	7/4/2010 & D10-292-JG-02	24 months
Gas Analysers												
6	CH_4 Meter	Methane fraction of LFG	CH_4	$W_{CH4,y}$	%	1. Guardian Plus (from 7 Aug - 8 Nov 10)	97460	30548	±2%	0-100%	7/5/2010 & NHqt2010-2160	Annually
						2. Guardian Plus (from 8 Nov 10 onwards)	97460	31453	±2%	0-100%	9/11/2010 & E-0419/1110	Annually
Power Generation and Electricity Consumption												
7	Power meter	Power consumed	EL	$EL_{PJ,y}$	kWh	Contrel Elettronica S.R.L.	EMM SERIE	43D9	±1%	0/999999999kWh	15/10/2009 & NA	Annually

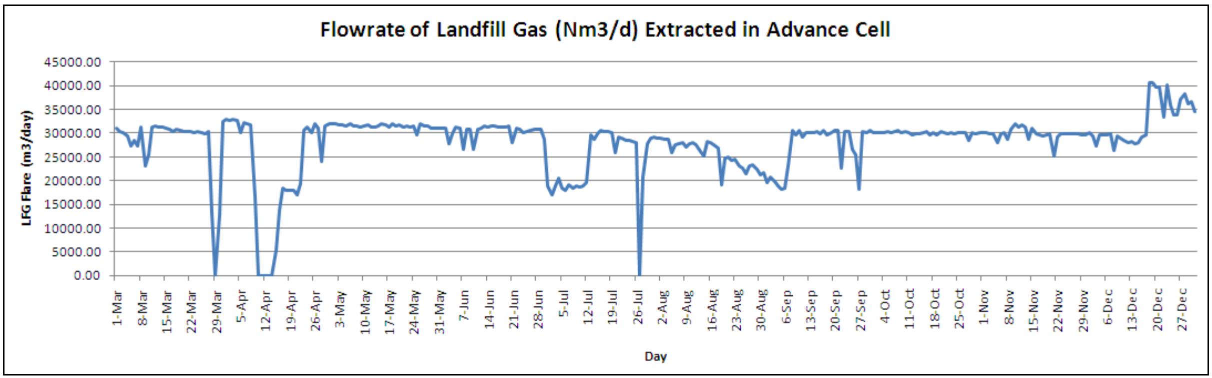
NOTE: All calibration certificates were valid throughout this monitoring period.

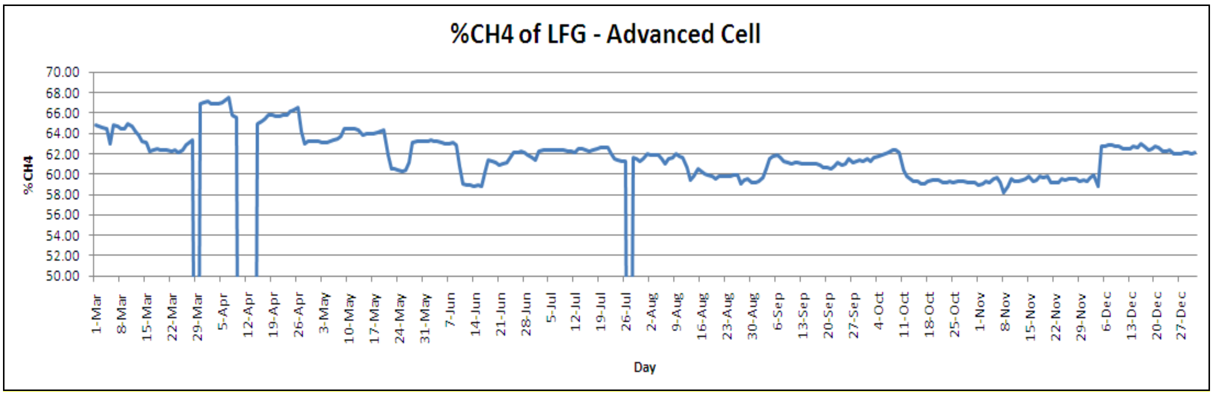
Data Collection (for the whole monitoring period)

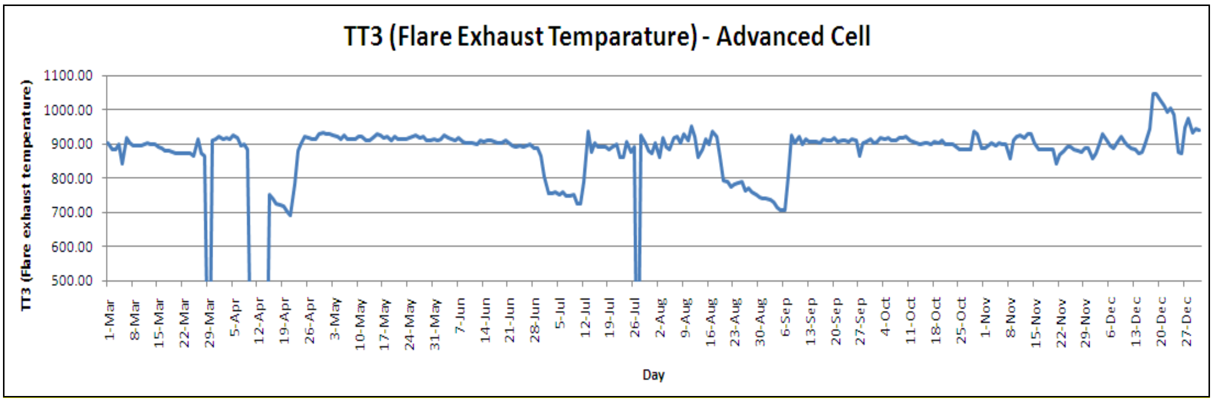
Based on the monitoring plan, key flaring parameters (temperature, pressure, flow of gas, CH_4 concentration in LFG) were continuously monitored and recorded via the data logger at the flare system control room. Continuous flaring data were logged and archived in every 1 minute in the database file. These raw data were compiled and analysed for the calculation of Certified ERs (CERs).

Data recorded for key parameters are compiled and presented below:

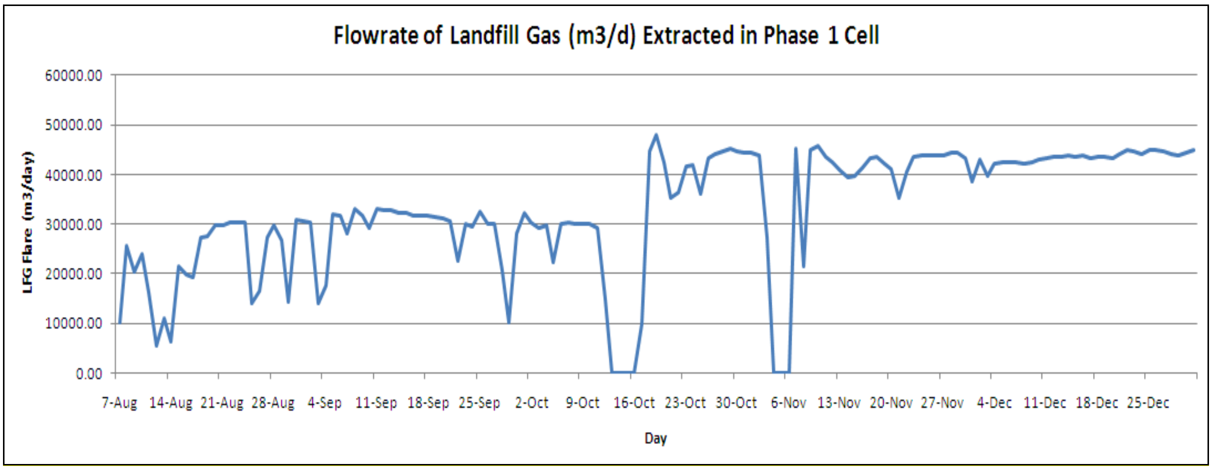
Flare No.1

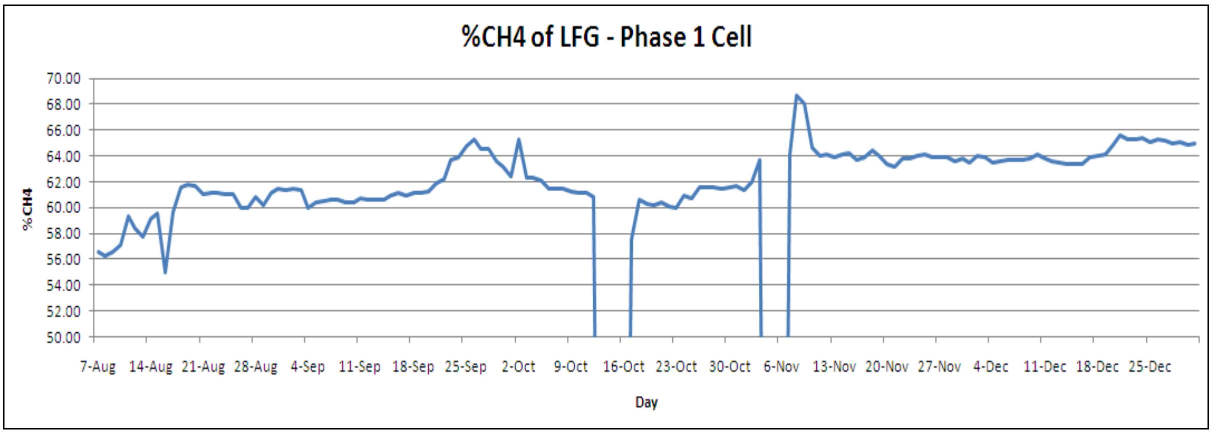


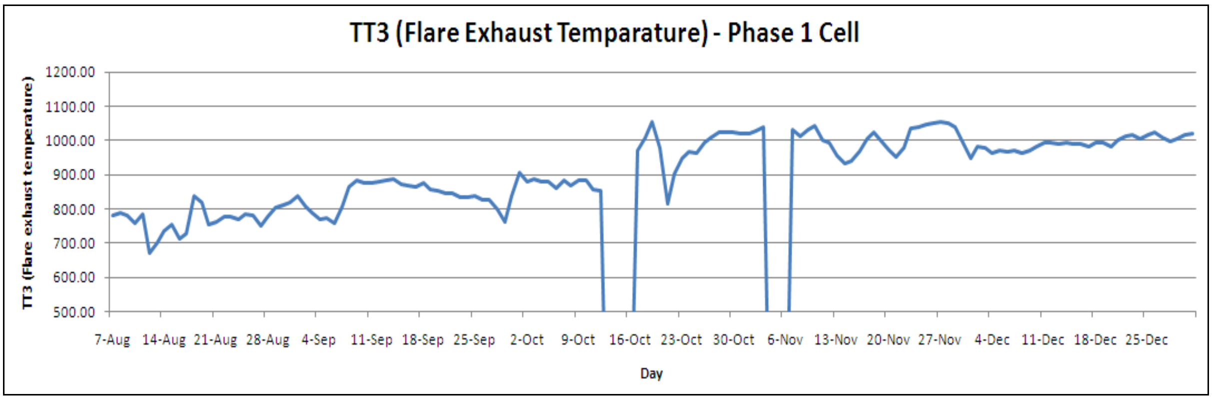




Flare No.2







As a back-up data recording system, the on-site staff manually recorded certain monitored parameters in the daily monitoring log sheets. 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 daily log-sheets on a daily basis and compiled in MS Excel format weekly.

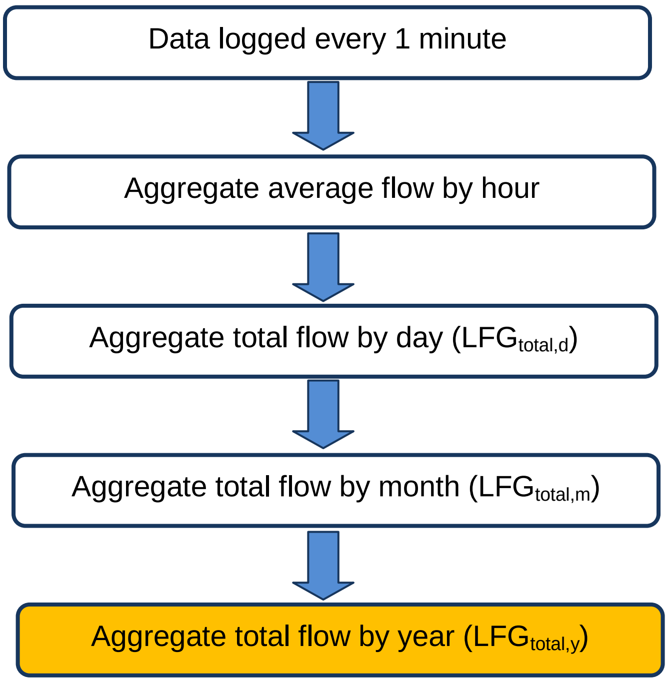
Data Processing

The data logged were archived in .db file format and compiled.

Data recorded were further processed to yield the results required. A specific computation programme (in Microsoft Access) was developed by the CDM Consultant to process continuous monitored data to required format and summary.

An example of data aggregation on site for flow rate of LFG at the main pipe is shown as follows:

Parameter: FT_1 (Flow rate of LFG at main pipe)



Hour	LFG-Total LFG Flow (m^3)
00:00-01:00	780
01:01-02:00	880
02:01-03:00	950
…..	
Total (day)	22,000

Figure 10: Example of Data Aggregation for Continuous Monitoring

Raw data logged at one (1) minute interval were used to compute the hourly average. Subsequently, daily readings were computed, followed by aggregation into monthly and finally, yearly summaries.

Similar average values were computed for parameters such as the temperature, pressure and CH_4 %.

In accordance to the “Tool to determine project emissions from flaring gases containing methane” (EB 28, Annex 13), 3 conditional default values for flare efficiency can be used for the calculation of CERs. The main criteria or condition for choosing the right default values for each hour is to assess the exhaust gas temperature from the flare stack ($T_{flare,h}$). On the other hand, all the operational parameters (temperature, pressure, etc.) related to CDM monitoring will also have to be taken into account as these parameters can affect $T_{flare,h}$.

Therefore, the data of these parameters were recorded continuously through the PLC system.

<u>Quality Assurance and Quality Control (QA/QC)</u>

<u>Documented Procedures and QA/QC Measures</u>

QA/QC was applied throughout the monitoring period:

- Daily inspection of LFG extraction, flaring and monitoring systems;
- Checking and counter signing of data forms by the CDM Manager;
- Data security (restricted access, password control) was applied to ensure the integrity of data;
- Inspection, observations, incidents and follow-up actions were documented;
- Independent audits were carried out by external consultants; and
- Data was analysed on a weekly basis to determine any irregularities.

<u>Data Management and Storage</u>

A proper data back-up system has been set up to ensure the data will not be compromise in case of any unforeseen incidents at site resulting in total loss of data.

<u>Continuous Monitoring (data logging system)</u>

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 back-up system was applied for this project:

Types of back-up	Frequency	Back-up location
Manual back-up using a portable hard disk (HD) (weekly)	Monthly	At the flare
Automatic back-up to the CDM Manager's PC located at the site office, BTSL	Weekly	On-site (site office)
Data server in the CDM Consultant's office (Eco-Ideal Consulting Sdn. Bhd., C-7-2, Wisma Goshen, Plaza Pantai, Kuala Lumpur, Malaysia)	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 loss of data from the flare data recording system.

The automatic data back-up system based on internet data transmission can be illustrated as follows:

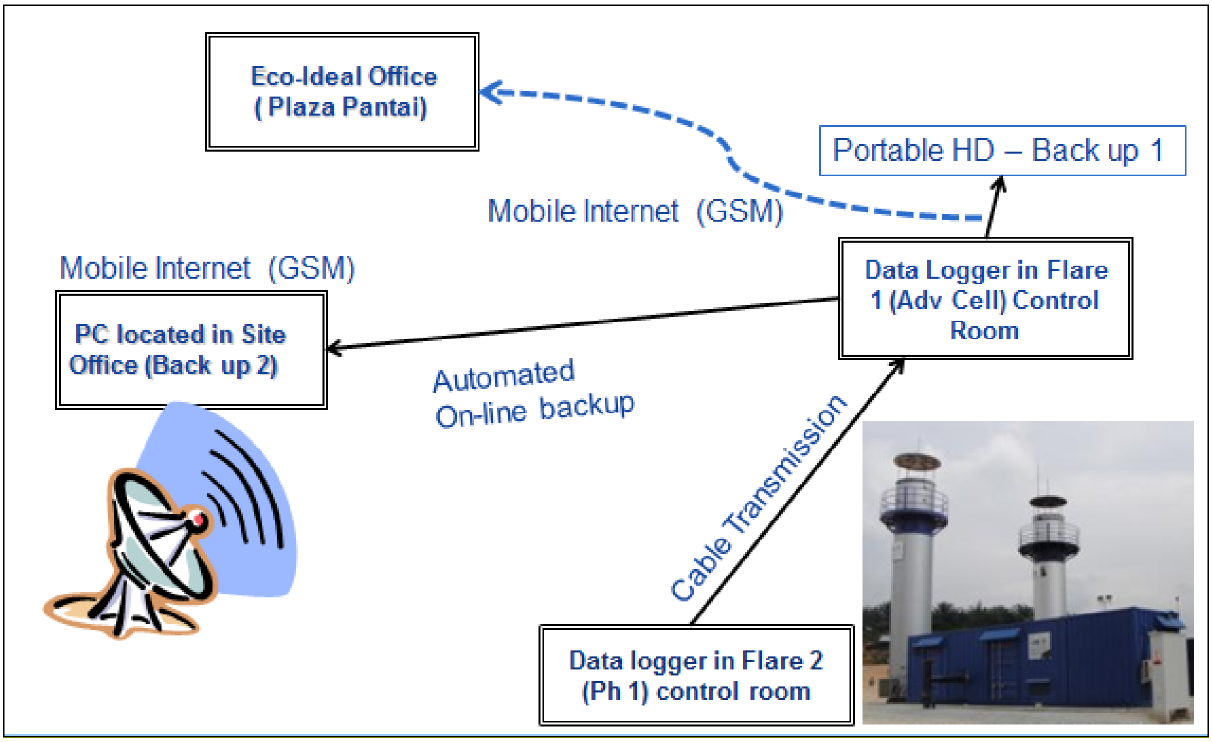


Figure 11: Automatic Data Back-up for Flaring System at BTSL

Manual Recording

Daily operational data (consisting of CDM parameters monitored) recorded manually was backed-up by scanning all the daily monitoring log sheets on a weekly basis. 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 a monthly basis for secondary back-up.

Independent Audits and Control Measures

All procedures for audit and QC measures were detailed in the CDM Monitoring Audit Plan and Procedures (October 2009). A total of 2 independent audits were conducted by the consultant (Eco-Ideal Consulting Sdn. Bhd.) relevant to the 2nd monitoring period:

- 1st Internal Audit – 6th September 2010
- 2nd Internal Audit – 5th January 2011

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

Training

Training is important to ensure that all the involved staff is provided with the needed knowledge and skills to undertake their roles effectively according to the CDM Monitoring Plan.

Refresher training was conducted on 27th September 2010 at Bukit Tagar project site office. The participants were staff from the BTSL's monitoring team which consisted of the Senior Landfill Operation Manager, CDM Manager, supervisors, chargeman and general workers.

The objective of the training was to ensure that all staff is provided with the needed knowledge and skills to undertake their roles efficiently according to the CDM Monitoring Plan.

Data recording and documentation and the updates from the monitoring manual were discussed and elaborated during the training.

The staffs also attended other technical/operational training provided by the suppliers/contractors as listed below:

No	Description	Date	No. of participants
1	Portable flow meter & gas analyser extraction wells	12th May 2010	7
2	Calibration for gas analysers – CH4, CO2, O2	22nd July 2010	6
3	Daily Monitoring Logsheet – Flare No.2	6th Aug 2010	8
4	Gas analyser – calibration with span gas	19th Aug 2010	8
5	SCADA system for Flare No.2	28 Sept 2010	9
6	Maintenance works for sump C & D for Flare No.2	10 Nov 2010	8
7	Training for maintenance work (filter) for Flare No.1	22 Dec 2010	8

SECTION D. Data and parameters

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

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential (GWP) for CH_4
Source of data used:	Intergovernmental Panel on Climate Change (IPCC), Technical Summary, Working Group 1, pg. 33 The default value given by IPCC 2006 guideline for GWP of CH_4
Value (s):	21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	NA

Data / Parameter:	**D_{CH4}**
Data unit:	$t_{CH4}/m^3{}_{CH4}$
Description:	CH_4 density at standard temperature and pressure
Source of data used:	ACM0001 – "Consolidated baseline and monitoring methodology for landfill gas project activities" (Version 8)
Value (s):	0.0007168
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project emission calculation
Additional Comment:	-

Data / Parameter:	**Φ**
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	This uncertainty factor was adopted and the value of 0.9 based on recommendations in the "Tool to determine methane emissions avoided from dumping waste at solid waste disposal site".
Value (s):	0.9
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	-

Data / Parameter:	f
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data used:	There are no methane flaring, combustion or other usage of the methane in the baseline scenario
Value (s):	0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	-

Data / Parameter:	OX
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Site visit reveals that this landfill is well managed and soil cover is applied on a daily basis. Therefore, the value 0.1 was applied as recommended by the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".
Value (s):	0.1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	-

Data / Parameter:	F
Data unit:	%
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	This value is applied based on the recommendation of the IPCC in the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site".
Value (s):	0.5
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	-

Data / Parameter:	DOC_f
Data unit:	%
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	This value is applied based on IPCC 2006 Guidelines for National

	Greenhouse Gas Inventories
Value (s):	0.5
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	-

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane Correction Factor
Source of data used:	This value is applied based on the recommendation of the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. The Bukit Tagar landfill site is a fully anaerobic managed solid waste disposal sites. The waste received at the landfill is deposited at specific tiping face and there is no scavenging of waste in the landfill. Waste are covered daily with compacted soil and compaction as well as levelling are practiced based on international landfill operational practices
Value (s):	1.0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	-

Data / Parameter:	**DOC_j**
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) in the waste type *j*
Source of data used:	The above values were adopted from IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4)
Value (s):	The following values for the different waste fraction (types) were applied:

DOC_j		
Waste type j	**DOC_j (% wet basis)**	**DOC_j (% dry basis)**
Wood and wood products	**43**	50
Pulp, paper and cardboard (other than sludge)	**40**	44
Food, food waste, beverages and tobacco (other than sludge)	**15**	38
Textiles	**24**	30
Garden, yard and park	**20**	49

	<table><tr><td>**waste**</td><td></td><td></td></tr><tr><td>**Glass, plastic, metal, other inert waste**</td><td>**0**</td><td>0</td></tr><tr><td>**Nappies**</td><td>**24**</td><td>60</td></tr></table>
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	-

Data / Parameter:	**kj**
Data unit:	-
Description:	Decay rate for the waste type *j*
Source of data used:	The above values were adopted from IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value (s):	The following values for the different waste fraction (types) were applied:
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	The project site is located in the State of Selangor, Malaysia. The climate is tropical with an annual mean 24 hr temperature of approximately 27 degree Celsius and annual mean precipitation of around 2700 mm. these values are long term average documented in the EIA report prepared for the landfill in 2005. Thus, the K values for tropical temperature and wet climate was used.

Waste type j		**Boreal and Temperature ($MAT<20^oC$)**		**Tropical ($MAT>20^oC$)**	
		Dry (MAP/PET<1)	**Wet (MAP/PET>1)**	**Dry (MAP<1000mm)**	**Wet (MAP>1000mm)**
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0/06	0.045	**0.07**
Slowly degrading	Wood, wood products and straw	0.02	0.03	0.025	**0.035**
Moderately degrading	Other (non-food) organic putrescrible garden and park waste	0.05	0.1	0.065	**0.17**
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	**0.4**

Data / Parameter:	η_{flare}
Data unit:	-
Description:	Flare efficiency per hour
Source of data used:	"Tool to determine project emissions from flaring gases containing methane" (EB 28, Annex 13, pg. 10)
Value applied:	0.90
Indicate what the data are used for (Baseline/ Project/ Leakage emission reduction calculations)	Project emission calculation
Additional comment:	As the project installed an enclosed flaring system, the default value of 0.90 for enclosed flare efficiency for flare temperature about 500^0C for more than 40 minutes in an hour was applied and monitored during the monitoring period. This is conservative as the enclosed flare is typically designed to operate at a much higher temperature (>900 ^0C).

Data / Parameter:	TDL_y
Data unit:	-
Description:	Average technical transmission and distribution losses for providing electricity to the grid in year y
Source of data used:	Default values from TNB Report, 2007
Value applied:	0.1
Indicate what the data are used for (Baseline/ Project/ Leakage emission reduction calculations)	Project emission calculation
Additional comment:	TDL_y should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed CDM project activity is connected to.

D.2. Data and parameters monitored

Data / Parameter:	$LFG_{total,adv,y}$
Data unit:	m^3
Description:	Total amount of LFG captured at Flare No.1 during the project at normal temperature and pressure
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by flow meter during operation of project activity

Value (s) of monitored parameter:	The total LFG captured is the same as the total LFG flared during the period (at normal temperature and pressure) as the gas engine has not yet been installed
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	<table><tr><th>Item</th><th>Description</th></tr><tr><td>Type</td><td>Differential Pressure Transmitter</td></tr><tr><td>Accuracy class</td><td>± 0.5%</td></tr><tr><td>Serial No.</td><td>4972946</td></tr><tr><td>Calibration frequency</td><td>2 years</td></tr><tr><td>Date of last calibration</td><td>28/4/2010</td></tr><tr><td>Validity</td><td>2 years</td></tr></table>
Measuring/ Reading/ Recording frequency:	Measured with a flow meter. Data will be aggregated on both monthly and yearly basis
Calculation method (if applicable)	Not applicable
QA/QC procedures to be applied:	Flow meters will be tested, calibrated and maintained regularly.

Data / Parameter:	**$LFG_{total,ph1,y}$**
Data unit:	m^3
Description:	Total amount of LFG captured at Flare No.2 during the project at normal temperature and pressure
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by flow meter during operation of project activity
Value (s) of monitored parameter:	The total LFG captured is the same as the total LFG flared during the period (at normal temperature and pressure) as the gas engine has not yet been installed
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project emission calculation

Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	**Item** / **Description**: Type: Differential Pressure Transmitter Accuracy class: ± 0.5% Serial No.: FT140 (10031701) Calibration frequency: 2 years Date of last calibration: 7/4/2010 Validity: 2 years
Measuring/ Reading/ Recording frequency:	Measured with a flow meter. Data will be aggregated on both monthly and yearly basis
Calculation method (if applicable)	Not applicable
QA/QC procedures to be applied:	Flow meters will be tested, calibrated and maintained regularly.

Item	Description
Type	Differential Pressure Transmitter
Accuracy class	± 0.5%
Serial No.	FT140 (10031701)
Calibration frequency	2 years
Date of last calibration	7/4/2010
Validity	2 years

Data / Parameter:	**$LFG_{flare,adv,y}$**
Data unit:	m^3
Description:	Total amount of LFG sent to Flare No.1 at normal temperature and pressure
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by flow meter during operation of project activity
Value (s) of monitored parameter:	(see table below)
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project emission calculation

Months	Value (Nm_3)
March 10	922,370.38
April 10	644,028.84
May 10	975,752.21
June 10	912,105.69
July 10	739,448.48
August 10	793,521.37
September 10	805,226.21
October 10	930,443.98
November 10	895,292.72
December 10	1,010,147.54

Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	<table><tr><th>Item</th><th>Description</th></tr><tr><td>Type</td><td>Differential Pressure Transmitter</td></tr><tr><td>Accuracy class</td><td>± 0.5%</td></tr><tr><td>Serial No.</td><td>4972945</td></tr><tr><td>Calibration frequency</td><td>2 years</td></tr><tr><td>Date of last calibration</td><td>28/4/2010</td></tr><tr><td>Validity</td><td>2 years</td></tr></table>
Measuring/ Reading/ Recording frequency:	Measured with a flow meter. Data will be aggregated on both monthly and yearly basis
Calculation method (if applicable)	Raw data logged at 1-minute interval will be used to compute the hourly average. Subsequently, daily readings can be computed, followed by aggregation into monthly and finally, yearly summaries.
QA/QC procedures to be applied:	Flow meters will be tested, calibrated and maintained regularly.

Data / Parameter:	**$LFG_{flare,ph1,y}$**
Data unit:	m^3
Description:	Total amount of LFG sent to Flare No.2 at normal temperature and pressure
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by flow meter during operation of project activity
Value (s) of monitored parameter:	<table><tr><th>Months</th><th>Value (Nm₃)</th></tr><tr><td>August 10</td><td>555,762.02</td></tr><tr><td>September 10</td><td>863,225.20</td></tr><tr><td>October 10</td><td>940,786.64</td></tr><tr><td>November 10</td><td>1,266,865.50</td></tr><tr><td>December 10</td><td>1,342,929.40</td></tr></table>
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project emission calculation

Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	**Item** / **Description**: Type: Differential Pressure Transmitter Accuracy class: ± 0.5% Serial No.: FT141 (10031702) Calibration frequency: 2 years Date of last calibration: 7/4/2010 Validity: 2 years
Measuring/ Reading/ Recording frequency:	Measured with a flow meter. Data will be aggregated on both monthly and yearly basis
Calculation method (if applicable)	Raw data logged at 1-minute interval will be used to compute the hourly average. Subsequently, daily readings can be computed, followed by aggregation into monthly and finally, yearly summaries.
QA/QC procedures to be applied:	Flow meters will be tested, calibrated and maintained regularly

Item	Description
Type	Differential Pressure Transmitter
Accuracy class	± 0.5%
Serial No.	FT141 (10031702)
Calibration frequency	2 years
Date of last calibration	7/4/2010
Validity	2 years

Data / Parameter:	**$PE_{flare,adv,y}$**
Data unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream flare no.1 in year y
Measured/ Calculated/ Default:	Calculated
Source of data:	Calculated as per the “Tool to determine project emissions from flaring gases containing methane”
Value (s) of monitored parameter:	(see table below)
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation

Months	Value (tCO_2e)
March 10	945.92
April 10	684.75
May 10	930.39
June 10	867.98
July 10	727.09
August 10	770.02
September 10	790.99
October 10	857.65
November 10	834.61
December 10	988.03

Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	Refer to $\mathbf{T_{flare}}$ below.
Measuring/ Reading/ Recording frequency:	As per the "Tool to determine project emissions from flaring gases containing methane"
Calculation method (if applicable)	As per the "Tool to determine project emissions from flaring gases containing methane"
QA/QC procedures to be applied:	As per the "Tool to determine project emissions from flaring gases containing methane"

Data / Parameter:	$\mathbf{PE_{flare,ph1,y}}$
Data unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream flare no. 2 in year y
Measured/ Calculated/ Default:	Calculated
Source of data:	Calculated as per the "Tool to determine project emissions from flaring gases containing methane"
Value (s) of monitored parameter:	see table below
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	Refer to $\mathbf{T_{flare}}$ below.
Measuring/ Reading/ Recording frequency:	As per the "Tool to determine project emissions from flaring gases containing methane"

Months	**Value (tCO_2e)**
August 10	669.64
September 10	867.01
October 10	913.65
November 10	1228.44
December 10	1306.02

Calculation method (if applicable)	As per the “Tool to determine project emissions from flaring gases containing methane”
QA/QC procedures to be applied:	As per the “Tool to determine project emissions from flaring gases containing methane”

Data / Parameter:	$w_{CH4,adv}$
Data unit:	m^3 CH4 / m^3 LFG
Description:	Fraction of CH_4 in LFG for Flare No. 1
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by using a multi-gas analyser
Value (s) of monitored parameter:	**Months** / **Value (% wet basis)**: March 10 – 63.60%; April 10 – 65.75%; May 10 – 63.04%; June 10 – 61.42%; July 10 – 62.06%; August 10 – 60.43%; September 10 – 60.99%; October 10 – 60.16%; November 10 – 59.35%; December 10 – 62.05%
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	**Item** / **Description**: Type – Infra-Red Gas Monitor; Accuracy class – ± 2% of full scale; Serial No. – 28931; Calibration frequency – Annually; Date of last calibration – 28/4/2010; Validity – 1 year
Measuring/ Reading/ Recording frequency:	The CH_4 fraction will be measured continuously with a multi-gas analyzer
Calculation method (if applicable)	Raw data logged at 1-minute interval will be used to compute daily average readings
QA/QC procedures	The CH_4 gas analyser will be checked and calibrated regularly

Value (s) of monitored parameter:

Months	Value (% wet basis)
March 10	63.60%
April 10	65.75%
May 10	63.04%
June 10	61.42%
July 10	62.06%
August 10	60.43%
September 10	60.99%
October 10	60.16%
November 10	59.35%
December 10	62.05%

Monitoring equipment:

Item	Description
Type	Infra-Red Gas Monitor
Accuracy class	± 2% of full scale
Serial No.	28931
Calibration frequency	Annually
Date of last calibration	28/4/2010
Validity	1 year

to be applied:	according to the manual given by the manufacturer.

Data / Parameter:	$w_{CH4,ph1}$
Data unit:	m^3 CH4 / m^3 LFG
Description:	Fraction of CH_4 in LFG for Flare No.2
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by using a multi-gas analyser
Value (s) of monitored parameter:	see table below
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	see tables below
Measuring/ Reading/ Recording frequency:	The CH_4 fraction will be measured continuously with a multi-gas analyzer

Value (s) of monitored parameter:

Months	**Value (% wet basis)**
August 10	59.62%
September 10	61.78%
October 10	61.13%
November 10	64.07%
December 10	64.25%

Monitoring equipment:

7 Aug - 8 Nov 2010

Item	**Description**
Type	Infra-Red Gas Monitor
Accuracy class	$\pm$ 2%
Serial No.	30548
Calibration frequency	Annually
Date of last calibration	7/5/2010
Validity	1 year

8 Nov 2010 - onwards

Item	**Description**
Type	Infra-Red Gas Monitor
Accuracy class	$\pm$ 2%
Serial No.	31453
Calibration frequency	Annually
Date of last calibration	9/11/2010
Validity	1 year

Calculation method (if applicable)	Raw data logged at 1-minute interval will be used to compute the daily average readings
QA/QC procedures to be applied:	The CH_4 gas analyser will be checked and calibrated regularly according to the manual given by the manufacturer.

Data / Parameter:	$\mathbf{T_{adv}}$
Data unit:	°C
Description:	Temperature of the LFG captured in Flare No.1
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by temperature meter.
Value (s) of monitored parameter:	(see table below)
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	(see table below)
Measuring/ Reading/ Recording frequency:	Measured continuously by temperature meter
Calculation method (if applicable)	Raw data logged at 1-minute interval will be used to compute the daily average readings

Value (s) of monitored parameter:

Months	Value (°C)
March 10	46.72
April 10	44.19
May 10	51.09
June 10	48.43
July 10	44.91
August 10	52.03
September 10	49.65
October 10	51.99
November 10	52.83
December 10	54.69

Monitoring equipment:

Item	Description
Type	Temperature Transmitter
Accuracy class	± 0.5%
Serial No.	B224836437
Calibration frequency	Annually
Date of last calibration	28/4/2010
Validity	1 year

QA/QC procedures to be applied:	The temperature will be tested and calibrated regularly according to the manual given by the manufacturer.

Data / Parameter:	**T_{ph1}**
Data unit:	°C
Description:	Temperature of the LFG captured in Flare No.2
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by temperature meter.
Value (s) of monitored parameter:	**Months** / **Value (°C)**: August 10 – 36.81; September 10 – 39.19; October 10 – 42.16; November 10 – 49.23; December 10 – 47.94
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	**Item** / **Description**: Type – Temperature Transmitter; Accuracy class – ± 0.5%; Serial No. – B839917437; Calibration frequency – Annually; Date of last calibration – 18/5/2010; Validity – 1 year
Measuring/ Reading/ Recording frequency:	Measured continuously by temperature meter
Calculation method (if applicable)	Raw data logged at 1-minute interval will be used to compute the daily average readings
QA/QC procedures to be applied:	The temperature will be tested and calibrated regularly according to the manual given by the manufacturer.

Value (s) of monitored parameter (T_{ph1}):

Months	Value (°C)
August 10	36.81
September 10	39.19
October 10	42.16
November 10	49.23
December 10	47.94

Monitoring equipment (T_{ph1}):

Item	Description
Type	Temperature Transmitter
Accuracy class	± 0.5%
Serial No.	B839917437
Calibration frequency	Annually
Date of last calibration	18/5/2010
Validity	1 year

Data / Parameter:	**P_{adv}**
Data unit:	Pa
Description:	Pressure of the LFG at Flare No.1
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by pressure transmitter

<table>
<tr><td>Value (s) of monitored parameter:</td><td>
<table>
<tr><th>Months</th><th>Value (kPa)</th></tr>
<tr><td>March 10</td><td>9.94</td></tr>
<tr><td>April 10</td><td>7.74</td></tr>
<tr><td>May 10</td><td>11.16</td></tr>
<tr><td>June 10</td><td>10.43</td></tr>
<tr><td>July 10</td><td>7.31</td></tr>
<tr><td>August 10</td><td>8.21</td></tr>
<tr><td>September 10</td><td>9.89</td></tr>
<tr><td>October 10</td><td>12.79</td></tr>
<tr><td>November 10</td><td>14.24</td></tr>
<tr><td>December 10</td><td>16.86</td></tr>
</table>
</td></tr>
<tr><td>Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline and project emission calculation</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)</td><td>
<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Type</td><td>Pressure Transmitter</td></tr>
<tr><td>Accuracy class</td><td>± 0.25%</td></tr>
<tr><td>Serial No.</td><td>01873654</td></tr>
<tr><td>Calibration frequency</td><td>Annually</td></tr>
<tr><td>Date of last calibration</td><td>28/4/2010</td></tr>
<tr><td>Validity</td><td>1 year</td></tr>
</table>
</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Measured continuously by pressure transmitter</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Raw data logged at 1-minute interval will be used to compute the daily average readings</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The meter will be checked and calibrated regularly according to the manual given by the manufacturer.</td></tr>
</table>

Data / Parameter:	**P_{ph1}**
Data unit:	Pa
Description:	Pressure of the LFG at Flare No.2
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by pressure transmitter

<table>
<tr><td>Value (s) of monitored parameter:</td><td><table><tr><th>Months</th><th>Value (Kpa)</th></tr><tr><td>August 10</td><td>4.61</td></tr><tr><td>September 10</td><td>6.28</td></tr><tr><td>October 10</td><td>8.51</td></tr><tr><td>November 10</td><td>13.93</td></tr><tr><td>December 10</td><td>13.69</td></tr></table></td></tr>
<tr><td>Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline and project emission calculation</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)</td><td><table><tr><th>Item</th><th>Description</th></tr><tr><td>Type</td><td>Pressure Transmitter</td></tr><tr><td>Accuracy class</td><td>± 0.25%</td></tr><tr><td>Serial No.</td><td>5584784</td></tr><tr><td>Calibration frequency</td><td>Annually</td></tr><tr><td>Date of last calibration</td><td>17/5/2010</td></tr><tr><td>Validity</td><td>1 year</td></tr></table></td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Continuous measurement by pressure transmitter</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Raw data logged at 1-minute interval will be used to compute the daily average readings</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The meter will be checked and calibrated regularly according to the manual given by the manufacturer.</td></tr>
</table>

Data / Parameter:	**$CEF_{elec,PR,y}$**
Data unit:	tCO_2/MWh
Description:	Carbon emission factor of electricity
Measured/ Calculated/ Default:	Calculated
Source of data:	Grid connected baseline for Peninsular Malaysia for 2008 by Malaysian Energy Centre (http://cdm.eib.org.my/subindex.php?menu=24&article=1052)
Value (s) of monitored parameter:	**0.672** based on the latest released grid connected baseline emission factor for Peninsular Malaysia for 2008

Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations
Measuring/ Reading/ Recording frequency:	To be re-calculated with any release of latest grid connected baseline emission factor
Calculation method (if applicable)	Not applicable
QA/QC procedures to be applied:	Not applicable

Data / Parameter:	**$EL_{PJ,adv,y}$**
Data unit:	MWh
Description:	Quantity of electricity consumed by project activity at Flare No.1
Measured/ Calculated/ Default:	Measured
Source of data:	Based on continuous measurement by sealed electricity meter installed
Value (s) of monitored parameter:	see table below
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	see table below

Value (s) of monitored parameter:

Months	Value (MWh)
March 10	14.13
April 10	5.88
May 10	11.28
June 10	14.50
July 10	8.91
August 10	11.68
September 10	12.53
October 10	11.06
November 10	11.73
December 10	16.81

Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity):

Item	Description
Type	Analog kWh Meter
Accuracy class	$\pm$ 2%
Serial No.	8383258
Calibration frequency	Annually
Date of last calibration	25/4/2010
Validity	1 year

Measuring/ Reading/ Recording frequency:	Continuous measurement
Calculation method (if applicable)	Not applicable
QA/QC procedures to be applied:	The electricity meter should be tested and calibrated as per the specifications prescribed by the manufacturer.

Data / Parameter:	$\mathbf{EL_{PJ,ph1,y}}$
Data unit:	MWh
Description:	Quantity of electricity consumed by project activity at Flare No.2
Measured/ Calculated/ Default:	Measured
Source of data:	Based on continuous measurement by sealed electricity meter installed
Value (s) of monitored parameter:	(see table below)
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	(see table below)

Value (s) of monitored parameter:

Months	Value (MWh)
August 10	3.34
September 10	9.27
October 10	7.49
November 10	14.28
December 10	17.72

Monitoring equipment:

Item	Description
Type	Digital Energy Multimeters
Accuracy class	$\pm$ 1%
Serial No.	43D9
Calibration frequency	Annually
Date of last calibration	15/10/2009
Validity	1 year

Measuring/ Reading/ Recording frequency:	Continuous measurement
Calculation method (if applicable)	Not applicable
QA/QC procedures to be applied:	The electricity meter should be tested and calibrated as per the specifications prescribed by the manufacturer.

Data / Parameter:	$\mathbf{T_{flare,adv,y}}$
Data unit:	°C
Description:	Temperature in exhaust gas of the enclosed flare no.1
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by temperature meter
Value (s) of monitored parameter:	see table below
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation

Months	Value (°C)
March 10	886.81
April 10	852.82
May 10	918.14
June 10	902.89
July 10	836.95
August 10	852.46
September 10	866.96
October 10	904.78
November 10	892.37
December 10	930.30

<table>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)</td><td>

<u>1 Mac – 15 Apr 10</u>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Type</td><td>Temperature Transmitter</td></tr>
<tr><td>Accuracy class</td><td>± 0.5%</td></tr>
<tr><td>Serial No.</td><td>B120876837</td></tr>
<tr><td>Calibration frequency</td><td>Annually</td></tr>
<tr><td>Date of last calibration</td><td>17/8/2008</td></tr>
<tr><td>Validity</td><td>1 year</td></tr>
</table>

In accordance to Annex 60, EB52, the maximum permissible error was applied to the period where the calibration was not valid during this crediting period (1 March 2010-27 April 2010) as follows:
* The maximum permissible error of +0.5% was applied to the flare temperature reading starting from 01 March 2010 – 13 April 2010 as a conservative approach

<u>15 Apr 10 – 08 Dec 10</u>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Type</td><td>Type K Thermocouple c/w Transmitter</td></tr>
<tr><td>Accuracy class</td><td>± 0.5%</td></tr>
<tr><td>Serial No.</td><td>090564565</td></tr>
<tr><td>Calibration frequency</td><td>Annually</td></tr>
<tr><td>Date of last calibration</td><td>14/4/2010</td></tr>
<tr><td>Validity</td><td>1 year</td></tr>
</table>

<u>08 Dec 10 onwards</u>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Type</td><td>Temperature Transmitter</td></tr>
<tr><td>Accuracy class</td><td>± 0.5%</td></tr>
<tr><td>Serial No.</td><td>B123070037</td></tr>
<tr><td>Calibration frequency</td><td>Annually</td></tr>
<tr><td>Date of last calibration</td><td>15/6/2010</td></tr>
<tr><td>Validity</td><td>1 year</td></tr>
</table>

</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>The enclosed flare is monitored continuously by temperature meter</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Raw data logged at 1-minute interval will be used to compute the daily average readings</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The temperature meter will be tested and calibrated as per the specifications prescribed by the manufacturer.</td></tr>
</table>

Data / Parameter:	$T_{flare,ph1,y}$
Data unit:	°C
Description:	Temperature in exhaust gas of the enclosed flare no.2
Measured/ Calculated/ Default:	Measured
Source of data:	Continuous measurement by temperature meter
Value (s) of monitored parameter:	<table><tr><th>Months</th><th>Value (°C)</th></tr><tr><td>August 10</td><td>768.58</td></tr><tr><td>September 10</td><td>837.76</td></tr><tr><td>October 10</td><td>934.05</td></tr><tr><td>November 10</td><td>1008.64</td></tr><tr><td>December 10</td><td>990.93</td></tr></table>
Indicate what the date are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration, frequency, date of last calibration, validity)	<table><tr><th>Item</th><th>Description</th></tr><tr><td>Type</td><td>Temperature Transmitter</td></tr><tr><td>Accuracy class</td><td>± 0.5%</td></tr><tr><td>Serial No.</td><td>B838901937</td></tr><tr><td>Calibration frequency</td><td>Annually</td></tr><tr><td>Date of last calibration</td><td>18/5/2010</td></tr><tr><td>Validity</td><td>1 year</td></tr></table>
Measuring/ Reading/ Recording frequency:	The enclosed flare is monitored continuously by temperature meter
Calculation method (if applicable)	Raw data logged at 1-minute interval will be used to compute the daily average readings
QA/QC procedures to be applied:	The temperature meter will be tested and calibrated as per the specifications prescribed by the manufacturer.

Data / Parameter:	**Regulatory requirement relating to landfill gas projects**
Data unit:	-
Description:	Regulatory requirement relating to landfill gas projects
Source of data used:	There are no regulatory requirement to recovery and utilize landfill gas in Malaysia. Confirmation from Department of National Solid Waste

	Management of the Ministry of Housing and Local Government regarding regulation aspects of landfill gas already done at the beginning of the current crediting period i.e. at the 1st Monitoring Period (28th August 2009- 28 February 2010).
Value (s):	NA
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional Comment:	To be checked before the renewal of the crediting period.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

The total baseline emissions according to ACM0001 (Version 8) were calculated according to the equations below:

$$BE_y = (MD_{project,y} - MD_{BL,y}) \cdot GWP_{CH4} + EL_{LFG,y} \cdot CEF_{elec,BL,y} + ET_{LFG,y} \cdot CEF_{ther,BL,y}$$

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y}$$

Determination of $MD_{project,y}$ for Flare No.1

	$MD_{flared,y} = \{LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$								$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$				$MD_{project,y}$
Month	Quantity of Flare No.1 flare no 1,y (Nm3)	Methane average fraction Flare No.1 WCH4 (% wet basis)	Density of Methane Flare No.1 DCH4 (t/Nm3)	Total methane Flare No.1 (tCH4)	Global Warming Potential Flare No.1 GWP (tCO2/tCH4)	Emissions from methane Flare No.1 (tCO2e)	PE Flare No.1 (tCO2e)	Quantity of Methane destroyed by flaring MD flared,y (tCH4)	Total for electricity generation Flare No.1 electricity,y (Nm3)	Methane average fraction Flare No.1 WCH4 (% wet basis)	Electricity Generated Emission Flare No.1 MD electricity,y (tCH4)	Emissions from electricity Flare No.1 (tCO2e)	Quantity of methane that would have been destroyed MD project,y (tCH4)
Mar-10	922,370.38	63.60%	0.0007168	420.48	21	8830.0	945.92	375.43	0.00	63.60%	0.00	0.00	375.43
Apr-10	644,028.84	65.75%	0.0007168	303.51	21	6373.8	684.75	270.91	0.00	65.75%	0.00	0.00	270.91
May-10	975,752.21	63.04%	0.0007168	440.92	21	9259.3	930.39	396.61	0.00	63.04%	0.00	0.00	396.61
Jun-10	912,105.69	61.42%	0.0007168	401.57	21	8432.9	867.98	360.23	0.00	61.42%	0.00	0.00	360.23
Jul-10	739,448.48	62.06%	0.0007168	328.94	21	6907.8	727.09	294.32	0.00	62.06%	0.00	0.00	294.32
Aug-10	793,521.37	60.43%	0.0007168	343.75	21	7218.7	770.02	307.08	0.00	60.43%	0.00	0.00	307.08
Sep-10	805,226.21	60.99%	0.0007168	352.01	21	7392.2	790.99	314.34	0.00	60.99%	0.00	0.00	314.34
Oct-10	930,443.98	60.16%	0.0007168	401.21	21	8425.5	857.65	360.37	0.00	60.16%	0.00	0.00	360.37
Nov-10	895,292.72	59.35%	0.0007168	380.86	21	7998.0	834.61	341.12	0.00	59.35%	0.00	0.00	341.12
Dec-10	1,010,147.54	62.05%	0.0007168	449.31	21	9435.4	988.03	402.26	0.00	62.05%	0.00	0.00	402.26

Determination of $MD_{project,y}$ for Flare No.2

	MD_{flared}, $MD_{flared,y} = (LFG_{flare,y} \cdot w_{CH4} \cdot D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$								$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$				$MD_{project,y}$
Month	Quantity of to Flare No.2 flare no.2,y (Nm3)	Methane average fraction Flare No.2 WCH4 (% wet basis)	Density of Methane Flare No.2 DCH4 (t/Nm3)	Total methane Flare No.2 (tCH4)	Global Warming Potential Flare No.2 GWP (tCO2/tCH4)	Emissions from methane Flare No.2 (tCO2e)	PE Flare No.2 (tCO2e)	Quantity of Methane destroyed by flaring MD flared,y (tCH4)	Total for electricity generation Flare No.2 electricity,y (Nm3)	Methane average fraction Flare No.2 WCH4 (% wet basis)	Electricity Generated Emission Flare No.2 MD electricity,y (tCH4)	Emissions from electricity Flare No.2 (tCO2e)	Quantity of methane that would have been destroyed MD project,y (tCH4)
Aug-10	555,762.02	59.62%	0.0007168	237.51	21	4987.6	669.64	205.62	0.00	59.62%	0.00	0.00	205.62
Sep-10	863,225.20	61.78%	0.0007168	382.28	21	8028.0	867.01	341.00	0.00	61.78%	0.00	0.00	341.00
Oct-10	940,786.64	61.13%	0.0007168	412.21	21	8656.4	913.65	368.70	0.00	61.13%	0.00	0.00	368.70
Nov-10	1,266,865.50	64.07%	0.0007168	581.80	21	12217.8	1228.44	523.30	0.00	64.07%	0.00	0.00	523.30
Dec-10	1,342,929.40	64.25%	0.0007168	618.52	21	12988.9	1306.02	556.33	0.00	64.25%	0.00	0.00	556.33

Determination of BE_y for Flare No.1

$(MD_{project,y} - MD_{BL,y}) * GWP_{CH4}$	$EL_{LFG,y} \cdot CEF_{elec,BL,y}$			Bey Flare No.1
Emissions from Flare No.1 (tCO2e)	Total electricity generated from Flare No.1 EL,y (MWh)	CoEF for electricity Flare No.1 CEF electricity,y	Baseline Emission from electricity generation Flare No.1 (tCO2e)	Total Baseline Emissions Flare No.1 (tCO2e)
7884.08	0.00	0.672	0.00	7,884.08
5689.05	0.00	0.672	0.00	5,689.05
8328.91	0.00	0.672	0.00	8,328.91
7564.93	0.00	0.672	0.00	7,564.93
6180.67	0.00	0.672	0.00	6,180.67
6448.63	0.00	0.672	0.00	6,448.63
6601.17	0.00	0.672	0.00	6,601.17
7567.86	0.00	0.672	0.00	7,567.86
7163.42	0.00	0.672	0.00	7,163.42
8447.40	0.00	0.672	0.00	8,447.40

Determination of BE_y for Flare No.2

$(MD_{project,y} - MD_{BL,y}) * GWP_{CH4}$	$EL_{LFG,y} \cdot CEF_{elec,BL,y}$			Bey Flare No.2
Emissions from Flare No.2 (tCO2e)	Total electricity generated from Flare No.2 EL,y (MWh)	CoEF for electricity Flare No.2 CEF electricity,y	Baseline Emission from electricity generation Flare No.2 (tCO2e)	Total Baseline Emissions Flare No.2 (tCO2e)
4318.00	0.00	0.672	0.00	4,318.00
7160.97	0.00	0.672	0.00	7,160.97
7742.78	0.00	0.672	0.00	7,742.78
10989.32	0.00	0.672	0.00	10,989.32
11682.90	0.00	0.672	0.00	11,682.90

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
2. For this project, $MD_{BL,y}$ is zero since there are no destroy or combustion of CH_4 today due to the regulatory and contractual requirements
3. $ET_{LFG,y}$ and $CEF_{ther,BL,y}$ are not applicable (=0) to this project since there are no thermal energy production
4. Density of CH_4 for LFG is obtained from ACM0001, Version 8.0, page 14

Total BE_y

Month	Bey Flare No.1	Bey Flare No.2	Total Bey
Mar-10	7884		7,884
Apr-10	5689		5,689
May-10	8329		8,328
Jun-10	7565		7,564
Jul-10	6181		6,180
Aug-10	6449	4318	10,766
Sep-10	6601	7161	13,762
Oct-10	7568	7743	15,310
Nov-10	7163	10989	18,152
Dec-10	8447	11683	20,130
Total	**71876**	**41894**	**113,765**

E.2. Project emissions calculation

The total project emissions according to ACM0001 (Version 8) were estimated according to the equations below:

$$PE_y = PE_{EC,y} + PE_{FC,j,y}$$

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

Month	Electricity consumed by project activity Flare No.1 ELPJ,flare no.1,y (MWh)	Electricity consumed by project activity Flare No.2 ELPJ,flare no.2,y (MWh)	Total Electricity consumed by project activity ELPJ,total,y (MWh)	Coefficient for grid electricity EF grid,y	Transmission and Distribution Losses TDL,y	Total Project Emission from project activity (tCO2e)
Mar-10	14.13		14.13	0.672	0.1	10.45
Apr-10	5.88		5.88	0.672	0.1	4.35
May-10	11.28		11.28	0.672	0.1	8.34
Jun-10	14.50		14.50	0.672	0.1	10.72
Jul-10	8.91		8.91	0.672	0.1	6.58
Aug-10	11.68	3.34	15.02	0.672	0.1	11.10
Sep-10	12.53	9.27	21.80	0.672	0.1	16.11
Oct-10	11.06	7.49	18.56	0.672	0.1	13.72
Nov-10	11.73	14.28	26.01	0.672	0.1	19.23
Dec-10	16.81	17.72	34.53	0.672	0.1	25.52

For this project, the following applies:

1. $PE_{fc,y}$ is zero as no heat of fossil fuel is used to generate electricity for this project
2. The grid connected baseline for Peninsular Malaysia for 2008 was applied to this project and the $EF_{BL,EL,y}$ calculated was 0.672tCO_2/MWh (http://cdm.eib.org.my/subindex.php?menu=24&article=1052)

E.3. Leakage calculation

No leakage is applicable to this project.

E.4. Emission reductions calculation / table

The total emission reduction was calculated as follows:

$$ER_y = BE_y - PE_Y$$

Month	Total Bey	Total Pey	Total ER = BEy - PEy
Mar-10	7,884	11	7,873
Apr-10	5,689	5	5,684
May-10	8,328	9	8,319
Jun-10	7,564	11	7,553
Jul-10	6,180	7	6,173
Aug-10	10,766	12	10,754
Sep-10	13,762	17	13,745
Oct-10	15,310	14	15,296
Nov-10	18,152	20	18,132
Dec-10	20,130	26	20,104
Total	**113,765**	**132**	**113,633**

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 baseline emission figure has been rounded down while the project emission has been rounded up for conservativeness

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

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reduction (tCO_2e)	135,094*	113,633

** proportioned for 10 months (March-Dec 2010) – 162,113x(10/12)*

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

The total emission reduction claimed was lower as compared to the value in the ex-ante calculation. This is mainly due to the delayed commissioning of Flare No.2 and extraction from Phase 1 cell.