

“Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)”



By

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Summary:

KBS Certification Services Pvt. Ltd. has been contracted by, "South Pole Carbon Asset Management Ltd." to undertake independent 1st periodic verification and certification (2nd crediting period) for the greenhouse gas (GHG) emission reductions reported from 'Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)' for the monitoring period 01/01/2017 to 31/12/2017 in the initial monitoring report version 01 date 28/02/2018, with regard to the relevant requirements of VCS Standard Version 3.7.

The project was validated and registered with reference no. 430 under VCS (Verified Carbon Standard) program on 14/11/2009. The project was validated by TÜV NORD CERT GmbH (validation report N° 53208109-08/510 issued on 14-November-2009).

For the 2nd crediting period, project has been validated by KBS Certification Services Pvt. Ltd. (Validation report ID "VCS.18.VER.010_Crediting period renewal", Dated 28/05/2018). This is the 1st periodic verification (2nd crediting period) of this project which covers the period from 01/01/2017 to 31/12/2017 (including both the days). The project is verified against the VCS Version 3. The verification is based on the monitoring plan of registered VCS Project Description document (VCS PD) for 2nd crediting period /27/, requirements of VCS (VCS Standard and VCS Program Guide of VCS Version 3) and CDM Validation and Verification Standard for project activity /24/.

The methodologies applied for the project to estimate the GHG emission reduction are AMS-III.H., version 18 – "Methane Recovery in Wastewater Treatment", AMS-I.D., version 18 - "Grid connected renewable electricity generation" and AMS-I.C., Version 20 – "Thermal energy for the user with or without electricity" /28/.

The verification is based on the VCS PD, proof of title, proof of right, additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and supporting documents made available to the verification team by project proponent.

Monitoring report (MR)/02/, Emission reduction calculation spread sheet (ER sheet)/04/, Project Description document (VCS PD) for 2nd crediting period /27/ and other supporting documents have also been made available to the verification team.

A risk based approach has been followed to perform the verification of the project activity. In the course of verification, 02 Corrective Action Requests (CAR) and 02 Clarification Request (CL) have been raised. All the CARs and CLs have been closed out successfully.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/01/2017 to 31/12/2017 based on the reported emission reductions in the final monitoring report Version 02.1 dated 22/08/2018 for the same period.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

As a result of the verification, the verifiers confirm that the GHG emission reduction in the verification period from 01/01/2017 to 31/12/2017, including both the days, is **29,796 tCO₂e**.

KBS confirms the following;

Reporting period: 01/01/2017 to 31/12/2017

Year	Net GHG emission reductions or removals (tCO ₂ e)
2017 (01/01/2017 to 31/12/2017)	29,796
Total	29,796

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1 INTRODUCTION

1.1 Objective

KBS has been commissioned by 'South Pole Carbon Asset Management Ltd.' to perform verification of its registered VCS project 'Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)', for the reported GHG emission reductions for the given monitoring period 01/01/2017 to 31/12/2017 (both dates included). The VCS projects must undergo an independent third party verification and certification of emission reductions as the basis for issuance of Voluntary Emission Reductions (VERs).

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the project description (PD) and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.
- To confirm that the monitoring system is implemented and fully functional to generate Voluntary Emission Reductions (VERs/VCUs) without any double counting, and
- To establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation.

1.2 Scope and Criteria

The verification scope is defined as an independent and objective review of monitoring report, VCS project description (VCS PD), including the monitored data and other relevant documents made available to verifier and information collected through performing interviews during on-site assessment of the project activity.

The project is assessed against the requirements of VCS standard version 3.6 and related rules and guidance. KBS has, based on the recommendations in the latest version of Verified Carbon standard, and employed a rule-based approach (as criteria) in the verification, focusing on the identification of significant reporting rules and the reliability of project monitoring.

The aspects to be covered under the purview of verification are:

- Ensure that the project activity has been implemented and operated as per the registered VCS PD and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place as per the documents provided by the client and on-site visit;
- Ensure that the monitoring report and other supporting documents provided are complete
- Ensure that the practiced monitoring system and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved CDM methodology;
- Evaluate the data recorded and stored are as per the monitoring methodology.

1.3 Level of Assurance

☒ Reasonable level of assurance

1.4 Summary Description of the Project

Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi), hereafter 'the project activity', involves the installation and operation of a biogas recovery and utilization system (an open anaerobic effluent treatment system) at Chol Charoen Co. Ltd., a tapioca starch factory in Cholburi, Thailand. The system has been in operation since 7th January 2006 (project start date).

This starch factory has a design daily production capacity of 240 tonnes of dried starch, generating 2,400 m³ of wastewater per operational day. Under the previous system, wastewater released from the plant was treated in 13, cascading, open anaerobic lagoons. With the depth of these ponds being greater than 2 m from the water surface, and the mean temperature of the area being in the region of 29°C, there is a suitable anaerobic environment within the ponds. 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 or COD of the wastewater.

The project activity involves modification of the existing open anaerobic lagoon-based process into a closed anaerobic system for treatment of high organic matter wastewater. This is based on Anaerobic Fixed Film Reactor (AFFR) technology, which is a technology derived from joint research between King Mongkut's University of Technology Thonburi (KMUTT) and the National Centre for Genetic Engineering and Biotechnology (BIOTEC). In addition, three open lagoons at the outlet of the AFFRs were redesigned and converted to covered lagoons in order to 1) increase gas-storage capacity and 2) serve as an emergency wastewater treatment system in case the AFFR system malfunctions.

The implementation of AFFR system enables the recovery of biogas that would have been released to the atmosphere and the utilization of the recovered biogas for thermal and electricity generation. Excess biogas (if any) is sent to the enclosed flare system. The hot oil boiler in the existing plant was originally designed to burn fuel oil for heat generation. Under the project activity, the burner is retrofitted with a combination fuel burner, which allows the boiler to be co-fired using both fuel oil and the biogas collected from the reactors. The power produced by the captured biogas augments the electricity requirement of the plant and may, in the future, be fed to the national grid, under the pending power purchase agreement with the Provincial Electricity Authority (PEA). With such utilization of biogas, the project activity achieves GHG emission reduction through avoidance of methane being released to the atmosphere, and also through reduction of fossil fuel consumption (with fuel oil and grid electricity being displaced).

Verification team has checked the project activity equipments installed as the project site and found in compliance with the registered VCS PD for 2nd crediting period /27/.

The project site is located in Banbung district, Cholburi province. It is approximately 250 km away from Bangkok. Street address: 204 Moo 3 Nongchak, Banbung, Cholburi, 20170, Thailand with geographical coordinates: 13° 17.736'N latitude and 101° 09.108'E longitude as verified during site visit.

Project second crediting period is from 01-01-2017 to 31-12-2026, Hence the monitoring period selected for 1st periodic verification i.e. 01/01/2017 to 31/12/2017 is within the crediting period.

The total emission reduction for 1st verification period from 01/01/2017 to 31/12/2017 is 29,796 tCO₂e. The emission reduction is calculated conservatively as per the applied methodologies.

Project entity information is presented below:

Item	Data
Project Entities	Chol Charoen Co.,Ltd 1004/200 Rama3 Road , Bangpongpan , Yannawa Bangkok 10120
	South Pole Carbon Asset Management Ltd. Technoparkstrasse 1 , Zurich , Switzerland 8005

2 VERIFICATION PROCESS

2.1 Method and Criteria

The verification process was carried out inline with the requirements VCS Version 3. In addition, the verification team followed the guidelines of the CDM Validation and Verification Standard. Standard auditing techniques and KBS's CDM Procedures were also applied during the verification. A risk-based approach was followed to carry out verification and access all the factors and concerns that relate to the issuance of emission reductions from a project activity.

They include:

- Identification of all the sources contributing to the baseline emissions, project emissions and emission reductions.
- Authenticity of the provided data is checked.
- A risk based analysis is carried out to ensure a clear and transparent assessment. The risks involved in this process are mainly with the informational flows and data recording.

KBS follows a risk based verification approach, wherein a desk review of the project documentation is undertaken, which is followed by an onsite visit by the members of verification team. The verification protocol is filled by the verification team that is based on standard auditing practices and VCS requirements. The verification protocol provides transparent means to record the observations by the verification team members and the non-conformities, if any. The verification protocol is an internal document, and available on request.

Duration of Verification:

Verification Contract	26/02/2018
On site verification	14/03/2018
Findings raised	19/03/2018
Draft Verification Report	21/08/2018
Final Verification Report	24/08/2018

2.2 Document Review

A desk review is undertaken, involving but not limited to,

- A review of the data and information presented to verify their completeness;
- 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 quality assurance and quality control procedures;
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

The list of document reviewed is included in the Appendix 2: 'References'

2.3 Interviews

The site visit for this verification assessment was undertaken by Chetan Swaroop Sharma (Team Leader and Technical Expert (TA 1.1, 13.1)). Summary of on-site activities are mentioned below;

Location	Chol Charoen Co., Ltd., in Banbung district, Cholburi province. It is approximately 250 km away from Bangkok. Street address: 204 Moo 3 Nongchak, Banbung, Cholburi, 20170, Thailand.
Dates	14/03/2018
Key points discussed	Name of persons interviewed, Designation, Organization
• General aspects of the project • Project equipment operation and technical details • Changes since validation • Monitoring and measurement equipment • Remaining issues from previous verification • Calibration procedures • Quality management system • Involved personnel and responsibilities • Training and practice of the operational personnel • Implementation of the monitoring plan • Monitoring data management • Data uncertainty and residual risks • GHG calculation • Maintenance	Kamontorn Mnckvlohit, Quality Control, Chol Charoen Co., Ltd. Mr. Pracha Koompai, Farmer Mr. Wichan Sinlaprasat, Farmer Mr. Sauangsab Saetun, Farmer Nattaya Lonawan, Project Manager, South Pole Carbon Asset Management Ltd.

2.4 Site Inspections

A site visit is undertaken by members of verification team, involving but not limited to,

- An assessment of the implementation and operation of the project activity as per the registered VCS PD;
- A review of information flows for generating, aggregating and reporting the monitoring parameters;

- Interviews with relevant personnel to confirm that the operational and data collection procedures are implemented in accordance with the approved monitoring plan;
- A cross-check between information provided in the monitoring report and data from other sources such as plant log books, inventories, purchase records or similar data sources;
- A check of the monitoring equipments including calibration performance and observations of monitoring practices against the requirements of the registered VCS PD and the selected methodologies/28/;
- A review of calculations and assumptions made in determining the GHG data and emission reductions;
- An identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

2.5 Resolution of Findings

KBS applies the risk based approach aimed at focusing on high risk issues to the validation results whilst not omitting any part of the mandatory processes. A few discrepancies were found during the validation and the validation report was submitted to the project proponent, indicated under the titles corrective action requests (CARs) and clarification requests (CLs). CARs and CLs require the PP to take relevant actions. Criteria for judging items as CAR or CL are as follows:

Corrective action request (CAR):

- the project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions
- the Voluntary Carbon Standard's requirements have not been met, or
- there is a risk that emission reductions cannot be monitored or calculated.

Clarification request (CL):

- Information is insufficient or not sufficiently clear to determine whether the applicable VCS requirements have been met.

FARs is to be raised to highlight issues related to project implementation that require review during the first verification of the project activity. FARs does not relate to VCS requirements for registration.

CARs and CLs are to be resolved or closed out if the PP modifies the project description, rectifies the PD or provides adequate additional explanations or evidence that satisfies the concerns. If this is not completed, the project activity cannot be recommended for registration under VCS registry.

The project description document was revised addressing the CARs & CLs issued by KBS. After reviewing the revised and resubmitted project description/27/; resolving the CARs & CLs raised and outstanding concerns, KBS issues this final validation report and opinion.

02 CAR and 02 CL were found during verification and closed satisfactorily. The list of CARs/CLs raised and the response provided, the means of verification, reasons for their closure and references to correction in the MR are provided in appendix 4 of this report. The revised MR with

changes incorporated as per the issues raised were rechecked with the documentary evidences and found to be inline.

2.5.1 Forward Action Requests

No FAR was raised during this monitoring period.

2.6 Eligibility for Validation Activities

KBS has conducted the 1st periodic verification activity; the validation was performed by KBS Certification Services Pvt. Ltd. and the separate validation report issued and approved by the VCS association. KBS has a valid UNFCCC accreditation in the sectoral scope from UNFCCC.

3 VALIDATION FINDINGS

Refer above section.

3.1 Participation under Other GHG Programs

PP does not apply for other GHG program as declared in the registered VCS PD.

3.2 Methodology Deviations

One deviation has been applied by the PP during this monitoring period. Description of the deviation and the assessment on conservativeness of the deviation is provided below.

Deviation 01:

Description of the deviation
Methodology and formula that is deviated Baseline emissions for estimating the fossil fuel replaced. The latest version of methodology AMS I.C., requires monitoring of the fuel that would have been consumed in the absence of the project activity. Deviated approach or formula The project proponent uses a conservative approach, based on amount of heat required for starch drying, which in turn is estimated on heat requirements per tonne of starch when only fuel oil was used. The approach compensates the fuel oil usage from total fuel oil requirement (in baseline) and conservatively estimates the fuel oil replaced by methane. Irrespective of quantity of methane burnt. Justification for deviation Due to incompleteness of the monitoring equipment, a deviation has been made to the approach specified in methodology AMS I.C. The deviated approach ensures that efficiency lost in system

due to dual fired system is conservatively adjusted in baseline emissions. This means that if any efficiency loss happens due to dual fired system and the energy of same is supplied by fuel oil, using the given approach the loss is accounted in biogas usage, thereby estimating lower fuel oil replacement for baseline emission estimation. In addition, the approach does not have any negative impact on additionality of the project.

With reference to the clarification made by the SSC WG, this approach can be considered as not impact negatively on the conservativeness of the applied methodology's criteria and procedures to quantify data leading to GHG emission reductions or removals. The clarification from EB, as referenced above, can be used to substantiate this statement.

Assessment by the verification team

The deviation has been transparently described in section 2.2.1 of the MR.

The verification team is of the opinion that the approach followed by the PP is appropriately described and justified and the project remains in compliance with the VCS rules. The deviation does not overestimate the emission reduction and hence accepted to the verification team. Hence the deviation is accepted.

3.3 Project Description Deviations

The verification team confirms that no deviations were observed during the current monitoring period.

3.4 Grouped Project

The project is not a grouped project. Therefore this section is not applicable.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The project activity is in operation stage as evidenced by the physical verification of the site.

All the physical components and project boundary are in conformity with the description in registered VCS PD. The capacity of project equipments have been cross-checked during the on-site visit and found in-compliance with the registered VCS-PD/27/. On the basis of the on-site visit and the reviewed project documentation, the verification team confirms that the project was implemented and operated as described in the registered VCS PD/27/.

There is one deviation which has been addressed in the section 3.3 of this report and has been assessed by the verification team.

Ownership and other programs:

The PP declared that the project is not registered any other mechanism apart VCS. Thus emission reductions generated by project will be solely claimed by PP and PP has right of use and hence

accepted. Net GHG emission reductions or removals generated by this project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions as the host country i.e. Thailand is not a participant in any emission trading programs or nor does it have any binding limits.

PP will not claim the carbon credits under any other GHG emission reduction scheme for the crediting period under VCS and PP has provided declaration on the same during the validation. Hence there is no possibility of double counting. Apart from VCS, it has neither applied nor been rejected under any other GHG program.

Management and operational system:

Verification team was able to verify that authorities and responsibilities for monitoring and reporting of all data related to the emission reductions were clearly defined for the monitoring period from 01/01/2017 to 31/12/2017.

The allocation of the responsibilities is documented in a written form and is followed as described in the registered VCS PD. Routines for the archiving of data are defined and documented. During the site visit all the required plant records were verified and found that the data is consistent with the provided in the final MR/02/ and ER sheets/04/.

The monitoring plan described in section 3.3 of the MR is confirmed to be correct. All the parameters of the monitoring plan are monitored using appropriate metering system.

The verification team has interviewed the plant personnel who are involved in the monitoring of the parameters that are used to determine the emission reductions of the VER project. It is confirmed based on the interviews that the plant's team is competent enough to monitor the parameters as described in the monitoring plan.

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

Implementation status of the monitoring plan:

Verification team confirms through on-site verification and from the document review, the actual monitoring system complies with the monitoring plan mentioned in the registered VCS-PD/27/.

During the verification, all relevant monitoring parameters of the registered monitoring plan have been verified with regard to the appropriateness of the verification method; the correctness of the values applied for ER calculation, the accuracy and applied QA/QC measures. All monitoring parameters have been measured / determined without material misstatements and are in line with all applicable standards and relevant requirements. It is confirmed that the monitoring mechanism is effective and reliable. Wherever a parameter was not sufficiently monitored as per the monitoring plan of the VCS PD, a deviation was applied by the PPs and the emission reduction was calculated by a conservative approach.

Therefore, from the document review and onsite verification, it is confirmed that all the parameters were monitored in accordance with the registered monitoring plan during the monitoring period. Following are the details of monitoring in accordance with the monitoring plan of the registered VCS PD:

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$Q_{ww,i,y}$ Volume of wastewater treated in the year y (m^3)
Measuring frequency:	Continuously The total volume of wastewater is cumulative of waste water flows through flow meter FM1 (installed at inlet of AFFR system), FM2 (installed at inlet of covered lagoons) and FM3 (installed at inlet of covered lagoons).

	The parameter is measured on a continuous basis and recorded by the flow meters (FM1, FM2 and FM3) on daily basis as per the VCS PD /27/.																							
Reporting frequency:	Daily basis. As per the VCS PD /27/, the plant operators shall archive the monitored data manually into the log sheets /05/ and then, upload and transfer the same to the electronic storage. The same was also verified during the on-site visit and found OK.																							
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequencies are inline with the monitoring plan of the registered VCS PD /27/.																							
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table><tr><td>Meter name</td><td>FM1</td><td>FM2</td><td>FM3</td></tr><tr><td>Serial Number</td><td>YAL 1623</td><td>YAL 1624</td><td>YAL 1625</td></tr><tr><td>Accuracy</td><td>0.2%</td><td>0.2%</td><td>0.2%</td></tr><tr><td>Calibration Frequency</td><td>Once in 3 years</td><td>Once in 3 years</td><td>Once in 3 years</td></tr><tr><td>Calibration Date</td><td>22/06/2015, 18/06/2016, 10/06/2017</td><td>22/06/2015, 18/06/2016, 12/06/2017</td><td>22/06/2015, 18/06/2016, 12/06/2017</td></tr></table>				Meter name	FM1	FM2	FM3	Serial Number	YAL 1623	YAL 1624	YAL 1625	Accuracy	0.2%	0.2%	0.2%	Calibration Frequency	Once in 3 years	Once in 3 years	Once in 3 years	Calibration Date	22/06/2015, 18/06/2016, 10/06/2017	22/06/2015, 18/06/2016, 12/06/2017	22/06/2015, 18/06/2016, 12/06/2017
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Calibration Date	22/06/2015, 18/06/2016, 10/06/2017	22/06/2015, 18/06/2016, 12/06/2017	22/06/2015, 18/06/2016, 12/06/2017																					
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Volumetric Flow meters (FM1, FM2 and FM3) to monitor the flow of waste water are of 0.2% accuracy class which is in compliance with the registered VCS PD /27/. Hence accepted to the verification team.																							
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years which is in compliance with the registered VCS PD /27/. Hence accepted to the verification team.																							
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes.																							
Did calibration confirm proper functioning of monitoring equipment?	Yes																							

(Yes / No):	
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation								
Data / Parameter: (as in monitoring plan of the VCS PD):	COD _{ww, untreated, y} The chemical oxygen demand of the wastewater before the treatment system affected by the project activity. (t COD/m ³)								
Measuring frequency:	It has to be measured daily as per the validated PD /27/ using colorimetric analysis at the lab located at the project site however the same is not done. The analysis of the composite sample (Daily sample over a week) is done on weekly basis. Deviation approach has been taken in this regard as a conservative approach which is accepted to the verification team.								
Reporting frequency:	Weekly basis.								
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, It should be done on daily basis however the analysis of the composite sample (Daily sample over a week) is done on weekly basis. Deviation has been taken in this regard as a conservative approach which is accepted to the verification team.								
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table border="1"> <tr> <td>Meter name</td><td>CS</td></tr> <tr> <td>Serial Number</td><td>HAC160600001037</td></tr> <tr> <td>Calibration Frequency</td><td>Once in 3 years</td></tr> <tr> <td>Calibration Date</td><td>29/02/2016</td></tr> </table>	Meter name	CS	Serial Number	HAC160600001037	Calibration Frequency	Once in 3 years	Calibration Date	29/02/2016
Meter name	CS								
Serial Number	HAC160600001037								
Calibration Frequency	Once in 3 years								
Calibration Date	29/02/2016								
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment,	Verification team has found that the equipment installed is as per the best practice. Hence the same is accepted to the verification team.								

does the monitoring equipment represent good monitoring practice?	
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years which is in compliance with the registered VCS PD /27/. Hence accepted to the verification team.
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	COD _{ww,treated,y} The chemical oxygen demand of the wastewater after the treatment system affected by the project activity. (t COD/m ³)
Measuring frequency:	It has to be measured daily as per the validated PD /27/ using colorimetric analysis at the lab located at the project site however the same is not done. The analysis of the composite sample (Daily sample over a week) is done on weekly basis. Deviation approach has been taken in this regard as a conservative approach which is accepted to the verification team.
Reporting frequency:	Weekly basis.
Is measuring and reporting frequency in accordance with the monitoring plan and	No, It should be done on daily basis however the analysis of the composite sample (Daily sample over a week) is done on weekly basis. Deviation has been taken in this regard as a conservative approach which is accepted to the verification team.

monitoring methodology? (Yes / No)									
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table border="1"> <tr> <td>Meter name</td> <td>CS</td> </tr> <tr> <td>Serial Number</td> <td>HAC160600001037</td> </tr> <tr> <td>Calibration Frequency</td> <td>Once in 3 years</td> </tr> <tr> <td>Calibration Date</td> <td>29/02/2016</td> </tr> </table>	Meter name	CS	Serial Number	HAC160600001037	Calibration Frequency	Once in 3 years	Calibration Date	29/02/2016
Meter name	CS								
Serial Number	HAC160600001037								
Calibration Frequency	Once in 3 years								
Calibration Date	29/02/2016								
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Verification team has found that the equipment installed is as per the best practice. Hence the same is accepted to the verification team.								
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years which is in compliance with the registered VCS PD /27/. Hence accepted to the verification team.								
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes.								
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes								
If applicable, has the reported data been crosschecked with other available data?	NA								
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.								
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.								

processes in place?	
Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$S_{final,PJ,y}$ Amount of dry matter in the sludge – Tonnes
Measuring frequency:	Daily Plant operators record every sludge removal trips. In recording this parameter, plant's operators first manually archive the monitored data onto log sheets then transfer to the computer for electronic storage.
Reporting frequency:	Plant operators record every sludge removal trips.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment:	There was no sludge removed and applied during this monitoring period. CL-02 has been raised in this regard and successfully closed.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the	NA

reported data been crosschecked with other available data?	
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet have been verified with the operator log sheets/05/.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/ Observation								
Data / Parameter: (as in monitoring plan of the VCS PD):	BG _{burnt,combusted,y} Amount of biogas combusted for gainful use in the year y (Nm3)								
Measuring frequency:	Continuously BG _{combusted, y} is calculated by summing the volume of biogas sent to the boiler (GM1) and generation sets (GM3). The biogas sent to the boiler (GM1) and generation sets (GM3) are measured on a continuous basis and recorded on daily basis. The value is available in Nm ₃ . The gas flow meters are installed and values recorded regularly by skilled employees. In recording this parameter, plant's operators first manually archive the monitored data onto log sheets then transfer to the computer for electronic storage.								
Reporting frequency:	Daily basis. As per the VCS PD /27/, the operators shall archive the monitored data manually into the log sheets /05/ and then, upload and transfer the same to the electronic storage. The same was verified during the on-site visit and found OK.								
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes								
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table><tr><td>Meter name</td><td>GM1</td><td>GM3</td></tr><tr><td>Serial Number</td><td>V9107-</td><td>20880</td></tr></table>			Meter name	GM1	GM3	Serial Number	V9107-	20880
Meter name	GM1	GM3							
Serial Number	V9107-	20880							

		03.1	
	Accuracy	1%	1%
	Calibration Frequency	Once in 3 years	Once in 3 years
	Calibration Date	18/06/2015, 16/06/2016	18/06/2015, 16/06/2016, 19/06/2017
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	The accuracy class of the flow meters is as per the VCS PD /27/.		
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years.		
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes		
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes		
If applicable, has the reported data been crosschecked with other available data?	NA		
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information. CAR-01 has been raised in this regard and successfully closed.		
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.		

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of	BG _{burnt,TOFlare,y} / V _{RG,m}

the VCS PD):	Amount of biogas sent to flare system in the year y (Nm ³)										
Measuring frequency:	Continuously The biogas sent to the flare (GM2) is measured on a continuous basis and recorded on daily basis. The value is available in Nm³. The gas flow meter is installed and values recorded regularly by skilled employees. In recording this parameter, plant's operators first manually archive the monitored data onto log sheets then transfer to the computer for electronic storage.										
Reporting frequency:	Daily basis. As per the VCS PD /27/, the operators shall archive the monitored data manually into the log sheets /05/ and then, upload and transfer the same to the electronic storage. The same was verified during the on-site visit and found OK. However no biogas was sent to flare during this monitoring period as verified during the site visit and from document review.										
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes										
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table border="1"> <tr> <td>Meter name</td><td>GM2</td></tr> <tr> <td>Serial Number</td><td>V21059-01.1</td></tr> <tr> <td>Accuracy</td><td>1%</td></tr> <tr> <td>Calibration Frequency</td><td>Once in 3 years</td></tr> <tr> <td>Calibration Date</td><td>18/06/2015, 16/06/2016</td></tr> </table>	Meter name	GM2	Serial Number	V21059-01.1	Accuracy	1%	Calibration Frequency	Once in 3 years	Calibration Date	18/06/2015, 16/06/2016
Meter name	GM2										
Serial Number	V21059-01.1										
Accuracy	1%										
Calibration Frequency	Once in 3 years										
Calibration Date	18/06/2015, 16/06/2016										
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	The accuracy class of the flow meters is as per the VCS PD /27/.										
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years.										
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency	Yes										

represent good monitoring practice?	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	W_{CH_4} Methane content in biogas in the year y (%)
Measuring frequency:	Measured by portable gas analyzer and adjusted for 90% of confidence level (MS1, MS2, MS3). Reading is taken by the plant's operators every four hours at three locations i.e. at common gas header before cleansing, before the boiler and before the gas engines in every operational day of the machines. The monitored values are adjusted which is accepted to the verification team.
Reporting frequency:	Hourly The readings are measured at three places as mentioned above every four hours and average value is considered for calculation. The final average is adjusted through estimation using 90% confidence level. CAR-02 has been raised in this regard and successfully closed. 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.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, The monitored values are adjusted which is accepted to the verification team.
Type of monitoring	The monitoring equipment details have been checked during the site visit

equipment:	and found consistent.								
	<table> <tr> <td>Meter name</td><td>MS</td></tr> <tr> <td>Serial Number</td><td>12368</td></tr> <tr> <td>Calibration Frequency</td><td>Once in three year</td></tr> <tr> <td>Calibration Date</td><td>04/05/2015</td></tr> </table>	Meter name	MS	Serial Number	12368	Calibration Frequency	Once in three year	Calibration Date	04/05/2015
Meter name	MS								
Serial Number	12368								
Calibration Frequency	Once in three year								
Calibration Date	04/05/2015								
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PD does not specify the accuracy of monitoring equipment. However, the accuracy of gas analyser represents good monitoring practice.								
Calibration frequency /interval:	According to VCS PD /27/, the gas analyzer shall be calibrated once in 3 years.								
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes								
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates were checked and the meter was found functioning properly.								
Is (are) calibration(s) valid for the whole reporting period?	Yes								
If applicable, has the reported data been crosschecked with other available data?	NA								
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.								
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.								

Monitored Parameter	Assessment/ Observation
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Data / Parameter: (as in monitoring plan of the VCS PD):	$\eta_{\text{flare-m}}$ The flare efficiency – %
Measuring frequency:	0% - conservative default value for enclosed flare in case of incomplete monitoring which is conservative and in accordance with Tool “Project emissions from flaring” version 02.0.0.
Reporting frequency:	0% - conservative default value for enclosed flare in case of incomplete monitoring which is conservative and in accordance with Tool “Project emissions from flaring” version 02.0.0.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	0% - conservative default value for enclosed flare in case of incomplete monitoring which is conservative and in accordance with Tool “Project emissions from flaring” version 02.0.0.
Type of monitoring equipment:	-
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	-
Calibration frequency /interval:	-
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	-
Company performing the calibration:	-
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	-
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	0% - conservative default value for enclosed flare in case of incomplete monitoring which is conservative and in accordance with Tool “Project emissions from flaring” version 02.0.0.
Does the data	0% - conservative default value for enclosed flare in case of incomplete

management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	monitoring which is conservative and in accordance with Tool “Project emissions from flaring” version 02.0.0.
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Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	EC _{PJ,y} Electricity consumption by wastewater treatment system and biogas plant in year y – MWh
Measuring frequency:	NA
Reporting frequency:	Calculated from rated power consumption of motors installed in wastewater treatment plant.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, however conservative approach has been taken which is accepted to the verification team. Since this approach has taken into account the distribution losses (TDL _{j,y}) and the calculation is based on an assumption that the electrical appliances will be running at full capacity on the operating days for the entire year, the QA/QC aspect has already been assured.
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA

Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	Calculation based on maximum rated consumption is conducted in a conservative manner. The installed capacity has been updated as per actuals. This list was verified during site visit against name plate details.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	TDL _{j,y} Average technical transmission and distribution losses for providing electricity to the project activity (electricity import) – %
Measuring frequency:	Annually In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Reporting frequency:	Annually In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years. Recent data available for the host country
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency	NA

/interval:	
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	6.073% (based on most recent data in 2014 published by International Energy Agency ¹) The value mentioned in the monitoring report and ER sheet has been verified with the source as per foot note 1. The reported values in the MR and ER sheet were found to be consistent.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	EG _{PJ, y} Quantity of net electricity generation supplied by the project plant/unit to the grid in year y – MWh/y
Measuring frequency:	Measured continuously. The power monitoring equipment are installed for continuous measuring of electricity produced from each generator by the Energy meters (EM1, EM2, EM3). The total electricity is summation of electricity recorded from energy meters EM1, EM2 and EM3.

¹ <http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS>

	The electricity supplied from the 4 th gas engine (measured through EM4) is not included in the calculation since it is the additional equipment after project implementation.			
Reporting frequency:	Daily 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 in compliance with the VCS PD /27/.			
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes			
Type of monitoring equipment:	The power meter (EM1) is calibrated at least once every 3 years.			
	The details of the monitoring equipment was checked during the site visit and found consistent.			
	Meter name	EM1	EM2	EM3
	Serial Number	615800 00N005 0	HT080 51884	HT090 50004
	Accuracy	1%	0.5%	0.5%
	Calibration Frequency	Once in 3 years	Once in 3 years	Once in 3 years
	Calibration Date	23/05/2012	-	-
	Valid upto	22/05/2015	-	-
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Yes			
Calibration frequency /interval:	The calibration frequency is once in three year which is in compliance with the registered VCS PD. The Calibration for EM1 has been delayed during this monitoring period for which the monitored values are adjusted by applying the maximum error of 1% which is accepted to the verification team. There is no calibration record for meters EM2 and EM3 as they are attached to the generators. CL-01 has been raise in this regard and successfully closed. Refer CL-01 for more details. It does not impact negatively either the additionality of the project activity or applicable conditions and baseline.			
Is the calibration interval in line with the monitoring plan of the VCS PD? If	No, CL-01 has been raise in this regard and successfully closed. Refer CL-01 for more details.			

the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is (are) calibration(s) valid for the whole reporting period?	No, the Calibration for EM1 has been delayed during this monitoring period for which the monitored values are adjusted by applying the maximum error of 1% which is accepted to the verification team.
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet have been verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	EG _{thermal,y} Net quantity of thermal energy supplied by the project activity during the year y (TJ)
Measuring frequency:	Deviation approach has been used as mentioned in section 2.2.1 of the MR /02/
Reporting frequency:	Due to incompleteness of the monitoring equipment, a deviation has been made to the approach specified in methodology AMS I.C. The deviated approach ensures that efficiency lost in system due to dual fired system is conservatively adjusted in baseline emissions. This means that if any efficiency loss happens due to dual fired system and the energy of same is supplied by fuel oil, using the given approach the loss is accounted in biogas usage, thereby estimating lower fuel oil replacement for baseline emission estimation. In addition, the approach does not have any negative impact on additionality of the project.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, Due to incompleteness of the monitoring equipment, a deviation has been made to the approach specified in methodology AMS I.C. The deviated approach ensures that efficiency lost in system due to dual fired system is conservatively adjusted in baseline emissions. This means that if any efficiency loss happens due to dual fired system and the energy of same is supplied by fuel oil, using the given approach the loss is accounted in biogas usage, thereby estimating lower fuel oil replacement for baseline emission

	estimation. In addition, the approach does not have any negative impact on additionality of the project.
Type of monitoring equipment:	Conservative approach has been used.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	-
Calibration frequency /interval:	-
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	-
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	-
Is (are) calibration(s) valid for the whole reporting period?	-
If applicable, has the reported data been crosschecked with other available data?	-
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet have been verified with the operator log sheets/05/.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	FC _{i,j,y} Quantity of fossil fuel used in boiler in year y. (Liters)

Measuring frequency:	As per the validated PD/27/, fossil fuel (fuel oil) is measured continuously and recorded daily. The total volume of fuel oil is summation of oil flows through flow meter OM2 (installed at inlet of boiler). It is measured continuously and recorded on daily basis in compliance with validated PD /27/.												
Reporting frequency:	Daily												
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes.												
Type of monitoring equipment:	The details of the monitoring equipment was checked during the site visit and found consistent. <table border="1"> <tr> <td>Meter name</td><td>OM</td></tr> <tr> <td>Serial Number</td><td>20320</td></tr> <tr> <td>Brand</td><td>Aqua Metro</td></tr> <tr> <td>Accuracy</td><td>$\pm 1\%$</td></tr> <tr> <td>Calibration Frequency</td><td>Once in 3 years</td></tr> <tr> <td>Calibration Date</td><td>29/06/2015, 20/06/2016, 23/07/2017</td></tr> </table>	Meter name	OM	Serial Number	20320	Brand	Aqua Metro	Accuracy	$\pm 1\%$	Calibration Frequency	Once in 3 years	Calibration Date	29/06/2015, 20/06/2016, 23/07/2017
Meter name	OM												
Serial Number	20320												
Brand	Aqua Metro												
Accuracy	$\pm 1\%$												
Calibration Frequency	Once in 3 years												
Calibration Date	29/06/2015, 20/06/2016, 23/07/2017												
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PD does not specify the accuracy of monitoring equipment. The accuracy of 1% for oil flow meters represents good monitoring practice.												
Calibration frequency /interval:	The defined calibration frequency by the PPs is at least once every 3 years. From the calibration reports it can be confirmed that the meters were calibrated within the defined calibration frequency.												
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes												
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were checked and the meter was found functioning properly.												
Is (are) calibration(s) valid for the whole reporting	Yes. The calibration is valid for the whole reporting period.												

period?	
If applicable, has the reported data been crosschecked with other available data?	The verification team has checked the fuel oil purchase records and energy balance maintained at the site which the verification team has checked and found it to be satisfactory.
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet have been verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$Q_{starch,y}$ Quantity of dry starch produced – Tonnes
Measuring frequency:	Daily In recording this parameter, plant's operators first manually archive the monitored data onto log sheets then transfer to the computer for electronic storage.
Reporting frequency:	Daily
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of	NA

calibration, does the selected frequency represent good monitoring practice?	
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	The production data is crosschecked with the sale receipts and found to be correct.
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet have been verified with the operator log sheets/05/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Remaining Issues from Validation or Previous Verification:

From the review of validation report for 2nd crediting period, Verification team has found that there is no remaining FAR.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

The verification team has reviewed the emission reduction (ER) spread sheet and checked all the formulae and found they are correct and inline with the monitoring plan of the registered VCS PD and the applied monitoring methodologies.

All the monitored parameters are described above in section 4.1. All the ex-ante parameters which are used in the calculation of emission reduction are presented in section 3.1 of the MR transparently. It is confirmed that all the ex-ante parameters have been correctly used in the emission reduction calculation.

Baseline emissions:

It is noted that the formula and calculation used for baseline emission calculation in the monitoring report and ER sheet is in compliance with the registered VCS PD. The default values and data used in the monitoring report /02/ is in-line with the registered PD/27/. Hence, accepted.

Project Emissions:

It is noted that the formula and calculation used for project emission calculation in the monitoring report and ER sheet is in compliance with the registered VCS PD. The default values and data used in the monitoring report /02/ is in-line with the registered PD/27/. Hence, accepted.

Leakage:

The used technology is not equipment transferred from another activity, therefore according to the AMS.III.H, there is no leakage to be considered. All the equipment used in the project activity for power and heat generation is either already existing or brought for purpose of project activity and there is no shifting of old equipment takes place. Therefore, there is no leakage as per AMS.I.C and AMS.I.D.

The following are the ex-ante parameters used in the ER calculation which are in compliance with registered VCS PD/27/:

Parameter	Description	Value	Unit
GWP_{CH_4}	Global Warning Potential for methane	25	-
$B_{o, ww}$	Methane producing capacity of the wastewater	0.25	kg CH_4 /kg COD
UF_{BL}	Model correction factor to account of model uncertainties	0.89	-
UF_{PJ}	Model correction factor to account of model uncertainties	1.12	-
$MCF_{ww,treatment,BL,i}$	Methane correction factor for the baseline anaerobic wastewater treatment system j	0.8	-
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for the baseline anaerobic wastewater treatment system k	0.8	-
CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems.	0.9	Fraction
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline system i	87%	%
$EF_{grid,CM,y}$	Combined margin CO_2 emission factor for grid connected power generation in year y	0.5637	t CO_2 e/MWh
FE	Flare efficiency	0%	%
DE	Destruction efficiency of the electricity generator	100%	%
$EF_{CO_2,i,y}$	Emission factor of fossil fuel replaced – Residual Fuel oil	77.4	t CO_2 /TJ
$\rho_{CH_4,n}$	Density of methane gas at reference conditions	0.716	Kg/m ³
$\eta_{BL, thermal}$	Efficiency of the boiler using fossil fuel that would have been used in the absence of the project activity	100%	-
$NCV_{i,y}$	NCV of fuel oil i.e. fossil fuel displaced by biogas	0.0404	TJ/tonne
$Q_{FO,starch}$	Liters of fossil fuel required per tonne of dry starch historically	34.3	litres/tonne
D_{FO}	Density of fuel oil	0.93	Kg/litre
P_{el}	Total electrical capacity of the equipment installed in the project activity	139.25 kW	kW

According to the applied methodologies, the conservativeness of the achieved emission reduction was checked and the calculation has been transparently provided in the ER sheet. The emission reduction is calculated using both COD approach and MD approach as specified by the applied methodology, AMS III.H., version 18. The total emission reduction for the monitoring period calculated by MD approach and by COD approach is stated below.

	Parameter	2017	Unit
AMS III. H.	ER - approach 1 (COD)	49,996	t CO_2 e

	ER - approach 2 (MD _y)	21,888	tCO ₂ e
	ER _{ww, y}	21,888	tCO ₂ e
AMS I. C.	ER _{heat, y}	6,120	tCO ₂ e
AMS I. D.	ER _{power, y}	1,789	tCO ₂ e
Total ER		29,796	tCO ₂ e

The detailed emission reduction calculation is presented in the ER spread sheet/04/. All the formulae and the calculation procedure were checked by the verification team. It was observed that the emission reduction was determined in a conservative manner.

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

During the verification site visit, all relevant documents were checked to assess the correctness and quality of data submitted by the project participants, which are used to determine emission reductions. All records needed for monitoring are archived in line with the requirements of the registered monitoring plan. No significant, lack of evidence and missing data were detected during onsite verification. Hence, the verification team confirms that the monitoring system ensures required quality of the monitoring system to ensure the quality of the monitored data. All internal data are subjected to QA/QC measures.

It was verified through onsite interviews that the plant's team involved in the monitoring of project activity is well experienced. Hence, the verification team concludes that competent staff is employed by the project proponent to carry out the relevant tasks with sufficient accuracy.

4.4 Non-Permanence Risk Analysis

Not Applicable to the project activity

5 SAFEGUARDS

5.1 No Net Harm

The project activity has no potential negative environment and social-economic impacts. Assessment team confirms it based on its on-site visit, document review and local & sectoral expertise.

5.2 Local Stakeholder Consultation

The local stakeholder consultation meeting for the project activity has been conducted at a meeting room of Chol Charoen Co., Ltd. (in Choburi) on 24 July 2008 and the process was validated during the registration of project activity under VCS. VCS validation report verified to confirm the same. Stakeholder groups were identified and informed through oral and written means. The PP had invited identified stakeholders well in advance. The stakeholder meeting process is described in the section 5.3 of the registered VCS PD in detail. Further the verification

team has interviewed the local stakeholders during the on-site visit for this verification and could not found any negative impact out of the project activity.

6 VERIFICATION CONCLUSION

KBS Certification Services Pvt. Ltd. has been contracted by 'South Pole Carbon Asset Management Ltd.' to undertake independent 1st periodic verification and certification (2nd crediting period) for the greenhouse gas (GHG) emission reductions reported from "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)", for the monitoring period 01/01/2017 to 31/12/2017 (including both the days).

The verification is based on the registered VCS PD and the monitoring report for this project activity. Our verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakech accord, as well as those defined by the CDM Executive Board and the VCS Standard Version 3.7.

The management of the 'Chol Charoen Co., Ltd.' and "South Pole Carbon Asset Management Ltd." is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Final Monitoring Report Version 02.1 and dated 22/08/2018. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of 'Chol Charoen Co., Ltd.' and "South Pole Carbon Asset Management Ltd.". The development and maintenance of records and reporting procedures are in accordance with the Monitoring Report Version 02.1 and dated 22/08/2018.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/01/2017 to 31/12/2017 based on the reported emission reductions in the Final Monitoring Report Version 02.1 and dated 22/08/2018 for the same period.

As a result of the verification, the verification team confirms that:

- All operations of the project are implemented and installed as planned and described in the project description.
- The monitoring system is in place and functional.
- The installed equipment essential for generating emission reductions runs reliably.
- The GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner.

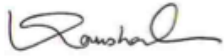
Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

Verification period: From [01-01-2017] to [31-12-2017]

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

Year	Net GHG emission reductions or removals (tCO ₂ e)
2017 (01/01/2017 to 31/12/2017)	29,796
Total	29,796

Location: Faridabad
Date: 24/08/2018



Authorized Signatory: Kaushal Goyal
Designation: Managing Director
KBS Certification Services Pvt. Ltd.

APPENDIX 1: ABBREVIATIONS

Abbreviations	Full texts
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CL	Clarification request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
DOE	Designated Operational Entity
EB	Executive Board
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse Gas(es)
MP	Monitoring Plan
MR	Monitoring Report
PD	Power Density
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCSA	VCS Association
VCS PD	VCS Project Design document

VCU	Verified Carbon Unit
VVS	Validation And Verification Standard

APPENDIX 2: REFERENCES

S. No.	Name of document	date
/1/	Draft Monitoring Report	Version 01, dated 28/02/2018
/2/	Final Monitoring Report	Version 02.1, dated 22/08/2018
/3/	Draft ER sheet	Version 01, dated 28/02/2018
/4/	Final ER sheet	Version 02, dated 09/05/2018
/5/	Daily reports for all the monitoring parameters.	-
/6/	COD Measurement from External Laboratory	-
/7/	Operating License	-
/8/	Calibration certificates for the instruments used in the project activity covering this monitoring Period	-
/9/	Competency proof of the calibrating agency.	-
/10/	Extract of manual of all the major equipments (UASB, HCLU, boiler) and all meters/measuring instruments/devices clearly indicating their specifications/technical details corresponding to the project activity. Specification of fuel oil meters Specification of portable gas analyzer specifications on flow meters	-
/11/	List of auxiliary drives along with their rated capacity	-
/12/	Operation Manual of Biogas Plant	-
/13/	COD sampling method.	-
/14/	Operation start date of the project activity, as per the first record of biogas sent to boiler.	-
/15/	Single line diagram corresponding to the project activity describing the monitoring points	-

/16/	Snap shots of the following 1. Equipments: Covering the equipment and corresponding nameplates under project boundary (all major equipments). 2. All the meters and measuring & testing equipment (including their specifications/nameplates).	-
/17/	1. Extract of operation and maintenance record 2. Records of outage	-
/18/	Competency certificates of operators.	-
/19/	Flare specification	-
/20/	All the Government approvals e.g. from local section and ministry of industry, Thailand. Operational permit.	-
/21/	Starch Production details along with the sales record.	-
/22/	Sludge removal and its application-supportive documents	-
/23/	Work Instructions for the Operation of wastewater treatment plant, emergency plan for biogas leakage, COD test and waste water sampling	-
/24/	CDM-EB: Clean Development Mechanism Validation and Verification Standard for project activity	Version 01.0
/25/	Registered VCS PD for the project "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)".	Version 3.1, dated 06/11/2009
/26/	TÜV NORD CERT GmbH: Validation report for the project "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)", report number 53208109-08/510	Dated 14/11/2009
/27/	2 nd crediting period: Registered VCS PD for the project "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)". KBS Certification Services Pvt. Ltd.: Validation report for the project "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)", report ID. VCS.18.VER.010_Crediting period renewal	Version 3, dated 21/05/2018 Dated 21/05/2018
/28/	Small-Scale CDM methodologies AMS III.H., version 18 – "Methane Recovery in Wastewater	-

	Treatment” AMS.I.D., version 18 - “Grid connected renewable electricity generation” AMS-I.C., Version 20 – “Thermal energy production with or without electricity”	
/29/	VCS Verified Carbon Standard: VCS Program Guide, VCS Version 03, v3.7	21 June 2017
/30/	VCS Verified Carbon Standard: VCS Standard, VCS Version 03, v3.7	21 June 2017
/31/	VCS Verified Carbon Standard: VCS Verification Report Template Version 3.4	19 October 2016
/32/	VCS Verified Carbon Standard: VCS Guidance, Validation and Verification Manual, Version 3.2	19 October 2016
/33/	VCS Verified Carbon Standard: VCS Monitoring Report Template Version 3.4	19 October 2016
/34/	IPCC: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, available at weblink http://www.ipcc-nggip.iges.or.jp/public/2006gl/	-
/35/	CDM-EB: Methodological tool “Project emission from flaring”	Version 02.0.0

APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Personnel Name:		Chetan Swaroop Sharma	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☒
Technical Reviewer	☒	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Energy industries (renewable/non-renewable sources)		TA 1.2: Energy generation from renewable energy sources	
		TA 1.1: Thermal energy generation from fossil fuels and	

	biomass including thermal electricity from solar
Approved by (Manager C & T)	Gagandeep Kakkar
Approval date:	09/10/2015

Personnel Name:	M P Kanal		
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☒
Technical Reviewer	☒	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope	Technical Area		
Energy industries (renewable/non-renewable sources)	TA 1.2: Energy generation from renewable energy sources		
Energy Demand	TA 3.1: Energy Demand		
Waste handling and disposal	TA 13.1. Solid waste and wastewater		
Agriculture	TA 15.1. Agriculture		
Approved by (Manager C & T)	Gagandeep Kakkar		
Approval date:	03/11/2015		

APPENDIX 4: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUESTS

Table 1. Remaining FAR from validation

No FAR raised during validation.

FAR-ID	xx	Section no.	xx	Date: xx/xx/xxxx
Description of FAR				
Project participant response				Date: xx/xx/xxxx
Documentation provided by project participant				
DOE assessment				Date: xx/xx/xxxx

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Table 2. CL from this verification

CL ID	01	Section no.	-	Date: 19/03/2018
Description of CL				
During the site visit, verification team has found that there is no calibration available for the Energy meters EM2 and EM3 (Corresponding to monitoring parameter EC _y). PP need to clarify the same.				
Project participant response				Date: 09/05/18
The power meter for EM2 and EM3 cannot be calibrated, according to the installation supplier of the generator set, SD Machinery (SEA) CO., Ltd. The manufacturer of the generator, Shengli, has issued the certificate to guarantee that the accuracy of power monitoring unit is within specification for more than ten years. To ensure the accurate function of power monitoring unit, SD Machinery who is the supplier of Sheng Dong generator in Thailand and responsible for the maintenance service of generator, will check the function of the power monitoring unit by checking the reading during the test run and record in the service report if there is any mal-function in the reading. The amount of electricity generated by Generator no. 1, 2 and 3 is deducted by 1% (max error of GM1) due to the calibration delay of GM1.				
Documentation provided by project participant				
- ER calculation sheet - Certificate for EM2 and EM3				
DOE assessment				Date: 18/05/2018
As per the clarification by the PP, EM2 and EM3 cannot be calibrated. As the meters are attached to the generators, hence the PP clarification is accepted. The meters are integral part of generators and cannot be removed. Hence this CL is closed.				

CL ID	02	Section no.	-	Date:	19/03/2018
Description of CL					
PP need to submit the calibration of the truck scale corresponding to the monitoring parameter S _{final,PJ,y} .					

Project participant response		Date: 09/05/2018
As per the calibration tag stamped by Central Bureau of Weights and Measures, the calibration date on 19/01/2016 (19/01/59) is valid until 18/01/18 (18/01/61) which covers this monitoring period.		
		
Documentation provided by project participant		
-		
DOE assessment		Date: 18/05/2018
The clarification provided by the PP seems ok and hence acceptable. Hence this CL is closed.		

Table 3. CAR from this verification

CAR ID	01	Section no.	-	Date: 19/03/2018
Description of CAR				
Verification team has found that the values for GM3 (Corresponding to monitoring parameter BG _{combusted,y}) is the ER calculation sheet /03/ are not consistent (few places) with the log sheets /05/.				
Project participant response				Date: 09/05/2018
The values from GM3 are rechecked and corrected. The corrected values are blue in ER sheet and highlighted in log sheet of GM3.				
Documentation provided by project participant				

CC_Log_GM3_2017	
DOE assessment	Date: 18/05/2018
Corrections have been done in the revised ER sheet /04/. Verification team has checked the same from the log sheet /05/ and found OK. Hence this CAR is closed.	

CAR ID	02	Section no.	-	Date: 19/03/2018
Description of CAR				
As per the monitoring parameter w_{CH_4} , The fraction of methane in the gas should be measured with a continuous analyser or, alternatively, with periodical measurements at a 90/10 confidence/precision level however the same is not clear. PP need to mention the same clearly.				
Project participant response				Date: 09/05/2018
The W_{CH_4} values are adjusted for 90/10 confidence level, the same is applied for COD readings as per the applied methodology.				
Documentation provided by project participant				
Revised MR and ER sheet				
DOE assessment				Date: 18/05/2018
Corrections have been done as per the monitoring plan /27/ and found OK. Verification team has checked the revised ER sheet /04/ and found OK. Hence this CAR is closed.				

Table 4. FAR from this verification

No FAR raised during this monitoring period.

FAR-ID	xx	Section No.		Date: DD/MM/YYYY
Description of FAR				
Project participant response				Date: DD/MM/YYYY
Documentation provided by project participant				

DOE assessment	Date: DD/MM/YYYY