

***VERIFICATION REPORT OF THE
“WASTEWATER TREATMENT WITH
BIOGAS PRODUCTION (UASB) AND
HEAT UTILIZATION AT GENERAL
STARCH CO. LTD.”***



Voluntary Carbon Standard 2007.1

Monitoring Period: 01 September 2009 – 31 August 2010
(including both days)

Report No: VCS-024 / rev. 02

Date: 2011-05-06

Date of first issue: 2011-02-24	Project No.: VCS 024
Approved by: Markus Weber	Organizational unit: Greenhouse Gas Services
Client: South Pole Carbon Asset Management Ltd.	Client ref. Mr. Patrick Buergi; Managing Partner
Summary: Germanischer Lloyd Certification GmbH (GLC) has performed the verification of the project "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd." against the requirements of VCS 2007.1. A combined validation and verification was carried out and the project was registered with reference no. 082 under VCS (Voluntary Carbon Standard) program in 2007. This is the fourth periodic verification of this project. This verification covers the period from 2009-09-01 to 2010-08-31. The project activity involves treatment of wastewater produced in starch manufacturing process at General Starch Ltd. through UASB (Up-flow Anaerobic Sludge Blanket) technology. The use of UASB to treat the wastewater generated in the plant enables capturing of methane produced during the process as well as meets the effluent standards. The captured methane is utilised as fuel in existing heat generating devices in the plant replacing heavy fuel oil. Surplus methane, if any, is flared in an open flare. The methodology applied for the project to estimate the GHG emission reduction is AM0022, version 04 – Avoided wastewater and onsite energy use emissions in the industrial sector. A risk based approach has been followed in this verification. In the course of the verification, 5 Corrective Action Requests (CAR), 2 Clarification Requests (CL) and 1 Forward Action Request (FAR) have been raised. All the CARs and CLs, upon addressing, have been closed out successfully. There are no pending CARs, CLs or FARs from the previous verification. The verification is based on registered VCS Project Design Document (VCS PDD), monitoring plan of the registered VCS PDD (VCS Ref. No. 082, https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=82), monitoring report (MR) and other supporting documents made available to the verification team by project participants.	

As a result of the verification, the verifiers confirm that:

The GHG emission reduction in the verification period (2009-09-01 to 2010-08-31, including both the days) is: **111,517 t CO₂e**.

Emission reductions 2009	39,210	t CO ₂ e
Emission reductions 2010	72,307	t CO ₂ e
Emission Reductions Total	111,517	t CO ₂ e

GLC does not assume any responsibility towards the issuance and utilization of VCUs hereby verified and certified. Request for issuance of VCUs shall be made by the project participants to an approved VCS Program Registry based on the requirements set out under the most recent version of the VCS Program Guidelines clause on VCS Registration. The verification of reported emission reductions is based on the information made available to GLC and the engagement conditions detailed in this report. Hence, GLC cannot be held liable by any party for decisions made or not made based on this report.

Report No.: VCS 024		Subject Group: Greenhouse Gas	Indexing terms Voluntary Carbon Standard ☒ No distribution without permission from the Client or responsible organizational unit ☐ Limited distribution ☐ Unrestricted distribution
Report title: Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.			
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Date of this revision: 2011-05-06	Rev. No.: 02	Number of pages: 64	

Abbreviations

BL	Baseline
BOT	Built Operate and Transfer
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CH ₄	Methane
CL	Clarification Request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
DOE	Designated Operational Entity
ER	Emission Reduction
FAR	Forward Action Request
FM	Wastewater flow meter
GHG	Green House Gas(es)
GM	Gas flow meter
GSL	General Starch Limited
MP	Monitoring Plan
MR	Monitoring Report
NA	Not Applicable
PDD	Project Design Document
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
t CO ₂ e	Ton of Carbon dioxide equivalent
UASB	Up-flow Anaerobic Sludge Blanket

UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VCSA	VCS Association
VCS 2007.1	Voluntary Carbon Standard - Version 2007.1
VCU	Voluntary Carbon Unit
VER	Voluntary Emission Reduction

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1. INTRODUCTION

South Pole Carbon Asset Management Ltd. has commissioned Germanischer Lloyd Certification GmbH (GLC) to carry out the 4th periodic verification of the emission reductions reported for the VCS project activity "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd." with regard to the relevant requirements for VCS program as per the Voluntary Carbon Standard 2007.1 (VCS 2007.1).

This verification report summarizes:

- (i) The findings from the VCS verification for the current monitoring period from 2009-09-01 to 2010-08-31; and
- (ii) Certification statement for the emission reductions.

1.1. Objective

VCS Verification is the periodic independent review and ex post determination by a Verification Entity or Designated Operational Entity (DOE) (which is approved/registered as a verifier by VCSA) of the monitored reductions in GHG emissions that have occurred as a result of the registered VCS project activity during a defined verification period.

VCS Certification is the written assurance by a Certification Entity (which is approved/registered as a certifier by VCSA) that, during a specific period in time, a project activity achieved the emission reductions as verified.

The objective of this verification was to verify and certify emission reductions reported for the project activity "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd." for the monitoring period from 2009-09-01 to 2010-08-31.

One of the objectives is also to confirm that the monitoring system is implemented and fully functional to generate Voluntary Emission Reductions (VERs/VCUs) without any double counting.

1.2. Scope and Criteria

1.2.1. Scope of the verification

The scope of the verification is:

- To ensure that the project activity has been implemented and operated as per the registered VCS PDD and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place.

- To verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan as per the registered PDD.
- To evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance whether the reported GHG emission reduction data is free from material misstatement.
- To verify that the reported GHG emission data is sufficiently supported by evidence.¹

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified.

The project design, its eligibility as project activity under VCS guidelines and the correct application of the approved CDM baseline and monitoring methodology AM0022, ver.04: Avoided Wastewater and Onsite Energy Use Emissions in the Industrial Sector ^{/17/} have already been validated and verified by the DOE “TUV-NORD” (Report No. 8000349679-07/63 – V01 issued on 31 August 2007) ^{/13/}. As stated in the combined verification report (no separate validation), the verification opinion of “TUV-NORD” is that the project activity as described in the registered VCS PDD dated 2007-06-19^{/2/} meets all VCS Program requirements as set out in the VCSA Rules (Voluntary Carbon Standard – 2007.1 and Voluntary Carbon Standard Program Guidelines 2007.1) and correctly applies the CDM approved baseline and monitoring methodology AM0022, ver.04: Avoided Wastewater and Onsite Energy Use Emissions in the Industrial Sector.

1.2.2.Verification Criteria

The verification team has focused on the identification of significant reporting risks and verifying the mitigation measures for these risks based on the recommendations in the “Validation and Verification Manual” ^{/1/}, “ISO 14064-3 “Greenhouse gases – Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions” ^{/12/} and employed a risk-based approach.

According to the requirements and guidance of VCS 2007.1, the criteria of this verification include the relevant applicable rules and steps for VER verification under the CDM excluding the following:

- The public availability of the VER/VCS Monitoring Report;
- Confirmation of contribution of the project activity towards sustainable development in the country where the project is located
- The public availability of the Verification Report and Certification Statement.

¹ As per VCS, Verified Emission Reductions (VERs) are considered to be VCs only after successful registration in an approved VCU Registry

1.3. VCS Project Description:

1.3.1. Project Characteristics

Table 1-1: Project Characteristics

Item	Data
Title of the project activity	Wastewater Treatment with Biogas production (UASB) and heat utilization at General Starch Co. Ltd.
Project Location (specific Address, Country)	Address: No.99, Chok Chai – Kornburi Road, Amphur Kornburi, Nakhorn Ratchasima Province, Thailand Country: Thailand.
Project participants	Papop Renewable Co., Ltd.
	South Pole Carbon Asset Management Ltd.
Project Entities	Papop Renewable Co., Ltd. 10/35, Soi Songseangtawan Ladphrao Rd, Samsennok Huaykwang Bangkok, 10320 Thailand
	South Pole Carbon Asset Management Ltd. Technoparkstrasse 1 Zurich-8005 Switzerland
Applied Methodology	AM0022, ver.04: Avoided Wastewater and Onsite Energy Use Emissions in the Industrial Sector
Sectoral Scope	13
Project crediting period	2004-01-01 to 2013-12-31
Period verified in this verification	2009-09-01 to 2010-08-31

1.3.2. Project Background

The project activity involves installation of an anaerobic wastewater treatment facility at General Starch Ltd., a starch manufacturing plant, which has been in operation since 1995.

The starch plant has a total production capacity of 600 tonnes of native starch per day generating approximately 5000 m³ of wastewater every production day. Prior to project implementation, the waste water was treated with an open lagoon based pond system with gravitational flow (cascading flow through 34 lagoons). The minimum depth of these ponds is about 10 m for first three lagoons and more than 3 m for rest of the lagoons. The average atmospheric temperature in the region is above 15 °C and the wastewater temperature is also above the 15 °C as required by the applied methodology.

These conditions result in anaerobic environment within the ponds resulting in methane generation from the organic content of the wastewater, characterized by its COD, which is released into the atmosphere.

The use of UASB technology to treat wastewater enables not only the avoidance of methane into the atmosphere but also capturing of methane produced and meeting the effluent standards. The captured methane (biogas) is utilized as fuel in existing heat generating devices in the plant replacing heavy fuel oil and the surplus biogas, if any, is flared into the atmosphere, thereby contributing to green house gas (GHG) emission reduction.

As per the registered VCS PDD (VCS Ref. No: 082) of the VCS project, baseline emissions are calculated as the sum of fugitive methane emissions from lagoons in the baseline case and CO₂ emissions by replacing fossil fuel with biogas for onsite heat generation. Project emissions are calculated as the fugitive methane emissions from the project activity i.e. in present scenario. The emission reduction is calculated as the difference of baseline emissions and the project emissions as the leakage emissions are considered to be negligible for the project activity as per the applied methodology.

The total emission reduction for the current verification period (2009-09-01 – 2010-08-31) is 111,842 tCO₂e. The emission reductions are calculated conservatively as per the applied methodology i.e. the methane emissions from the lagoons in the baseline situation calculated through the COD approach are not higher than the total emissions of biogas from the digesters and the lagoons in the project situation.

As per VCS guidelines, the project validated against the VCS v1, is grandfathered ^{/16/} to VCS 2007.1. Therefore, the project is verified against the VCS 2007.1. Further background information on the project activity can be found in the VCS Project Design Document (PDD) as well as the combined Voluntary Validation and first Verification report which are available on the VCS website:

<https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=82>

The previous verifications correspond to the following monitoring periods:

- 1st Verification: monitoring period from 2004-01-01 to 2007-05-31.^{/13/}
- 2nd Verification: monitoring period from 2007-06-01 to 2008-03-31.^{/14/}
- 3rd verification: monitoring period from 2008-04-01 to 2009-08-31^{/15/}

All the previous Verification and Monitoring Reports are available on the VCS website at the link mentioned above.

The project activity is located at the industrial facility of General Starch Ltd., 99, Chok Chai – Kornburi Road, Ampur Kornburi, Nakhorn Ratchasima, Thailand.

Main components of the project activity include Equalisation tanks (Acidification ponds), UASB (UASB-1: 13500 m³/day & UASB-2: 27000 m³/ day), Gas storage tanks, Hot oil & steam boilers, Cascading lagoons system (Evaporation ponds) and Flaring system.

1.3.3.Level of Assurance

As VCS 2007.1 only recognizes verified emission reductions, GLC has focused on providing a reasonable level of assurance that the emission reduction calculation methodology used is appropriate and correctly applied, and that emission reductions have been accurately monitored.

In accordance with the recommendation in the latest version of the Validation and Verification Manual ^{/1/}, GLC may “discount verified emission reductions or requests a discount of these by using conservative assumptions for uncertainties in emission reduction calculations that cannot be fully quantified or that cannot give a desired level of assurance”. For verifying/certifying VERs, the desired level of assurance was based on the combined quantitative assessment of the accuracy of monitoring project performance and the identification of material risks. For this verification, GLC is able to give a reasonable level of assurance.

2. METHODOLOGY

2.1. Verification Process Summary

The verification process was carried out inline with the requirements VCS 2007.1. In addition, the verification team followed the guidelines of the latest version of the Validation and Verification Manual ^{/1/}. Standard auditing techniques were also applied during the verification. The verification team performed first a desk review, followed by an on-site visit to review the project realization.

The verification process was based on assessment of the validated and registered Project Design Document (PDD) ^{/2/}, the monitoring report ^{/3/}, emission reduction

calculation spreadsheet ^{/4/}, supporting documents made available to the verifier and information collected through performing interviews during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

The verification was carried out on the basis of the following requirements, applicable for this project activity:

- Requirements and guidance of VCS 2007.1
- Applicable CDM guidelines and requirements, including applicable relevant methodological decisions made by the CDM Executive Board
- CDM Validation and Verification Manual ^{/1/}
- Other relevant rules, including the host country legislation
- Monitoring plan as given in the registered PDD ^{/2/}
- Approved CDM Methodology AM0022, version 04 – “Avoided Wastewater and On-site Energy Use Emissions in the Industrial Sector” ^{/17/}

2.2. Verification Team

A competent team with relevant knowledge and experience in the specific scopes and sectors is appointed. The verification team consists of the following members:

Table 2-1: Verification Team

	Name	Function ¹⁾	Scope Specific Knowledge	Sector Specific Knowledge	Host Country Knowledge	Type of involvement					
						Desk Review	On-site visit / interviews	Reporting	Technical review	Expert input	Approval
☒ Mr. ☐ Ms.	Markus Weber	ATL	x	x		x					x
☒ Mr. ☐ Ms.	Srikanth Meesa	A	x	x	x	x	x	x			
☒ Mr. ☐ Ms.	Karunakar Avuram	A	x	x		x	x	x			
☒ Mr. ☐ Ms.	Stephen P. Etheridge	E	x	x	x		x		x	x	

1) ATL: Assessment Team Leader; A: Auditor, E: Expert; TR: Technical Reviewer

- Preparations : from 2010-10-04 to 2010-10-15
- On-site verification: from 2010-11-29 to 2010-11-30
- Reporting/OA : from 2010- 12-06 to 2011-04-13

During the desk review all documents initially provided by the client and publicly available documents relevant for the verification were reviewed. The main documents are listed below:

- ## 2.4. On-site assessment

On 2010-11-29 and 2010-11-30 GLC carried out an on-site visit to General Starch Ltd. (GSL) site where the project is implemented. During the visit, GLC verified that the actual implementation of the project was as described in the registered VCS PDD.

On-site inspection included review of data and records, interviews with shift engineer, section manager, plant managers, BOT (Built Operate and Transfer) consultants, operations and maintenance personnel confirming all data sources used in the Monitoring Report.

The main tasks covered during the on-site visit included, but were not limited to:

- Confirmation that all project equipments have been installed and are operated as per the monitoring plan in the PDD.
- The operating staff was interviewed and observed in order to check the risks of inappropriate operation and data collection procedures.
- Information processes for generating, aggregating and reporting the selected monitored parameters were reviewed.
- Calibration records of all metering equipment were checked.
- Auditing of the monitoring processes, routines and documentations
- The monitored data was checked completely.

Representatives of GSL including the operational staff of the plant, BOT consultants and South Pole Carbon Asset Management Ltd. (project consultant) were interviewed to confirm selected information and to resolve issues identified in the document review.

The main topics of the interviews are summarized in Table 2-2.

Interview Topic	Interviewed persons and source of information
- General aspects of the project	Mr. Prayut Vitthayanukorn, Executive Director, VP – Projects & Engineering, GSL
- Technical equipment and operation	Mr. Krittapak Srisook, Biogas / Boiler Supervisor, GSL
- Changes since validation	Mr. Thamsak Sutthibun, Dept. of Electrical, GSL
- Monitoring and measurement equipment	Mr. Suchai Rattananadhekul, Electrical & Mechanical Manager, Papop Co. Ltd
- Remaining issues from validation	Mr. Patrick Burgi, Managing Partner, South Pole Carbon Asset Management Ltd.
- Calibration procedures	
- Quality management system	
- Involved personnel and responsibilities	

Interview Topic	Interviewed persons and source of information
- Training and practice of the operational personnel	Ms. Nattaya Lonawan, M & V Project Manager, South Pole Carbon Asset Management Ltd.
- Implementation of the monitoring plan	
- Monitoring data management	Ms. Pathathai Tonsuwonnont, Deputy Country Director, South Pole Carbon Asset Management Ltd.
- Data uncertainty and residual risks	
- GHG calculation	
- Procedural aspects of the verification	Mr. Harshpreet Singh, CDM Project Manager, South Pole Carbon Asset Management Ltd.
- Maintenance	
- Environmental aspects	

2.5. Reporting of Findings and Resolution of Outstanding Issues

On the basis of the desk review, the on-site visit, follow-up interviews and further background investigation the verification report is completed.

Findings established during the verification may be that:

- i) 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;
- ii) The verification has identified material misstatements in the reported emission reductions.

A detailed list of verification findings form the findings report, which is sent to the client for resolution of raised CARs, CLs and FARs.

Nonconformities raised during the verification can either be seen as a non-fulfillment of criteria ensuring the proper implementation of a project or where a risk to deliver high quality emission reductions is identified.

Corrective Action Requests (CARs) are issued, if:

- non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient;

- mistakes have been made in applying assumptions, data or calculations of emission reductions that will impair the estimate of emission reductions;
- issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants

Clarification Request (CL) is raised if the information is insufficient or not clear enough to determine whether the applicable VCS or CDM requirements have been met.

Forward Action Request (FAR) is raised if the monitoring and reporting require attention and/or adjustment for the next verification period.

For a detailed list of all CARs, CLs and FARs raised in the course of the verification please refer to Annex-1.

2.6. Technical Review

Before submission of the final report a technical review of the verification report is carried out. The technical reviewer is a competent GHG auditor appointed for the scope the project activity falls under.

As a result of the internal review process the verification opinion and the topic specific assessments as prepared by the verification team leader may be confirmed or revised. Furthermore reporting improvements might be achieved.

3. VERIFICATION FINDINGS

3.1. Remaining issues, FARs from previous validation or verification

The verification team has reviewed validation report and previous verification reports available on VCS database at

<https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=82>

The verification team identified no missing steps, open issues or material discrepancy and therefore, there were no pending issues from any previous verification.

3.2. Project implementation in accordance with the previously validated VCS PDD / registered PDD

On the basis of the on-site visit and the reviewed project documentation, the verification team confirms that the project was implemented as described in the registered VCS PDD. All the physical components and project boundary are in conformity with the description in registered VCS PDD.

The project activity involves capturing of methane generated from the wastewater treatment through UASB technology. The captured methane (biogas) is utilized as fuel in hot oil and steam boilers replacing heavy fuel oil.

GLC verification team has also verified that all the parameters are monitored as described in the monitoring plan of the VCS PDD in order to estimate the emission reduction.

3.2.1. Eligible GHG

Table: 3.1 Emission sources and gases included in the project boundary are:

	<i>GHGs involved</i>	<i>Description</i>
<i>Baseline emissions</i>	<i>CH₄</i>	<i>Major green house gas that is emitted from the wastewater due to decomposition of organic matter</i>
	<i>CO₂</i>	<i>Emissions from fossil fuel (HFO) used to produce thermal energy</i>
<i>Project emissions</i>	<i>CH₄</i>	<i>Emissions from inefficient combustion of biogas in the boilers, flaring of biogas and leakage of biogas (methane) in the project activity</i>
<i>Leakage</i>	<i>Nil</i>	<i>No leakage emissions are associated with the project activity.</i>

3.2.2. Project Starting Date and Emission Reduction Start Date

According to the VCS Program the project start date is the date the project activity began reducing or removing GHG emissions.

The project start date was 2004-01-01 ^{/13/} as it is the date on which the project has started operation.

3.2.3. Project Boundary

As per the applied methodology AM0022 Ver.04, ^{/17/} Project boundaries should be drawn encompassing (as appropriate):

- Methane emissions from the existing lagoon-based waste water treatment system up to, and including, the point at which organic material flows can be quantified or estimated into and out of the wastewater treatment facility;
- Potential methane emissions from the newly introduced anaerobic waste water treatment facility (or demonstration that they are negligible);
- CO₂ emissions from displaced fossil fuel use for on site heat and/or power generation;

- CO₂ emissions from displaced fossil fuel use for offsite/grid generation of electricity that would otherwise have been produced;
- Methane emissions from incomplete combustion of biogas in heat and/or power generation or in flare systems, or from leakage in piping.

It was clearly described in the registered PDD section B.3. For emission sources and gases included in the project boundary, see Section 3.2.1.

3.2.4. Baseline Determination

While the baseline determination for the project activity was previously assessed as part of the validation of the project under VCS 2007.1, it is confirmed that:

- i) The project correctly applies the approved baseline and monitoring methodology baseline and monitoring methodology AM0022, Ver.04: "Avoided Wastewater and Onsite Energy Use Emissions in the Industrial Sector".
- ii) The baseline and monitoring methodology has been correctly applied and the assumptions made for the selected baseline scenario are sound.

The baseline scenario is correctly defined as continuation of the current situation. As per the registered VCS PDD, *continuation of the current open lagoon based wastewater treatment system is considered as the most plausible alternative as it does not face any barrier and it is considered as the baseline scenario in the absence of the project activity in line with methodology condition.*

Baseline emissions are estimated inline with the applied methodology. Baseline emissions include emission reduction from capturing of methane generated from wastewater and replacing of HFO with biogas in heat generating equipment.

Detailed information regarding baseline determination for project activity is available in the VCS PDD dated 2007-06-19 ^{12/}.

3.2.5. GHG Emission

As the project design document was previously assessed as part of the validation of the project under VCS v1 and is grandfathered to VCS 2007.1, it is thus confirmed that the approach for determining project and baseline emissions are appropriate and in accordance with the selected baseline and monitoring methodologies. Project emissions include emissions from incomplete combustion of biogas in the heat generating equipment, methane emissions from biogas flaring and from leakage in piping.

3.2.6. Leakage Emission

As per the applied methodology AM0022 Ver. 04, Leakage emission is considered to be negligible.

3.3. Completeness of monitoring

The monitoring report ^{/3/} submitted to the verification team is in line with the requirements of the monitoring plan of the registered PDD as well as with the applied methodology AM0022, version 04. ^{/17/}

The verification team has followed two steps to assess the completeness of the monitoring. The first step is document review and the second one is on-site interviews and observations. As a part of the step 1, the verification team has reviewed the submitted documents MR^{/3/}, ER sheets^{/4/} and supporting documents stated in section 5. On site visit was conducted on 29-30 November 2010. Based on the document review and site visit observations, verification team has raised findings stated in Annex-1.

As per the applied methodology, the baseline emissions are estimated by measuring flow rate of wastewater and COD of wastewater at inlet and outlet of the UASB. The baseline emissions are also estimated, to cross check the conservativeness, by measuring the total biogas consumption including for flaring and the methane content of the biogas. Emission reduction is calculated as the difference between baseline emissions and project emissions. The procedure to estimate the baseline and project emissions is detailed in the VCS PDD ^{/2/}. Detailed calculation of baseline and project emissions are presented in the emission reduction spread sheets ^{/4/} in an understandable format.

During the verification site visit the verification team verified the “Quantity of wastewater treated through UASB technology”, “COD of wastewater at inlet and outlet of the UASB”, “Total biogas generation”, “Total biogas consumption”, “Methane content of biogas”, etc. with the log books. The plant personnel involved in monitoring of the VCS project were interviewed and found competent enough to maintain the required data. The data provided in the MR and ER sheets was also verified. The calibration certificates^{/5/} of all the measuring instruments (wastewater flow meters, biogas flow meters, gas analyser and COD meter) were also verified during the verification site visit.

The monitoring report and the monitoring plan of the registered VCS PDD^{/2/} state that the following parameters mentioned in the table are monitored.

	Assessment/ Observation
Data / Parameter: (as per the registered VCS PDD):	AM0022 ID 1 Wastewater flow entering the project treatment facility (m ³ /year)
Measuring frequency:	Continuously and is inline with the registered PDD. The parameter is measured on a continuous basis and recorded by the flow

	meters (FM3 & FM5). The measured data is logged in on a daily basis. The verification team has checked the log books ^{/11/} and interviewed the site personnel and found that the log book data is consistent with the data provided in the final ER sheet and plant operating personnel are competent.		
Reporting frequency:	Daily		
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The measuring and reporting frequency is inline with the monitoring plan.		
Type of monitoring equipment:	Type of meter	Magnetic flow meter (FM3)	Magnetic flow meter (FM5)
	Serial number	6B00EB20000	6B00E920000
	Accuracy ^{/10/}	± 0.5%	± 0.5%
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PDD does not specify the accuracy of monitoring equipment. However, the PP has installed magnetic flow meters with an accuracy class of 0.5. This is stated in the final MR and GLC understands that the accuracy of the meters represents good monitoring practice.		
Calibration frequency /interval:	The flow meters are calibrated at least once a year. Both the meters (FM3 & FM5) were calibrated on 2009-07-02 and again on 2010-10-26 which shows there is a delay in calibration by more than 3 months. However, as per the latest calibration report ^{/5/}, the error of the meters is within the limits. Therefore, PP has applied the maximum permissible error of 0.5%, as per the guidelines stated in Annex 60 of EB52, for a period from 2010-07-02 to 2010-08-31 for the monitored wastewater flow so as to result in conservative emission reductions. The corrected values of flow are found in 2010 data of emission reduction sheets ^{/4/}.		
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the	As per the registered VCS PDD, the flow meters would undergo calibration subject to appropriate industry standards. However, the		

frequency of calibration, does the selected frequency represent good monitoring practice?	calibration frequency is defined as 1 year as per the monitoring report which represents a good practice.
Company performing the calibration:	The calibration is carried out by instrument manufacturer "Endress+Hauser". ^{15/}
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates were checked and the meter was found functioning properly.
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a calibration gap of over 3 months. However, the values were re-calculated so as to be conservative for the period.
If applicable, has the reported data been cross-checked with other available data?	Yes. The reported data was cross checked with the daily log sheets and monthly reports ^{9/} during the verification site visit. All the reported values were found correct.
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as per the registered VCS PDD):	AM0022 ID 2 Wastewater flow leaving the project treatment facility (m ³ /year)
Measuring frequency:	Continuously. Assumed hydrological balance i.e. wastewater leaving the project treatment facility is equal to the wastewater leaving the wastewater treatment facility. Therefore, same values of FM3 & FM5 are considered for wastewater leaving the project treatment

	facility.		
Reporting frequency:	Daily		
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The measuring and reporting frequency is inline with the monitoring plan.		
Type of monitoring equipment:	Type of meter	Magnetic flow meter (FM3)	Magnetic flow meter (FM5)
	Serial number	6B00EB20000	6B00E920000
	Accuracy	$\pm 0.5\%$	$\pm 0.5\%$
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PDD does not specify the accuracy of monitoring equipment. However, the PP has installed latest magnetic flow meters with an accuracy class of 0.5%. GLC determines that the accuracy of the meters represents good monitoring practice.		
Calibration frequency /interval:	The flow meters are calibrated at least once a year. Both the meters (FM3 & FM5) were calibrated on 2009-07-02 and again on 2010-10-26 which shows there is a delay in calibration by more than 3 months. However, as per the latest calibration report ^{/5/}, the error of the meters is within the limits. Therefore, PP has applied the maximum permissible error of -0.5% for a period from 2010-07-02 to 2010-08-31 for the monitored wastewater flow so as to result in conservative emission reduction. The corrected values of flow are found in 2010 data of emission reduction sheets ^{/4/}.		
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per the registered VCS PDD, it was mentioned that the flow meters would undergo calibration subject to appropriate industry standards. However, the calibration frequency is defined as 1 year as per the monitoring report which represents a good practice.		
Company performing the calibration:	The calibration is carried out by instrument manufacturer "Endress+Hauser".		

Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates were checked and the meter was found functioning properly.
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a calibration gap of over 3 months. However, the values were re-calculated so as to be conservative for the period.
If applicable, has the reported data been cross-checked with other available data?	Yes. The reported data was cross checked with the daily log sheets during the verification site visit. All the reported values were found correct.
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 3 Wastewater organic material concentration entering the project treatment facility (kg COD / m ³)
Measuring frequency:	Daily. Sample is collected from the wastewater inlet to the UASB, COD of the wastewater is determined with the help of spectrometer and the value is recorded in a daily log sheet. ^{17/} The verification team has checked the log books and interviewed the site personnel and found that log book data is consistent with the data provided in the final ER sheet and the plant operating personnel are competent.
Reporting frequency:	Daily
Is measuring and reporting frequency in accordance with the monitoring	Yes. The measuring and reporting frequency is in accordance with the monitoring plan of the

plan and monitoring methodology? (Yes / No)	VCS PDD.		
Type of monitoring equipment:	Type of meter	Spectrophotometer	
	Serial number	38397	
	Accuracy	± 3.5% ^{/10/}	
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PDD does not specify the accuracy of monitoring equipment. However, it was observed during the verification site visit that the PP has a good monitoring system. The accuracy of spectrometer is ± 3.5%. Based on GLC's sectoral expert views, it is determined that the accuracy of the spectrometer is within the acceptable limits.		
Calibration frequency /interval:	The spectrometer is calibrated once every 3 years. It was calibrated on 2008-05-22 and again on 2010-11-01. The verification team has verified the calibration reports ^{/5/} and it was found that the instrument error is within the limits.		
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	The VCS PDD does not specify the calibration interval of meters. The manufacturer also does not specify any information related to the required frequency of calibration. Verification team has interviewed the lab experts to inquire whether there is any defined calibration frequency for the COD measuring equipments. As per the expert's view there is no defined calibration frequency for the spectrometers. However, it was found that 'Papop' is a BOT (built operate transfer) entity for the biogas plant project of GSL. They set up a well-defined management and operational system. This system includes the operation and management of the monitoring plan, which specifies the requirements and procedures for parameters monitoring, data recording and data archiving according to ISO 9001:2000. ^{/22/} As there was no recommendation from the instrument supplier about the calibration frequency and no industry standard is available, the PP has chosen a calibration		

	frequency of 3 years based on Papop's experience. Hence, verification team is of the opinion that the stated calibration is acceptable.
Company performing the calibration:	ILAB Fluid Control Co. Ltd., Bangkok ^{/5/} .
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates ^{/5/} were checked and it was evident that the meter is functioning properly.
Is(are) calibration(s) valid for the whole reporting period?	Yes. As discussed above, the calibration certificates were verified and found valid for the whole monitoring period. As described in the MR, the instrument was calibrated within a period of 3 years and the error was also found within the permissible limits. Hence the observed measurement represents good quality.
If applicable, has the reported data been cross-checked with other available data?	Yes. The reported data was cross checked with the daily log sheets during the site visit. Deviation of values was observed on few days. The same was notified to PP and the PP has corrected the values and re-submitted the data sheets, ER calculation sheet and MR. All the values in the final MR and ER sheets were found correct.
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation							
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 4 Wastewater organic material concentration leaving the project treatment facility (kg COD / m ³)							
Measuring frequency:	Daily. Sample is collected from the wastewater outlet of the UASB, COD of the wastewater is determined with the help of spectrometer and the value is recorded in a daily log sheet. The verification team has checked the log books ¹⁷¹ and interviewed the site personnel and found that log book data is consistent with the data provided in the final ER sheet and the plant operating personnel are competent.							
Reporting frequency:	Daily							
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The measuring and reporting frequency is in accordance with the monitoring plan of the VCS PDD.							
Type of monitoring equipment:	<table><tr><td>Type of meter</td><td>Spectrophotometer</td></tr><tr><td>Serial number</td><td>38397</td></tr><tr><td>Accuracy</td><td><u>±</u> 3.5%</td></tr></table>		Type of meter	Spectrophotometer	Serial number	38397	Accuracy	<u>±</u> 3.5%
Type of meter	Spectrophotometer							
Serial number	38397							
Accuracy	<u>±</u> 3.5%							
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PDD does not specify the accuracy of monitoring equipment. However, it was observed during the verification site visit that the PP has a good monitoring system. The accuracy of spectrometer is ±3.5%. Based on GLC's sectoral expert views, it is determined that the accuracy of the spectrometer is within the acceptable limits.							
Calibration frequency /interval:	The spectrometer is calibrated once every 3 years. It was calibrated on 2008-05-22 and again on 2010-11-01. The verification team has verified the calibration reports and it was found that the instrument error is within the limits.							
Is the calibration interval in line with the monitoring plan of the VCS PDD?	The VCS PDD does not specify the calibration interval of meters. The manufacturer also							

If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	does not specify any information related to the required frequency of calibration. Verification team has interviewed the lab experts to inquire whether there is any defined calibration frequency for the COD measuring equipments. As per the expert's view there is no defined calibration frequency for the spectrometers. However, it was found that 'Papop' is a BOT (built operate transfer) entity for the biogas plant project of GSL. They set up a well-defined management and operational system. This system includes the operation and management of the monitoring plan, which specifies the requirements and procedures for parameters monitoring, data recording and data archiving according to ISO 9001:2000. ^{/22/} As there was no recommendation from the instrument supplier about the calibration frequency and no industry standard is available, the PP has chosen a calibration frequency of 3 years based on Papop's experience. Hence, verification team is of the opinion that the stated calibration is acceptable.
Company performing the calibration:	ILAB Fluid Control Co. Ltd., Bangkok ^{/5/}.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates^{/5/} were checked and it was evident that the meter is functioning properly.
Is(are) calibration(s) valid for the whole reporting period?	Yes. As discussed above, the calibration certificates were verified and found valid for the whole monitoring period. As described in the MR, the instrument was calibrated within a period of 3 years and the error was also found within the permissible limits. Hence the observed measurement represents good quality.
If applicable, has the reported data been cross-checked with other available data?	Yes. The reported data was cross checked with the daily log sheets during the site visit. Deviation of values was observed on few days. The same was notified to PP and the PP has corrected the values and re-submitted the data sheets, ER calculation sheet and MR.

	All the values in the final MR and ER sheets were found correct.
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation								
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 5 Volume of biogas sent to facility heaters (Nm ³ biogas)								
Measuring frequency:	Continuously. The parameter is measured on a continuous basis and recorded by the gas flow meter (GM3). The measured data is logged in on a daily basis. The verification team has checked the log books ^{/6/ /8/} and interviewed the site personnel and found that log book data is consistent with the data provided in the final ER sheet and the plant operating personnel are competent.								
Reporting frequency:	Daily								
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The measuring and reporting frequency is in accordance with the monitoring plan of the VCS PDD.								
Type of monitoring equipment:	<table border="1"> <thead> <tr> <th>Meter</th><th>GM3</th></tr> </thead> <tbody> <tr> <td>Type of meter</td><td>Thermal mass flow meter</td></tr> <tr> <td>Serial number</td><td>9B09BD02000</td></tr> <tr> <td>Accuracy</td><td>± 1.0% of reading plus ± 0.5% of full scale^{/10/}</td></tr> </tbody> </table>	Meter	GM3	Type of meter	Thermal mass flow meter	Serial number	9B09BD02000	Accuracy	± 1.0% of reading plus ± 0.5% of full scale ^{/10/}
Meter	GM3								
Type of meter	Thermal mass flow meter								
Serial number	9B09BD02000								
Accuracy	± 1.0% of reading plus ± 0.5% of full scale ^{/10/}								
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the	VCS PDD does not specify the accuracy of monitoring equipment. However, it was observed during the verification site visit that								

accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	the PP has a good monitoring practice and the accuracy of 0.5% on full scale represents a good monitoring system.
Calibration frequency /interval:	The gas flow meter is calibrated at least once every 3 years. GM3 was calibrated on 2008-09-19 and again on 2010-08-06. The calibration frequency is within the specified period. The verification team verified the calibration reports of the meter ^{/5/} .
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	The VCS PDD does not specify the calibration interval of meters. As described above, the PP has set up a well-defined management and operational system with the help of Papop, a BOT entity. This system includes the operation and management of the monitoring plan, which specifies the requirements and procedures for parameters monitoring, data recording and data archiving according to ISO 9001:2000. As no calibration frequency was specified by the manufacturer, based on Papop's experience, a calibration period of 3 years was chosen.
Company performing the calibration:	The gas flow meter is calibrated internally by Papop with the help of master calibrator. Master calibrator is calibrated by PTT Public Company Limited, Chornburi, Thailand which is an external agency. It was calibrated on 2010-01-14 and on 2008-05-03^{/5/}.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates ^{/5/} were checked and found that the meter is functioning properly.
Is(are) calibration(s) valid for the whole reporting period?	Yes. As discussed above all the calibration certificates were verified and found valid.
If applicable, has the reported data been cross-checked with other available data?	Yes. The reported data in the final MR was crosschecked with the log books during site visit. The data reported was observed to be correct.

How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 8 Fossil fuel volume equivalent to generate the same amount of heat generated from the biogas collected in the anaerobic treatment facility (Litres per year)
Measuring frequency:	Calculated value. It is calculated from the measured volume of biogas sent to facility heaters, heating system combustion efficiency of 98.5% (default value as per methodology), calculated calorific value of biogas and calorific value of fuel oil (IPCC default value). Calculation approach is described in section 3.3 and Annex-1 of the MR.
Reporting frequency:	NA
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA

Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is(are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	NA
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 9 Biogas sent to flare (Nm ³ biogas)
Measuring frequency:	Continuously. The parameter is measured on a continuous basis and recorded by the gas flow meter (GM4). The measured data is logged in on a daily basis. The verification team has checked the log books ^{/6/ /8/} and interviewed the site personnel and found that the plant operating personnel are competent.

Reporting frequency:	Daily								
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The measuring and reporting frequency is in accordance with the monitoring plan of the VCS PDD								
Type of monitoring equipment:	<table border="1"> <thead> <tr> <th>Meter</th><th>GM4</th></tr> </thead> <tbody> <tr> <td>Type of meter</td><td>Thermal mass flow meter</td></tr> <tr> <td>Serial number</td><td>AA083102000</td></tr> <tr> <td>Accuracy</td><td>$\pm 1.0\%$ of reading plus $\pm 0.5\%$ of full scale^{/10/}</td></tr> </tbody> </table>	Meter	GM4	Type of meter	Thermal mass flow meter	Serial number	AA083102000	Accuracy	$\pm 1.0\%$ of reading plus $\pm 0.5\%$ of full scale ^{/10/}
Meter	GM4								
Type of meter	Thermal mass flow meter								
Serial number	AA083102000								
Accuracy	$\pm 1.0\%$ of reading plus $\pm 0.5\%$ of full scale ^{/10/}								
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PDD does not specify the accuracy of monitoring equipment. However, it was observed during the verification site visit that the PP has a good monitoring practice and the accuracy of 0.5% on full scale represents a good monitoring system.								
Calibration frequency /interval:	The gas flow meter is calibrated at least once every 3 years. GM4 was calibrated on 2007-11-29 by the supplier and again on 2010-08-04. The calibration frequency is within the specified period. The verification team verified the calibration reports of the meter ^{/5/} .								
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per the registered VCS PDD, the parameter is calculated as the difference of gas production and gas consumption of boilers. The meter (GM-4) was installed during the 2 nd verification period. As described above, the PP has set up a well-defined management and operational system with the help of Papop, a BOT entity. This system includes the operation and management of the monitoring plan, which specifies the requirements and procedures for parameters monitoring, data recording and data archiving according to ISO 9001:2000.								
Company performing the calibration:	The gas flow meter is calibrated internally by Papop with the help of master calibrator. Master calibrator is calibrated by PTT Public								

	Company Limited, Chornburi, Thailand which is an external agency. It was calibrated on 2010-01-14 and on 2008-05-03 ^{/5/} .
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates ^{/5/} were checked and found that the meter is functioning properly.
Is(are) calibration(s) valid for the whole reporting period?	Yes. As discussed above all the calibration certificates were verified and found valid.
If applicable, has the reported data been cross-checked with other available data?	Yes. The reported data in the final MR was crosschecked with the log books during site visit. The data reported was observed to be correct.
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 11 Biogas methane concentration (%)
Measuring frequency:	Continuous. The parameter is monitored electronically on a continuous basis by an online gas analyser. The monitored values are recorded on a daily basis in the log books ^{/11/} . The verification team has checked log books and interviewed the site personnel and found the plant operating personnel are competent.
Reporting frequency:	Daily
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	The monitoring plan in the VCS PDD does not specify any monitoring frequency. However, as per the applied monitoring methodology, the parameter has to be monitored on a

(Yes / No)	continuous basis. Therefore, the monitoring frequency of biogas concentration is inline with the monitoring methodology.	
Type of monitoring equipment:	Type of meter	Infrared gas analyzer
	Serial number	ABB EL 1020 IR 3.241376.5
	Accuracy	$\pm 1\%$
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PDD does not specify the accuracy of monitoring equipment. However, it was observed during the verification site visit that the PP has a good monitoring system. The accuracy of gas analyser is $\pm 1\%$.	
Calibration frequency /interval:	The gas analyser is calibrated at least once every year as per manufacturer's recommendation. The analyser was calibrated internally by Papop with standard gas. The Papop has set up a well defined monitoring system. The internal calibration is carried out by trained and skilled personnel. It was observed from the calibration reports that the analyser was calibrated every month from Sept 2009 to June 2010. It was also observed that the analyzer was sent for an external calibration in November 2010. Thai Steam Services & Supply Co. Ltd calibrated the gas analyzer on 2010-11-19. ^{/5/} After the BOT contract has expired in May 2010, the GSL team decided to carry out the calibration of gas analyzer once in year.	
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per the monitoring plan of the VCS PDD, the calibration interval is subject to appropriate industry standards. As described above, the PP has a good monitoring system and monitoring practice in place. All the meters are calibrated at regular intervals.	
Company performing the calibration:	The gas analyser is calibrated internally by Papop with the help of standard gas ^{/5/} .	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports ^{/5/} were checked and the meter is found functioning properly.	

Is (are) calibration(s) valid for the whole reporting period?	Yes. As discussed above all the calibration certificates were verified and found valid for the whole monitoring period. Hence the observed measurement represent good quality.
If applicable, has the reported data been cross-checked with other available data?	Yes. The reported values in the final MR and ER sheet were cross checked during site visit.
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 12 Project emissions from flaring of the residual gas stream (PEflare, t CO ₂ e)
Measuring frequency:	Calculated value. It is calculated from the flared gas quantity measured by GM4 and considering 0% flare efficiency conservatively.
Reporting frequency:	NA
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring	NA

practice?	
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 15 Heating system combustion efficiency (%)
Measuring frequency:	Default value of 98.5%. Default value of 98.5% is considered as per the methodology as no specification is available for this parameter.
Reporting frequency:	NA

Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	NA
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 17 Loss of biogas from pipeline (%)
Measuring frequency:	Calculated value. It is calculated as the difference between total biogas generation and total biogas consumption. Total biogas generation is measured by flow meters GM1 & GM2. Biogas consumption for facility heaters is measured by GM3 as described above and biogas consumption for flaring is measured by GM4. As the system also has gas storage tanks, the consumption of biogas is more than generation on some of the days. Therefore, the leakage quantity was calculated as – ve in the ER sheet on some of the days. However, the overall leakage quantity was calculates as +ve.
Reporting frequency:	NA
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	As per the registered VCS PDD, the value is estimated based on spot checks using a mobile leak detector. The applied method is more accurate and results in conservative estimation of emission reduction compared to the measurement method provided in monitoring plan of the VCS PDD.
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good	NA

monitoring practice?	
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 18 Organic material removed from wastewater facility (t COD)
Measuring frequency:	The parameter is measured by weigh bridge available at project site whenever the organic material is removed from the system. However, no organic material was removed from the system during the current verification period.
Reporting frequency:	Not applicable for the verification period
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA

Type of monitoring equipment:	Weigh bridge available at project site
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	No information is provided about the accuracy of the measuring system in the registered MP
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	NA
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PDD):	AM0022 ID 19 Biogas calorific value (MJ / Nm ³)
Measuring frequency:	Calculated value. It is calculated from the methane content in biogas.
Reporting frequency:	NA
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PDD? If the VCS PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PDD? If the VCS PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	NA

How were the values in the monitoring report verified?	Please see 3.5 and 3.6
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Please see 3.5 and 3.6

3.4. Accuracy of GHG emission reduction calculations

GHG emissions reductions for the project and the baseline scenario were correctly calculated using the formulae described in the applied methodology for this project. The verification team has reviewed the emission reduction (ER) spread sheet and checked all the formulae and found they are correct and inline with the monitoring plan of the registered PDD and the applied monitoring methodology^{/2/17/}.

All the ex-ante parameters which are used in the calculation of emission reductions are included in section 3.2 and are consistent with section B.6.2 of the VCS registered PDD.

The emission reduction due to methane capturing was estimated by measuring COD reduction and quantity of wastewater through project system and using the formulae described in the methodology. According to the applied methodology, the emission reduction arrived by COD method was also verified with the total emissions of biogas generation and the lagoons in the project situation. It was observed that the emission reduction estimated by COD measurement method is lesser than the emission reduction estimated from the total biogas generation. Thus, the verification team is of the opinion that the emission reductions determined using COD measurement approach is more conservative and accurate.

Period	As per PDD (annual VERs for 2010)	Monitoring report (achieved VERs)
Emission Reductions	99,955	111,517
% Deviation (+/-)	0	(+) 11.56 %

The achieved emission reduction during the current monitoring period is approximately 11.5% higher than the estimated emission reduction in the VCS PDD. The increase in ex-post emission reduction from ex-ante is mainly due to higher COD load entering the UASB system, variation in starch production level.

However, the achieved emission reduction during the current verification period is about 19% less compared to the annualized emission reduction during 2nd verification period and about 17% less compared to the 3rd verification period emission reductions. It was also observed as mentioned in the MR that the COD loading is increased to 15 % compared to the ex-ante COD loading. In proportion to that emission reductions are also approximately 16% higher than the emission reductions estimated in the registered PDD. Hence the verification team is of the opinion that this kind of variation is reasonable and acceptable.

The emission reductions claimed during the current monitoring period (2009-09-01 – 2010-08-31) is 111,517 tCO₂e.

3.5. Quality of evidence to determine emission reductions

During the verification site visit, all relevant documents as included in “Section 5 : References” were checked to assess the correctness and quality of data submitted by the project participant which are used to determine emission reductions as discussed in section 3.3 and 3.4 above.

During the verification site visit, inlet and outlet COD of UASB, quantity of wastewater through UASB, biogas consumption for boilers, biogas consumption for flaring, methane concentration of biogas, etc. were cross checked with the log book values to ensure that there is no over estimation of the VERs. The provided data was found to be of adequate quality.

All records needed for monitoring are archived in line with the requirements of the registered monitoring plan^{/21/}. No significant, lack of evidence and missing data were detected during on-site verification. Hence, the verification team confirms that the monitoring system ensures required quality of the monitoring system to ensure the quality of the monitored data. All internal data are subjected to QA/QC measures.

The PP has contracted a BOT entity for developing the project activity and monitoring its performance. Papop Renewable Energy Co. Ltd is the BOT entity for the project at General Starch Ltd. They have set up a well defined system at the project activity site. The quality management system of the BOT was certified by ISO 9001:2000 ^{/22/}. The ISO system also outlines proper monitoring plan in terms of monitoring frequency as well as accuracy. It was understood that the contract between PP and the BOT was expired in May 2010. Therefore, the operation of the wastewater treatment plant is handled by the GSL team since May 2010 following the same monitoring procedures laid by the BOT entity. Moreover, the wastewater treatment system of GSL was also certified under ISO 14001:2004. This certification is valid up to 2011-12-15^{/23/}. Monitoring of parameters, data recording and data archiving are required to be well managed as per the ISO 14001 requirements.^{/23/}

All the meters (wastewater flow meters, biogas flow meters, COD meter, gas analyser and master calibration devices)^{/5/} are calibrated as per the manufacturers' specifications or best practices in the industry (described in section 3.3) to ensure the quality of data. In cases where the calibration is delayed, the PP has applied CDM

calibration guidelines as per EB 52, Annex 60 and calculated the emission reductions conservatively. Hence the verification team confirms that the quality of data is good.

The monitoring personnel at site are well experienced and follow established and documented routines, which were produced to the DOE. This was verified during the verification site interview. Hence, the verification team concludes that competent staff is employed by the project participant to carry out the relevant tasks with sufficient accuracy.

The PP has taken a deviation for this monitoring period. The deviation is described in Annex-1 of the monitoring report. The gist of deviation is as follows:

Two of the boilers (boiler no.6 & 9) were installed during the current monitoring period. Therefore, the biogas consumption of these boilers is excluded from the total biogas combusted in facility heaters as recorded by the gas flow meter GM3. To arrive at the biogas consumption of boiler no.6 & 9, the PP has operated each of the boilers at full load and recorded the biogas consumption of each boiler at full load. This number is used to calculate the biogas consumption during the operational hours. The operational hours of each boiler are available on daily basis from log records.

The biogas consumption for each boiler is added up and percentage of biogas consumption in each boiler can be established on daily basis. This percentage figure is used to estimate the amount of biogas consumed in each boiler using the total biogas consumption for all boilers as per GM3. This percentage is multiplied by biogas volume from GM3, the result of which will be the biogas usage of each boiler. The biogas consumption by steam boiler no.6 and 9 is deducted from total biogas sent to boilers for emission calculation.

GLC is of the opinion that this method of estimation is accurate and results in conservative estimation of emission reduction and is line with the applicable VCS requirements.

3.6. Management and quality assurance

The allocation of responsibilities is documented in a written form and is followed as described in the registered PDD^{/2/}. Routines for the archiving of data are defined and documented. During the site visit all the required plant records were verified and found that the data is consistent with the provided in the final MR^{/3/} and ER sheets^{/4/}. Hence, the DOE confirms that the calculations laid down in the monitoring report^{/3/} are in line with the PDD^{/2/}.

The verification team has interviewed the site personnel who are involved in the monitoring of the parameters that are used to determine the emission reductions of the VER project and convinced that the organisation structure is followed as per the monitoring plan of the registered PDD.

Moreover it was also found that competent staff is employed by the project participant and they were also interviewed to assess how they perform the monitoring and

maintain the data. The verification team is satisfied with staff competence and the quality of data and operational system.

All internal data are subjected to QA/QC measures. During verification site visit the verification team has verified the various documents which are included in the references: section 5 and interviewed the site personnel and convinced that the project proponent is following the required QA-QC measures as per the monitoring plan of the registered VCS PDD ^{12/}.

As discussed above, the verification team concludes that management and operational system of the project is implemented and running well. Thus it ensures the quality of data which is required in calculating the emission reductions.

3.7. Project Scorecard

Risk Areas		Conclusions			Summary of findings and comments	Error/Discounted Uncertainty
		Baseline Emissions	Project Emissions	Calculated Emission Reductions		
Completeness	Source coverage/ boundary definition	Good	Good	Good	The source coverage was complete as per the registered PDD and validation report.	No error was found
Accuracy	Physical Measurement and Analysis	Good	Good	Good	The physical measurement / recording of data were found to be accurate.	No error was found
	Data calculations	Good	Good	Good	Formulae and calculation of VERs and relevant data were found to be accurate. A deviation was applied to calculate the emission reductions. However it did not impact the conservativeness of the calculated emission reduction. It was in line with the available VCS / CDM requirements.	No error was found

Risk Areas		Conclusions			Summary of findings and comments	Error/Discounted Uncertainty
		Baseline Emissions	Project Emissions	Calculated Emission Reductions		
	Data management & reporting	Good	Good	Good	The relevant GHG data was achieved and readily retrievable.	No error was found
Consistency	Changes in the project	Good	Good	Good	No changes in the project. However, a deviation was opted to calculate the emissions reductions. But the deviation is in line with the VCS requirements and the deviation does not have any impact on the conservativeness of the emission reductions.	No error was found

4. VERIFICATION STATEMENT

Germanischer Lloyd Certification GmbH (GLC) has performed the verification of the project: "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", with regard to the applicable relevant requirements for VCS project activity.

The project activity involves treatment of wastewater produced in a starch manufacturing process at General Starch Ltd. through UASB technology. The use of UASB to treat the wastewater enables capturing of methane produced during the process which would otherwise be released into the atmosphere. The captured methane is utilised as fuel in existing boilers in the plant replacing heavy fuel oil and the surplus methane, if any, is flared into the atmosphere.

This verification covers the period from 2009-09-01 to 2010-08-31 (including both days).

Southpole Carbon Asset Management Ltd. and General Starch Ltd. (GSL) are responsible for the collection of data in accordance with the validated monitoring plan and the reporting of GHG emission reductions from the project.

It is GLC's responsibility to express an independent verification statement on the reported GHG emission reductions from the project. GLC does not express any opinion on the selected baseline scenario or on the validated and registered VCS PDD.

The scope of this verification covers the determination of voluntary greenhouse gas emission reductions generated by the above mentioned project. The verification is based on the registered VCS PDD^{/2/}, combined validation and verification report ^{/13/}, monitoring report^{/3/} and supporting documents made available to the verifiers by the project participants.

As a result of the verification, the verifier confirms that;

- All operations of the project are implemented and installed as planned and described in the project design document.
- The monitoring system is in place and functional.
- The installed equipments essential for estimating emission reductions work reliable and are calibrated appropriately.
- The GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner. Also all the documents checked during on-site visit and verification process will be kept confidential and will not be disclosed without the Project Participant's consent as required by VCSA.

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Germanischer Lloyd Certification GmbH herewith confirms that the project has achieved emission reductions during the reporting period 2009-09-01 to 2010-08-31 (including both days) as follows:

Emission reductions 2009	39,210	t CO ₂ e
Emission reductions 2010	72,307	t CO ₂ e
Emission Reductions Total	111,517	t CO ₂ e

A handwritten signature in blue ink, appearing to read 'M. Weber'.

Markus Weber

Team Leader

Hamburg, 2011-05-06

5. REFERENCES

Reference	Document
1.	Clean Development Mechanism Validation and Verification Manual (Version 01.2 as per EB 55)
2.	VCS registered Project Description Document for project: "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", Version 01, 2007-06-19.
3.	Draft Monitoring Report of "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", Version no. 1, 2010-11-26. Monitoring Report of "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", Version no. 2, 2011-01-04. Monitoring Report of "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", Version no. 3, 2011-01-20. Monitoring Report of "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", Version no. 4, 2011-01-24. Monitoring Report of "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", Version no. 5, 2011-02-11. Final Monitoring Report of "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co. Ltd.", Version no. 6, 2011-04-11.
4.	Draft Emission reduction calculation spreadsheet dated 2010-09-29. Final Emission reduction calculation spreadsheet dated 2011-04-11.
5.	Calibration Certificates of all the meters; wastewater flow meters, COD meter, gas flow meters, gas analyser and master calibrator for the

Reference	Document																														
	current verification period (2009-09-01-2010-08-31) <table><tr><th>ID</th><th>Description</th><th>Calibration date</th></tr><tr><td>GM1</td><td>Biogas from UASB #1</td><td>2010-08-04</td></tr><tr><td>GM2</td><td>Biogas from UASB #2</td><td>2010-08-05</td></tr><tr><td>GM3</td><td>Biogas to Boiler</td><td>2010-08-06 & 2008-09-19</td></tr><tr><td>GM4</td><td>Biogas to Flare</td><td>2010-08-04 & 2007-11-29</td></tr><tr><td>Master</td><td>Master biogas flow meter</td><td>2010-01-14 & 2008-05-03</td></tr><tr><td>FM3</td><td>Wastewater flow meter to UASB #1</td><td>2010-10-26 & 2009-07-02</td></tr><tr><td>FM5</td><td>Wastewater flow meter to UASB #2</td><td>2010-10-26 & 2009-07-02</td></tr><tr><td>CS</td><td>COD vario Photometer (Spectrometer)</td><td>2010-11-01 & 2008-05-22</td></tr><tr><td>%CH₄</td><td>Gas analyzer</td><td>2010-11-19, 2010-06-04 & 2009-08-13</td></tr></table>	ID	Description	Calibration date	GM1	Biogas from UASB #1	2010-08-04	GM2	Biogas from UASB #2	2010-08-05	GM3	Biogas to Boiler	2010-08-06 & 2008-09-19	GM4	Biogas to Flare	2010-08-04 & 2007-11-29	Master	Master biogas flow meter	2010-01-14 & 2008-05-03	FM3	Wastewater flow meter to UASB #1	2010-10-26 & 2009-07-02	FM5	Wastewater flow meter to UASB #2	2010-10-26 & 2009-07-02	CS	COD vario Photometer (Spectrometer)	2010-11-01 & 2008-05-22	%CH ₄	Gas analyzer	2010-11-19, 2010-06-04 & 2009-08-13
ID	Description	Calibration date																													
GM1	Biogas from UASB #1	2010-08-04																													
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GM4	Biogas to Flare	2010-08-04 & 2007-11-29																													
Master	Master biogas flow meter	2010-01-14 & 2008-05-03																													
FM3	Wastewater flow meter to UASB #1	2010-10-26 & 2009-07-02																													
FM5	Wastewater flow meter to UASB #2	2010-10-26 & 2009-07-02																													
CS	COD vario Photometer (Spectrometer)	2010-11-01 & 2008-05-22																													
%CH ₄	Gas analyzer	2010-11-19, 2010-06-04 & 2009-08-13																													
6.	Hourly calculation spread sheet of biogas consumption for 2009 Hourly calculation spread sheet of biogas consumption for 2010																														
7.	Sample daily reports of COD for August 2010																														
8.	Sample energy report for August 2010 (biogas production & consumption)																														
9.	Sample monthly report (indicates all monitored parameters) for August 2010																														
10.	Measuring instruments specifications - Photometer specifications - Photometer manual - Biogas flow meter specifications - Gas analyzer specifications - Wastewater flow meter manual																														

Reference	Document
11.	Sample daily log sheets - Wastewater & biogas flow meter readings for August 2010 - % CH₄ measurement in biogas for February 2010 - COD measurement of UASB-1 for August 2010 - COD measurement of UASB-2 for August 2010
12.	ISO 14064-3:2006; Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions; http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=38700
13.	Combined Verification Report (validation & verification) for the VER project "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co Ltd.", dated 2007-08-31 for the 1st verification period: 2004-01-01 to 2007-05-31.
14.	Verification report of the VER project "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co Ltd.", for the 2nd periodic verification: 2007-06-01 to 2008-03-31.
15.	Verification report of the VER project "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co Ltd.", for the 3rd periodic verification: 2008-04-01 to 2009-08-31.
16.	PPRR (Project Proponent Registration Representation) for grandfathering dated 2009-11-24
17.	CDM-EB approved CDM baseline and monitoring methodology AM0022, Ver.04: "Avoided Wastewater and Onsite Energy Use Emissions in the Industrial Sector"
18.	Methodological "Tool to determine project emissions from flaring gases containing methane" (EB 28, Annex 13)

Reference	Document
19.	Guidelines for assessing compliance with the calibration frequency requirements (EB 52, Annex 60) Ver.01, 2010-02-12
20.	GLC GmbH: Germanischer Lloyd CDM Procedures
21.	IPCC: 1996 IPCC Guidelines for National Greenhouse Gas Inventories: work book IPCC: 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book
22.	ISO 9001: 2000 certificate of Papop Renewable Co. Ltd. valid till 2010-01-19.
23.	ISO 14001: 2004 certificate of General Starch Ltd valid till 2011-12-15. Summary of Requirements for ISO 14001:2004
24.	Voluntary Carbon Standard Program Guidelines dated 2008-11-18
25.	Voluntary Carbon Standard 2007.1 dated 2008-11-18



ANNEX – 1
List of CARs,CLs and FARs



Corrective Action Requests (CAR), Clarification Requests (CL) and Forward Action Requests (FAR)

Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment <i>The assessment shall include</i> <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
CAR 1 GLC carried out a site visit at General Starch Ltd. for verification of the VCS project. A few differences in the implementation of the project activity compared to the project description provided in section A.4.3 of the registered VCS PD have been observed as follows: 1. As per the wastewater flow diagram in the VCS PD, the wastewater first enters the equalisation basins. However, as per the actual site conditions, it enters the	2010-12-20	1. The function of the equalisation basin (EQ) is to homogenize the quality of wastewater and maintain steady flow rate to the UASB*. In the equalisation basins, the acidification process takes place. This is to control the pH of water before it enters the UASB system. This is to optimize the output of waste water system.	2011-01-05	Ok. GLC confirms that 1. Equalisation basins function same as acidification tanks in the project activity and it does not have any impact on the estimation of emission reductions. 2. Pumping water from final lagoon to the inlet of UASB to neutralise the PH will also reduce the COD of water entering UASB. Therefore, it does not result in overall estimation of emission	2011-01-19

* <http://faculty.washington.edu/markbenj/CEE483/Equalization.pdf>

† http://www.wrc.org.za/Lists/Knowledge%20Hub%20Items/Attachments/6524/WaterSA_1991_17_0614_abstract.pdf

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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment The assessment shall include <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
acidification tanks 2. Water from the final lagoon is pumped back to the pump sump i.e. to the inlet of UASB which is not mentioned in the registered VCS PD. Therefore, Project Participant (PP) is requested to address this deviation in the project implementation in the monitoring report (MR) with respect to the VCS guidelines and also demonstrate that it will not have any impact on the emission reductions.		Thereby the nomenclature of this pond can be as 'Equalisation basin' or 'Acidification tank' but they functionally represent the same process node. 2. As per the validated VCS PD, lime is supposed to be used for adjusting pH in wastewater before entering the UASB. This operation done on batch basis, resulted in very high maintenance cost. The water from the last lagoon has pH higher than the fresh waste water and thereby can be used for neutralizing the fresh wastewater. The treated water with low COD from the final lagoon to pump		reductions. Therefore, the CAR is closed.	

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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment The assessment shall include <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
		back to the sump constant flow rate to neutralize the pH. The waste water volume and COD measurement is done at the entrance of the UASB. The COD samples and waste water volume measurements already include the recycled waste water. This actually lower the COD concentration of waste water entering the system and doesn't over estimate the emission reduction. This operational change is practiced more commonly now and is considered as process improvement[†].			
CAR 2 Presently there are total 9	2010-12-20	The 2 new steam boiler no.	2011-01-05	Not OK. Change has been reflected in "input data" sheet	2011-01-19

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boilers in operation out of 10 boilers; 6 boilers for hot oil generation and 3 boilers for steam generation. The generated biogas is used in the boilers replacing part of the fossil fuel (fuel oil). Emission reduction is claimed equivalent to the reduction in fossil fuel consumption. However, it was understood during the discussion that one of the boilers was installed in 2008 i.e. after the registration of the project. Therefore, PP is not eligible to claim for the emission reduction equivalent to the fuel consumption in that particular boiler. Therefore, PP is requested to recalculate the emission reduction and provide the		6 and no. 9 which installed in the monitoring period is not included in the system boundary. The acceptance report is provided. The emission reduction calculation is revised and the biogas volume used by these 2 boilers is excluded from the estimations, as per sheet "input data" in the calculation spreadsheet.		but not in "ERcal" sheet. Changes in input data are not reflected in ER calculation. Please refer cell E89 in ERcal sheet. Clarification is required on the values provided in "2010_data" sheet from cells X190 to X250. Also refer the value provided in cell E102 in ERcal sheet.	

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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment <i>The assessment shall include</i> <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
respective documents to verification team for assessment.					
CAR 2 Continues		The calculation is ER sheet cell E89 is revised. The value in the specified column in 2010_data sheet is corrected. The figure MR is also updated for both changing.	2011-01-24	OK. The ER sheet and the MR have been updated. Therefore, the CAR is closed.	2011-02-09
CAR 3 The verification team has cross checked the COD values presented in the spreadsheet with the daily log sheets during the site visit. Though majority of the values are matching with the log sheet readings, some of the values have been found deviating. The	2010-12-20	The values in the spreadsheet are corrected and cross-checked with the daily log sheet. The GHG calculation sheet and monitoring table in MR is revised accordingly.	2011-01-05	OK. The COD values have been corrected and ER calculation sheet and MR have been updated. Therefore, the CAR is closed.	2011-01-19

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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment The assessment shall include <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
deviated values have been highlighted in the enclosed spreadsheet. PP is requested to verify the values with the log sheets and correct them.					
CAR 4 The emission factor for fuel oil has been considered as 77.367 tCO ₂ /TJ in the registered VCS PD (section B.6.2) as well as in the monitoring report (section 3.2). However, in the emission reduction spreadsheet, the value has been considered as 77.4 tCO ₂ /TJ which results in difference in emission reduction by 11 VERs. Therefore, PP is requested to use the value consistently in order to result in conservative	2010-12-20	The emission factor of fuel oil in the spreadsheet is revised to 77.367 tCO ₂ /TJ.	2011-01-05	OK. The value has been revised and hence the CAR is closed.	2011-01-19

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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment The assessment shall include <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
emission reduction.					
CAR 5 It was mentioned in section 3.2 of the MR that the wastewater flow meters are calibrated once every year. The flow meters (FM3 & FM5) were calibrated on 2009-07-02 and again on 2010-10-26 which shows a gap of more than 3 months. Therefore as per EB 52 Annex 60, for the period for which calibration was not done, maximum permissible error or the actual error as per the delayed calibration whichever is higher should be applied in conservative manner such that the adjusted values result in lower emission reduction.	2010-12-20	The accuracy level of the flow meter at 0.5% is used as the correction factor for FM3 and FM5 for the monitoring period 2010-07-02 to 2010-08-31. As per Annex – 60, EB – 52; the correction is done in a conservative manner for both baseline and project emissions.	2011-01-05	OK. The flow meter readings have been corrected for the specified period. The accuracy of the flow meter has also been verified with the instrument specifications. Therefore, the CAR is closed.	2011-01-19

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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment <i>The assessment shall include</i> <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
CL1 The accuracy class of the measuring instruments has not been mentioned in the monitoring report and is also not available on site to verify. Therefore, for the sake of clarity and transparency, PP is requested to include the accuracy class of all the measuring instruments in the monitoring report. This information would be useful to verify whether the actual error of the instruments is within the limits or not.	2010-12-20	The accuracy of the measuring equipment is added to the revised monitoring report.	2011-01-05	OK. The accuracy of the instruments has been mentioned in the MR. The accuracy values of the instruments have been verified with the supporting documents provided. Therefore, the CL is closed.	2011-01-19
CL2 Calibration frequency of gas flow meters has been mentioned as 3 years in the	2010-12-20	Refer to the operating instruction of thermal mass flow meter, page 64*, the	2011-01-05	OK. Calibration frequency of 3 years is accepted as it is not recommended by the manufacturer and the error	2011-01-19

* <https://wa001.endress.com/dla/50000092471/000/00/BA111DEN.pdf>

Verification Report
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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment The assessment shall include <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
MR where as it has been mentioned as 'subject to appropriate industry standards' in the VCS PD. Therefore, PP is requested to clarify on what basis the calibration frequency of 3 years has been chosen.		frequency of calibration is not recommended by manufacturer (E+H). The calibration interval for 3 years is planned by Papop who is the developer and as well plant operator under the Build Own Operate agreement with the starch plant. The comparison of the results in the previous and present calibration report indicates that the average error is still in acceptance limit.		observed during the calibration is within the limits. Therefore, the CL is closed.	
FAR 1 The boilers are retrofitted. The operational conditions of the dual fuel boiler need	2010-12-20	The project proponent understands that only boilers included in initial project boundary of the	2011-01-05	It has to be verified during the subsequent verifications.	2011-01-19

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Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what required and why; address the context (e.g. section)</i>	Date (yyyy-mm-dd)	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	Date (yyyy-mm-dd)	GLC Assessment <i>The assessment shall include</i> <i>how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Date (yyyy-mm-dd)
to be verified during the subsequent verifications. In case it is found that the existing boiler is replaced with new boiler during any monitoring period, no emission reduction shall be claimed for heat displacement.		project can be included in emission reduction estimate. Thereby, in future only the biogas component monitored to be used in boilers shall be used for emission reduction estimate for the heat replacement component.			