

VERIFICATION REPORT TITLE

Document Prepared By

EPIC Sustainability Services Private Limited



Project Title	Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co., Ltd Project ID: 82
Version	01
Monitoring period	01-January-2012 to 31-December-2013 (6 th monitoring period)
Report ID	ESSPL/VCS/2014/009

Report Title	Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co., Ltd
Client	Papop Renewable Co., Ltd (Service recipient), South Pole Carbon Asset Management Ltd. (Invoice recipient) (Both are project proponents)
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Work Carried Out By	Mr. R. Vijayaraghavan (Lead Auditor) Mr. Attavute Ruenruengjai (Technical cum host country expert)
Technical reviewer team	Mr. A. Prabu das and Dr. G. Vishnu

Summary:

South Pole Carbon Asset Management Ltd. has appointed EPIC Sustainability Services Private Limited to perform the sixth periodic verification of the emission reductions reported for the project titled “Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co., Ltd” (Project ID: 82) for the period from 01st January 2012 to 31st December 2013. The verification was based on the validated project design document (PD)^{9/} version 1.0 dated 19th June 2007, corresponding validation report, previous monitoring reports, previous verification reports and other supporting documents made available to the verification team by the client.

The project activity involves the installation of an anaerobic wastewater treatment facility, based on Upflow Anaerobic Sludge Blanket (UASB) technology, at a starch manufacturing plant. Prior to project implementation, the wastewater was treated using an open lagoon system. Anaerobic bacteria in the ponds break down organic compounds in the wastewater, resulting in the release of biogas. The resulting biogas is characterized by the chemical oxygen demand of the wastewater. The implementation of system enables the recovery of biogas that would have been released to the atmosphere in the baseline scenario and the utilization of the recovered biogas for thermal use.

The verification team identified, through the verification process, six CARs, eleven CRs and one FAR. The client has taken actions and submitted to EPIC the revised monitoring report and supporting evidence. The verification team, through the verification process, confirmed that the emission reductions achieved by the project activity during the monitoring period are correctly calculated in the monitoring report, Version 2, dated 23/09/2014. Therefore, EPIC certifies the emission reductions amounting to 232,127 tCO₂e for the period 01st January 2012 to 31st December 2013 (both days inclusive).

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1 INTRODUCTION

1.1 Objective

EPIC Sustainability Services Private Limited (EPIC) has been contracted by SouthPole Carbon Asset Management Ltd to undertake the sixth periodic independent verification of the project activity titled “Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co., Ltd”.

- To verify that the actual monitoring system and procedures are in full compliance with the system and procedures described in the monitoring plan of validated PD, version 1.0 dated 19th June 2007 as well as with the applicable methodology;
- To verify that the data reported were accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation; and
- To verify and certify GHG emission reduction reported for the project for the period from 1st January 2012 to 31st December 2013.

1.2 Scope and Criteria

The scope of the verification was the independent and objective review and ex-post determination of the monitored reductions in GHG emissions from “Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co., Ltd”. The verification of this VCS project was based on the validated and registered project design document (PD), validation report, previous monitoring reports, previous verification reports and supporting documents made available to the verification team. These documents were reviewed against the requirements of the VCS standard^{/1/} version 3.4, VCS guidelines, the CDM Modalities and Procedures, related rules and guidance, and the Validation and Verification standard^{/2/} Version 7.0. The verification is not meant to provide any consulting towards the client. However, stated request for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 Level of Assurance

In line with VCS requirements and as per ISO 14064-3:2006 para A.2.3.2, a reasonable level of assurance is defined for the verification of the project.

This implies that based on the process and procedures conducted EPIC should state whether the information in the monitoring report is materially correct and is a fair representation of the of the actual project details, and is prepared in accordance with the VCS requirements and the applied CDM methodology for information pertaining to additionality, GHG quantification, monitoring and reporting.

1.4 Summary Description of the Project

The project activity involves the installation of an anaerobic wastewater treatment facility, based on Upflow Anaerobic Sludge Blanket (UASB) technology, at a starch manufacturing plant. Prior to project implementation, the wastewater was treated using an open lagoon system. Anaerobic bacteria in the ponds break down organic compounds in the wastewater, resulting in the release of biogas. The resulting biogas is characterized by the chemical oxygen demand of the wastewater. The implementation of system enables the recovery of biogas that would have been released to the atmosphere in the baseline scenario and the utilization of the recovered biogas for thermal use. The project activity started to reduce emission reductions from 1st January 2004 (Project commissioned or project start date).

2 VERIFICATION PROCESS

2.1 Method and Criteria

The verification process consists of the following phases:

- i) a document review of the project design documents, monitoring reports and preparation of verification protocol;
- ii) on-site visit to the project activity and interviews with project developer and project consultant; and
- iii) resolution of outstanding issues and the issuance of final verification report and opinion

In order to ensure transparency, a verification protocol was prepared for the project according to the VVS version 7.0 verification requirements and VCS Standard version 3.4. The verification protocol serves the following purposes:

- it organizes, details and clarifies the requirements that a VCS project is expected to meet;
- it ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The completed validation protocol is enclosed in Appendix of this report.

During the verification, non-fulfillment of the verification protocol criteria or identified risks to the fulfillment of project objectives were raised as either CAR or CR. Corrective Action Requests (CAR) were issued, where:

- i) mistakes had been made that directly impacted on the project results; or
- ii) CDM and VCS requirements had not been met; or
- iii) there was a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

The Clarification Requests (CR) were issued where additional information was needed to clarify issues, and Forward Action Requests (FAR) for issues relating to project implementation that required review during the first verification of the project activity.

The following team members were involved in identifying the following:

Name	Role	Components reviewed
Mr. R. Vijayaraghavan	Lead Auditor	Completeness check, desk review, onsite inspection, Interview with project representatives, issuance of findings, report preparation
Mr. Attavute Ruenruengjai	Technical cum host country expert	Desk review, onsite inspection, Interview with project representatives, report preparation
Prabu das. A and G. Vishnu	Technical Reviewer	Technical review

2.2 Document Review

The verification was performed primarily based on the review of the monitoring report and the supporting documentation. This process included:-

1. a review of data and information presented to verify their completeness

2. a review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the QA/QC procedures, and
3. an evaluation of data management and the QA/QC system in the context of their influence on the generation and reporting of ERs.

The monitoring report^{5/}, Version 01, dated 13th August 2014 was initially reviewed and further EPIC requested the PP to present the supporting evidences. Additional background information and documents related to the project performance were also reviewed by EPIC. Through the process of the verification, the revised monitoring report and the supporting documents were evaluated to confirm the actions taken by the PP to the CARs and CRs issued by EPIC. The documents reviewed by EPIC are listed in References section of this report. EPIC reviewed the final version of the monitoring report^{5/} Version 2.0 dated 23rd September 2014 to confirm that all changes agreed had been incorporated.

2.3 Interviews

After the review of the Project description and documents a site visit was carried out from 1st and 2nd September 2014. During the site visit physical inspection of the project components followed by interviews with the on-site personnel was carried out to verify the project details. A follow-up meeting was also conducted with the project representatives. The following persons were interviewed.

Name & Designation	Company	Details of Interview
Mr. Santosh Kumar Singh Regional Director	Southpole	Technical Details, Monitoring system, calibration procedures and Overall Project management.
Ms. Nattaya Lonawan Project Manager-		Technical details Baseline, ER calculations.

2.4 Site Inspections

During the site visit, the actual on-site practices adopted and followed for the operation of the project were compared with the description given in the monitoring report. The implementation of the monitoring plan, metering practices, calibration and level of accuracy were examined. The archived data of the energy generated was also reviewed.

An on-site assessment was conducted as a part of verification activity and involved:

- 1) an assessment of the implementation and operation of the VCS project activity as per the validation PD
- 2) a review of information flows for generating, aggregating and reporting of the monitoring parameters
- 3) interviews with relevant personnel to confirm that the operational and data collection procedures are implemented in accordance with the Monitoring Plan
- 4) a cross-check between information provided in the MR and data from other sources
- 5) a check of the monitoring equipment including calibration performance, and observations of monitoring practices against the requirements of the PD and the applied methodology
- 6) A review of calculations and assumptions made in determining the GHG data and ERs, and
- 7) An identification of QA/QC procedures in place to prevent, or identify and correct, any errors or omissions in the reported monitoring parameters.

2.5 Resolution of Findings

Resolution of Clarification and Corrective Action Requests

The objective of this phase of the verification was to resolve the corrective action requests and clarifications and any other outstanding issues which needed to be clarified prior to EPIC positive conclusion on the monitoring report and the project design. During the validation process six CARs, eleven CRs and one FAR were raised.

All the CARs, CRs and FARs were resolved during this phase. In order to ensure the transparency of the validation process, the concerns raised and responses that were given are summarized in Appendix 1 of this report and documented in more detail in the Verification in Appendix 1. All the corrective actions have been incorporated into the monitoring report.

Internal quality control

A Technical Reviewer is appointed to review the final draft verification report and the final verification report. The comments made by the Technical Reviewer are taken into consideration and incorporated in the final report. The final report (after resolutions of all findings) is then submitted to the Head – Operations for review and approval.

2.5.1 Forward Action Requests

There was one FAR raised during this verification process.

2.6 Eligibility for Validation Activities

EPIC has accredited for validation and verification for the scopes 1-11 and 13-15 by CDM UNFCCC and as well as by the VCS board.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The project is not applied under any other GHG program.

3.2 Methodology Deviations

The verification team did not identify any new methodology deviations. However, carried over deviations from the previous monitoring period are detailed in section 4.2.

3.3 Project Description Deviations

The verification team did not identify any new project related deviations. However, carried over deviations from the previous monitoring period are detailed in section 4.2.

3.4 Grouped Project

The project activity is not a grouped project.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The verification based on the onsite observation, found that there is no material discrepancies between the project implementation and the project description. The verification team checked the status of monitoring plan the completeness of monitoring system and found no discrepancies between the actual monitoring system and the monitoring plan set in the validated project description. The project is not applied for under any other GHG scheme and there will not be any double counting. The verification team was able to conclude the project has been implemented as described in the validated project description.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

The verification of all the data ex-ante and data ex-post (monitoring parameters) used for the calculation of baseline emissions, project emissions and leakage emissions are tabulated below.

Parameter	Conclusion by the verification team
Baseline emissions (E_{BL})	As per AM0022 ver 4.0, baseline emissions consists of 1) 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 ($E_{CH4_lagoons_BL}$) 2) CO₂ emissions from fossil fuel use for onsite heat and/or power generation ($E_{CO2_heat+power_BL}$); 3) CO₂ emissions from fossil fuel use for offsite/grid generation of electricity that would otherwise have been produced ($E_{CO2_grid_BL}$). As per the applied methodology, Baseline boundaries are almost identical to the project boundaries, but do not include potential methane emissions from the project anaerobic waste water treatment facility, or from biogas (incomplete combustion, leaks). It is agreed as per the applied methodology that emissions such as nitrous oxide from the waste treatment system, nitrous oxide and methane from fossil energy use in heat and/or electricity generation are ignored. The verification team has checked the validated PD and accepted the same as correct. Total estimated baseline emissions are the sum of fugitive methane emissions from the existing lagoon-based water treatment system and, if relevant, CO₂ emissions from the generation of heat on site and/or the generation of power on site or off site. $E_{BL} = E_{CH4_lagoons_BL} + E_{CO2_heat+Power_BL} + E_{CO2_Gid_BL}$

	The verification details of each of the parameter and calculation methods are indicated below.
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 ($E_{CH4_lagoons_BL}$)	As per equation 2 of AM0022, $E_{CH4_lagoons_BL}$ is calculated as follows. $E_{CH4_lagoons_BL} = M_{lagoon_anaerobic} \times EF_{CH4} \times GWP_{CH4}$ Where $M_{lagoon_anaerobic}$ - Amount of organic material removed by anaerobic processes in the lagoon system EF_{CH4}- Methane emission factor GWP_{CH4}- Global warming potential of methane
Amount of organic material removed by anaerobic processes in the lagoon system ($M_{lagoon_anaerobic}$)	As per equation 3 of AM0022, $M_{lagoon_anaerobic}$ is calculated as follows. $M_{lagoon_anaerobic} = M_{lagoon_total} - M_{lagoon_aerobic} - M_{lagoon_chemical_ox} - M_{lagoon_deposition}$ Where M_{lagoon_total} - Total amount of organic material removed in the lagoon system $M_{lagoon_aerobic}$- Amount of organic material degraded aerobically in the lagoon system $M_{lagoon_chemical_ox}$- Amount of organic material lost through chemical oxidation in the lagoon system $M_{lagoon_deposition}$- Amount of organic material lost through deposition in the lagoon system
Total amount of organic material removed in the lagoon system (M_{lagoon_total})	As per equation 5 of AM0022, M_{lagoon_total} is calculated as follows. $M_{lagoon_total} = M_{lagoon_input} \times R_{lagoon}$ Where M_{lagoon_input} - Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system R_{lagoon}- Total organic material removal ratio of the lagoon
Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system (M_{lagoon_input})	As per the validated PD, to assess amount of COD entering the lagoon system, amount of two waste water flows need to be quantified. 1) The amount of COD actually entering the lagoon system from the new wastewater treatment facility which is equivalent to the amount of COD entering the new wastewater treatment facility minus the amount of COD removal as a result of new wastewater treatment facility (M_{input_total}) and 2) The amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility ($M_{input_lagoon_bypass}$) As per equation 4 of AM0022, it is calculated as follows $M_{lagoon_input} = M_{input_total} \times (1 - R_{NAWTF}) + M_{input_lagoon_bypass}$

M _{input_total}	It is calculated based on COD load into UASB1 and UASB 2. Daily COD load for each of the UASB is calculated as follows Daily COD load = Waste water flows entering the project treatment facility x COD of wastewater organic material concentration entering the project treatment facility. Yearly COD load is summation of all the daily values.																											
Waste water flows entering the project treatment facility i.e. UASB 1 and UASB 2. (expost parameter) <table><tr><td></td><td>AM0022 ID1 (M³/year)</td></tr><tr><td>y=2012</td><td>1,461,603</td></tr><tr><td>y=2013</td><td>893,902</td></tr></table> Waste water flows leaving the project treatment facility i.e. UASB 1 and UASB 2. (expost parameter) <table><tr><td></td><td>AM0022 ID2 (M³/year)</td></tr><tr><td>y=2012</td><td>1,461,603</td></tr><tr><td>y=2013</td><td>893,902</td></tr></table> Calibration record <table><tr><td></td><td>FM3</td><td>FM5</td></tr><tr><td>Serial no of the meter</td><td>6B00EB2000</td><td>6B00E920000</td></tr><tr><td>Max permissible error</td><td>0.5%</td><td>0.5%</td></tr><tr><td>Date of calibration no 1</td><td>14th Oct 2011</td><td>14th Oct 2011</td></tr><tr><td>Validity upto</td><td>13th Oct 2014</td><td>13th Oct 2014</td></tr></table>		AM0022 ID1 (M ³ /year)	y=2012	1,461,603	y=2013	893,902		AM0022 ID2 (M ³ /year)	y=2012	1,461,603	y=2013	893,902		FM3	FM5	Serial no of the meter	6B00EB2000	6B00E920000	Max permissible error	0.5%	0.5%	Date of calibration no 1	14 th Oct 2011	14 th Oct 2011	Validity upto	13 th Oct 2014	13 th Oct 2014	The total volume of wastewater entering the project treatment facility is the cumulative of waste water flows through flow meter FM3 (installed at inlet of UASB 1 system), FM5 (installed at inlet of UASB 2). It is measured continuously and recorded on daily basis as per the validated PD. Daily readings of each meter are calculated from the final reading of the day and initial reading of the day for all the two meters. Yearly reading is cumulative of daily data. The total volume of wastewater leaving the project treatment facility is same as that of waste water entering the project facility by assuming 100% hydrological balance. The hydrological balance is assumed at the time of validation is remains for the entire crediting period. The verification team has checked the measurement methods and found that plant operators first manually archive the monitored data onto the log sheets then transfer to the computer for electronic storage. The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured.
	AM0022 ID1 (M ³ /year)																											
y=2012	1,461,603																											
y=2013	893,902																											
	AM0022 ID2 (M ³ /year)																											
y=2012	1,461,603																											
y=2013	893,902																											
	FM3	FM5																										
Serial no of the meter	6B00EB2000	6B00E920000																										
Max permissible error	0.5%	0.5%																										
Date of calibration no 1	14 th Oct 2011	14 th Oct 2011																										
Validity upto	13 th Oct 2014	13 th Oct 2014																										
COD of wastewater organic material concentration entering the project treatment facility. (expost parameter) <table><tr><td></td><td>AM0022 ID3 (mg/L)</td></tr><tr><td>y=2012</td><td>16999</td></tr><tr><td>y=2013</td><td>21463</td></tr></table> Calibration record <table><tr><td></td><td>CS</td></tr><tr><td>Serial no of the meter</td><td>38397</td></tr><tr><td>Max permissible error</td><td>3.5%</td></tr></table>		AM0022 ID3 (mg/L)	y=2012	16999	y=2013	21463		CS	Serial no of the meter	38397	Max permissible error	3.5%	It has to be measured daily as per the validated PD using colorimetric analysis at the lab located at the project site. Daily sampling of the untreated process effluent was carried out and is analyzed for COD concentration on a daily basis. The verification team has checked the measurement methods and found that COD content will be analyzed using colorimetric method in the onsite lab. The results are then logged by the operators in the plant operation report on a daily basis. The plant operators then transfer to the computer for electronic storage. The colorimetric method is found to be as per national standards. (SPCC-WI-24-Rev 5). The verification team has checked the calibration															
	AM0022 ID3 (mg/L)																											
y=2012	16999																											
y=2013	21463																											
	CS																											
Serial no of the meter	38397																											
Max permissible error	3.5%																											

<table> <tr> <td>Date of calibration no 1</td><td>1st Nov 2010</td></tr> <tr> <td>Validity upto</td><td>31st Oct 2013</td></tr> <tr> <td>Date of calibration no 2</td><td>24th Aug 2013</td></tr> <tr> <td>Validity upto</td><td>23rd Aug 2016</td></tr> </table>	Date of calibration no 1	1 st Nov 2010	Validity upto	31 st Oct 2013	Date of calibration no 2	24 th Aug 2013	Validity upto	23 rd Aug 2016	certificates against model, serial number, date of calibration, validity and actual error and found that spectrometers are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured.
Date of calibration no 1	1 st Nov 2010								
Validity upto	31 st Oct 2013								
Date of calibration no 2	24 th Aug 2013								
Validity upto	23 rd Aug 2016								
M_{input_total} <table> <tr> <td>y</td><td>M_{input_total}</td></tr> <tr> <td>y=2012</td><td>24081 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>19702 tonnes of COD</td></tr> </table>	y	M _{input_total}	y=2012	24081 tonnes of COD	y=2013	19702 tonnes of COD	Daily COD load = Waste water flows entering the project treatment facility x COD of wastewater organic material concentration entering the project treatment facility. M_{input_total} is yearly COD load is summation of all the daily values.		
y	M _{input_total}								
y=2012	24081 tonnes of COD								
y=2013	19702 tonnes of COD								
Total organic material removal efficiency of the new project water treatment facility for baseline (R_{NAWTF}) =0%	As per the applied methodology AM22, In the baseline case, without the new anaerobic treatment facility, no material is degraded from the waste water before entering the lagoon system and all the organic material to be treated enters the lagoon system. In other words, it is assumed that R_{NAWTF} for the baseline scenario is zero. It is assumed at the time of validation and it remains same during the entire crediting period.								
Amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility (M_{input_lagoon_bypass})	The applied methodology did not recognize the parameter but project had included this parameter as the monitoring methodology identified this parameter. Amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility is characterised by the amount of wastewater bypassing the new wastewater treatment facility.								
Flow of wastewater directly to the current wastewater treatment system (expost parameter) AM0022 ID 16 <table> <tr> <td>y</td><td>AM0022 ID 16</td></tr> <tr> <td>y=2012</td><td>0 NM3</td></tr> <tr> <td>y=2013</td><td>0 NM3</td></tr> </table>	y	AM0022 ID 16	y=2012	0 NM3	y=2013	0 NM3	As per the validated PD, bypass flow is to be measured by an electromagnetic flow meter. It is also reported that this meter is not in use as all waste water is sent to the reactors. Since there is no waste water (with COD concentration) actually entering the lagoon system, bypassing the new wastewater treatment facility, this parameter is zero. The verification team was able to conclude that there is no wastewater bypassing the new treatment plant. Even if wastewater is sent directly to any facilities, it will not have any effect on the overall emission reductions, as, in such a case, M_{input_lagoon_bypass} in baseline and project emission would be the same. Hence QA/QC is assured in overall emission reduction calculation. .		
y	AM0022 ID 16								
y=2012	0 NM3								
y=2013	0 NM3								
Amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility (M_{input_lagoon_bypass}) <table> <tr> <td>y</td><td>M_{input_lagoon_bypass}</td></tr> <tr> <td>y=2012</td><td>0 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>0 tonnes of COD</td></tr> </table>	y	M _{input_lagoon_bypass}	y=2012	0 tonnes of COD	y=2013	0 tonnes of COD	Amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility is zero, as there is no wastewater bypassing the new treatment facility.		
y	M _{input_lagoon_bypass}								
y=2012	0 tonnes of COD								
y=2013	0 tonnes of COD								
Input of organic material from the new project anaerobic waste water treatment facility into the	$M_{\text{lagoon_input}} = M_{\text{input_total}} \times (1 - R_{\text{NAWTF}}) + M_{\text{input_lagoon_bypass}}$								

lagoon system ($M_{\text{lagoon_input}}$) <table> <tr> <th>y</th><th>$M_{\text{lagoon_input}}$</th></tr> <tr> <td>y=2012</td><td>24081 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>19702 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_input}}$	y=2012	24081 tonnes of COD	y=2013	19702 tonnes of COD	
y	$M_{\text{lagoon_input}}$						
y=2012	24081 tonnes of COD						
y=2013	19702 tonnes of COD						
Total organic material removal ratio of the lagoon (R_{lagoon}) =87.88%	It is assumed at the time of validation and it remains same during the entire crediting period.						
Total amount of organic material removed in the lagoon system ($M_{\text{lagoon_total}}$) <table> <tr> <th>y</th><th>$M_{\text{lagoon_total}}$</th></tr> <tr> <td>y=2012</td><td>21163 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>17314 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_total}}$	y=2012	21163 tonnes of COD	y=2013	17314 tonnes of COD	$M_{\text{lagoon_total}} = M_{\text{lagoon_input}} \times R_{\text{lagoon}}$
y	$M_{\text{lagoon_total}}$						
y=2012	21163 tonnes of COD						
y=2013	17314 tonnes of COD						
Amount of organic material degraded aerobically in the lagoon system ($M_{\text{lagoon_aerobic}}$)	As per the methodology AM0022 ver 4.0, $M_{\text{lagoon_aerobic}}$ is defined as Surface aerobic losses of organic material in pond based systems equal to 254 kg COD per hectare of pond surface area and per day is assumed to be lost through aerobic processes or it is calculated as follows $M_{\text{lagoon_aerobic}} = \text{Surface area of treatment of 34 open lagoons} \times \text{operating days} \times M_{\text{lagoon_aerobic per hectare per day}}$						
Surface area of treatment =16 hectare	It is assumed at the time of validation and it remains same during the entire crediting period.						
Operating days <table> <tr> <th>y</th><th>Operating days</th></tr> <tr> <td>Y=2012</td><td>366</td></tr> <tr> <td>Y=2013</td><td>365</td></tr> </table>	y	Operating days	Y=2012	366	Y=2013	365	It is measured with data is available. Since all the daily values are available during this monitoring period, the values are accepted.
y	Operating days						
Y=2012	366						
Y=2013	365						
$M_{\text{lagoon_aerobic per hectare per day}} = 254 \text{ kg per ha per day}$	It is assumed at the time of validation and it remains same during the entire crediting period.						
$M_{\text{lagoon_aerobic}}$ <table> <tr> <th>y</th><th>$M_{\text{lagoon_aerobic}}$</th></tr> <tr> <td>Y=2012</td><td>1487 tonnes of COD</td></tr> <tr> <td>Y=2013</td><td>1483 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_aerobic}}$	Y=2012	1487 tonnes of COD	Y=2013	1483 tonnes of COD	$M_{\text{lagoon_aerobic}} = \text{Surface area of treatment of 34 open lagoons} \times \text{operating days} \times M_{\text{lagoon_aerobic per hectare per day}}$
y	$M_{\text{lagoon_aerobic}}$						
Y=2012	1487 tonnes of COD						
Y=2013	1483 tonnes of COD						
Amount of organic material lost through chemical oxidation in the lagoon system ($M_{\text{lagoon_chemical_ox}}$) =0 tonnes of COD	The verification team has checked that the calculation methods are not defined adequately in the validated PD. Since PP has assumed that there is no amount of organic material lost through the chemical oxidation in the lagoon system, and the same results in conservativeness of overall emission reductions, the verification team has accepted the value.						
Amount of organic material lost through deposition in the lagoon system ($M_{\text{lagoon_deposition}}$)	As per equation 6 of AM0022 ver 4, $M_{\text{lagoon_deposition}}$ is calculated as follows. $M_{\text{lagoon_deposition}} = M_{\text{lagoon_input}} \times R_{\text{deposition}}$ Where $M_{\text{lagoon_input}}$ - Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system $R_{\text{deposition}}$ - Organic material deposition ratio of the lagoon						

Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system ($M_{\text{lagoon_input}}$) <table border="1"> <tr> <th>y</th><th>$M_{\text{lagoon_input}}$</th></tr> <tr> <td>y=2012</td><td>24081 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>19702 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_input}}$	y=2012	24081 tonnes of COD	y=2013	19702 tonnes of COD	$M_{\text{lagoon_input}} = M_{\text{input_total}} \times (1 - R_{\text{NAWTF}}) + M_{\text{input_lagoon_bypass}}$
y	$M_{\text{lagoon_input}}$						
y=2012	24081 tonnes of COD						
y=2013	19702 tonnes of COD						
Organic material deposition ratio of the lagoon ($R_{\text{deposition}}$) = 0	It is assumed at the time of validation and it remains same during the entire crediting period.						
Amount of organic material lost through deposition in the lagoon system ($M_{\text{lagoon_deposition}}$) <table border="1"> <tr> <th>y</th><th>$M_{\text{lagoon_deposition}}$</th></tr> <tr> <td>Y=2012</td><td>0 tonnes of COD</td></tr> <tr> <td>Y=2013</td><td>0 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_deposition}}$	Y=2012	0 tonnes of COD	Y=2013	0 tonnes of COD	$M_{\text{lagoon_deposition}} = M_{\text{lagoon_input}} \times R_{\text{deposition}}$
y	$M_{\text{lagoon_deposition}}$						
Y=2012	0 tonnes of COD						
Y=2013	0 tonnes of COD						
Amount of organic material removed by anaerobic processes in the lagoon system ($M_{\text{lagoon_anaerobic}}$) <table border="1"> <tr> <th>y</th><th>$M_{\text{lagoon_anaerobic}}$</th></tr> <tr> <td>Y=2012</td><td>19675 tonnes of COD</td></tr> <tr> <td>Y=2013</td><td>15831 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_anaerobic}}$	Y=2012	19675 tonnes of COD	Y=2013	15831 tonnes of COD	$M_{\text{lagoon_anaerobic}} = M_{\text{lagoon_total}} - M_{\text{lagoon_aerobic}} - M_{\text{lagoon_chemical_ox}} - M_{\text{lagoon_deposition}}$
y	$M_{\text{lagoon_anaerobic}}$						
Y=2012	19675 tonnes of COD						
Y=2013	15831 tonnes of COD						
Methane emission factor (EF_{CH_4}) = 0.241 kg CH₄/kg COD	It is assumed at the time of validation and it remains same during the entire crediting period.						
Global warming potential of methane (GWP_{CH_4}) <table border="1"> <tr> <th>y</th><th>GWP_{CH_4}</th></tr> <tr> <td>Y=2012</td><td>21 kg of CO₂/ kg CH₄</td></tr> <tr> <td>Y=2013</td><td>25 kg of CO₂/ kg CH₄</td></tr> </table>	y	GWP_{CH_4}	Y=2012	21 kg of CO ₂ / kg CH ₄	Y=2013	25 kg of CO ₂ / kg CH ₄	PP has considered for the first commitment period upto 2012, as 21 kg CO₂/Kg CH₄. PP has considered GWP of methane as 25 which is accepted for the second commitment period which is in accordance with decision 4/CMP 7 as prescribed by the "Standard for application of the global warming potentials to CDM PA and PoA for the second commitment period of the Kyoto protocol" Version 1.0 (EB 69 Annex 3).
y	GWP_{CH_4}						
Y=2012	21 kg of CO ₂ / kg CH ₄						
Y=2013	25 kg of CO ₂ / kg CH ₄						
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 ($E_{\text{CH}_4_lagoons_BL}$) <table border="1"> <tr> <th>y</th><th>$E_{\text{CH}_4_lagoons_BL}$</th></tr> <tr> <td>Y=2012</td><td>99576 tCO₂e</td></tr> <tr> <td>Y=2013</td><td>95380 tCO₂e</td></tr> </table>	y	$E_{\text{CH}_4_lagoons_BL}$	Y=2012	99576 tCO ₂ e	Y=2013	95380 tCO ₂ e	$E_{\text{CH}_4_lagoons_BL}$ is calculated as follows. $E_{\text{CH}_4_lagoons_BL} = M_{\text{lagoon_anaerobic}} \times EF_{\text{CH}_4} \times GWP_{\text{CH}_4}$
y	$E_{\text{CH}_4_lagoons_BL}$						
Y=2012	99576 tCO ₂ e						
Y=2013	95380 tCO ₂ e						
CO₂ emissions from on - site fossil heat and/or power generation in the baseline case that are displaced by generation based on biogas collected in the anaerobic treatment facility. ($E_{\text{CO}_2_heat+power_BL}$)	$E_{\text{CO}_2_heat+power_BL}$ consists of two terms. $E_{\text{CO}_2_heat+power_BL} = E_{\text{CO}_2_heat_BL} + E_{\text{CO}_2_power_BL}$ Where $E_{\text{CO}_2_heat_BL}$- CO₂ emissions from on - site fossil heat in the baseline case that are displaced by generation based on biogas collected in the anaerobic treatment facility $E_{\text{CO}_2_power_BL}$- CO₂ emissions from on - site power generation in the baseline case that are displaced						

	by generation based on biogas collected in the anaerobic treatment facility.						
CO ₂ emissions from on - site fossil heat in the baseline case that are displaced by generation based on biogas collected in the anaerobic treatment facility (E _{CO2_heat_BL})	As per the methodology AM22, equation 9, E_{CO2_heat_BL} is calculated as below $E_{CO2_heat_BL} = F_{FO} \times NCV_{FO} \times EF_{FO}$ Where F_{FO}- Amount of fossil fuel (fuel oil) displaced by the use of biogas for the generation of onsite heat. NCV_{FO}- Net calorific value of fuel oil EF_{FO} - Carbon emission factor of the fossil fuel considered						
Amount of fossil fuel (fuel oil) displaced by the use of biogas for the generation of onsite heat (F _{FO}) (expost parameter) (AM0022 ID 8)	PP has assumed that heat supplied by biogas in the project activity is equal to heat that would be supplied by fuel oil in the baseline. The verification team has accepted the approach as one of the purpose of the project activity is to replace fuel oil in the boiler with biogas. So the amount of fuel oil replaced is calculated as follows Amount of fuel oil replaced = volume of biogas consumed in the boiler (V_{boiler}) x NCV of biogas / NCV of fuel oil As per the validated PD, it is an expost parameter calculated as above using parameters such as ID 5, ID 11, ID 19.						
Biogas sent to boiler that is generated in covered lagoon (CL3) (Deviation 1)	As a result of increment of starch production amount in the year 2013, to handle the additional load, PP had installed a covered lagoon (CL3) on 12th September 2013. The verification team has checked the commissioning certificate of CL3. PP has discounted the generation of biogas from this covered lagoon as it was installed after the validation of the project activity. The portion of biogas generated by CL3 is excluded from the calculation of emission reduction. By this deviation (deviation 1), applicability of the methodology, additionality and conservativeness of overall emission reductions, hence accepted by the verification team. Biogas sent to boiler that is generated in covered lagoon is calculated as follows. Biogas sent to boiler that is generated in covered lagoon = (Biogas generated in covered lagoon CL3 - biogas flared near to CL3)/ Total biogas supplied to the boilers in the year 2013.						
Volume of biogas supplied to all the boilers in the year 2013 (V _{boiler supplied})	Volume of biogas supplied to all the boilers in the year 2013 (V_{boiler-supplied}) = Biogas generated in UASB 1 and UASB 2 + Biogas generated in covered lagoon CL3- Biogas flared in gas storage- biogas flared near to CL3 Biogas generated from UASB 1 and 2 is measured from flowmeter GM1 and GM2 respectively. Biogas generated in covered lagoon CL3 is measured through GM3. Biogas flared in gas storage and						
<table border="1"> <tr> <td>Biogas generated from UASB 1</td><td>7,051,714</td></tr> <tr> <td>Biogas generated from UASB 2</td><td>12,148,842</td></tr> <tr> <td>Biogas generated from Covered lagoon</td><td>3,018,165</td></tr> </table>	Biogas generated from UASB 1	7,051,714	Biogas generated from UASB 2	12,148,842	Biogas generated from Covered lagoon	3,018,165	
Biogas generated from UASB 1	7,051,714						
Biogas generated from UASB 2	12,148,842						
Biogas generated from Covered lagoon	3,018,165						

(CL3) Biogas flared in gas storage Biogas flared near to CL3 Vboiler supplied (Deviation 1)		biogas flared at near to covered lagoon is measured through GM6 and GM7 respectively. It is found that biogas flow is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values.	
Biogas generated in covered lagoon CL3 - Biogas flared near to CL3 Biogas generated from Covered lagoon (CL3) Biogas flared near to CL3 Biogas generated in covered lagoon CL3 - Biogas flared near to CL3 3,018,165 15,581 3002584 (Deviation 1)		Biogas generated in covered lagoon CL3 is measured through GM3 and biogas flared at near to covered lagoon is measured through GM6 and GM7 respectively. It is found that biogas flow is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values.	
Percentage Biogas sent to boiler that is generated in covered lagoon (CL3) =14% (Deviation 1)		Percentage Biogas sent to boiler that is generated in covered lagoon = (Biogas generated in covered lagoon CL3 - biogas flared near to CL3)/ Total biogas supplied to the boilers in the year 2013.	
Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon (Deviation 1)		Biogas supplied including all the boilers is calculated as total biogas that is supplied to the boilers minus Biogas sent to boiler that is generated in covered lagoon Or Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon = total biogas that is supplied to the boilers x (1- Percentage Biogas sent to boiler that is generated in covered lagoon)	
Volume of biogas consumed in the boilers including in boilers 6,9,10,11 (V_{boiler}) (expost parameter) y Y=2012 Y=2013 V_{boiler} AM0022 ID 5 20792221 NM³ 19122114 NM³		As per the validated PD, it is measured continuously. It is found that biogas flow is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values. For the year 2012: Gas flow meter GM3 (installed at the inlet of boilers) measures the total biogas sent to the boilers. Biogas consumed in the all the boilers including that of boiler 6, 9 and 10 are measured through flowmeter GM3 (installed at the inlet of boilers). This meter used for total biogas consumed in the boiler in the year 2012. For the year 2013: But in the year 2013, biogas discharge line form gas blowers were modified. From one line, separated into two lines with	
	GM3	GM4	GM5
Serial no of the meter	9B09BD02000	9B09BD02000	AA083102000
Max permissible error	1.5%	1.5%	1.5%
Date of calibration	24 th June	24 th June	23 rd June

no 1	2011 (moved to and as GM4)	2011	2011	separate flow meters namely GM4 and GM5 (installed at the inlet of boilers). Biogas consumed in the all the boilers including that of boiler 6, 9,10 and 11 are measured through these flowmeters. This meter used for total biogas consumed in the boiler in the year 2013. Boilers 6, 9, 10 and 11 are installed after the validation of the project.						
Validity upto	23 rd June 2014	23 rd June 2014	22 nd June 2014							
				The verification team has checked the calibration certificates against model, serial number, date of calibration, validity and actual error and found that spectrometers are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured.						
Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon =16471719 NM ³				Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon = total biogas that is supplied to the boilers x (1- Percentage Biogas sent to boiler that is generated in covered lagoon)						
Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 + excluded biogas produced from CL3)				It is calculated as follows Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) = Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon- Volume of biogas consumed in the boilers in boilers 6,9,10,11						
Volume of biogas consumed in the boilers in boilers 6,9,10,11 (V _{boiler})				PP has discounted the consumption of biogas in the boilers 6, 9, 10 as they are found installed after the validation of the project activity. Boilers 10 are installed during 2012. The verification team has checked the commissioning certificates and the details are consistent with the claim of PP and accepted the same as such.						
<table><tr><td>y</td><td>V_{boiler}</td></tr><tr><td>Y=2012</td><td>4529021 NM³</td></tr><tr><td>Y=2013</td><td>3820402 NM³</td></tr></table>				y	V _{boiler}	Y=2012	4529021 NM ³	Y=2013	3820402 NM ³	
y	V _{boiler}									
Y=2012	4529021 NM ³									
Y=2013	3820402 NM ³									
(Deviation 2)				Since there is no separate meters for each boiler and to calculate the % consumption for each boiler such as boiler 6, 9 and 10. PP had conducted a performance test to identify the biogas consumption of each boiler at its full load by running boiler at full load and the biogas totalised flow at biogas flow meter is recorded when the boiler is started and stopped. The resulting values are used to calculate the biogas consumption during the operational hours. The operation hours of each boiler are available on a daily basis taken from the log sheets. So the biogas consumed is hence calculated from maximum biogas consumption and running hours of each boiler. Then the percentage of biogas consumed by each boiler is calculated. This deviation does not affect the applicability conditions in any way, additionality and conservativeness of overall emission reductions, hence accepted by the verification team as it falls in line with the VCS						

	requirements. For the year 2013: But in the year 2013, biogas discharge line form gas blowers were modified. From one line, separated into two lines with separate flow meters namely GM4 and GM5 (installed at the inlet of boilers). This meter used for total biogas consumed in the boiler in the year 2012 PP has discounted the consumption of biogas in the boilers 6, 9, 10, 11 as they are found installed after the validation of the project activity. Boilers 11 are installed during 2013. The verification team has checked the commissioning certificates and the details are consistent with the claim of PP and accepted the same as such.						
Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) <table> <tr> <td>y</td><td>V_{boiler}</td></tr> <tr> <td>Y=2012</td><td>16263200</td></tr> <tr> <td>Y=2013</td><td>12651318</td></tr> </table>	y	V _{boiler}	Y=2012	16263200	Y=2013	12651318	Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) = Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon-Volume of biogas consumed in the boilers in boilers 6,9,10,11
y	V _{boiler}						
Y=2012	16263200						
Y=2013	12651318						
NCV of biogas (expost parameter) AM0022 ID 19	As per the validated PD, it is calculated. NCV of biogas is calculated as follows NCV of biogas = NCV of methane x methane content in biogas Since NCV of biogas is calculated from values like methane content which is QA/QC assured, the calculation of NCV of biogas is thus QA/QC assured.						
NCV of methane = 36.73 MJ/M³	It is sourced from Oil and Thailand 2009 by DEDE. Hence accepted by the verification team.						
Methane content <table> <tr> <td></td><td>Methane content</td></tr> <tr> <td>Y =2012</td><td>54.48%</td></tr> <tr> <td>Y= 2013</td><td>53.44%</td></tr> </table> (Deviation 3)		Methane content	Y =2012	54.48%	Y= 2013	53.44%	As per the validated PD, methane content will be measured continuously and recorded daily. The monitoring of this parameter is the periodic measurement by the portable gas analyzer. But daily readings are not available. The monitored data is adjusted for 95% confidence level. The verification team has checked the approach and accepted the deviation as it complies with the VCS requirements. (Deviation 3). The readings are measured above every four hours and average value is considered for calculation. The final average is adjusted as per deviation 3 through estimation using 95% confidence level. The verification team has checked the rationale and factors used in the calculation of the final adjusted value and accepted. Since this value is used for baseline calculation, lower bound value is used for the calculation which is considered conservative and hence accepted. Lower bound value = Mean value- t x standard
	Methane content						
Y =2012	54.48%						
Y= 2013	53.44%						

	deviation/count Where Mean value- Final average t- value from standard t distribution for a confidence level of 95% with degrees of freedom (n_m-1) The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. In addition to this calibration, flow meter was calibrated via an external agency which the verification team has checked and found to be satisfactory. The verification team was able to conclude that QA/QC of the meters is ensured.						
NCV of biogas <table border="1"> <tr> <td></td><td>NCV of biogas</td></tr> <tr> <td>Y =2012</td><td>20.01 MJ/NM³</td></tr> <tr> <td>Y= 2013</td><td>19.63 MJ/NM³</td></tr> </table>		NCV of biogas	Y =2012	20.01 MJ/NM ³	Y= 2013	19.63 MJ/NM ³	NCV of biogas is calculated as follows NCV of biogas = NCV of methane x methane content in biogas
	NCV of biogas						
Y =2012	20.01 MJ/NM ³						
Y= 2013	19.63 MJ/NM ³						
NCV of fuel oil =40400 kJ/Tonne of fuel oil	It is assumed at the time of validation and it remains same during the entire crediting period.						
Amount of fossil fuel (fuel oil) displaced by the use of biogas for the generation of onsite heat (F_{FO}) (expost parameter) <table border="1"> <tr> <td></td><td>F_{FO}</td></tr> <tr> <td>Y =2012</td><td>8055 tonnes</td></tr> <tr> <td>Y= 2013</td><td>6146 tonnes</td></tr> </table>		F_{FO}	Y =2012	8055 tonnes	Y= 2013	6146 tonnes	Amount of fuel oil replaced = volume of biogas consumed in the boiler (V_{boiler}) x NCV of biogas / NCV of fuel oil.
	F_{FO}						
Y =2012	8055 tonnes						
Y= 2013	6146 tonnes						
NCV of fuel oil =0.0404 TJ/Tonne of fuel oil	It is assumed at the time of validation and it remains same during the entire crediting period.						
Carbon emission factor of the fossil fuel considered (EF_{FO}) = 77.367 tCO₂/TJ	It is assumed at the time of validation and it remains same during the entire crediting period.						
CO₂ emissions from on - site fossil heat in the baseline case that are displaced by generation based on biogas collected in the anaerobic treatment facility ($E_{CO_2 \text{ heat BL}}$) <table border="1"> <tr> <td></td><td>$E_{CO_2 \text{ heat BL}}$</td></tr> <tr> <td>Y =2012</td><td>25176 tCO₂e</td></tr> <tr> <td>Y=2013</td><td>19210 tCO₂e</td></tr> </table>		$E_{CO_2 \text{ heat BL}}$	Y =2012	25176 tCO ₂ e	Y=2013	19210 tCO ₂ e	$E_{CO_2 \text{ heat BL}} = F_{FO} \times NCV_{FO} \times EF_{FO}$
	$E_{CO_2 \text{ heat BL}}$						
Y =2012	25176 tCO ₂ e						
Y=2013	19210 tCO ₂ e						
CO₂ emissions from on - site power generation in the baseline case that are displaced by generation based on biogas collected in the anaerobic treatment facility. ($E_{CO_2 \text{ power BL}}$) <table border="1"> <tr> <td></td><td>$E_{CO_2 \text{ power BL}}$</td></tr> <tr> <td>Y =2012</td><td>0 tCO₂e</td></tr> <tr> <td>Y=2013</td><td>0 tCO₂e</td></tr> </table> =0 tCO₂e		$E_{CO_2 \text{ power BL}}$	Y =2012	0 tCO ₂ e	Y=2013	0 tCO ₂ e	Since there is no power generation in the baseline that is displaced by the generation based on biogas collected in the anaerobic treatment facility, this parameter is zero.
	$E_{CO_2 \text{ power BL}}$						
Y =2012	0 tCO ₂ e						
Y=2013	0 tCO ₂ e						
CO₂ emissions from fossil fuel use for offsite/grid generation of electricity that would otherwise have been produced ($E_{CO_2 \text{ grid BL}}$)= 0 tCO₂e.	Since there is no power generation which was supplied by the grid in the baseline that is displaced by the generation based on biogas collected in the						

	$E_{CO_2 \text{ grid_BL}}$	anaerobic treatment facility, this parameter is zero
Y =2012	0 tCO ₂ e	
Y=2013	0 tCO ₂ e	
Baseline emissions (E_{BL})		$E_{BL} = E_{CH_4 \text{ lagoons_BL}} + E_{CO_2 \text{ heat+Power_BL}} + E_{CO_2 \text{ Gid_BL}}$
	E_{BL}	
Y =2012	124752 tCO ₂ e	
Y= 2013	114591 tCO ₂ e	
Project emissions ($E_{Project}$)		Total estimated project emissions are the sum of fugitive methane emissions from the existing lagoon-based water treatment system, from possible methane emissions from the new anaerobic waste water treatment facility, from incomplete biogas combustion, biogas leaks. $E_{Project}$ is calculated as follows. $E_{project} = E_{CH_4 \text{ lagoons}} + E_{CH_4 \text{ NAWTF}} + E_{CH_4 \text{ IC+leaks}}$
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 ($E_{CH_4 \text{ lagoons_PJ}}$)		As per equation 2 of AM0022, $E_{CH_4 \text{ lagoons_BL}}$ is calculated as follows. $E_{CH_4 \text{ lagoons_PJ}} = M_{lagoon_anaerobic} \times EF_{CH_4} \times GWP_{CH_4}$ Where $M_{lagoon_anaerobic}$ - Amount of organic material removed by anaerobic processes in the lagoon system EF_{CH_4}- Methane emission factor GWP_{CH_4}- Global warming potential of methane
Amount of organic material removed by anaerobic processes in the lagoon system ($M_{lagoon_anaerobic}$)		As per equation 3 of AM0022, $M_{lagoon_anaerobic}$ is calculated as follows. $M_{lagoon_anaerobic} = M_{lagoon_total} - M_{lagoon_aerobic} - M_{lagoon_chemical_ox} - M_{lagoon_deposition}$ Where M_{lagoon_total} - Total amount of organic material removed in the lagoon system $M_{lagoon_aerobic}$- Amount of organic material degraded aerobically in the lagoon system $M_{lagoon_chemical_ox}$- Amount of organic material lost through chemical oxidation in the lagoon system $M_{lagoon_deposition}$- Amount of organic material lost through deposition in the lagoon system
Total amount of organic material removed in the lagoon system (M_{lagoon_total})		As per equation 5 of AM0022, M_{lagoon_total} is calculated as follows. $M_{lagoon_total} = M_{lagoon_input} \times R_{lagoon}$ Where M_{lagoon_input} - Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system R_{lagoon}- Total organic material removal ratio of the lagoon
Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system (M_{lagoon_input})		As per the validated PD, to assess amount of COD entering the lagoon system, amount of two waste water flows need to be quantified. 1)The amount of COD actually entering the lagoon system from the new wastewater treatment facility which is equivalent to the amount of COD entering the new wastewater treatment facility minus the amount of COD removal as a result of new

	wastewater treatment facility (M_{input_total}) and 2) The amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility ($M_{input_lagoon_bypass}$) As per equation 4 of AM0022, it is calculated as follows $M_{lagoon_input} = M_{input_total} \times (1 - R_{NAWTF}) + M_{input_lagoon_bypass}$						
M_{input_total}	It is calculated based on COD load into UASB1 and UASB 2. Daily COD load for each of the UASB is calculated as follows Daily COD load = Waste water flows entering the project treatment facility x COD of wastewater organic material concentration entering the project treatment facility. Yearly COD load is summation of all the daily values.						
Waste water flows entering the project treatment facility i.e. UASB 1 and UASB 2. (expost parameter) <table border="1"> <thead> <tr> <th></th><th>AM0022 ID1 ($M^3/year$)</th></tr> </thead> <tbody> <tr> <td>y=2012</td><td>1,461,603</td></tr> <tr> <td>y=2013</td><td>893,902</td></tr> </tbody> </table>		AM0022 ID1 ($M^3/year$)	y=2012	1,461,603	y=2013	893,902	The total volume of wastewater is the cumulative of waste water flows through flow meter FM3 (installed at inlet of UASB 1 system), FM5 (installed at inlet of UASB 2). It is measured continuously and recorded on daily basis as per the validated PD. Daily readings of each meter are calculated from the final reading of the day and initial reading of the day for all the two meters. Yearly reading is cumulative of daily data. The verification team has checked the measurement methods and found that plant operators first manually archive the monitored data onto the log sheets then transfer to the computer for electronic storage. The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured.
	AM0022 ID1 ($M^3/year$)						
y=2012	1,461,603						
y=2013	893,902						
COD of wastewater organic material concentration entering the project treatment facility. <table border="1"> <thead> <tr> <th></th><th>AM0022 ID3 (mg/L)</th></tr> </thead> <tbody> <tr> <td>y=2012</td><td>16999</td></tr> <tr> <td>y=2013</td><td>21463</td></tr> </tbody> </table>		AM0022 ID3 (mg/L)	y=2012	16999	y=2013	21463	It has to be measured daily as per the validated PD using colorimetric analysis at the lab located at the project site. Daily sampling of the untreated process effluent was carried out and is analyzed for COD concentration on a daily basis. The verification team has checked the measurement methods and found that COD content will be analyzed using colorimetric method in the onsite lab. The results are then logged by the operators in the plant operation report on a daily basis. The plant operators then transfer to the computer for electronic storage. The colorimetric method is found to be as per national standards.
	AM0022 ID3 (mg/L)						
y=2012	16999						
y=2013	21463						

	(SPCC-WI-24-Rev 5). In addition, PP has sent the wastewater samples to external lab to compare the internal readings. The results are found to be satisfactory. The verification team has checked the calibration certificates against model, serial number, date of calibration, validity and actual error and found that spectrometers are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured.																				
M_{input_total} <table> <tr> <th>y</th><th>M_{input_total}</th></tr> <tr> <td>y=2012</td><td>24081 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>19702 tonnes of COD</td></tr> </table>	y	M_{input_total}	y=2012	24081 tonnes of COD	y=2013	19702 tonnes of COD	Daily COD load = Waste water flows entering the project treatment facility x COD of wastewater organic material concentration entering the project treatment facility. M_{input_total} is yearly COD load is summation of all the daily values.														
y	M_{input_total}																				
y=2012	24081 tonnes of COD																				
y=2013	19702 tonnes of COD																				
Total organic material removal efficiency of the new project water treatment facility for project activity (R_{NAWTF})	As per the applied methodology AM22, It is a project specific factor used to estimate how much COD will be removed from the system. $R_{NAWTF} = (COD_{acid} - COD_{effluent}) / COD_{acid}$																				
COD of wastewater organic material concentration entering the project treatment facility (COD acid) (expost parameter) (AM0022 ID3) <table> <tr> <th>y</th><th>COD acid</th></tr> <tr> <td>y=2012</td><td>16.999 kg of COD/M3</td></tr> <tr> <td>y=2013</td><td>21.448 kg of COD/M3</td></tr> </table> Calibration record <table> <tr> <th></th><th>CS</th></tr> <tr> <td>Serial no of the meter</td><td>38397</td></tr> <tr> <td>Max permissible error</td><td>3.5%</td></tr> <tr> <td>Date of calibration no 1</td><td>1st Nov 2010</td></tr> <tr> <td>Validity upto</td><td>31st Oct 2013</td></tr> <tr> <td>Date of calibration no 2</td><td>24th Aug 2013</td></tr> <tr> <td>Validity upto</td><td>23rd Aug 2016</td></tr> </table>	y	COD acid	y=2012	16.999 kg of COD/M3	y=2013	21.448 kg of COD/M3		CS	Serial no of the meter	38397	Max permissible error	3.5%	Date of calibration no 1	1 st Nov 2010	Validity upto	31 st Oct 2013	Date of calibration no 2	24 th Aug 2013	Validity upto	23 rd Aug 2016	It has to be measured daily as per the validated PD using colorimetric analysis at the lab located at the project site. Daily sampling of the untreated process effluent of both UASB systems was carried out and is analyzed for COD concentration on a daily basis. The verification team has checked the measurement methods and found that COD content will be analyzed using colorimetric method in the onsite lab. The results are then logged by the operators in the plant operation report on a daily basis. The plant operators then transfer to the computer for electronic storage. The colorimetric method is found to be as per national standards. The verification team has checked the calibration certificates against model, serial number, date of calibration, validity and actual error and found that spectrometers are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured.
y	COD acid																				
y=2012	16.999 kg of COD/M3																				
y=2013	21.448 kg of COD/M3																				
	CS																				
Serial no of the meter	38397																				
Max permissible error	3.5%																				
Date of calibration no 1	1 st Nov 2010																				
Validity upto	31 st Oct 2013																				
Date of calibration no 2	24 th Aug 2013																				
Validity upto	23 rd Aug 2016																				
COD of wastewater organic material concentration entering the project treatment facility (COD effluent) (expost parameter) (AM0022 ID4) <table> <tr> <th>y</th><th>COD effluent</th></tr> </table>	y	COD effluent	It has to be measured daily as per the validated PD using colorimetric analysis at the lab located at the project site. Daily sampling of the treated process effluent of both UASB systems was carried out and is analyzed for COD concentration on a daily basis.																		
y	COD effluent																				

y=2012	0.916 kg of COD/M3
y=2013	1.472 kg of COD/M3

Calibration record

	CS
Serial no of the meter	38397
Max permissible error	3.5%
Date of calibration no 1	1 st Nov 2010
Validity upto	31 st Oct 2013
Date of calibration no 2	24 th Aug 2013
Validity upto	23 rd Aug 2016

The verification team has checked the measurement methods and found that COD content will be analyzed using colorimetric method in the onsite lab. The results are then logged by the operators in the plant operation report on a daily basis. The plant operators then transfer to the computer for electronic storage. The colorimetric method is found to be as per national standards. (SPCC-WI-24-Rev 5).

The verification team has checked the calibration certificates against model, serial number, date of calibration, validity and actual error and found that spectrometers are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured.

R_{NAWTF}

	R _{NAWTF}
Y =2012	93.65%
Y=2013	91.70%

Daily average of both the UASB systems is calculated. Yearly average values then calculated.

Amount of COD actually entering the lagoon system , bypassing the new wastewater treatment facility ($M_{input_lagoon_bypass}$) <table> <tr> <th>y</th><th>$M_{input_lagoon_bypass}$</th></tr> <tr> <td>y=2012</td><td>0 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>0 tonnes of COD</td></tr> </table>	y	$M_{input_lagoon_bypass}$	y=2012	0 tonnes of COD	y=2013	0 tonnes of COD	The applied methodology did not recognize the parameter but project had included this parameter as the monitoring methodology identified this parameter. Since there is no waste water (with COD concentration) actually entering the lagoon system, bypassing the new wastewater treatment facility, this parameter is zero. The verification team was able to conclude that there is no wastewater bypassing the new treatment plant.
y	$M_{input_lagoon_bypass}$						
y=2012	0 tonnes of COD						
y=2013	0 tonnes of COD						
Amount of COD actually entering the lagoon system , bypassing the new wastewater treatment facility ($M_{input_lagoon_bypass}$)	The applied methodology did not recognize the parameter but project had included this parameter as the monitoring methodology identified this parameter. Amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility is characterised by the amount of wastewater bypassing the new wastewater treatment facility.						
Flow of wastewater directly to the current wastewater treatment system (expost parameter) AM0022 ID 16 <table> <tr> <th>y</th><th>AM0022 ID 16</th></tr> <tr> <td>y=2012</td><td>0 NM3</td></tr> <tr> <td>y=2013</td><td>0 NM3</td></tr> </table>	y	AM0022 ID 16	y=2012	0 NM3	y=2013	0 NM3	As per the validated PD, bypass flow is to be measured by an electromagnetic flow meter. It is also reported that this meter is not in use as all waste water is sent to the reactors. Since there is no waste water (with COD concentration) actually entering the lagoon system, bypassing the new wastewater treatment facility, this parameter is zero. The verification team was able to conclude that there is no wastewater bypassing the new treatment plant. Even if wastewater is sent directly to any facilities, it will not have any effect on the overall emission reductions, as, in such a case, $M_{input_lagoon_bypass}$ in baseline and project emission would be the same. Hence QA/QC is assured in overall emission reduction calculation.
y	AM0022 ID 16						
y=2012	0 NM3						
y=2013	0 NM3						
Amount of COD actually entering the lagoon system , bypassing the new wastewater treatment facility ($M_{input_lagoon_bypass}$) <table> <tr> <th>y</th><th>$M_{input_lagoon_bypass}$</th></tr> <tr> <td>y=2012</td><td>0 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>0 tonnes of COD</td></tr> </table>	y	$M_{input_lagoon_bypass}$	y=2012	0 tonnes of COD	y=2013	0 tonnes of COD	Amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility is zero, as there is no wastewater bypassing the new treatment facility.
y	$M_{input_lagoon_bypass}$						
y=2012	0 tonnes of COD						
y=2013	0 tonnes of COD						
Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system (M_{lagoon_input}) <table> <tr> <th>y</th><th>M_{lagoon_input}</th></tr> <tr> <td>y=2012</td><td>1529 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>1636 tonnes of COD</td></tr> </table>	y	M_{lagoon_input}	y=2012	1529 tonnes of COD	y=2013	1636 tonnes of COD	$M_{lagoon_input} = M_{input_total} \times (1 - R_{NAWTF}) + M_{input_lagoon_bypass}$
y	M_{lagoon_input}						
y=2012	1529 tonnes of COD						
y=2013	1636 tonnes of COD						
Total organic material removal ratio of the lagoon (R_{lagoon}) =87.88%	It is assumed at the time of validation and it remains same during the entire crediting period.						
Total amount of organic material removed in the lagoon system (M_{lagoon_total}) <table> <tr> <th>y</th><th>M_{lagoon_total}</th></tr> </table>	y	M_{lagoon_total}	$M_{lagoon_total} = M_{lagoon_input} \times R_{lagoon}$				
y	M_{lagoon_total}						

<table> <tr> <td>y=2012</td><td>1343 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>1437 tonnes of COD</td></tr> </table>	y=2012	1343 tonnes of COD	y=2013	1437 tonnes of COD			
y=2012	1343 tonnes of COD						
y=2013	1437 tonnes of COD						
Amount of organic material degraded aerobically in the lagoon system ($M_{\text{lagoon_aerobic}}$)	As per the methodology AM0022 ver 4.0, $M_{\text{lagoon_aerobic}}$ is defined as Surface aerobic losses of organic material in pond based systems equal to 254 kg COD per hectare of pond surface area and per day is assumed to be lost through aerobic processes or it is calculated as follows $M_{\text{lagoon_aerobic}} = \text{Surface area of treatment of 34 open lagoons} \times \text{operating days} \times M_{\text{lagoon_aerobic}} \text{ per hectare per day}$						
Surface area of treatment =16 hectare	It is assumed at the time of validation and it remains same during the entire crediting period.						
Operating days	It is measured with data is available. Since all the daily values are available during this monitoring period, the values are accepted.						
<table> <tr> <td>y</td><td>Operating days</td></tr> <tr> <td>Y=2012</td><td>366</td></tr> <tr> <td>Y=2013</td><td>365</td></tr> </table>	y	Operating days	Y=2012	366	Y=2013	365	
y	Operating days						
Y=2012	366						
Y=2013	365						
$M_{\text{lagoon_aerobic}}$ per hectare per day =254 kg per ha per day	It is assumed at the time of validation and it remains same during the entire crediting period.						
<table> <tr> <td>y</td><td>$M_{\text{lagoon_aerobic}}$</td></tr> <tr> <td>Y=2012</td><td>1487 tonnes of COD</td></tr> <tr> <td>Y=2013</td><td>1483 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_aerobic}}$	Y=2012	1487 tonnes of COD	Y=2013	1483 tonnes of COD	$M_{\text{lagoon_aerobic}} = \text{Surface area of treatment of 34 open lagoons} \times \text{operating days} \times M_{\text{lagoon_aerobic}} \text{ per hectare per day}$
y	$M_{\text{lagoon_aerobic}}$						
Y=2012	1487 tonnes of COD						
Y=2013	1483 tonnes of COD						
Amount of organic material lost through chemical oxidation in the lagoon system ($M_{\text{lagoon_chemical_ox}}$) =0 tonnes of COD (expost parameter) (AM0022 ID 13)	The verification team has checked that the calculation methods are not defined adequately in the validated PD. PP has assumed that there is no amount of organic material lost through the chemical oxidation in the lagoon system, the verification team has accepted the value. Moreover, there is no oxidising agents are used. The wastewater from the last lagoon is used for balancing the pH of the wastewater.						
Amount of organic material lost through deposition in the lagoon system ($M_{\text{lagoon_deposition}}$)	As per equation 6 of AM0022 ver 4, $M_{\text{lagoon_deposition}}$ is calculated as follows. $M_{\text{lagoon_deposition}} = M_{\text{lagoon_input}} \times R_{\text{deposition}}$ Where $M_{\text{lagoon_input}}$ - Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system $R_{\text{deposition}}$ - Organic material deposition ratio of the lagoon						

Input of organic material from the new project anaerobic waste water treatment facility into the lagoon system ($M_{\text{lagoon_input}}$) <table> <tr> <th>y</th><th>$M_{\text{lagoon_input}}$</th></tr> <tr> <td>y=2012</td><td>1529 tonnes of COD</td></tr> <tr> <td>y=2013</td><td>1636 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_input}}$	y=2012	1529 tonnes of COD	y=2013	1636 tonnes of COD	$M_{\text{lagoon_input}} = M_{\text{input_total}} \times (1 - R_{\text{NAWTF}}) + M_{\text{input_lagoon_bypass}}$
y	$M_{\text{lagoon_input}}$						
y=2012	1529 tonnes of COD						
y=2013	1636 tonnes of COD						
Organic material deposition ratio of the lagoon ($R_{\text{deposition}}$) = 0	It is assumed at the time of validation and it remains same during the entire crediting period. PP has assumed that all solid material that could sediment is assumed to be removed by the UASB system implemented by the project activity. This results in conservativeness, hence accepted.						
Amount of organic material lost through deposition in the lagoon system ($M_{\text{lagoon_deposition}}$) <table> <tr> <th>y</th><th>$M_{\text{lagoon_deposition}}$</th></tr> <tr> <td>Y=2012</td><td>0 tonnes of COD</td></tr> <tr> <td>Y=2013</td><td>0 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_deposition}}$	Y=2012	0 tonnes of COD	Y=2013	0 tonnes of COD	$M_{\text{lagoon_deposition}} = M_{\text{lagoon_input}} \times R_{\text{deposition}}$
y	$M_{\text{lagoon_deposition}}$						
Y=2012	0 tonnes of COD						
Y=2013	0 tonnes of COD						
Amount of organic material removed by anaerobic processes in the lagoon system ($M_{\text{lagoon_anaerobic}}$) <table> <tr> <th>y</th><th>$M_{\text{lagoon_anaerobic}}$</th></tr> <tr> <td>Y=2012</td><td>0 tonnes of COD</td></tr> <tr> <td>Y=2013</td><td>0 tonnes of COD</td></tr> </table>	y	$M_{\text{lagoon_anaerobic}}$	Y=2012	0 tonnes of COD	Y=2013	0 tonnes of COD	$M_{\text{lagoon_anaerobic}} = M_{\text{lagoon_total}} - M_{\text{lagoon_aerobic}} - M_{\text{lagoon_chemical_ox}} - M_{\text{lagoon_deposition}}$ Since overall $M_{\text{lagoon_anaerobic}}$ results in negative value, it is taken as zero, which the verification team has accepted.
y	$M_{\text{lagoon_anaerobic}}$						
Y=2012	0 tonnes of COD						
Y=2013	0 tonnes of COD						
Methane emission factor (EF_{CH_4}) = 0.241 kg CH₄/kg COD	It is assumed at the time of validation and it remains same during the entire crediting period.						
Global warming potential of methane (GWP_{CH_4}) <table> <tr> <th>y</th><th>GWP_{CH_4}</th></tr> <tr> <td>Y=2012</td><td>21 kg of CO₂/ kg CH₄</td></tr> <tr> <td>Y=2013</td><td>25 kg of CO₂/ kg CH₄</td></tr> </table>	y	GWP_{CH_4}	Y=2012	21 kg of CO ₂ / kg CH ₄	Y=2013	25 kg of CO ₂ / kg CH ₄	PP has considered for the first commitment period upto 2012, as 21 kg CO₂/Kg CH₄. PP has considered GWP of methane as 25 which is accepted for the second commitment period which is in accordance with decision 4/CMP 7 as prescribed by the "Standard for application of the global warming potentials to CDM PA and PoA for the second commitment period of the Kyoto protocol" Version 1.0 (EB 69 Annex 3).
y	GWP_{CH_4}						
Y=2012	21 kg of CO ₂ / kg CH ₄						
Y=2013	25 kg of CO ₂ / kg CH ₄						
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 ($E_{\text{CH}_4_lagoons_PJ}$) <table> <tr> <th>y</th><th>$E_{\text{CH}_4_lagoons_PJ}$</th></tr> <tr> <td>Y=2012</td><td>0 tCO₂e</td></tr> <tr> <td>Y=2013</td><td>0 tCO₂e</td></tr> </table>	y	$E_{\text{CH}_4_lagoons_PJ}$	Y=2012	0 tCO ₂ e	Y=2013	0 tCO ₂ e	$E_{\text{CH}_4_lagoons_PJ}$ is calculated as follows. $E_{\text{CH}_4_lagoons_PJ} = M_{\text{lagoon_anaerobic}} \times EF_{\text{CH}_4} \times GWP_{\text{CH}_4}$
y	$E_{\text{CH}_4_lagoons_PJ}$						
Y=2012	0 tCO ₂ e						
Y=2013	0 tCO ₂ e						
Methane emissions from new anaerobic waste water treatment facility ($E_{\text{CH}_4_NAWTF}$) = 0 tCO₂e	It is assumed at the time of validation and it remains same during the entire crediting period. Since the methane emissions from the reactor are not significant as assumed during the validation, thus assumed to be nil in this monitoring period as well.						
Methane emissions from Inefficient Combustion	As per the methodology, AM0022 ver 4.0, The						

Emissions ($E_{CH_4_{IC+leaks}}$)	combustion of biogas methane may give rise to significant methane emissions as a result of incomplete or inefficient combustion. The three predominant potential routes for the destruction of methane are 1a) Biogas flaring (PE_{flare}) 1b) Biogas use in heating systems ($E_{CH_4_{IC_{heat}}}$) 1c) Biogas use for on-site electricity generation. ($E_{CH_4_{IC_{elec}}}$) 2) Emissions due to leakage in the biogas system. ($E_{CH_4_{Leak}}$)						
Methane emissions as a result of incomplete or inefficient combustion through the route for the destruction of methane in heating systems ($E_{CH_4_{IC_{heat}}}$)	It is calculated as follows. $E_{CH_4_{IC_{heat}}} = V_r \times C_{CH_4} \times (1-f_r) \times \rho_{CH_4} \times GWP_{CH_4}$ Where V_r - Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) C_{CH_4} - methane content f_r - proportion of biogas destroyed by combustion ρ_{CH_4} - Density of methane GWP_{CH_4} - Global warming potential						
Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3)	Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) = Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon- Volume of biogas consumed in the boilers in boilers 6,9,10,11						
<table border="1" data-bbox="188 840 773 932"> <tr> <th>y</th><th>$V_{heat\ in\ boiler}$</th></tr> <tr> <td>Y=2012</td><td>16263200 NM³</td></tr> <tr> <td>Y=2013</td><td>12651318 NM³</td></tr> </table>	y	$V_{heat\ in\ boiler}$	Y=2012	16263200 NM ³	Y=2013	12651318 NM ³	
y	$V_{heat\ in\ boiler}$						
Y=2012	16263200 NM ³						
Y=2013	12651318 NM ³						
Methane content (C_{CH_4}) <table border="1" data-bbox="188 999 773 1100"> <tr> <th></th><th>Methane content</th></tr> <tr> <td>Y =2012</td><td>54.48%</td></tr> <tr> <td>Y= 2013</td><td>53.44%</td></tr> </table> (Deviation 3)		Methane content	Y =2012	54.48%	Y= 2013	53.44%	As per the validated PD, methane content will be measured continuously and recorded daily. The monitoring of this parameter is the periodic measurement by the portable gas analyzer. But daily readings are not available. The monitored data is adjusted for 95% confidence level. The verification team has checked the approach and accepted the deviation as it complies with the VCS requirements. (Deviation 3). The readings are measured above every four hours and average value is considered for calculation. The final average is adjusted as per deviation 3 through estimation using 95% confidence level. The verification team has checked the rationale and factors used in the calculation of the final adjusted value and accepted. Since this value is used for baseline calculation, lower bound value is used for the calculation which is considered conservative and hence accepted. Lower bound value = Mean value- t x standard deviation/count Where Mean value- Final average t- value from standard t distribution for a confidence level of 95% with degrees of freedom (n_m-1) The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence
	Methane content						
Y =2012	54.48%						
Y= 2013	53.44%						

	accepted. In addition to this calibration, flow meter was calibrated via an external agency which the verification team has checked and found to be satisfactory. The verification team was able to conclude that QA/QC of the meters is ensured.						
Proportion of biogas destroyed by combustion (Fr) =98.5% (expost parameter (AM00222 ID 15))	As per the validated PD, this parameter was determined during commissioning. It is assumed as no supplier specification is available. The heating system efficiency was determined during commissioning which the verification team has accepted. The fact that the same value was being used for the previous verification periods as well substantiates the accuracy level of the value. Hence QA/Qc is assured.						
Global warming potential of methane (GWP_{CH_4}) <table border="1"> <tr> <th>y</th><th>GWP CH4</th></tr> <tr> <td>Y=2012</td><td>21 kg of CO2/ kg CH4</td></tr> <tr> <td>Y=2013</td><td>25 kg of CO2/ kg CH4</td></tr> </table>	y	GWP CH4	Y=2012	21 kg of CO2/ kg CH4	Y=2013	25 kg of CO2/ kg CH4	PP has considered for the first commitment period upto 2012, as 21 kg CO2/Kg CH4. PP has considered GWP of methane as 25 which is accepted for the second commitment period which is in accordance with decision 4/CMP 7 as prescribed by the "Standard for application of the global warming potentials to CDM PA and PoA for the second commitment period of the Kyoto protocol" Version 1.0 (EB 69 Annex 3).
y	GWP CH4						
Y=2012	21 kg of CO2/ kg CH4						
Y=2013	25 kg of CO2/ kg CH4						
Density of methane (p_{CH_4}) =0.716 kg/NM ³	It is assumed at the time of validation and it remains same during the entire crediting period.						
Methane emissions as a result of incomplete or inefficient combustion through the route for the destruction of methane in heating systems ($E_{CH_4_IC_heat}$) <table border="1"> <tr> <th>y</th><th>$E_{CH_4_IC_heat}$</th></tr> <tr> <td>Y=2012</td><td>1998 tCO2e</td></tr> <tr> <td>Y=2013</td><td>1815 tCO2e</td></tr> </table>	y	$E_{CH_4_IC_heat}$	Y=2012	1998 tCO2e	Y=2013	1815 tCO2e	It is calculated as follows. $E_{CH_4_IC_heat} = V_r \times C_{CH_4} \times (1-f_r) \times p_{CH_4} \times GWP_{CH_4}$
y	$E_{CH_4_IC_heat}$						
Y=2012	1998 tCO2e						
Y=2013	1815 tCO2e						
Methane emissions as a result of incomplete or inefficient combustion through the route for the destruction of methane for on-site electricity generation ($E_{CH_4_IC_elec}$) <table border="1"> <tr> <th>y</th><th>$E_{CH_4_IC_elec}$</th></tr> <tr> <td>Y=2012</td><td>0 tCO2e</td></tr> <tr> <td>Y=2013</td><td>0 tCO2e</td></tr> </table>	y	$E_{CH_4_IC_elec}$	Y=2012	0 tCO2e	Y=2013	0 tCO2e	It is assumed to be nil at the time of validation and it remains same during the entire crediting period. The verification team has accepted the argument that there is no biogas used in the gas engines. Hence assumption for nil emissions deemed to be correct.
y	$E_{CH_4_IC_elec}$						
Y=2012	0 tCO2e						
Y=2013	0 tCO2e						

Emissions from flaring of the residual gas stream (PE_{Flare}) (expost parameter) (AM0022 ID 12)	Biogas is flared when biogas production exceeds the capacity of boilers or during maintenance shutdown of the starch plant when no biogas is required. As per the validated PD, Emissions from flaring of the residual gas stream are calculated as per the tool to determine project emissions from flaring gases containing methane. It is calculated as follows. $PE_{Flare} = V_{flare} \times C_{CH_4} \times (1 - Eff_{flare}) \times \rho_{CH_4} \times GWP_{CH_4}$ Where V_{flare}- Biogas flared in the project emissions C_{CH_4}- Methane content Eff_{flare}- Flare efficiency. ρ_{CH_4}- Density of methane GWP_{CH_4}- Global warming potential Since it is calculated from parameters like Biogas flared and methane content which are QA/QC assure, the calculation of PE flare is QA/QA assured																					
Biogas flared in the project emissions (V_{flare}) (expost parameter) (AM0022 ID9) <table><tr><td>y</td><td>V_{flare}</td></tr><tr><td>Y=2012</td><td>199868 NM3</td></tr><tr><td>Y=2013</td><td>540046 NM3</td></tr></table> Calibration record <table><tr><td></td><td>GM4</td><td>GM6</td></tr><tr><td>Serial no of the meter</td><td>AA08310 2000</td><td>H1120802 000</td></tr><tr><td>Max permissible error</td><td>1.5%</td><td>1.5%</td></tr><tr><td>Date of calibration no 1</td><td>23rd June 2011 (moved since to and as GM5)</td><td>8th May 2014</td></tr><tr><td>Validity upto</td><td>22nd June 2014</td><td>7th May 2014</td></tr></table>	y	V_{flare}	Y=2012	199868 NM3	Y=2013	540046 NM3		GM4	GM6	Serial no of the meter	AA08310 2000	H1120802 000	Max permissible error	1.5%	1.5%	Date of calibration no 1	23 rd June 2011 (moved since to and as GM5)	8 th May 2014	Validity upto	22 nd June 2014	7 th May 2014	As per the validated PD, it is measured continuously. It is found that biogas that is flared is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values. For the year 2012: Gas flow meter GM4 (installed at the gas storage) measures the total biogas sent to the flare. For the year 2013: Gas flow meter GM6 (installed at the gas storage) measures the total biogas sent to the flare. The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. In addition to this calibration, flow meter was calibrated via an external agency which the verification team has checked and found to be satisfactory. The verification team was able to conclude that QA/QC of the meters is ensured.
y	V_{flare}																					
Y=2012	199868 NM3																					
Y=2013	540046 NM3																					
	GM4	GM6																				
Serial no of the meter	AA08310 2000	H1120802 000																				
Max permissible error	1.5%	1.5%																				
Date of calibration no 1	23 rd June 2011 (moved since to and as GM5)	8 th May 2014																				
Validity upto	22 nd June 2014	7 th May 2014																				
Methane content (C_{CH_4}) (expost parameter) (AM0022 ID 11) <table><tr><td></td><td>Methane content</td></tr><tr><td>Y =2012</td><td>54.48%</td></tr><tr><td>Y= 2013</td><td>53.44%</td></tr></table> (Deviation 3) Calibration record <table><tr><td></td><td>MS1</td><td>MS2</td></tr><tr><td>Serial no of the meter</td><td>0505</td><td>3.241376.5</td></tr><tr><td>Max permissible error</td><td>2%</td><td>2%</td></tr></table>		Methane content	Y =2012	54.48%	Y= 2013	53.44%		MS1	MS2	Serial no of the meter	0505	3.241376.5	Max permissible error	2%	2%	As per the validated PD, methane content will be measured continuously and recorded daily. The monitoring of this parameter is the periodic measurement by the portable gas analyzer. But daily readings are not available. The monitored data is adjusted for 95% confidence level. The verification team has checked the approach and accepted the deviation as it complies with the VCS requirements. (Deviation 3). The readings are measured above every four hours and average value is considered for calculation. The final average is adjusted as per deviation 3 through estimation using 95% confidence level. The verification team has checked the rationale and factors used in the calculation of the final adjusted						
	Methane content																					
Y =2012	54.48%																					
Y= 2013	53.44%																					
	MS1	MS2																				
Serial no of the meter	0505	3.241376.5																				
Max permissible error	2%	2%																				

<table><tr><td>Date of calibration no 1</td><td>21st Dec 2011</td><td>21st Dec 2011</td></tr><tr><td>Validity upto</td><td>20th Dec 2014</td><td>20th Dec 2014</td></tr></table>	Date of calibration no 1	21 st Dec 2011	21 st Dec 2011	Validity upto	20 th Dec 2014	20 th Dec 2014	value and accepted. Since this value is used for baseline calculation, lower bound value is used for the calculation which is considered conservative and hence accepted. Lower bound value = Mean value- t x standard deviation/count Where Mean value- Final average t- value from standard t distribution for a confidence level of 95% with degrees of freedom (n_m-1) The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. In addition to this calibration, flow meter was calibrated via an external agency which the verification team has checked and found to be satisfactory. The verification team was able to conclude that QA/QC of the meters is ensured.
Date of calibration no 1	21 st Dec 2011	21 st Dec 2011					
Validity upto	20 th Dec 2014	20 th Dec 2014					
Flare efficiency (Eff _{flare}) =50%	It is assumed at the time of validation and it remains same during the entire crediting period.						
Density of methane (p _{CH₄}) =0.716 kg/NM ³	It is assumed at the time of validation and it remains same during the entire crediting period.						
Global warming potential of methane (GWP _{CH₄})	PP has considered for the first commitment period upto 2012, as 21 kg CO ₂ /Kg CH ₄ . PP has considered GWP of methane as 25 which is accepted for the second commitment period which is in accordance with decision 4/CMP 7 as prescribed by the “Standard for application of the global warming potentials to CDM PA and PoA for the second commitment period of the Kyoto protocol” Version 1.0 (EB 69 Annex 3).						
<table><tr><td>y</td><td>GWP CH₄</td></tr><tr><td>Y=2012</td><td>21 kg of CO₂/ kg CH₄</td></tr><tr><td>Y=2013</td><td>25 kg of CO₂/ kg CH₄</td></tr></table>	y	GWP CH ₄	Y=2012	21 kg of CO ₂ / kg CH ₄	Y=2013	25 kg of CO ₂ / kg CH ₄	
y	GWP CH ₄						
Y=2012	21 kg of CO ₂ / kg CH ₄						
Y=2013	25 kg of CO ₂ / kg CH ₄						
Emissions from flaring of the residual gas stream (PE Flare)	It is calculated as follows. PE Flare =V _{flare} x C _{CH₄} X (1-Eff _{flare}) x p _{CH₄} x GWP _{CH₄}						
<table><tr><td>y</td><td>PE_{flare}</td></tr><tr><td>Y=2012</td><td>819 tCO₂e</td></tr><tr><td>Y=2013</td><td>2583 tCO₂e</td></tr></table>	y	PE _{flare}	Y=2012	819 tCO ₂ e	Y=2013	2583 tCO ₂ e	
y	PE _{flare}						
Y=2012	819 tCO ₂ e						
Y=2013	2583 tCO ₂ e						
Methane Emissions From Leaks in Biogas System (E _{CH₄_leaks})	Emissions due to biogas Leaks in the biogas system include leaks from any anaerobic digester and leaks from the biogas pipeline delivery system. The calculation method is not defined in the applied methodology. But it is proposed to be calculated with formula used for PE flare as above assuming flare efficiency to be 0%.						
Loss of biogas from pipeline (expost parameter) AM0022 ID 17	As per the validated PD, it is measured using mobile gas leak detector. It is denoted as percentage of biogas generated by the PP. The verification team has observed that UASB reactor gas collection system consists of a gas tight concrete coated gas dome and the delivery pipe to the boilers is less than 2 km in length. Integrity of biogas pipeline for losses or leakages is checked using mobile gas leak detector and there is no such losses in this						
<table><tr><td>y</td><td>Loss of biogas from pipeline</td></tr><tr><td>Y=2012</td><td>0%</td></tr><tr><td>Y=2013</td><td>0%</td></tr></table>	y	Loss of biogas from pipeline	Y=2012	0%	Y=2013	0%	
y	Loss of biogas from pipeline						
Y=2012	0%						
Y=2013	0%						

Methane Emissions From Leaks in Biogas System ($E_{CH_4 \text{ leaks}}$)		monitoring period. Thus QA/QC is assured. Since there is no losses this parameter is zero.
y	$E_{CH_4 \text{ leaks}}$	
Y=2012	0 tCO ₂ e	
Y=2013	0 tCO ₂ e	
Methane emissions from Inefficient Combustion Emissions ($E_{CH_4 \text{ IC+leaks}}$)		It is calculated as follows. $E_{CH_4 \text{ IC+Leaks}} = E_{CH_4 \text{ IC_heat}} + E_{CH_4 \text{ IC_elec}} + PE_{\text{flare}} + E_{CH_4 \text{ leaks}}$
y	$E_{CH_4 \text{ IC+leaks}}$	
Y=2012	2817 tCO ₂ e	
Y=2013	4398 tCO ₂ e	
Project emissions (E_{Project})		E_{Project} is calculated as follows. $E_{\text{project}} = E_{CH_4 \text{ lagoons_PJ}} + E_{CH_4 \text{ NAWTF}} + E_{CH_4 \text{ IC+leaks}}$
y	E_{project}	
Y=2012	2817 tCO ₂ e	
Y=2013	4398 tCO ₂ e	
Leakage (LE_y)		As per the methodology, AM0022, leakage to be considered to be zero.
y	LE_y	
Y=2012	0 tCO ₂ e	
Y=2013	0 tCO ₂ e	
Initial Emission reductions (ER_y)		Emission reductions is calculated as follows $ER = E_{BL} - E_{\text{project}} - LE_y$
y	ER_y	
Y=2012	121,934.6 tCO ₂ e	
Y=2013	110,192.5 tCO ₂ e	
$F_{\text{conservative}}$		As per the applied methodology, AM0022 equation 13 , The calculation of emission reduction delivers a conservative estimate of emission reductions i.e. that the emissions of CH ₄ from the lagoons in the baseline situation are not higher than the total emissions of biogas from the digester and the lagoons in the project situation. Therefore a factor to be calculated as follows and if the factor is positive then the factor to be deducted from the initial emission reduction to arrive at the final emission reductions. $F_{\text{conservative}} = E_{CH_4 \text{-Lagoons_BL}} - (E_{CH_4 \text{ lagoons_PJ}} + E_{CH_4 \text{ NAWTF}} + E_{CH_4 \text{ Coll}})$ Where $E_{CH_4 \text{-Lagoons_BL}}$ - methane emissions from the lagoons in the baseline scenario $E_{CH_4 \text{ lagoons_PJ}}$ - Emissions from the lagoons in the baseline scenario $E_{CH_4 \text{ NAWTF_PJ}}$ - Emissions from the new anaerobic waste water treatment facility $E_{CH_4 \text{ Coll}}$ - amount of methane contained in the biogas collected from the anaerobic treatment facility

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 ($E_{CH4_lagoons_BL}$) <table border="1"> <tr> <th>y</th><th>$E_{CH4_lagoons_BL}$</th></tr> <tr> <td>Y=2012</td><td>99576 tCO₂e</td></tr> <tr> <td>Y=2013</td><td>95380 tCO₂e</td></tr> </table>	y	$E_{CH4_lagoons_BL}$	Y=2012	99576 tCO ₂ e	Y=2013	95380 tCO ₂ e	$E_{CH4_lagoons_BL}$ is calculated as follows. $E_{CH4_lagoons_BL} = M_{lagoon_anaerobic} \times EF_{CH4} \times GWP_{CH4}$
y	$E_{CH4_lagoons_BL}$						
Y=2012	99576 tCO ₂ e						
Y=2013	95380 tCO ₂ e						
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 ($E_{CH4_lagoons_PJ}$) <table border="1"> <tr> <th>y</th><th>$E_{CH4_lagoons_PJ}$</th></tr> <tr> <td>Y=2012</td><td>0 tCO₂e</td></tr> <tr> <td>Y=2013</td><td>0 tCO₂e</td></tr> </table>	y	$E_{CH4_lagoons_PJ}$	Y=2012	0 tCO ₂ e	Y=2013	0 tCO ₂ e	$E_{CH4_lagoons_PJ}$ is calculated as follows. $E_{CH4_lagoons_PJ} = M_{lagoon_anaerobic} \times EF_{CH4} \times GWP_{CH4}$
y	$E_{CH4_lagoons_PJ}$						
Y=2012	0 tCO ₂ e						
Y=2013	0 tCO ₂ e						
Methane emissions from new anaerobic waste water treatment facility (E_{CH4_NAWTF}) = 0 tCO₂e	It is assumed at the time of validation and it remains same during the entire crediting period. Since the methane emissions from the reactor are not significant as assumed during the validation, thus assumed to be nil in this monitoring period as well.						
Amount of methane contained in the biogas collected from the anaerobic treatment facility (E_{CH4_Coll})	As per the applied methodology AM0022 ver 4.0, It is characterized by biogas sent to heaters, the biogas sent to the gen sets and the biogas sent to the flare. It is therefore calculated as follows $E_{CH4_Coll} = (V_{heat\ in\ boiler} + V_{flare}) \times CCH4 \times pCH4 \times GWP_{CH4}$						
Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) <table border="1"> <tr> <th>y</th><th>$V_{heat\ in\ boiler}$</th></tr> <tr> <td>Y=2012</td><td>16263200 NM³</td></tr> <tr> <td>Y=2013</td><td>12651318 NM³</td></tr> </table>	y	$V_{heat\ in\ boiler}$	Y=2012	16263200 NM ³	Y=2013	12651318 NM ³	Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) = Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon-Volume of biogas consumed in the boilers in boilers 6,9,10,11
y	$V_{heat\ in\ boiler}$						
Y=2012	16263200 NM ³						
Y=2013	12651318 NM ³						

Biogas flared in the project emissions (V_{flare}) <table border="1"> <tr> <th>y</th><th>V_{flare}</th></tr> <tr> <td>Y=2012</td><td>199868 NM3</td></tr> <tr> <td>Y=2013</td><td>540046 NM3</td></tr> </table>	y	V_{flare}	Y=2012	199868 NM3	Y=2013	540046 NM3	As per the validated PD, it is measured continuously. It is found that biogas that is flared is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values. For the year 2012: Gas flow meter GM4 (installed at the gas storage) measures the total biogas sent to the flare. For the year 2013: Gas flow meter GM6 (installed at the gas storage) measures the total biogas sent to the flare. The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. In addition to this calibration, flow meter was calibrated via an external agency which the verification team has checked and found to be satisfactory. The verification team was able to conclude that QA/QC of the meters is ensured.
y	V_{flare}						
Y=2012	199868 NM3						
Y=2013	540046 NM3						
Methane content (C_{CH_4}) <table border="1"> <tr> <th></th><th>Methane content</th></tr> <tr> <td>Y =2012</td><td>54.48%</td></tr> <tr> <td>Y= 2013</td><td>53.44%</td></tr> </table> (Deviation 3)		Methane content	Y =2012	54.48%	Y= 2013	53.44%	As per the validated PD, methane content will be measured continuously and recorded daily. The monitoring of this parameter is the periodic measurement by the portable gas analyzer. But daily readings are not available. The monitored data is adjusted for 95% confidence level. The verification team has checked the approach and accepted the deviation as it complies with the VCS requirements. (Deviation 3). The readings are measured above every four hours and average value is considered for calculation. The final average is adjusted as per deviation 3 through estimation using 95% confidence level. The verification team has checked the rationale and factors used in the calculation of the final adjusted value and accepted. Since this value is used for baseline calculation, lower bound value is used for the calculation which is considered conservative and hence accepted. Lower bound value = Mean value- t x standard deviation/count Where Mean value- Final average t- value from standard t distribution for a confidence level of 95% with degrees of freedom (n_m-1) The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. In addition to this calibration, flow meter
	Methane content						
Y =2012	54.48%						
Y= 2013	53.44%						

	was calibrated via an external agency which the verification team has checked and found to be satisfactory. The verification team was able to conclude that QA/QC of the meters is ensured.								
Density of methane (p_{CH_4}) =0.716 kg/NM ³	It is assumed at the time of validation and it remains same during the entire crediting period.								
Global warming potential of methane (GWP_{CH_4})	PP has considered for the first commitment period upto 2012, as 21 kg CO2/Kg CH4. PP has considered GWP of methane as 25 which is accepted for the second commitment period which is in accordance with decision 4/CMP 7 as prescribed by the “Standard for application of the global warming potentials to CDM PA and PoA for the second commitment period of the Kyoto protocol” Version 1.0 (EB 69 Annex 3).								
<table><tr><td>y</td><td>GWP_{CH_4}</td></tr><tr><td>Y=2012</td><td>21 kg of CO2/ kg CH4</td></tr><tr><td>Y=2013</td><td>25 kg of CO2/ kg CH4</td></tr></table>		y	GWP_{CH_4}	Y=2012	21 kg of CO2/ kg CH4	Y=2013	25 kg of CO2/ kg CH4		
y		GWP_{CH_4}							
Y=2012		21 kg of CO2/ kg CH4							
Y=2013	25 kg of CO2/ kg CH4								
Amount of methane contained in the biogas collected from the anaerobic treatment facility ($E_{CH_4_Coll}$)									
<table><tr><td>y</td><td>$E_{CH_4_Coll}$</td></tr><tr><td>Y=2012</td><td>134857 tCO2e</td></tr><tr><td>Y=2013</td><td>126181 tCO2e</td></tr></table>	y	$E_{CH_4_Coll}$	Y=2012	134857 tCO2e	Y=2013	126181 tCO2e			
y	$E_{CH_4_Coll}$								
Y=2012	134857 tCO2e								
Y=2013	126181 tCO2e								
$F_{conservative}$	It is calculated as follows $E_{CH_4_Coll} = (V_{heat\ in\ boiler} + V_{flare}) \times C_{CH_4} \times p_{CH_4} \times GWP_{CH_4}$								
<table><tr><td>y</td><td>$F_{conservative}$</td></tr><tr><td>Y=2012</td><td>-35282 tCO2e</td></tr><tr><td>Y=2013</td><td>-30800 tCO2e</td></tr></table>	y	$F_{conservative}$	Y=2012	-35282 tCO2e	Y=2013	-30800 tCO2e	$F_{conservative} = E_{CH_4_Lagoons_BL} - (E_{CH_4_lagoons_PJ} + E_{CH_4_NAWTF} + E_{CH_4_Coll})$		
y	$F_{conservative}$								
Y=2012	-35282 tCO2e								
Y=2013	-30800 tCO2e								
Final Emission reductions (ER)	As per he applied methodology AM0022, Final Emission reductions is calculated as follows Final ER= initial ER – $f_{conservative}$ if $f_{conservative}$ is positive								
<table><tr><td>y</td><td>ER</td></tr><tr><td>Y=2012</td><td>121,934.6 tCO2e</td></tr><tr><td>Y=2013</td><td>110,192.5 tCO2e</td></tr><tr><td>Total (rounded)</td><td>232,127 tCO2e</td></tr></table>	y	ER	Y=2012	121,934.6 tCO2e	Y=2013	110,192.5 tCO2e	Total (rounded)	232,127 tCO2e	
y	ER								
Y=2012	121,934.6 tCO2e								
Y=2013	110,192.5 tCO2e								
Total (rounded)	232,127 tCO2e								

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

Refer section 4.2 above for details

4.4 Non-Permanence Risk Analysis

Not applicable for a project applying AM0022 or non AFOLU project.

5 VERIFICATION CONCLUSION

EPIC Sustainability Services Private Limited has been engaged by Southpole to perform the fourth periodic verification of the VCS project "Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co., Ltd" for the period from 01/01/2012 to 31/12/2013.

The verification was based on the validated PD, the baseline and monitoring methodology, validation reports, previous monitoring reports, previous verification reports, emission reduction spread sheets and other supporting documents made available to EPIC verification team by the project participant. The management of project proponents are responsible for the preparation and reporting of GHG emissions data, and the reported GHG emissions reduction on the basis set out within the project monitoring plan.

It is the responsibility of EPIC verification team to express an independent GHG verification opinion on the GHG emissions from the project for the monitoring period starting from 01st January 2012 to 31st December 2013 and on the calculation of GHG emission reductions from the project based on the verified emissions for the same period.

The verification was carried out in accordance with the requirements of the Validation and Verification standard Version 7.0 and VCS Standard 3.4. As a result of the verification, the verification team confirms that for the reporting period:

- all operations of the project were implemented as described in the registered PD (project ID 82)
- the monitoring plan is in accordance with the approved monitoring methodologies applied by the project activity.
- the monitoring has been carried out in accordance with the validated PD version 1.0 dated 19th June 2007.
- the monitoring aspects (i.e. additional monitoring parameters, monitoring frequency and calibration frequency) were in place and functional, with the installed equipment essential for generating emission reduction operating appropriately and the calibration of all the equipment had been carried out accordingly and appropriate adjustments had been made when there were delays in the calibration, and
- the GHG emission reductions achieved were calculated correctly on the basis of approved monitoring methodology.

We have verified that the information included in the final monitoring report (version 2.0, dated 23rd September 2014) was correct and that the emission reductions achieved had been determined correctly. In our opinion, the GHG emission reductions for the period from 1st January 2012 to 31st December 2013 stated in the latest revised monitoring report for the project are fairly stated.

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

Verification period: From [01-January-2012] to [31-December-2013]

Verified GHG emission reductions and removals in the above verification period:

Year	Emission reductions
Year 2012	121,934.6 tCO ₂ e
Year 2013	110,192.5 tCO ₂ e
Total	232,127 tCO ₂ e

Prepared by :	Approved by:
 (R. Vijayaraghavan) Verification Team Leader	 (K. Sudheendra) Head-Operations

Verification checklist

Project name: Wastewater Treatment with Biogas Production (UASB) and Heat Utilization at General Starch Co., Ltd” (Project ID: 82)

TABLE 1: VERIFICATION REQUIREMENTS BASED ON CDM VVS 7.0

	Checklist Questions	Comments by verifier	Conclusion
	Compliance of the project implementation with the registered project design document		
1	Was an on-site visit conducted for this verification? If no, please justify the rationale of the decision. (Refer VVS 262)	The verification team visited physically to the sites and found that project was commissioned and running.	OK
2	Are all physical features of the VCS project activity proposed in the registered PDD in place? (Refer 262)	The verification team was able to confirm that all physical features of the proposed project activity matches with that mentioned in the registered PDD.	OK
3	Have the project participants operated the proposed VCS project activity as per the registered PDD or any approved revised PDD? (Refer VVS 262 and 265)	It has implemented and operated the project as per the registered PDD.	OK
4	For this monitoring period, what is the status of the implementation of the project? For project activities that consist of more than one site, the DOE shall describe the status of implementation and starting date of operation for each site. (Refer VVS 263 (a))	The project activity was commissioned and being operated from The project activity began on 1 st January 2004.	OK
5	For project activities with phased implementation, what is the progress of the proposed project activity achieved in each phase under	The project activity was commissioned and being operated from 1 st January 2004.	OK

	Checklist Questions	Comments by verifier	Conclusion
	verification. If the phased implementation is delayed, describe the reasons and present the expected implementation dates; (Refer VVS 263 (a))		
6	Describe the actual operation of the project activity. (Refer VVS 263 (b))	The project activity involves the installation of an anaerobic wastewater treatment facility, based on Upflow Anaerobic Sludge Blanket (UASB) technology, at a starch manufacturing plant. Prior to project implementation, the wastewater was treated using an open lagoon system. Anaerobic bacteria in the ponds break down organic compounds in the wastewater, resulting in the release of biogas. The resulting biogas is characterized by the chemical oxygen demand of the wastewater. The implementation of system enables the recovery of biogas that would have been released to the atmosphere in the baseline scenario and the utilization of the recovered biogas for thermal use. The project activity started to reduce emission reductions from 1st January 2004 (Project commissioned or project start date). However, CR 1 is raised as follows. PP is requested to explain the rationale behind the assuming 100% hydrological balance before accepting the wastewater output is equal to Wastewater output considering that there is biogas that is being generated and sludge (nevertheless small in quantity) is formed in the UASBs. CR 10 is raised as follows. At the site, it was observed that Calorimeter method was used to measure COD but the new monitoring report (Refer p. no 14&15 of 28) informs that the meter used is spectrophotometer which is not clear. FAR 1 is raised as follows. The boilers are retrofitted. The operational conditions of the dual fuel boiler need 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.	CR-1 CR-10 FAR-1
7	Any information (data and variables) provided in the monitoring report that is different from that stated in the registered PDD or any ap-	There are five deviation identified by the PP. The verification team has checked and all the deviations are in compliance with VCS requirements.	OK

	Checklist Questions	Comments by verifier	Conclusion
	proved revised PDD? (that has caused an increase in estimates of the emission reductions in the current monitoring period or is highly likely to increase the estimates of emission reductions in the future monitoring) (Refer VVS 263 (c))		
	Compliance of the monitoring plan with the monitoring methodology including applicable tool(s)		
	The monitoring plan of the proposed VCS project activity shall comply with the applied methodology.		
8	For monitoring aspects that are not specified in the methodology and where applicable the standardized baseline, particularly in the case of small-scale methodologies (e.g. additional monitoring parameters, monitoring frequency and calibration frequency), these should be brought to the attention of the Board issues which may enhance the level of accuracy and completeness of the monitoring plan. (Refer VVS 266)	Not applicable	OK
	Compliance of monitoring activities with the registered monitoring plan.		
	Determine whether the monitoring of parameters related to the GHG emissions reductions in the project activity has been implemented in accordance with the monitoring plan contained in the registered PDD or any accepted revised monitoring plan.		

	Checklist Questions	Comments by verifier	Conclusion
9	Is the monitoring plan of the VCS project activity complying with the methodology applied by the registered VCS project activity or an approved revised PDD? (Refer VVS 268)	Yes. Monitoring plan and applied methodology have been properly implemented and duly followed by PP.	OK
10	Has the monitoring plan been properly implemented and followed by the project participants? (Refer VVS 269 (a))	Yes. Monitoring plan and applied methodology have been properly implemented and duly followed by PP	OK
11	Have all parameters stated in the monitoring plan, and relevant CDM Executive Board decisions been sufficiently monitored and updated as applicable, including: (Refer VVS 269 (b))		

Checklist Questions	Comments by verifier	Conclusion
i) project emission parameters	Yes. Project related emissions are calculated as per validated PD. However, CAR 1 is raised as follows.	CAR-1
	As per the validated PDD (ver 1.0 dated 19th June 2007), total organic material removal efficiency of the new project waste water facility (R_{NAWTF}) was fixed at 95.92% and new Monitoring report (p.no 11 of 28) reflects the same value. But the VER sheet (Tab ERCal; Cell C29&C30) gives different values. (93.65% for 2012; 91.70% for 2013). It has learned from the 2nd verification report that it is calculated based on the measured values of COD acid and COD effluent of UASB 1 and 2. But it is not clear why this information or deviation if at all any is not clearly mentioned in the new monitoring report and also the conservativeness of the value is not demonstrated clearly by the PP in the new monitoring report. For the purpose of this verification report, new monitoring report means the monitoring report dated 13th August 2014 pertains to the monitoring period starting from 1st January 2012 to 31st December 2013.	
	CAR 2 is raised as follows. It was observed at the site COD load reported for UASB1 and UASB 2 in the VER sheet, does not match with that mentioned in the logsheets/computer stored data. PP is requested to do the needful.	CAR-2
	CAR 3 is raised as follows. As per the validated PDD (ver 1.0 dated 19th June 2007), flare efficiency for open flare is fixed at 50% and the new monitoring report (p.no 12 of 28) reflects the same value. But the VER sheet (Tab ERCal; Cell D57&E57) gives a different value.	CAR-3
	CR 4 is raised as follows. PP is requested to provide evidence to support boiler efficiency of 98.5%.	CR-4
	CAR 6 is raised as follows. The methane content is not measured for some days (Refer VER sheet; tab: data_2012; Cell O119 to O240) as observed at the site and log sheets are reflects the same. How the conservative approach is followed in determining the average value. In doing so, PP is requested to confirm that the measurement is done as per the validated PDD. CR 6 is raised as follows.It is not clear how wetness ratio of 1.04 is assumed in the calculation.(Refer VER sheet; Tab: Data; Cell C85 to C87)	CAR-6 CR-6

[illegible]

	Checklist Questions	Comments by verifier	Conclusion
	iii) leakage parameters	This parameter was adequately justified in the monitoring report.	OK
	iv) Management and operational system: the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan?	It is demonstrated that project management system procedures, including responsibility and authority of monitoring and reporting activities are comply with registered monitoring plan.	OK
12	Has the equipment used for monitoring is in accordance with section 4 below and is controlled and calibrated in accordance with the monitoring plan, the applied methodology, the applied standardized baseline, the Board guidance, local/national standards, or as per the manufacturer's specification? (Refer VVS 269 (c))	It is found that there is all the meters are calibrated and actual error is less than the permissible level thus QA/QC is assured.	OK
13	Are monitoring results consistently recorded as per approved frequency? (Refer VVS 269 (d))	Yes. But the frequency of calibration of Energy meters is mentioned explicitly in the monitoring report.	OK
14	Have quality assurance and quality control procedures been applied in accordance with the monitoring plan or revised monitoring plan? (Refer VVS 269 (e))	It is clearly indicated that in the monitoring report the activities related to the project, e.g. Measurement, calculation, reporting complies with the procedures defined in the registered PD and applied methodology	OK
	Compliance with the calibration frequency requirements for measuring instruments.		
	Determine whether the calibration of those measuring equipments that have an impact on the claimed emission reductions is conducted by the project participants at a frequency specified in the applied monitoring methodology, the applied standardized baseline and/or the monitoring plan.		

	Checklist Questions	Comments by verifier	Conclusion
15	Identify if there is any monitoring equipment not calibrated in accordance with the monitoring plan, the applied monitoring methodology, the Board guidance, local/national standards, or as per the manufacturer's specification? (Refer VVS 272)	There is no such meter.	OK
16	If there is delayed and the calibration has been implemented after the monitoring period in consideration (i.e. the results of delayed calibration are available), has the following conservative approach adopted in the calculation of emission reductions: (a) Applying the maximum permissible error of the instrument to the measured values taken during the period between the scheduled date of calibration and the actual date of calibration, if the results of the delayed calibration do not show any errors in the measuring equipment, or if the error is smaller than the maximum permissible error; or	It is found that there is no calibration due for any of the meter. However CR 11 is raised as follows. PP is not demonstrated in clear terms that the actual error of the all the meters found through the calibration is less than the maximum permissible error of the meter.	CR 11
17	(b) Applying the error identified in the delayed calibration test, if the error is beyond the maximum permissible error of the measuring equipment. (Refer VVS 283)	It is found that there is all the meters are calibrated and actual error is less than the permissible level thus QA/QC is assured.	OK
18	Confirm that the error has been applied: (a) In a conservative manner, such that the adjusted measured values of the delayed calibration shall result in fewer claimed emission reductions;	It is found that there is all the meters are calibrated and actual error is less than the permissible level thus QA/QC is assured.	OK

	Checklist Questions	Comments by verifier	Conclusion
	(b) For all measured values taken during the period between the scheduled date of calibration and the actual date of calibration. (Refer VVS 283)	It is found that there is all the meters are calibrated and actual error is less than the permissible level thus QA/QC is assured.	OK
19	In cases where the results of the delayed calibration are not available, or the calibration has not been conducted at the time of verification, the verification team, prior to finalizing verification, shall request the project participants to conduct the required calibration and shall determine whether the project participants have calculated the emission reductions conservatively using the approach mentioned in paragraph 4.2 above. (Refer VVS 275)	It is found that there is all the meters are calibrated and actual error is less than the permissible level thus QA/QC is assured.	OK
20	In cases where the verification team determines that it is not possible for the project participants to conduct the calibration at a frequency specified by either the applied methodology, the applied standardized baseline, guidance provided by the Board, and/or the registered monitoring plan due to reasons beyond the control of project participants (For example, due to the contractual terms between the project participant and purchasing/selling entities), the verification team, shall follow the requirements for post registration changes in section of E of the VVS. (Refer VVS 276)	It is found that there is all the meters are calibrated and actual error is less than the permissible level thus QA/QC is assured.	OK

	Checklist Questions	Comments by verifier	Conclusion
21	In cases where neither the applied monitoring methodology, where applicable, the applied standardized baseline nor the monitoring plan specify any requirements for calibration frequency for measuring equipments, the verification team shall determine whether the equipments are calibrated either in accordance with the specifications of the local/national standards, or as per the manufacturer's specification. If neither local/national standards nor the manufacturer's specification are available, international standards may be used. Refer to appendix 1 of the VVS for an illustrative example to apply the above requirements. (Refer VVS 277)	It is found that there is all the meters are calibrated and actual error is less than the permissible level thus QA/QC is assured.	OK
	Assessment of data and calculation of emission reductions		
	Assess the data and calculations of GHG emission reductions achieved by/resulting from the project activity by the application of the selected methodology and, where applicable, the applied standardized baseline.		
22	If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, the verification team shall raise a CAR for the project participants to comply with the requirements of Appendix 1 of the Project Standard or submit a request for deviation prior to submitting the request for issuance, if appropriate; (Refer VVS 280 a)	Not applicable	OK

	Checklist Questions	Comments by verifier	Conclusion
23	Has information provided in the monitoring report been crosschecked with other sources such as plant log books, inventories, purchase records, laboratory analysis? (Refer VVS 280 b)	It is crosschecked as per the procedures given in validated PD.	OK
24	Have calculations of baseline emissions, proposed VCS project activity emissions and leakage, as appropriate, been carried out in accordance with the formulae and methods described in the monitoring plan, the applied methodology and where applicable, the applied standardized baseline? (Refer VVS 280 c)	Yes, the calculations of baseline emissions, project activity emissions and leakage, as appropriate, been carried out in accordance with the formulae and methods described in the monitoring plan. However CR 7 is raised as follows. How GWP of methane is considered as 25 in 2013 is not clearly indicated in the monitoring report. CR 8 is raised as follows. It is mentioned in the new monitoring report (p. 22 of 28) that “even if wastewater is sent directly to any facility, it will have no affect on the emission reduction estimate as baseline emissions are equal to project emissions for such a case”. Kindly clarify the statement. CR 9 is raised as follows. How the measurement is undertaken during the monitoring period for loss of biogas due to leakage in the biogas pipes or ID 17 (Refer validated PD dated 19th June 2007; page no 34 of 47) and provide logsheets maintained at the site to support for nil leakage.	CR-7 CR-8 CR-9
25	Any assumptions used in emission calculations? If yes, they been justified? (Refer VVS 280 d)	Yes, the calculations of baseline emissions, project activity emissions and leakage, as appropriate, been carried out in accordance with the formulae and methods described in the monitoring plan.	OK
26	Have appropriate emission factors, IPCC default values and other reference values been correctly applied? (Refer VVS 280 e)	Yes. Appropriate values are assumed with support which is acceptable.	OK

	Checklist Questions	Comments by verifier	Conclusion
27	For a registered VCS project activity using an approved standardized baseline that standardizes baseline emissions, have the standardized value(s) of the parameter(s) are applied using the correct version of the applied standardized baseline in accordance with the Project standard. (Refer VVS 280 f)	Not applicable.	OK
	Post registration changes Temporary deviations from the registered monitoring plan, monitoring methodology and/or standardized baseline		
28	Where the deviation is identified during verification, the DOE shall indicate in the verification report how the monitoring report reflects the application of the approved guidance from the Board regarding the deviation from the provisions of the registered monitoring plan, the applied methodology and /or the applied standardized baseline. (Refer VVS 290)	Not applicable	OK
29	Where the deviation is identified prior to verification, the DOE shall state its opinion on whether the deviation reflects the application of the approved guidance from the Board regarding the deviation from the provisions of the registered monitoring plan, the applied methodology and /or the applied standardized baseline and as per the applicable provisions of the Project Standard. (Refer VVS 291)	Not applicable.	OK
	Corrections		

	Checklist Questions	Comments by verifier	Conclusion
30	If the DOE identifies that the project participants have made corrections to project information or parameters determined at validation, the DOE shall determine whether: (a) The corrected information is an accurate reflection of actual project information; and/or (Refer VVS 293 a)	Not applicable.	OK
31	The corrected parameters are in accordance with the applied methodology the monitoring plan and /or the applied standardized base-line. (Refer VVS 293 b)	Not applicable.	OK
	Changes to the start date of the crediting period		
32	The DOE shall indicate if the requirements in the Project standard have been met and shall submit a request for post registration changes in accordance with the Project cycle procedure. (Refer VVS 296)	The start date of the crediting period is correctly mentioned.	OK
	Permanent changes from the registered monitoring plan or monitoring methodology		
33	The DOE shall determine whether the changes to the monitoring plan contained in the registered PDD proposed by the project participants are in compliance with the applied methodology and, where applicable, the applied standardized baseline and do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan. (Refer VVS 298)	Not applicable.	OK

	Checklist Questions	Comments by verifier	Conclusion
34	In cases where the proposed changes refer to a later version of the applied methodology and /or the applied standardized baseline in the registered PDD, the DOE shall determine whether the application of any later version of the applied methodology any applicable tool(s) and/or the applied standardized baseline does not impact the conservativeness of the monitoring and verification process, including the related emission reduction calculations. (Refer VVS 299)	Not applicable.	OK
35	If the DOE identifies that the project participants are unable to implement the monitoring plan contained in the registered PDD and it will not be possible to monitor the registered CDM project activity in accordance with a monitoring plan that would comply with the applied methodology any applicable tools, and, where applicable, the standardized baseline or the relevant provisions of appendix 1 of the Project standard, the DOE shall request guidance from the Board concerning the acceptability of the permanent changes in accordance with the section on post registration changes in the Project cycle procedure. (Refer VVS 300)	Not applicable.	OK

	Checklist Questions	Comments by verifier	Conclusion
36	The DOE shall determine whether the permanent changes are likely to lead to a reduction in the accuracy of the calculation of emission reductions. In cases where the DOE considers that the permanent changes will lead to a reduction in the accuracy of the calculation of emission reductions, the DOE shall request the project participants to apply conservative assumptions or discount factors to the calculations to the extent required to ensure that emission reductions will not be over-estimated as a result of the permanent change. (Refer VVS 301)	Not applicable.	OK
	Changes to the project design of a registered project activity		
37	If the DOE identifies that the project design in the implementation or operation of the project activity does not conform with the description contained in the registered PDD or the relevant provisions of appendix 1 of the Project standard, the DOE shall request guidance from the Board concerning the acceptability of the proposed or actual changes in accordance with the section on post registration changes in the Project cycle procedure. (Refer VVS 305)	Not applicable.	OK

	Checklist Questions	Comments by verifier	Conclusion
38	In case of actual changes, the DOE shall, by means of an on-site visit and review of the submitted revised PDD by the project participants, which describes the nature and extent of the actual changes, determine whether this description accurately reflects the implementation, operation and monitoring of the modified project activity. (Refer VVS 306)	Not applicable.	OK
39	The DOE shall conduct an on-site inspection to assess the impacts of the actual changes on the compliance of the monitoring plan, the level of accuracy of the monitoring activity, the applied monitoring methodology and including applicable tool(s) and/or, where applicable, the applied standardized baseline. (Refer VVS 307)	Not applicable.	OK

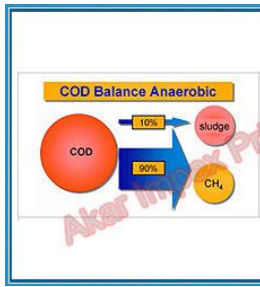
	Checklist Questions	Comments by verifier	Conclusion
40	The DOE shall, by means of reviewing the revised PDD against applicable additionality and methodological requirements, determine whether the proposed or actual changes would adversely affect the conclusions of the validation report of the registered PDD with regard to: (a) Additionality of the project activity; (b) Scale of the project activity; (c) Applicability and application of the approved baseline methodology and, where applicable, the approved standardized baseline under which the project activity has been registered; or (d) The compliance of the monitoring plan with the applied monitoring methodology and, where applicable, the applied standardized baseline (Refer VVS 308)	Not applicable.	OK
41	If the proposed or actual changes affect the additionality of the project activity then the DOE shall confirm that: (a) In the case of investment analysis, project participants have only modified the key parameters in the original spreadsheet calculations affected by the proposed or actual changes to the project activity; (b) In the case where only barriers have been claimed to demonstrate additionality, project participants have demonstrated that the barriers are still valid under the new circumstances. (Refer VVS 309)	Not applicable.	OK

	Checklist Questions	Comments by verifier	Conclusion
42	For registered VCS project activity using an approved standardized baseline that standardizes additionality:- If the proposed or actual changes affect the additionality of the project activity then the DOE shall confirm that the project activity complies with the positive list of the applied standardized baseline in the registered PDD. (Refer VVS 309)	Not applicable.	OK
43	The DOE shall confirm that the applied methodology including applied tools and/or the applied standardized baseline do not impact the conservativeness of the monitoring and verification process and the related emission reduction calculations in cases where: (a) The proposed or actual changes impact the implementation of the project activity; (b) The original methodology and/or the original standardized baseline would no longer be applicable; and (c) The project participant applies: (i) A later version of the methodology and/or the standardized baseline; or (ii) Another methodology and/or another standardized baseline that is(are) applicable to the project activity. (Refer VVS 310)	Not applicable.	OK

	Checklist Questions	Comments by verifier	Conclusion
44	The DOE shall assess whether the revised PDD complies with: (a) The applied methodology, tools and/or standardized baseline; (b) Any later version of the methodology and/or the standardized baseline; or (c) The requirements of another methodology and/or another standardized baseline that is(are) applicable to the project activity. (Refer VVS 311)	Not applicable.	OK

Table 2 Resolution of CARs and CRs

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
CAR 1 As per the validated PDD (ver 1.0 dated 19th June 2007), total organic material removal efficiency of the new project waste water facility (R_{NAWTF}) was fixed at 95.92% and new Monitoring report (p.no 11 of 28) reflects the same value. But the VER sheet (Tab ERCal; Cell C29&C30) gives different values. (93.65% for 2012; 91.70% for 2013). It has learned from the 2nd verification report that it is calculated based on the measured values of COD acid and COD effluent of UASB 1 and 2. But it is not clear why this information or deviation if at all any is not clearly mentioned in the new monitoring report and also the conservativeness of the value is not demonstrated clearly by the PP in the new monitoring report. For the purpose of this verification report, new monitoring report means the monitoring report dated 13th August 2014 pertains to the monitoring period starting from 1st January 2012 to 31st December 2013.	S.No 11 i	1st response; This monitored parameter has been changed as per CAR raised during the 2nd verification.	As per the applied methodology AM22, It is a project specific factor used to estimate how much COD will be removed from the system. $RNAWTF = (\text{COD acid} - \text{COD effluent}) / \text{COD acid}$ Daily average of both the UASB systems is calculated. Yearly average values then calculated. The verification team has accepted the argument of PP. Conclusion: CAR 1 is closed.
CAR 2 It was observed at the site COD load reported for UASB1 and UASB 2 in the VER sheet, does not match with that mentioned in the logsheets/computer stored data. PP is requested to do the needful.	S.No 11 i	1st response ; The monitored data is rechecked. The FM5 values of 30-31 Dec 2012 are corrected in the VER sheet.	The verification team has checked the corrected values and accepted the same. Conclusion: CAR 2 is closed.
CAR 3 As per the validated PDD (ver 1.0 dated 19th June 2007), flare efficiency for open flare is fixed at 50% and the new monitoring report (p.no 12 of	S.No 11 i	1st response ; The flare efficiency in the VER sheet is corrected to 50%.	The verification team has checked the corrected values and accepted the same. It is assumed at the time of validation and it remains same during the entire crediting period.

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
28) reflects the same value. But the VER sheet (Tab ERCal; Cell D57&E57) gives a different value.			Conclusion: CAR 3 is closed.
CR 1 PP is requested to explain the rationale behind the assuming 100% hydrological balance before accepting the wastewater output is equal to Wastewater output considering that there is biogas that is being generated and sludge (nevertheless small in quantity) is formed in the UASBs.	S.No 6	1st response ; The hydrological balance of the UASB system is designed and confirmed by technology provider (Papop) since the initial stage of the project implementation. Refer to the description in the registered PD for ID 2 , <i>Established using ID 1 and assuming hydrological balance.</i> The dissolved COD in wastewater is digested by anaerobic bacteria*. The 90% of COD digested is converted to methane and 10% is used for cell growth (sludge) [†] .  The above bio-chemical reaction does not change the wastewater volume in the reactor , only the dissolved nutrient is	The verification team has accepted the argument of PP. The total volume of wastewater leaving the project treatment facility is same as that of waste water entering the project facility by assuming 100% hydrological balance. The hydrological balance is assumed at the time of validation is remains for the entire crediting period. Conclusion: CR 1 is closed.

* <http://www.intechopen.com/books/biomass-now-sustainable-growth-and-use/microbial-biomass-in-batch-and-continuous-system>

† <http://www.tratamientodeaguas.org.mx/Waste-Water-Treatment/>

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
		changed. With the overflow weir structure at the outlet from reactor , the flow in is always equals to flow out from the reactor.	
CAR 4 It was not clear how the wastewater organic material concentration entering the project treatment facility calculation from the monitored value (Refer VER sheet; tab Data; Cell D13 and E13) is in-line with the that mentioned in the validated PDD (ver 1.0 dated 19th June 2007). PP is also requested to explain when daily values are available (i.e FM3 values and FM5 values and COD load values for both UASB 1 and UASB 2 are available) why arithmetic average (and not daily weighted average) is calculated. In doing so explain the sampling analysis used if any in the calculation also.	S.No 11 ii	1st response ; In the previous verifications , the CODin and CODout are 2 values for each UASB. It was recommended by DOE to apply the weight average value. However , it is removed from revised MR and VER sheet. .	It has to be measured daily as per the validated PD using colorimetric analysis at the lab located at the project site. Daily sampling of the untreated process effluent of both UASB systems was carried out and is analyzed for COD concentration on a daily basis. Then average value is calculated The verification team has checked the measurement methods and found that COD content will be analyzed using colorimetric method in the onsite lab. The results are then logged by the operators in the plant operation report on a daily basis. The plant operators then transfer to the computer for electronic storage. The colorimetric method is found to be as per national standards. The verification team has checked the calibration certificates against model, serial number, date of calibration, validity and actual error and found that spectrometers are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured. Conclusion:

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			CAR 4 is closed.
CAR 5 There is a huge difference between the monitored value measured daily for eg. Lowest value monitored by meter FM3 is 50 M3/day whereas the highest one is 2978 M3/day (Refer VER sheet; ta: data_2012; Column E). How the both values are considered for the calculation and how the quality control check is conducted in accepting the same. Similar issue observed in column C to column I. PP is also requested to provide evidence if both the wider range of values are accepted by the supervisor before recording in the log sheets and/or for further use by providing approved log sheets.	S.No 11 ii	1st response ; The flow rate into UASB 1 (FM3) and 2 (FM5) can be varied and/or fluctuated by the starch production plan and the condition inside the UASBs. In the normal operation condition of the UASBs , with the operation of starch plant , the UASB can receive the high wastewater volume. In case the over-loaded of UASB (high COD at the effluent or low pH in the reactor) or process failure , the lowest flow rate of wastewater is fed until the UASB is back to normal condition. Both highest value and lowest value are used in calculation. The biogas plant supervisor has responsibility to approve data before filling in report and submit to consultant.	The verification team has accepted the argument of PP. The total volume of wastewater entering the project treatment facility is the cumulative of waste water flows through flow meter FM3 (installed at inlet of UASB 1 system), FM5 (installed at inlet of UASB 2). It is measured continuously and recorded on daily basis as per the validated PD. Daily readings of each meter are calculated from the final reading of the day and initial reading of the day for all the two meters. Yearly reading is cumulative of daily data. The total volume of wastewater leaving the project treatment facility is same as that of waste water entering the project facility by assuming 100% hydrological balance. The hydrological balance is assumed at the time of validation is remains for the entire crediting period. The verification team has checked the measurement methods and found that plant operators first manually archive the monitored data onto the log sheets then transfer to the computer for electronic storage. The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured. Conclusion: CAR 5 is closed.
CR 2 If data is not available or not measured for (FM3, FM5, GM1, GM2, GM3 and GM4) as observed from the VER sheet for 2012 and 2013, how the same is estimated for that particular day. How the data is conservatively used in the overall data. Even it is considered that there is no wastewater fed or no biogas produced, on the same days in question, methane content is measured and recorded, electricity is consumed/recorded and dry starch is produced/recorded. PP is requested to clarify.	S.No 11 ii	1st response ; Most of the blank means there is no wastewater fed or no biogas produced / used. It is considered as 0. In case of no record of monitored parameters , it will be zero in the VER calculation as well. There is no data estimating or assuming applied. It is conservative since the lower biogas consumed and wastewater quantity , also decrease the baseline emission.	The verification team has accepted the argument of PP. Conclusion: CR 2 is closed.
CR 3 It is not clear with respect to deviation 1 and 2 and deduction of gas consumption in steam boilers 6,9,10 and 11 and covered lagoon CL3. It is not clear how gas consumption steam boilers 6,9,10 and 11 are calculated on a monthly basis. It is learned from the previous verification reports that is calculated but the approach followed in calculating the same is not clearly indicated in the	S.No 11 i	1st response ; The biogas consumption of each boiler is not monitored. We monitor only the total biogas consumption by all boilers. The individual consumption for each boiler is calculated on monthly basis , explained in MR ; deviated approach a) and b). The values are presented in VER sheet , tab data , row 93-124. This deviated approach	Amount of fossil fuel (fuel oil) displaced by the use of biogas for the generation of onsite heat (F_{FO}) : PP has assumed that heat supplied by biogas in the project activity is equal to heat that would be supplied by fuel oil in the baseline. The verification team has accepted the approach as one of the purpose of the project activity is to replace fuel oil in the boiler with biogas.

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
VER sheet nor in the new monitoring report. And provide commissioning certificates of steam boilers especially boiler no 10 and 11. And for CL3-(covered lagoon) commissioning certificates.		has been established and verified since the previous verification. The commissioning reports of boiler 10 and 11 are submitted.	So the amount of fuel oil replaced is calculated as follows Amount of fuel oil replaced = volume of biogas consumed in the boiler (V_{boiler}) x NCV of biogas / NCV of fuel oil As per the validated PD, it is an ex-post parameter calculated as above using parameters such as ID 5, ID 11, ID 19. Biogas sent to boiler that is generated in covered lagoon (CL3) : in the year 2013, to handle the additional load, PP had installed a covered lagoon (CL3) on 12th September 2013. The verification team has checked the commissioning certificate of CL3. PP has discounted the generation of biogas from this covered lagoon as it was installed after the validation of the project activity. The portion of biogas generated by CL3 is excluded from the calculation of emission reduction. By this deviation (deviation 1), applicability of the methodology, additionality and conservativeness of overall emission reductions, hence accepted by the verification team. Biogas sent to boiler that is generated in covered lagoon is calculated as follows. Biogas sent to boiler that is generated in covered lagoon = (Biogas generated in covered lagoon CL3 - biogas flared near to CL3) / Total biogas supplied to the boilers in the year 2013. Volume of biogas supplied to all the boilers in the year 2013 ($V_{\text{boiler supplied}}$)

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			Volume of biogas supplied to all the boilers in the year 2013 ($V_{\text{boiler-supplied}}$) = Biogas generated in UASB 1 and UASB 2 + Biogas generated in covered lagoon CL3- Biogas flared in gas storage- biogas flared near to CL3 Biogas generated from UASB 1 and 2 is measured from flowmeter GM1 and GM2 respectively. Biogas generated in covered lagoon CL3 is measured through GM3. Biogas flared in gas storage and biogas flared at near to covered lagoon is measured through GM6 and GM7 respectively. It is found that biogas flow is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values. Biogas generated in covered lagoon CL3 - Biogas flared near to CL3: Biogas generated in covered lagoon CL3 is measured through GM3 and biogas flared at near to covered lagoon is measured through GM6 and GM7 respectively. It is found that biogas flow is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values. Percentage Biogas sent to boiler that is generated in covered lagoon (CL3): Percentage Biogas sent to boiler that is generated in covered lagoon = (Biogas generated in covered lagoon CL3 - biogas flared near to CL3)/ Total biogas supplied to the boilers in the year 2013. Biogas sent to boiler that is generated

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			UASBs but that is excluded from covered lagoon Biogas supplied including all the boilers is calculated as total biogas that is supplied to the boilers minus Biogas sent to boiler that is generated in covered lagoon Or Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon = total biogas that is supplied to the boilers x (1- Percentage Biogas sent to boiler that is generated in covered lagoon) Volume of biogas consumed in the boilers including in boilers 6,9,10,11 (V_{boiler}) As per the validated PD, it is measured continuously. It is found that biogas flow is measured continuously and recorded in log sheets on a daily basis. Yearly data is arrived at by summing all the daily values. For the year 2012: Gas flow meter GM3 (installed at the inlet of boilers) measures the total biogas sent to the boilers. Biogas consumed in the all the boilers including that of boiler 6, 9 and 10 are measured through flowmeter GM3 (installed at the inlet of boilers). This meter used for total biogas consumed in the boiler in the year 2012. For the year 2013: But in the year 2013, biogas discharge line form gas blowers were modified. From one line, separated into two lines with separate flow meters namely GM4 and GM5 (installed at the inlet of boilers). Biogas consumed in the all the boilers including that of boiler 6, 9,10 and

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			11 are measured through these flowmeters. This meter used for total biogas consumed in the boiler in the year 2013. Boilers 6, 9, 10 and 11 are installed after the validation of the project. The verification team has checked the calibration certificates against model, serial number, date of calibration, validity and actual error and found that spectrometers are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. The verification team was able to conclude that QA/QC of the meters is ensured. Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon: Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon = total biogas that is supplied to the boilers x (1- Percentage Biogas sent to boiler that is generated in covered lagoon) Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 + excluded biogas produced from CL3): It is calculated as follows Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) = Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon- Volume of biogas consumed in the boilers in boilers 6,9,10,11 Volume of biogas consumed in the boilers

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			in boilers 6,9,10,11 (V_{boiler}): PP has discounted the consumption of biogas in the boilers 6, 9, 10 as they are found installed after the validation of the project activity. Boilers 10 are installed during 2012. The verification team has checked the commissioning certificates and the details are consistent with the claim of PP and accepted the same as such. Since there is no separate meters for each boiler and to calculate the % consumption for each boiler such as boiler 6, 9 and 10. PP had conducted a performance test to identify the biogas consumption of each boiler at its full load by running boiler at full load and the biogas totalised flow at biogas flow meter is recorded when the boiler is started and stopped. The resulting values are used to calculate the biogas consumption during the operational hours. The operation hours of each boiler are available on a daily basis taken from the log sheets. So the biogas consumed is hence calculated from maximum biogas consumption and running hours of each boiler. Then the percentage of biogas consumed by each boiler is calculated. This deviation does not affect the applicability conditions in any way, additionality and conservativeness of overall emission reductions, hence accepted by the verification team as it falls in line with the VCS requirements. For the year 2013: But in the year 2013,

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			biogas discharge line form gas blowers were modified. From one line, separated into two lines with separate flow meters namely GM4 and GM5 (installed at the inlet of boilers). This meter used for total biogas consumed in the boiler in the year 2012 PP has discounted the consumption of biogas in the boilers 6, 9, 10, 11 as they are found installed after the validation of the project activity. Boilers 11 are installed during 2013. The verification team has checked the commissioning certificates and the details are consistent with the claim of PP and accepted the same as such. Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) Total biogas sent to boiler (excluded steam boiler # 6 , 9 ,10 and 11 excluding biogas produced from CL3) = Biogas sent to boiler that is generated UASBs but that is excluded from covered lagoon- Volume of biogas consumed in the boilers in boilers 6,9,10,11 Conclusion: CR 3 is closed.
CR 4 PP is requested to provide evidence to support boiler efficiency of 98.5%.	S.No 11 i	1st response ; This value is applied since the 1st verification , cannot find the reference. Anyway , it can be crosschecked with the	As per the validated PD, this parameter was determined during commissioning. It is assumed as no supplier specification is available. The heating system efficiency was determined during commissioning

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion																																																																																																	
		PD (pg.25) that the f_{heat} applied is 99% (roundup from 98.5%).	which the verification team has accepted. The fact that the same value was being used for the previous verification periods as well substantiates the accuracy level of the value. Hence QA/Qc is assured. Conclusion: CR 4 is closed.																																																																																																	
CR 5 PP is requested to confirm NCV of biogas is measured annually as per the validated PDD and in doing so explain why when measured value of NCV is available, it is calculated during indirect method.(Refer VER sheet; Tab: Data; Cell D27 and E27 & D75 and E75). It is learned from the previous verification reports that it is calculated but the rationale behind indirect calculation and the conservativeness in the calculation of emission reductions is not demonstrated by the PP in the new monitoring report.	S.No 11 ii	1st response ; This approach has been developed since the 2 nd verification. It can be found in CAR no.07 of verification finding report from SGS. <table border="1"><tr><td>Date:</td><td>23/04/2008</td><td>Raised by:</td><td>KS/DT/PT</td></tr><tr><td>No.:</td><td>07</td><td>Type:</td><td>CAR</td></tr><tr><td>Issue:</td><td colspan="2">Monitoring parameters</td><td>Ref.:</td><td>Sec. C.9</td></tr><tr><td colspan="2">Lead Assessor Comment</td><td colspan="2">Date:</td><td>23/04/2008</td></tr><tr><td colspan="4">Please explain why the methane content of biogas is not monitored as per the requirement of applicable methodology and how the methane content of biogas has been estimated in the emission reduction calculations. Also, how the calorific value of biogas is estimated and does this approach conservative?</td></tr><tr><td colspan="2">Project Participant Response:</td><td colspan="2">Date:</td><td>23/06/2008</td></tr><tr><td colspan="4">The methane content of biogas (%CH₄) was measured during the monitoring period by an Infrared Gas Analyzer and recorded in SCADA on a daily basis. The average measured methane content value of 63.6% over the monitoring period has been used in the emission reduction calculations.</td></tr><tr><td colspan="4">A 63.6% is the average actual value of Methane concentration of biogas is used in this crediting period.</td></tr><tr><td colspan="4">Therefore, the calculation of emission reduction is revised by using 63.6% CH₄ instead of plant design data (65%), which is more conservative.</td></tr><tr><td colspan="4">The net calorific value of biogas is estimated based on the average percentage of CH₄ of the biogas times the Net Calorific Value of Thai natural gas (according to official energy statistics) as shown below:</td></tr><tr><td colspan="4"> - 1 m³ of 100% of CH₄ on a wet basis has following NCV = 1.04 (MJ/m³)² / 0.02832 (Nm³/ft³) = 36.723 MJ/Nm³ - Therefore, the Net calorific value of 1 m³ biogas at 63.6% CH₄ = 36.723 * 63.6% = 23.36 MJ </td></tr><tr><td colspan="2">Acceptance and Close out by Lead Assessor:</td><td colspan="2">Date:</td><td>15/07/2008</td></tr><tr><td colspan="2">Information Provided:</td><td colspan="2">Verified Document Reference:</td></tr><tr><td colspan="2">The methane content in biogas is monitored and the average value 63.6% has used now for emission reduction calculations.</td><td colspan="2">Spread sheet and MR version 1.2</td></tr><tr><td colspan="2">The net calorific value of biogas is calculated based on the conservative estimates and 1m³ of biogas has 23.36MJ of energy.</td><td colspan="2">14/05/2008</td></tr><tr><td colspan="2">Information Verified:</td><td colspan="2"></td></tr><tr><td colspan="2">The monitored values were checked from the plant records and found correct.</td><td colspan="2"></td></tr><tr><td colspan="2">The net calorific value of biogas is calculated based on the conservative estimates and 1m³ of biogas has 23.36MJ of energy.</td><td colspan="2"></td></tr><tr><td colspan="4">Reasoning for not acceptance or acceptance and close out:</td></tr><tr><td colspan="4">Please provide the calibration certificate, covering this monitoring period, of Infrared Gas Analyser (methane analyser).</td></tr><tr><td colspan="4">CAR 07 kept open</td></tr><tr><td colspan="2">Project Participant Response:</td><td colspan="2">Date:</td><td>11/08/2008</td></tr><tr><td colspan="4">Calibration certificate for gas analyzer dated 12/07/2007 and 29/01/2008 is provided.</td></tr></table>	Date:	23/04/2008	Raised by:	KS/DT/PT	No.:	07	Type:	CAR	Issue:	Monitoring parameters		Ref.:	Sec. C.9	Lead Assessor Comment		Date:		23/04/2008	Please explain why the methane content of biogas is not monitored as per the requirement of applicable methodology and how the methane content of biogas has been estimated in the emission reduction calculations. Also, how the calorific value of biogas is estimated and does this approach conservative?				Project Participant Response:		Date:		23/06/2008	The methane content of biogas (%CH ₄) was measured during the monitoring period by an Infrared Gas Analyzer and recorded in SCADA on a daily basis. The average measured methane content value of 63.6% over the monitoring period has been used in the emission reduction calculations.				A 63.6% is the average actual value of Methane concentration of biogas is used in this crediting period.				Therefore, the calculation of emission reduction is revised by using 63.6% CH ₄ instead of plant design data (65%), which is more conservative.				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The net calorific value of biogas is calculated based on the conservative estimates and 1m ³ of biogas has 23.36MJ of energy.				Reasoning for not acceptance or acceptance and close out:				Please provide the calibration certificate, covering this monitoring period, of Infrared Gas Analyser (methane analyser).				CAR 07 kept open				Project Participant Response:		Date:		11/08/2008	Calibration certificate for gas analyzer dated 12/07/2007 and 29/01/2008 is provided.				As per the validated PD, it is calculated. NCV of biogas is calculated as follows NCV of biogas = NCV of methane x methane content in biogas Since NCV of biogas is calculated from values like methane content which is QA/QC assured, the calculation of NCV of biogas is thus QA/QC assured. Conclusion: CR 5 is closed.
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CAR 6	S.No 11 i	1st response ;	As per the validated PD, methane content will be measured continuously and																																																																																																	

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The methane content is not measured for some days (Refer VER sheet; tab: data_2012; Cell O119 to O240) as observed at the site and log sheets are reflects the same. How the conservative approach is followed in determining the average value. In doing so, PP is requested to confirm that the measurement is done as per the validated PDD.		The deviation 3 is added in both MR and VER sheet.	recorded daily. The monitoring of this parameter is the periodic measurement by the portable gas analyzer. But daily readings are not available. The monitored data is adjusted for 95% confidence level. The verification team has checked the approach and accepted the deviation as it complies with the VCS requirements. (Deviation 3). The readings are measured above every four hours and average value is considered for calculation. The final average is adjusted as per deviation 3 through estimation using 95% confidence level. The verification team has checked the rationale and factors used in the calculation of the final adjusted value and accepted. Since this value is used for baseline calculation, lower bound value is used for the calculation which is considered conservative and hence accepted. Lower bound value = Mean value- t x standard deviation/count Where Mean value- Final average t- value from standard t distribution for a confidence level of 95% with degrees of freedom (nm-1) The verification team has checked the calibration certificates against meter number, serial number, date of calibration, validity and actual error and found that meters are having sufficient validity covering this monitoring period. The actual error is less than that of maximum permissible error hence accepted. In

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
			addition to this calibration, flow meter was calibrated via an external agency which the verification team has checked and found to be satisfactory. The verification team was able to conclude that QA/QC of the meters is ensured. Conclusion: CAR 6 is closed.
CR 6 It is not clear how wetness ratio of 1.04 is assumed in the calculation.(Refer VER sheet; Tab: Data; Cell C85 to C87)	S.No 11 i	1st response ; The same response as CR 5.	The verification team has reviewed the argument of PP and accepted. Conclusion: CR 6 is closed.
CR 7 How GWP of methane is considered as 25 in 2013 is not clearly indicated in the monitoring report.	S.No 24	1st response ; The explanation about GWP is added in section 4.1 and 4.2 of MR.	The verification team has checked the MR and accepted the same. PP has considered for the first commitment period upto 2012, as 21 kg CO₂/Kg CH₄. PP has considered GWP of methane as 25 which is accepted for the second commitment period which is in accordance with decision 4/CMP 7 as prescribed by the “Standard for application of the global warming potentials to CDM PA and PoA for the second commitment period of the Kyoto protocol” Version 1.0 (EB 69 Annex 3). Conclusion: CR 7 is closed.
CR 8 It is mentioned in the new monitoring report (p. 22 of 28) that “even if wastewater is sent directly to any facility, it will have no affect on the emission	S.No 24	1st response ; From PD ; <i>M_{lagoon_anaerobic} becomes zero when all wastewater is treated in the new waste</i>	Amount of COD actually entering the lagoon system , bypassing the new wastewater treatment facility: The applied methodology did not recognize the parameter but project had included this

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
reduction estimate as baseline emissions are equal to project emissions for such a case". Kindly clarify the statement.		<i>water treatment facility as all remaining COD entering the lagoon is removed on aerobic basis.</i> This sentence is mentioned in PD because in the beginning period of project activity , only UASB no.1 was installed. The excess wastewater from UASB was bypassed directly to the open lagoon. From the 2nd monitoring period , the UASB no.2 was in operation , as per the MR ; $M_{\text{lagoon_input_bypass}} = M_{\text{input_bypass}}$ Where $M_{\text{input_bypass}}$ is the total organic material that is entering the lagoon untreated. It is equivalent to the waste water flow of the bypass and the same COD load (mg/l) as measured for the waste water entering the lagoon. The second part is not recognized by AM0022 even though AM0022 monitoring method identifies this parameter. It is, however, not included in the calculation for AM0022 projects. For the purposes of this calculation Miagoon input is defined as $M_{\text{lagoon_input}}$ (as defined in AM0022) plus $M_{\text{lagoon_input_bypass}}$ Total Material Removed in the Lagoon System is: $M_{\text{lagoon_total}} = M_{\text{lagoon_input}} \cdot R_{\text{lagoon}}$ Where: $M_{\text{lagoon_total}}$ is the total amount of organic material removed in the lagoon system through various routes (kg COD) R_{lagoon} is the total organic material removal ratio of the lagoon (-). It is a project specific factor, and is equal to the proportion of organic material removed (through all routes) within the boundaries of the lagoon system under consideration. This factor should be determined by carrying out a series of biochemical tests prior to project implementation. These tests will determine the COD flows into the system, and the COD flows out of the system at the system boundary. The relative difference of COD flowing in and out of the system over a period of time will allow determination of the Total Organic Material Removal Ratio. and where $M_{\text{lagoon_input}}$ includes $M_{\text{lagoon_input_bypass}}$ $M_{\text{lagoon_input_bypass}} = 0$, because no waste water was bypassing the new waste water treatment facility due to the capacity expansion of the new waste water treatment facility since 2006 (UASB2). It was recommended by DOE to note this in the previous MR. Because the wastewater bypass was not longer monitored. Even the wastewater was bypass , it will be accounted as BE and if it is considered as PE , the final result is 0. Hence the bypass	parameter as the monitoring methodology identified this parameter. Amount of COD actually entering the lagoon system, bypassing the new wastewater treatment facility is characterised by the amount of wastewater bypassing the new wastewater treatment facility. Flow of wastewater directly to the current wastewater treatment system : As per the validated PD, bypass flow is to be measured by an electromagnetic flow meter. It is also reported that this meter is not in use as all waste water is sent to the reactors. Since there is no waste water (with COD concentration) actually entering the lagoon system, bypassing the new wastewater treatment facility, this parameter is zero. The verification team was able to conclude that there is no wastewater bypassing the new treatment plant. Even if wastewater is sent directly to any facilities, it will not have any effect on the overall emission reductions, as, in such a case, Minput_lagoon_bypass in baseline and project emission would be the same. Hence QA/QC is assured in overall emission reduction calculation. Conclusion: CR 8 is closed.

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		can be happened but it does not affect the final VER result.	
CR 9 How the measurement is undertaken during the monitoring period for loss of biogas due to leakage in the biogas pipes or ID 17 (Refer validated PD dated 19 th June 2007; page no 34 of 47) and provide logsheets maintained at the site to support for nil leakage.	S.No 24	1st response ; There is no record or log sheet. It is not required by methodology and not identified in PD. The gas leakage can be detected by gas detector for safety requirement according to regulations. When the operator find the leakage , they will follow the safety procedure of the factory.	As per the validated PD, it is measured using mobile gas leak detector. It is denoted as percentage of biogas generated by the PP. The verification team has observed that UASB reactor gas collection system consists of a gas tight concrete coated gas dome and the delivery pipe to the boilers is less than 2 km in length. Integrity of biogas pipeline for losses or leakages is checked using mobile gas leak detector and there is no such losses in this monitoring period. Thus QA/QC is assured. Conclusion: CR 9 is closed.
CR 10 At the site, it was observed that Calorimeter method was used to measure COD but the new monitoring report (Refer p. no 14&15 of 28) informs that the meter used is spectrophotometer which is not clear.	S.No 6	1st response ; The COD test procedure is the standard colorimetric method. The principle is to measure the colour (absorbance) at the certain wavelength and measure COD by using spectrophotometer*.	The verification team has accepted the argument of PP. Conclusion: CR 10 is closed.
CR 11 PP is not demonstrated in clear terms that the actual error of the all the meters found through the calibration is less than the maximum permissible	S.No 16	1st response ; PP submits the calibration certificate for verification.	The verification team has checked he calibration certificates and found that the actual error is less than the maximum permissible level.

* <https://www.envexp.com/download/techsupport/articles/COD%20Article.pdf>

Correction Action Request (CAR) or Clarification Request (CR) or Forward Action Request (FAR)	Refer to table 1	Response from project participant	Verification team conclusion
error of the meter.			
FAR 1 (carried from the previous verification) The boilers are retrofitted. The operational conditions of the dual fuel boiler need 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.	S.No 6	1st response ; No boiler was replaced with new boilers. However, there were four new steam boilers numbered 6,9,10 and 11 were installed after the validation of the project and boilers no. 10 and 11 were installed during the monitoring period. They are excluded from project boundary as per description in deviation in MR.	The verification team has accepted the argument based on the onsite observation. Conclusion : FAR 1 is closed for this verification period.
FAR 1.1 (carrying over to the next verification period) The aspect of FAR 1 can be an issue in the next verification period also.	S.No 6	PP accepts that in case it is found that the existing boiler is replaced with new boiler during the next monitoring period, no emission reduction shall be claimed for heat displacement.	FAR 1.1 is open