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# GOLD STANDARD VERIFICATION AND CERTIFICATION REPORT

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PROJECT TITLE  
UNIVANICH LAMTHAP POME BIOGAS  
PROJECT

Gold Standard Ref. No. GS458  
(UNFCCC Registration Ref. No. 2076)

Verification Period:  
13 March 2008 – 31 January 2009

Report No. : SQAS-GS-EU02350003  
Revision No.: 3

<b>Report No.:</b> SQAS-GS-EU02350003	<b>Date of first issue:</b> 10 May 2011	<b>Version :</b> 1	<b>Date of this revision :</b> 30 November 2011
<b>Project title</b>	Univanich Lamthap POME Biogas Project		
<b>Organisational Unit</b>	SIRIM QAS International Sdn Bhd		
<b>Client</b>	Unvanich Palm Oil Public Co. Ltd.		

**Summary:**

Univanich Palm Oil Public Co. Ltd. had appointed SIRIM QAS International Sdn. Bhd. to perform the verification and certification of the pre-CDM voluntary emission reductions reported for the 'Univanich Lamthap POME Biogas Project' for the period from 13/3/2008 to 31/1/2009. The project was registered by the UNFCCC Executive Board on 1/2/2009. The verification was based on the registered project design document (PDD)<sup>2/</sup>, the Validation Report<sup>4/</sup>, Monitoring Report (MR)<sup>6/153/57/</sup> and other supporting documents made available to the verification team by the project participant.

The project activity is an anaerobic digestion project, which treats wastewater from the Lamthap Palm Oil Mill in Krabi Province, Southern Thailand. The project activity involved the construction of a covered lagoon anaerobic reactor with a biogas capture system. The biogas from the covered anaerobic reactor is captured and used in the biogas engines. Initially, one unit of gas engine with 952kW capacity was installed to generate electricity that was sold and exported to the local Provincial Electricity Authority (PEA) grid. A second unit of gas engine with another 952kW was installed in April 2009. The excess biogas is combusted in an open flare system.

The project activity contributes to the GHG reduction in two ways, by avoiding methane release into the atmosphere and by generating clean electricity. This partially replaces electricity from Thailand's PEA grid which predominantly consumes fossil fuels for its electricity generation.

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

Monitoring period	13/3/2008 to 31/1/2008	01/1/2009 31/1/2009
Total Baseline Emissions	45,059 tCO <sub>2</sub> e	2,925 tCO <sub>2</sub> e
Total Project Emissions	12,414 tCO <sub>2</sub> e	621tCO <sub>2</sub> e
Emission Reductions - after application of equation 13 (rounded value)	27,460 tCO <sub>2</sub> e	2,304tCO <sub>2</sub> e

**Subject :** Gold Standard Verification

**Work carried out by :**

Aminah Ang - Team Leader  
 Azhar Abdul Raof - Auditor  
 Hafriazhar Mohd. Mokhtar - Trainee Auditor

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**Work verified by :** Syed Anuar Shah Syed Mansor

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**Report approved by:** Parama Iswara Subramaniam

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## Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CIGAR	Covered In-Ground Anaerobic Reactor
CL	Clarification Request
DOE	Designated Operational Entity
EB	UNFCCC Executive Board
ER	Emission Reduction
FAR	Forward Action Request
FFB	Fresh Fruit Bunches
GHG	Greenhouse Gas(es)
GS	Gold Standard
HDPE	High-density Polyethylene
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
PDD	Project Design Document
PEA	Provincial Electricity Authority
PP	Project Participant
POME	Palm Oil Mill Effluent
SIRIM QAS Intl.	SIRIM QAS International Sdn Bhd
UNFCCC	United Nations Framework Convention for Climate Change
Univanich	Unvanich Palm Oil Public Co. Ltd.
VER	Voluntray Emission Reduction
VVM	Validation and Verification Manual version 1.2

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Annex 1: Verification Protocol

## 1. INTRODUCTION

Univanich Palm Oil Public Co. Ltd. had appointed SIRIM QAS International Sdn. Bhd. to carry out the verification of the pre-CDM voluntary emission reductions reported for the CDM project activity 'Univanich Lamthap POME Biogas Project' for the period from 13/3/2008 to 31/1/2009

The verifiers have reviewed the implementation of the monitoring plan (MP) in the registered Gold Standard GS registry project number GS 458, GHG data for the monitoring period was verified in detailed manner applying the set of requirements, audit practices and principles as required under the Validation and Verification Manual /VVM/ of the UNFCCC. This report summarizes the findings and conclusions of this verification of the above mentioned UNFCCC registered project activity.

### 1.1 Objective

The objectives of this verification were:

- To verify that the actual monitoring system and procedures were in full compliance with the system and procedures described in the monitoring plan of registered PDD and the registered Gold Standard annex for the project<sup>8/</sup>, the Gold Standard v1 rules as well as the applicable methodology AM0022 version 4<sup>3/</sup>.
- To verify that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation; and
- To certify the pre-CDM voluntary emission reduction reported for 'Univanich Lamthap POME Biogas Project' for the period of 13/3/2008 to 31/1/2009.

### 1.2 Scope

The scope of the verification is the independent and objective review and *ex-post* determination of the monitored reductions in GHG emissions from 'Univanich Lamthap POME Biogas Project'. The verification is based on the validated and registered project design document and the monitoring report and the Registered Gold Standard Annex for the project. These documents were reviewed against the requirements of the Gold Standard v1, the Kyoto Protocol, the CDM Modalities and Procedures and related rules and guidance.

The verification team has, based on the recommendations in the Validation and Verification Manual, employed a risk-based approach in the verification, focusing on the identification of significant risks and reliability of project monitoring and generations of VERs.

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

### 1.3 Description of the Project Activity

Project Parties	: i) Univanich Palm Oil Company Limited ii) Carbon Bridge Pte Ltd
Title of project activity	: Univanich Lamthap POME Biogas Project
GS reference no.	: GS458
UNFCCC CDM reference no.	: 2076
Registered date by UNFCCC EB	: 1 February 2009
Project location	: Univanich Lamthap Palm Oil Mill, Krabi Province, Thailand

The 'Univanich Lamthap POME Biogas Project' (hereinafter referred to as the project activity) is an anaerobic digestion project, which treats wastewater from the Lamthap Palm Oil Mill in Krabi Province, Southern Thailand.

The project activity involves construction of a covered lagoon anaerobic reactor (CIGAR) with a biogas capture system. The biogas from the covered anaerobic reactor is captured and used in the biogas engine. During this monitoring period, one unit of biogas engine with 952kW capacity was installed to generate the electricity that is exported to the Provincial Electricity Authority (PEA) grid. The excess biogas is combusted in an open flare system. The project activity contributes to the GHG reduction in two ways. The first is by avoiding the methane release into the atmosphere and the second is by generating clean electricity that partially replaces the electricity from Thailand's PEA grid which predominantly consumes fossil fuels for its electricity generation.

## 2. METHODOLOGY

The project assessment was based on the methodology developed in the Validation and Verification Manual.

In order to ensure transparency, a verification protocol was customized for the project, according to the Validation and Verification Manual. The protocol shows, in a transparent manner, requirements, means of verification and the results. The verification protocol serves the following purpose;

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

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

### Verification Team

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

Verification team leader : Aminah Ang  
Verification team member : Azhar Abdul Raof  
Trainee auditor : Hafriazhar Mohd. Mokhtar

Aminah Ang, the validation team leader is a qualified verification team leader in accordance with SIRIM QAS Intl.'s qualification criteria. She has been a lead auditor for environmental management systems (ISO 14001) for the past 14 years.

Azhar Abdul Raof is a Chemical Engineer by qualification. He has extensive experience in the area of wastewater treatment technology including the anaerobic waste treatment processes in the palm oil industries. He has been trained in the CDM validation and verification processes, and is a qualified verifier.

Hafriazhar Mohd. Mokhtar is a Chemical Engineer by qualification. He has several years of direct work experience in palm oil milling including the operation of wastewater treatment plants. Currently, he is an auditor under training.

#### **Duration of verification**

Preparations & document review : 18<sup>th</sup> to 20<sup>th</sup> April 2011  
On-site verification : 25<sup>th</sup> to 26<sup>th</sup> April 2011  
Preparation of draft report : 5<sup>th</sup> to 10<sup>th</sup> May 2011  
Preparation of final report : September to October 2011  
Revision to the verification report : November 2011

## **2.1 Review of Documentation**

The following documents were reviewed and verified:

- Registered PDD<sup>/2/</sup>, version 3.1 dated 08/08/2008
- Validation report<sup>/4/</sup> by TUV SUD (report no. 1025537) dated 11/08/2008
- Monitoring Report<sup>/6/</sup> dated 01/04/2011 (version 1)
- Univanich Lamthap VER ER Calculations V1 Worksheet<sup>/7/</sup> April 2011
- Registered Gold Standard Annex, version 6.1 July 2009<sup>/8/</sup>.

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

## **2.2 Site Visits**

An on-site audit of the project was carried out by the verification team from 25<sup>th</sup> to 26<sup>th</sup> April 2011. The on-site audit consisted of visits to the project site to verify project implementation, the location of the monitoring equipment, and the review of documents and data in the office. Interviews with relevant personnel were also carried out to confirm the method of recording the GHG data.

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

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

Coverage	Source of information/Persons interviewed
<ul style="list-style-type: none"> <li>• GHG reporting and calculation</li> <li>• Information in the monitoring report</li> <li>• Assessment of physical boundary</li> <li>• Review of physical components</li> <li>• Plant operation</li> <li>• Qualification and training</li> <li>• Roles and responsibilities</li> <li>• GHG raw data compilation</li> <li>• Reporting and reviewing of GHG data</li> <li>• CDM Monitoring and reporting</li> <li>• Collection of measurements</li> <li>• Data logging and reporting</li> <li>• Data filing, maintenance and upkeep</li> <li>• Maintenance of monitoring equipment</li> <li>• Calibration of equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Phipit Khlaisombat- Group Engineer</li> <li>• Thongchai Posew- CDM Biogas Manager/QC Manager</li> <li>• Bridget McIntosh- Carbon Bridge</li> <li>• Ninrapat Promrit- CDM Biogas Supervisor</li> </ul>

## 2.3 Assessment

Means of verification used:

- Review of project documentation.
- On-site inspection, including review of performance records, interviews with plant engineer, supervisor and shift leader, collection of measurements and confirming all data sources and constants used in the monitoring report.
- Review of monitoring results and verification of the correct application of monitoring methodologies.
- Determination of the accuracy of the GHG emission reduction calculations.

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

## 2.4 Reporting of Findings

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

A CAR may be raised if

- the verification is not able to obtain sufficient evidence for the reported emission reductions or part of the reported emission reductions. In this case these emission reductions shall not be verified and certified; or
- the verification has identified material misstatements in the reported emission reductions. Emission reductions with material misstatements shall be discounted based on the verifiers ex-post determination of the achieved emission reductions.

The verification process may be halted until corrective actions have been carried out and made available to the auditor's satisfaction.

A Forward Action Requests (FAR) should be issued, where:

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

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

## **3 VERIFICATION FINDINGS**

During this verification, 5 CARs and 17 CLs were raised after the on-site audit carried out on 25<sup>th</sup> and 26<sup>th</sup> April 2011. Details of the findings are listed in the verification protocol as per Annex 1.

### **3.1 Remaining Issues, CARs, FARs from Previous Validation or Verification**

This is the first verification for the project activity. No FAR was raised during the validation stage by the validator. However, during the registration with GS, a Forward Action Request from Gold Standard (13/07/2009) was raised on the following:

“On page 17 of the validation report it is mentioned that on-site interviews took place. However, no follow-up interviews with local stakeholders were conducted by the DOE during this site visit. Please, during the first Verification site visit make sure the DOE selects a few local inhabitants, local NGOs and/or local officials to verify that comments and concerns raised during the ISC and MSC have been duly taken into account”. This finding was followed up and reported under

the GS monitoring requirements in Section 3.3. Based on the action taken, the FAR can be closed.

### 3.2 Project Implementation

The project has been implemented as described in the PDD<sup>/1/</sup> and monitored in accordance with the monitoring plan and methodology. The project activity involves construction of a covered lagoon anaerobic reactor with a biogas capture system. The CIGAR is a 46,000 m<sup>3</sup> lagoon covered with thick HDPE sheets. The biogas from the covered anaerobic reactor is captured, treated and used in two units of 952 kW capacity Guascor-brand biogas engines.. The first unit of the biogas engine was commissioned in January 2008 while the second unit was commissioned in April 2009 (not within the monitoring period). The generated electricity is sold to PEA and is also used on-site when the existing biomass boiler is not in operation. The excess biogas is combusted in an open flare system.

### 3.3 Completeness of Monitoring

Following are the parameters required to be monitored by the monitoring plan<sup>/1/</sup> and the method of which the verification of the parameters was carried out by the verification team:

ID No. :	1
Data/parameter:	$Q_{y,wwinput}$
Data unit:	m <sup>3</sup> /year
Description:	POME flows entering system boundary
Source of data used:	Measured using an on-line magnetic flow meter
Means of verification :	<p>Measured using Kobold magnetic flow meter identified as FI02 (S/N. A0738372). The flow meter is located at the inlet pipe to the CIGAR. The flow meter is with digital indicator with totalized volume (m<sup>3</sup>) and flow rate (m<sup>3</sup>/h) displayed on the panel. The flow meter is linked to a data logger which captures and records data once in every hour.</p> <p>Data from the data logger which is in *.FDT format was viewed using the data logger software i.e. Data Viewer, before being converted into spread sheet *.CSV format<sup>/42/</sup>. The conversion of the data was carried out by the Biogas Plant Supervisor. Data from this *.CSV file was then copied and pasted into the reporting file on a daily basis.</p> <p>Daily cumulative reading was also recorded in CIGAR Report Form LBP005 manually by the operator. The current day's reading minus the previous day's reading gives the total reading of the POME input for previous day. These data are used as back up in case there is problem in the data logger. Manually recorded data from LBP005 was used during the period from 13/3/08 to 7/4/08 as the data logger was not functioning properly. No data transfer error was found.</p>

ID No. :	2a
Data/parameter:	$Q_{y,wwout}$
Data unit:	$m^3/year$
Description:	POME flows leaving project treatment facility
Source of data used:	Measured using an on-line magnetic flow meter
Means of verification :	<p>Measured using Kobold magnetic flow meter identified as FI40. The flow meter is located at the outlet pipe of the CIGAR. Data from FI40 gives an in-situ flow rate reading as well as a totalizer reading. The flow meter is with digital indicator that provides totalized volume (<math>m^3</math>) and flow rate (<math>m^3/h</math>) displayed on the panel. The flow meter is linked to a data logger which captured and recorded data once in every hour.</p> <p>Data from the data logger which is in *.FDT format was viewed using the data logger software i.e. Data Viewer, before being converted into spread sheet *.CSV format<sup>/42/</sup>. The conversion of the data was carried out by the Biogas Plant Supervisor. Data from this *.CSV file was then copied and pasted into the reporting file on a daily basis.</p> <p>Daily cumulative volume was also manually recorded in the CIGAR report form LBP005 by the operator. During the beginning of the monitoring period,i.e. from 13/3/08 to 7/4/08, data from LBP005 was used as the data logger was not functioning properly. No data transfer error was found.</p>

ID No. :	2b.
Data/parameter:	$Q_{y,wwrecycle}$
Data unit:	$m^3/year$
Description:	POME flows leaving project treatment facility and being recycled back to digester
Source of data used:	Measured using an on-line magnetic flow meter
Means of verification :	<p>Measured using Kobold magnetic flow meter identified as FI38. The flow meter is located at the outlet pipe of the settling pond that is connected to the mixing tank. Data from FI38 gives an in-situ flow rate reading as well as a totalizer reading. The flow meter is linked to a data logger which captured and recorded data once in every hour.</p> <p>Data from the data logger which is in *.FDT format was viewed using the data logger software i.e. Data Viewer before being converted into spread sheet *.CSV format<sup>/42/</sup>. The conversion of the data was carried out by the Biogas Plant Supervisor. Data from this *.CSV file was then copied and pasted into the reporting file on a daily basis.</p> <p>Daily cumulative volume was also manually recorded in CIGAR</p>

	<p>report form LBP005 by the operator. During the beginning of the monitoring period, i.e. from 13/3/08 to 7/4/08, data from LBP005 was used as the data logger was not functioning properly. No data transfer error was found.</p> <p>During the verification, CL2 was raised as in the spreadsheet the data from FI38 was labelled as WW<sub>output</sub> instead of WW<sub>recycle</sub> and 2(a) instead of 2(b) (i.e. column C of the spreadsheet should be for 2(b)). Detail of the findings and resolutions are as in Table 2 of Annex 1 of this report.</p>
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ID No. :	3
Data/parameter:	COD <sub>y,wwin</sub>
Data unit:	kgCOD/m <sup>3</sup>
Description:	POME organic material concentration entering project boundary
Source of data used:	Laboratory analysis
Means of verification :	<p>COD sampling and analysis were carried out daily in accordance with the methodology and PDD. Daily analysis was carried out by the in-house laboratory using the standard bar-coded vials of the spectrophotometer (S/N: 1218955). A standard operating procedure (SOP) was established to guide the laboratory technician in carrying out the analysis. The SOP was found to be in accordance with the HACH method. Daily analysis results were recorded in LBP003 Wastewater Analysis Report form. The sampling point was checked and it was confirmed that samples are taken after the screen in the mixing tank.</p> <p>External analysis was carried out by the accredited laboratories, Saint Envir Co. Ltd. and Sritrang Management Science Co. Ltd. No frequency is indicated in the PDD. However, the PP had indicated in the Monitoring Report that it was to be carried out on a weekly basis.</p> <p>In the ER spreadsheet, data from the external lab analysis was included and labelled as external data. During the day where external lab analysis result was available, the data from the external lab is used in the spreadsheet.</p> <p>During the verification, CAR 1 was raised on the requirements for external lab analysis, and CL 8 on some COD values indicated in the ER spreadsheets. Details of the findings and the resolutions are as in Table 2 of Annex 1 of this report.</p>

ID No. :	4
Data/parameter:	COD <sub>y,wwout</sub>
Data unit:	kgCOD/m <sup>3</sup>
Description:	POME organic material concentration leaving project boundary

Source of data used:	Laboratory analysis
Means of verification :	<p>COD sampling and analysis were carried out daily in accordance with the methodology and PDD. Daily analysis was carried out by the in-house laboratory using the standard bar-coded vials of the spectrophotometer (S/N: 1218955). A standard operating procedure (SOP) was established to guide the laboratory technician to carry out the analysis. The SOP was found to be in accordance with the HACH method. Daily analysis results were recorded in LBP003 Wastewater Analysis Report form.</p> <p>External analysis was carried out by the accredited laboratories, Saint Envir Co. Ltd. and Sritrang Management Science Co. Ltd. No frequency is indicated in the PDD. However, the PP had indicated in the Monitoring Report that it was to be carried out on a weekly basis.</p> <p>In the ER spreadsheet, data from the external lab analysis was included and labelled as external data. On the days when the result from the external lab analysis was available, the data from the external lab was used</p> <p>During the verification, CAR 1 was raised on the requirements for external lab analysis, CL 3 on the sampling point reported in the Monitoring Report and CL 4 on some COD values indicated in the ER spreadsheets, Details of the findings and the resolutions is as in Table 2 of Annex 1 of this report.</p>

ID No. :	5
Data/parameter:	EL <sub>generate</sub>
Data unit:	MWh
Description:	Electricity generated from the biogas collected in the anaerobic treatment facility and consumed on site or sent the grid
Source of data used:	Measured using power meter(M1)
Means of verification :	<p>The electricity generated from the biogas engine is measured using a power meter identified by the PP as M1. The power meter provides the total cumulative kWh reading. Data from the meter was recorded daily by the Biogas Plant Operators and recorded in the Genset Data Report Logsheet (LBP004).</p> <p>The net electricity generated was calculated as the total electricity generated by the biogas engines minus the amount of electricity used by the biogas plant. The formula in the spreadsheet was confirmed to be accurate.</p>

ID No. :	5b.
Data/parameter:	EL <sub>projectused</sub>

Data unit:	MWh
Description:	Electricity generated by the biogas engine used to operate the biogas plant
Source of data used:	Measured using power meter(M4)
Means of verification :	<p>The electricity used by the biogas plant is measured using power meter identified by PP as M4. M4 monitors electricity from both PEA and biogas engines. The cumulative kWh reading in the power meter was recorded in the Genset Data Report form (LBP004) by the technician on a daily basis. The current day's reading minus the previous day's reading gives the final consumption of electricity for the previous day. The final kWh reading was checked and transferred into the spreadsheets by the Biogas Plant Supervisor.</p> <p>During the verification, CL5 was raised on the reporting of this parameter in the Monitoring Report and spreadsheet. Details of the findings and the resolutions is as in Table 2 of Annex 1 of this report.</p> <p>It was noted that the PEA meter is located at the gate to the factory, which is about 532m from the internal power meters connected by distribution line. Therefore, distribution losses are negligible. In addition, part of the electricity produced by the biogas plant is supplied to the Lamthap Palm Oil Factory which would otherwise have been imported from the grid. The same distribution losses were not accounted as 'gains' of emission reductions, despite the fact they are negligible.</p>

ID No. :	6a.
Data/parameter:	$Q_{\text{biogas, flare}}$
Data unit:	Nm <sup>3</sup> biogas
Description:	Volume of biogas sent to flare
Source of data used:	Measured using flow meter
Means of verification :	<p>The amount of biogas flared is measured using Kobold oscillator flow meter (identified as F163), installed on the biogas pipeline prior to the open flare system. The flow meter is linked to a data logger. At the same pipeline, a pressure transducer and temperature sensor are also installed. With the P and T measurement of the biogas, the flow meter reading is converted automatically to the normalised value (Nm<sup>3</sup>) by the data logger. The supplier of the flow meter (ST Control Co. Ltd.), who set up the equipment provided a summary of the equipment setting and how the flow computer algorithm calculates the value in Nm<sup>3</sup>. The algorithm provided was confirmed to be in accordance</p>

	<p>with the standard formula used in the calculation for normalisation of gas volume.</p> <p>During the verification, CAR 2 was raised on the data presented in the spreadsheet. Details of the findings and the resolutions are as in Table 2 of Annex 1 of this report.</p>
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ID No. :	6b.
Data/parameter:	$FVRG_h$
Data unit:	$Nm^3/h$
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h. Normalised to take into account pressure and temperature. To calculate project emissions from flare.
Source of data used:	Measured using flow meter
Means of verification :	<p>The amount of biogas flared is measured using Kobold oscillator flow meter (identified as F163), installed on the biogas pipeline prior to the open flare system. The flow meter is linked to a data logger. At the same pipeline, a pressure transducer and temperature sensor are also installed. With the P and T measurement of the biogas, the flow meter reading is converted automatically to the normalised value (<math>Nm^3</math>) by the data logger. The supplier of the flow meter (ST Control Co. Ltd.), who set up the equipment provided a summary of the equipment setting and how flow the computer algorithm calculates the value in <math>Nm^3</math>. The algorithm provided was confirmed to be in accordance with the standard formula used in the calculation for normalisation of gas volume.</p> <p>During the verification, CAR 2 was raised on the data presented in the spreadsheet. Details of the findings and the resolutions are as in Table 2 of Annex 1 of this report.</p>

ID No. :	7.
Data/parameter:	$Q_{biogas\_engine}$
Data unit:	$Nm^3$ biogas
Description:	Biogas sent to generator sets and used for electricity generation
Source of data used:	Measured using flow meter
Means of verification :	<p>The amount of biogas combusted in the engine is measured using Kobold oscillator flow meter (identified as F164), installed on the biogas supply pipeline to the engine. This flow meter was installed with a pressure transducer and temperature sensor for automatic conversion of reading into <math>Nm^3</math> by data logger. Digital indicator with totalized volume (<math>m^3</math>) and flow rate (<math>m^3/h</math>) was displayed on the panel. The flow meter was linked to a dedicated data logger which captured and recorded data once in every hour. The supplier of the flow meter (ST Control Co. Ltd.), who set up the equipment provided a summary of the equipment setting and how the flow computer algorithm</p>

	<p>calculates the value in Nm<sup>3</sup>. The algorithm provided was confirmed to be in accordance with the standard formula used in the calculation for normalisation of gas volume.</p> <p>Data from the data logger which is in *.FDT format was viewed using the data logger software, i.e. Data Viewer before being converted into spreadsheet *.CSV format<sup>43/</sup>. The conversion of the data is carried out by the Biogas Plant Supervisor. Data from this *.CSV file was then copied and pasted into the reporting file daily by the Biogas Plant Supervisor.</p> <p>Manual recording of the data was also carried out by the technician and recorded on LBP004 on an hourly basis.</p> <p>During the verification, CL 9 was raised on some of the values indicated in the spreadsheet. Details of the findings and the resolutions are as in Table 2 of Annex 1 of this report.</p>
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ID No. :	8.
Data/parameter:	CH <sub>4</sub>
Data unit:	%
Description:	Biogas methane concentration
Source of data used:	Measured using methane gas analyser
Means of verification :	<p>The fraction of methane was measured using an on line gas analyser which was installed at the biogas plant. During this monitoring period two gas analyzers were used. The first was an infrared spectrometry gas analyser with S/N 25791 which was later replaced by a second meter JE Gas Sensor with S/N. 28652, which was installed on 21/1/2009. The analysers were linked to a data logger which captured and recorded data every minute. Manual readings were also taken by the technician and recorded in LBP005 CIGAR Report form on an hourly basis. Data from the data logger was downloaded into the 'Methane tool spreadsheet' using dedicated software.</p> <p>It was noted that the first analyser had been faulty since 2/1/09 and was removed for repair on 6/1/09. During the period from 2/1/09 to 21/1/09, data from the portable gas analyser was used. Four analyses were carried out by the Biogas Supervisor daily and the average of the values was used in the spreadsheet. The use of manual sampling was not indicated in the 'Methane Tool VER PE' 2009. It was only indicated in the 'VER ER calculation spreadsheet'. This issue was raised as CL 10. Detailed responses to the findings are as in Table 2 of Annex 1 of this report.</p> <p>During the verification, a CAR (CAR 4) was also raised for some of the data used in the spreadsheets. Details of the findings and the resolutions are as in Table 2 of Annex 1 of this report.</p>

ID No. :	9
Data/parameter:	Project emissions from flaring of the residual gas stream
Data unit:	tCO <sub>2</sub>
Description:	Project emissions from flaring of the residual gas stream
Source of data used:	Measured/Calculated
Means of verification :	<p>In accordance with the 'Tool to determine project emissions from flaring gases containing methane' this parameter was calculated based on the measured biogas flow to flare system and the methane concentration. Default value for open flare combustion efficiency of 50% or 0% was applied depending on the flame detector signal.</p> <p>A separate spreadsheet 'Methane tool PE' was established. Review of the 2008 spreadsheet it was unclear how the determination of flare efficiency of 50% was made when there was no data on every minute or hourly to determine the operational of the system meeting the 20minutes requirement. CAR 3 was raised on this issue. Also during the period when the flowrate data to the flare was incomplete, the theoretically most conservative value possible was applied to the flare tool and the AM0022 version 4 conservativeness check calculation. This was considered reasonable considering this concept is accepted by the CDM EB for the CDM verification period in the first CER issuance.</p> <p>Detailed responses to the findings are as in Table 2 of Annex 1 of this report</p>

ID No. :	10.
Data/parameter:	Amount of chemical oxidizing agents entering /leaving system boundary
Data unit:	mg/L
Description:	Measurement of the presence of sulfates in the POME
Source of data used:	Laboratory analysis
Means of verification :	<p>According to the PDD, this parameter is to be analysed on a quarterly basis by an external laboratory. PP had appointed an external accredited laboratory Saint Envir Co. Ltd. (Bangkok) to carry out the analysis. During this monitoring period six (6) samples from the POME inlet and outlet of the CIGAR (i.e. the same sampling point as the COD of POME to and from CIGAR) were sent to the laboratory for analysis. However, the frequency of the analysis at the beginning was not carried out on a quarterly basis. CL 6 was raised on this issue. Details of the findings and the resolutions are as in Table 2 of Annex 1 of this report.</p>

ID No. :	11
Data/parameter:	Gen set combustion efficiency
Data unit:	%
Description:	Gen set combustion efficiency
Source of data used:	Testing by external laboratory
Means of verification :	According to the monitoring plan in the registered PDD, this parameter is to be tested on an annual basis by an external laboratory. During this monitoring period, the testing was carried out by Environment Research & Technology Company Limited on 25/3/09. The test measured the % of CH <sub>4</sub> in the exhaust gas from the biogas engines stack using the USEPA standards. The result was included in the Annual Parameter Report form (LBP010) and used in the calculation of the project emission.

ID No. :	12
Data/parameter:	$Q_{y,wwbypass}$
Data unit:	m <sup>3</sup> /year
Description:	Flow of POME directly to the current water treatment system, and bypassing the new POME treatment facility
Source of data used:	Measured using flow meter
Means of verification :	<p>Measured using Kobold magnetic flow meter identified as FI01. The flow meter is located at the bypass pipe out from the fat trap that pumped the POME directly to the current wastewater treatment system (i.e. by passing the new POME treatment facility). This process is only carried out if there is plant upset in the CIGAR.</p> <p>The flow meter is with digital indicator which provides totalized volume (m<sup>3</sup>) and flow rate (m<sup>3</sup>/h) displayed on the panel. The flow meter is linked to a data logger which captured and recorded data once in every hour.</p> <p>Data from the data logger which is in *.FDT format was viewed using the data logger software, i.e. Data Viewer before being converted into spread sheet *.CSV format<sup>42/</sup>. The conversion of the data is carried out by the Biogas Plant Supervisor. Data from this *.CSV file was then copied and pasted into the reporting file daily by him.</p> <p>Daily cumulative volume was also manually recorded in CIGAR Report Form LBP005 by the operator. During the period from 13/3/08 to 7/4/08, manually recorded data from LBP005 was used as the data logger was not functioning properly. No data transfer error was found.</p>

ID No. :	13
Data/parameter:	Loss of biogas from pipeline
Data unit:	%
Description:	Loss of biogas from pipeline
Source of data used:	Pipeline leak test report
Means of verification :	<p>The integrity of biogas pipeline was carried out by pressurizing the pipeline and measuring the pressure drop. According to the monitoring plan in the PDD, this parameter is to be tested annually.</p> <p>During this monitoring period, the pressure drop test was carried out during the plant shutdown on 4/2/2009 by the Biogas Plant Supervisor. The test reported no leak in the pipeline. Result of the test was recorded in the Annual Parameter Report (LBP010).</p>

ID No. :	14
Data/parameter:	COD <sub>removed</sub>
Data unit:	tCOD
Description:	Organic material removed from POME facility
Source of data used:	Quarterly Reports
Means of verification :	<p>The monitoring plan stated that the COD test will be carried out after any screening of the POME, which was confirmed through the Quarterly Monitoring Parameters Report (LBP009)<sup>49/</sup> and also through interview of the technician involved in taking the samples. It was demonstrated that the samples were taken after the screening process at the mixing tank. Therefore, the value of this parameter was taken as zero as no organic material was removed in this situation.</p>

ID No. :	15
Data/parameter:	Other flare operation parameters – flame detector
Data unit:	On – Off
Description:	Flame on or off detector
Source of data used:	Data logger
Means of verification :	<p>The open flare system is equipped with a flame ionization detector which gives a signal to the data logger when the flame is detected. The data logger records the signal once in every minute. If no flame is detected, the data logger records as '0V' and with flame as '5V'.</p> <p>The flame detector is linked to data logger that captured and recorded data on every minute. The records data in *.PRJ format (graphical chart) was viewed using dedicated software i.e. Historical Viewer before converted into spread sheet *.CSV format<sup>43/</sup>. Data in this *.CSV file then copied and pasted into the reporting file daily by the Biogas Plant Supervisor.</p> <p>During the verification, CL 7 was raised to clarify on how the</p>

	QA/QC procedure being implemented in 2008 period. Detail of the findings and resolutions is as in Table 2 of Annex 1 of this report.
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ID No. :	16
Data/parameter:	Pressure of biogas sent to flare
Data unit:	mBar
Description:	Pressure of biogas sent to flare
Source of data used:	Measured continuously using a pressure gauge
Means of verification :	<p>Measured using pressure gauge (S/N AFF223M). The meter is connected to data logger that be used in the conversion of the flow to Nm<sup>3</sup>.</p> <p>The pressure reading was also checked on a quarterly basis and recorded in the Quarterly Monitoring Parameters Report (LBP009) to ensure that it is within the specified range of 10-100 mBar. From the report, it was confirmed that the pressure was operating at the specified range.</p>

ID No. :	17
Data/parameter:	Proportion of methane emitted from covered lagoon
Data unit:	m <sup>3</sup> biogas leaked/m <sup>3</sup> biogas produced.
Description:	Proportion of methane emitted from covered lagoon
Source of data used:	Portable gas detector
Means of verification :	<p>This was measured using a portable gas detector JE S/N. BM11014/08) on daily basis by the Biogas Plant Supervisor in the area surrounding the covered lagoon. The daily check was recorded in the Safety Review Walkthrough Checklist which then summarised into the Quarterly Monitoring Parameter Report (LBP009). The meter only detects the occurrence of the leak. During this monitoring period, it was reported that there were 3 occurrences of the detection and actions had been immediately taken to rectify the problem in each instance. This was evident as the following day's results showed no detection.</p> <p>Data from this daily monitoring was included in the ER spreadsheet. However, for the purpose of ER calculation, PP had applied equation 30 of ACM0014 which was found to be more conservative as it used the default factor.</p>

### Gold Standard Monitoring Parameters

ID No. :	1.
Data/parameter:	No. of new jobs created - 5
Data unit:	No. of new jobs
Description:	-
Means of verification :	Since the beginning of the project, 5 new staff (1 Biogas Supervisor and 4 technicians) have been recruited to operate

	and maintain the biogas plant. This was verified from the appointment letter, latest payroll <sup>/52/</sup> of the staff and through interview of the staff.
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ID No. :	2
Data/parameter:	Safety Review of biogas plant on quarterly basis
Data unit:	-
Description:	Safety Review of biogas plant on quarterly basis <sup>/50/51/</sup> sighting at least the following: <ul style="list-style-type: none"> <li>• Leaks or cracks in pipes and joints</li> <li>• Leaks or cracks in the CIGAR cover</li> <li>• Equipment in the engine room with potential to produce sparks</li> <li>• Sufficient ventilation in engine room</li> <li>• Potential for sparks in any of the pumps or blowers</li> </ul>
Means of verification :	Carried out on quarterly basis. These criteria have been included in the Quarterly Parameter report. The filled reports were checked and found that the inspection was carried out according to the requirements by the biogas plant supervisor.

ID No. :	3
Data/parameter:	New legislation mandating biogas plants.
Data unit:	-
Description:	-
Means of verification :	Confirmation from the Deputy Executive Director, Thailand Greenhouse Gas Management Organization dated 9 May 2011 has been obtained. It was confirmed that since March 2008 there is no new legislation development that mandate methane recovery from wastewater treatment for agro-processing plants in Thailand <sup>/55/</sup> .

ID No. :	4
Data/parameter:	Odour reduction
Data unit:	-
Description:	Interview with the surrounding stakeholders.
Means of verification :	Interview with the following stakeholders were carried out during the on-site verification. <ul style="list-style-type: none"> <li>i) Mr.Phool Chaibury* – Local Councillor</li> <li>ii) Mr. Nukon Srichoo* – Lamthap Subdistrict Representative</li> <li>iii) Mr.Chalong Saengmanee* – Lamphthap Mill worker</li> </ul>

	<p>iv) Mr.Pitaya Tawisuwan - villager</p> <p>The stakeholders have confirmed that since the implementation of the project , the odour from the factory had reduced. A visit to the surrounding villages was carried out in the evening (after heavy rain). The verifiers confirmed that there was no bad smell from the factory in the surrounding villages.</p> <p>Note: * participated in the local stakeholder consultation process.</p>
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ID No. :	5
Data/parameter:	Minimum 65% of biogas used for energy purposes
Data unit:	%
Description:	-
Means of verification :	From the ER spreadsheet and MR, the amount of biogas flared is 910,510.49 Nm <sup>3</sup> and the amount of biogas sent to the gas engine is 2,855,806.71Nm <sup>3</sup> . Hence, the total amount of biogas captured is 3,766,317.20 Nm <sup>3</sup> . Therefore, the amount of biogas used for energy purpose = 76%, which is more than the stipulated target of 65%.

ID No. :	6
Data/parameter:	Land for oil palm expansion
Data unit:	-
Description:	-
Means of verification :	<p>A letter from Krabi Agriculture Office dated 28 March 2011<sup>56/</sup>, confirmed that the sources of land for new oil palm in year 2009 to 2010 are from land that were previously planted with the coffee, fruit orchards and coconut trees, and empty land (ex-paddy and prawn farms). No forest had been cleared for the expansion of oil palm plantations. This is in addition to documentation provided for 2008 (already uploaded to Gold Standard Registry from previous Verification) also from official source as Krabi Agricultural office, indicates that the source of land for new oil palm is not increasing pressure on primary forests.</p> <p>During the verification, this letter was not made available to the verification team (CL 17 was raised). Details of findings and resolutions is as in Table 2 of Annex 1 of this report.</p>

ID No. :	7
Data/parameter:	Status of RSPO
Data unit:	-

Description:	-
Means of verification :	Confirmation from the RSPO Secretary General on the acceptance as a member in the RSPO was verified. The status is also reflected in the RSPO website. Interview with the Managing Director of Univanich confirmed that Univanich had participated in major meetings of the RSPO.

In addition to the GS monitoring parameters, PP had also included the 'changes to the key sustainable development indicators' in Section 5 of the Monitoring Report. The information for each indicator had been checked and verified. It can be confirmed that the information provided in the report correct and that there are no changes in the score of these indicators. Further to that, the previous verification (i.e. 1 February 2009 to 31 March 2009) which has been verified and certified by SGS and Gold Standard, confirmed that there was no change in score up to March 2009.

### 3.4 Accuracy of Emission Reduction Calculations

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

- i) Data recorded from meters installed in the plant
- ii) Default values determined during the validation period
- iii) Data provided by internal and third party laboratory

The data recorded from the meters installed in the plant were as follows:

Parameter	Equipment	Unit
$Q_{y,wwinput}$	Magnetic flow meter	m <sup>3</sup> /year
$Q_{y,wwout}$	Magnetic flow meter	m <sup>3</sup> /year
$Q_{y,wwrecycle}$	Magnetic flow meter	m <sup>3</sup> /year
$EL_{generate}$	Electricity meter	MWh
$EL_{projectused}$	Electricity meter	MWh
$Q_{biogas, flare}$	Biogas flow meter	Nm <sup>3</sup>
$FVRG_h$	Biogas flow meter	Nm <sup>3</sup> /h
$Q_{biogas, engine}$	Biogas flow meter	Nm <sup>3</sup>
CH <sub>4</sub> concentration	Gas analyzer	%
$Q_{y,wwbypass}$	Magnetic flow meter	m <sup>3</sup> /year
Flare flame on-off	Flame detector	On-Off
Biogas flare pressure	Pressure gauge	mBar

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

Parameter	Value	Unit	Remarks
EF <sub>CH<sub>4</sub></sub>	0.21	kg CH <sub>4</sub> /kg POME	PDD page 21
R <sub>lagoon</sub>	97 (year 1 to 3) 86 (year 4 to 10)	%	PDD page 22
R <sub>deposition</sub>	5	%	AM0022 Version 4
Surface Oxidation Rate	254	kgCOD/hectare	AM0022 Version 4
CEF	0.5098	tCO <sub>2</sub> /MWh	PDD page 23
η <sub>flare,h</sub>	50 or 0	%	PDD page 23
ρ <sub>CH<sub>4</sub></sub>	0.716	kg CH <sub>4</sub> /Nm <sup>3</sup> biogas	PDD page 24

As for the data from the internal laboratory analysis and third party laboratory report, the summary of the parameters is as follows:

Parameter	Value	Unit	Remarks
COD <sub>y,wwin</sub>	As in Excel spreadsheet	kgCOD/m <sup>3</sup>	<ul style="list-style-type: none"> <li>Internal Wastewater Analysis Report</li> <li>Third party laboratory report</li> </ul>
COD <sub>y,wwout</sub>	As in Excel spreadsheet	kgCOD/m <sup>3</sup>	<ul style="list-style-type: none"> <li>Internal wastewater Analysis Report</li> <li>Third party laboratory report</li> </ul>
Gen set combustion efficiency	As in Excel spreadsheet	%	<ul style="list-style-type: none"> <li>Third party test report</li> </ul>
SO <sub>4</sub> at the POME	As in Excel spreadsheet	mg/L	<ul style="list-style-type: none"> <li>Third party laboratory report</li> </ul>
Loss of biogas from pipeline	As in Excel spreadsheet	%	<ul style="list-style-type: none"> <li>Annual Parameter Report (LBP010).</li> </ul>
Proportion of methane emitted from covered lagoon	As in Excel spreadsheet	-	<ul style="list-style-type: none"> <li>Safety Review Walkthrough Checklist</li> </ul>

The formulae used in the emission reductions calculation spreadsheet to calculate the emission reductions were also verified and found to be in accordance to that in the PDD. The emissions in the project and the baseline scenario were correctly calculated. The following table summarizes the calculation of the emission reductions:

Monitoring period	13/3/2008 to 31/1/2008	01/1/2009 to 31/1/2009
Total baseline emissions $E_{BL}$ = total fugitive methane emissions from lagoons in the baseline, $E_{BL\_CH4\_lagoons}$	45,059 tCO <sub>2</sub> e	2,925 tCO <sub>2</sub> e
Total project emissions $E_{PA}$ = sum of the methane emissions from lagoons project emissions, the emissions resulting from incomplete combustion ( $PE_{flare}$ ) and emissions from grid electricity ( $PE_{EC,Y}$ ).	12,414 tCO <sub>2</sub> e	621 tCO <sub>2</sub> e
Total emission reductions (using equation (12) of AM0022) $ER = E_{BL} - E_{PA}$	32,645 tCO <sub>2</sub> e	2,304 tCO <sub>2</sub> e
Conservativeness check using equation 13 of AM0022  $E_{conservativeness} = E_{CH4\_lagoons\_BL} - (E_{CH4lagoon} + E_{CH4\_nawtf} + E_{CH4\_coll})$ In accordance with AM0022, if the difference is positive, it has to be deducted from the result obtained from equation 12)	5,186 tCO <sub>2</sub> e	-370 tCO <sub>2</sub> e
Total emission reductions for the period (after application of equation 13)	27,460 tCO <sub>2</sub> e	2,304 tCO <sub>2</sub> e

### 3.5 Quality of Evidence to Determine Emission Reductions

No.	Monitoring and measuring equipment	Equipment no.	Calibration date	Frequency of calibration	Remarks
1	Liquid Flowmeter (FI02) for monitoring ID No. 1 : $Q_{y,wwinput}$	A0738372	28/8/2007 (Factory calibrated <sup>/11/</sup> )	Once every 2 years	<ul style="list-style-type: none"> <li>Kobold Magnetic flow meter with accuracy class of <math>\pm 0.3\%</math> was verified installed at site</li> <li>Equipment was installed on 13/03/2008</li> <li>Calibration cycle was as per manufacturer's recommendation<sup>/22/</sup></li> <li>Preventive maintenance carried out periodically by ST</li> </ul>

					Control Co. Ltd. <sup>/23/</sup>
2	Liquid Flowmeter (FI40) for monitoring ID.2a : $Q_{y,wwout}$	A0723936	28/8/2007 (Factory calibrated <sup>/17/</sup> )	Once every 2 years	<ul style="list-style-type: none"> <li>• Kobold Magnetic flow meter with accuracy class of <math>\pm 0.3\%</math> was verified installed at site.</li> <li>• Equipment was installed on 13/03/08</li> <li>• Calibration cycle was as per manufacturer's recommendation <sup>/22/</sup></li> <li>• Preventive maintenance carried out periodically by ST Control Co. Ltd. <sup>/23/</sup></li> </ul>
3.	Liquid Flowmeter (FI38) for monitoring ID 2b.: $Q_{y,wwrecycle}$	A0737740	28/8/2007 (Factory calibration <sup>/15/</sup> )	Once every 2 years	<ul style="list-style-type: none"> <li>• Kobold Magnetic flow meter with accuracy class of <math>\pm 0.3\%</math> was verified installed at site.</li> <li>• Equipment was installed on 6/10/2008</li> <li>• Calibration cycle was as per manufacturer's recommendation <sup>/22/</sup></li> <li>• Preventive maintenance carried out periodically by ST Control Co. Ltd. <sup>/23/</sup></li> </ul>
4.	Spectrophotometer for monitoring ID.3 : $COD_{y,wwin}$ & ID.4: $COD_{y,wwout}$	HACH DR2800 1218955	29/5/2009	1 year	<ul style="list-style-type: none"> <li>• Spectrophotometer brand Hach DR2800 being used for on site COD analysis.</li> <li>• Manufacturer's (HACH) certificate of conformance dated 1 April 2009 confirmed that the delivered equipment had been calibrated</li> </ul>

					<p>prior to supply to site</p> <ul style="list-style-type: none"> <li>• Calibration on 29/05/2009<sup>27/</sup> was carried out by the Envi Science Co. Ltd.</li> <li>• Calibration frequency was not specified by the manufacturer so PP ensured calibration once a year</li> </ul>
5.	Power meter (M1) for monitoring ID. 5: EL <sub>generate</sub>	BH011002 5000N/ BG339002 2100P	12/12/2009	1 year	<ul style="list-style-type: none"> <li>• The power meter was installed on 31/1/08.</li> <li>• There was no initial calibration certificate prior to installation.</li> <li>• The calibration was only carried out on 12/12/2009 by the Thailand Provincial Electricity Authority (PEA).</li> <li>• During this monitoring period PP had applied the EB52 Annex 60 due to the non-compliance to the calibration requirement.</li> <li>• The manufacturer did not specify the calibration frequency. PP had initially indicated in the Monitoring Report that the calibration frequency is 2 years, following the PEA practices. However, there was no supporting document to</li> </ul>

					support this. (Refer to CL 12). In response to the finding, the calibration frequency was changed to once a year.
6.	Power meter (M4) for monitoring ID. 5b: EL <sub>projectused</sub>	0068001327	12/12/2009	1 year	<ul style="list-style-type: none"> <li>• The power meter model and maker PowerLogic PM700 by Schneider Electric with accuracy class of <math>\pm 1.0\%</math>.</li> <li>• The meter was installed on 14/11/2007</li> <li>• There was no initial calibration certificate prior to installation.</li> <li>• The calibration was only carried out on 12/12/2009 by the Thailand Provincial Electricity Authority (PEA).</li> <li>• During this monitoring period PP had applied the EB52 Annex 60 requirements for the non-compliance with the calibration issue</li> <li>• The manufacturer did not specify the calibration frequency. PP had initially indicated in the Monitoring Report that the calibration frequency is 2 years, following the PEA practices. However, there was no supporting</li> </ul>

					document to support this. (Refer to CL 12). In response to the finding, the calibration frequency was changed to once a year.
7.	Gas flowmeter (FI63) for monitoring ID. 6a : Q <sub>biogas, flare</sub>	5329/4350	26/9/2007 (Factory calibration <sup>/19/</sup> )	Once every 3 years	<ul style="list-style-type: none"> <li>• Kobold Fluidic Oscillator flow meter with accuracy class of <math>\pm 1.5\%</math> was verified installed at site.</li> <li>• Calibration cycle was as per manufacturer's recommendation<sup>/22/</sup>.</li> <li>• Equipment was installed on 15/01/2008</li> <li>• Preventive maintenance was carried out periodically by ST Control Co. Ltd.<sup>/23/</sup></li> </ul>
8.	Gas flowmeter (FI64) for monitoring ID. 6b.: Q <sub>biogas, engine</sub>	5331/4352	26/9/2007 (Factory calibration <sup>/20/</sup> )	Once every 3 years	<ul style="list-style-type: none"> <li>• Kobold Fluidic Oscillator flow meter with accuracy class of <math>\pm 1.5\%</math> was verified installed at site.</li> <li>• Calibration cycle was once in every 3 years as per manufacturer's recommendation<sup>/22/</sup>.</li> <li>• Equipment was installed on 15/01/2008</li> <li>• Preventive maintenance was carried out periodically by ST Control Co. Ltd.<sup>/23/</sup></li> <li>•</li> </ul>

9.	Gas Analyzer for monitoring ID.8: % CH <sub>4</sub>	25791 <i>Note: in operation until 6/1/09</i>	15/04/08	1 year	<ul style="list-style-type: none"> <li>• The analyser was installed on 21/2/2008 and in operation until 6/1/09.</li> <li>• The gas analyser was calibrated on 15/4/2008. Initially, this meter was not included in the Monitoring Report. (refer to CL 13)</li> <li>• No recommendation from manufacturer on the calibration frequency but PP had decided to calibrate once a year</li> <li>• The meter was removed on 6/1/2009. During this period data from the portable gas analyser was used.</li> </ul>
		28652 <i>Note: in operation from 21/1/09</i>	15/01/09	1 year	<ul style="list-style-type: none"> <li>• JE Gas Sensor model 0-100% with accuracy range of +/- 2.5%, as per technical specs<sup>/24/</sup></li> <li>• The analyser was installed on 21/1/2009 and was factory calibrated by Jiamphattana</li> <li>• Energy International (manufacturer) on 15/1/2009<sup>/25/</sup></li> <li>• No recommendation from manufacturer on the calibration frequency so PP ensured calibration once a year</li> </ul>

10.	Flow meter (FI01) for monitoring ID.12: Q <sub>y,wwbypass</sub>	A0732088	28/8/2007 (Factory calibration <sup>/9/</sup> )	Once every 2 years	<ul style="list-style-type: none"> <li>• Kobold Magnetic flow meter with accuracy class of <math>\pm 0.3\%</math> was verified installed at site.</li> <li>• Calibration cycle was as per manufacturer's recommendation <sup>/22/</sup></li> <li>• Equipment was installed on 16/12/07</li> <li>• Preventive maintenance was carried out periodically by ST Control Co. Ltd. <sup>/23/</sup></li> </ul>
11.	Other flare operation parameters – flame detector	-	-	-	<ul style="list-style-type: none"> <li>• Flame ionization detector (FID) was installed at the flare system to detect the flame. The FID was linked to data logger</li> <li>• No calibration required but the checking on the functionality of the detector was carried out by the Biogas Supervisor on a quarterly basis and the results were recorded in the Quarterly Parameter Report (LBP009).</li> </ul>
12.	Pressure gauge for monitoring ID 16: Pressure of biogas sent to flare	AFF223M	-	-	<ul style="list-style-type: none"> <li>• No information on the calibration as there was no calibration certificates for this gauge.</li> <li>• PP had installed another pressure gauge to calibrate each other and confirm correct</li> </ul>

					reading.
13.	Portable gas detector for the monitoring ID.17: Proportion of methane emitted from covered lagoon	TESTO 316-1	26/9/09	2 years	<ul style="list-style-type: none"> <li>The calibration was carried out by the supplier TESTO AG Germany.</li> <li>The validity of the calibration was specified as 2 years</li> </ul>

### 3.6 Management System and Quality Assurance

The roles and responsibilities for monitoring of emission reduction data have been clearly defined. The monitoring of the GHG parameters is part of the biogas plant normal operations. The CDM Manager and the biogas plant supervisor are the key persons managing GHG data records.

## 4 VERIFICATION AND CERTIFICATION STATEMENT

SIRIM QAS International Sdn Bhd was engaged by Univanich Palm Oil Public Co. Ltd. to carry out the verification of the greenhouse gas (GHG) pre-CDM voluntary emissions reduction reported from 'Univanich Lamthap POME Biogas Project' for the period from 13/3/2008 to 31/1/2009.

The verification was based on the CDM registered PDD<sup>/2/</sup>, the approved baseline and monitoring methodology AM0022 version 4, the Monitoring Report<sup>/6//53//57/</sup>, the registered Gold Standard Annex<sup>/8/</sup>, emission reduction calculation spreadsheet<sup>/54//58//59/</sup> and other supporting documents made available to SIRIM QAS Intl.'s verification team by the client. SIRIM QAS Intl. expresses no opinion on the baseline methodology of both the project and the validated and registered PDD.

The management of Univanich Palm Oil Public Co. Ltd. is responsible for the preparation and reporting of GHG emissions data, and the reported GHG emission reduction on the basis set out within the project monitoring plan. The development and maintenance of records and reporting procedures in accordance with the monitoring plan, including the calculation and determination of GHG emission reduction from the project is the responsibility of the management of the project.

It is the responsibility of SIRIM QAS Intl. verification team to express an independent GHG verification opinion on the GHG emissions from the project for the monitoring period starting

from 13/3/2008 to 31/1/2009 and on the calculation of GHG emission reductions from the project based on the verified emissions for the same period.

Our approach was risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. We planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that the amount of calculated GHG emission reductions for the period from 13/3/2008 to 31/1/2009 were fairly stated.

We have verified whether the information included in revised monitoring report<sup>57/</sup> (version 6.1 dated 30 November 2011) is correct and that the emission reduction achieved has been determined correctly. The verification team confirmed that the GHG emission reductions were calculated without material misstatements for the whole monitoring period. Our opinion is based on the project's GHG emissions and resulting GHG emission reductions reported, and, to the valid and registered project baseline and monitoring documents. Based on the information we have seen and evaluated, we confirm the following:

Monitoring period	13/3/2008 to 31/1/2008	01/1/2009 to 31/1/2009
Total Baseline Emissions	45,059 tCO <sub>2</sub> e	2,925 tCO <sub>2</sub> e
Total Project Emissions	12,414 tCO <sub>2</sub> e	621tCO <sub>2</sub> e
Emission Reduction – before application of equation for conservativity check	32,645 tCO <sub>2</sub> e	2,304 tCO <sub>2</sub> e
Emission Reductions – after application of equation 13 (rounded value)	27,460 tCO <sub>2</sub> e	2,304 tCO <sub>2</sub> e

Prepared by :

Approved by :



(Aminah Ang )  
Verification Team  
Leader



(Parama Iswara  
Subramaniam)  
DOE Representative

## 5 REFERENCES

- /1/ Validation and Verification Manual, version 1.2
- /2/ Registered PDD, version 3.1 dated 08/08/2008
- /3/ AM0022 – Avoided Wastewater and On-site Energy Use Emissions in the Industrial Sector, Version 4
- /4/ Validation report by TUV SUD (report no. 1025537)
- /5/ Verification and Certification Report by SGS dated 23/02/2010 (report no. CDM.VER0920, issue 5.1)
- /6/ Monitoring Report dated 01/04/2011 (version 1)
- /7/ Univanich Lamthap VER ER Calculations V1 Worksheet April 2011
- /8/ Registered Gold Standard Annex, Version 6.1 July 2009
- /9/ Bypass wastewater flowmeter FI01 Calibration Certificate dated 27/08/2007
- /10/ Bypass wastewater flowmeter FI01 Calibration Certificate dated 16/02/2010
- /11/ CIGAR in wastewater flowmeter FI02 Calibration Certificate dated 28/08/2007
- /12/ CIGAR in wastewater flowmeter FI02 Calibration Certificate dated 16/02/2010
- /13/ Sludge out flowmeter FI30 Calibration Certificate dated 28/08/2007
- /14/ Sludge out flowmeter FI30 Calibration Certificate dated 16/02/2010
- /15/ Recycled wastewater flowmeter FI38 Calibration Certificate dated 28/08/2007
- /16/ Recycled wastewater flowmeter FI38 Calibration Certificate dated 16/02/2010
- /17/ CIGAR out wastewater flowmeter FI40 Calibration Certificate dated 28/08/2007
- /18/ CIGAR out wastewater flowmeter FI40 Calibration Certificate dated 16/02/2010
- /19/ Biogas to Flare flowmeter FI63 Calibration Report dated 26/09/2007
- /20/ Biogas to Engine no. 1 flowmeter FI64 Calibration Report dated 26/09/2007
- /21/ Biogas to Engine no. 2 flowmeter FI65 Calibration Report dated 25/04/2009
- /22/ Flowmeter Manufacturer (Kobold Instruments Ltd.) undated letter of recommended recalibration cycle
- /23/ Flowmeter servicing & maintenance contractor undated letter of undertaking the servicing & maintenance checking of flowmeters
- /24/ Manufacturer (JE) Specifications Catalog for Gas Sensor (CH<sub>4</sub> analyzer)
- /25/ Manufacturer (JE) Certificate of Calibration for Inline Gas Sensor (CH<sub>4</sub> analyzer) dated 15/01/2009
- /26/ Contractor (Entech) Calibration Certificate for Inline Gas Sensor (CH<sub>4</sub> analyzer) dated 19/01/2010
- /27/ Supplier (Envi Science) Test Report for Spectrophotometer (COD analyzer) dated 29/05/2009
- /28/ Contractor (Bangkok High Lab) Certificate of Calibration for Spectrophotometer (COD analyzer) dated 11/02/2010
- /29/ Engine no. 1 Commissioning Test Report by Guascor dated 21/02/2008

- /30/ Engine no. 2 Commissioning Test Report by JE dated 30/07/2009
- /31/ Meter M1 Field Inspection and Test Report by PEA dated 12/12/2009
- /32/ Meter M1 Field Inspection and Test Report by PEA dated 06/01/2011
- /33/ Meter M4 Field Inspection and Test Report by PEA dated 12/12/2009
- /34/ Meter M4 Field Inspection and Test Report by PEA dated 06/01/2011
- /35/ Meter M5 Field Inspection and Test Report by PEA dated 06/01/2011
- /36/ Meter M6 Field Inspection and Test Report by PEA dated 12/12/2009
- /37/ Meter M6 Field Inspection and Test Report by PEA dated 06/01/2011
- /38/ Sludge Removal Report summary table from 10/04/2009 – 07/03/2010
- /39/ Sludge Removal & Disposal of sludge daily records dated 28/11/2009
- /40/ Sludge Removal & Disposal of sludge daily records dated 16/12/2009
- /41/ Sludge Removal & Disposal of sludge daily records dated 08/03/2010
- /42/ Data Viewer (software) sample file of data logger (.FDT) & spreadsheet file (.CSV) for biogas & wastewater flow meter
- /43/ Historical Viewer (software) sample file of data logger (.PRJ) & spreadsheet file (.CSV) for flame indicator & methane concentration
- /44/ Daily manual record of flow meter reading for wastewater volume dated 03/04//2008
- /45/ Daily Maintenance Engineer Biogas Plant Inspection form dated 01/05/2008
- /46/ Analysis Report for Exhaust from Gas Engine Stack dated 31/03/2009
- /47/ Data Flow Diagram for Lamthap Biogas Plant
- /48/ Factory Annual Shutdown for Plant Maintenance and Repairs 2009/2010 schedule
- /49/ Quarterly Monitoring Parameters Report LBP009 for October 2009
- /50/ Quarterly Safety Review Walkthrough Inspection Checklist dated 19/10/2009
- /51/ Quarterly Safety Review Walkthrough Inspection Report dated 19/10/2009
- /52/ Payroll Form for Lamthap Biogas Plant Operator December 2010
- /53/ Monitoring Report dated October 2011 (version 5.1)
- /54/ Univanich Lamthap VER ER Calculations V5.1 Worksheet October 2011
- /55/ Letter from the Deputy Executive Director, Thailand Greenhouse Gas Management Organization dated 9 May 201
- /56/ Letter from Krabi Agriculture Office dated 28 March 2011
- /57/ Monitoring Report dated 30 November 2011 (version 6.1)
- /58/ Lamthap VER ER calcs 2008 version 6
- /59/ Lamthap VER ER calcs 2009 version 6

**ANNEX 1:**  
**VERIFICATION PROTOCOL**  
**SQAS-GS- EU02350003**

**SIRIM QAS INTERNATIONAL SDN BHD**  
**Verification checklist**

**Project name :** Univanich Lamthap POME Biogas Project Thailand (Project no. 2076)  
GS Monitoring Period: 13/3/2008 to 31/1/2009 (Pre-CDM)

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

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
<b>1. Project implementation in accordance with the registered PDD</b>  <b>Any concern related to the conformity of the actual project activity and its operation with the registered PDD shall be identified.</b>					
1.1 Was an on-site visit conducted for this verification? If no, please justify the rationale of the decision.	VVM	196	Yes, an on-site visit was carried out on 25 and 26 April by Aminah, Azhar and Hafriazhar.	OK	OK
1.2 Are all physical features of the proposed GS project activity proposed in the registered PDD in place?	VVM	196	Yes, all the physical features of the proposed CDM project activity as described in the registered PDD were in place. The following were as in the PDD : <ul style="list-style-type: none"> <li>• A covered inground anaerobic reactor (CIGAR) with bio-gas capturing system</li> <li>• One biogas engines (Guascor) with 952kW capacity was installed on 15/1/2008</li> <li>• An open flare system</li> </ul>	OK	OK

Checklist Questions	Ref.	§	Comments by verifier	Draft Concl	Final Concl
1.3 Have the project participants operated the proposed CDM project activity as per the registered PDD?	VVM	196	Yes, the PP had operated the project activity as in the registered PDD. The following was verified: i) The effluent collection system ii) The covered lagoon digester (CIGAR) iii) Biogas extraction and cleaning system iv) Biogas sent to 1 unit of biogas engines with capacity of 952kW v) Biogas sent to open flare.	OK	OK
1.4 Is there any implementation or operation of the CDM project activity not conforming with the description contained in the registered PDD? If yes, proceed to 1.5.	VVM	197	None.	OK	OK
1.5 Has an assessment been conducted on the potential impacts due to these changes following EB 48 report, paragraph 73 and its annex 67? If yes, proceed to 1.6.	VVM	197	Not applicable.	OK	OK
1.6 Has a notification or a request for approval of changes been submitted from the project activity as described in the registered PDD prior to the conclusion of the verification/certification for the corresponding monitoring period based on the assessment above?	VVM	197	Not applicable.	OK	OK

<b>2. Compliance of the monitoring plan with the monitoring methodology</b> <b>The monitoring plan of the proposed CDM project activity shall comply with the applied methodology.</b>					
2.1 Is the monitoring plan of the CDM project activity complying with the applied methodology?	VVM	200	The monitoring plan in the registered PDD generally complying with the requirements for monitoring as specified in the methodology for avoided wastewater and on-site energy use emissions in the industrial sector (AM0022 version 4) except for the amount of chemical oxidizing agents entering system is measured quarterly rather than continuous.	GL-1	OK
2.2 If no, was a request for revision of the monitoring plan done? (Approval from EB for the revised monitoring plan shall be obtained prior to concluding the verification and certification decisions.)	VVM	201	Not applicable.	OK	OK
2.3 Are there any monitoring aspects of the project activity that are not specified in the methodology, particularly in the case of small scale methodologies (e.g. additional monitoring parameters, monitoring frequency and calibration frequency)?	VVM	202	No.	OK	OK
2.4 If yes, is the request for revision of the monitoring plan necessary? (This revision may contribute in enhancing the level of accuracy and completeness of the monitoring plan)	VVM	202	Not applicable.	OK	OK

<p><b>3. Compliance of monitoring with the monitoring plan.</b></p> <p><b>Monitoring of reductions in GHG emissions to result from the proposed CDM project activity shall be implemented in accordance with the monitoring plan contained in the registered PDD or the accepted revised monitoring plan.</b></p>					
<p>3.1 Have the monitoring plan and the applied methodology been properly implemented and followed by the project participants?</p>	VVM	205 (a)	Yes, the monitoring plan as in the registered PDD complies with the methodologies AM0022 version 4 and AMS I.D version 12.		
<p>3.2 Have all parameters stated in the monitoring plan, the applied methodology and relevant CDM Executive Board decisions been sufficiently monitored and updated as applicable, including: i) project emission parameters</p>	VVM	205 (b)	<p>i) POME flows leaving project treatment facility (Monitoring I.D.2a)</p> <ul style="list-style-type: none"> <li>• Measured using an on-line magnetic flow meter (Kobold S/N. A0723936) identified by PP as F140 which was installed on 13/3/08.</li> <li>• The location of the meter was checked and confirmed located at the outlet pipe of the CIGAR.</li> <li>• The flow meter is with digital indicator that provides totalized volume (m<sup>3</sup>) and flow rate (m<sup>3</sup>/h) displayed on the panel.</li> <li>• The flow meter is linked to a data logger which captured and recorded data on an hourly basis.</li> <li>• The data from the data logger was downloaded into the Excel spreadsheet via dedicated software.</li> </ul>	OK	OK

			<ul style="list-style-type: none"> <li>• Daily cumulative volume recorded in CIGAR report form LBP005 manually by the operator.</li> <li>• During the beginning of the monitoring period .i.e. 13/3/08 to 7/4/08, data from LBP005 was used.</li> <li>• No data transfer error was found.</li> </ul> <p>ii) POME flows leaving project treatment facility and being recycled back to CIGAR (Monitoring I.D.2b)</p> <ul style="list-style-type: none"> <li>• Measured using an on-line magnetic flow meter (Kobold S/N. A0737740) identified by PP as FI38.</li> <li>• The meter is located at the recycle pipe from the Settling Pond that pumped the treated POME back to the Mixing Tank.</li> <li>• The flow meter is with digital indicator that provides totalized volume (m<sup>3</sup>) and flow rate (m<sup>3</sup>/h) displayed on the panel.</li> <li>• This recycling of the POME back to CIGAR is not a continuous process. It is carried out only if needed to maintain the conditions of the CIGAR.</li> <li>• The flow meter is linked to a data logger which captured and recorded data on an hourly basis.</li> <li>• The data from the data logger was downloaded into the Excel spreadsheet via dedicated software.</li> <li>• Daily cumulative volume recorded in CIGAR report form LBP005 manually by the operator.</li> <li>• During the beginning of the monitoring period i.e. from 13/3/08 to 7/4/08, data from LBP005 was used.</li> <li>• No data transfer error was found.</li> <li>• In the spreadsheet the data from FI38 was labelled as WW<sub>output</sub> instead of WW<sub>recycle</sub> and 2(a) instead of 2(b) (i.e. column C of the spreadsheet should be for 2(b))</li> </ul>	OK	OK
				<del>CL-2</del>	OK

			<p>iii) POME organic material concentration leaving the treatment facility (Monitoring I.D.4)</p> <ul style="list-style-type: none"> <li>Initially, samples were taken at the POME outlet from the CIGAR (i.e. before the settling pond was installed) prior to entering the existing pond.</li> <li>According to the monitoring report, the settling pond was commissioned at the end of October 2008. However, from the spreadsheet it was indicated that the COD output from Settling Pond to Pond 6 had COD analysed since 2/9/2008.</li> <li>Daily analysis of POME COD concentration by the in-house laboratory had been carried out since the first verification. Training on the analysis method has been provided to the laboratory technician and supervisor by the equipment supplier.</li> <li>External analysis was carried out by an accredited laboratory - Saint Envir Co. Ltd. and Sritrang Management Science Co. Ltd. No frequency indicated in the PDD, however PP had indicated in the Monitoring Report that it was carried out on a weekly basis.</li> <li>In the ER spreadsheet there was a clear indication of which data was from the external lab analysis. In the day where external lab analysis was available, the data from the external lab will be used.</li> <li>From the start of the monitoring period until 15/8/08, there was no external lab analysis carried out. This is non-compliance to the monitoring plan.</li> <li>In house laboratory test method was established – “Procedure for COD concentration data collection”. The method included the samples preparation and operation of the equipment. The method was in accordance with the HACH method.</li> </ul>	<p><del>CL-3</del></p>	<p>OK</p>
				<p><del>CAR-1</del></p>	<p>OK</p>

		<ul style="list-style-type: none"> <li>• Data recorded in the Wastewater Analysis Report (LBP003)</li> <li>• There was no remark as to why on some of the days for example on 13/4/08 to 17/4/08 and 31/12/08. There were no data in the spreadsheet.</li> <li>• Error in the spreadsheet for data on 21/4/08 and 22/4/08 were found.</li> </ul> <p>iv) Electricity generated by the biogas engine used to operate the biogas plant (Monitoring I.D.5b)</p> <ul style="list-style-type: none"> <li>• The electricity used from the biogas plant measured using kWh meter identified by PP as M4 (S/N. 0068001327).</li> <li>• M4 is used to monitor the electricity from both the PEA and biogas engines</li> <li>• The cumulative kWh reading in the power meter was recorded in the Genset Data Report form (LBP004) by the technician on daily basis. The present day reading minus the previous day reading gives the final consumption of electricity for the previous day. The final kWh reading was checked and transferred into the spreadsheets by the Biogas Plant Supervisor.</li> <li>• In the spreadsheet, data from M4 was identified as having a monitoring I.D of 5b(ii) which is not in the PDD.</li> <li>• In the monitoring report, this parameter was reported under 'Baseline emissions parameters' rather than project emissions.</li> <li>• From 13/3/08 to 1/4/08, 6/8 to 7/8/08 and 23/11/08 data recorded in the spreadsheet was '0' which was found not accurate as the biogas plant has been in operation during this period.</li> </ul>	<p>GL-4</p> <p>GL-5</p>	<p>OK</p> <p>OK</p>
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		<p>v) Surplus biogas sent to flare (Monitoring I.D.6a) and FVRG,h volumetric flow rate of the residual gas in dry basis at normal (NTP) condition in the hour h (Monitoring I.D.6b)</p> <ul style="list-style-type: none"> <li>• Measured continuously using an on-line oscillator flow meter (Kobold S/N. 5329) identified by PP as FI63.</li> <li>• The meter is located at the pipeline prior to the open flare system after bio-scrubber.</li> <li>• The meter is linked to a data logger that recorded the data as normalize volumetric flow rate (the unit recorded as Nm<sup>3</sup>/h according to flaring tool) on an hourly basis. The data was electronically transferred into the an Excel spreadsheet using a dedicated software.</li> <li>• In the spreadsheet 'Methane tool VER PE' for 2008, it was mentioned that the volumetric flow rate was derived from the average of flow rates for quarter September to November 2008 (cell B13). It was unclear how this was derived.</li> <li>• From 20/4/08 to 31/7/08 the data for Vflare was mentioned to be reconstructed data. This was found to be not possible as Vflare should be measured.</li> <li>• The unit for FV(RG,h) should be Nm<sup>3</sup>/hr rather than m<sup>3</sup>/hr</li> </ul> <p>vi) Project emission from flaring of residual gas stream (Monitoring I.D. 9)</p> <ul style="list-style-type: none"> <li>• In accordance with the 'Tool to determine project emissions from flaring gases containing methane' this parameter was calculated based on the measured biogas flow to flare system and the methane concentration. Default value for open flare combustion efficiency of 50% or 0% was applied depending on the flame detector signal.</li> </ul>	<p>OK</p> <p>CAR-2</p>	<p>OK</p> <p>OK</p>
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			<ul style="list-style-type: none"> <li>Separate spreadsheet called the 'Methane tool PE' was established. From 2008 spreadsheet it was unclear how the determination of flare efficiency of 50% was made when there was no data on every minute or hourly to determine the operational of the system meeting the 20minutes requirement.</li> </ul>	CAR-3	OK
			<p>vii) Amount of organic material loss through chemical oxidising agents (Monitoring I.D.10)</p> <ul style="list-style-type: none"> <li>According to the PDD, monitoring of SO<sub>4</sub> at the POME to be carried out on quarterly basis by external accredited laboratory.</li> <li>During the monitoring period, PP had carried out 6 analysis of SO<sub>4</sub> at the POME outlet from the CIGAR (same sampling point as the COD of POME out from CIGAR) by Saint Envir Co. Ltd. However, the frequency of the analysis at the beginning was not based on quarterly. Please clarify.</li> <li>Results of analysis were checked and no data transfer error was found.</li> </ul>	OK	OK
			<ul style="list-style-type: none"> <li>During the monitoring period, PP had carried out 6 analysis of SO<sub>4</sub> at the POME outlet from the CIGAR (same sampling point as the COD of POME out from CIGAR) by Saint Envir Co. Ltd. However, the frequency of the analysis at the beginning was not based on quarterly. Please clarify.</li> <li>Results of analysis were checked and no data transfer error was found.</li> </ul>	CL-6	OK
			<p>viii) Gen set combustion efficiency (Monitoring I.D.11)</p> <ul style="list-style-type: none"> <li>According to the monitoring plan in the registered PDD, this parameter is to be tested on annual basis by external laboratory.</li> <li>During this monitoring period, the testing was carried out by Environment Research &amp; Technology Company Limited on 25/3/09.</li> <li>The test was measuring the % of CH<sub>4</sub> in the exhaust gas from the biogas engines stack using the USEPA standards. The result was included in the Annual Parameter Report form (LBP010) and used in the calculation of the project emission.</li> </ul>	OK	OK

			<p>ix) Flow of POME directly to the current water treatment system, and bypassing the new POME treatment facility (Monitoring I.D.12)</p> <ul style="list-style-type: none"> <li>• Measured using an on-line magnetic flow meter (Kobold S/N. A0732088) identified by PP as FI01.</li> <li>• The meter is located at the bypass pipe out from the fat trap that pumped directly to the current waste water treatment system. This process is only carried out if there is plant upset at the CIGAR (i.e. not a continuous process).</li> <li>• The flow meter is with digital indicator which provides totalized volume (m<sup>3</sup>) and flow rate (m<sup>3</sup>/h) displayed on the panel.</li> <li>• The flow meter is linked to a data logger which captured and recorded data on an hourly basis.</li> <li>• The data from the data logger was downloaded into the Excel spreadsheet via dedicated software.</li> <li>• Daily cumulative volume recorded in CIGAR Report Form LBP005 manually by the operator.</li> <li>• During the period from 13/3/08 to 7/4/08 manual recorded data from LBP005 was used. No data transfer error was found.</li> </ul>	OK	OK
			<p>x) Loss of biogas from pipeline (Monitoring I.D.13)</p> <ul style="list-style-type: none"> <li>• The integrity of biogas pipeline was carried out through pressurizing the pipeline and measuring the pressure drops. According to the monitoring plan in the PDD, this parameter is to be tested annually.</li> <li>• This pressure drop test in the pipeline was carried out during the plant shutdown by the Biogas Plant Supervisor. During the monitoring period, one test had been conducted 4/2/2009. The test reported no leak in the pipeline. Result of the test was recorded in the Annual Parameter Report (LBP010).</li> </ul>	OK	OK

			<p>xi) Organic material removed from POME facility (Monitoring I.D 14)</p> <ul style="list-style-type: none"> <li>The monitoring plan stated that the COD test will be carried out after any screening of the POME, which was confirmed through the Quarterly Monitoring Parameters Report (LBP009) and also interview with the technician involved in taking the samples. It was demonstrated that the samples were taken after the screening process at the mixing tank. Therefore, the value of this parameter was taken as zero as no organic material removed in this situation.</li> </ul>	OK	OK
			<p>xii) Other flare operation parameters – flame detector (Monitoring I.D.15)</p> <ul style="list-style-type: none"> <li>The open flare system is equipped with a flame ionization detector which gives signal to data logger when the flame is detected. The data logger will record the signal every minute. If no flame, the data logger will record as '0' voltage and with flame as 5V.</li> <li>For year 2008, please clarify why there was no reading on the detection on flame recorded in the 'Methane tool VER PE'. It was also unsure how the QA/QC procedure being implemented during this period.</li> </ul>	OK	OK
			<p>xiii) Other flare operation parameters – pressure of biogas sent to flares (Monitoring I.D.16)</p> <ul style="list-style-type: none"> <li>Measured using pressure gauge (S/N AFF223M). The meter is connected to data logger that be used in the conversion of the flow to Nm3.</li> <li>The pressure reading was also quarterly checked and recorded in the Quarterly Monitoring Parameters Report (LBP009) to ensure that it is within the specified range of 10-100mB.</li> </ul>	OK	OK

			<p>xiv) Proportion of methane emitted from covered lagoon (Monitoring I.D.17)</p> <ul style="list-style-type: none"> <li>• Measured using a portable gas detector JE S/N. BM11014/08) on daily basis by the Biogas Plant Supervisor surrounding the covered lagoon. The daily check was recorded in the Safety Review Walkthrough Checklist which will then be summarised into the Quarterly Monitoring Parameter Report (LBP009)</li> <li>• During this monitoring period, it was reported that there were 3 occurrences of the detection and actions have been immediately taken to rectify the problem. This was evident as the next day results showed no detection.</li> <li>• Data from this daily monitoring was included in the ER spreadsheet. However, for the purpose of ER calculation, PP had applied the formula defined in ACM0014 .. which was found to be conservative.</li> </ul>	OK	OK
ii) baseline emission parameters			<p>i) POME flows entering system boundary (Monitoring I.D.1)</p> <ul style="list-style-type: none"> <li>• Measured using an on-line magnetic flow meter (Kobold S/N. A0738372) identified by PP as FI02.</li> <li>• The meter is located at the POME inlet pipe to the CIGAR</li> <li>• The flow meter is with digital indicator with totalized volume (m<sup>3</sup>) and flow rate (m<sup>3</sup>/h) displayed on the panel.</li> <li>• The flow meter is linked to a data logger which captured and recorded data once in every hour.</li> <li>• The data from the data logger was downloaded into the Excel spreadsheet via dedicated software.</li> </ul>	OK  OK	OK  OK

			<ul style="list-style-type: none"> <li>• Daily cumulative reading was also recorded in CIGAR Report Form LBP005 manually by the operator. The present day reading minus the previous day reading gives the total readings of the POME input for a day. These data are used as back up in case there is problem in the data logger.</li> <li>• Manual recorded data from LBP005 was used during the period from 13/3/08 to 7/4/08. No data transfer error was found.</li> </ul> <p>ii) POME organic material concentration entering project boundary (COD<sub>y,wwin</sub>) (Monitoring I.D.3)</p> <ul style="list-style-type: none"> <li>• Sampling point was checked and confirmed to be taken after the screen in the mixing tank.</li> <li>• Daily sampling and analysis of the incoming COD (untreated POME) was carried out at the in-house laboratory.</li> <li>• In house laboratory test method was established – “Procedure for COD concentration data collection”. The method included the samples preparation and operation of the equipment. The method was in accordance with the HACH method.</li> </ul> <ul style="list-style-type: none"> <li>• According to the monitoring plan of the PDD, the COD will be analysed by an accredited laboratory on weekly basis. During this monitoring period, the external laboratory analysis was carried out from 15/8/08 onwards. There were no external analysis carried out prior to this date. Please explain why?</li> <li>• Accredited laboratories engaged to conduct the test were Saint Envir Co. Ltd. and Sritrang Management Science Co. Ltd.</li> </ul>	OK	OK
				Refer to CAR 1	OK

		<ul style="list-style-type: none"> <li>• Daily analysis results were recorded in the Wastewater Analysis Report (LBP003)</li> <li>• Error in data transfer was found on 21/4/08 and 22/4/08</li> <li>• PP needs to include remarks as to why on 13/4/08 to 17/4/08, and 1/5/08 no analysis was carried out (i.e. days without COD values recorded in the spreadsheet)</li> </ul> <p>iii) Electricity generated from the biogas collected in the anaerobic treatment facility and consumed on site or sent to the grid, less any electricity consumed by the biogas plant (Monitoring I.D.5)</p> <ul style="list-style-type: none"> <li>• The biogas engine is equipped with power meter which was identified by PP as M1.</li> <li>• The power meter is PowerLogic™ model PM700 by Schneider Electric with equipment S/N. BH011002500N, provides the total cumulative kWh reading.</li> <li>• Data from the meter was recorded daily by the Biogas Plant Operators and recorded in the Genset Data Report Logsheet (LBP004).</li> <li>• The net electricity generation was calculated as the total electricity generation by the biogas engines minus the amount of electricity used by the biogas plant. The formula in the spreadsheet was confirmed to be accurate.</li> </ul>	<p>CL-8</p> <p>OK</p>	<p>OK</p> <p>OK</p>
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		<p>iv) Biogas sent to generator sets and used for electricity generation (Monitoring I.D.7)</p> <ul style="list-style-type: none"> <li>• The biogas engine is equipped with an on-line oscillator flow meter which was identified by PP as FI64 (Kobold S/N. 5331)</li> <li>• The flow meter is linked to a data logger that recorded the data on an hourly basis. The data from the data logger was transferred into the ER spreadsheet via dedicated software.</li> <li>• Manual hourly reading was also carried out by the technician and recorded on LBP004 Genset Data Report.</li> <li>• In the spreadsheet, it was indicated that from 31/3/08 to 7/4/08, data from LBP004 was used.</li> <li>• From 13/3/08 to 30/3/08 and 30/6/08 it was indicated that no biogas flow but there was electricity generation during this time. Please clarify.</li> <li>• From 9/8/08 to 3/9/08 it was indicated that the data was a reconstructed data. The calculation of how these data was obtained was not provided to the verification team.</li> </ul> <p>v) Biogas methane concentration (Monitoring I.D.8)</p> <ul style="list-style-type: none"> <li>• During this monitoring period two gas analyzers were used. The first was an infrared spectrometry gas analyser with S/N 25791 and second meter JE Gas Sensor with S/N. 28652 was installed 21/1/2009.</li> <li>• It was noted that the first analyser was faulty since 2/1/09 and was removed for repair on 6/1/09. During the period from 2/1/09 to 21/1/09 data from the portable gas analyser was used. Four analyses were carried out by the Biogas Supervisor daily and average of the values was used in the spreadsheet. The used of manual sampling was not indicated in the 'Methane Tool VER PE' 2009. It was only indicated in the 'VER ER calculation spreadsheet'</li> </ul>	<p>CL-9</p> <p>CL-10</p>	<p>OK</p> <p>OK</p>
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			<ul style="list-style-type: none"> <li>The gas analyser is linked to a data logger which captured and recorded data every minute.</li> <li>Manual reading also taken on hourly by technician and recorded in LBP005 CIGAR Report form.</li> <li>The data from the data logger was downloaded into the 'Methane tool PE spreadsheet' via a dedicated software.</li> <li>For year 2008, there was no %CH4 reading recorded in the spreadsheet, and in the VER ER spreadsheet it was verified that from 13/3/08 to 7/4/08, 24/6/08 to 29/9/08 and other days that were highlighted in yellow in the spreadsheet, the CH4 concentration reading was based on measured value using handheld CH4 meter, 4 readings a day. This deviation from the methodology, was not reflected/explained in the MR.</li> <li>For the readings which were highlighted in blue, which indicated reading from the recorder, it was found that the values were not included in the Methane tool PE spreadsheet'</li> </ul>	GAR-4	OK
			<p>vi) Amount of organic material loss through chemical oxidising agents (Monitoring I.D.10)</p> <ul style="list-style-type: none"> <li>According to the PDD, monitoring of SO<sub>4</sub> at the POME to be carried out on quarterly basis by external accredited laboratory.</li> <li>During the monitoring period, PP had carried out 6 analysis of SO<sub>4</sub> at the POME outlet from the CIGAR (same sampling point as the COD of POME out from CIGAR) by Saint Envir Co. Ltd. However, the frequency of the analysis at the beginning was not based on quarterly. Please clarify.</li> </ul>	Refer to CL-6	OK
iii) leakage parameters			In accordance with AM0022 and AMS I.D, leakage is not applicable to the project activity.		

<p>iv) Management and operational system: the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan?</p>			<p>The following personnel was involved in the monitoring and reporting of the CDM project activity:</p> <ul style="list-style-type: none"> <li>i) Mr.Phiphit Khlaisombat – Univanich Group Engineer</li> <li>ii) Mr.Thongchai Posew – CDM Biogas Manager /QC Manager</li> <li>iii) Mr. Ninrapat – Biogas Supervisor</li> <li>iv) Ms. Bridget McIntosh – CDM Consultant.</li> </ul> <p>The responsibilities and authorities for monitoring and reporting was confirmed to be in accordance with that described in the PDD.</p>	OK	OK
<p>3.3 Is the accuracy of equipment used for monitoring is in accordance with the relevant guidance provided by the CDM Executive Board and is controlled and calibrated in accordance with the monitoring plan?</p>	VVM	205 ( c )	<p>Calibration of the following equipment was verified:</p> <ul style="list-style-type: none"> <li>i) Liquid flow meter to measure POME flow entering system boundary (Monitoring I.D.1) <ul style="list-style-type: none"> <li>• Magnetic flow meter brand Kobold with S/N. A0738372, and accuracy class of <math>\pm 0.3\%</math> (as per equipment specification. Equipment identified by PP as F102.</li> <li>• Calibration cycle was as per manufacturer's recommendation (Kobold Instruments Ltd) – once in 2 years</li> <li>• Manufacturer's calibration on 28/08/2007</li> <li>• Flow meter was installed on 13/03/2008</li> <li>• The meter was service and checked annually by ST Control Co. Ltd. (the supplier)</li> <li>• Re-calibration was carried out on 12/02/2010 by MIT Co. Ltd.</li> </ul> </li> <li>ii) Liquid flow meter to measure POME flows leaving project treatment facility (Monitoring I.D.2a) <ul style="list-style-type: none"> <li>• Magnetic flow meter brand Kobold with S/N: A0723936 and accuracy class of <math>\pm 0.3\%</math> (as per equipment specification. Equipment identified by PP as F140</li> <li>• Calibration cycle was as per manufacturer's recommendation (Kobold Instruments Ltd) – once in 2 years.</li> </ul> </li> </ul>	OK	OK

			<ul style="list-style-type: none"> <li>• Manufacturer's calibration : 28/08/2007</li> <li>• Flow meter was installed on 13/03/2008</li> <li>• The meter was service and checked annually by ST Control Co. Ltd. (the supplier)</li> <li>• No re-calibration carried out during this monitoring period.</li> </ul>	OK	OK
			<p>iii) Liquid flow meter to measure POME flows leaving project treatment facility, and being recycled back to CIGAR (Monitoring I.D.2b)</p> <ul style="list-style-type: none"> <li>• Magnetic flow meter brand Kobold with S/N: A0737740 and accuracy class of <math>\pm 0.3\%</math>(as per equipment specification. Equipment identified by PP as FI38</li> <li>• Calibration cycle was as per manufacturer's recommendation (Kobold Instruments Ltd) – once in 2 years.</li> <li>• Manufacturer's calibration : 28/08/2007</li> <li>• Flow meter was installed on 6/10/2008</li> <li>• The meter was service and checked annually by ST Control Co. Ltd. (the supplier)</li> <li>• No re-calibration was carried out during this monitoring period.</li> </ul>	OK	OK
			<p>iv) COD meter to measure <math>COD_{y,ww,untreated}</math> (Monitoring I.D. 3) and <math>COD_{y,ww,treated}</math> (Monitoring I.D.4)</p> <ul style="list-style-type: none"> <li>• The analysis of COD was carried out using Spectrophotometer (Hach DR2800) with S/N. 1218955.</li> <li>• The equipment was first calibrated on 29/05/2009 by Envi Science Co.Ltd.</li> <li>• Calibration frequency was not specified by the manufacturer but PP had decided to calibrate once a year</li> <li>• Factory calibration certification of the COD meter was not seen during the audit.</li> </ul>	OK	OK
				} CL-11	OK

		<p>v) Power meters to measure electricity generated from the biogas collected in the anaerobic treatment facility and consumed on site or sent to the grid, less any electricity consumed by the biogas plant (Monitoring I.D.5)</p> <ul style="list-style-type: none"> <li>• The power meter identified by PP as M1 (equipment S/N. BH0110025000N) was installed on 31/1/08.</li> <li>• There was no calibration certificate prior to installation. The calibration was only carried out on 12/12/2009 by the Thailand Provincial Electricity Authority (PEA).</li> <li>• During this monitoring period PP had applied the EB52 Annex 60 requirements for the non-compliance with the calibration issue</li> <li>• The manufacturer did not specify the calibration frequency. PP had indicated in the Monitoring Report that the calibration frequency is 2 years following the PEA practices. However, there was no supporting document to support this.</li> </ul> <p>vi) Power meter to measure electricity used to operate the biogas plant (Monitoring I.D.5b)</p> <ul style="list-style-type: none"> <li>• The power meter identified as M4 by PP, model and maker PowerLogic PM700 by Schneider Electric with accuracy class of <math>\pm 1.0\%</math>.</li> <li>• The meter (S/N 0068001327) was installed on 14/11/2007</li> <li>• M4 was first calibrated on 12/12/2009 by the Thailand Provincial Electricity Authority (PEA).</li> <li>• During this monitoring period PP had applied the EB52 Annex 60 requirements for the non-compliance with the calibration issue</li> <li>• The manufacturer did not specify the calibration frequency. PP had indicated in the Monitoring Report that the calibration frequency is 2 years once following to PEA practices. However, there was no supporting document to support this.</li> </ul>	<p>OK</p> <p>CL-12</p> <p>OK</p> <p>Refer to CL-12</p>	<p>OK</p> <p>OK</p> <p>OK</p>
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			<p>vii) Biogas flow meter to measure surplus biogas sent to flare (Monitoring I.D.6a) and to measure volumetric flow rate of the residual gas in dry basis at normal conditions (Monitoring I.D.6b)</p> <ul style="list-style-type: none"> <li>• Measured using Kobold oscillator flow meter S/N.5329 (identified by PP as FI63) with accuracy class of <math>\pm 1.5\%</math></li> <li>• the manufacturer (Kobold Instruments Ltd) has specified that the frequency of calibration is 3 years.</li> <li>• The meter was factory calibrated on 26/09/2007 and installed on 15/01/2008.</li> <li>• The meter is serviced and checked annually by ST Control Co. Ltd.</li> <li>• No re-calibration was carried out during this monitoring period.</li> </ul>	OK	OK
			<p>viii) Biogas flow meter to measure biogas sent to generator sets and used for electricity generation (Monitoring I.D.7)</p> <ul style="list-style-type: none"> <li>• The biogas engine is equipped with biogas flow meter identified by PP as FI64 (equipment S/N.5331).</li> <li>• The meter is a Kobold oscillator flow meter with accuracy class of <math>\pm 1.5\%</math> and the manufacturer (Kobold Instruments Ltd) has specified that the frequency of calibration is 3 years.</li> <li>• FI64 was calibrated on 26/9/2007 and installed on 15/1/2008.</li> <li>• The meter was serviced and checked annually by ST Control Co. Ltd.</li> <li>• No re-calibration was carried out during this monitoring period.</li> </ul>	OK	OK

		<p>ix) Methane analyser to measure the biogas methane concentration (Monitoring I.D.8)</p> <ul style="list-style-type: none"> <li>• During this monitoring period two gas analyzers were used. The first was an infrared spectrometry gas analyser with S/N 25791. The analyser was calibrated on 21/2/2008. This meter was not included in the Monitoring Report. The meter was removed on 6/1/2009. During this period data from the portable gas analyser was used.</li> <li>• The second meter JE Gas Sensor with S/N. 28652, with accuracy <math>\pm 2.5\%</math> was installed 21/1/2009 and was factory calibrated by Jiamphattana Energy International (manufacturer) on 15/1/2009.</li> <li>• No recommendation from manufacturer on the calibration frequency but PP had decided to calibrate once a year</li> <li>• In accordance with the QA/QC procedure in the PDD, a quarterly calibration check against a reference bottle of known concentration of methane will be conducted and calibration checks every 6 months. This needs to be clarified.</li> <li>• This results of the cross checking was recorded in the Quarterly Monitoring Parameter Report (LBP009).</li> </ul> <p>x) Liquid flow meter to measure the flow of POME directly to the current water treatment system, and bypassing the new POME treatment facility (Monitoring I.D.12)</p> <ul style="list-style-type: none"> <li>• Magnetic flow meter brand Kobold with S/N. A0732088 and accuracy class of <math>\pm 0.3\%</math> (as per equipment specification. Equipment identified by PP as FI01</li> <li>• Calibration cycle was as per manufacturer's recommendation (Kobold Instruments Ltd) – once in 2 years</li> <li>• Manufacturer's calibration on 28/08/2007</li> </ul>	<p><del>CL-13</del></p> <p>CL-13</p> <p>OK</p>	<p>OK</p> <p>OK</p> <p>OK</p>
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			<ul style="list-style-type: none"> <li>• Flow meter was installed on 16/12/2007</li> <li>• The meter was service and checked annually by ST Control Co. Ltd. (the supplier)</li> <li>• No re-calibration was carried out during this monitoring period.</li> </ul> <p>xi) Flame detector (Monitoring I.D.15)</p> <ul style="list-style-type: none"> <li>• Flame ionization detector was installed at the flare system to detect the flame. The FID was linked to data logger.</li> <li>• No calibration required but the checking on the functionality of the detector was carried out by the Biogas Supervisor on a quarterly basis and the results were recorded in the Quarterly Parameter Report (LBP009).</li> </ul>	OK	OK
			<p>xii) Methane gas detector (Monitoring I.D.17)</p> <ul style="list-style-type: none"> <li>• The hand held gas detector (TESTO S/N.31143.20) was calibrated on 26 September 2009. The validity of the calibration was specified as 2 years. This was found not consistent with the QA/QC procedure of the PDD.</li> </ul>	CL-14	OK
3.4 Are monitoring results consistently recorded as per approved frequency?	VVM	205 ( c )	During the beginning of the monitoring period, the monitoring of the parameter by the external laboratory was not properly carried out.	Refer to CL-1 and CL-6	OK

3.5 Have quality assurance and quality control procedures been applied in accordance with the monitoring plan monitoring plan?	VVM	205 ( c )	The QA/QC procedures have been applied except for some parameters.	Refer to CAR 1, CL 6, CL11, CL12, CL 13 and CL 14 -	OK
<b>4. Assessment of data and calculation of greenhouse gas emission reductions. GHG emission reduction achieved by/resulting from the proposed CDM project activity calculated applying the selected methodology.</b>					
4.1 Is a complete set of data for the specified monitoring period is available? (If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, the DOE shall opt to either make the most conservative assumption theoretically possible in finalizing the verification report, or raise a request for deviation prior to submitting request for issuance if appropriate).	VVM	208 (a)	<p>During this monitoring period, some data for monitoring I.D.6 (a) and 7 were not based on the meters. Instead it was mentioned to be reconstructed data, Issues were raised as it was not sure how the data was reconstructed.</p> <p>For monitoring I.D.8 – during the period from 2/1/09 to 21/1/09, the online methane analyser was faulty. PP had used the portable gas analyser where 4 analyses were carried out on daily basis and average data of these 4 analyses was taken as the methane concentration for the day.</p>	Refer to CAR 2, CAR 3, CAR 4, CL 8, CL 9 and CL 10	OK

<p>4.2 Has information provided in the monitoring report been crosschecked with other sources such as plant log books, inventories, purchase records, laboratory analysis?</p>	<p>VVM</p>	<p>208 (b)</p>	<p>The following was verified :</p> <ul style="list-style-type: none"> <li>i) Monitoring I.D. 1, 2(a), 2(b) and 12 – checked with data from data logger or manually recorded data in LBP005 was used.</li> <li>ii) Monitoring I.D.3, 4 – checked with the internal laboratory results in LBP003 and external laboratory analysis reports</li> <li>iii) Monitoring I.D. 5 and 5(b) – checked with Genset Data Report (LBP004)</li> <li>iv) Monitoring I.D. 6(a) and 6(b) – checked with data from the data logger</li> <li>v) Monitoring I.D.7 – checked with Genset Data Report (LBP004)</li> <li>vi) Monitoring I.D.8 – checked with data from the data logger and the manual recorded in CIGAR daily Report (LBP005)</li> <li>vii) Monitoring I.D.9 – checked with the Methane tool PE spreadsheet.</li> <li>viii) Monitoring I.D 10 , 11 – checked with external lab analysis reports</li> <li>ix) Monitoring I.D.13 – checked with the records in the Annual Parameter Report (LBP010)</li> <li>x) Monitoring I.D.14, 15, 16 and 17 – checked with the Quarterly Monitoring Parameters reports (LBP009)</li> <li>xi) Monitoring I.D 15 and 16 – checked the Quarterly</li> </ul>	<p>OK</p>	<p>OK</p>
<p>4.3 Have calculations of baseline emissions, proposed CDM project activity emissions and leakage, as appropriate, been carried out in accordance with the formulae and methods described in the monitoring plan and the applied methodology document?</p>	<p>VVM</p>	<p>208 (c)</p>	<p>The formulae for calculations of baseline emissions and project emissions as in the ER spreadsheet were found to be correct except for the following:</p> <ul style="list-style-type: none"> <li>i) The number of days used in the calculation of Mla-goon_aerobic_BL and Methane emissions from leakage of biogas - based on monitored data (ECH4_NAWTF) found not correct.</li> <li>ii) The unit for 'Total surface area of the lagoons' should be m<sup>2</sup> instead of ha.</li> </ul>	<p><del>CAR-5</del></p>	<p>OK</p>

			iii) For electricity generated from biogas system and used in the biogas plant (ER sheet D33 and D34), the cell starts with I128 '=SUM('Project Data'!I128:I360)' and J128 '=SUM('Project Data'!J128:J360)' which was dated 20/6/2008.		
4.4 Any assumptions used in emission calculations? If yes, they been justified?	VVM	208 (d)	<p>There were no assumptions used in the calculation of emission reductions.</p> <p>In page 3 of the Monitoring Report, PP had justified the reason for actual ER to be higher than the estimated value in the PDD. However, PP had not included the actual POME/FFB ratio obtained during this monitoring period.</p>	OK  <del>GL-15</del>	OK  OK
4.5 Have appropriate emission factors, IPCC default values and other reference values been correctly applied?	VVM	208 (e)	The parameters determined during the validation (i.e. ex-ante) have included the emissions factors, IPCC values and default values as defined in the methodology. These parameters were as indicated in Table 1 of the spreadsheet and Section 4 in the Monitoring Report.	OK	OK

**TABLE 2 : GOLD STANDARD MONITORING PARAMETERS**

No.	Parameter	Assessment
1)	No. of new jobs created - 5	Since the beginning of the project, 5 new staffs (1 Biogas Supervisor and 4 technicians) have been recruited to operate and maintain the biogas plant.
2)	Safety Review of biogas plant on quarterly basis sighting at least the following: <ul style="list-style-type: none"> <li>• Leaks or cracks in pipes and joins</li> <li>• Leaks or cracks in the CIGAR cover</li> <li>• Potential equipment that could spark in engine room</li> <li>• Sufficient ventilation in engine room</li> <li>• Potential sparks at any pumps or blowers</li> </ul>	Carried out on quarterly basis. These criteria have been included in the Quarterly Parameter report.
3)	New legislation mandating biogas plants.	Confirmation from Thailand Greenhouse Gas Office (TGO) was not provided to the verification team. (CL 16)
4)	Odour reduction.	Interview with the following stakeholders were carried out during the on-site verification. <ul style="list-style-type: none"> <li>i) Mr.Phool Chaibury* – Local Councillor</li> <li>ii) Mr. Nukon Srichoo* – Lamthap Subdistrict Representative</li> <li>iii) Mr.Chalong Saengmanee* – Lamphthap Mill worker</li> <li>iv) Mr.Pitaya Tawisuwan - villager</li> </ul> The stakeholders have confirmed that since the project has been implemented, the odour from the factory has reduced. A visit to the surrounding villages was carried out in the evening (after heavy rain). The verifiers confirmed no bad smell from the factory at the surrounding villages.

		Note: * participated in the local stakeholder consultation process.
5)	Minimum 65% of biogas used for energy purposes	The % of biogas used for energy purposes will need to be reviewed once the corrective action requests and clarification request related to the used of biogas has been resolved, (refer to CAR 2, CAR 5 and CL9).
6)	Land for oil palm expansion	Letter from Krabi Agriculture Extension Office was not provided to the verification team. (CL 17)
7)	Status of RSPO	Confirmation from the RSPO Secretary General on the acceptance as a member in the RSPO was verified. The status is also reflected in the RSPO website.

**TABLE 3: RESOLUTION OF CORRECTIVE ACTION AND CLARIFICATION REQUESTS**

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
<p><b><u>CAR 1</u></b></p> <p>For COD parameter, there was no analysis by external laboratory carried out from the start of the monitoring period until 15/8/08.</p>	<p>205 (b)</p>	<p>Unfortunately it took some time for the team to arrange for the external laboratory testing and this only commenced in August.</p> <p>However there was close contact for training and servicing of the COD equipment with the Supplier in that period:</p> <p>Please see statement from Supplier for training of laboratory staff for COD testing equipment attached with this Verification Findings Report titled "Training for COD metering operation". This was conducted on 20<sup>th</sup> March. Please also see the Service Reports by the COD laboratory equipment supplier for the equipment check provided with this Verification Findings Report for dates 17th July 2008 and 29th May 2009 titled "COD Supplier Service Reports for Univanich". A statement from Equipment Supplier clarifying the remarks related to Temperature are also provided titled "Statement from COD supplier re Temperature"..</p>	<p>The supplier had provided list of trainee that had attended the training for the COD testing equipment. Interview with the relevant lab personnel revealed that they are competent in carrying out the COD testing, and as per standard SOP.</p> <p>Conclusion : CAR 1 closed.</p>
<p><b><u>CAR 2</u></b></p> <p>The following was found in the spreadsheet for monitoring I.D.6a and 6b.:</p> <p>i) In the spreadsheet 'Methane tool VER PE' for 2008, it was mentioned that the volumetric</p>	<p>205(b)</p>	<p>From 20/4/2008 – 31/7/2008 the flowrate meter the flare Vflare was not working – the meter malfunctioned due to vibrations in the pipeline; and a replacement from Germany took many months to arrive. Therefore the spreadsheet 'Methane Tool PE v1 -Apr to Aug 08' mentions in cell B13 that the volu-</p>	<p>The verification team agreed that the reconstruction of data for biogas volumetric flow rate was not possible. Hence, assuming '0' value flared is acceptable as it lower the ER captured. This had been reflected in the revised spread-</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
<p>flow rate was derived from the average of flow rates for quarter September to November 2008 (cell B13). It was unclear how this was derived.</p> <p>ii) From 20/4/08 to 31/7/08 the data for Vflare was mentioned to be reconstructed data. This was found to be not possible as Vflare should be measured.</p> <p>iii) The unit for FV(RG,h) should be Nm<sup>3</sup>/hr rather than m<sup>3</sup>/hr</p>		<p>metric flowrate was derived from the average of flow rates for quarter September to November 2008.</p> <p>It is difficult to reconstruct the Vflare flowrate based on other data.</p> <p>It is proposed to take the most theoretically conservative possibly value for the Vflare and FV<sub>RG,h</sub>; which is 0 – this is because both Equation 13 of AM0022v4 and to flare emissions. Equation 13 requires the sum of all captured biogas to be deducted from the calculated baseline emissions, the lower value for captured biogas value, the higher the penalty deducted.</p> <p>This approach has been previously Verified by the CDM DOE and Certified by the CDM EB (when the issue of malfunction of flare monitoring equipment occurred during the CDM Monitoring Period 1-2-09 to 31-3-09).</p> <p>The MR and ER spreadsheets have been updated accordingly and the reconstructed data has been removed.</p> <p>The unit for FV<sub>RG,h</sub> has been corrected to read Nm<sup>3</sup>/hr</p>	<p>sheet.</p> <p>The unit for FV(RG,h) had been corrected accordingly.</p> <p>Conclusion : CAR 2 closed.</p>
<p><b>CAR 3</b></p> <p>Separate spreadsheet called the 'Methane tool PE' was established. From 2008 spreadsheet it</p>	205(b)	<p>Please see response to CL7. From March until May 2008, there flare detector was not connected to the data logger. Although the flare detector was working, there are no rec-</p>	<p>The spreadsheet had been amended accordingly. The flare efficiency was taken as 0% for the period when there was no data on every minute or hourly to determine the</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
<p>was unclear how the determination of flare efficiency of 50% was made when there was no data on every minute or hourly to determine the operational of the system meeting the 20 minutes requirement.</p>		<p>ords of the flame on/off for the flare tool calculation. In addition, until 25<sup>th</sup> August 2008, the flare detector was only logging on a 10minute basis, and therefore the calculation for flare tool on 20minute requirement could not be accurately calculated.</p> <p>It is difficult to reconstruct flame on/off data from previous and subsequent data.</p> <p>Therefore, during the periods when the flow rate meter was working (8/4/2008 to 19/4/2008 and 1/8/2008 to 9/8/2008) but the flare detector was not working, then 0% efficiency was applied during these times as the theoretically most conservative value possible; please see files 'Methane Tool VER PE April 08w code' and 'Methane Tool VER PE Aug 8 w code'. After 25 August when all data is available, then file 'Methane Tool VER PE Aug to Jan 09 w code' correctly calculates according to the Flare Tool.</p> <p>The MR has been updated to reflect these issues.</p>	<p>operational of the system in meeting the 20 minutes requirement.</p> <p>Conclusion : CAR 3 closed.</p>
<p><b>CAR 4</b> For biogas methane concentration (Monitoring I.D.8) spreadsheet, the following were found:</p> <p>i) For year 2008, there was no CH4 reading recorded in the spreadsheet, and in the VER ER spreadsheet it was verified that from 13/4/08 to 7/4/08, 24/6/08 to 29/9/08 and other days that were highlighted in yellow</p>		<p>For the year 2008, there were some problems with the function of the inline methane analyser – these days were highlighted in yellow in the VER ER spreadsheet. As a backup, the PP conducted manual tests of the methane concentration in the biogas stream 4 times/day. The MR has been updated to include this deviation from the</p>	<p>The MR had been revised to include the use of the manual analyse methane value.</p> <p>PE flare spreadsheet had included the methane results based on hourly recorded measurement.</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
<p>low in the spreadsheet, the CH4 concentration reading was based on measured value using handheld CH4 meter, 4 readings a day. This deviation from the methodology, was not reflected/explained in the MR.</p> <p>ii) For the readings which were highlighted in blue, which indicated reading from the recorder, it was found that the values were not included in the Methane tool PE spreadsheet'</p>		<p>methodology from continuous reading to daily average of the 4 manual readings each day.</p> <p>As the average of the continuous inline readings is higher than the average of the manual readings, it is conservative to use the manual readings in the flare tool calculation. However, for the Equation 13 deduction from baseline emissions (see CAR02) it is more conservative to use the lower of the methane average readings, and therefore the average of the inline readings is used for this equation.</p> <p>This deviation from the methodology is outlined in the MR.</p> <p>For the daily readings highlighted in blue – for the file 'Methane Tool PE v1 -Apr to Aug 08' there are no methane readings included, since the flare tool cannot be applied as per CAR02. After 25<sup>th</sup> August 2008, the values in blue indicate the average of the daily continuous readings of methane shown in the file The file 'Methane Tool VER PE Aug to Jan 09'.</p>	<p>Conclusion: CAR 4 closed.</p>
<p><b><u>CAR 5</u></b></p> <p>The following issues were found in the ER spreadsheets:</p> <p>i) The number of days used in the calculation of Mlagoon_aerobic_BL and Methane emissions</p>	<p>208(c)</p>	<p>Mlagoon_aerobic_BL has been corrected for the correct number of days in the Monitoring Period, including correcting the number of days for July and ensuring it is for 11 months. ECH4_NAWTF has also been corrected,</p>	<p>i) The number of days used in the calculation of Mlagoon_aerobic_BL had been corrected..</p> <p>ii) Unit for the total surface area has been</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
<p>from leakage of biogas - based on monitored data (ECH4_NAWTF) found not correct.</p> <p>ii) The unit for 'Total surface area of the lagoons' should be m<sup>2</sup> instead of ha.</p> <p>iii) For electricity generated from biogas system and used in the biogas plant (ER sheet D33 and D34), the cell starts with I128 '=SUM('Project Data'!I128:I360)' and J128 '=SUM('Project Data'!J128:J360)' which was dated 20/6/2008.</p>		<p>however this value is not actually used in the ER calculation; since the more (significantly) conservative approach of the default factor from ACM13 has been applied.</p> <p>The unit for surface area has been changed to m<sup>2</sup>.</p> <p>The ER sheet cells D33 and D34 have been corrected to read from I26 and J26.</p>	<p>changed to m2.</p> <p>iii) The cell has been changed accordingly.</p> <p>Conclusion: CAR 5 closed.</p>
<p><b>CL 1</b></p> <p>Please clarify why the amount of chemical oxidizing agents entering system is measured quarterly rather than continuous as specified in AM0022 version 4.</p>	200	<p>AM0022 version 4 is inconsistent for measurement frequency - on page 21 it states "Regular samples will test for concentration of oxidising agents ..." Whereas on page 13 it mentions continuous monitoring. Since tests for sulphates is a laboratory test, it is impossible to measure it continuously so the 'regular samples' on page 21 of the Methodology was followed and quarterly test was validated in the Monitoring Plan.</p> <p>The Monitoring procedures in the Monitoring Plan were corrected followed during the Verification period.</p>	<p>It was agreed that the sulphates analysis involved the laboratory test. Cross checked with other registered CDM projects applying the same methodology also seen that the monitoring of this parameter is carried out on a periodical basis and not continuous.</p> <p>Conclusion: CL 1 closed.</p>
<p><b>CL 2</b></p> <p>In the spreadsheet the data from FI38 was labelled as WW output instead of WW recycle and 2(a) instead of 2(b) (i.e. column C of the spreadsheet should be for 2(b))</p>	205 (b)	<p>The ER Spreadsheet has been corrected so that FI38 in column C is 2b as per the Monitoring Plan. Column D for FI40 has been corrected to 2a.</p> <p>FI38 has been correctly titled as WW recycle.</p>	<p>The spreadsheet had been revised accordingly.</p> <p>Conclusion : CL 2 closed.</p>

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<p><b>CL 3</b> The following sampling of COD<sub>output</sub> need clarification :</p> <p>According to Section 1 of the monitoring report, the settling pond was commissioned at the end of October 2008. However, from the spreadsheet it was indicated that the COD<sub>output</sub> from Settling Pond to Pond 6 had COD analysed since 2/9/2008.</p>	205 (b)	<p>The settling pond was filled with wastewater from the CIGAR since 15 Aug 2008 when there was the w/w flow out from settling pond. However, the water recycle pipe and pumping for FI38 was finished end of Oct 2008 so this is why there are some COD result since 28 Aug 2008. The MR has been updated to include this information.</p>	
<p><b>CL 4</b></p> <p>ER spreadsheet for CODout:</p> <p>i) There was no remark as to why on some of the days for example on 13/4/08 to 17/4/08 and 31/12/08. There were no data in the spreadsheet.</p> <p>ii) Error in the spreadsheet for data on 21/4/08 and 22/4/08 were found.</p>	205 (b)	<p>The ER spreadsheet for CODout has been corrected:</p> <p>i) included remarks for days where there is no data in spreadsheet for 13/4/08 to 17/4/08 and 31/12/08 (public holidays in Thailand)</p> <p>ii) Copying errors of data for 21/4/08 and 22/4/08 have been corrected in ER spreadsheet.</p>	<p>i) Remarks have been included. ii) Data had been corrected as verified.</p> <p>Conclusion: CL 4 closed.</p>
<p><b>CL 5</b></p> <p>For parameter with Monitoring I.D.5b., the following need to be clarified:</p> <p>i) In the spreadsheet, data from M4 was identified as having a monitoring I.D of 5b(ii) which</p>	205(b)	<p>The ER spreadsheet for Monitoring I.D.5b.has been corrected:</p> <p>i) I.D 5b(ii) corrected as I.D 5b ii) As per the Monitoring Plan, 5b is subtracted from 5a to determine net electricity sold to the grid, which becomes base-</p>	<p>i) Correction had been made in the spreadsheet. ii) Explanation provided is correct. It was</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
<p>is not in the PDD.</p> <p>ii) In the monitoring report, this parameter was reported under 'Baseline emissions parameters' rather than project emissions</p> <p>iii) From 13/3/08 to 1/4/08, 6/8 to 7/8/08 and 23/11/08 data recorded in the spreadsheet was '0' which was found not accurate as the biogas plant has been in operation during this period.</p>		<p>line emissions. 5b is not used to calculate and deduct as project emissions.</p> <p>iii) From 13/3/08-1/4/08 there were no readings for M4. To be conservative, the highest readings recorded during the whole monitoring period were taken for this dates. For 6-7 /8/08 the meter M4 took the record on 8/8/08 so the kWh of M4 on 6th and 7th summed up as total on 8/8/08 On the 7/8/08 the biogas plant stopped to repair the Scrubber. On the 23/11/08 Gas engine breakdown and M4 was included on 24/11/08. These have all been marked in the ER spreadsheet.</p>	<p>seen that this data was deducted from the total generation of electricity to get the net electricity exported to the grid.</p> <p>iii) The use of highest kWh value during the monitoring period for 13/3 to 1/4/08 is conservative. On 6/8 to 7/8/08 and 23/11/08, it can be see that the kWh readings after that days without data is higher as compared to other normal days.</p> <p>Conclusion: CL 5 closed.</p>
<p><b>CL 6</b></p> <p>The quarterly analysis of SO<sub>4</sub> was not carried out during the period March 2008 until 15/8/08.</p>	205(b)	<p>Unfortunately it took some time for the team to arrange for the external laboratory testing and this only commenced in August. The external laboratory is far away in Hat Yai province.</p> <p>However, as average over the period is used, it is considered reasonable to assume the average over the period August 2008-January 2009 would represent sufficiently the period March – August 2008.</p>	<p>A total of 6 samples were analysed during the monitoring period which were sufficient.</p> <p>Conclusion: CL6 closed.</p>
<p><b>CL 7</b></p> <p>Please clarify why for year 2008, there was no reading on the detection on flame recorded in the 'Methane tool VER PE'. It was also unsure how the QA/QC procedure being implemented during</p>	205(b)	<p>Unfortunately it took until 9<sup>th</sup> May 2008 to arrange the connection of the flare detector to the data logger. During this time the flare detector was working, but there are no records of the flame on/off. After this date, the flare detector was connected to the data log-</p>	<p>The spreadsheet had included the data from 25 August 2008 onwards. As mentioned in CAR 3, data prior to this is considered as '0'</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
this period		ger on 10minute intervals. On the 25 <sup>th</sup> August the flare detector was connected to the 1 minute data logger to ensure the flare tool calculation could be correctly implemented.	Conclusion: CL7 closed.
<p><b>CL 8</b></p> <p>The following issues were found on the spreadsheet relating to CODin (monitoring I.D.3):</p> <ul style="list-style-type: none"> <li>i) Error in data transfer in 21/4/08 and 22/4/08.</li> <li>ii) No remarks why on 13/4/08 to 17/4/08, and 1/5/08 no analysis was carried out.</li> </ul>		<p>The ER spreadsheet has been updated for CODin (monitoring I.D.3):</p> <ul style="list-style-type: none"> <li>i) Corrected copying errors in data transfer for 21/4/08 and 22/4/08.</li> <li>ii) Made remarks for public holidays on 13/4/08 to 17/4/08, and 1/5/08 when no analysis was carried out.</li> </ul>	<ul style="list-style-type: none"> <li>i) COD data had been corrected as per verified values.</li> <li>ii) Remarks had been made in the spreadsheet.</li> </ul> <p>Conclusion : CL 8 closed.</p>
<p><b>CL 9</b></p> <p>Spreadsheet for monitoring I.D. 7 was checked and found the following:</p> <ul style="list-style-type: none"> <li>i) Please clarify why from 13/3/08 to 30/3/08 and 30/6/08 it was indicated that no biogas flow but there was electricity generation during this time.</li> <li>ii) From 9/8/08 to 3/9/08 it was indicated that the data was a reconstructed data. The calculation of how these data was obtained was not provided to the verification team</li> </ul>		<p>The ER spreadsheet has been updated for monitoring I.D. 7 t</p> <ul style="list-style-type: none"> <li>i) From 13/3/08 to 30/3/08 the flow meter was not connected to the data logger and despite the fact that there was biogas flow. On 30/6/08 there was the signal problem from flow meter.</li> <li>ii) From 9/8/08 to 3/9/08 (and for above dates) the data was a reconstructed based on the biogas usage per MWh for the rest of the monitoring period. This is considered a reasonably conservative calculation as the period is small in</li> </ul>	<p>The amount of biogas needed to generate a kWh of electricity is commonly use in the design of the genset. Further to that, the period of the missing data was short and therefore, the reconstruction of data using this method was accepted. The spreadsheet to calculate the Nm3 biogas/kWh generation had been included in the VER spreadsheet and found that using the lower boundary of the 95% confidence level data was found conservative.</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
		<p>comparison to the remaining monitoring period. To ensure conservativeness of this value, the lower bound of 95% confidence level was used. In addition, any abnormal values were excluded. The ER Spreadsheet has been updated to include the calculation in the spreadsheet so the team can verify the calculation.</p>	<p>Conclusion: CL 9 closed.</p>
<p><b>CL 10</b></p> <p>It was noted that the first methane analyser was faulty since 2/1/09 and was removed for repair on 6/1/09. During the period from 2/1/09 to 21/1/09 data from the portable gas analyser was used. Four analyses were carried out by the Biogas Supervisor daily and average of the values was used in the spreadsheet. The used of manual sampling was not indicated in the 'Methane Tool VER PE' 2009. It was only indicated in the 'VER ER calculation spreadsheet'</p>	<p>205(b)</p>	<p>There are no methane values used in the file 'Methane Tool PE v1 -Apr to Aug 08' since the flare tool cannot be applied as per CAR02. After 25<sup>th</sup> August 2008, when the methane analyser was not working, the daily average of the 4 manual samples has been used in the file 'Methane Tool VER PE Aug to Jan 09'. These values are the same as the values in the VER ER calculation spreadsheet.</p> <p>The file Methane Tool VER PE Aug to Jan 09 has been updated to indicate when the use of manual CH4 readings were made.</p>	<p>The use of manual recorded CH4 reading had been indicated in the spreadsheet and the Monitoring Report.</p> <p>Conclusion: CL 10 closed.</p>
<p><b>CL 11</b></p> <p>The record of initial calibration of COD meter prior to the used of the equipment was not provided to the verification team.</p>	<p>205(c)</p>	<p>The certificate for the COD Hach meter is provided with this Verification Protocol. This was provided to Univanich by Hach company in April 2009, in preparation for the first CDM Verification site visit.</p> <p>The COD meter was received on the 27<sup>th</sup> November 2007. The certificate of conformance indicating the delivered product was in conformance, was provided by the manufac-</p>	<p>A Certificate of Conformance from supplier was issued on 1 April 2009. The letter confirmed that the equipment supplied to Univanich had been factory calibrated.</p> <p>Conclusion : CL 11 closed.</p>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Verification team conclusion
		turer in 2009, since this is when it was requested as part of the CDM Verification process.	
<p><b>CL 12</b></p> <p>The manufacturer of the power meters did not specify the calibration frequency. PP had indicated in the Monitoring Report that the calibration frequency is 2 years following the PEA practices. However, there was no supporting document to support this.</p>		<p>The Provincial Electricity Authority of Thailand calibrates the meters annually. PEA has not provided evidence of the requirement for this frequency however annually is considered applicable.</p>	<p>Annual calibration of the power meters is acceptable. The calibration was carried out by the PEA who is the power utility company.</p> <p>Conclusion: CL12 closed.</p>
<p><b>CL 13</b></p> <p>The following issues relating to the methane gas analyser need clarification:</p> <ul style="list-style-type: none"> <li>i) The first infrared spectrometry gas analyser with S/N 25791 was not included in the Monitoring Report.</li> <li>ii) In accordance with the QA/QC procedure in the PDD, a quarterly calibration check against a reference bottle of known concentration of methane will be conducted and calibration checks every 6 months.</li> </ul>	205(c)	<p>The first methane analyser with S/N 25791 has been added to the MR.</p> <p>A quarterly monitoring check of the methane concentration using a hand held methane analyser was conducted quarterly, as per the quarterly monitoring procedures PD012 and documented in LBP009. The statement 'calibration checks every 6 months' is a typo as it is a repetition of calibration checks every 3 months.</p> <p>A Request for Revision has been submitted to the CDM EB to change this to 3<sup>rd</sup> party calibration according to manufacturer's specifications, in addition to the quarterly calibration checks.</p>	<ul style="list-style-type: none"> <li>i) The monitoring report had included the S/N 25791</li> <li>ii) Comparison of readings between the hand held methane analyser and the on line methane analyser was carried out on a quarterly basis by the Biogas Supervisor. The actual calibration was carried out in accordance with the manufacturer's specification. A request for revision of monitoring plan which was submitted to the CDM EB had included the change in the QA/QC procedure.</li> </ul> <p>Conclusion: CL 13 closed.</p>
<p><b>CL 14</b></p> <p>The hand held gas detector (TESTO</p>	205(c)	Methodology AM0022 does not specify the method used to quantify the methane leak in	It was confirmed that data from this gas detector was not used in the calculation of

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S/N.31143.20) was calibrated on 26 September 2009. The validity of the calibration was specified as 2 years. This was found not consistent with the QA/QC procedure of the PDD which indicated monthly calibration.		the anaerobic digester system. The DOE during validation asked for the inclusion of the leak detection, however for the calculation of methane leaks, the verifying DOE required that Equation 30 of ACM14 v3.1 with the default factor of 5% to calculate leaks, which is highly conservative. Therefore the monitored parameter is not use to calculate emission reductions. Therefore although the calibration doesn't follow the MP frequency, it does not affect the calculation. The PP has submitted a Request for Revision of the MP to change the calibration of the gas detector to be as per manufacturer's specification rather than monthly calibration.	the ER. Instead equation 30 from ACM 14 was used to estimate the leak from the bio-gas system. A request for revision of the monitoring plan has also been submitted to CDM EB to change the calibration requirements in the QA/QC procedure.  Conclusion: CL 14 closed.
<b>CL 15</b> In page 3 of the Monitoring Report, PP had justified the reason for actual ER to be higher than the estimated value in the PDD. However, PP had not included the actual POME/FFB ratio obtained during this monitoring period.	208(d)	The actual POME/FFB ratio is provided with this Verification protocol and the MR has been updated to state the actual ratio of 63% based on this data.	The monitoring report had included the data. A separate spreadsheet to calculate the POME/FFB ration was also provided to the verification team. The values were as verified.  Conclusion: CL 15 closed.
<b>CL 16</b> The confirmation from Thailand Greenhouse Gas (TGO) on no new legislation mandating biogas plants was not provided to the verification team.	GS (3)	Please see confirmation from Dr Chaiwat, Deputy Executive Director, of the Thailand Greenhouse Gas Office which confirms there was no new legislation introduced into Thailand relating to the requirement for biogas plants (file 'RE TGO confirmation of legislation mandating methane recovery from ww agro-processing plants in Thailand'.	Confirmation from the Deputy Executive Director, Thailand Greenhouse Gas Management Organization dated 9 May 2011 has been obtained. It was confirmed that since March 2008 there is no new legislation development that mandate methane recovery from wastewater treatment for Agro-processing

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			plants in Thailand. Conclusion: CL 16 closed.
<p><b>CL 17</b> Letter from Krabi Agriculture Extension Office was not provided to the verification team.</p>	GS (6)	Please see Letter 'Krabi land for oil palm 2009_10' provided by Krabi Agriculture Extension Office which summarises the source of land for new oil palm and demonstrates that no forests were cleared for the expansion of oil palm in that period.	Letter from Krabi Agriculture Office dated 28 March 2011 confirmed that the sources of land for new oil palm in year 2009 to 2010 are from land that is used to replace the coffee, fruit orchards and coconut areas, and empty land (ex-paddy and prawn farms). There was no forest cleared for the expansion of oil palm.  Conclusion: CL 17 closed.