No.1, Persiaran Dato' Menteri
Section 2, 40700 Shah Alam
Selangor Darul Ehsan
Malaysia
http://www.sirim-qas.com.my

VERIFICATION AND CERTIFICATION REPORT

BIONERSIS PROJECT THAILAND 1

(UNFCCC Registration Ref. No. 2514)
Verification Period: 1 January 2011 – 31 December 2011

Report No. : SQAS-CDM-EB04330001
Revision No.:6

Report No.:	Date of first issue:	Revision :	Date of this revision :
SQAS-CDM-EB04330001	13 February 2012	1	31 December 2012

Project title	:	Bionersis Project Thailand 1
Organisational Unit	:	SIRIM QAS International Sdn Bhd
Client	:	Bionersis S.A

Summary:

Bionersis S.A has appointed SIRIM QAS International Sdn Bhd to perform the second verification and certification of the emission reductions reported for the 'Bionersis project Thailand 1' for the period from 1 January 2011 to 31 December 2011. The project activity was registered by the UNFCCC Executive Board on 24 September 2009. The verification was based on the validated project design document (PDD)[/1/], validation report[/4/], first verification and certification report[/5/] monitoring reports[/6/7/148/149/152//160/] and other supporting documents made available to the verification team by client.

The project captures and flares the landfill gas (LFG) containing methane. The project involved the installation of a gas collection network, a high temperature enclosed flare, and monitoring and control systems. Currently, the captured LFG is flared in an enclosed flare system[/136/&/137/]. In the Phase 2 of the project, the captured LFG will be combusted in the biogas generator to produce electricity. The project results in the reduction of GHG emissions by the avoidance of methane from being emitted into the atmosphere.

As a result of the verification, SIRIM QAS Intl. verification team confirms that the project has achieved emission reductions for the monitoring period as detailed below:

Monitoring period	1 January 2011 – 31 December 2011
$MD_{project,y}$	30,673.02 tCO_{2e}
$PE_{EC,y}$	27.81 tCO_{2e}
Emission Reduction (rounded down value)	30,645 tCO_{2e}

Subject : CDM Verification

Work carried out by :

Team Leader : Mansor Shah Aziz
Team Members : Azhar Abdul Raof
: Sew Shuh Ping

Work verified by : Isnazunita Ismail

Work approved by : Parama Iswara Subramaniam

Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH_4	Methane
CL	Clarification Request
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse Gas(es)
IPCC	Intergovernmental Panel on Climate Change
LFG	Landfill gas
MP	Monitoring Plan
PDD	Project Design Document
PP	Project participant
SIRIM QAS Intl.	SIRIM QAS International Sdn Bhd
UNFCCC	United Nations Framework Convention for Climate Change
VVM	Validation and Verification Manual 1.2

Table of Contents ***Page***

1.0 INTRODUCTION

1.1 OBJECTIVE

The objectives of this verification were:

- To verify that the project has been implemented as described in the registered project design document and that the actual monitoring systems are in full compliance with the procedures and systems described in the monitoring plan of the registered PDD as well as the applicable methodology;

- To verify that the data reported were accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation; and

- To verify and certify GHG emission reduction reported for *'Bionersis Project Thailand 1'* project for the period from 1 January 2011 to 31 December 2011.

.

1.2 SCOPE

The scope of the verification was the independent and objective review and *ex-post* determination of the monitored reductions in GHG emissions from '*Bionersis Project Thailand 1'* project. The verification of this CDM project activity was based on the validated and registered project design document (PDD), validation report, and first verification report, monitoring reports and supporting documents made available to the verification team. These documents were reviewed against the requirements of the Kyoto Protocol, the CDM Modalities and Procedures, related rules and guidance, and the Validation and Verification Manual (VVM).

The verification is not meant to provide any consulting towards the client. However, stated request for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 Description of the Project Activity

Project Participants/Parties	:	i) Bionersis (Thailand) Ltd. / Thailand ii) Bionersis S.A. / France iii) E.ON Carbon Sourcing GmbH / Netherlands
Title of project activity	:	Bionersis Project Thailand 1
UNFCCC registration No	:	2514
Registered date	:	24 September 2009
Location of the project activity	:	T. Sa Si Mum, Kamphaeng Saen, Nakhon Pathom, Thailand
GPS coordinates	:	14^0 03' 36.35" North and 99^0 58' 01.19" East.

The 'Bionersis Project Thailand 1' (hereafter referred to as the project) is a CDM project activity that involved building, operating and maintaining a landfill gas (LFG) collection and flaring system on the Kamphaeng Saen landfill in Nakhon Pathom, Thailand. The landifill is an anaerobic managed landfill and was opened in 1991 and closed in 2005.

The project involves capturing of the LFG through the installation of a gas collection network of vertical and horizontal wells, flaring the LFG in a high temperature enclosed flare[/136/&/137/] and monitoring and control system. For phase 2, the captured LFG will be combusted in a biogas generator for electricity generation. This had yet to be implemented during this monitoring period.

1.4 Verification Team

The following verification team was assigned to carry out the verification of the project:

Verification team leader	:	Mansor Shah Aziz
Verification team member	:	Azhar Abdul Raof
		Sew Shuh Ping

Mansor Shah Aziz, the verification team leader, holds a degree in Chemical Engineering. He has been trained in the CDM validation and verification processes and is a trainee CDM lead auditor. He is also a qualified ISO 14001 auditor.

Azhar Abdul Raof is a Chemical Engineer by qualification. He has extensive experience in the area anaerobic waste treatment processes. He has been trained in the CDM validation and verification processes, and was qualified as a CDM auditor in accordance with SIRIM QAS Intl.'s qualification criteria.

Sew Shuh Ping, holds a degree in Chemical Engineering. He has been trained in the CDM validation and verification processes and is a qualified CDM lead auditor. He is also a qualified ISO 14001 lead auditor.

2. METHODOLOGY

The SIRIM QAS Intl.'s verification process consisted of the following phases:

i) document review of the CDM registered PDD, the Validation Report, the Monitoring Report, and the emission reductions calculation spreadsheets submitted by the client;

ii) verification audit planning;

iii) on-site visit to the project activity which included interviews with the project owner, review of various monitoring records and records of calibration of the monitoring equipment, and verification of measurement procedures;

iv) preparation of draft verification report (issuance of verification audit findings);

v) resolution of outstanding issues and the issuance of final verification report and opinion.

Duration of Verification

The verification of the project was carried out from 31 January 2012 to 2 February 2012, with details as follows:

Off site preparation / document review and planning: 19 January 2012

On-site verification: 31 January 2012 – 2 February 2012

Preparation of draft report: 10 – 13 February 2012

Preparation of final report: 1 March – 12 April 2012

The project assessment was based on the methodology developed in the VVM. In order to ensure transparency, a verification protocol was customized for the project, according to the VVM. The protocol shows, in a transparent manner, requirements, means of verification and the results. The verification protocol serves the following purpose;

- it organizes, provides details and clarifies the requirements of a CDM project is expected to meet;
- it ensures a transparent verification process where the verifier will document how a particular requirement has been proved, and the results of the verification.

The completed protocol is enclosed in Annex 1 to this report.

2.1 Review of Documentation

The following documentation were reviewed and verified:

i) Registered PDD/1/ (version 3 , dated 12 January 2009),
ii) Approved baseline methodology for the project, ACM0001 ver. 8 – "Consolidated baseline and monitoring methodology for landfill gas project activities" /2/
iii) Monitoring Reports for period 1 January 2011 to 31 December 2011/6//7/147/149/152/160/, and
iv) *ER Summary KPS* Excel sheets/8//9/148/150/161/

A complete list of all documents reviewed is as listed in part 5 (References) of this report.

2.2 Site Visits

An on-site audit of the project was carried out by the verification team from 31 January 2012 to 2 February 2012. The on-site audit consisted of visits to the project site to verify project implementation, the location of the monitoring equipment and the review of documents and data in the office. Interviews with relevant personnel were also carried out to confirm the method of recording the GHG data.

The verification of data in the monitoring report included the raw data from the respective checklists, results of analysis and the plant design diagram.

The personnel interviewed and the coverage of interviews is summarized below.

Topic covered	Persons interviewed
• GHG reporting and calculation • Information in the monitoring report • Assessment of project boundary • Review of physical components • Plant operation • Qualification and training • Roles and responsibilities • GHG raw data compilation • Reporting and reviewing of GHG data • CDM Monitoring and reporting • Maintenance of monitoring equipment • Calibration of equipment	• Supida Piwkhow, Monitoring Manager, Bionersis

2.3 Assessment

- desk review, involving
  - a review of the data and information presented to verify their completeness;
  - a review of the monitoring plan and monitoring methodology;
  - an evaluation of data management and the quality assurance and quality control system;

- on-site assessment, involving
  - an assessment of the implementation and operation of the CDM project activity as per the registered PDD;
  - a review of information flows for the monitoring parameters;
  - interviews with relevant personnel to confirm that the operational and data collection procedures are implemented in accordance with the monitoring plan in the PDD;
  - a cross-check between information provided in the monitoring report and data from other sources;
  - a check of the monitoring equipment including calibration performance and observations of monitoring practices;
  - a review of calculations and assumptions made in determining the GHG data and emission reductions;
  - an identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

Details of all findings are recorded in the verification protocol in Annex 1 of this report.

2.4 Reporting of Findings

Findings identified during the verification may be classified into Corrective Action Request (CAR), Clarification Request (CL) and/or Forward Action Request (FAR).

A CAR is raised if one of the following occurs:

- non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient; or
- mistakes have been made in applying assumptions, data or calculations of emission reductions that will impair the estimate of emission reductions; or
- issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.

A CL is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

For CAR and CL, the client is required to take necessary corrective actions and provide evidence of the implementation. All CARs and CLs shall be resolved prior to submitting a request for issuance.

A FAR should be issued, where:

- the actual project monitoring and reporting requires attention and /or adjustment for the next verification period, or
- an adjustment of the MP is recommended.

In the context of FARs, risks have been identified, which may endanger the delivery of high quality CERs in the future, i.e. by deviations from standard procedures as defined by the monitoring plan. As a consequence, such aspects should receive a special focus during the next consecutive verification. A FAR may originate from lack of data sustaining claimed emission reductions.

3 VERIFICATION FINDINGS

During this second periodic verification, one (1) CAR and five (5) CLs were raised after the on-site audit carried out on 31 January to 2 February 2012. Details of the findings and the respective resolutions are in Table 2 of Annex 1 of this report.

3.1 Remaining Issues, CARs, FARs from Previous Validation

This is the second verification for the project activity. No FAR was raised during the first verification. All findings have been satisfactorily closed out.

3.2 Project Implementation in accordance with the Registered PDD

The 'Bionersis Project Thailand 1' captures and flares LFG containing methane. It was confirmed that the project captures LFG through a gas collection network of vertical and horizontal wells, flares the LFG in a high temperature enclosed flare[/136/&/137/] and includes a monitoring and control system. Based on the visit to project site and the review of the PDD, the

verification team confirms that the project has been constructed and installed in accordance to the registered PDD and monitored in accordance with the monitoring methodology. The project was commissioned on 26 March 2010[/122/]. During this monitoring period, the Phase 2 of the project, where the captured LFG is to be combusted in a biogas generator for electricity generation, had yet to be implemented. **CL1** was raised on the status of implementation of Phase 2 of the project.. PP responded by presenting the quotation from the prospective power generator supplier[/138/], and the signed power purchase agreement with the Provincial Electricity Authority of Thailand[/138/]. These have been updated in the revised monitoring report[/6//7/147/149/152/160/] Hence, **CL1** was closed.

3.3 Completeness of Monitoring

3.3.1 Compliance of monitoring plan with the monitoring methodology

The verification team reviewed the monitoring plan as stated in the registered PDD against the monitoring methodology of the applied methodology ACM0001 (version 8)[/2/]. The monitoring plan was also reviewed against the 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption'[/144/] (version 1) and the 'Tool to determine project emissions from flaring gases containing methane' (version 1)[/3/]. Based on the review, the verification team confirms that monitoring plan as stated in the registered PDD conforms to the monitoring methodology of the applied methodology ACM0001 (version 8)[/2/] and the relevant Tools.

3.3.2 Compliance of monitoring with the monitoring plan

The monitoring has been carried out in accordance with the monitoring plan of the registered PDD. Since Phase 2 of the project had yet to be implemented during this monitoring period, the parameters for Phase 2 are not included in this report. The monitoring plan, as in the PDD, requires the monitoring of the following parameters:

- Total amount of LFG captured and flared ($LFG_{flare,y}$),
- Methane fraction in the LFG ($w_{CH4,y}$),
- Temperature of the LFG (T),
- Pressure of the LFG (P),
- Project emissions from flaring of the residual gas stream in the year y ($PE_{flare,y}$),
- Quantity of electricity consumed by the project activity during the year y (EC_{PJ}),
- Temperature in the exhaust gas of the flare (T_{flare}),
- Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h ($t_{O2,h}$),
- Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h ($fv_{CH4,FG,h}$),

All parameters stated in the registered monitoring plan were monitored and reported appropriately. The monitoring report had included each parameter required by the monitoring plan. The monitoring methodology and sustaining records were sufficient to enable the verification of the emissions reduction. The verification of each parameter was as follows:

Data/parameter:	$LFG_{flare,y}$
Data unit:	Nm^3
Description:	Total amount of LFG captured and flared
Source of data used:	The LFG is measured using a turbine gas type flow meter from Elster Instromet[/22/]. The flow meter is located after the gas condensing unit[/145/]. The LFG flow data is recorded every minute by the data logger. The signal or the LFG flow meter data is received by the Memograph M RSG240[/143/] data logger. The signal is sent to

	the data logger on a minutely basis. This input data is converted to RSD format as an input data to the Readwin 2000 software[/142/]. The data is kept as back-up in the data logger memory card. Together with input from the pressure sensor and temperature sensor, the software computes the data and provides the output data in the form of normalized LFG flow in Nm^3. The output flow data is also recorded in a minutely basis and kept as back-up in memory card. The data is aggregated monthly.
Means of verification :	There is no manual handling of the raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into the memory card. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program[/10/ to /21/] and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*[/161/] Excel sheet.

Data/parameter:	$W_{CH4,y}$
Data unit:	% (m^3CH_4/m^3LFG)
Description:	Methane fraction in the LFG
Source of data used:	Methane fraction in the LFG is measured using a Gascard NG infrared gas analyzer from Edinburgh Instruments[/46/]. The gas analyzer is located after the gas condensing unit[/145/]. The data from the analyzer is recorded by the data logger every minute. This input data is converted to RSD format as an input data to the Readwin 2000 software[/142/]. The software computes the data and provides the output data. The output data is recorded on a minutely basis and kept as back-up in memory card.
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into the memory card. The verification team has confirmed this based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program[/10/ to /21/] and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*[/161/] Excel sheet. During the verification of this parameter, **CL2** was raised as the methane fraction was recorded as being more than 60% during certain hours on 23 – 24 January 2011. PP acknowledged that an increase in the CH_4 concentration in LFG between 23 January 2011 and 24 January 2011 was caused by a failure in the ventilation system. This caused an increase in temperature inside the analyser panel and forced the CH_4 sensor to work outside of its normal operating temperature. The problem was resolved after the ventilation system was repaired on 24 January 2011. To remove the effect of the abnormal readings during this period, the production data between 00:00:00 on 23 January 2011 until 14:18:00 on 24 January 2011 was removed from ER calculation. Hence **CL2** was closed.

Data/parameter:	T
Data unit:	^0C
Description:	Temperature of the LFG

Source of data used:	The temperature of the LFG is monitored using a H&B temperature sensor/88/. The data is captured and recorded every minute. It is used as an input to data logger to normalize the LFG flow data. The signal is sent to the data logger on a minutely basis. This input data is converted to RSD format as an input data to the Readwin 2000 software/142/. The data is kept as back-up in the data logger memory card. Together with input from the pressure sensor and the LFG flow meter, the software computes the data and provides the output data in the form of normalized LFG flow in Nm^3. The output flow data is also recorded in minutely basis and kept as back-up in the data logger memory card.
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into memory card. The verification team has confirmed this based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program/10/ to /21/ and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet.

Data/parameter:	P
Data unit:	Mbar
Description:	Pressure of the LFG
Source of data used:	The pressure of the LFG is monitored using Sensit/Rox Spur Measurement & Control Ltd pressure sensors/80/. The data is recorded every minute. It is used as an input to the data logger to normalize the LFG flow data. The signal is sent to the data logger on a minutely basis. This input data is converted to RSD format as an input data to the Readwin 2000 software. The data is kept as back-up in the data logger memory card. Together with input from the temperature sensor and the LFG flow meter, the software computes the data and provides the output data in the form of normalized LFG flow in Nm^3. The output flow data is also recorded on a minutely basis and kept as back-up in the data logger memory card.
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into the memory card. The verification team has confirmed this based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program/10/ to /21/ and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet.

Data/parameter:	$PE_{flare,y}$
Data unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream in the year y
Source of data used:	The value of $PE_{flare,y}$ is calculated using these parameters, T_{flare} , $t_{O2,h}$, $fv_{CH4,FG,h}$, $FV_{RG,h}$
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into memory card. The verification team has

	confirmed this based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program/10/ to /21/ and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet.

Data/parameter:	$fv_{CH4,FG,h}$
Data unit:	mg/m^3
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h.
Source of data used:	The concentration of methane in the exhaust gas of the flare is measured using a Gascard NG infrared gas analyzer from Edinburgh Instruments/69/. The data from the exhaust gas analyzer is recorded by the data logger every minute. This input data is converted to RSD format as an input data to the Readwin 2000 software/142/. The software computes the data and provides the output data. The output data is recorded on a minutely basis and is kept as back-up in memory card.
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into memory card. The verification team has confirmed based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program/10/ to /21/ and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS ER summary KPS v5 24 12 2012*/161/ Excel sheet.

Data/parameter:	$FV_{RG,h}$
Data unit:	-
Description:	Volumetric flow rate of residual gas in dry basis at normal conditions in the hour h
Source of data used:	Equal to the 'total amount of LFG captured and flared' ($LFG_{flare,y}$) in the hour h
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into memory card. The verification team has confirmed this based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program/10/ to /21/ and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet.

Data/parameter:	$t_{O2,h}$
Data unit:	
Description:	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h
Source of data used:	Volumetric fraction of O_2 in the exhaust gas of the flare is measured using an exhaust gas analyzer from City Technology/70/. The data from the analyzer is recorded by the data logger every minute. This input data is converted to RSD format as input data to the Readwin 2000 software/142/. The software computes the data and provides

	the output data. The output data is recorded on a minutely basis and kept as back-up in memory card.
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into a memory card. The verification team has confirmed based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program/10/ to /21/ and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet.

Data/parameter:	T_{flare}
Data unit:	^0C
Description:	Temperature in the exhaust gas of the flare
Source of data used:	Temperature in the exhaust gas of the flare is measured using an N type thermocouple from Thermology Co. Ltd/92/. The data from the thermocouple is recorded by the data logger every minute. This input data is converted to RSD format as an input data to the Readwin 2000 software/142/. The software computes the data and provides the output data. The output data is recorded on a minutely basis and kept as back-up in memory card.
Means of verification :	There is no manual handling of raw data. The Memograph data logger automatically retrieves the data, computes the data and records the data into memory card. The verification team has confirmed this based on the visit to the project site. There were no manual recordings of the readings from the Memograph panel. The verification team verified the monthly emission reductions by running through the monthly input data onto the CER Calculator Program/10/ to /21/ and confirming the monthly output. From the process, the verification team confirmed and agreed with the monthly ER in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet. During the verification of this parameter, **CL3** was raised on the flare temperature that exceeded 700^0C. PP responded by providing the letter issued by the flare manufacturer which confirmed that this type of flare operates satisfactorily as long as the temperature is between 500 °C and 1,200 °C. In addition, the average temperature measured by the thermocouple during the monitoring period was 827 °C and the continuous monitoring of flare efficiency showed an average combustion efficiency of 99.99%. These measured values provided further evidence that the flare was operating satisfactorily at temperatures above 700 °C, allowing destruction of almost all the methane contained in the LFG. From the review of the documentations/97//136//137/&/139/ related to the thermocouple and the flare system which were provided by the suppliers of the related equipment, the verification team had closed the CL3. The documents provided were from the experts of the equipment. From these documents and visit to the site to witness the operation of the flare system, the verification team was able to confirm that the N type thermocouple can operate at temperatures above 700^0C and that the flare is satisfactorily operated when the flare temperatures is above 700°C. This is consistent with

	AM_CLA_0047/151/ which further clarifies that temperature above 700°C can be observed in low height flares, i.e. less than 10 internal diameters, which is the case of the flare installed in the project activity. As mentioned in the second condition of the clarification, since it is a low height flare system, the methane composition throughout the sampling section is uniform. Therefore, no further verification was carried out regarding the uniformity of the measurement. Though a procedure is described to measure once a year the methane concentration in one axis of at least 8 points, this procedure is a recommendation, not a requirement (definition of "should" as per VVS §10 / PCP §6). It is also noted that the latest version of the tool, Project emissions from flaring version 2.0.0 (EB 68 Annex 15), does not make reference to any of the conditions of AM_CLA_0047 for low height flares, neither in terms of flare temperature ("(above 700 ºC) and the uniformity of the methane concentration measurement.

Data/parameter:	EC_{PJ}
Data unit:	MWh
Description:	Quantity of electricity consumed by the project activity during the year y
Source of data used:	The quantity of electricity consumed by the project activity is taken from the Schneider Electric electricity meter model PM710MG/98/. The data is recorded on a daily basis. The data is recorded in the plant logbook/146/. The data is transferred manually into the *Electricity Consumption RecordKPS-2011*/121/ Excel sheet. In monthly basis, the data is sent to the Monitoring Manager to be included in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet.
Means of verification :	The verification team verified the transfer of data from the plant logbook/146/ into the *Electricity Consumption RecordKPS-2011*/121/ Excel sheet. The verification team also verified the monthly data by cross checking with the monthly electricity invoices/109 to 120/. The summation in the *Electricity Consumption RecordKPS-2011*/121/ Excel sheet was confirmed and verified against the total electricity consumed during the monitoring period as stated in the *ER summary KPS v5 24 12 2012*/161/ Excel sheet.

It shall be noted that:

- the parameter $fv_{CH4,FG,h}$ Volumetric fraction of CH_4 in the residual gas in the hour h was monitored as $w_{CH4,y}$ Methane fraction in the landfill gas.
- the parameters $fv_{CO2,h}$, fv_{O2h}, $fv_{N2,h}$, the volumetric fraction of CO_2, O_2, and N_2 in the residual gas in the hour h were not monitored. Using a simplified approach, only the methane content of the residual gas was measured and the remaining gases were considered as N_2.

This monitoring approach is in accordance with the registered PDD and with the "Tool to determine project emissions from flaring gases containing methane"/3/.

During the on-site verification, the verification team checked all the monitoring equipment used to monitor the above parameters. The verification team was able to confirm that the above parameters had been monitored in accordance with the monitoring plan.

During this monitoring period, a request for review by the EB was made with regards to the flare temperature and compliance to the condition stipulated in AM_CLA_0047. To response to the findings, the PP had revised the approach in determining the flare efficiency. Instead of measuring it continuously, PP had applied the default values as provided in the Tool to determine project emissions from flaring gases containing methane[3]. Hence, the parameters $t_{O2,h}$ and $fv_{CH4,FG,h,}$ although they have been measured, the values have not been used in the calculation.

The used of the default efficiency, the emission reductions had been reduced. The verification team had accepted the approach since the tool allows the use of the option. Further to that, it can be confirmed that the flare is operating as specified by the manufacturer and the flare temperature has been monitored continuously.

3.4 Accuracy of Emission Reductions Calculations

In the calculation of emission reductions, the following data input were used :

i) Data recorded from the meters installed either linked to a data logger or manually recorded in the log book;
ii) Default/fixed values determined during validation and remained fixed throughout the crediting period;
iii) Data obtained from calculation.

The following parameters were recorded from the meters installed in the project activity and linked to a data logger. The data was recorded on a minutely basis by the data logger. The data was kept in the data logger memory card. The data was then downloaded to the dedicated laptop for data transfer to Bangkok office. Using the CER Calculator Program, the output will be aggregated into the *ER summary KPS v5 24 12 2012*[161] Excel sheet for emission reductions calculation .

Parameter	Units
Volumetric flow rate of residual gas in dry basis at normal conditions in the hour h ($FV_{RG,h}$)	Nm^3/h
Temperature of LFG (T)	^0C
Pressure of LFG (P)	mbar
Temperature in the exhaust gas of the flare (T_{flare})	^0C
Methane fraction in the LFG ($w_{CH4,y}$)	% (m^3CH4/m^3LFG)
Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h ($t_{O2,h}$)	-
Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h ($fv_{CH4,FG,h}$)	mg/m^3

The following parameter was measured using meter that is not linked to the data logger. The data was recorded manually on a daily basis into the plant log book. The data was transferred into the *ER summary KPS v5 24 12 2012*[161] Excel sheet for emission reductions calculation.

Parameter	Units
Quantity of electricity consumed by the project activity during the year y (EC_{PJ})	MWh

For the default/fixed values, the values determined during the validation were used. These values were fixed for the entire crediting period of the project. Following are the default values that were used in the calculation of the emission reductions:

Parameter	Value	Unit	Remarks
GWP_{CH4}	21	tCO_2e/tCH_4	Global Warming Potential of CH_4, as defined by the IPCC.
D_{CH4}	0.0007168	t_{CH4}/m^3_{CH4}	Density of methane, as defined by the methodology.
AF	0	%	Adjustment factor
EF_{EL}	0.610	tCO_2e/MWh	CO_2 emission factor of Thai grid.
TDL	20	%	Technical transmission and distribution losses in the grid

The following is the input data derived using calculation. The data was automatically calculated by a CER calculator program. The monthly result of the calculations of MD_{flared} – was transferred into the *ER summary KPS v5 24 12 2012*[/161/] Excel sheet and used for compiling emission reductions calculation for the monitoring period.

Parameter	Units
Amount of LFG captured and flared at normal temperature and pressure ($LFG_{flare,y}$)	Nm^3
Quantity of methane destroyed by flaring ($MD_{flared,y}$)	tCH_4
Flare efficiency in hour h ($\eta_{flare,h}$)	%
Mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h ($TM_{FG,h}$)	kg/h
Mass flow rate of methane in the residual gas in the hour h ($TM_{RG,h}$)	kg/h
Project emissions from flaring of the residual gas stream (PE_{flare})	tCO_2e

<u>Emission reductions calculation:</u>

The emission reductions are calculated using the following formula:

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

Where

$MD_{project,y}$ is the amount of methane that would have been destroyed/combusted during the year *y*, in tons of methane (tCH4) in project scenario.
i.e. $MD_{project,y} = (LFG_{flare} \times w_{CH4} \times D_{CH4}) – (PE_{flare,y}/GWP_{CH4})$

$MD_{BL,y}$ is the amount of methane that would have been destroyed/combusted during the year *y* in the absence of the project due to regulatory and/or contractual requirement, in tons of

methane (t_{CH4})
i.e. $MD_{BL,y} = MD_{project,y}$ x AF

since AF=0, where there are no regulatory requirements relating to landfill gas projects,
Therefore, $MD_{BL,y} = 0$

PE_y Project emissions which are calculated as below.

Calculation for project emissions

According to ACM0001 (version 8)[2], the project emissions include emissions due to i) combustion of auxiliary fuel to supplement waste gas and ii) consumption of electricity by the project activity.

Project emissions resulting from electricity consumption are calculated as below:

$$PE_{EC,y} = EC_{PJ,y} * EF_{EL,y} * (1+TDL)$$
$$= 37.997 \text{ x } 0.610 \text{ x } (1+ 20\%)$$
$$= 27.81 \text{ tCO}_{2e}$$

During the monitoring period, the methane destruction efficiency of the flare (flare efficiency PE_{flare} or $\eta_{flare,h}$) was based on the default values stipulated in the tool[3]. Parameters required to calculate the hourly flare efficiency are recorded every minute. The formula used as described in the PDD and the tool are provided in the Excel sheet. The formula applied in the Excel sheet has been verified and found to be correctly applied.
Formula used for PE_{flare} :

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

Formula used for $\eta_{flare,h}$:

$$\eta_{flare,h} = 1 - \frac{TM_{FG,h}}{TM_{RG,h}}$$

Project emissions from flaring are determined by multiplying the methane flow rate in the residual gas with the flare efficiency for each hour of the monitoring period.

Therefore, $MD_{project,y} = (LFG_{flare} \text{ x } W_{CH4} \text{ x } D_{CH4}) - (PE_{flare,y}/GWP_{CH4})$
$= 1460.62 \text{ tCH}_4$

Hence, $ER_y = (MD_{project,y} - MD_{BL,y}) \text{ x } GWP_{CH4} - PE_{EC,y}$
$= (1460.62 - 0) \text{ x } 21 - 27.81 \text{ tCO}_{2e}$
$= 30,645.21 \text{ tCO}_{2e}$
$= 30,645 \text{ tCO}_{2e}$

All formulae used in the emission reductions calculation Excel sheet were verified and found to be in accordance with the methodology. The emissions in the project activity were found to be correctly calculated.

During the verification, **CL5** was raised on the statement in Section E.6 of the monitoring report regarding the remark on difference from estimated value in the PDD. PP responded that by providing summary of the average leachate level in landfill since the beginning of the project implementation and the annual precipitation record from the meteorology/141/ station located near the landfill site for the justification on the difference from estimated value in the PDD and hence **CL5** was closed.

3.5 Quality of Evidence to Determine Emission Reductions

It was verified that the monitoring equipment was calibrated prior to use and installation. The calibration records and certificates were verified and from the calibration results it can be concluded that the equipment were functioning properly within the permissible limits. Calibrations were carried out by qualified third party, mostly by the equipment manufacturers. Following are the calibration status of the equipment:

Description of the monitoring equipment & serial no.	Calibration validity date	Calibration frequency	Calibration certificate & Remarks
LFG flow meter / No. 10514495	26/03/2010 - 26/03/2013	Every 3 years	• Manufacturer: Elster Instromet • Turbine gas flow meter • Model Q75 DN300 4000 • Accuracy: ±1.5% for $0.2Q_{max}$ to Q_{max} • : ±3% for Q_{min} to $0.2Q_{max}$ where Q_{min} = 200, Q_{max} = 4000 • Calibration report 753170-10/23/ • Flow meter No. 10514495 was replaced with No. 10514496 on 12/05/2011
LFG flow meter / No. 10514496	12/05/2011 – 12/05/2014	Every 3 years	• Manufacturer: Elster Instromet • Turbine gas flow meter • Model Q75 DN300 4000 • Accuracy: ±1.5% for $0.2Q_{max}$ to Q_{max} • : ±3% for Q_{min} to $0.2Q_{max}$ where Q_{min} = 200, Q_{max} = 4000 • Calibration report 753170-10/25/
Temperature sensor / No. 72529-03	26/03/2010 – 26/03/2011	Yearly basis	• Manufacturer: H&b Sensors • Model: STD-527 / PtR100. • Accuracy: class B ±0.3°C + 0.005[t°] • Calibration certificate 000001438/91/ • Sensor No. 72529-03 was replaced with No. 72529-03 on 16/03/2011
Temperature sensor / No. 72529-02	16/03/2011 – 16/03/2012	Yearly basis	• Manufacturer: H&b Sensors • Model: STD-527 / PtR100. • Accuracy: class B ±0.3°C + 0.005[t°] • Calibration certificate 000001438/90/
Pressure sensor	26/03/2010 –	Yearly basis	• Manufacturer: Sensit / Rox Spur

– gauge / No. 421922	26/03/2011		• Type HPS-A Series • Accuracy: class C ±1% • Calibration certificate Sira 02ATEX2386X/86/ • ±0.03% span best fit straight line (BFSL) limit of ±1% • Sensor No. 421922 was replaced temporarily with No. 421921 from 16/03/2011 to 20/03/2011 • Sensor No. 421922 was replaced with No. 421919 on 26/03/2011
Pressure sensor – gauge / No. 421921	16/03/2011 – 16/03/2012	Yearly basis	• Manufacturer: Sensit / Rox Spur • Model: HPS-A Series • Accuracy: class C ±1% • Calibration certificate Sira 02ATEX2386X/85/ • ±0.03% span best fit straight line (BFSL) limit of ±1% • Sensor No. 421921 was replaced back to No. 421922 20/03/2011
Pressure sensor – gauge / No. 421919	26/03/2011 – 26/03/2012	Yearly basis	• Manufacturer: Sensit / Rox Spur • Model: HPS-A Series • Accuracy: class C ±1% • Calibration certificate Sira 02ATEX2386X/84/ • ±0.03% span best fit straight line (BFSL) limit of ±1%
Pressure sensor – atmospheric / No. 421916	26/03/2010 – 26/03/2011	Yearly basis	• Manufacturer: Sensit / Rox Spur • Model: HPS-A Series • Accuracy: class C ±1% • Calibration certificate Sira 02ATEX2386X/82/ • ±0.03% span best fit straight line (BFSL) limit of ±1% • Sensor No. 421916 was replaced with No. 437830 on 16/03/2012
Pressure sensor – atmospheric / No. 437830	16/03/2011 – 16/03/2012	Yearly basis	• Manufacturer: Sensit / Rox Spur • Model: HPS-A Series • Accuracy: class C ±1% • Calibration certificate Sira 02ATEX2386X/83/ • ±0.03% span best fit straight line (BFSL) limit of ±1%
LFG gas analyzer / No. 26698	27/12/2010/154/ 03/01/2011/28/	Monthly basis	• Manufacturer: Edinburgh Instrument • Model: Gas card NG • Accuracy: ±2% • Calibrated by comparison with certified standard gas cylinders. - Cylinder 45.15% CH4 #K05601/105/ - Cylinder 20.04% O2 #K39551/106/ - Cylinder 99.99% N2/108/ • Review of calibration record/28/154/ revealed that the error was within the allowable limit. • Analyzer No. 26698 was replaced with No. 150 on 14/01/2011

LFG gas analyzer / No. 150	07/02/2011[/29/] 28/02/2011[/30/] 21/03/2011[/31/] 18/04/2011[/32/] 16/05/2011[/33/] 30/05/2011[/34/] 27/06/2011[/35/] 11/07/2011[/36/] 01/08/2011[/37/] 15/08/2011[/38/] 05/09/2011[/39/] 19/09/2011[/40/] 17/10/2011[/41/] 07/11/2011[/42/] 21/11/2011[/43/] 12/12/2011[/44/] 26/12/2011[/45/] 02/01/2012[/156/]	Monthly basis	• Manufacturer: Edinburgh Instrument • Model: Gas card NG • Accuracy: ±2% • Calibrated by comparison with certified standard gas cylinders. - Cylinder 45.15% CH4 #K05601[/105/] - Cylinder 20.04% O2 #K39551[/106/] - Cylinder 99.99% N2[/108/] • Regular calibration was carried out by Bionersis[/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/156/] • Review of all calibration records revealed that the error was within the allowable limit.
Flare Exhaust gas analyzer (CH_4) / No. 697	27/12/2010[/155/] 03/01/2011[/51/] 07/02/2011[/52/] 28/02/2011[/53/] 21/03/2011[/54/] 18/04/2011[/55/] 16/05/2011[/56/] 30/05/2011[/57/] 27/06/2011[/58/] 11/07/2011[/59/] 01/08/2011[/60/] 15/08/2011[/61/]	Monthly basis	• Manufacturer: Edinburgh Instruments • Model: Gas card NG • Accuracy: : ±2% • Calibrated by comparison with certified standard gas cylinders. - Cylinder 20.04% O2 #K39551[/106/] - Cylinder 4.54% CH4 #K05685[/107/] - Cylinder 99.99% N2[/108/] • Regular calibration was carried out by Bionersis[/51/52/53/54/55/56/57/58/59/60/61/155/] • Review of all the calibration records revealed that the error was within the allowable limit. • Analyzer No. 697 was replaced with No. 289 on 29/08/2011
Flare Exhaust gas analyzer (CH_4) / No. 289	29/08/2011[/73/] 05/09/2011[/62/] 19/09/2011[/63/] 17/10/2011[/64/] 07/11/2011[/65/] 21/11/2011[/66/] 12/12/2011[/67/] 26/12/2011[/68/] 02/01/2012[/157/]	Monthly basis	• Manufacturer: Edinburgh Instruments • Model: Gas card NG • Accuracy: : ±2% • Calibrated by comparison with certified standard gas cylinders. - Cylinder 20.04% O2 #K39551[/106/] - Cylinder 4.54% CH4 #K05685[/107/] - Cylinder 99.99% N2[/108/] • Regular calibration was carried out by Bionersis[/73/62/63/64/65/66/67/68/157/] • Review of all the calibration records revealed that the error was within the allowable limit.
Flare Exhaust gas analyzer (O_2) / No.15556996	27/12/2010[/155/] 03/01/2011[/77/]	Monthly basis	• Manufacturer: City Technology • Model: T7OX Oxigen CITIceL Transmitter • Accuracy: 1% • Calibrated by comparison with certified

			standard gas cylinders. - Cylinder 20.04% O2 #K39551[/106/] - Cylinder 4.54% CH4 #K05685[/107/] - Cylinder 99.99% N2[/108/] • Review of the calibration record revealed that the error was within the allowable limit. • Analyzer No.15556996 was replaced with No. 15557003 on 14/01/2011
Flare Exhaust gas analyzer (O_2) / No.15557003	14/01/2011[/153/]	Monthly basis	• Manufacturer: City Technology • Model: T7OX Oxigen CITIceL Transmitter • Accuracy: 1% • Calibrated during the installation in the plant on 14/01/2011 • Calibrated by comparison with certified standard gas cylinders. - Cylinder 20.04% O2 #K39551[/106/] - Cylinder 4.54% CH4 #K05685[/107/] - Cylinder 99.99% N2[/108/] • Review of the calibration record revealed that the error was within the allowable limit. • Analyzer No.15557003 was replaced with No. 15556997 on 31/01/2011
Flare Exhaust gas analyzer (O_2) / No.15556997	03/01/2011[/159/] 31/01/2011[/77/]	Monthly basis	• Manufacturer: City Technology • Model: T7OX Oxigen CITIceL Transmitter • Accuracy: 1% • Calibrated during the installation in the plant on 03/01/2011 • Calibrated by comparison with certified standard gas cylinders. - Cylinder 20.04% O2 #K39551[/106/] - Cylinder 4.54% CH4 #K05685[/107/] - Cylinder 99.99% N2[/108/] • Review of the calibration record revealed that the error was within the allowable limit. • Analyzer No.15556997 was replaced with No. 17035465 on 07/02/2011
Flare Exhaust gas analyzer (O_2) / No.17035465	07/02/2011[/52/] 28/02/2011[/53/] 21/03/2011[/54/] 18/04/2011[/55/] 16/05/2011[/56/] 30/05/2011[/57/] 27/06/2011[/58/] 11/07/2011[/59/] 01/08/2011[/60/] 15/08/2011[/61/] 05/09/2011[/62/] 19/09/2011[/63/]	Monthly basis	• Manufacturer: City Technology • Model: T7OX Oxigen CITIceL Transmitter • Accuracy: 1% • Calibrated during the installation in the plant on 07/02/2011 • Calibrated by comparison with certified standard gas cylinders. - Cylinder 20.04% O2 #K39551[/106/] - Cylinder 4.54% CH4 #K05685[/107/] - Cylinder 99.99% N2[/108] • Review of the calibration record revealed that the error was within the allowable limit.

	17/10/2011[/64/] 07/11/2011[/65/] 21/11/2011[/66/] 12/12/2011[/67/] 26/12/2011[/68/]		
Electricity meter/ No. 44ECB945	22/07/2010 – 22/07/2013	Every 3 years	• Manufacturer: Schneider Electric • Model: PM710MG • Accuracy: 2% (class 2) • Calibration certificate 0203EL10[/103/] • No error was found from the calibration report.
Thermocouple/ No. TT-4638-1	26/03/2010 – 26/03/2011	Yearly basis	• Manufacturer: Thermology Co. Ltd • Model: Type N • Accuracy: ±2.2^{0}C or 75% of reading whichever is larger • Calibration certificate 10/0269[/93/] • Result as in certificate showed that the uncertainty of ±4.1^{0}C is within the 95% confidence level. • Thermocouple TT-4638-1 was replaced with No. TT-4638 on 16/03/2011
Thermocouple/ No. TT-4638-3	16/03/2011 – 16/03/2012	Yearly basis	• Manufacturer: Thermology Co. Ltd • Model: Type N • Accuracy: ±2.2^{0}C or 75% of reading whichever is larger • Calibration certificate 10/0271[/94/] • Result as in certificate showed that the uncertainty of ±4.1^{0}C is within the 95%confidence level.

During the verification of this section, **CL4** was raised on manufacturer's guidelines on the frequency of calibration. In response to the CL, PP had furnished the related documents on manufacturer's calibration and maintenance guidelines and hence **CL4** was closed.

Management System and Quality Assurance

The roles and responsibilities for monitoring of emission reduction data have been clearly defined and accordingly practiced. It has been verified that the roles and responsibilities of the CDM project have been implemented accordingly. The monitoring of the GHG parameters (except for the electricity consumed) is automated. The automation has eliminated the handling of raw data to avoid any tempering of data. The data from the Memograph is extracted by the Monitoring Manager on weekly basis and is sent to Bionersis France office in Paris for review. The data is also kept as back up in Bionersis Thailand office in Bangkok.

4 VERIFICATION AND CERTIFICATION STATEMENT

SIRIM QAS International Sdn Bhd has been engaged by Bionersis S.A to perform the second periodic verification of the CDM project *"Bionersis Project Thailand 1"* for the period from 1 January 2011 to 31 December 2011. The verification was based on the validated and registered PDD/1/, the approved baseline and monitoring methodologies ACM0001 version 8/2/, the Monitoring Reports/6//7/147/149/152//160/, emission reduction calculation Excel sheets/8/9/148/150//161/ and other supporting documents made available to SIRIM QAS International verification team by the project participant

The management of Bionersis was responsible for the preparation and reporting of GHG emissions data, and the reported GHG emission reduction on the basis set out within the project monitoring plan.

It is the responsibility of SIRIM QAS Intl. verification team to express an independent GHG verification opinion on the GHG emissions from the project for the period from 1 January 2011 to 31 December 2011 and on the calculation of GHG emission reductions from the project based on the verified emissions for the same period.

The verification was carried out in accordance with the requirements of the Validation and Verification Manual version 1.2. As a result of the verification, the verification team confirms that for the reporting period:

- all operations of the project were implemented as described in the registered PDD.
- the monitoring system was in place and functional, with the installed equipment essential for generating emission reduction operating appropriately. Calibration of all the equipment had been carried out accordingly.
- the monitoring plan in the monitoring report is as per the PDD and the applied methodology, and
- the GHG emission reductions were calculated correctly on the basis of approved monitoring methodology ACM0001 version 8/2/.

We have verified the information included in the final monitoring report/160/ (version 6, dated 24 December 2012) was correct and that the emission reductions achieved had been determined correctly. In our opinion, the GHG emission reductions for the period from 1 January 2011 to 31 December 2011 stated in the latest revised monitoring report/160/ (version 6, dated 24 December 2012) for the project are fairly stated.

The verifier confirms that the GHG emission reductions were calculated without material misstatements for the whole monitoring period. Our opinion is based on the project's GHG emissions and resulting GHG emission reductions reported, and, to the valid and registered project baseline and monitoring documents. Based on the information we have seen and evaluated, we confirm the following:

Monitoring Period	1 January 2011 – 31 December 2011
$MD_{project,y}$	30,673.02 tCO_{2e}
$PE_{EC,y}$	27.81 tCO_{2e}
Emission Reduction (rounded down)	30,645 tCO_{2e}

Prepared by :

(Mansor Shah Aziz)
Verification Team Leader
31/12/2012

Approved by :

(Parama Iswara Subramaniam)
DOE Representative
31/122012

5 REFERENCE

/1/	PDD (version 3) dated 12 01 2009
/2/	ACM0001 'Consolidated baseline and monitoring methodology for landfill gas project activities' (version 8)
/3/	'Tool to determine project emissions from flaring gases containing methane' (version 1)
/4/	SGS 'Bionersis Project Thailand 1' Validation Report, (version 3) dated 12 01 2009
/5/	1st verification report Bionersis
/6/	Monitoring Report *KPS v1 02 01 2012*
/7/	Monitoring Report *KPS v2 16 02 2012*
/8/	*ER summary KPS v1 02 01 2012* Excel sheet
/9/	*ER summary KPS v2 16 02 2012* Excel sheet
/10/	*ER_KPS 1-Apr-11 00h00mn to 30-Apr-11 23h59mn*
/11/	*ER_KPS 1-Aug-11 00h00mn to 31-Aug-11 23h59mn*
/12/	*ER_KPS 1-Dec-11 00h00mn to 31-Dec-11 23h59mn*
/13/	*ER_KPS 1-Feb-11 00h00mn to 28-Feb-11 23h59mn*
/14/	*ER_KPS 1-Jan-11 00h00mn to 31-Jan-11 23h59mn*
/15/	*ER_KPS 1-Jul-11 00h00mn to 31-Jul-11 23h59mn*
/16/	*ER_KPS 1-Jun-11 00h00mn to 30-Jun-11 23h59mn*
/17/	*ER_KPS 1-Mar-11 00h00mn to 31-Mar-11 23h59mn*
/18/	*ER_KPS 1-May-11 00h00mn to 31-May-11 23h59mn*
/19/	*ER_KPS 1-Nov-11 00h00mn to 30-Nov-11 23h59mn*
/20/	*ER_KPS 1-Oct-11 00h00mn to 31-Oct-11 23h59mn*
/21/	*ER_KPS 1-Sept-11 00h00mn to 30-Sept-11 23h59mn*
/22/	Flowmeter_Technical_specifications
/23/	Flowmeter-10514495_Calibration_certificate_Elster-Instromet
/24/	Flowmeter-10514495_Conformity_certificate_Elster-Instromet
/25/	Flowmeter-10514496_Calibration_certificate_Elster-Instromet
/26/	Flowmeter-10514496_Conformity_certificate_Elster-Instromet
/27/	Organic_Statement_flow_normalisation
/28/	110103_KPS_Calibration_Report_Primary Analyzer
/29/	110207_KPS_Calibration_Report_Primary Analyzer
/30/	110228_KPS_Calibration_Report_Primary Analyzer
/31/	110321_KPS_Calibration_Report_Primary Analyzer
/32/	110418_KPS_Calibration_Report_Primary Analyzer
/33/	110516_KPS_Calibration_Report_Primary Analyzer
/34/	110530_KPS_Calibration_Report_Primary Analyzer
/35/	110627_KPS_Calibration_Report_Primary Analyzer
/36/	110711_KPS_Calibration_Report_Primary Analyzer
/37/	110801_KPS_Calibration_Report_Primary Analyzer

/38/	110815_KPS_Calibration_Report_Primary Analyzer
/39/	110905_KPS_Calibration_Report_Primary Analyzer
/40/	110919_KPS_Calibration_Report_Primary Analyzer
/41/	111017_KPS_Calibration_Report_Primary Analyzer
/42/	111107_KPS_Calibration_Report_Primary Analyzer
/43/	111121_KPS_Calibration_Report_Primary Analyzer
/44/	111212_KPS_Calibration_Report_Primary Analyzer
/45/	111226_KPS_Calibration_Report_Primary Analyzer
/46/	Gascard-CH4-Analyzer_Manual_Edinburgh Instruments
/47/	Primary_Analyzer-150_Certificate_conformity_Edinburgh
/48/	Primary_Analyzer-150_Initial_calibration_certificate_Edinburgh
/49/	Primary_Analyzer-26698_Certificate_conformity_Edinburgh
/50/	Primary_Analyzer-26698_Initial_calibration_certificate_Edinburgh
/51/	110103_KPS_Calibration_Report_Secondary_Analyser
/52/	110207_KPS_Calibration_Report_Secondary_Analyser
/53/	110228_KPS_Calibration_Report_Secondary_Analyser
/54/	110321_KPS_Calibration_Report_Secondary_Analyser
/55/	110418_KPS_Calibration_Report_Secondary_Analyser
/56/	110516_KPS_Calibration_Report_Secondary_Analyser
/57/	110530_KPS_Calibration_Report_Secondary_Analyser
/58/	110627_KPS_Calibration_Report_Secondary_Analyser
/59/	110711_KPS_Calibration_Report_Secondary_Analyser
/60/	110801_KPS_Calibration_Report_Secondary_Analyser
/61/	110815_KPS_Calibration_Report_Secondary_Analyser
/62/	110905_KPS_Calibration_Report_Secondary_Analyser
/63/	110919_KPS_Calibration_Report_Secondary_Analyser
/64/	111017_KPS_Calibration_Report_Secondary_Analyser
/65/	111107_KPS_Calibration_Report_Secondary_Analyser
/66/	111121_KPS_Calibration_Report_Secondary_Analyser
/67/	111212_KPS_Calibration_Report_Secondary_Analyser
/68/	111226_KPS_Calibration_Report_Secondary_Analyser
/69/	CH4-Analyser_Manual_Gascard-Edinburgh Instrument
/70/	O2-Analyser_Operating instruction_City Technology
/71/	O2-Analyser_Specification_City Technology
/72/	Secondary_CH4_Analyzer-289_Certificate_conformity_Edinburgh
/73/	Secondary_CH4_Analyzer-289_Initial_calibration_certificate_Edinburgh
/74/	Secondary_CH4_Analyzer-697_Certificate_conformity_Edinburgh
/75/	Secondary_CH4_Analyzer-697_Initial_calibration_certificate_Edinburgh
/76/	Secondary_O2_Analyzer-15556996-15556997-15557003_Certificate_conformity_Edinburgh
/77/	Secondary_O2_Analyzer-15556996-15556997-15557001_Initial_calibration_certificate_Edinburgh

/78/	Secondary_O2_Analyzer-17035465_Certificate_conformity_Edinburgh
/79/	Secondary_O2_Analyzer-17035465_Initial_calibration_certificate_Edinburgh
/80/	Pressure_sensor_HPS-A_Specifications_Roxpur-Sensit
/81/	Pressure_sensor_HPS-A-codification
/82/	Pressure_sensor-atmospheric-421916_Certificate_calibration_Roxpur-Sensit
/83/	Pressure_sensor-atmospheric-437830_Certificate_calibration_Roxpur-Sensit
/84/	Pressure_sensor-gauge-421919_Certificate_calibration_Roxpur-Sensit
/85/	Pressure_sensor-gauge-421921_Certificate_calibration_Roxpur-Sensit
/86/	Pressure_sensor-gauge-421922_Certificate_calibration_Roxpur-Sensit
/87/	Pressure_sensor_HPS-A_Certificate_conformity_Roxpur-Sensit
/88/	Temperature_sensor_Specification_HB Sensors
/89/	Temperature-sensor_Certificate_conformity_HB-Sensors
/90/	Temperature-sensor-72529-02_Certificate_calibration_HB-Sensors
/91/	Temperature-sensor-72529-03_Certificate_calibration_HB-Sensors
/92/	Thermocouple Manual_Thermology
/93/	Thermocouple-TT-4638-01_Certificate_calibration_Thermology
/94/	Thermocouple-TT-4638-03_Certificate_calibration_Thermology
/95/	Standard_IEC 584-2-1982
/96/	Thermocouple_Certificate_conformity_Thermology
/97/	Thermocouple_Manufacturer specification_N type
/98/	Electricity Meter_Schneider_Characteristics
/99/	Electricity Meter_PEA_Calibration_certificate (English Translation)
/100/	Electricity Meter_PEA_Calibration_certificate (Thai)
/101/	Electricity Meter_Schneider_Calibration_frequency
/102/	Electricity Meter_Schneider_Calibration_certificate_2010.03
/103/	Electricity Meter_Schneider_Calibration_certificate_2010.07
/104/	Electricity Meter_Schneider_conformity_certificate_schneider
/105/	Primary_CH4_Certificate-cylinder_K05601_Air Liquide
/106/	O2_Certificate-cylinder_K39551_Air Liquide
/107/	Secondary_CH4_Certificate-cylinder_K05685_Air Liquide
/108/	N2_Certificate-cylinder_26121002_Air Liquide
/109/	2011-1_Electricity Invoice_KPS
/110/	2011-2_Electricity Invoice_KPS
/111/	2011-3_Electricity Invoice_KPS
/112/	2011-4_Electricity Invoice_KPS
/113/	2011-5_Electricity Invoice_KPS
/114/	2011-6_Electricity Invoice_KPS
/115/	2011-7_Electricity Invoice_KPS
/116/	2011-8_Electricity Invoice_KPS

/117/	2011-9_Electricity Invoice_KPS
/118/	2011-10_Electricity Invoice_KPS
/119/	2011-11_Electricity Invoice_KPS
/120/	2011-12_Electricity Invoice_KPS
/121/	*Electricity Consumption Record KPS 2011*
/122/	Commissioning_certificate_KPS_26March2010
/123/	100310_Trainer-Accreditation_Calibration_Training_Mark-Moulden_Organics
/124/	100310_Trainer-Accreditation_Flare-Operation_Training_Mark-Moulden_Organics
/125/	100331_Accreditation_Gas-Analyser_Calibration_Training_Alban Casimir_Bionersis
/126/	100331_Accreditation_Gas-Analyser_Calibration_Training_Supida Piwkhow_Bionersis
/127/	100331_Accreditation_Gas-Analyser_Calibration_Training_Suthep Kaewsaihmun_Bionersis
/128/	100331_Flare_Operation_and_Maintenance_Training_Certificate_Bionersis
/129/	100331_Gas_Analyser_Calibration_Training_Certificate_Bionersis
/130/	100331_Flare_Operation_and_Maintenance_Training_Certificate_Bionersis
/131/	100331_Flare_Operation_Maintenance_Training_Certificate_Bionersis
/132/	100331_Flare_Operation_and_Maintenance_Training_Certificate_Bionersis
/133/	100331_Gas_Analyser_Calibration_Training_Certificate_Bionersis
/134/	100331_Flare_Operation_Maintenance_Training_Certificate_Bionersis
/135/	100331_Gas_Analyser_Calibration_Training_Certificate_Bionersis
/136/	4638 KPS flare operation statement
/137/	5027 Flare operation confirmation
/138/	CL1-Document of Electricity Generation-KPS
/139/	CL2-Proper Flare Operation Document
/140/	CL3-Flare OM and Calibration Schedule
/141/	CL4-Leachate and Rainfall Record
/142/	http://www.readwin2000.com/en_readwin2000.htm
/143/	http://www.endress.com/eh/home.nsf/?Open&DirectProductURL=1C89019428735893C12572AA0036BFF3
/144/	Tool to calculate baseline project and/or leakage emissions from electricitry consumption
/145/	Plant Log Book
/146/	Drawing no.:4638-01-001 (A), title: SC Ground Flare Process & Instrumentation Diagram
/147/	Monitoring Report *KPS v3 06 03 2012*
/148/	*ER summary KPS v3 06 03 2012* Excel sheet
/149/	Monitoring Report *KPS v4 10 04 2012*
/150/	*ER summary KPS v4 10 04 2012*
/151/	Clarification by CDM AP on AM_CLA_0047
/152/	Monitoring Report *KPS V5 20 07 2012*

/153/	110114_KPS_Calibration_Report_Secondary Analyser
/154/	101227_KPS_Calibration_Report_Primary Analyser
/155/	101227_KPS_Calibration_Report_Secondary Analyser
/156/	120102_KPS_Calibration_Report_Primary Analyser
/157/	120102_KPS_Calibration_Report_Secondary Analyser
/158/	110620_Certificate-of-calibration_O2-analyser_18025346_City-Technology_Factory-calibration
/159/	110103_KPS_Calibration_Report_Primary Analyser
/160/	Monitoring Report *KPS V6 24/12/2012*
/161/	ER summary KPS v5 24 12 2012

- o0o -

ANNEX 1:

VERIFICATION PROTOCOL

SQAS-CDM-EB04330001

SIRIM QAS INTERNATIONAL SDN BHD
Verification checklist

Project name : Bionersis Project Thailand 1(UNFCCC project no. 2514)
Monitoring period : 1 January 2011 – 31 December 2011

TABLE 1: VERIFICATION REQUIREMENTS BASED ON CDM VALIDATION AND VERIFCATION MANUAL VERSION 01.2

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
1. Project implementation in accordance with the registered PDD **Any concern related to the conformity of the actual project activity and its operation with the registered PDD shall be identified.**					
1.1 Was an on-site visit conducted for this verification? If no, please justify the rationale of the decision.	VVM	196	On-site visit to the project site for this verification period was carried out on 31 January 2012 - 2 February 2012.	OK	OK
1.2 Are all physical features of the proposed CDM project activity proposed in the registered PDD in place?	VVM	196	It was sighted on-site that the CDM project activity were installed in accordance to the registered PDD. The equipment installed includes • a gas collection network consisting of vertical gas wells and a main collector, • a high temperature enclosed flare system, and • measuring equipment and control system.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
1.3 Have the project participants operated the proposed CDM project activity as per the registered PDD?	VVM	196	It was confirmed that Bionersis (Thailand) Ltd operates the project activity. The landfill site is managed and operated by Group 79, which is not a project participant. It was seen that, in this phase 1, the LFG captured is flared. The phase 2, where the LFG will be combusted in biogas generators to displace electricity in the grid, is yet to be materialized. However, PP has yet to clearly justify in section B.1 of the monitoring report the status of project implementation for phase 2.	~~CL 1~~	OK
1.4 Is there any implementation or operation of the CDM project activity not conforming with the description contained in the registered PDD? If yes, proceed to 1.5.	VVM	197	There are no operations of the implemented CDM project activity that are non-conforming with the description contained in the registered PDD.	OK	OK
1.5 Has an assessment been conducted on the potential impacts due to these changes following EB48 report, paragraph 73 and its annex 67? If yes, proceed to 1.6.	VVM	197	Not applicable.	OK	OK
1.6 Has a notification or a request for approval of changes been submitted from the project activity as described in the registered PDD prior to the conclusion of the verification/certification for the corresponding monitoring period based on the assessment above?	VVM	197	Not applicable.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
2. **Compliance of the monitoring plan with the monitoring methodology** **The monitoring plan of the proposed CDM project activity shall comply with the applied methodology.**					
2.1 Is the monitoring plan of the CDM project activity complying with the applied methodology?	VVM	200	It was confirmed that the monitoring plan complies with the applied methodology ACM 0001 (version 8) 'Consolidated baseline and monitoring methodology for landfill gas project activities' and the 'Tool to determine project emissions from flaring gases containing methane' (version 1) and 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption' (version 1). The parameters monitored are • the amount of LFG captured and flared at normal temperature and pressure, LFG_{flare}, • the temperature of the LFG, T, • the pressure of LFG, P, • the methane fraction in the LFG, w_{CH4}, • the quantity of electricity consumed by the project activity, EC_{PJ}, • the project emissions from flaring of the residual gas, $PE_{flare,y}$, • the flare efficiency in hour, $\eta_{flare,h}$, • the temperature of the exhaust gas of the flare, T_{flare}, • the volumetric fraction of O_2 in the exhaust gas of the flare in the hour, t_{O2},h, • the concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour, $fv_{CH4,FG,h}$.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
2.2 If no, was a request for revision of the monitoring plan done? (Approval from EB for the revised monitoring plan shall be obtained prior to concluding the verification and certification decisions.)	VVM	201	Not applicable.	OK	OK
2.3 Are there any monitoring aspects of the project activity that are not specified in the methodology, particularly in the case of small scale methodologies(e.g. additional monitoring parameters, monitoring frequency and calibration frequency)?	VVM	202	There are no monitoring aspects of the project activity that are not specified in the methodology.	OK	OK
2.4 If yes, is the request for revision of the monitoring plan necessary? (This revision may contribute in enhancing the level of accuracy and completeness of the monitoring plan)	VVM	202	Not applicable.	OK	OK
3. Compliance of monitoring with the monitoring plan. **Monitoring of reductions in GHG emissions to result from the proposed CDM project activity shall be implemented in accordance with the monitoring plan contained in the registered PDD pr the ace[ted revised monitoring plan.**					
3.1 Have the monitoring plan and the applied methodology been properly implemented and followed by the project participants?	VVM	205 (a)	The monitoring plan and the applied methodology have been properly implemented and followed by the project participant. This was evident from the project monitoring report for the monitoring period 2: 1 January 2011 to 31 December 2011. The parameters, as stated in section 2.1 above, were monitored in accordance to the monitoring plan and the applied methodology.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
3.2 Have all parameters stated in the monitoring plan, the applied methodology and relevant CDM Executive Board decisions been sufficiently monitored and updated as applicable, including:	VVM	205 (b)			
i) project emission parameters			In accordance to the PDD, the project emissions are due to the electricity consumed from the grid by the project activity, EC_{PJ} and from flaring of the residual gas containing methane, $PE_{flare,y}$. Referring to the 'Tool to determine project emissions from flaring gases containing methane' (version 1) and 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption' (version 1), the parameters have been monitored accordingly. i)Gas analyzer was used to monitor, the volumetric fraction of O_2 in the exhaust gas of the flare ($t_{O2,h}$) and the concentration of methane in the exhaust gas of the flare ($fv_{CH4,FG,h}$). The gas analyzer was seen linked to the data logger system. ii)Thermocouple was used to monitor the temperature in the exhaust gas of the flare (T_{flare}). The thermocouple was seen linked to the data logger system iii)Electricity meter was used to monitor the quantity of electricity consumed by the project activity (EC_{PJ}). The readings were recorded in the plant logbook daily.	OK	OK
ii) baseline emission parameters			i)Flow meter was used to monitor the amount of LFG captured and flared (LFG_{flare}). The flow meter was seen linked to the data logger system ii)Temperature sensor and pressure sensor were used to monitor the temperature (T) and pressure (P) of the LFG respectively. The sensors were seen linked to the data logger system iii)Gas analyzer was used to monitor the methane fraction in LFG (w_{CH4}), The gas analyzer was seen linked to the data logger system.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
iii) leakage parameters			No leakage in this project activity.	OK	OK
iv) Management and operational system: the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan?			Based on the interview and discussion with the project site personnel, it was seen that the field supervisor is responsible to download the data from the Memograph and to email the downloaded data to the Monitoring and Maintenance Manager in Bangkok office. The Monitoring and Maintenance Manager is responsible to extract the RSD format data convert to Excel format. She is also responsible to run the Excel format data into the CER Calculator Program for the emission reduction data. Apart from the data collection and monitoring, she is also in-charge of the calibration and maintenance of the equipment used. She reported the monitoring and maintenance activities of the project to the Director of CDM & Carbon Finance. She also kept the CDM Project Manager updated on the monitoring and maintenance activities of the project. Therefore, it can be confirmed that the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
3.3 Is the accuracy of equipment used for monitoring is in accordance with the relevant guidance provided by the CDM Executive Board and is controlled and calibrated in accordance with the monitoring plan?	VVM	205 (c)	The monitoring equipments were calibrated and controlled in accordance with the monitoring plan. i)The flow meter for amount of landfill gas captured and flared n^{o} 10514495 was replaced by n^{o} 1051496 on 12 May 2011. Both meters were calibrated by the manufacturer prior to installation on 27 January 2010. The calibration validity period for n^{o} 10514495is from 26 March 2010 to 25 March 2013 and for n^{o} 10514496 is from 12 May 2011 to 12 May 2014 (every 3 years as specified in the registered PDD). ii)The temperature sensor for landfill gas n^{o} 72529-03 was replaced by n^{o} 72529-02 on 16 March 2011. Both sensors were calibrated by the manufacturer prior to installation on 4 March 2010. The calibration validity period for n^{o} 72529-03 is from 26 March 2010 to 25 March 2011 and for n^{o} 72529-02 is from 16 March 2011 to 16 March 2012 (every year as specified in the PDD). iii)The gauge pressure sensor n^{o} 421921 was used to replace n^{o} 421922 between 16 March 2011 to 20 March 2011 and replaced againby n^{o} 421919 on 26 March 2011. All pressure gauges were calibrated by the manufacturer prior to installation on 29 January 2010. The calibration validity period for n^{o} 421922 is from 26 March 2010 to 26 March 2011 and for n^{o} 421919 is from 26 March 2011 to 26 March 2012 (every year as specified in the PDD). iv)The atmospheric pressure sensor n^{o} 421916 was replaced by n^{o} 437830 on 16 March 2011 and both sensors were calibrated by the manufacturer prior to installation on 29 January 2010 and 10 August 2010 respectively. The calibration validity period for n^{o} 421916 is from 26 March 2010 to 26 March 2011 and for n^{o} 437830 is from 16 March 2011 to 16 March 2012. (every year as specified in PDD)	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
			v)The electricity meter was calibrated prior to installation on 26 March 2010 and recalibrated on 22 July 2010. The first calibration carried out by the manufacturer, Schneider Electric. The second calibration was conducted by the Electrical and Electronics Institute of Thailand where a more detail calibration report was produced. The calibration validity period is from 22 July 2010 to 22 July 2013 (every 3 years as specified in the registered PDD) vi)For the gas analyzer measuring the CH4 content in LFG , the gas card n^{o} 26698 was replaced by n^{o} 150 on 14 January 2011. Both were were calibrated by the manufacturer prior installation on 8 December 2009 and 26 October 2010 respectively. Calibration valid for the entire monitoring period. The gas analyzer was calibrated by comparison with certified gas cylinders. Cylinder 45.15% CH4 n^{o} K05601, cylinder 20.04% O2 n^{o} K39551 and cylinder 99.999% N2 supplied by Air Liquide. However, PP has yet to clarify the CH4 concentration in LFG that exceeds more than 60% on 23 January 2011 and 24 January 2011. vii) For the exhaust gas analyzer, the concentration of methane was measured by the gas card n^{o} 697 was replaced by n^{o}289 on 29 August 2011. Gas card n^{o} 697 was calibrated by manufacturer prior installation on 30 August 2010 and gas card n^{o} 289 on 26 October 2010. Calibration valid during the entire monitoring period. A zero check and a typical value check was performed by comparison with a standard gas. Gas cylinders used for the calibration of the gas analyzer during monitoring period. Cylinder 4.54% CH4 n^{o}K05685, cylinder 20.04% O2 n^{o} K39551 and cylinder 99.999% N2.	~~CL 2~~	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
			viii)For the exhaust gas analyzer measuring the volumetric fraction of oxygen, the gas card n°15556996 was replaced by n° 15557003 on 14 January 2011. Gas card n° 15557003 was replaced by n° 15556997 on 31 January 2011. Gas card n° 15556997 was replaced by n° 17035465 on 7 February 2011. All gas cards was calibrated by manufacturer prior to installation on 27 January 2010. Gas card n° 17035465 was calibrated by the manufacturer prior installation on 9 November 2010 was also calibrated at the date of installation on 7 February 2011. Calibration valid for the entire monitoring period. A zero check and a typical value check was performed by comparison with a standard gas analyzer during the monitoring period. Cylinder 20.04% O2 n° K39551, cylinder 4.54% n° K05685 and cylinder 99.999% N2. ix)The thermocouple n° TT-4638-1 was replaced by TT-4638-3 on 16 March 2011. Both thermocouples were calibrated by the manufacturer prior to installation on 3 February 2010. The calibration validity period is from 26 March 2010 to 25 March 2011 (calibrated or replaced every year). However, PP has yet to clarify the flare temperature that exceeds more than 700 deg C.	~~CL 3~~	OK
3.4 Are monitoring results consistently recorded as per approved frequency?	VVM	205 (c)	The monitored data were recorded in accordance to the approved frequency in the monitoring plan. The data logger recorded the data from flow meter, sensors and analyzer on a minutely basis. The electricity consumed was recorded on daily basis.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
3.5 Have quality assurance and quality control procedures been applied in accordance with the monitoring plan monitoring plan?	VVM	205 (c)	Quality assurance and quality control procedures have been applied in accordance with the monitoring plan. The monitoring equipments were calibrated in accordance to the manufacturer specification. The locations of the equipments were secure and free from possible accidental damage. Trainings were given to the personnel. The design of the Memograph data acquisition system has reduced the manual handling of the monitored data which prevent the tempering of raw data. The data transfer was reviewed initially by the Monitoring and Maintenance Manager based in Bangkok and reviewed again by the CDM Project Manager and the CDM Director based in France. The review process is by running the raw data into the CER Calculator Program.	OK	OK
4. Assessment of data and calculation of greenhouse gas emission reductions. GHG emission reduction achieved by/resulting from the proposed CDM project activity calculated applying the selected methodology.					
4.1 Is a complete set of data for the specified monitoring period is available? (If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, the DOE shall opt to either make the most conservative assumption theoretically possible in finalizing the verification report, or raise a request for deviation prior to submitting request for issuance if appropriate).	VVM	208 (a)	A complete set of data is available for the stated monitoring period from 1 January 2011 to 31 December 2011. The remote meters/sensors below were linked to the 'Memograph' data acquisition system, except for the quantity of electricity consumed by the project activity where the readings from the meter were manually recorded by the field technician. The Memograph recorded the data on minutely basis whereas for electricity consumed, meter readings were taken on daily basis.	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
4.2 Has information provided in the monitoring report been crosschecked with other sources such as plant log books, inventories, purchase records, laboratory analysis?	VVM	208 (b)	The parameters monitored by the data logger were recorded on minutely basis. (There were no data from the data logger which were manually recorded as back-up by the field technician.) The data were kept in ReadWin 2000 software data format installed in the Memograph data acquisition system. In monthly basis, the Monitoring Manager extracted data and kept the data as the monthly production input data (in Excel format). This monthly production input data was used as input data into the CER Calculator Program. The output data were kept in the monthly ER data in a Macro-Enabled Excel sheet. The verification team has verified the data transfer from the extracted data (in Excel format) by running again the monthly production input data into the CER Calculator Program.The output data has been confirmed to the *ER summary KPS v4 10 04 2012* Excel sheet. The amount of electricity consumed by the project activity was monitored manually. The verification team has verified by crosschecking with the site daily logbook and the *Electricity Consumption Record KPS 2011*Excel sheet. The figure from this Excel sheet has been confirmed against the *ER summary KPS v4 10 04 2012* Excel sheet. The calibration certificates for the monitoring equipments issued by the testing laboratory were verified. The monitoring equipments used have been verified against the equipment technical specifications. It was confirmed that the equipment used are appropriate. However, PP has yet to furnish the manufacturer guidelines of frequency of calibration and maintenance schedule which justifying on frequencies of calibration of all measuring equipment. There were typo errors observed in section D.2 of the monitoring report, refer below i)the serial number of the flow meter, ii)accuracy of the flow meter	~~CL 4~~ ~~CAR 1~~	OK OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
4.3 Have calculations of baseline emissions, proposed CDM project activity emissions and leakage, as appropriate, been carried out in accordance with the formulae and methods described in the monitoring plan and the applied methodology document?	VVM	208 (c)	In accordance to the methodology ACM 0001 (version 8), the formula used for baseline emissions and project emissions calculations are appropriate where, $ER_y = (MD_{project,y} - MD_{BLy}) * GWP_{CH4} - PE_{,y}$, where, $MD_{project,y} = (LFG_{flare,y} * w_{CH4} * D_{CH4}) – (PE_{flare,y}/GWP_{CH4})$ $MD_{BL,y} = MD_{project,y} * AF$, where AF is set as 0% $PE_{,y} = PE_{EC,y} = EC_{PJ,y} * EF_{EL,y} * (1+TDL)$ $$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1-\eta_{flare,h}) \times \frac{GWP_{CH4}}{1000}$$ In this phase 1 of the project, all LFG captured in the project activity is flared, therefore $MD_{project,y} = MD_{flare,y}$. The formula and calculation applied in the CER Calculator Program has been verified to be in accordance with the applied methodology. Leakage is not applicable.	OK	OK
4.4 Any assumptions used inemission calculations? If yes, they beenjustified?	VVM	208 (d)	The assumption used in the emission calculation are compliant with the parameters fixed ex-ante in the registered PDD: $GWP_{CH4} = 21$ $D_{CH4} = 0.0007168\ t_{CH4}/m3_{CH4}$ AF = 0 CEF = 0.610 tCO_2/MWh TDL = 20%	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
4.5 Have appropriate emission factors, IPCC default values and other reference values been correctly applied?	VVM	208 (e)	The emission factor and the ex ante parameters have been correctly applied in the CER Calculator Program. . PP has yet to include more information in Section E.6 of the monitoring report regarding the remark on difference from estimated value in the PDD.	OK ~~CL 5~~	OK OK

TABLE 2 :RESOLUTION OF CORRECTIVE ACTION AND CLARIFICATION REQUESTS

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 1	Summary of project owner response	Verification team conclusion
CAR 1 There were typo errors observed in section D.2 of the monitoring report, refer below i)the serial number of the flow meter, ii)accuracy of the flow meter.	4.2	Section D.2 of the MR is corrected accordingly, please see detail in Monitoring report KPS *V6 24/12/2012*	Comment Typo error in the monitoring report has been corrected. Conclusion CAR 1 closed.
CL 1 PP has yet to clearly justify in section B.1 of the monitoring report the status of project implementation for phase 2.	1.3	Item 4 is added to section B.1 to include information on the development of project phase II which is the electricity generation, please see detail in Monitoring report KPS *V6 24/12/2012*. In addition, the supporting documents including quotation from supplier, power purchase agreement between PP and the Provincial Electricity Authority of Thailand, as proof for the progression of project phase II are provided in supporting document CL1.	Comment Supporting evidence on quotation for gas engine has been furnished and power purchased agreement with PEA of Thailand has been finalized. Section B.1 of the monitoring report has been updated. Conclusion CL 1 closed.
CL 2 PP has yet to clarify the CH4 concentration in LFG that exceeds more than 60% on 23 January 2011 and 24 January 2011.	3.3	An increase in the CH4 concentration in LFG between 23 January 2011 and 24 January 2011 was resulting from failure of the ventilation system. This caused an increase in temperature inside the analyser panel and forced the CH4 sensor to work outside of its normal operating temperature. The problem was removed after the ventilation system was repaired on 24 January 2011. Considered this abnormality of measurement, the production data between 00:00:00 on 23 January 2011 until	Comment ER calculation on Excel sheet on specified time of 23 and 24 January 2011 has been corrected. Total ER has also been corrected in the monitoring report. Conclusion CL 2 closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 1	Summary of project owner response	Verification team conclusion
		14:18:00 on 24 January 2011 is removed from ER calculation for the month of January 2011.	
CL 3 PP has yet to clarify the flare temperature that exceeds more than 700 deg C.	3.3	In reference to the "Flare Operation Statement_Organics'' document issued by the flare manufacturer, it is stated that " The flare operates within the range of operating conditions, as long as the flare temperature is maintained at a minimum of 500 °C." Therefore, it is the PP's opinion as the flare operator that this technical statement from the manufacturer confirms that the flare operates "adequately" in these conditions. Although the flare manufacturer's statement does not indicate the above limit for which the flare is not properly/adequately operating, but the technical specifications of the flare indicates that the combustion temperature is 1,000 °C. The confirmation letter issued by the manufacturer also further confirms that this type of flare is operating adequately as long as the temperature is between 500 °C and 1,200 °C. In addition, the average temperature measured by the thermocouple during the monitoring period is 827 °C and the continuous monitoring of flare efficiency has proven an average combustion efficiency of 99.99%. These measured values further evidence that temperature above 700 °C indicates that the flare is adequately operating, allowing destruction of almost all the methane contained in the LFG.	Comment Statement of Flare Performance and its Technical specification from the manufacturer has been furnished and PP justification on flare operation is adequate. Conclusion CL 3 closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 1	Summary of project owner response	Verification team conclusion
		The three documents from the manufacturer referred to in this part of clarification are provided in supporting document CL2.	
CL 4 PP has yet to furnish the manufacturer guidelines of frequency of calibration and maintenance schedule which justifying on frequencies of calibration of all measuring equipment.	4.2	The manufacturer guidelines of frequency of calibration are provided in supporting document CL3. Should the recommended calibration frequency recommended by the flare manufacturer is longer that what stated in the PDD for a given CDM equipment, the PP complies with the schedule in the PDD.	Comment Manufacturer guidelines on frequency of calibration and maintenance have been furnished. Conclusion CL 4 closed.
CL 5 PP has yet to include more information in Section E.6 of the monitoring report regarding the remark on difference from estimated value in the PDD.	4.5	Further information is provided in Section E.6 of the Monitoring report KPS *V6 24/12/2012*. A summary of the average leachate level in landfill since the beginning of the project implementation and the annual precipitation record from the meteorology station located near the landfill site are provided in supporting document CL4.	Comment Sufficient information on leachate level and meteorological data has been furnished. Monitoring has been updated accordingly. Conclusion CL 5 closed.