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Verification Report

PANGEA GREEN ENERGY S.R.L.

Periodic Verification of the Registered CDM Project

"Quezon City Controlled Disposal Facility Biogas Emission Reduction Project"

UNFCCC 1258-CDMP

Monitoring period 2: 01-09-2008 to 30-06-2009

Report No. 600500356

28 February 2011

TÜV SÜD Industrie Service GmbH
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Industrie Service

Report No.	**Date of first issue**	**Version No.:**	**Revision date**	**No. of pages**
600500356	07-04-2010	06	28-02-2011	26
Subject:			Second Periodic Verification	
Executing Operational Unit:				
TÜV SÜD Industrie Service GmbH, Carbon Management Service Westendstrasse 199 - 80686 Munich, Federal Republic of Germany				
Project Participant (client):				
Pangea Green Energy S.r.l. Corso Vittorio Emanuele II 83, Turin 10128, Italy				
Registration number / Project Title			Project 1258: "Quezon City Controlled Disposal Facility Biogas Emission Reduction Project"	
Monitoring period:			01-09-2008 to 30-06-2009	
First Monitoring Report (version/date)			Version 00 / July 2009	
Final Monitoring Report (version/date)			Version 09 / 10-02-2011	

Summary: TÜV SÜD Industrie Service GmbH has performed the second periodic verification of the registered CDM project: "Quezon City Controlled Disposal Facility Biogas Emission Reduction Project". The project consists of the extraction, collection, processing and flaring of biogas (landfill gas) from the Quezon City controlled disposal facility and use for electricity generation or flaring when electricity generation is not possible. The project thus avoids methane emissions to the atmosphere.

The management of Pangea Green Energy S.r.l is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions.

A document review, followed by a site visit was conducted to verify the information submitted by the project participant regarding the present verification period. Based on the assessment carried out, the verifier confirms the following:

- the project has been implemented and operated in accordance with the description given in the registered PDD (version 11, 30-11-2007, registration date 01-02-2008).
- the project is partly implemented as described in the registered PDD. As described in the PDD, phase I of the project is in progress and has been the implementation status of this given monitoring period i.e. landfill is being flared and electricity generated for on-site consumption only. As per the registered PDD, phase II which is to install a bigger biogas electrical engine for the conversion of a portion of the methane to electricity that will be delivered to the local grid is planned for the 3rd year;
- the emission reductions presented in the current monitoring report are lower and deviate significantly from the emission reductions as indicated in the registered PDD. The garbage dumping activity at the land fill site is not under the control of PP and solely rests with the Payatas Operations Group (POG). On request from POG, Pangea Green Energy has to partially disconnect some gas wells causing stoppage of gas extraction from them and hence lower emission reductions than envisaged in the PDD.
- the monitoring plan complies with the applied methodologies (ACM0001 version 5 and AMS-I.D version 10) and the monitoring has been carried out in accordance with the monitoring plan. A Request for Deviation (I-DEV0273) was submitted by TUV SUD on 27/11/2009 as:
  a) T_{flare} is supposed to be a measure of temperature in the exhaust gas of the enclosed flare as per the "*Tool to determine project emissions from flaring gases containing methane*" and as per the registered PDD; however in practice the flare combustion temperature has been monitored with a probe located just above the burner. The DOE ascertained that this deviation did not require an amendment of the methodology applied nor did it affect the estimation of emission reported.
  b) $LFG_{TOTAL,y}$ in main line should be monitored as per ACM001, version 5 and the registered PDD. However the turbine flow meter measuring this parameter suffered a breakdown due to which an alternative method not prescribed by the methodology was used that resulted in deviation. The DOE ascertained that this deviation did not require an amendment of the methodology applied nor did it affect the estimation of emission reported.

Installed equipment essential for generating emission reductions run reliably and the measuring instruments except those of methane content analyzer and flare exhaust gas analyzer are calibrated appropriately. The data of both these instruments where calibration was delayed by six days, was adjusted conservatively as per para 4(b), Annex 60 of EB 52. The project is generating emission reductions as a CDM project.

The verifier can confirm that the GHG emission reductions are calculated without material misstatements. Our opinion refers to the project's GHG emissions and resulting GHG emission reductions reported, both determined using the valid and registered project's baseline, its monitoring plan and its associated documents.

Based on the information we have seen and evaluated, we confirm that the implementation of the project resulted in 75 376 t CO_2e of emission reductions during the verification period 01-09-2008 to 30-06-2009.

Assessment Team Leader: Bratin Roy **Assessment Team Members:** Praveen Pyata, Supratik Dutta, Nikunj Agarwal **Trainee** Jayme A Boehnert	**Technical Reviewer:** Johann Thaler, Thomas Kleiser **Certification Body responsible:** Thomas Kleiser

Abbreviations

AMS	Approved Methodology Small Scale
ACM	Approved Consolidated Methodology
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM-EB	CDM Executive Board
CER	Certified Emission Reduction
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
CO_2e	Carbon dioxide equivalent
CR / CL	Clarification Request
DNA	Designated National Authority
DOE	Designated Operational Entity
EF	Emission Factor
EIA / EA	Environmental Impact Assessment / Environmental Assessment
ER	Emission Reduction
FAR	Forward Action Request
FSR	Feasibility Study Report
GHG	Greenhouse Gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
IRL	Information Reference List
KP	Kyoto Protocol
MP	Monitoring Plan
MR	Monitoring Report
PDD	Project Design Document
PP	Project Participant
TÜV SÜD	TÜV SÜD Industrie Service GmbH
UNFCCC	United Nations Framework Convention on Climate Change
VVM	Validation and Verification Manual

Main Documents (referred to in this report)

Methodology (name / version)	ACM0001 Version 05, AMS-I.D Version 10	
Scope	1, 13	
Technical Area	1.2, 13.1	
Registered PDD:	Version 11, date 30-11-2007	
Revised Monitoring Plan:	-	
	Version	Date
Published Monitoring Report	00	July 2009
Revised Monitoring Report	09	10-02-2011
Project documentation link:	http://cdm.unfccc.int/Projects/DB/DNV-CUK1185342160.98/view	

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1 INTRODUCTION

1.1 Objective

Pangea Green Energy S.r.l has commissioned an independent verification by TÜV SÜD Industrie Service GmbH (TÜV SÜD) of its registered CDM project: "Quezon City Controlled Disposal Facility Biogas Emission Reduction Project".
The objective of the verification work is to comply with the requirements of paragraph 62 of the CDM Modalities and Procedures. According to this assessment TÜV SÜD shall:

- ensure that the project activity has been implemented and operated as per the registered PDD "Quezon City Controlled Disposal Facility Biogas Emission Reduction Project" Version 11 dated 30-11-2007, and that all physical features (technology, project equipment, monitoring and metering equipment) of the project related to phase I are in place,
- ensure that the published MR and other supporting documents provided are complete, verifiable and in accordance with applicable CDM requirements,
- ensure that the actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved methodology,
- evaluate the data recorded and stored as per the "Consolidated baseline and monitoring methodology for landfill gas project activities", ACM0001 version 05 and "Grid connected renewable electricity generation" AMS-I.D version 10.

1.2 Scope

The verification scope encompasses an independent and objective review and ex-post determination of the monitored reductions in GHG emissions by the Designated Operational Entity. The verification is based on the submitted monitoring report, the validated project design documents including its monitoring plan and validation report, previous verification reports, the applied monitoring methodologies, relevant decisions, clarifications and guidance from the CMP and the EB and any other information and references relevant to the project activity's resulting emission reductions. These documents are reviewed against the requirements of the Kyoto Protocol, the CDM Modalities and Procedures and related rules and guidance.

Based on the requirements in the VVM, TÜV SÜD has applied a rule-based approach for the verication of the project. The principles of accuracy,completeness, relevance, reliability and credibility were combined with a conservative approach to establish a traceable and transparent verification opinion.

The verification considers both quantitative and qualitative information on emission reductions.

The verification is not meant to provide any consultancy towards the client. However, stated requests for clarifications, corrective and/or forward actions may provide input for improvement of the monitoring activities.

1.3 GHG Project Description

Project activity:	"Quezon City Controlled Disposal Facility Biogas Emission Reduction Project"
UNFCCC registration number:	1258
Project Participants:	1. Pangea Green Energy S.r.l 2. Pangea Green Energy Philippines, Incorporated 3. Quezon City Government
Location of the project:	Latitude: 14.715469°; Longitude: 121.104114°

	Barangay Payatas, Quezon City, Metro Manila, Philippines
Date of registration:	01-02-2008
Starting date of the crediting period:	01-02-2008

The Project activity involves the extraction, collection, processing and flaring, including the conversion into electricity of the biogas emissions at the Quezon City Controlled Disposal Facility ("Facility") located in Area 2, Barangay Payatas, Quezon City, the Philippines. Phase I of the project has been implemented. This has included the installation of the combustion plant composed of a biogas extraction system (wells and blower), a high temperature torch for flaring the methane extracted and an electrical engine, fed by biogas during plant operation for on-site power supply. The plant was completed and commissioned in March 2008. The gas collection system currently consists of 64 wells distributed between two dump sites known as the Old and New Mound. Biogas from the wells is conveyed to 4 substations through 90 mm dia. HDPE pipes. The substations convey the biogas to the main line constituting of 90-160 mm diameter HDPE pipes. Condensate traps are located on the main line within the biogas plant and provided with the float required for the condensate gravity draining whereby condensate is captured and returned to the well. The flow of biogas is controlled by a Continental Industrie type 051A.03 biogas blower. Some of the biogas is sent to the Engine unit in order to satisfy the internal on-site electricity demand, which is equipped with Heat exchanger to cool biogas, Refrigerator group, Condensate separator and 250 kVA Electricity generator. The rest of the biogas is conveyed to the high temperature enclosed gas flare with capacity 500 - 2500 Nm^3/h, made of stainless steel AISI 304 with temperature control enabled through continuous thermocouple type Pt-Rh-Pt.

On the requests from Payatas Operations Group (POG) partial disconnection of some gas wells is implemented by Pangea Green Energy causing stoppage of gas extraction from those wells. This allowed garbage truck movement and fresh dumping at existing landfill however reduced biogas recovery from the existing well performing wells. As a result the emission reductions during the monitored period are reduced from the PDD value of 120,199 to 75,376 when compared on pro-rata basis (for 10 months).

2 METHODOLOGY

2.1 Verification Process

The verification process is based on the approach depicted in the Validation and Verification Manual.

Standard auditing techniques have been adopted for the verification process. The verification team performs first a desk review, followed by an on-site visit, which results in the formation of a protocol that includes all the findings. The next step involves the evaluation of the findings through direct communication with the PPs and then finally the preparation of the verification report. This verification report and other supporting documents then undergo an internal quality control by the CB "climate and energy" before submission to the CDM-EB.

2.2 Verification Team

The appointment of the verification team takes into account the technical area(s), sectoral scope(s) and relevant host country experience required amongst team members for verifying the ER achieved by the project activity in the relevant monitoring period for this verification.

The verification team consisted of the following members:

Name	Qualification	Coverage of scope	Coverage of technical area	Host country experience
Bratin Roy	**ATL**	**þ**	**þ**	**-**
Praveen Pyata	GHG-V	þ	þ	-
Nikunj Agarwal	GHG-V	þ	þ	þ
Supratik Dutta	GHG-V	þ	þ	-
Jayme A Boehnert	T	-	-	þ

Bratin Roy is an Assessment Team Leader for CDM/JI projects for CDM/JI projects and also a lead auditor for quality and environmental management systems (according to ISO 9001 and ISO 14001). He holds a Master Degree in Environmental Science. Mr. Roy has worked for 10 years as a consultant in the field of energy industries, renewable and non-renewable sources, and energy distribution equipment, especially biomass and solar energy. He has presented several papers related to climate change, energy efficiency and corporate sustainability in various national and international seminars and workshops. He has received extensive training in the CDM and JI validation and verification processes and has already participated in several CDM/JI project assessments.

Praveen Pyata is GHG Verifier at TÜV SÜD South Asia and also a certified lead auditor for environmental management systems (according to ISO 14001). He holds a post-graduate degree in Environmental Science and Technology. Before joining TÜV SÜD South Asia he worked on biomethanation technologies, industrial waste management, emissions reduction technologies and waste to energy projects for more than 6 years. Mr. Pyata is Product Manager for CDM services in India and has received extensive training in the CDM validation and verification processes. He has already participated in several CDM project assessments within and outside India.

Nikunj Agarwal is appointed as Assessment Team Leader, Technical Reviewer and GHG-Auditor by the certification body "climate and energy". He holds a Masters Degree in Energy

and Environment and passed successfully internal training schemes in the field of auditing as well as the technical features of Manufacturing and energy related projects. He is the certified Energy Auditor from the Ministry of Power and Government of India.

Supratik Dutta is a GHG verifier at TÜV SÜD South Asia, TÜV SÜD Group and also a certified lead auditor for environmental management systems (according to ISO 14001). He holds a post-graduate degree in energy management. He is based in Kolkata, India. He has received extensive training in the CDM validation and verification process and participated already in several CDM project assessments.

Jayme A Boehnert was a GHG Auditor Trainee and a certified Auditor for quality management systems (ISO 9001) at TÜV SÜD PSB Philippines Inc. He's a duly registered mechanical engineer with the Philippine Regulatory Commission, having experience in automotive manufacturing industry as a product development engineer for 7 years. Joined TÜV SÜD as a lifting equipment inspector in 2007 and has received training in CDM in 2009. He has participated in several CDM assessments in and around South East Asia covering a wide range of projects from biomass to N_2O abatement.

2.3 Review of Documents

The Monitoring Report version 00 submitted by the PP was made publicly available on the UNFCCC website before the verification activities started. The published MR was assessed based on all the relevant documents as listed above. The aim of the assessment in the desk review was to:

- verify the completeness of the data and the information presented in the MR,
- check the compliance of the MR with respect to the monitoring plan depicted in the registered PDD and verify that the applied methodology was carried out. Particular attention to the frequency of measurements, the quality of the metering equipment including calibration requirements, and the quality assurance and quality control procedures was paid,
- evaluate the data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

A complete list of all documents reviewed is available in annex 2 of this report.

2.4 On-site Assessment and follow-up Interviews

During 23-09-2009 to 24-09-2009, TÜV SÜD performed a physical site inspection and on-site interviews with project stakeholders to:

- confirm the implementation and operation of the project,
- review the data flow for generating, aggregating and reporting the monitoring parameters,
- confirm the correct implementation of procedures for operations and data collection,
- cross-check the information provided in the MR documentation with other sources,
- check the monitoring equipment against the requirements of the PDD and the approved methodology, including calibrations, maintenance, etc.,
- review the calculations and assumptions used to obtain the GHG data and ER,
- identify if the quality control and quality assurance procedures are in place to prevent or correct errors or omissions in the reported parameters.

A list of the persons interviewed during this verification activity is included in annex 2.

2.5 Quality of Evidence to Determine Emission Reductions

Among several evidence items submitted, the following relevant and reliable evidence material have been used by the audit team during the verification process:

1. Biotecnogas manual for flaring system (IRL9)
2. Certificates of Operation (IRL 11 & 12)
3. Training records (IRL 13)
4. Quality procedures namely POTR001, PGSYS003, PGBI001, PGSYS001, PGSYS002, POEM001 (IRL 14)
5. Machine Book (IRL 15)
6. Supervision Software Manual (IRL 16)
7. Calibration certificates of all monitoring instruments (IRL 18)
8. SCADA (Supervisory Control and Data Acquisition) system reports that registered the raw data during the monitoring period (IRL 19)
9. Internal audit report (IRL 20)
10. Siemens Inspection Certificates (IRL 21 & 22)
11. Preventive action report (IRL 25)
12. Daily plant report including daily event log (IRL 26)
13. Calibration protocol of CH_4 analyzer (IRL 30)
14. Flow meter calibration specifications (IRL 31)
15. Spreadsheet file explaining calculation of error (in %) of instruments when they were not included in the certificates (IRL 34)
16. Siemens manual for instrument error calculation (IRL 35)
17. Layout of land fill (IRL 36)
18. MR_Annex 2 (IRL 40)

Sufficient evidence covering the full verification period in the required frequency is available to validate the figures stated in the final MR. The source of the evidence will be discussed in chapter 3 of this report. Specific cross-checks have been done in cases that further sources were available. The monitoring report's figures were checked by the audit team against the raw data. The data collection system meets the requirements of the monitoring plan as per the methodology.

2.6 Resolution of Clarification and Corrective and Forward Action Requests

The objective of this phase of the verification process is to resolve any outstanding issues which require clarification for TÜV SÜD's positive conclusion of the achieved GHG emission reduction. The findings raised as Forward Action Requests (FARs) (if any) indicated in previous reports (validation/verification) were discussed during this phase and, issues raised in the FARs were resolved, during communications between the PP and TÜV SÜD.

Concerns raised in the desk review, the on-site audit assessments and the follow up interviews and the responses provided for the raised concerns are documented in Annex 1 (verification protocol) to guarantee the transparency of the verification process.

A Corrective Action Request is raised where TÜV SÜD identifies:

- non-conformities in monitoring and/or reporting with the monitoring plan and/or methodology;

- that the evidence provided is not sufficient to prove conformity;
- mistakes in assumptions, data or calculations that impair the ER;
- FARs stated during validation that are not solved until the on-site visit.

A Clarification Request is raised where TÜV SÜD does not have enough information or the information is not clear in order to confirm a statement or data.

A Forward Action Request is raised where TÜV SÜD identifies that monitoring and/or reporting require special attention or adjustments for the next verification period.

Information or clarifications provided as a response to a CAR, CL or FAR could also lead to a new CAR.

2.7 Internal Quality Control

As a final step of verification, the final documentation including the verification report and annexes have to undergo an internal quality control by the Certification Body (CB) "climate and energy", i.e. each report has to be finally approved either by the Head of the CB or the Deputy (a Veto person can be used). In case one of these two persons is part of the assessment team, the approval can only be given by the person who is not a part of the assessment team. If the documents have been satisfactorily approved, the Request for Issuance is submitted to the CDM-EB along with the relevant documents.

3 VERIFICATION RESULTS

In the following sections, the results of the verification are stated. The verification results relate to the project performance as documented and described in the final PDD and Monitoring Report (dated 10-02-2011, version 09). The verification findings for each verification subject are presented below:

3.1 FARs from Validation / Previous Verification

The verification team confirms that all FARs presented in the first verification report have been correctly addressed by the PPs. Please refer to chapter 1.4 of the protocol.

3.2 Project Implementation in accordance with the registered Project Design Document

The project is partly implemented according to the description presented in the registered PDD. The verifier confirms, through the visual inspection that all physical features of the proposed CDM project activity including data collecting systems and storage related to phase I have been implemented in accordance with the registered PDD. Phase I which is the collection and flaring of LFG and conversion of LFG for on-site power use is going on as per the registered PDD description. Phase II which is the generation of power for export to the local power grid in a bigger biogas electrical generator will be implemented at a future date during third year as envisioned in the registered PDD. Therefore, while the project activity is implemented as per the PDD, only the first of out two phases can be stated to be operational.

None of the data and variable affects the additionality, scale or applicability of the project; hence no notification has been submitted to the EB.

The emission reductions achieved during the current monitoring period are lower and deviate significantly from the emission reductions as indicated in the registered PDD. The reason for this can be attributed to the fact that garbage dumping activity at the land fill site is not under the control of PP and solely rests with the Payatas Operations Group (POG). The POG during the monitored period occasionally has been requested the PP to partially disconnect some of the wells located in the two mound areas in order to facilitate dumping of fresh garbage. This resulted in reduction of biogas capture capacity of the project thus generating much lower emission reductions.

3.3 Compliance of the Monitoring Plan with the Monitoring Methodology

The monitoring plan is in accordance with the approved methodologies, ACM0001, Version 05 and AMS-I.D Version 10, applied by the proposed CDM project activity. No revision to the monitoring plan has been requested to the CDM Executive Board. A Request for Deviation (I-DEV0273, http://cdm.unfccc.int/Projects/deviations/13660) was raised by TUV SUD Industrie Services GmbH for two following reasons:

1. The T_{flare} probe has been installed inside the enclosed flare at a height of 1.8 meters above the burner which doesn't actually measure the "Temperature in the exhaust gas of the flare" (as defined in the "Tool to determine project emissions from flaring gases containing

methane").
This deviation from the Methodological Tool has been confirmed by the DOE during site audit on 23rd and 24th September 2009, and it can also be confirmed that the same issue has been addressed and resolved by the PP's by installing a second T_{flare} probe at the correct height of the flare on 9th November 2008; this probe, has been be placed at the same level of the oxygen and methane fraction probes, thus allowing compliance with the methodology. No amendment of the Methodology was required.

The actual location of the measurement point of the T_{flare} has no impact on the estimation of the Emission Reductions. In fact, the calculation tool doesn't include T_{flare} in its calculation formula. T_{flare} is only used as a reference value i.e.: under 500°C the flare efficiency is automatically considered equal to zero. The only parameters considered in the flare efficiency calculation are the "Volumetric fraction of O_2 in the exhaust gas of flare" and the "Concentration of methane in the exhaust gas of flare". In the case the flare had not worked properly and efficiently due to inadequate capacity or operation, the direct consequence would have been an amount of methane in the exhaust gas greater than zero. In the actual situation this is not the case, because the flare was correctly designed for a maximum flow of 2500 Nm^3/h and a minimum flow of 500 Nm^3/h and the concentration of methane in the exhaust gas can be greater than zero only for few minutes in the transitory conditions during shut down or start up. Furthermore, according to the operating manual of the flare, the Tflare (measured at the actual point, above the burner) should range between 850°C to 1250°C to ensure an optimal and proper operation of the flare. The T_{flare} data collected during this monitoring period falls within the manufacturer's specification, further demonstrating that the flare has been properly installed and operated. According to these considerations this deviation cannot have impact on the ER's estimation.

2. The $LFG_{TOTAL,y}$ parameter has been measured by PP's using two additional Annubar-type meters on lines A and B instead of a single turbine meter on the main line, as defined in the registered PDD. As confirmed by the DOE during site audit on 23rd and 24th September 2009, this deviation in the $LFG_{TOTAL,y}$ measurement approach has been applied by the project participants due to the breakdown of the main turbine meter. The redundancy of the measurement equipments which was in place has allowed the PP's to use the two Annubar meters to estimate the $LFG_{TOTAL,y}$ and to compare it with the sum of the flow data $LFG_{flare,y}$ and $LFG_{electricity,y}$. The results obtained confirm that this approach, due to the accuracy of the Annubar meters, allow to perform the required verification (i.e. $LFG_{TOTAL,y} = LFG_{flare,y} + LFG_{electricity,y}$) in a reliable way. A deviation is therefore necessary due to this breakdown event and it is confirmed that this is a project-specific situation. Thus, an amendment of the applied Methodology is not required.

   The deviation to measure the $LFG_{TOTAL,y}$ using the two Annubar-type meters instead of the turbine meter aswell has no impact on the estimation of the Emission Reductions. Two Annubar flowmeters have been installed in Line A and line B. These two lines combine ahead to form the "main line" which later divides into flare line and engine line; $LFG_{TOTAL,y}$ is measured considering the sum of Annubar instruments instead of the broken flow (turbine) meter. The instruments are correctly identified and calibrated periodically and the precision is higher than the turbine flow meter (Annubar error 0.075% - turbine meter error 0.25%). Even if SCADA system has not been registering the readings of the annubar flowmeter, anyway it has been verified on site through real time readings that the data are consistent. According to these considerations this deviation cannot have impact on the ER's estimation.

CDM EB has accepted the deviation vide its decision in EB 52 dated 08 to 12 February 2010.

3.4 Compliance of the Monitoring with the Monitoring Plan

The monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD. All parameters were monitored and determined as per the Monitoring Plan. The verification of the parameters required by the monitoring plan is provided as follows:

Data / Parameter:	$LFG_{TOTAL,y}$
Data unit:	m^3
Description:	Total amount of landfill gas captured
Source of data used:	Until 26 March 2009 the SCADA system was adjusted to automatically calculate $LFG_{TOTAL,y}$ based on $LFG_{flare,y}$ (FT04) and $LFG_{electricity,y}$ (FT05). Calibration details of these two flow meters are reported in the related sections which follow below. From 27 March 2009 onwards annubar flow meter FT03_a EMERSON - ROSEMOUNT 485 – 0075923 / 3051S1CD1A2E12A1AB4D2E1L4Q4 -8696153 was used. The data from annubar meter was acquired by the SCADA system and the calibration of the annubar meter has been done on 28/2/2009 by the Manufacturer (EMERSON - ROSEMOUNT). As part of the QA/ QC procedures the monitoring methodology requires regular maintenance and testing regime to be followed to ensure accuracy. The manufacturers specifications defines the calibration frequency to be ten years while the Pangea Green Energy is doing it once in two years. The manufacturers' recommendation was verified from the product data sheet (IRL 31) and the frequency of once in two years can be accepted. The calibration followed European Standard DIN EN 10204, as accredited by the Physikalisch Technische Bundesanstalt (PTB), according to the" Rules for testing volume and gas meters at atmoshperic pressure".
Means of verification/Comments:	A Request for Deviation was submitted by the project participant as it was not possible to compare the $LFG_{TOTAL,y}$ against the sum of $LFG_{flare,y}$ and $LFG_{electricity,y}$ due to the malfunctioning of the turbine flowmeter FT03 monitoring $LFG_{TOTAL,y}$, until 26 March 2009. Instead the auditor on-site compared real-time readings of the more precise annubar flowmeters (Annubar error 0.075% - turbine meter error 0.25%) located on line A and line B which merge to form the main line against those of the flow meters measuring $LFG_{flare,y}$ and $LFG_{electricity,y}$ and thus was able to verify the reliability of $LFG_{flare,y}$ and $LFG_{electricity,y}$ values. The Request for Deviation which explains this situation was approved by the EB in EB 52 meeting. From 26 March 2009 onwards $LFG_{TOTAL,y}$ was monitored directly using annubar flow meter FT03_a and the values were verified from SCADA.
Cross-check	For the deviation period $LFG_{TOTAL,y}$ was acquired as a sum of $LFG_{flare,y}$ and $LFG_{electricity,y}$ and the same was cross- checked against real-time readings of the annubar flowmeters located on lines A and B. For the rest of the period the values were crosschecked against the sum of $LFG_{flare,y}$ and $LFG_{electricity,y}$.

Data / Parameter:	$LFG_{flare,y}$ and $FV_{RG,h}$
Data unit:	m^3
Description:	Amount of landfill gas flared and Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*

Source of data used:	OMRON Programmable Logic Controller extracts the monitored data on $LFG_{flare,y}$ and $FV_{RG,h}$ from the sensor. The data is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor used for the period 01/09/2008 to 26/03/2009 is Turbine flowmeter (FT04) TRZ-03 - 34808 which was last calibrated on 29/05/2008 by the Manufacturer. As part of the QA/ QC procedures the monitoring methodology requires regular maintenance and testing regime to be followed to ensure accuracy. The manufacturers specifications defines the calibration frequency to be twelve years while the Pangea Green Energy is doing it once in seven years. The manufacturers' recommendation was verified from the product data sheet (IRL 31) and the frequency of once in seven years can be accepted. The calibration has been done by the laboratory of the Manufacturer (RMG Messtechnik GmbH) as accredited by the Physikalisch Technische Bundesanstalt (PTB), according to the "Rules for testing volume and gas meters at atmoshperic pressure". The sensor used for the period 27/03/2009 to 30/06/2009 is FT04_a EMERSON -ROSEMOUNT/ 3051S1CD1A2E12A1AB4D2E1L4Q4 - 8696152 annubar flowmeter 485 - 0075924 which was last calibrated on 28/2/2009 by the Manufacturer. As part of the QA/ QC procedures the monitoring methodology requires regular maintenance and testing regime to be followed to ensure accuracy. The manufacturers specifications defines the calibration frequency to be ten years while the Pangea Green Energy is doing it once in two years. The manufacturers' recommendation was verified from the product data sheet (IRL 31) and the frequency of once in two years can be accepted. The calibration followed European Standard DIN EN 10204, as accredited by the Physikalisch Technische Bundesanstalt (PTB), according to the" Rules for testing volume and gas meters at atmoshperic pressure".
Means of verification/Comments:	The audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system. The existence of a chiller (IRL 9 and 15) confirmed that the flow rate (as well as methane content) was measured on dry basis after drying the biogas.
Cross-check	$LFG_{TOTAL,y}$ acquired as a sum of $LFG_{flare,y}$ and $LFG_{electricity,y}$ was cross-checked against real-time readings of the annubar flowmeters located on lines A and B and thus the reliability of $LFG_{flare,y}$ was verified until 26th March 2009. The Request for Deviation which explains the circumstance of this cross- check was approved by the EB in EB 52. From 27th March 2009 the FT04_a directly measures LFG_{flare}.

Data / Parameter:	$LFG_{electricity,y}$
Data unit:	m^3
Description:	Amount of landfill gas combusted in power plant
Source of data used:	OMRON Programmable Logic Controller extracts the data from the sensor. The data is is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor is Turbine flowmeter (FT05) TRZ-03 – 34809 located on the Engine Line which was last calibrated on 23/05/2007 by the Manufacturer. As part of the QA/ QC procedures the monitoring methodology requires regular maintenance and testing regime to be followed to ensure accuracy. The manufacturers specifications defines the calibration frequency to be twelve years whereas the Pangea Green Energy is doing it once in seven years. The manufacturers' recommendation was verified from the product data sheet

	(IRL 31) and the frequency of once in seven years can be accepted. The calibration has been done by the laboratory of the Manufacturer (RMG Messtechnik GmbH) as accredited by the Physikalisch Technische Bundesanstalt (PTB), according to the "Rules fo testing volume and gas meters at atmoshperic pressure". The sensor used for the period 11/06/2009 to 30/06/2009 is FT05_a EMERSON -ROSEMOUNT/ 3051S1CD1A2E12A1AB4D2E1L4Q4 - 8696154 annubar flowmeter 485 - 0075925 which was last calibrated on 29/4/2009 by the Manufacturer. As part of the QA/ QC procedures the monitoring methodology requires regular maintenance and testing regime to be followed to ensure accuracy. The manufacturers specifications defines the calibration frequency to be ten years while the Pangea Green Energy is doing it once in two years. The manufacturers' recommendation was verified from the product data sheet (IRL 31) and the frequency of once in two years can be accepted. The calibration followed European Standard DIN EN 10204, as accredited by the Physikalisch Technische Bundesanstalt (PTB), according to the" Rules for testing volume and gas meters at atmoshperic pressure".
Means of verification/Comments:	The audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system.
Cross-check	$LFG_{TOTAL,y}$ acquired as a sum of $LFG_{flare,y}$ and $LFG_{electricity,y}$ was cross-checked against real-time readings of the annubar flowmeters located on lines A and B and thus the reliability of $LFG_{flare,y}$ was verified until 26th March 2009. The Request for Deviation which explains the circumstance of this cross- check was approved by the EB in EB 52. From 11th June 2009 FT05_a directly measures $LFG_{electricity,y}$.

Data / Parameter:	T
Data unit:	° C
Description:	Temperature of the landfill gas
Source of data used:	OMRON Programmable Logic Controller extracts the data from the sensor. The data is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor (TT02) is a thermocouple (ELSI Srl Probe Model: G1.U10-P20-B0150-S00, Transmitter Model: Y1-SEM203P, s/n 08-07/290) located on the main line which was last calibrated on 12/09/2007 with next calibration due 2 years from this date. The manufacturers specifications defines the calibration frequency to be once in two years while the Pangea Green Energy complies with the same. The manufacturers' recommendation was verified from the product data sheet (IRL 31). The thermocouple has been calibrated by the laboratory Elsi Srl as accredited by the Italian SIT (Servizio di Taratura in Italia) following national standards for the calibration range and procedure.
Means of verification/Comments:	The audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system.
Cross-check	-

Data / Parameter:	T_{flare}

Data unit:	° C
Description:	Temperature in the exhaust gas of the flare
Source of data used:	OMRON Programmable Logic Controller extracts the data from the sensor. The data is is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor (TT05) is a thermocouple (ELSI Srl Probe Model: M1.U07- S00-M00400.1-S20, Transmitter Model: Y1-SEM210/S, s/n 10-07/748) located in the Closed FLARE (at 85% height of flare inside), which was last calibrated on 10/08/2009 (earlier calibrations having done on 20/08/2008 and 15/12/2007) with next calibration due 1 year from this date. The PDD and the manufacturers specifications defines the calibration frequency to be annual while the Pangea Green Energy complies with the same. The manufacturers' recommendation was verified from the product data sheet (IRL 31). The thermocouple has been calibrated by the laboratory Premier Phisic metrologie and Elsi Srl as accredited by the Italian SIT ("Servizio di Taratura in Italia") following national standards for the calibration range and procedure.
Means of verification/Comments:	A Request for Deviation was requested for the period 1st September 2008 to 8th November 2008 since T_{flare} probe was installed 1.80 meters above the burner which doesn't actually measure the "Temperature in the exhaust gas of the flare". However T_{flare} data collected during this part of the monitoring period fell within the manufacturer's specification, demonstrating that the flare had been properly installed and operated. The Request for Deviation was approved by the EB in EB 52. For the rest of the period the audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system. The tool to determine project emissions from flaring methane mentions that "in case of enclosed flares and continuous monitoring of the flare efficiency, the flare efficiency in the hour h is 0% if the temperature of the exhaust gas of the flare (T_{flare}) is below 500°C during more than 20 minutes during the hour h. This has been verified from the PLC SCADA software where the following control was programmed: On PLC checks the T_{flare} every one minute and if the value is 500c° for more than 20 min the T_{flare} of that hour is automatically set =0.
Cross-check	-

Data / Parameter:	P
Data unit:	mbar (although the monitoring plan metions Pa this minor deviation can be accepted since both the units differ by a factor of 100 and the factor has been accounted for in the ER calculations)
Description:	Pressure of the landfill gas

Source of data used:	OMRON Programmable Logic Controller extracts the data from the sensor. The data is is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor (PT04) is a Pressure meter (s/n: 6407024078, Model: ABB / 264HS) located on the main line which was last calibrated on 10/08/2009 (earlier calibration was done on 25/09/2007) with next calibration due 2 years from this date. The manufacturers specifications defines the calibration frequency to be once in five years while the Pangea Green Energy is doing it once in two years and the same can be accepted. The manufacturers' recommendation was verified from the product data sheet (IRL 31). The pressure meter has been calibrated by the Premier Phisic metrologie and Laboratory ABB Sace SpA as accredited by the Italian SIT ("Servizio di Taratura in Italia") following national standards for the calibration range and procedure.
Means of verification/Comments:	The audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system.
Cross-check	-

Data / Parameter:	EL_{IMP}
Data unit:	MWh
Description:	Total amount of electricity imported to meet project requirements
Source of data used:	OMRON Programmable Logic Controller extracts the data from the sensor. The data is is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor (EM01) is a Polyphase meter (s/n: 206584765, Model: Genius / EDMI N680) located on the main electrical panel which was last calibrated on 10/3/2009 (previous calibration was done on 14/03/2007) with next calibration due 2 years from this date. The manufacturers specifications defines the calibration frequency to be once in five years while the Pangea Green Energy is doing it once in two years and the same can be accepted. The manufacturers' recommendation was verified from the product data sheet (IRL 31).The meter has been calibrated by the ERC Meter Division, part of the Republic of the Philippines – Energy Regulatory Commission, according to national standards for calibration.
Means of verification/Comments:	The audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system.
Cross-check	-

Data / Parameter:	$fv_{i,h}$
Data unit:	-
Description:	Volumetric fraction of component *i* in the residual gas in the hour *h* where *i* = CH_4, CO, CO_2, O_2, H_2, N_2

Source of data used:	As a simplified approach, only methane content of the residual gas was measured and the difference to 100% was considered as being N_2 as permitted by the "Tool to determine project emissions from flaring gases containing methane" (EB 28, Annex 13). OMRON Programmable Logic Controller extracts the data from the sensor. The data is is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor (GA01) is a Biogas Analyzer (s/n: N1-V7-0538, Model: Siemens / ULTRAMAT 23 7MB2335-2DR10-6AA1) which was last calibrated on 19/03/2009 (earlier calibration was done on 13/03/2008) with next calibration due a year from this date. During the "normal period" (19/03/2009 to 30/06/2009) when the instruments are properly calibrated, actual error (0.111%) after calibration was used in ER calculation. The data for delayed calibration period (01/09/2008 to 18/03/2009) was adjusted by applying a conservative error of 4.783% obtained in the delayed calibration (and not 1% maximum permissible error indicated by the manufacturer). This error is also beyond the maximum permissible error of the measuring equipment and thus the PP's follow para 4(b) Annex 60 of EB52. A zero check and a typical value check have been performed by comparison with a standard certified gas. As part of the QA/ QC procedures the monitoring methodology requires analyser to be periodically calibrated according to manufacturers recommendation. The manufacturers specifications defines the calibration frequency to be annual and the Pangea Green Energy complies with the same. The manufacturers' recommendation was verified from the calibration protocol (IRL 30) of gas analyzer. As manufacturer, Siemens Production Automatisation S.A.S. have performed the calibration of the equipment according to internal calibration instructions. Siemens Production Automatisation S.A.S. is a qualified company to do calibrations according quality standards and procedures. The latest calibration was done by Pangea Air Liquide a qualified company to do calibrations according to quality standards and procedures.
Means of verification/Comments:	The audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system. The existence of a chiller (IRL 9 and 15) confirmed that the methane content was measured on dry basis after drying the gas.
Cross-check	-

Data / Parameter:	$t_{O2,h}$ and $fv_{CH4,FG,h}$
Data unit:	O_2 %, CH_4 %
Description:	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h and Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour *h.* It is noted that in the registered PDD, there was a textual error in the parameter description for $fv_{CH4,FG,h}$ however, the parameter was correctly measured and applied in all the calculation sheets.

Source of data used:	OMRON Programmable Logic Controller extracts the data from the sensor. The data is is automatically archived by the SCADA system every hour into daily reports and every day into monthly reports. The sensor (GA02) is a Biogas Analyzer (Serial Number: N1-V0-0038, Model: Siemens / ULTRAMAT 23 7MB2335-2DH10-6AA1) which was last calibrated on 19/03/2009 (earlier calibration was done on 13/03/2008) with next calibration due a year from this date. During the "normal period" (19/03/2009 to 30/06/2009) when the instruments are properly calibrated, actual error (0.0%) after calibration was used in ER calculation. The data for delayed calibration period (01/09/2008 to 18/03/2009) was adjusted by applying a conservative error of 1.923% obtained in the delayed calibration (and not 1% maximum permissible error indicated by the manufacturer). This error is also beyond the maximum permissible error of the measuring equipment and thus the PP's follow para 4(b) Annex 60 of EB52. A zero check and a typical value check have been performed by comparison with a standard certified gas. As part of the QA/ QC procedures the monitoring methodology requires analyser to be periodically calibrated according to manufacturers recommendation. The manufacturers specifications defines the calibration frequency to be annual and the Pangea Green Energy complies with the same. The manufacturers' recommendation was verified from the calibration protocol of gas analyzer. As manufacturer, Siemens Production Automatisation S.A.S. have performed the calibration of the equipment according to internal calibration instructions. Siemens Production Automatisation S.A.S. is a qualified company to do calibrations according quality standards and procedures. The latest calibration was done by Pangea Air Liquide a qualified company to do calibrations according to quality standards and procedures.
Means of verification/Comments:	The audit team verified that the values used in the calculation tool (excel file) and reported in the Monitoring Report matched the raw data by comparing the values directly with the data embedded in the SCADA system.
Cross-check	-

It can be noted that the parameters $EL_{EX,LFG}$ and H (operation of the energy plant) don´t have to be monitored yet as the same are only applicable to phase 2 of the project.
It could also be noted here that national standard/ norms for recalibration of flow-meters, electricity meters and analyzers do not exist in the Host Country. The same was verified by the audit team based on country expertise.

3.5 Assessment of Data and Calculation of Greenhouse Gas Emission Reductions

All data has been available and all the parameters have been monitored in accordance with the registered monitoring plan except for the parameters $LFG_{TOTAL,y}$ and $T_{flare,y}$. However the deviations were investigated by the DOE and found to have no impact on the emission reductions reported. A Request for Deviation as described in section 3.3, was submitted to the CDM Executive Board and approved.

The reported data have been cross-checked against other sources where available as explained above in chapter 3.4.

The verifier confirms that the methods and formulae used to obtain the baseline and project emissions are appropriate. The same has been done in accordance with the methods and formulae described in the registered monitoring plan and applicable methodology.

The verifier confirms that the monitoring report includes all parameters and the monitored data at the intervals required by the methodologies and PDD.

The verifier confirms that all the emission factors and default values have been correctly justified. All the emission factors and default values are explicitly mentioned in the monitoring report.

4 SUMMARY OF FINDINGS

The verifier can confirm that the published MR and related documents are complete and verifiable in accordance with the CDM requirements. All the findings raised by the verification team, the responses by the PPs and the conclusion from the team are presented in Annex 1. The means of verification and resulting changes in the MR or related documents are identified in the following table:

CAR 1: The geographical coordinates (to be in decimal format with +/- sign, and NOT with a N/E/S/W specifier) of the project activity should be included in MR. Also indicate exact date of version on the cover page of MR.
CAR 1, means of verification
The geographical coordinates (in decimal format with +/- sign, and NOT with a N/E/S/W specifier) of the project activity have been cross checked from the google maps imagery and the tool at http://www.cache-test-dummies.de/tools/koordinatenumrechnung/.
CAR 1, changes in the MR or related documents
The MR has been revised to include the geographical coordinates (degree:minutes:seconds) of the project activity. Also the exact date of version has been indicated on the cover page of MR.

CAR 2: a) Please explain in MR the variation in number of wells from registered PDD (49 wells), first MR (48 wells) and second MR (64 wells). Also clarify in MR how there will be no impact on either quality or quantity of biogas due to this variation as compared to PDD. b) Confirm in the MR whether the generator installed as part of the project is capable of firing fossil fuels. c) Include in MR make/ manufacturer, type, capacity/specifications of the project equipment e.g. wells, flare / engine, blowers etc. Information is preferred in a tabular form. d) Add in MR actual dates of implementation, date of completion of wells and substations during second monitored period. It should be described in MR what phase 2 consists of as per PDD. Also please explicitly inform about the implementation status of the project DURING THE MONITORING PERIOD UNDER CONSIDERATION. e) Indicate actual date of revision on the MR. f) Referring to drawing included under section B.1 of MR: i) It should be clarified why this on-site power generator does not refer to the phase 1 (200 kW) generator, but the picture below; the power generation unit (exporting electricity) is not in operation in phase 1 but only in phase 2; Please clarify; ii) Table B.1.2. just mentions one "flow meter in the engine pipeline"; why here 2 flow meters (one to on site power generator; another one to power generation unit) are indicated? Please clarify;
CAR 2, means of verification
a) Variation in number of wells has been confirmed from layout of land fill. Impact on biogas generation due to disconnection of wells was confirmed by interviewing the POG personnel. b) The generator installed as part of the project is not capable of firing fossil fuels; this has been confirmed from the manufacturer's technical document. c) All the requested information has been verified from the name plates and manufacturer's technical documents. d) Details of well and substation timelines were verified from from layout of land fill.

Implementation status including that of Phase-2 was cross checked on site. e) Verified from the date of submission of MR to DOE. f) The details of drawing included under section B.1 of MR was cross checked with actual equipment/instrument onsite.
CAR 2, changes in the MR or related documents
MR has been revised to incorporate all the changes requested above by the DOE.

CAR 3: Please explain the reasons behind missing data on certain days i.e for $LFG_{total,y}$ in December 2008 and for $LFG_{electricity,y}$ June 2009. The justification needs to be stated in the MR. Please mention reference to AMS-I. D, version 10 in section A.5 of the MR.
CAR 3, means of verification
Verified from SCADA, Daily plant report and List of outages and shutdowns maintained at the site.
CAR 3, changes in the MR or related documents
The justification from missing data has been stated in the MR.

CAR 4: Correct the following (refer to table B.2.2 of MR) in MR to be in line with the methodology, tool and PDD: 1. Parameters for LFG_{total} , LFG_{flare} and $LFG_{electricity}$ 2. Description of LFG_{total} 3. Unit of measure of LFG_{total} , LFG_{flare}, $LFG_{electricity}$, $f_{vCH4,h}$
CAR 4, means of verification
The parameters their description and units were verified from the methodology and the tool.
CAR 4, changes in the MR or related documents
The parameters their description and units as pointed out by the DOE have been corrected in the MR.

CAR 5: During site audit the audit team was informed by the PP that the FT03_a, FT04_a & FT05_a annubar flow meters, have been installed respectively on 27th March 2009, 27th March 2009, and 10th June 2009 with the same function of original FT03, FT04 & FT05 turbine flow meters to permit the maintenance operations and realize a more reliable flow measuring system. Please explain the difference in the type of flow meters used. Also indicate in the MR whether the change would impact CER calculations.
CAR 5, means of verification
Product data sheets of annubar flow meters and turbine flow meters have been verified to understand their respective working principles. The accuracy was also verified from the product sheet and the same was also crosschecked from the calibration certificates.
CAR 5, changes in the MR or related documents
The MR has been revised to include information on types of flowmeters used and the impact of their use on CER calculations.

CAR 6: Information (refer to table B.2.2 of MR) on measurement procedures, monitoring frequencies and QA/QC procedures for all the parameters need to be included in MR. Also check the dates of last calibration of TT02, PT04, TT03, FT01 and FT02 and confirm whether these equipment are calibrated at a frequency of 2 years as required. TT05 calibration frequency of 1 year also needs confirmation. Finally revise the drawing included in the Annex I of MR to represent the contemporary status.
CAR 6, means of verification
The calibration requirements specified by the manufacturer as part of the product data sheets have been verified on site. Compliance with the same was cross checked from the calibration certificates that were submitted to the audit team.

CAR 6, changes in the MR or related documents
The MR was revised to include all the required information as per latest guidance from EB.

CAR 7: The following corrective actions are requested: 1. Identify location of TT03 "flare bottom" TT05 "flare top" MR, Table B.1.2. 2. Please confirm in Monitoring Report whether TT04 or TT05 is used for monitoring T_{flare} (see page 5 and also table B.1.2 of MR).
CAR 7, means of verification
Technical draw of the flare BTG2500HT-T150 and ANNEX I: monitoring equipment location was compared with actual situation on site.
CAR 7, changes in the MR or related documents
The MR was revised to include all the information in a clear manner.

CAR 8: The previous calibration should be indicated as well in MR (table B.1.2) once the monitoring instrument is in operation since the beginning of the monitoring period, for the following instruments: GA01, PT04, TT05, GA02, EM01, FT01 and FT02. Furthermore to which "monitoring plan" is the text below the table referring to?
CAR 8, means of verification
The previous calibrations of all the instruments affetcing the monitoring period are verified from the respective calibration certificates. The "monitoring plan" referred to the "MR_annex2_Monitoring plan Payatas_Version 08", the latter has been verified.
CAR 8, changes in the MR or related documents
The previous calibrations are clearly indicated in MR (table B.1.2) wherever essential. The "monitoring plan" is clarified to be referring to the "MR_annex2_Monitoring plan Payatas_Version 08", a supplement to the MR.

CR 1: Please submit report copy of the Environmental Impact Assessment conducted for land fill gas project during the monitored period.
CR 1, means of verification
Letter from Environmental Management Bureau was verified to confirm the fact that since a Certificate of Non-Coverage was already issued, an Environmental Impact Assessment relevant for the monitored period is not required as a mandate for the project activity.
CR 1, changes in the MR or related documents
No changes were required in MR or related documents.

CR 2: "Biogas plant operation, maintenance and control activities" PGBIO001 Rev. 1, submitted to audit team is stated to be issued on "30/11/09", how is the same possible? Please clarify. Also provide information on person's, roles and responsibilities of the plant relevant for the monitored period. Are Gonzales, Sumalo, Cruz and Edgar mentioned in the Training Registration form checked on-site for the training conducted on 18/03/2008, part of the project team monitored period? Clarify.
CR 2, means of verification
Typographic error was checked by the audit team. Information on person's, roles and responsibilities was verified from the onsite interviews and organization chart.
CR 2, changes in the MR or related documents
PGBIO001 document has been revised to include correct date of the document.

CR 3: The Training Registration form checked on-site was for the training conducted on 18/03/2008 and was not relevant for the monitored period. Therefore please clarify whether any training were conducted during the monitored period. In addition also provide up to date information on the following issues:

1. Training on general control panel, biogas analyzers, SW supervision, configuration, line parameters, data sheet, data recording, data storage, maintenance 2. Training on biogas analyzer setting, CH4 measuring, maintenance, calibration, etc 3. Training on safety and emergency procedures 4. Training on start-up and shut-down, general safety rules, mgt control and regulation procedures, plant maintenance, operation anomalies, etc. 5. Training on general controls, panel setting, engine switch on and shut-down
CR 3, means of verification
Training records for the monitored period and Internal audit report including documentation on trainings conducted during the commissioning and in the fist year of plant running were verified.
CR 3, changes in the MR or related documents
No changes were required in MR or related documents.

CR 4: Submit daily plant report that was implemented to record daily events log and peculiar events during MP. This will aid in analysis of root cause of inconsistencies if any, in the registered data.
CR 4, means of verification
Verified from SCADA, Daily plant report and List of outages and shutdowns maintained at the site.
CR 4, changes in the MR or related documents
No changes were required in MR or related documents.

5 VERIFICATION STATEMENT

TÜV SÜD Industrie Service GmbH has performed the second periodic verification of the CDM project: "Quezon City Controlled Disposal Facility Biogas Emission Reduction Project". The verification is based on the currently valid documentation of the UN Framework Convention on Climate Change (UNFCCC).
The management of Pangea Green Energy S.r.l. is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions on the basis set out within the project's Monitoring Plan indicated in the registered PDD version 11, dated 30-11-2007 and the applied methodologies ACM0001 Version 05 and AMS-I.D Version 10. A Request for Deviation (I-DEV0273) was submitted by TUV SUD regarding monitoring of T_{flare} and $LFG_{TOTAL,y}$ on 27/11/2009 as given and was approved in EB 52.

The verifier can confirm that:

- the development and maintenance of records and reporting procedures are in accordance with the registered monitoring plan;
- the phase I of the project is in progress while phase II which is to install a bigger biogas electrical engine for the conversion of a portion of the methane to electricity that will be delivered to the local grid is planned for the 3rd year;
- the installed equipment being essential for generating emission reduction runs reliably;
- the measuring instruments except those of methane content analyzer and flare exhaust gas analyzer are calibrated appropriately. The data of both these instruments where calibration was delayed by six days, was adjusted conservatively as per para 4(b), Annex 60 of EB 52.
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements;
- the monitoring plan in Monitoring Report except for monitoring of T_{flare} and $LFG_{TOTAL,y}$ (please refer to I-DEV0273) is as per the PDD and monitoring plan approved by the EB;
- the monitoring plan in the monitoring report (Version 09 / 10-02-2011) is as per the PDD
- the monitoring plan in the approved PDD is as per the applied methodologies.

Our opinion is based on the project's GHG emissions and resulting GHG emission reductions reported, which have been both determined through the valid and registered project's baseline, its monitoring plan and its associated documents.
Based on the information we have seen and evaluated, we confirm the following statement:

Reporting period: From 01-09-2008 to 30-06-2009

Verified emissions in the above reporting period:

Baseline emissions:	75 390	t CO_{2e}
Project emissions:	14	t CO_{2e}
Leakage emission:	0	t CO_{2e}
Emission reductions:	75 376	t CO_{2e}

Munich, 28-02-2011

Certification Body "climate and energy"
TÜV SÜD Industrie Service GmbH

Pune, 28-02-2011

Assessment Team Leader

Annex 1: Verification Protocol

Verification Protocol

Project Title: Quezon City Controlled Disposal Facility Biogas Emission Reduction Project
Date of Completion: 28 February 2011
Number of Pages: 59

Industrie Service

Table of Contents

Industrie Service

1. Project Activity Implementation

1.1. Technology

PDD	Verified Situation	Conclusion
Location(s)		
Description / Address:	Area 2, Barangay Payatas, Quezon City. It's confirmed that this is the address as indicated in PDD.	☑
GSP coordinates:	**Corrective Action Request No.1.** The geographical coordinates (to be in decimal format with +/- sign, and NOT with a N/E/S/W specifier) of the project activity should be included in MR. Also indicate exact date of version on the cover page of MR.	**CAR1**
Technical Equipment – Main Components		
Component 1: *Description* The project will be implemented in two phases. During phase 1, the combustion plant will be composed of a biogas extraction system (wells and blower), a high-temperature torch for flaring the methane extracted and an electrical engine for on-site power supply. The electrical engine will be fed by biogas during plant operation (about 7,500 hours/year). An electrical connection to the local grid will be provided in order to supply electricity requirement of the plant during engine maintenance and start-up operations. Phase 2 will begin on the	*Biogas extraction system:* - 64 wells (vertical wells drilled in the body of the waste) - HDPE pipe connecting well to substation (90 mm dia) - Main HDPE main (160 mm dia) - Substation - blowers - high-temperature torch - electrical engine - Portable equipment to extract leachate; Leachate is transferred in drums - Leachate drums to leachate pumping station already present to leachate treatment system (leachate is not managed by Pangea) - Condensate trap inside the plant; Part of condensate goes back to the well **Corrective Action Request No.2.**	**CAR2**

PDD	Verified Situation	Conclusion
third year, depending on the actual availability of biogas and the financial and technical viability of the project, Pangea will install a bigger biogas electrical engine (about 700 kW) for the conversion of a portion of the methane to electricity that will be delivered to the local grid. The LFG collection system designed in the frame of our project will be composed by 49 wells (drilled in the body of the waste) connected by HDPE pipes (DN 200) to three substations. From these three substations will start three main manifolds transporting LFG to the burning and power plant (the layout is reported in Figure 1).	a) Please explain in MR the variation in number of wells from registered PDD (49 wells), first MR (48 wells) and second MR (64 wells). Also clarify in MR how there will be no impact on either quality or quantity of biogas due to this variation as compared to PDD. b) Confirm in the MR whether the generator installed as part of the project is capable of firing fossil fuels. c) Include in MR make/ manufacturer, type, capacity/specifications of the project equipment e.g. wells, flare / engine, blowers etc. Information is preferred in a tabular form. d) Add in MR actual dates of implementation, date of completion of wells and substations during second monitored period. It should be described in MR what phase 2 consists of as per PDD. Also please explicitly inform about the implementation status of the project DURING THE MONITORING PERIOD UNDER CONSIDERATION. e) Indicate actual date of revision on the MR. f) Referring to drawing included under section B.1 of MR: i) It should be clarified why this on-site power generator does not refer to the phase 1 (200 kW) generator, but the picture below; the power generation unit (exporting electricity) is not in operation in phase 1 but only in phase 2; Please clarify; Table B.1.2. just mentions one "flow meter in the engine pipeline"; why here 2 flow meters (one to on site power generator; another one to power generation unit) are indicated? Please clarify;	
Component 2: *Description* According to the PDD, biogas aspiration and conditioning system consists of blowers and purification and dehumidification equipment to transport and clean gas of impurities that can	*Condensate separator (located on the main line)* The equipment (dehumidification and purification) is properly installed on-site. AISI 304 in-oxidizable steel made, 315 mm dia and it is provided with the float required for the condensate gravity draining	☑

PDD	Verified Situation	Conclusion
damage the system		
Component 3: *Description* According to the PDD, the combustion plant will be composed of a biogas extraction system (wells and blower).	*Biogas blower (Type 051A.03) and electrical engine to start blower* The blower is properly installed and related electrical engine connected. Details obtained from 'Biogas extraction & combustion plant for 2500 nm3/hr with electricity generation technical documentation, BTG027/07-C Nov '07' Manufacturer: Continental Industrie Continental, type: 051A.03 Flow: 2500 Nm3/h Discharge pressure: 80 mbar Discharge temp: 56.4 degrees C Electric engine supplied also by Continental Industrie, 37kW Commissioning date March 2008	☑
Component 4: *Description* According to the PDD: • feeding pressure : 50 mbar • min CH4 percentage : 30% • min calorific capacity : 2.500 kW • flow rate : 500 – 2.500 Nm3/h • combustion temperature : >850 °C, retention time > 0,3 sec • critical temperature : 1.260 °C • combustion coefficient	*High temperature enclosed gas flare* The same flare as described in PDD has been found on-site. Details obtained from 'Biogas extraction and combustion plant for 2500 nm^3/hr with electricity generation technical documentation, BTG027/07-C Nov '07' Technology provider: Biotecnogas, Type (BTG2500 HT) Capacity 500 - 2500 Nm^3/h, External diam: 2,200 mm, Height 9.50 mm, Thickness 150 mm, Material: stainless steel AISI 304; Feeding pressure: 50 mbar	☑

PDD	Verified Situation	Conclusion
(CO2/CO+CO2) : min. 99% • temperature control : continuous, by a thermocouple Pt-Rh-Pt with output signal 4÷20 mA	Min CH4 %: 30% Ratio CH4/CO2>1 Combustion chamber: refractory made of ceramic fiber modules, thickness 150 mm Combustion temperature: > 850 degrees Celcius, retention time >= 0.3 sec Critical temperature: 1,260 degrees Celcius Combustion coeff (CO2/ CO + CO2): min 99% Exhaust oxygen measure: continuous Exhaust methane measure: continuous Temperature control: continuous thermocouple Pt-Rh-Pt with output signal 2/20 mA Commissioning date March 2008 Flare drawing was viewed on-site and the dimensions verified.	
Component 5: *Description* According to the PDD, energy production plant is composed of electricity generating equipment utilizing methane from biogas as fuel to produce electricity	*Electricity Generator/ Engine* Comprises: - Heat exchanger to cool biogas from 65 degrees Celcius to 3 degrees Celcius for biogas flow of 150 Nm3/h – AISI 304 pipes and carbon steel skirt refrigerator liquid (water and glycol 20% solution) - Refrigerator group - Condensate separator – AISI 304 in-oxidizable steel made, 315 mm dia and it is provided with the float required for the condensate gravity draining - Electricity generator Manufacturer Iveco-ATME, capacity 250 kVA, power capacity 200 kW (power factor 0.8). Commissioning date March 2008	☑
Component 6:	*Booster before generator*	☑

PDD	Verified Situation	Conclusion
Description No applicable information in PDD	Technology provider: Biotecnogas, Nominal flow rate: 150 Nm3/h ca; Pressure in: 50 mbar; Pressure out: 150 mbar Power: 3.6 kW ca Electric supply: 400 V/60 Hz Commissioning date March 2008	
Operation Status during verification		
Approvals / Licenses	The following mandatory operational permits for 2009 were submitted to the audit team: Fire Permit Mechanical Permit Permit to Operate **Clarification Request No. 1.** Please submit report copy of the Environmental Impact Assessment conducted for land fill gas project during the monitored period.	**CR1**
Actual Operation Status	Under construction ☐ In operation ☒ Out of operation ☐ Reason (when out of operation):	☑
Remarks to Special Operational Status During the Verification Period	Phase I of the landfill is in progress i.e. landfill gas is being flared and electricity generated using 200 kW generator for on-site consumption. Part of the electricity is also supplied to the requirements of locally settled people outside the project boundary. More wells are being drilled to tap into newly closed areas of the dumpsite.	☑

1.2. Organization

PDD	Verified Situation	Conclusion
Project Participant(s)		
Entity / Responsible person: 1. Pangea Green Energy S.r.l 2. Pangea Green Energy Philippines, Incorporated 3. Quezon City Government	PPs are the same as described per the PDD- Project developer: Pangea Green Energy Philippines Inc. (Pangea Phils.) and Pangea Green Energy S.r.l Responsible person: Mr. Danilo Cruz and Mr. Ivano Conte Responsible person on site: Mr. Danilo Cruz and Mr. Ivano Conte	☑
CDM Project management:	Project developer: Pangea Green Energy Philippines Inc. (Pangea Phils.) and Pangea Green Energy S.r.l Responsible person: Mr. Danilo Cruz and Mr. Ivano Conte Responsible person on site: Mr. Danilo Cruz and Mr. Ivano Conte	☑

1.3. Quality Management System

PDD	Verified Situation	Conclusion
Quality Management Manual:	A quality management system has been implemented during the monitored period with the following procedures: 1. POTR001 'Human Resources' which gives the roles and responsibilities for managing the quality and environment management system as well as the procedure for identifying training needs 2. PGSYS003 'Nonconformity, preventive and corrective actions management' to deal with nonconformities in the quality management system and take corrective/preventive actions 3. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'. The	☑

	Machine Book was also seen on-site which gives the maintenance requirement for each component of the biogas plant i.e. flare, engine, blower and chiller heat exchange including frequency and the records of maintenance performed and the Machine book is periodically reviewed by the Plant Head, Mr. Danilo Cruz 4. PGSYS001 'Documents STANDARD' which is the document control procedure 5. PGSYS002 'Internal Audit' to verify EMS and QMS conformance with expected performance. Internal Audit report dated 12/06/2009 was checked. It documents procedures referenced, non-conformance (NC) identified and Corrective Action (CA) proposed. Internal audit was conducted by Mr. Daniele Ferrero who is independent of people involved in the processes: Mr. Danilo Cruz. No non-conformities were raised during this audit. ~~6.~~ POEM001: 'Emergency Management' procedure. No emergencies were identified during the monitored period.	
Responsibilities:	Roles and responsibilities of the Plant Head, Technical Consultant, Security Personnel, Plant engineer and Plant Engineer Assistant have been documented in the following Quality Management System documents: "Biogas plant operation, maintenance and control activities" PGBIO001 Rev. 1, issued 30/11/08 "Emergency Management" POEM001, Rev. 0, issued 01/04/06 **Clarification Request No. 2.** "Biogas plant operation, maintenance and control activities" PGBIO001 Rev. 1, submitted to audit team is stated to be issued on "30/11/09", how is the same possible? Please clarify. Also provide information on person's, roles and responsibilities of the plant relevant for the monitored period. Are Gonzales, Sumalo, Cruz and Edgar mentioned in the Training Registration form checked on-site for the training conducted on 18/03/2008, part of the project team monitored period? Clarify.	**CR2**
Qualification and Training:	The responsible person on site is trained and qualified on the job by technicians of the company or by external parties. There is a procedure for training POTR001. The	**CR3**

	RSAQ (Danilo Cruz) identifies training needs and draws up an annual training plan. The personnel named below performing key operations at the Payatas landfill biogas capture and combustion plant have been trained: Mr. Danilo Cruz (Payatas Plant Operation Manager) Sumalo (Assistant Manasger) Cruz Arthur (Plant engineer) Edgar (Plant engineer assistant) **Clarification Request No. 3.** The Training Registration form checked on-site was for the training conducted on 18/03/2008 and was not relevant for the monitored period. Therefore please clarify whether any training were conducted during the monitored period. In addition also provide up to date information on the following issues: 1. Training on general control panel, biogas analyzers, SW supervision, configuration, line parameters, data sheet, data recording, data storage, maintenance 2. Training on biogas analyzer setting, CH4 measuring, maintenance, calibration, etc 3. Training on safety and emergency procedures 4. Training on start-up and shut-down, general safety rules, mgt control and regulation procedures, plant maintenance, operation anomalies, etc 5. Training on general controls, panel setting, engine switch on and shut-down	
Implementation of QM-system	The available documents (drawings, certificates, installation and operation manuals) were easily accessible. It was checked that the relevant procedures such as PGSYS003 and POTR001 have been implemented.	☑

1.4. Remaining FARs from previous Verifications (or forwarded issues of validation report)

Remaining Requests from Previous Verifications	Summary of project owner response	Audit team conclusion
Forward Action Request No.1. It is recommended that the roles and responsibilities of the Plant Head, Technical Consultant, Security Personnel, Plant engineer and Plant Engineer Assistant are documented in the relevant procedure in the context of the CDM project (e.g. responsibilities for monitoring equipment maintenance and calibration, data processing and internal review). If they are given different titles under the Quality Management System, the corresponding titles should be reflected in the monitoring plan. It is also recommended to develop organizational structure identifying the key personnel involved.	A role definition document was updated. A named organization chart was done	An organization chart (IRL24) has been submitted to the DOE. Therefore the issue remains closed. ☑
Forward Action Request No.2. It is recommended to explore the possibility to connect a back-up PC to the PLC. This way if there is a breakdown in one PC or a loss in connection to one PC, data can still be registered in the second PC.	The setting of office PC like a spare pc with configuration of SCADA has done on spare laptop available in the plant.	The PP has connected a back-up PC to the PLC before the beginning of the second monitored period. This helps in a case if there is a breakdown in one PC or a loss in connection to one PC, data can still be registered in the second PC. Therefore the issue remains closed. ☑
	An integration of SCADA report with a XLS file pro-	The same has been accomplished during the

Remaining Requests from Previous Verifications	Summary of project owner response	Audit team conclusion
Forward Action Request No.3. Please explore the possibility of configuring SCADA to also generate reports in read-only format such as PDF in addition to excel reports.	tected by password has done to achieve a better file protection.	monitored period. Therefore the issue remains closed. ☑
Forward Action Request No.4. Please incorporate conservativeness check of comparing calculated $LFG_{total,y}$ with measured $LFG_{total,y}$ in the calculation tool as $LFG_{total,y}$ will be measured in the future.	A column in the ER calculation files was created	The same has been accomplished during the monitored period. Therefore the issue remains closed. ☑
Forward Action Request No.5. It is recommended to implement a daily events log to record peculiar events in future. This will aid in analysis of root cause of inconsistencies if any, in the registered data.	A daily plant report including daily event log was implemented.	It was verified that the PP has implemented a daily events log (IRL26) to record peculiar events during the monitored period. Therefore the issue remains closed. ☑

2. Data Management System

2.1. Description

Structure of raw data archiving				
Describe all the different data collection systems				
Type	Name	Responsible	Procedures	Comments
Programmable Logic Computer (PLC)	OMRON	Plant Engineer (Mr. Sumalo)	No documented procedure as data is automatically archived by the SCADA system every hour into the daily reports and every day into the monthly reports.	The PLC has inbuilt supervising software which monitors and register all the data continuously gathered by the sensors installed along the plant's piping. Operating anomalies that will result in the block signal to the plant by the PLC comprises: 1. Pre-alarm system is activated at 7% O_2 and the system automatically shuts down when O_2 level reaches 10%. 2. The SCADA display panel is monitored by the Plant Engineer to detect anomalies. Alarms displayed on the panel include: 3. Flare temperature high: flare ignition system has failed to light the flame within the time set in the flare configuration window 4. High percentage oxygen in main line 5. Gas leak in analysis panel 6. Thermal switch alarm: concerns all blowers in the plant and indicates the thermal switch has tripped due to a motor break-

				down or voltage surge 7. Absence of 24 Vdc power: lack of current in the electric panel due to possible mal-function of the power supply 8. Monostat alarm: caused by a low pressure level in the compressed air system proba-bly due to leak somewhere along piping The data of biogas flowrate, temperature, pres-sure, methane concentration and flare tempera-ture are obtained from the sensors as per the Capture Time setting. The PLC compiles the data and provides a rolling hourly average value for each of the parameters and prints the hourly data into an excel sheet for each day of the month. The hourly readings are also auto-matically converted to daily readings and printed into separate excel sheets for every month. Information on the Capture Time setting (fre-quency of capturing data from the sensors) of the SCADA system has been verified. Information on the computer in Pangea's Italy office also has been submitted.

Key Reporting Risks:
The PLC can operate on battery in case the power fails. In the event that the PLC breaks down the entire plant will shut down as the PLC controls the entire plant; Sometimes the data may not get transferred from PLC to PC if the active report has been opened or if the Personal Computer (PC) is not connected; In case the PC at the Payatas Plant suffers a breakdown, there is no possibility to acquire data from the PLC until there is a replacement PC.

Risk Classification: Low

Further Remarks:
Nil

2.2. Raw Data Archiving and Protection measures

Name	Description of data archiving and protection measures	Risks and comments	Concl.
Personal Computer located in the Pangea Green Energy office in Payatas Plant (Dell Optiplex 745)	The daily and monthly excel reports are saved in a folder in the PC in the Payatas Plant Pangea office which is password protected. The password is known only to those handling the data such as the Chief Plant Engineer (Mr Danilo Cruz) and the Assistant Plant Engineer (Mr. Sumalo). The password is reset every 2 months. Further the screen-saver is set to 1 minute. The computer is connected to UPS so it can last for approximately 18 hours in the case of power outage. Periodically the responsible persons in the main offices in Italy connect the computer to the net and retrieve the SCADA raw data data for review using the UltraVNC software. The UltraVNC software guarantees a sufficiently high level of safety in the data transfer and it is protected by a password to avoid unintentional	The manual supplied by Biotecnogas BTG027-07-C-NOVDEMBER 2007 Supervision Software Manual was seen on-site. The A.B. Energy supervision system runs on SCADA software (already installed on the PC) which communicates through an RS232 serial interface with the PLC located in the power panel. The SCADA software has been developed in the WONDOWSTM XP environment to monitor and visualise the entire biogas capture and combustion plant. The system uses password to	☑

	use. In the Italy office, the daily and monthly excel reports are stored on a server and access to the server is also controlled by password. Risk of losing data is minimized because a copy of the raw data exists both in the Pangea office in the Payatas plant as well as in Italy.	access the various plant configurations and settings. As for the raw data collection the system has no redundancy.	
Key Reporting Risks: The PLC can operate on battery in case the power fails. In the event that the PLC breaks down the entire plant will shut down as the PLC controls the entire plant; Sometimes the data may not get transferred from PLC to PC if the active report has been opened or if the Personal Computer (PC) is not connected; In case the PC at the Payatas Plant suffers a breakdown, there is no possibility to acquire data from the PLC until there is a replacement PC. **Risk Classification:** Low **Further Remarks:** Nil			☑

2.3. Data transfer

Description of data transfer from raw data archiving to calculation tool			
Name	Description and responsibilities	Risks and comments	Concl.
Personal Computer In Pangea's Italy office	Periodically the responsible persons in the main offices in Italy connect the computer to the net and retrieve the SCADA raw data data for review using the UltraVNC software. A review is performed on the raw data files (i.e. the SCADA-generated daily and monthly reports) to check for proper registration of the data as per the procedure POTR001. The raw data files are copied onto the excel sheets named ER calculation sheet_2008-09 MONTH.xls which contain built-in formulae to process the data by the Quality	There is a low residual risk of human error in copying and pasting the raw data into the calculation tool. The calculation files are reviewed internally prior to generating the monitoring report. The roles and responsibilities for data processing and review for the purpose of generating monitoring report	☑

	& Environment Manager (Mr. Daniele Ferrero).	have been documented clearly (see FAR1).	
Key Reporting Risks: The UltraVNC software guarantees a sufficiently high level of safety in the data transfer and it is protected by a password to avoid unintentional use. The raw data that is saved on the server in Italy is copied manually onto the calculation tool and there is a low risk of error during this process. **Risk Classification:** Low Data is transferred through copy and paste function and there is no transcription of any data. Therefore, the reporting risk is low. **Further Remarks:** Nil.			☑

2.4. Data Processing

Description of data processing from transferred data to final results in the calculation tool			
Step	Description	Risks and comments	Concl.
Consistency	The following inconsistencies between the registered PDD, the methodology ACM0001 v. 5, "Tool to calculate project emissions from electricity consumption" (EB 28/ Annex 13) and the implemented monitoring plan were identified by DOE during first verification: 1. T_{flare} is supposed to be a measure of temperature in the exhaust gas of the enclosed flare as per the Tool & registered PDD however in practise the flare combustion temperature has been monitored with a probe located at	The DOE has submitted a Request for Deviation regarding the noted deviation from the monitoring plan in monitoring T_{flare} and $lfg_{total,y}$ to the UNFCCC Executive Board for further guidance on 05/11/2008 (see IRL7 and 8). Subsequently after EB accepted the deviation (see IRL9) the PP installed the instruments for T_{flare} and $LFG_{TOTAL,y}$ respectively	☑

	the bottom of the stack. 2. $LFG_{TOTAL,y}$ should be monitored as per ACM001 v. 5 and the registered PDD however the turbine flowmeter measuring this parameter suffered a breakdown. The breakdown was due to mechanical wear and tear and corrosion caused by a combination of high exit temperatures at the blower and the location of the meter on the horizontal length of the main line resulting in prolonged exposure to condensate. The SCADA system was automated to calculate $LFG_{totaL,y}$ by summing measured values for $LFG_{flare,y}$ and $LFG_{electricity,y}$. Therefore the conservativeness check of comparing measured and calculated values for $LFG_{totaL,y}$ and taking the lower value for emission reduction computation could not be carried out. On the other hand, screenshots of real-time readings from 2 spare annubar flowmeters measuring biogas flow rate on line A and line B which merge to form the main line serve as an indicator of how closely calculated and measured $LFG_{totaL,y}$ match.	on 09/11/2008 and 27/03/2009. Both the days fall during the current monitored period i.e between 01/09/2008 and 30/06/2009. It was verified onsite that the said inconsistencies between the registered PDD, the methodology ACM0001 v. 5, "Tool to calculate project emissions from electricity consumption" (EB 28/ Annex 13) and the implemented monitoring plan, were resolved by PP.	
Calculation Tool description	The calculation tool follows formulae as per ACM0001 v. 5 and "Tool to calculate project emissions from electricity consumption" (EB 28/ Annex 13). PE_{flare} is calculated based on hourly average fraction of oxygen and methane in the exhaust gas of the flare and fraction of methane in the residual gas. A check is performed on whether during each hour of biogas flow, the flare is operational. Emission reductions are calculated based on daily averaged values for $LFG_{flare,y}$, $LFG_{electricity,y}$, methane fraction in the biogas and $PE_{flare,y}$. Normalization has been performed based on measured values of biogas T and P. However, the conservativeness check of comparing calculated $LFG_{total,y}$ with measured	Errors in instrumentation have been accounted for which is a good practice.	☑

	$LFG_{total,y}$ has not been incorporated. This step is not relevant to the part of current monitoring period as $LFG_{total,y}$ has not been measured but only calculated until 27/03/2009. It was noted that the calculation tool accounts for instrument error in computing the final emission reductions although this is not required by the monitoring plan. This step can reduce the uncertainty in the final calculated values.		
Transformation from transferred data to useable data	A visual check on the raw data is done by the responsible person at Pangea's Italy office in order to ensure that all the data has been properly registered before proceeding with the calculation.	A low risk of mistake by the responsible person is possible. Responsibility for internal review has been clearly documented.	☑
Elimination of not plausible data	Errors in data registration leading to implausible data most likely occur due to: 1. Monitoring equipment error 2. Failure in PLC to PC connection 3. Fluctuations on first day of commissioning There is a procedure PGSYS003 to deal with identified nonconformities in the Quality Management System. Example, if there is malfunctioning equipment, an NC report would be raised and corrective action such as replacement or repair of the said equipment, taken. Procedure POTR001 requires the RSAQ to check for proper registration of raw data.	The raw data for most months was complete. However the audit team noticed a few cases of non-registration of data at certain days i.e for $LFG_{total,y}$ in December 2008 and for $LFG_{electricity,y}$ June 2009. **Corrective Action Request No.3.** Please explain the reasons behind missing data on certain days i.e for $LFG_{total,y}$ in December 2008 and for $LFG_{electricity,y}$ June 2009. The justification needs to be stated in the MR. Please mention reference to AMS-I. D, version 10 in section A.5 of the MR.	**CAR3**
Transformation from useable data to input data for further calculation	SCADA has been configured to generate hourly and monthly average data automatically. The daily report by SCADA consisting of hourly averages is copied onto the workskeet PEflare in the file ER calculation sheet_YEAR MONTH.xls and used to	The different steps to transform from usable data to input data for calculation is correct and very low risk of misstatement are foreseen.	☑

	compute project emissions from flaring as per the tool. The monthly report by SCADA consisting of daily averages is copied onto the worksheet ER in the same file and used to compute the emission reductions. The data are aggregated monthly.	The formulae in the excel files are all linked together protecting from a non correct use.	
Ex-ante data	$CEF_{electricity}$ has been calculated applying ACM0002 ver. 6	No comments.	☑
Default parameter	- GWP_{CH4} = 21 tCO_2e/tCH_4 is in compliance with the value defined for the first commitment period; - D_{CH4} = 0.0007168 tCH_4/m^3CH_4 is in compliance with the value defined in ACM0001/version 5; These default values used are consistent with those in the PDD.	The compliance of the data used within the documentation and the methodology assure that the final results are reliable. No risks of mistakes due to incorrect default parameters have therefore been found.	☑
Formulae check	No errors in the application of formulae in the calculation tool were identified. Final BE have been rounded down, and final PE rounded up conservatively.	No comments.	CAR
Rounding functions	No rounding functions have been explicitly applied, due to very low amount of parameters.	No comments.	☑
Calculation tool changes and protection measures	The SCADA system, PC and calculation tools are all password protected. However for submission of calculation tool to EB the excel file has been unprotected as per EB48, Annex 68, 9 (b).	The PC screen saver is set at 1 minute therefore there is minimal chance of data tampering	☑
Key Reporting Risks: The key risks in data processing are related to the absence of a redundant system and to the definition of a procedure to describe the calculation tool, even if correctly applied, and to describe the performance of necessary modification to the tool. A password on the excel sheets of the calcuations should be put in place to protect from unauthorized access. **Risk Classification:** Medium The risk of an incorrect application of the calculation tool is low; a procedure to describe the different steps and behaviour in case of unusable data is available with a protection system of the files, therefore the risk could be considered low. **Further Remarks:** Nil.			☑

3. Monitoring Plan Implementation

3.1. List of Parameter to be monitored

ID-PDD	ID-Meth.	ID-Internal	Description	Conclusion
Instrumentation				
$LFG_{total,y}$	1. $LFG_{total,y}$	$LFG_{TOTAL,y}$ **(FT03_a)**	Total amount of landfill gas captured	See 3.2.1
$LFG_{flare,y}$	2. $LFG_{flare,y}$	$LFG_{flare,y}$ **(FT04 & FT04_a)**	Amount of landfill gas flared	See 3.2.2
$LFG_{electricity,y}$	3. $LFG_{electric-ity,y}$	$LFG_{electricity,}$ **(FT05 & FT05_a)**	Amount of landfill gas combusted in power plant	See 3.2.3
T	7. T	T **(TT02)**	Temperature of the landfill gas	See 3.2.4
T_{flare}	5. $PE_{flare,y}$	T_{flare} **(TT05)**	Temperature in the exhaust gas of the flare	See 3.2.5
P	8. p	P **(PT04)**	Pressure of the landfill gas	See 3.2.6
$EL_{EX,LFG}$	9.$EL_{EX,LFG}$	$EL_{EX,LFG}$ **(EM01)**	Total amount of electricity exported out of the project	See 3.2.7
EL_{IMP}	10. EL_{IMP}	EL_{IMP} **(EM01)**	Total amount of electricity imported to meet project requirement	See3.2.7
$fv_{i,h}$	5. $PE_{flare,y}$ 6. $wCH_{4,y}$	$fv_{i,h}$ **(GA01)**	Volumetric fraction of component *i* in the residual gas in the hour *h* where *i* = CH4, CO, CO2, O2, H2, N2	See 3.2.8
$t_{O2,h}$	5. $PE_{flare,y}$	$t_{O2,h}$ **(GA02)**	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour *h*	See 3.2.9
$FV_{RG,h}$	5. $PE_{flare,y}$	$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in the	See 3.2.2

ID-PDD	ID-Meth.	ID-Internal	Description	Conclusion
		(FT04 and FT04_a)	hour *h*	
$fv_{CH4,FG,}h$	5. $PE_{flare,y}$	$fv_{CH4,FG,h}$ **(GA02)**	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour *h*	See 3.2.9
H	14.	HC01	SCADA, Operation of the energy plant counted within the Plant pc. No separate instrument required.	NA
			Corrective Action Request No.4. Correct the following (refer to table B.2.2 of MR) in MR to be in line with the methodology, tool and PDD: 1. Parameters for LFG_{total} , LFG_{flare} and $LFG_{electricity}$ 2. Description of LFG_{total} 3. Unit of measure of LFG_{total} , LFG_{flare}, $LFG_{electricity}$ $f_{vCH4,h}$	**CAR4**
Sampling				
			n.a.	☑
Accounting				
			n.a.	☑
External Data				
n.a.	n.a.	P_{atm}	Atmospheric pressure at site- Data from PAGASA (for normalization function) (IRL 41); the audit team validated these data by crosschecking the data entry into spreadsheet with the actual PAGASA data.	☑
Others				
			n.a.	☑

3.2. Monitoring Instrumentation

3.2.1. Instrument i

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	**$LFG_{TOTAL,y}$**	☑
ID-Internal:	**$LFG_{TOTAL,y}$ (FT03_a)**	☑
Data to be Measured:	Total amount of landfill gas captured	☑
Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Impulsive	☑
Period of Operating Time:	FT03_a: From 27/03/2009 till date	☑
Instrument Type:	FT03_a: Annubar meter	☑
Serial Number:	FT03_a: 485 – 0075923 / 3051S1CD1A2E12A1AB4D2E1L4Q4 -8696153	☑
Manufacturer Model Nr.:	FT03_a: EMERSON - ROSEMOUNT	☑
Specific Location:	MAIN PIPELINE	☑
Measurement Range:	130-2500 m^3/h Max pressure 10 bar	☑
Measurement Unit:	m^3	☑
Calibration:	FT03_a: Last calibration: 28/2/2009	☑
Required Calibration Frequency:	FT03_a: 2 years	☑
Uncertainty Level:	FT03_a: ±0.025%/ error: 0.0087%	☑
Monitoring & Calculation		

Reading Frequency:	Continuous through PLC	☑
Recording Frequency:	Continuous through PLC	
Trouble Shooting:	Managed through procedures: 1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to PDD and methodology ACM0001/v.5. Also refer to the deviation accepted by EB 52.	Utilization of annubar method to indicate the flow velocity.	☑
Installation:	Visual control	Correctly installed	☑
Functionality:	Visual control	Operating correctly	☑
Quality assurance:	Calibration certificates and documental evidences	As per calibration certificate / sample gas certificate / inspection report **Corrective Action Request No.5.** During site audit the audit team was informed by the PP that the FT03_a, FT04_a & FT05_a annubar flow meters, have been installed respectively on 27th March 2009, 27th March 2009, and 10th June 2009 with the same function of original FT03, FT04 & FT05 turbine flow meters to permit the maintenance operations and realize a more reliable flow measuring system. Please explain the difference in the type of flow meters used. Also indicate in the MR whether the change would impact CER calculations. **Corrective Action Request No.6.**	**CAR5** **CAR6**

		Information (refer to table B.2.2 of MR) on measurement procedures, monitoring frequencies and QA/QC procedures for all the parameters need to be included in MR. Also check the dates of last calibration of TT02, PT04, TT03, FT01 and FT02 and confirm whether these equipment are calibrated at a frequency of 2 years as required. TT05 calibration frequency of 1 year also needs confirmation. Finally revise the drawing included in the Annex I of MR to represent the contemporary status.	
Maintenance:	Interview with Plant Head and Technical Director	As per manufacturing data	☑
Key Reporting Risks: Nil **Risk Classification:** Nil **Further Remarks:** Nil			☑

Return to 3.1

3.2.2. Instrument ii

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	LFGflare,y and $FV_{RG,h}$	☑
ID-Internal:	LFGflare,y and $FV_{RG,h}$ **(FT04 & FT04_a)**	☑
Data to be Measured:	Amount of landfill gas flared and Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*	☑
Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Impulsive	☑

Period of Operating Time:	FT04: 1/9/2008-26/3/2009 FT04_a: 27/3/2009-30/6/2009	☑
Instrument Type:	**FT04:** Turbine **FT04_a:** Annubar meter	☑
Serial Number:	**FT04:** TRZ-03-34808 **FT04_a:** 485 – 0075924 / 3051S1CD1A2E12A1AB4D2E1L4Q4 -8696152	☑
Manufacturer Model Nr.:	**FT04:** RMG **FT04_a:** EMERSON – ROSEMOUNT	☑
Specific Location:	FLARE LINE	☑
Measurement Range:	130-2500 m^3/h Max pressure 10 bar	☑
Measurement Unit:	m^3	☑
Calibration:	**FT04:** Last calibration: 29/05/2008 **FT04_a:** Last calibration: 28/02/2009	☑
Required Calibration Frequency:	**FT04:** 7 years **FT04_a:** 2 years	☑
Uncertainty Level:	FT04 : 0.26% / 0.49% **FT04_a:** ±0.025%/error 0.01%	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures: 1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to PDD and methodology ACM0001/v.5	Utilization of annubar method to indicate the flow velocity.	☑
Installation:	Visual control	Correctly installed	☑
Functionality:	Visual control	Operating correctly	☑
Quality assurance:	Calibration certificates and documental evidences	As per calibration certificate / sample gas certificate / inspection report	☑
Maintenance:	Interview with Plant Head and Technical Director	As per manufacturing data	
Key Reporting Risks: Nil **Risk Classification:** Nil **Further Remarks:** Nil			☑

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3.2.3. Instrument iii

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	LFGelectricity,y	☑
ID-Internal:	LFGelectricity,y (**FT05 & FT05_a)**	☑
Data to be Measured:	Amount of landfill gas combusted in power plant	☑

Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Impulsive	☑
Period of Operating Time:	FT05 01/09/2008 to 10/06/2009 FT05_a 11/06/2009 to 30/06/2009	☑
Instrument Type:	**FT05:** Turbine **FT05_a:** Annubar meter	☑
Serial Number:	**FT05:** TRZ-03-34809 **FT05_a:** 485 – 0075925 / 3051S1CD1A2E12A1AB4D2E1L4Q4 -8696154	☑
Manufacturer Model Nr.:	**FT05:** RMG **FT05_a:** EMERSON - ROSEMOUNT	☑
Specific Location:	ENGINE LINE	☑
Measurement Range:	13-250 m^3/h Max pressure 10 bar	☑
Measurement Unit:	m^3	☑
Calibration:	**FT05:** Last calibration: 23/05/2007 **FT05_a:** Last calibration: 29/04/2009	☑
Required Calibration Frequency:	**FT05:** 7 years **FT05_a:** 2 years	☑
Uncertainty Level:	**FT05:** error 0.11%/ 0.26% **FT05_a:** ±0.025%/ error 0.01%	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑

Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures: 3. PGSYS003 'Nonconformity, preventive and corrective actions management' 4. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to PDD and methodology ACM0001/v.5	Utilization of annubar method to indicate the flow velocity.	☑
Installation:	Visual control	Correctly installed	☑
Functionality:	Visual control	Functional	☑
Quality assurance:	Calibration certificates and documental evidences	As per calibration certificate / sample gas certificate / inspection report	☑
Maintenance:	Interview with Plant Head and Technical Director	As per OEM data	
Key Reporting Risks: Nil **Risk Classification:** Nil **Further Remarks:** Nil			☑

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3.2.4. Instrument iv

PDD	Verified Situation	Conclusion
Instrumentation Information		

ID-PDD:	T	☑
ID-Internal:	T (TT02)	☑
Data to be Measured:	Temperature of the landfill gas	☑
Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Analogic 4 – 20 mA	☑
Period of Operating Time:	From 13/03/2008 till date	☑
Instrument Type:	Thermocouple	☑
Serial Number:	08-07/290	☑
Manufacturer Model Nr.:	ELSI Srl Probe Model: G1.U10-P20-B0150-S00 Transmitter Model: Y1-SEM203P	☑
Specific Location:	MAIN LINE	☑
Measurement Range:	0-250 °C	☑
Measurement Unit:	° C	☑
Calibration:	Last calibration: 12/09/2007	☑
Required Calibration Frequency:	2 years	☑
Uncertainty Level:	±0.1 C° (range 0-250°) error 0.2% 0.15% at 60.32C°	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures:	☑

	1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to PDD and methodology ACM0001/v.5	Thermocouple	☑
Installation:	Visual control	The instrument is correctly working and running	☑
Functionality:	Visual control	The meter is correctly calibrated	☑
Quality assurance:	Calibration certificates and documental evidences	Calibration report by Elsi Calibration Center	☑
Maintenance:	Interview with technicians	The thermostat is installed properly	☑
Key Reporting Risks: A malfunctioning of the instrument will result in an incorrect calculation of the normalized value of the biogas flared. In case of problems a troubleshooting procedure will be applied. **Risk Classification:** Low Due to the characteristic of this metering equipment a malfunctioning is quite improbable. **Further Remarks:** None			☑

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3.2.5. Instrument v

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	T_{flare}	☑
ID-Internal:	T_{flare} (**TT05)**	☑
Data to be Measured:	Temperature in the exhaust gas of the flare	☑
Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Impulsive	☑
Period of Operating Time:	from 08/11/2008 till date	☑
Instrument Type:	thermocouple	☑
Serial Number:	10-07/748	☑
Manufacturer Model Nr.:	ELSI Srl Probe Model: M1.U07-S00-M00400.1-S20 Transmitter Model: Y1-SEM210S	☑
Specific Location:	Closed FLARE (at 85% height of flare inside)	☑
Measurement Range:	0-1600 °C	☑
Measurement Unit:	° C	☑
Calibration:	Last calibration: 15/12/2007, 20/08/2008, 10/08/2009	☑
Required Calibration Frequency:	1 year	☑
Uncertainty Level:	0.29% / error 0.19%	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	

Trouble Shooting:	Managed through procedures: 1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumen-tation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According methodology ACM0001/v.5. Also refer to the deviation accepted by EB 52.	Correctly applied	☑
Installation:	Visual control	The meter is installed properly	☑
Functionality:	Visual control	The instrument is correctly working and running	☑
Quality assurance:	Calibration certificates and documental evidences	Calibration report by ELSI calibration center and PREMIER Phisic metrologie; **<u>Corrective Action Request No.7.</u>** The following corrective actions are requested: 1. Identify location of TT03 "flare bottom" TT05 "flare top" MR, Table B.1.2. 2. Please confirm in Monitoring Report whether TT04 or TT05 is used for monitoring T_{flare} (see page 5 and also table B.1.2 of MR).	**CAR7**
Maintenance:	Interview with Plant Head, Technical Director	Maintenance as per Machine Book	☑
Key Reporting Risks: A malfunctioning of the probe will result in non-registration of status of flare operation. This will heighten uncertainty regarding flare efficiency.			☑

Risk Classification: Low Due to the characteristic of this metering equipment a malfunctioning is quite improbable. **Further Remarks:** T_{flare} is supposed to be a measure of temperature in the exhaust gas of the enclosed flare as per the Tool & registered PDD however in practise the flare combustion temperature has been monitored with a probe located at the bottom of the stack until 9th November 2008. The calculation tool describes the monitored parameter as 'Exhausted temperature'. Such inconsistencies between the registered PDD, the methodology ACM0001 v. 5, "Tool to calculate project emissions from electricity consumption" (EB 28/ Annex 13) and the implemented monitoring plan have been addressed by a Request for Deviation.	

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3.2.6. Instrument vi

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	P	☑
ID-Internal:	P (PT04)	☑
Data to be Measured:	Pressure of the landfill gas	☑
Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Impulsive	☑
Period of Operating Time:	from 13/03/2008 till date	☑

Instrument Type:	Pressure meter	☑
Serial Number:	6407024078	☑
Manufacturer Model Nr.:	ABB / 264HS	☑
Specific Location:	MAIN LINE	☑
Measurement Range:	0 to 250 mbar	☑
Measurement Unit:	Mbar	☑
Calibration:	Calibration dates: 25/09/2007 and 10/8/2009	☑
Required Calibration Frequency:	2 years	☑
Uncertainty Level:	0.49%	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures: 1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to methodology ACM0001/v.5	Correctly applied	☑
Installation:	Visual control	The meter is installed properly	☑
Functionality:	Visual control	The instrument is correctly working and running	☑

Quality assurance:	Calibration certificates and documental evidences	Calibration Certificate from PREMIER Phisic metrologie and ABB quality test check.	☑
Maintenance:	Interview with Plant Head and Technical Director	Instrument is properly calibrated	☑
Key Reporting Risks: A malfunctioning of the meter will result in a missing value of biogas pressure needed to normalize biogas volume. **Risk Classification:** Low Due to the characteristic of this metering equipment a malfunctioning is quite improbable. **Further Remarks:** None			☑

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3.2.7. Instrument vii

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	$EL_{EX,LFG}$ and EL_{IMP}	☑
ID-Internal:	$EL_{EX,LFG}$ and EL_{IMP} (EM01)	☑
Data to be Measured:	Total amount of electricity exported out of the project boundary and Total amount of electricity imported to meet project requirements	☑
Data Logging:	Continuous	☑

Archiving of Raw Data:	PLC	☑
Measurement Principle:	Analogue (4-20 mA)	☑
Period of Operating Time:	From 17/03/2008 till date	☑
Instrument Type:	Polyphase meter	☑
Serial Number:	206584765	☑
Manufacturer Model Nr.:	Genius / EDMI N680	☑
Specific Location:	MAIN ELECTRICAL PANEL	☑
Measurement Range:	5(20)A, 240V	☑
Measurement Unit:	KW, kVA, KWh	☑
Calibration:	Last Calibration: 10/3/2009	☑
Required Calibration Frequency:	2 years	☑
Uncertainty Level:	0. 148%; Accuracy Class 1 & 2 (to IEC 61036)	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures: 1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to "Tool to deter-	Correctly applied	☑

	mine project emissions from flaring gases containing methane"		
Installation:	Visual control	The instrument is installed correctly	☑
Functionality:	Visual control	The instrument is correctly working and running	☑
Quality assurance:	Calibration certificates and documental evidences	Polyphase Meter Test Report calibrated by Energy Regulatory Commission of Philippines tested on 10/03/2009	☑
Maintenance:	Interview with Plant Head and Technical Director	The instrument is correctly calibrated.	☑
Key Reporting Risks: A malfunctioning of the meter will result in a missing value of EL_{IMP} and $EL_{EX,LFG}$ (only when there is export in Phase 2). **Risk Classification:** Low Due to the characteristic of this metering equipment a malfunctioning is quite improbable. When exporting electricity, the power distribution company will install its own meter to countercheck $EL_{EX,LFG}$. **Further Remarks:** None			☑

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3.2.8. Instrument viii

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	fvi,h	☑

ID-Internal:	fvi,h (**GA01)**	☑
Data to be Measured:	Volumetric fraction of component *i* in the residual gas in the hour *h* where *i* = CH4, CO, CO2, O2, H2, N2	☑
Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Non Dispersive Infra-Red principle (N.D.I.R.)	☑
Period of Operating Time:	From 13/03/2008 till date	☑
Instrument Type:	Biogas Analyzer	☑
Serial Number:	N1-V7-0538	☑
Manufacturer Model Nr.:	Siemens / ULTRAMAT 23 7MB2335-2DR10-6AA1	☑
Specific Location:	MAIN LINE	☑
Measurement Range:	CH_4: 0 - 100% O_2: 0 - 25%	☑
Measurement Unit:	O_2 %, CH_4 %	☑
Calibration:	Last Calibration: 19/03/2009 (earlier calibration was done on 13/03/2008) During the "normal period" (19/03/2009 to 30/06/2009) when the instruments are properly calibrated, actual error (0.111%) after calibration was used in ER calculation. The data for delayed calibration period (01/09/2008 to 18/03/2009) was adjusted by applying a conservative error of 4.783% obtained in the delayed calibration. This error is also beyond the maximum permissible error of the measuring equipment and thus the PP's follow para 4(b) Annex 60 of EB52.	☑
Required Calibration Frequency:	Yearly	☑
Uncertainty Level:	1% CH_4 0.5% O_2	☑
Monitoring & Calculation		

Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures: 1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to "Tool to determine project emissions from flaring gases containing methane"	Correctly applied	☑
Installation:	Visual control	The thermocouple is installed correctly	☑
Functionality:	Visual control	The instrument is correctly working and running	☑
Quality assurance:	Calibration certificates and documental evidences	Correctly calibrated by manufacturer prior to delivery. Calibration frequency requirement has been noted as per the manufacturer's requirement.	☑
Maintenance:	Interview with Plant Head and Technical Director	As per the manufacturer's specifications	☑

Key Reporting Risks:
A malfunctioning of the meter will result in a missing value of methane fraction in the residual gas.

Risk Classification: Low
Due to the characteristic of this metering equipment a malfunctioning is quite improbable. ☑

Further Remarks: None	

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3.2.9. Instrument ix

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	tO_2,h and $fv_{CH4,FG,h}$	☑
ID-Internal:	tO_2,h **(GA02)**	☑
Data to be Measured:	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h and Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h	☑
Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Non Dispersive Infra-Red principle (N.D.I.R.)	☑
Period of Operating Time:	From 19/03/2009 till date	☑
Instrument Type:	Biogas Analyzer	☑
Serial Number:	N1-V0-0038	☑
Manufacturer Model Nr.:	Siemens / ULTRAMAT 23 7MB2335-2DH10-6AA1	☑
Specific Location:	Exhausted Gas from FLARE	☑
Measurement Range:	CH_4: 0 - 100% O_2: 0 - 25%	☑
Measurement Unit:	O_2 %, CH_4 %	☑

Calibration:	Last Calibration: 19/03/2009 (earlier calibration was done on 13/03/2008) During the "normal period" (19/03/2009 to 30/06/2009) when the instruments are properly calibrated, actual error (0.0%) after calibration was used in ER calculation. The data for delayed calibration period (01/09/2008 to 18/03/2009) was adjusted by applying a conservative error of 1.923% obtained in the delayed calibration. This error is also beyond the maximum permissible error of the measuring equipment and thus the PP's follow para 4(b) Annex 60 of EB52.	☑
Required Calibration Frequency:	Yearly	☑
Uncertainty Level:	1% CH4 0.5% O2	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures: 1. PGSYS003 'Nonconformity, preventive and corrective actions management' 2. PGBI001 'Biogas Plant Operation, Maintenance and Control Activities'.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	According to "Tool to determine project emissions from flaring gases containing methane"	Correctly applied	☑
Installation:	Visual control	The analyzer is installed correctly	☑
Functionality:	Visual control	The instrument is correctly working and running	☑
Quality assurance:	Calibration certificates and documental evidences	Correctly calibrated by manufacturer prior to delivery. Calibration frequency requirement has been noted as per the	☑

		manufacturer's requirement.	
Maintenance:	Interview with Plant Head and Technical Director	The instrument doesn't need maintenance besides correct calibration.	☑
Key Reporting Risks: A malfunctioning of the meter will result in a missing value of methane and oxygen in the exhaust gas which will impact flare efficiency calculation. **Risk Classification:** Low Due to the characteristic of this metering equipment a malfunctioning is quite improbable. **Further Remarks:** None			☑
Corrective Action Request No.8. The previous calibration should be indicated as well in MR (table B.1.2) once the monitoring instrument is in operation since the beginning of the monitoring period, for the following instruments: GA01, PT04, TT05, GA02, EM01, FT01 and FT02. Furthermore to which "monitoring plan" is the text below the table referring to?			

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3.2.10. Instrument x

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	T	☑
ID-Internal:	T (TT03)	☑
Data to be Measured:	Temperature of flare bottom	☑

Data Logging:	Continuous	☑
Archiving of Raw Data:	PLC	☑
Measurement Principle:	Analogic 4 – 20 mA	☑
Period of Operating Time:	Serial number 10-05/9387: from 1/9/2008 - 6/12/2008 Serial number 12-08/3358: 7/12/2008 - 30/6/2009	☑
Instrument Type:	Thermocouple	☑
Serial Number:	10-05/9387 and 12-08/3358	☑
Manufacturer Model Nr.:	Probe Model: M1.U07- S00-M00400.1-S20, Transmitter Model: Y1- SEM210/S	☑
Specific Location:	Flare Bottom	☑
Measurement Range:	0-1,600 °C	☑
Measurement Unit:	° C	☑
Calibration:	Calibration dates: 12/09/2007 (10-05/9387) and 04/12/2008 (12-08/3358)	☑
Required Calibration Frequency:	2 years	☑
Uncertainty Level:	1. 0.21% / error 0.08%, 2. 0.21% / error 0.107%	☑
Monitoring & Calculation		
Reading Frequency:	Continuously through PLC	☑
Recording Frequency:	See CAR4	
Trouble Shooting:	Managed through procedures: 1. PGSYS003 ‘Nonconformity, preventive and corrective actions management’ 2. PGBI001 ‘Biogas Plant Operation, Maintenance and Control Activities’.	☑
Inspection Results During Verification		

Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	NA	Thermocouple	☑
Installation:	Visual control	The instrument is correctly working and running	☑
Functionality:	Visual control	The meter is correctly calibrated	☑
Quality assurance:	Calibration certificates and documental evidences	Calibration report by Elsi Calibration Center	☑
Maintenance:	Interview with technicians	The thermostat is installed properly	☑
Key Reporting Risks: A malfunctioning of the instrument will result in an incorrect calculation of the normalized value of the biogas flared. In case of problems a troubleshooting procedure will be applied. **Risk Classification:** Low Due to the characteristic of this metering equipment a malfunctioning is quite improbable. **Further Remarks:** None			☑

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3.3. External Data

3.3.1. External Data 1

PDD	Verified Situation	Conclusion
External Data		

ID-PDD:	n.a	☑
ID-Internal:	n.a.	☑
Description of Data / Data Refers to:	Regulatory requirements relating to landfill gas projects	☑
Unit of Data (if appropriate):	Not Applicable	☑
Date of Data Income:	Not Applicable	☑
Source of Data:	The auditor on-site had a meeting with the Mayor of Quezon City. In the course of this interview it was clear that there are still no prevailing laws mandating capture and destruction of landfill biogas (IRL28).	☑
Reliability of Data Source:	High	☑
Is the Data up-to-date?	Yes	☑
Uncertainty Level:	Nil	☑
Key Reporting Risks: None **Risk Classification:** Absent **Further Remarks:** None		☑

4 Data Verification

4.1 Internal Review

Description and performance of internal review			
	Description	Comments	Concl.
Procedure	The calculation tool is reviewed internally by Pangea Green Energy office in Italy. The responsibility for this internal check is not clearly documented however.	No comments	☑
Documentation	No comments	No comments	☑
Responsibilities	No comments	No comments	☑
Key Reporting Risks: Although there is a risk of error, the risks have been minimized by using automatic cell referencing and automated data extraction from SCADA. However, a procedure for internal review and approval is in place. **Risk Classification:** Low **Further Remarks:** None			☑

4.2 Usage of default values

Not applicable

4.3 Reproducibility

Description and performance of the assessment

	Description	Comments and Results	Concl.
Procedure	Audit team onsite verified/checked the excel calculation tool against the SCADA raw data. There were no discrepancies observed. The excel sheet was thoroughly examined for missing dates or times, some missing data was found (see CAR3).	As data extraction is done automatically and the excel sheet incorporates built-in formulae all of which were checked the risk for error in transcription have been minimized. Data integrity was also checked by comparing with the original SCADA output.	☑
Key Reporting Risks: None identified; Data is well protected **Risk Classification:** Low **Further Remarks:** None			☑

4.4 Peculiarities

Description of Peculiarities and unexpected Daily Events during the verification period			
	Description	Comments and Results	Concl.
Performance	1. Subsequently after EB accepted the deviation (see IRL9) the PP installed the instruments for T_{flare} and $LFG_{TOTAL,y}$ respectively on 09/11/2008 and 27/03/2009. Both the days fall during the current monitored period i.e between 01/09/2008 and 30/06/2009. 2. During site audit the audit team was informed by the PP that the FT03_a, FT04_a & FT05_a annubar flow meters, have been installed respectively on 27th March 2009, 27th March 2009, and 10th June 2009 with the same function of	**Clarification Request No. 4.** Submit daily plant report that was implemented to record daily events log and peculiar events during MP. This will aid in analysis of root cause of inconsistencies if any, in the registered data.	**CR4**

	original FT03, FT04 & FT05 turbine flow meters to permit the maintenance operations and realize a more reliable flow measuring system. Please explain the difference in the type of flow meters used. Also indicate in the MR whether the change would impact CER calculations (see CAR5). 3. The audit team noticed a few cases of non-registration of data at certain days i.e for $LFG_{total,y}$ in December 2008 and for $LFG_{electricity,y}$ June 2009. It is advisable to maintain a daily log to register any peculiar events such as flare shut-down.		
Documentation	See CR4	See CR4	CR4
Measures	See CR4	See CR4	CR4
Key Reporting Risks: Lack of documentary support to analyze inconsistencies should they arise**.** However the quality management system has other procedures in place to manage the system such as a procedure to take corrective and preventive action **Risk Classification:** Low**-**Medium **Further Remarks:** None			☑

4.5 Reliability and Plausibility

Description of crosschecks and plausibility checks			
	Description	Comments and Results	Concl.
Performance	FlareT_{flare} temperature was found to be > 700 degrees Celsius from 01/09/2008 (12:00:00AM) until 08/11/2008 (2:59:59PM). The	Request for Deviation from monitoring plan in the registered PDD has been	☑

	reason is because for some part of the monitoring period the probe was located at the bottom of the stack measuring combustion temperature rather than flare exhaust temperature. The calculation tool has already incorporated discount for measuring instrument uncertainties to account for uncertainties Total biogas flow of every month was divided by total hours of operation of the flare and the average flow rate was seen to be a plausible figure.	raised.	
Key Reporting Risks: Nil. **Risk Classification:** Nil. **Further Remarks:** Nil.			☑

4.5 Completeness and Correctness

Description of completeness and correctness			
	Description	Comments and Results	Concl.
Correctness	Data reported was verified on-site by comparing the excel calculation tool against the SCADA raw data and was correlated for all parameters. Some CRs and CARs have been raised to address uncertainties in the reported values.	Not Applicable.	CR, CAR
Completeness	$LFG_{total,y}$ and T_{flare} have not been monitored exactly as per the monitoring plan in the registered PDD therefore a Request for	Not Applicable.	☑

	Deviation was raised and accepted.		
Further Remarks: N/A			

5 Additional requirements

Description of additional requirements to be checked			
	Description	Comments and Results	Concl.
e.g. environmental issues	Not applicable.	-	-
e.g. market price of the product	Not applicable.	-	-
Key Reporting Risks: Nil **Risk Classification:** Nil. **Further Remarks:** Nil.			

6 Data Reporting

Description of the Monitoring Report		
	Comments and Results	Concl.
Compliance with UNFCCC regulations	The final MR complies with the VV manual and all the latest applicable guidelines.	☑
Completeness and Transparency	Yes	☑
Correctness	Yes	☑
Key Reporting Risks: N/A **Risk Classification:** N/A **Further Remarks:** N/A		☑

7 Compilation and Resolutions of CARs, CRs and FARs

Corrective Action Requests by audit team	Summary of project owner response	Audit team conclusion
Corrective Action Request No.1. The geographical coordinates (to be in decimal format with +/- sign, and NOT with a N/E/S/W specifier) of the project activity should be included in MR. Also indicate exact date of version on the cover page of MR.	The geographical coordinates and exact date and version on the cover page of MR have been done (see MR rev1. dated 8/2/2010) Evidence has been submitted	The evidence has been verified and MR has been revised to include the correction. Therefore the issue remains closed. ☑
Corrective Action Request No.2. a) Please explain in MR the variation in number of wells from registered PDD (49 wells), first MR (48 wells) and second MR (64 wells). Also clarify in MR how there will be no impact on either quality or quantity of biogas due to this variation as compared to PDD. b) Confirm in the MR whether the generator installed as part of the project is capable of firing fossil fuels. c) Include in MR make/ manufacturer, type, capacity/specifications of the project equipment e.g. wells, flare / engine, blowers etc. Information is preferred in a tabular form. d) Add in MR actual dates of implementation, date of completion of wells and substations during second monitored period. It should be described in MR what phase 2 consists of as per PDD. Also please explicitly inform about the implementation status of the	a) The garbage disposal activity of the Disposal Facility Management Office (POG), requests periodically the partial disconnection of some wells located in the two Mound areas; this situation has caused and causes a loss in biogas production in the areas occupied by dumping activity; the lost production is partially recovered through the installation of new wells in elevation, and horizontal trenches (see MR rev1. dated 8/2/2010 pg. 5) - a wells history file is available for DOE. b) the engine is not capable to run with fossil fuel at present (see MR rev1. dated 8/2/2010 pg. 5) . c) (see MR rev1. dated 8/2/2010 pg. 4-5 *tab.1*). d) a summary of wells implementation is indicated in MR (see MR rev1. dated 8/2/2010 pg. 6 *tab.2*) a wells history file is available for DOE. e) done (see MR rev1. dated 8/2/2010 cover)	a) The justification regarding variation in number of wells is acceptable since it was verified onsite that the garbage dumping schedules at land fill are out of the PP's influence. This is also observed to be the reason for significant variation in CERs compared to PDD. MR has been revised transparently to reflect the same. b) MR has been revised to indicate the aspect related to fossil fuel firing transparently. c) MR has been revised to include all necessary technical details of project equipment. d) MR has been revised to indicate dates of implementation, date of completion of wells and substations during second monitored period. The wells history file has been verified and accepted to be in line with the site audit findings. Phase 2 and implementation are sufficiently mentioned. e) MR has been revised to include the actual

Corrective Action Requests by audit team	Summary of project owner response	Audit team conclusion
project DURING THE MONITORING PERIOD UNDER CONSIDERATION. **e)** Indicate actual date of revision on the MR. **f)** Referring to drawing included under section B.1 of MR: ii) It should be clarified why this on-site power generator does not refer to the phase 1 (200 kW) generator, but the picture below; the power generation unit (exporting electricity) is not in operation in phase 1 but only in phase 2; Please clarify; iii) Table B.1.2. just mentions one "flow meter in the engine pipeline"; why here 2 flow meters (one to on site power generator; another one to power generation unit) are indicated? Please clarify;		date. f) The details of drawing included are corrected under section B.1 of MR and the same was cross checked with actual equipment/instrument onsite. Therefore the issue remains closed. ☑
<u>Corrective Action Request No.3.</u> Please explain the reasons behind missing data on certain days i.e for $LFG_{total,y}$ in December 2008 and for $LFG_{electricity,y}$ June 2009. The justification needs to be stated in the MR.	The missing data on days 4th ,5th ,6th December 2008 related to $LFG_{total,y}$ were caused by a flare temperature signal defection, solved on 7th December 2008 and the missing data on days 20th -26th June 2009 related the $LFG_{electricity,y}$ were referred to the engine biogas chiller defection due to the compressor failure, all the events are indicated in the Plant daily report available for DOE (see MR rev1. dated 8/2/2010 pg. 5)	The missing data on certain days of the monitored period has been cross checked from the plant daily report and was found to be tallying. The reasons stated for the same are also acceptable and the PP has put in place all necessary measures to prevent such events in future. ☑
		MR has been revised to include the correction.

Corrective Action Requests by audit team	Summary of project owner response	Audit team conclusion
Corrective Action Request No.4. Correct the following (refer to table B.2.2 of MR) in MR to be in line with the methodology, tool and PDD: 1. Parameters for LFG_{total} , LFG_{flare} and $LFG_{electricity}$ 2. Description of LFG_{total} 3. Unit of measure of LFG_{total} , LFG_{flare}, $LFG_{electricity}$, $f_{vCH4,h}$	Every point has been corrected (see MR rev1. dated 8/2/2010 pg. 13-15 *tab. 5*) The correction has been completed (see MR rev2 dated 9/3/2010 table 5)	Therefore the issue remains closed. ☑
Corrective Action Request No.5. During site audit the audit team was informed by the PP that the FT03_a, FT04_a & FT05_a annubar flow meters, have been installed respectively on 27th March 2009, 27th March 2009, and 10th June 2009 with the same function of original FT03, FT04 & FT05 turbine flow meters to permit the maintenance operations and realize a more reliable flow measuring system. Please explain the difference in the type of flow meters used. Also indicate in the MR whether the change would impact CER calculations.	The Annubar flow meter is a "Pitot" type flow meter "auto average" where the fluid pressure is determinated through an "impact shape" extended for the complete pipe section. The Rosemount 3051 Annubar Primary Element series is the shape, in AISI 316 steel, with sensing holes flow meter , to warranty the best accuracy and repeatability in application from low to medium pressure and temperature requirements. The instruments installed are a counter which counts every m^3 of biogas passed in the line. The functioning is the measure of pressure difference between the static pressure (parallel to the flow direction) and the dynamic pressure (perpendicular to the flow) The pressure holes are disposed on the length of the Annubar shape that permit the evaluation of the different speed of fluid profile in the total pipe length. The non-constricting design of the Annubar	It can be confirmed that the annubar flow meters are more accurate and reliable than the turbine type flow meters. Therefore the issue remains closed. ☑

Corrective Action Requests by audit team	Summary of project owner response	Audit team conclusion
	sensor creates minimal blockage in the pipe, which reduces permanent pressure loss. Permanent pressure loss can be converted directly into energy savings in the form of compressor cost for gas. The Annubar sensor is designed to prevent wear and blockage in the pipe. The electronics is the most stable in the industry and allows up to 10 year calibration cycles, providing significant maintenance savings. A DP transmitter 485 Ultra series integrates the flow meters measurement system. DP transmitter, converts the signal from Annubar into analogical output signal 4-20mA directly to PLC. The maintenance is very easy and requires only, a on-site holed shape cleaning ; very different compared to mechanical flow meter (off site maintenance) ;besides this instrument, doesn't affect from internal damage due to the biogas corrosive atmosphere. The calibration can be effectuated on-site periodically, with an official supplier present in the area. The accuracy of this instrument is 0.025% (mechanical flow meter 0.26%) - see MR rev1. dated 8/2/2010 pg. 10-11 *tab. 3* The New Flow meters installation didn't have impact in the CERs calculation.	

Corrective Action Requests by audit team	Summary of project owner response	Audit team conclusion
Corrective Action Request No.6. Information (refer to table B.2.2 of MR) on measurement procedures, monitoring frequencies and QA/QC procedures for all the parameters need to be included in MR. Also check the dates of last calibration of TT02, PT04, TT03, FT01 and FT02 and confirm whether these equipment are calibrated at a frequency of 2 years as required. TT05 calibration frequency of 1 year also needs confirmation. Finally revise the drawing included in the Annex I of MR to represent the contemporary status.	see MR rev1. dated 8/2/2010 pg. 10-11 *tab. 3* ; pg. 13-15 *tab. 5; annex 1* The calibration frequency is in compliance of "Guidelines for assessing compliance with the calibration frequency requirements" Version 01, EB 52 Annex 60. : see MR rev2 dated 9/3/2010 table 5) page 10-12 see also Calib_freq_2010.doc	MR has been revised to include the correction. Therefore the issue remains closed. ☑
Corrective Action Request No.7. The following corrective actions are requested: 1. Identify location of TT03 "flare bottom" TT05 "flare top" MR, Table B.1.2. 2. Please confirm in Monitoring Report whether TT04 or TT05 is used for monitoring T_{flare} (see page 5 and also table B.1.2 of MR).	see MR rev1. dated 8/2/2010 pg. 10-11 *tab. 3* TT05 is used for T_{flare} monitoring.	MR has been revised to include the corrections. Therefore the issue remains closed. ☑
Corrective Action Request No.8. The previous calibration should be indicated as well in MR (table B.1.2) once the monitoring instrument is in operation since the beginning of the monitoring period, for the following instruments: GA01, PT04, TT05, GA02, EM01, FT01 and FT02. Furthermore to which "monitoring plan" is the text below the table referring to?	The previous calibrations are clearly indicated in MR (table B.1.2). Related "QCCDFBERP Monitoring Plan" is included as Annex 2 in MR. A copy of this document was already submitted.	The previous calibrations are clearly indicated in MR (table B.1.2) wherever essential. The "monitoring plan" is clarified to be referring to the "MR_annex2_Monitoring plan Payatas_Version 08", a supplement to the MR. Therefore the issue remains closed. ☑

Clarification Requests by audit team	Summary of project owner response	Audit team conclusion
Clarification Request No. 1. Please submit report copy of the Environmental Impact Assessment conducted for land fill gas project during the monitored period.	As indicated during the audit the Environmental Impact Assessment is not requested (see the communication DENRE dated 9/3/2007)	Letter from Environmental Management Bureau dated 09/03/2007 makes it clear that since a Certificate of Non-Coverage was already issued, an Environmental Impact Assessment is not required as a mandate. Therefore the issue remains closed. ☑
Clarification Request No. 2. "Biogas plant operation, maintenance and control activities" PGBIO001 Rev. 1, submitted to audit team is stated to be issued on "30/11/09", how is the same possible? Please clarify. Also provide information on person's, roles and responsibilities of the plant relevant for the monitored period. Are Gonzales, Sumalo, Cruz and Edgar mentioned in the Training Registration form checked on-site for the training conducted on 18/03/2008, part of the project team monitored period? Clarify.	The date of PGBIO001 Rev. 1 is a misprint error. A corrected PGBIO001 Rev. 1 is available for DOE. Gonzales, Sumalo, Cruz and Edgar mentioned in the Training Registration form, checked on-site for the training conducted on 18/03/2008, were members of Pangea staff during the 2nd monitoring period (see table of organization identifying the key personnel involved in the plant management).	The corrected documents are resubmitted. Therefore the issue remains closed. ☑
Clarification Request No. 3. The Training Registration form checked on-site was for the training conducted on 18/03/2008 and was not relevant for the monitored period. Therefore please clarify whether any training were conducted during the monitored period. In addition also provide up to date information on the following issues: 1. Training on general control panel, biogas analyzers, SW supervision, configuration, line parameters, data sheet,	The training form dated 18/3/2008 is relevant for the monitored period because the teaching, as indicated in the training subjects, was done to instruct all the people involved for the plant management and don't require additional instructions. Based on general management practice trained during the commissioning and in the fist year of plant running; Pangea Green energy conducted Internal Audits that confirmed the good practice management consistent to the instructions and procedures.	The justification included is reasonable. Therefore the issue remains closed. ☑

Corrective Action Requests by audit team	Summary of project owner response	Audit team conclusion
data recording, data storage, maintenance 2. Training on biogas analyzer setting, CH4 measuring, maintenance, calibration, etc 3. Training on safety and emergency procedures **4.** Training on start-up and shut-down, general safety rules, mgt control and regulation procedures, plant maintenance, operation anomalies, etc **5.** Training on general controls, panel setting, engine switch on and shut-down	Additional training session was done for the new people employed during the 2nd monitoring period.	
Clarification Request No. 4. Submit daily plant report that was implemented to record daily events log and peculiar events during MP. This will aid in analysis of root cause of inconsistencies if any, in the registered data.	A plant daily report is a common practice done from plant start up; a copy of this for the 2nd monitored period is available for DOE.	The plant daily report has been now submitted to audit team the same is also crosschecked from with the list of outages and shutdowns. Therefore the issue remains closed. ☑
Forward Action Requests by audit team	**Summary of project owner response**	**Audit team conclusion**
-	-	-

Annex 2: Information Reference List

Refer-ence No.	Document or Type of Information
1.	On-site interviews at the Quezon City Controlled Disposal Facility conducted on 23 and 24 September, 2009 by the auditing team of TÜV SÜD: Validation team on site: Praveen Pyata — TUV SUD South Asia Jayme A. Boenhert — TÜV SÜD PSB Philippines Interviewed persons: Feliciano Belmonte, Jr. — Mayor of Quezon City Ivano Conte — Pangea Green Energy Daniele Ferrero — Pangea Green Energy Danilo Cruz — Pangea Green Energy Jameel Jaymalin — Payatas Operations Group Luis Sabater — Payatas Operations Group
2.	Registered Project Design Document for CDM project "Quezon City Controlled Disposal Facility Biogas Emission Reduction Project" Ver. 11, 30/11/2007 (UNFCCC No: 1258)
3.	ACM0001 Version 05 "Consolidated baseline methodology for landfill gas project activities"
4.	AMS-I.D Version 10 "Grid connected renewable electricity generation"
5.	Tool to determine project emissions from flaring gases containing Methane, EB 28, Annex 13
6.	MONITORING REPORT (Monitoring period: 1st September 2008, to 30th June 2009) 2nd verification http://cdm.unfccc.int/UserManagement/FileStorage/HZ2QW8EDMGIO564YBV1T3RASNX9CUL
7.	Request for Deviation (I-DEV0273) submitted to EB on 27/11/2009 regarding the noted deviation in monitoring T_{flare} and $lfg_{total,y}$ http://cdm.unfccc.int/Projects/deviations/13660 Drawing submitted to EB along with request for deviation a) Technical draw of the flare BTG2500HT-T150, http://cdm.unfccc.int/UserManagement/FileStorage/0SIX8B57EVUJK4PGAOR3FWMTYLCHN1 b) **ANNEX I:** monitoring equipment location, http://cdm.unfccc.int/UserManagement/FileStorage/IADSZJVE17YCMK03WBQ64R8FHN9XTU
8.	CDM EB 52 decision dated 08/02/2010, accepting the deviation http://cdm.unfccc.int/Projects/deviations/13660
9.	Biotecnogas Manual "Biogas extraction & combustion plant for 2500 nm^3/hr with electricity generation technical documentation, BTG027/07-C, submitted on 09/03/2010
10.	Fire Safety Inspection Certificate dated, 25/11/2008, submitted on 09/03/2010

Refer-ence No.	Document or Type of Information
11.	Certificate of Operation – Internal Combustion Engine dated 26/11/2008, submitted on 09/03/2010
12.	Certificate of Operation – Machinery dated 25/02/2009, submitted on 09/03/2010
13.	Training records for the monitored period, submitted on 09/03/2010
14.	Quality procedures POTR001, PGSYS003, PGBI001, PGSYS001, PGSYS002, POEM001, submitted on 09/03/2010
15.	Machine Book which gives the maintenance requirement for each component of the biogas plant i.e.flare, engine, blower and chiller heat exchange including frequency and the records of maintenance performed, submitted on 09/03/2010
16.	Biotecnogas BTG027-07-C Supervision Software Manual, submitted on 09/03/2010
17.	Emission reduction calculation excel spreadsheets for the monitored period, submitted on 14/09/2009
18.	Calibration Certificates for parameters given below were submitted on 09/03/2010
19.	SCADA (Supervisory Control and Data Acquisition) reports that registered the raw data for the monitored period, submitted on 09/03/2010
20.	Internal audit report dated 12/06/2009, submitted on 09/03/2010
21.	Siemens Inspection Certificate – Manufacturing Calibration of product PA (Continuous Gas Analyzer) – ULTRAMAT 23 s/n:N1-V7-0538,

Parameter	Certificate number	Calibration date/s	Calibrating institute
FT03	NA	21//05/2007	RMG Messtechnik (authorized by PTB-DE)
FT03_a	NA	28/2/2009	EMERSON – PROCESS MANAGEMENT
FT04	34808/297508	29/5/2008	RMG Messtechnik (authorized by PTB-DE)
FT04_a	NA	28/2/2009	EMERSON – PROCESS MANAGEMENT
FT05	NA	23/5/2007	RMG Messtechnik (authorized by PTB-DE)
FT 05_a	NA	29/4/2009	EMERSON – PROCESS MANAGEMENT
GA01	NA	13/3/2008; 19/3/2009	SIEMENS; Pangea Air Liquide
TT02	EL07/860	12/9/2007	Elsi Calibration center
PT04	1000278111; 0809CAL5119	25/9/2007; 10/8/2009	ABB quality test PT04 Pressure check; PREMIER Phisic metrologie
TT03 (two meters)	EL07/0861; EL08/1021	12/9/2007; 04/12/2008	Elsi Calibration center
TT05	EL07/953; 0808CAL5820; 0809CAL5125	15/12/2007; 20/8/2008; 10/8/2009	Elsi Calibration center; PREMIER Phisic metrologie
GA02	NA	13/3/2008; 19/3/2009	Pangea Air Liquide; SIEMENS
EM01	070314-0003; 1044341 LA	14/3/2007; 10/3/2009	ERC Philippines
FT01	1000274979; 0809CAL5124	3/9/2007; 10/8/2009	ABB quality test check; PREMIER Phisic metrologie
FT02	1000274978; 0809CAL5123	31/8/2007; 10/8/2009	ABB quality test check; PREMIER Phisic metrologie

Refer-ence No.	Document or Type of Information
	dated 13/03/2008- date of expiry 28/05/2011, submitted on 09/03/2010
22.	Siemens Inspection Certificate – Manufacturing Calibration of product PA (Continuous Gas Analyzer) – ULTRAMAT 23 s/n:N1-V7-0038, dated 13/03/2008- date of expiry 22/12/2011, submitted on 09/03/2010
23.	Quality Management System Certificate (ISO 9001:2008) Siemens AG Industry Sector Sensors and Communication I IA SC – No.000656QM08, issued on 27-02-2009 and valid also for the unit located in Chemin de la Sandlach 67506 Haguenau France- date of expiry 28/05/2011, submitted on 09/03/2010
24.	Organization chart submitted in response to FAR1, submitted on 09/03/2010
25.	Preventive action report in response to FAR2, FAR3 and FAR4 of 1st verification, submitted on 09/03/2010
26.	Daily plant report including daily event log submitted in response to FAR5, submitted on 09/03/2010
27.	List of outages and shutdowns for the monitored period, submitted on 09/03/2010, submitted on 09/03/2010
28.	Letter from Environmental Management Bureau dated 09/03/2007, submitted on 09/03/2010
29.	Certificate of Non-Coverage dated 29/09/2005, submitted on 09/03/2010
30.	Calibration protocol of gas analyzer, submitted on 09/03/2010
31.	Product data sheets respectively for ABB pressure transmitters, Emerson Rosemount flowmeters, EDMI N680, ELSI temperature probes, ULTRAMAT 23 and TRZ 03 turbine meters , submitted on 17/03/2010
32.	Emergency list SYS020, submitted on 17/03/2010
33.	Evidence of project location GSP co-ordinates, submitted on 17/03/2010
34.	Spreadsheet file explaining calculation of error (in %) of instruments, submitted on 11/02/2011
35.	Siemens manual for error calculation, submitted on 17/03/2010
36.	Layout of land fill, submitted on 03/03/2010
37.	Final emission reduction calculation excel spreadsheets for the monitored period, submitted on 11/02/2011
38.	Final MR version 09, dated 10/02/2011, submitted on 11/02/2011
39.	First verification report No. 1251506 dated 28/04/2009 http://cdm.unfccc.int/UserManagement/FileStorage/GLC298D6B5AQJNURS1V4IOPMHYFTEX
40.	MR_annex2_Monitoring plan Payatas_Version 08, submitted on 23/06/2010
41.	Data from PAGASA (for normalization function), http://www.pagasa.dost.gov.ph/