



VERIFICATION REPORT 'CHOL CHAROEN GROUP WASTEWATER TREATMENT WITH BIOGAS SYSTEM I (KHONKAEN)'



Document Prepared By Carbon Check India Pvt. Ltd.

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Summary:

Carbon Check India Pvt. Ltd. (Carbon Check), commissioned by South Pole Carbon Asset Management Ltd., has verified the greenhouse gas emission reductions reported for the project activity "Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)" in Thailand, VCS Registration Reference N° 427, for the period 01/01/2019 to 14/07/2019 (under the first crediting period) with regard to the relevant requirements for VCS activities.

The objective of the verification is to have an independent review ex-post determination of the monitored reductions in GHG emission reductions, Verification was conducted using Carbon Check procedures in line with the requirements specified in the VCS Version 4.0 Requirements, VCS validation and verification manual version 3.2, CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques. The verification consisted of desk review, off-site assessment and the resolution of outstanding issues and the issuance of the final verification report and certification

The verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable VCS / CDM requirements in order to be certified.

The project was validated by TUV Nord (validation report N° 53208409-09/309 of 17/11/2009) and it was registered under the VCS registration reference N° 427.

The GHG emission reductions are calculated on the basis of the approved methodology AMS-III.H version 13, AMS-I.C version 15 and AMS-I.D version 14 and the monitoring plan included in the registered Project Design Document, version 3.1 of 13/11/2009.

During this verification, 2 clarification requests (CL) were raised related to operation, GHG emission reduction estimation, monitoring and baseline scenario of the VCS project activity in relation to all relevant VCS requirements for the project activity and the applied baseline and monitoring methodology, and these CLs are successfully closed after necessary corrections/clarifications by the client. The same has been discussed in Appendix B of this verification report.

In conclusion, it is Carbon Check's opinion that the project activity "Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)" in Thailand, VCS project ID 427, meets all relevant requirements for VCS standard and guidelines and correctly applies the baseline and monitoring methodology AMS-III.H 'Methane Recovery in Wastewater Treatment' version 13, AMS-I-D 'Grid connected renewable electricity generation' version 14 and AMS-I.C 'Thermal energy production with or without electricity' version 15. The monitoring system is in place and the emission reductions are calculated without material misstatement. Hence, Carbon Check is able to certify that the emission reductions from the project during the monitoring period 01/01/2019 to 14/07/2019 amount to 32,993 tCO₂e.

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1 INTRODUCTION

1.1 Objective

Carbon Check (India) Pvt. Ltd. has been commissioned by "South Pole Carbon Asset Management Ltd." to perform an independent verification of its VCS project, "Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)", already registered under VCS with Project ID. 427 for the reported GHG emission reductions for the given monitoring period 01/01/2019 up to 14/07/2019. The VCS projects must undergo independent third party verification and certification of emission reductions as the basis for issuance of Verified Carbon Units (VCUs).

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 Verified Carbon Units (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:

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

The project is assessed against the requirements of VCS version 4.0, VCS program guide version 4.0, validation and verification manual version 3.2 and related rules and guidance. Carbon Check has, based on the recommendations in the latest version of CDM Validation and Verification Standard, VCS validation and verification manual 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.

Verification is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

1.3 Level of Assurance

All the revisions of the verification report before being submitted to the client were subjected to an independent internal technical review to confirm that all verification activities had been completed according to the pertinent Carbon Check instructions, with reasonable level of assurance.

The technical review was performed by a technical reviewer(s) qualified in accordance with Carbon Check's qualification scheme for VCS and CDM validation and verification.

The verification team and the technical reviewers consist of the following personnel:

Role	Last Name	First Name	Country
Team Leader, verifier & Technical Expert (TA 13.1, TA 1.1)	Buragohain	Champok	India
Technical reviewer	Anand	Amit	India

1.4 Summary Description of the Project

The project activity involves installation and operation of a methane recovery and utilization system (two anaerobic covered lagoon facility (converted from open lagoon) at Kean Charoen Co. Ltd. a tapioca starch factory in Khonkaen, Thailand. Prior to project implementation, the wastewater was treated in cascading open anaerobic lagoons. The minimum depth of these ponds being more than 2m and the average atmospheric temperature in the region about 28°C, these conditions resulted in anaerobic environment within the ponds resulting in methane generation from the organic content of the wastewater, characterized by its COD, which was released into the atmosphere. The project system has been in operational since 2nd October 2006 (project start date). The starch factory has a mean daily production capacity of 175 tonnes of dries starch generating 2,000 m³ of wastewater per operational day.

The use covered lagoon technology to treat wastewater enables not only the avoidance of methane into the atmosphere but also capturing of methane produced and meeting the effluent standards. The captured methane (or biogas) is utilized as fuel in two dual-fired boilers with thermal capacity of 4.070 MW_{th} and 3.78 MW_{th}. Excess biogas is also used in two gas-based power generators of capacity 952 kW_e each. An open flaring system is available in the plant. This is an automatic flare system that will operate when the pressure is higher than 3 mbar. There is also a flame arrestor to ensure the safe operation of the flare system. The capacity of auxiliary drives is 458 kW. The details have been checked during off-site assessment and from previous verification report/**12**/.

The project site is located at Kean Charoen Co. Ltd. in Kranuan district, Khonkaen province situated in the Northeast of Thailand approximately 450 km from Bangkok. The project coordinates are 16° 48.498'N and 103° 05.148'E.

The project's initial crediting period is from 15/07/2009 to 14/07/2019 and emission reductions upto 31/12/2018 has been already verified.

As per the registered VCS PD (VCS Ref. No: 427) of the VCS project, baseline emissions are calculated as the sum of fugitive methane emissions from lagoons in the baseline case and CO₂ emissions by fossil fuel usage in the boilers in the absence of the project activity. Project emissions are calculated as the fugitive methane emissions from the project activity, the electricity consumption and the fossil fuel consumption in boilers in present scenario. The emission reduction is calculated as the difference of baseline emissions and the project emissions as the leakage emissions are considered to be negligible for the project activity as per the applied methodologies.

The project is going for the 4th verification under the first crediting period. The emission reductions are calculated conservatively as per the applied methodology.

Main components of the project activity include Acidification ponds, covered ponds with gas storage, Thermal oil boilers, Cascading open lagoons system (Evaporation ponds) and Open flaring system.

The main information of the project activity is summarized in the table below:

Project Participant(s)	Kean Chareon Co., Ltd. South Pole Carbon Asset Management Ltd.		
Project Title	Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)		
Location of the project	The project site is located Kean Charoen Co. Ltd. in Kranuan district, Khonkaen province situated in the Northeast of Thailand approximately 450 km from Bangkok. The project coordinates are 16° 48.498'N and 103° 05.148'E		
Methodology(ies)	AMS-III.H version 13, AMS-I.C version 15 and AMS-I.D version 14		
Sectoral Scope(s)	13 & 1	Carbon Check's Technical Area(s)	13.1 & 1.1
Registered PDD	Version 3.1 of 13/11/2009		
Starting date of the crediting period	15/07/2009		
Project's crediting period	15/07/2009 – 14/07/2019 (First crediting period)		
Project documentation link	https://registry.verra.org/app/projectDetail/VCS/427		

2 VERIFICATION PROCESS

2.1 Method and Criteria

Verification was conducted using Carbon Check procedures in line with the requirements specified in the VCS Requirements, i.e. VCS Program Guide, VCS Version 4 and VCS Standard, VCS Version 4.0. The GHG emission reductions are on the basis of the approved Baseline and monitoring methodology AMS-III.H version 13, AMS-I.D version 14 and AMS-I.C version 15.

The verification consisted of the following three phases

- Document review;
- Off-site assessment including Interviews;

Resolution of any Material Discrepancy and the issuance of the final verification report and certification.

The following sections outline each step in more detail.

2.2 Document Review

The monitoring report (MR) version 01 of 07/04/2020 and version 02 of 05/06/2020 **/01/**, the emission reduction calculations spreadsheet (VCS427_Chol Charoen (Khonkaen)_ER Cal_MP4CP1_v1_07042020) version 01 of 07/04/2020 and version 02 (VCS427_Chol Charoen (Khonkaen)_ER Cal_MP4CP1_v2_05022020) of 05/06/2020, were assessed as part of the verification. In addition, the registered Project Design Documents (VCS-PDs) **/02/** in particular the baseline estimations and the monitoring plan for the project were reviewed.

The following table lists the documentation that was reviewed during the verification:

/01/	South Pole Carbon Asset Management Ltd.: VCS monitoring report for the project activity "Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)", version 1.0 of 07/04/2020 and version 02 of 05/06/2020
/02/	South Pole Carbon Asset Management Ltd.: VCS project description for project activity "Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)" in Thailand, version 3.1 of 13/11/2009
/03/	South Pole Carbon Asset Management Ltd.: Emission Reduction spread sheet titled "VCS427_Chol Charoen (Khonkaen)_ER Cal_MP4CP1_v1_07042020" version 01 of 07/04/2020 and version 02 of 05/06/2020
/04/	VCS: VCS Program Guide, version 4.0, of 19/09/2019
/05/	VCS: VCS Standard, version 4.0 of 19/09/2019
/06/	CDM Executive Board: AMS-III.H 'Methane Recovery in Wastewater Treatment' version 13

/07/	CDM Executive Board: AMS-I.C 'Thermal energy for user with or without electricity' version 15
/08/	CDM Executive Board: AMS-I.D 'Grid connected renewable electricity generation' version 14
/09/	VCS: Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen) (ID: 427) https://registry.verra.org/app/projectDetail/VCS/427
/10/	VCS: Monitoring report form (MONITORING REPORT: VCS Version 4.0) , dated 19/09/2019
/11/	TUV Nord: Validation report (validation report N° 53208409-09/309 of 17/11/2009) for the project activity "Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)"
/12/	KBS Certification Services Pvt. Ltd: Verification report for the project activity 'Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)' covering the monitoring period 12/05/2016 to 31/12/2018
/13/	Daily monitoring log sheets by Kean Chareon Co., Ltd: a) Wastewater flow meter readings for the period 01/01/2019 to 14/07/2019 b) Methane content (% CH ₄) in biogas for the period 01/01/2019 to 14/07/2019 c) COD measurement of wastewater for the period 01/01/2019 to 14/07/2019 d) Biogas consumption in boiler for the period 01/01/2019 to 14/07/2019 e) Biogas consumption in generator for the period 01/01/2019 to 14/07/2019 f) Biogas consumption for flare for the period 01/01/2019 to 14/07/2019 g) Quantity of starch produced for the period 01/01/2019 to 14/07/2019 h) Quantity of furnace oil consumed in boiler 2 for the period 01/01/2019 to 14/07/2019
/14/	Calibration Reports: a) Wastewater Flow meter (FM1): Serial Number: LA020720000 Calibrated by Endress+Hauser. calibrated on 18/05/2017 b) Wastewater Flow meter (FM2): Serial Number: M102FC20000 Calibrated by Endress+Hauser. calibrated on 19/05/2017 c) Spectrophotometer with serial number HI9945I calibrated on 25/07/2016 by HANNA Instruments d) Biogas flow meter (GM4) with serial number N1-V905-9663007 calibrated on 25/04/2016 and on 11/01/2018 by Miracle International Technology Co. Ltd. e) Biogas flow meter (GM3) with serial number 5314 calibrated on 11/05/2016 and on 29/11/2018 by Miracle International Technology Co. Ltd. f) Biogas flow meter (GM2) with serial number 7568 calibrated on 28/04/2016 by Miracle International Technology Co. Ltd g) Oil meter: Serial Number: 5449943 Calibrated by Miracle International Technology Co. Ltd. on 07/05/2016 and on 29/11/2018

	h) Weighing scale: Serial Number: B406274156, B406274200, B301690263, B315226070 and B316230849; Calibrated by inhouse laboratory on 06/06/2018 and on 15/05/2019 i) Portable gas analyser: Serial Number: G503004; By QED Environmental Systems Ltd. on 21/11/2016 j) Weighing bridge: Serial number: 0008666; Calibrated by Central Bureau of Weights and Measures on 18/05/2017 and on 04/06/2019
/15/	List of Accredited Laboratories; webpage https://www.tisi.go.th/home/en in English language retrieved on 25/03/2020
/16/	The World Bank: Electric power transmission and distribution losses (% of output); weblink https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS in English accessed on 25/03/2020
/17/	UNFCCC: CDM Executive Board agrees to relax mandatory site visits by DOEs for a period of three months (23 March to 23 June 2020) because of COVID-19; Website ' https://cdm.unfccc.int/newsroom/latestnews/releases/2020/01041_index.htm ' in English language retrieved on 03/04/2020
/18/	South Pole Carbon Asset Management Ltd.: E-mail communicated between South Pole Carbon Asset Management Ltd. and VERRA regarding site visit exclusion due to COVID-19 impact dated 31/03/2020 VERRA guidance: https://verra.org/covid-19-travel-guidance/
/19/	UNFCCC: SSC_324: Determination of the flare efficiency for project activity involving combustion and/or flaring of recovered methane, dated 29-07-2009
/20/	Boiler Inspection report: Boiler 1 with serial number 10036 of Scherrer Industries inspected on 17/11/2019 and Boiler 2 with serial number 99038 of Scherrer Industries inspected on 17/11/2019
/21/	Environment & Laboratory Co. Ltd.: COD analysis report for the year 2019

2.3 Interviews

The key personnel interviewed and the main topics of the interviews are summarized in the table below:

	Date	Name and Role	Organization	Topic
/a/	15/04/2020 & 04/06/2020	Ms. Suwipa Rukwongtrakool - Project Manager	South Pole Carbon Asset Management Ltd.	Monitoring report, emission reduction calculations, records of monitoring parameters, VCS rules, application of methodology etc.

/b/	15/04/2020 & 04/06/2020	Mr. Preecha Suwannasim- Factory Manager	Kean Chareon Co., Ltd.	Technical aspects of the project activity. Operational life, environmental aspects etc.
/c/	15/04/2020 & 04/06/2020	Ms. Kwanroen Somchob- Head of biogas		Operational details of the project, management structure, legal compliance, health, safety and environmental aspects, data monitoring and recording procedure, safety practices, production controls, internal audits etc.
/d/	04/06/2020	Mr. Buapan Srisomkut	Local Farmer	Stakeholder interaction regarding views and impact from project activity in local area including health, safety and environmental aspects.
/e/	04/06/2020	Mr. Chanchai Kamkoon	Local Farmer	

2.4 Site Inspections

Site visit for the subject project activity was avoided due to travel restrictions imposed due to COVID-19 impact. The validation body noted VERRA guideline on travel due to COVID-19 (<https://verra.org/covid-19-travel-guidance/>) and e-mail communication between project participant and VERRA dated 31/03/2020 clarifies that VERRA standard do not mandate site visit to be conducted in person /18/. VVB also noted CDM Executive Board's decision to relax mandatory site visits by DOEs for a period of three months (23 March to 23 June 2020) because of COVID-19 /17/. The alternative means used for the purpose of verification are demonstrated as follow.

The audit team has carried out off site interviews (over phone call and video call) to assess the information included in the project documentation and to gain additional information regarding the compliance of the project with the relevant criteria applicable for the verification. During the desk review, the relevant documents, including the registered VCS-PD and corresponding validation reports for the 1st crediting period, the previous periodic monitoring report and verification reports, the picture of nameplate of the main equipment, the picture of monitoring meters and other relevant background documents were provided and assessed. The audit team can confirm the project operation and monitoring are consistent with registered monitoring plan, last monitoring report and verification report.

The validation report and previous verification reports were checked, comparing the relevant evidence and off-site interview with the PP representative and operation staff through telephone and video call, Carbon Check team has confirmed that the project is implemented in line with the PDD and the monitoring system is in line with the latest approved VS-PD and latest MR. Therefore, a reasonable level of assurance was achieved without an in-person site visit.

2.5 Resolution of Findings

The objective of this phase of the verification is to resolve any outstanding issues which need to be clarified for Carbon Check's positive conclusion on the project description. To guarantee transparency a verification protocol has been customized for the project. The protocol shows in a transparent manner the requirements, means of verification and the results from verifying the identified criteria. The verification protocol consists of three tables; the different columns in these tables are described below.

A corrective action request (CAR) is raised if one of the following occurs:

- Non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient;
- Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impair the estimate of emission reductions;
- Issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.

A clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable VCS requirements have been met.

In summary, 2 CLs were raised during this verification which were closed successful and details are given under Appendix B of this report.

2.5.1 Forward Action Requests

Based on the review of the validation report /11/ and previous verification report /12/, it is noted that 4 (four) FARs raised during validation and all are closed during first verification with one FAR (FAR M3) addressed with a deviation as described in section 3.3 below. Therefore, there are no FAR which needs to be closed during this verification.

2.6 Eligibility for Validation Activities

The project activity is registered under VCS registration reference Number 427 /09/, hence this section is not applicable.

3 VALIDATION FINDINGS

The project was validated by TUV Nord (validation report N° 53208409-09/309 of 17/11/2009) and it was registered under the VCS registration reference N° 427. The first crediting period is from 15/07/2009 – 14/07/2019. This verification assessment for the monitoring period 01/01/2019 to 14/07/2019 falls under the first crediting period.

3.1 Participation under Other GHG Programs

The project is registered only under VCS and not registered in any other GHG program.

3.2 Methodology Deviations

Methodology applied in the registered project activity remains same; although 2 deviations are applied in calculation formula from the stated one in applied methodology as described below:

Data/parameters /variables	Reference of the methodology	Description of deviation	Assessment by audit team
The baseline emissions from the heat displaced by the project activity $BE_{thermal,CO_2}$ is estimated through an alternative equation against the prescribed equation by the applied methodology.	AMS I.C., version 15 Para 15, Equation 2 & Para 30 (b)	Since there is no metering mechanism for measurement of net quantity of heat supplied by the project activity ($EG_{y,Thermal}$), an alternative approach is used. This approach is based on amount of heat required for starch drying, which 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 biogas, irrespective of quantity of biogas combusted. The deviated approach ensures that efficiency lost in system due to dual fired system is conservatively adjusted in the baseline emissions.	The deviated approach described in the section 4.1, of the final PD ver. 3.1 is verified by the validation team and found to be conservative as efficiency loss due to dual fired system is accounted in biogas usage, thereby estimating lower fuel oil replacement for baseline emission estimation. Thus the deviated approach is deemed appropriate and hence acceptable to the validation team. Thus the audit team confirms that the deviations do not affect the conservativeness of the baseline. The deviation is adopted from first verification of the project.

Flare efficiency is assumed 100% in case of combustion MDy (i.e. gainful utilisation of biogas in boiler and gas engine. Whereas it need to be measured as per the applied methodology.	Paragraph 32 and equation 16 of AMS III.H. Ver.13.	In the case that biogas is combusted for a gainful use of the released energy, a flare efficiency (combustion efficiency in boiler and gas engines) can be assumed to be 100% in case calculation of MDy.	This approach has been confirmed by the SSC WG on 29th July 2009 /19/, who agreed to include such approach in a future revision of AMS III.H. Based on this, it can be concluded that the adopted approach is appropriate and acceptable.
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3.3 Project Description Deviations

As per FAR M3 raised during validation, PP adopted a deviation is project as discussed below:

Deviation: The boiler 1 was replaced by the new bigger one. The capacity of thermal energy output was changed from 3.488 to 4.070 MW_{th}. As per description in FAR M3 of the validation report, if existing boiler is replaced with a new one during any verification no emission reduction shall be granted for heat displacement. Hence the heat displacement at this boiler was neglected from the emission reductions.	Audit team assessment: PPs have excluded the fossil fuel displacement from the boiler 1 from the emission reduction calculation. The approach has been considered to be appropriate. PP has been following this approach from the first verification and being a conservative approach, the deviation is accepted.
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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

Implementation of the project activity has been assessed through document review, off-site interview and video call with project proponent. The project activity involves the installation and operation of a methane recovery and utilization system (covered lagoon system). The captured methane (biogas) is utilized as fuel in dual fire boilers replacing fossil fuel (i.e. HFO) and gas engines for electricity generation. As per the registered VCS PD, there are two dual fired boilers of 3.488 MWth and 3.78 MWth capacities. However, from first verification onwards, the boiler with capacity 3.488 MWth was replaced with a new boiler of capacity 4.070 MWth. On a conservative side PP decided not to claim emission reduction from the new boiler as explained in section 3.3 above. The capacity of each boiler confirmed from photographic evidence and boiler inspection certificate /20/. According to the VCS PD, the captured biogas is also utilised in two gas engines each having a capacity of 952 kWe. From first verification onwards it was noted that two additional gas engines of 450 kWe have also been installed. The baseline emissions on account of biogas utilisation in these two gas engines have not been included in the emission reduction calculation. This is confirmed based on the review of ER sheet and previous verifications. The photographic evidence and log sheets are used to cross check the gas generators.

The project boundary is the physical, geographical site where the wastewater treatment takes place in baseline and project situation. It covers all facilities affected by the project activity including sites where the processing, transportation and application or disposal of waste products as well as biogas takes place.

Based on document review, off-site interview and video call, it is confirmed that all the emission sources within the boundary have been considered appropriately. Monitoring of all parameters during the monitoring period is followed as per registered monitoring plan except the deviations described in section 3.2 above.

Data parameters fixed ex-ante and available at validation are given below:

DATA/PARAMETER Unit	Source of data	Reported value for the project period	Assessment/Observation
Global Warming Potential for	Data based on registered PD /02/ and	25	The value is ex-ante fixed for 10 years crediting period as per the registered PD. The

Methane (GWP_{CH_4}) in tCO_2e/tCH_4	validation report /11/		value is as per IPCC fourth assessment report. Hence, correct value is considered.
Methane producing capacity of the wastewater ($B_{o,ww}$); $kg\ CH_4/kg\ COD$	Data based on registered PD /02/ and validation report /11/	0.21	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Model correction factor to account for model uncertainties (UF_{BL})	Data based on registered PD /02/ and validation report /11/	0.94	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Model correction factor to account for model uncertainties (UF_{PJ})	Data based on registered PD /02/ and validation report /11/	1.06	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Methane correction factor for baseline wastewater treatment systems i ($MCF_{ww,treatment,BL,Lagoon}$)	Data based on registered PD /02/ and validation report /11/	0.8	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Methane correction factor for project wastewater treatment systems equipped with biogas recovery ($MCF_{ww,treatment,PJ,CL}$)	Data based on registered PD /02/ and validation report /11/	0.8	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Methane correction factor for project secondary treatment systems k ($MCF_{ww,treatment,PJ,Lagoon}$)	Data based on registered PD /02/ and validation report /11/	0.8	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.

Chemical oxygen demand removal efficiency of baseline treatment system; %	Data based on registered PD /02/ and validation report /11/	87.16%	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Capture efficiency of the biogas recovery equipment in the wastewater treatment systems ($C_{FE_{ww}}$)	Data based on registered PD /02/ and validation report /11/	0.9	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
CO ₂ emission factor for grid power (EF_Y); tCO ₂ /MWh	Data based on registered PD /02/ and validation report /11/	0.5057	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Emission factor of fossil fuel replaced – Residual Fuel oil (EF_{CO_2}); tCO ₂ /TJ	Data based on registered PD /02/ and validation report /11/	77.4	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
NCV of fuel oil i.e. fossil fuel displaced by biogas (NCV_{FO}); GJ/tonne	Data based on registered PD /02/ and validation report /11/	42.76	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
NCV of biogas (NCV_{biogas}); MJ/Nm ³	Data based on registered PD /02/ and validation report /11/	20.93	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Liters of fossil fuel required per tonne of	Data based on registered PD	39.6	The value is ex-ante fixed for 10 years crediting period as

dry starch historically ($Q_{FO, starch}$); L/tonne	/02/ and validation report /11/		per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Density of methane gas at reference conditions (D_{CH_4}); kg/m ³	Data based on registered PD /02/ and validation report /11/	0.716	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Density of fuel oil (D_{FO}); Kg/litre	Data based on registered PD /02/ and validation report /11/	0.93	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Flare efficiency (FE) (%)	Data based on registered PD /02/ and validation report /11/	50%	Default value taken as per applicable tool which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Destruction efficiency of the electricity generator (DE; %)	Data based on registered PD /02/ and validation report /11/	100%	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
Total electrical capacity of the equipment installed in the project activity (P_{el}); kW	Data based on registered PD /02/ and validation report /11/	458	The value is fixed ex-ante as per registered PD was 277 kW which was found to be 458 kW during first verification and accordingly used for subsequent verifications.

Data parameters monitored:

Data/Parameter	Assessment
Data Unit	$Q_{y, ww}$; m ³
Description	Volume of wastewater treated in the year y
Source of data to be used	Measured – Volumetric flow meters (FM1 & FM2)

Value of monitored parameter for the monitoring period	Period		Total value (m³)
	01/01/2019 to 14/07/2019		368,579
	The values mentioned in the monitoring report and ER sheet have been verified with the daily log book reports /13 (a)/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.		
Monitoring equipment	Tag No.	Serial Number	Model
	FM1	LA020720000	Endress Hauser
	FM2	M102FC20000	Endress Hauser
Accuracy of the monitoring equipment	PP has installed flow meter with an accuracy class of ±0.50%. The accuracy of the meters are as per industry standard.		
Measuring/Reading/Recording frequency	Continuous monitoring, recording on the daily basis.		
Calcualtion method (if applicable)	Values as recorded in flow meter is taken and no calculation method is applied.		
Calibration			
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	The flow meter is calibrated at least once every 3 years. This is consistent with registered monitoring plan and previous verifications and hence accepted.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The flow meter FM1 was calibrated on 18/05/2017 (valid until 17/05/2020). Flow meter FM2 was calibrated on 19/05/2017 (valid until 18/05/2020). Hence, the calibration of flow meter covers the monitoring period.		
Calibration certificates	Serial no.	Calibration details	
	LA020720000 (FM 1)	Calibrated by by Endress+Hauser on 18/05/2017 (14 (a)).	
	M102FC20000 (FM 2)	Calibrated by Endress+Hauser on 19/05/2017 (14 (b)).	
Whether calibration done by an accredited person or institution?	Endress+Hauser is the manufacturer of the flow meters and accredited to do calibration.		

Data/Parameter	Assessment
Data Unit	COD _{ww,untreated,y} ; mg/l

Description	The chemical oxygen demand of the wastewater entering the covered lagoon reactor system						
Source of data to be used	Measured – Colorimetric method						
Value of monitored parameter for the monitoring period	<table border="1"> <tr> <th>Monitoring period</th><th>Average value(mg/l)</th></tr> <tr> <td>01/01/2019 to 14/07/2019</td><td>35,178</td></tr> </table> The values mentioned in the monitoring report and ER sheet have been verified with log book reports /13 (c)/. The reported values in the MR and ER sheet were found to be consistent with the lab analysis reports and the operator log sheet information. The wastewater samples are sent to an external laboratory once in a year as per the monitoring plan. The verification team confirms that the COD values determined by the internal laboratory are close to that of external laboratory results /21/.	Monitoring period	Average value(mg/l)	01/01/2019 to 14/07/2019	35,178		
Monitoring period	Average value(mg/l)						
01/01/2019 to 14/07/2019	35,178						
Monitoring equipment	Spectrophotometer: <table border="1"> <tr> <td>Brand</td><td>Hanna</td></tr> <tr> <td>Type</td><td>HI83214</td></tr> <tr> <td>Serial number</td><td>HI19945I</td></tr> </table>	Brand	Hanna	Type	HI83214	Serial number	HI19945I
Brand	Hanna						
Type	HI83214						
Serial number	HI19945I						
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment. However, the PP has installed latest Spectrophotometer with an accuracy class of 10 mg/l (HR) & 1 mg/l (LR). The verification team is of the opinion that the accuracy of the meter represents good monitoring practice.						
Measuring/Reading/Recording frequency	As per registered monitoring plan it is required to be done on daily basis. Wastewater samples are collected and the COD measurement is carried out on every operational day and the results are recorded in log book. The Colorimetric method is well documented and well accepted by international standards.						
Calculation method (if applicable)	Values as recorded from measurement method is taken and no calculation method is applied.						
Calibration							
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Calibration frequency is defined least once in every 3 years. This is consistent with registered monitoring plan and previous verifications and hence accepted.						

Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The spectrophotometer was calibrated on 25/07/2016 (valid until 24/07/2019) /14(c)/. Hence, the calibration covers the monitoring period. The calibration frequency has been checked with calibrations records and found that the calibration frequency has been respected.	
Calibration certificates	Serial no.	Calibration details
	HI9945I	Calibrated by HANNA Instruments on 25/07/2016 (14 (c)).
Whether calibration done by an accredited person or institution?	HANNA Instruments (Thailand) Ltd. Which is accredited laboratory to do the calibration.	

Data/Parameter	Assessment	
Data Unit	COD _{out,lagoon,PJ,y} ; tCOD/m ³	
Description	The chemical oxygen demand of the wastewater coming out of the last lagoon	
Source of data to be used	Measured – Colorimetric method	
Value of monitored parameter for the monitoring period	Monitoring period	Average value(tCOD/m ³)
	01/01/2019 to 14/07/2019	0.000203
	The values mentioned in the monitoring report and ER sheet have been verified with log book reports /13(c)/. The reported values in the MR and ER sheet were found to be consistent with the lab analysis reports and the operator log sheet information. The wastewater samples are sent to an external laboratory once in a year as per the monitoring plan. The verification team confirms that the COD values determined by the internal laboratory are close to that of external laboratory results /21/.	
Monitoring equipment	Spectrophotometer:	
	Brand	Hanna
	Type	HI83214
	Serial number	HI19945I
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment. However, the PP has	

	installed latest Spectrophotometer with an accuracy class of 10 mg/l (HR) & 1 mg/l (LR). The verification team is of the opinion that the accuracy of the meter represents good monitoring practice.	
Measuring/Reading/Recording frequency	As per registered monitoring plan it is required to be done on daily basis. Wastewater samples are collected and the COD measurement is carried out on every operational day and the results are recorded in log book. The Colorimetric method is well documented and well accepted by international standards.	
Calculation method (if applicable)	Values as recorded from measurement method is taken and no calculation method is applied.	
Calibration		
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Calibration frequency is defined least once in every 3 years. This is consistent with registered monitoring plan and previous verifications and hence accepted.	
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The spectrophotometer was calibrated on 25/07/2016 (valid until 24/07/2019) /14(c)/. Hence, the calibration covers the monitoring period. The calibration frequency has been checked with calibrations records and found that the calibration frequency has been respected.	
Calibration certificates	Serial no.	Calibration details
	HI9945I	Calibrated by HANNA Instruments on 25/07/2016 (14 (c)).
Whether calibration done by an accredited person or institution?	HANNA Instruments (Thailand) Ltd. Which is accredited laboratory to do the calibration.	

Data/Parameter	Assessment		
Data Unit	COD _{out,CL,y} ; tCOD/m ³		
Description	The chemical oxygen demand of the wastewater coming out of the covered lagoon		
Source of data to be used	Measured – Colorimetric method		
Value of monitored parameter for the monitoring period	Monitoring period	Average CL 1 (tCOD/m ³)	Average CL 2 (tCOD/m ³)

	<table><tr><td>01/01/2019 to 14/07/2019</td><td>0.00118</td><td>0.00121</td></tr><tr><td>Average</td><td colspan="2">0.00119</td></tr></table>	01/01/2019 to 14/07/2019	0.00118	0.00121	Average	0.00119	
01/01/2019 to 14/07/2019	0.00118	0.00121					
Average	0.00119						
	The values mentioned in the monitoring report and ER sheet have been verified with log book reports /13(c)/. The reported values in the MR and ER sheet were found to be consistent with the lab analysis reports and the operator log sheet information. The wastewater samples are sent to an external laboratory once in a year as per the monitoring plan. The verification team confirms that the COD values determined by the internal laboratory are close to that of external laboratory results /21/.						
Monitoring equipment	Spectrophotometer: <table><tr><td>Brand</td><td>Hanna</td></tr><tr><td>Type</td><td>HI83214</td></tr><tr><td>Serial number</td><td>HI19945I</td></tr></table>	Brand	Hanna	Type	HI83214	Serial number	HI19945I
Brand	Hanna						
Type	HI83214						
Serial number	HI19945I						
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment. However, the PP has installed latest Spectrophotometer with an accuracy class of 10 mg/l (HR) & 1 mg/l (LR). The verification team is of the opinion that the accuracy of the meter represents good monitoring practice.						
Measuring/Reading/Recording frequency	As per registered monitoring plan it is required to be done on daily basis. Wastewater samples are collected and the COD measurement is carried out on every operational day and the results are recorded in log book. The Colorimetric method is well documented and well accepted by international standards.						
Calculation method (if applicable)	Values as recorded from measurement method is taken and no calculation method is applied.						
Calibration							
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Calibration frequency is defined least once in every 3 years. This is consistent with registered monitoring plan and previous verifications and hence accepted.						
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The spectrophotometer was calibrated on 25/07/2016 (valid until 24/07/2019) /14(c)/. Hence, the calibration covers the monitoring period. The calibration frequency has been						

	checked with calibrations records and found that the calibration frequency has been respected.	
Calibration certificates	Serial no.	Calibration details
	HI9945I	Calibrated by HANNA Instruments on 25/07/2016 (14 (c)).
Whether calibration done by an accredited person or institution?	HANNA Instruments (Thailand) Ltd. Which is accredited laboratory to do the calibration.	

Data/Parameter	Assessment		
Data Unit	BG _{combusted,y} ; Nm ³		
Description	Amount of biogas combusted for gainful use		
Source of data to be used	Measured using Gas flow meters at boiler (GM 4) and generation sets (GM 3)		
Value of monitored parameter for the monitoring period	Monitoring Period		Total value (Nm ³)
	01/01/2019 to 14/07/2019		3,262,040
	There are 3 gas meters installed for measurement of biogas combusted (GM 1-boiler 1, GM 4-boiler 2 and GM 3-generators). However, as per deviation, the biogas value from boiler 1 (GM 1) was excluded from the biogas combusted for a conservative estimation of baseline emissions. Monitored values of GM 4 and GM 3 mentioned in the monitoring report and ER sheet have been verified with the daily reports /13(d),(e)/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.		
Monitoring equipment	Tag No.	Serial Number	Brand
	GM4	N1-V905-9663007	Siemens
	GM3	5314	Fox
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment. The accuracy of the meters is as per industry standard.		
Measuring/Reading/Recording frequency	Continuous monitoring and daily recording for emission reduction calculation.		
Calcualtion method (if applicable)	Values as recorded in flow meter is taken and no calculation method is applied.		
Calibration			

Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	The flow meter is calibrated at least once every 3 years as per registered monitoring plan.	
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The flow meter N1-V905-9663007 (GM 4) was calibrated on 25/04/2016 (valid until 24/04/2019) and on 11/01/2018 (valid until 10/01/2021) /14(d)/. Also, GM3 (5314) was calibrated on 11/05/2016 (valid until 10/05/2019) and on 29/11/2018 (valid until 28/11/2021 /14(e)/). Hence, calibration cover the monitoring period.	
Calibration certificates	Meter no.	Calibration details
	N1-V905-9663007	By Miracle International Technology Co. Ltd. calibrated on 25/04/2016 and on 11/01/2018 /14(d)/
	5314	By Miracle International Technology Co. Ltd. calibrated on 11/05/2016 and on 29/11/2018 /14(e)/.
Whether calibration done by an accredited person or institution?	Miracle International Technology Co. Ltd. is accredited for calibration /15/.	

Data/Parameter	Assessment		
Data Unit	W _{CH₄,y} ; %		
Description	Methane content in the biogas		
Source of data to be used	Measured using gas analyzer or using portable gas analyzer.		
Value of monitored parameter for the monitoring period			
	Period	Lower value	Upper value
	01/01/2019 to 14/07/2019	52.5%	53.7%
	Average	53.1%	
	During the monitoring period online monitoring equipment was not available and therefore, PP used portable gas analyzer for periodic measurement and the measured values were applied 95% confidence level. This is in consistent with registered monitoring plan. The lower and upper values are used for calculation of baseline		

	and project emission calculation in a conservative manner. The average value mentioned in the monitoring report and ER sheet have been verified with the daily reports /13(b)/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.	
Monitoring equipment	Serial number	G503004
	Model/Brand	Geotech/Biogas 5000
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment. However, the accuracy of gas analyser is 0.5% as per the specification of the equipment.	
Measuring/Reading/Recording frequency	Periodic using a portable gas analyser. Measurement follows 95% confidence interval which is consistent with the applied methodology.	
Calcualtion method (if applicable)	Values as recorded in monitoring device is taken and no calculation method is applied.	
Calibration		
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	The analyser is calibrated at least once every 3 years as per registered monitoring plan.	
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The gas analyser was calibrated on 21/11/2016 (valid until 20/11/2019)/14(i)/. Hence calibration cover the monitoring period.	
Calibration certificates	Serial no.	Calibration details
	G503004	By QED Environmental Systems Ltd. on 21/11/2016 /14(i)/
Whether calibration done by an accredited person or institution?	QED Environmental Systems Ltd. is accredited to calibrate the gas analyser.	

Data/Parameter	Assessment
Data Unit	$BG_{to\ Flare,y}/Q_{biogas,flare,h}; Nm^3$
Description	Amount of biogas sent to flare
Source of data to be used	Measured using Gas flow meter (GM2)
Value of monitored parameter for the monitoring period	0 (Zero). During the monitoring period no flaring was recorded as verified with the daily reports /13(f)/. The reported values in the MR and ER sheet were

	found to be consistent with the daily reports and the operator log sheet information.								
Monitoring equipment	<table><tr><td>Tag No.</td><td>Serial Number</td><td>Brand</td></tr><tr><td>GM2</td><td>7568</td><td>FOX</td></tr></table>			Tag No.	Serial Number	Brand	GM2	7568	FOX
Tag No.	Serial Number	Brand							
GM2	7568	FOX							
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment. The accuracy of the meter is as per industry standard.								
Measuring/Reading/Recording frequency	Continuous monitoring and daily recording.								
Calcualtion method (if applicable)	Values as recorded in flow meter is taken and no calculation method is applied.								
Calibration									
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	The flow meter is calibrated at least once every 3 years as per registered monitoring plan.								
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The low meter was calibrated on 28/04/2016 (valid until 27/04/2019)/14(f)/. Although there is gap in calibration, there was no flow of biogas for flaring and hence the delay has no impact on the emission reduction calculation.								
Calibration certificates	<table><tr><td>Serial no.</td><td>Calibration details</td></tr><tr><td>7568</td><td>By Miracle International Technology Co. Ltd. on 28/04/2016 /14(f)/</td></tr></table>			Serial no.	Calibration details	7568	By Miracle International Technology Co. Ltd. on 28/04/2016 /14(f)/		
Serial no.	Calibration details								
7568	By Miracle International Technology Co. Ltd. on 28/04/2016 /14(f)/								
Whether calibration done by an accredited person or institution?	Miracle International Technology Co. Ltd. is accredited for calibration /15/.								

Data/Parameter	Assessment				
Data Unit	$q_{HFO,y}$; Liters/y				
Description	Quantity of fossil fuel used in boiler in year y				
Source of data to be used	Measured by continuous Fuel oil meter				
Value of monitored parameter for the monitoring period	<table border="1"> <tr> <th>Monitoring period</th><th>Total value (Litres)</th></tr> <tr> <td>01/01/2019 to 14/07/2019</td><td>68,566</td></tr> </table> There are two boilers at the starch factory. However, as per deviation, the oil consumption in boiler 1 is excluded in a conservative manner. The	Monitoring period	Total value (Litres)	01/01/2019 to 14/07/2019	68,566
Monitoring period	Total value (Litres)				
01/01/2019 to 14/07/2019	68,566				

	reported value for boiler 2 (above) are checked from log book records /13(h)/.		
Monitoring equipment	Tag No.	Serial Number	Model
	OM 2 (Boiler 2)	5449943	CONTOIL
Accuracy of the monitoring equipment	1% as per equipment specification.		
Measuring/Reading/Recording frequency	Defined frequency is continuous measurement and daily recording.		
Calcualtion method (if applicable)	Values as recorded in oil meter method is taken and no calculation method is applied.		
Calibration			
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Calibration frequency is once in three years.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Monitoring period is from 01/01/2019 to 14/07/2019. Flow meter was calibrated on 07/05/2016 (valid until 06/05/2019) and on 29/11/2018 (valid until 28/11/2021).		
Calibration certificates	Serial no.	Calibration details	
	5449943	By Miracle International Technology Co. Ltd. on 07/05/2016 and on 29/11/2018 /14(g)/	
Whether calibration done by an accredited person or institution?	Miracle International Technology Co. Ltd. is accredited for calibration /15/.		

Data/Parameter	Assessment	
Data Unit	Q _{starch,y} ; Tonnes	
Description	Quantity of dry starch produced	
Source of data to be used	Based on operational log sheet at the plant	
Value of monitored parameter for the monitoring period	Period	Total value (Ton)
	01/01/2019 to 14/07/2019	39,886
	This was checked from log book records /13(g)/.	
Monitoring equipment	Type	Weighing scale
	Sl. Number	B406274156 B406274200 B301690263 B315226070

		B316230849
	Brand/Model	Ohaus / T32XW
Accuracy of the monitoring equipment	±2% accuracy class is as per industry standard.	
Measuring/Reading/Recording frequency	Defined frequency is daily measurement and daily recording.	
Calcualtion method (if applicable)	Values as recorded in weighing scale is taken and no calculation method is applied.	
Calibration		
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Calibration frequency is once in a year.	
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The weighing scales were calibrated on 06/06/2018 (valid until 05/06/2019) and on 15/05/2019 (valid until 14/05/2020). Therefore, calibration cover the monitoring period.	
Calibration certificates	Serial no.	Calibration details
	B406274156	Calibrated by inhouse laboratory on 06/06/2018 and on 15/05/2019
	B406274200	
	B301690263	
	B315226070	
B316230849		
Whether calibration done by an accredited person or institution?	Calibration is done by inhouse lab with traceability to national standard.	

Data/Parameter	Assessment						
Data Unit	EG _y ; MWh/year						
Description	Net electricity produced by the generators during the year y						
Source of data to be used	Measured – Electricity meters installed at the generation sets						
Value of monitored parameter for the monitoring period	The energy meters are not calibrated during the entire monitoring period and hence PP has considered conservatively zero value for the parameter.						
Monitoring equipment	<table><tr><th>Type</th><th colspan="2">Energy Meter</th></tr><tr><td>Sl. Number</td><td>62560 1 00N0030</td><td>62560 1 00N0034</td></tr></table>	Type	Energy Meter		Sl. Number	62560 1 00N0030	62560 1 00N0034
Type	Energy Meter						
Sl. Number	62560 1 00N0030	62560 1 00N0034					

	Brand	CARLO GAVAZZI	CARLO GAVAZZI
Accuracy of the monitoring equipment	±0.5%		
Measuring/Reading/Recording frequency	Continuous monitoring and daily recording.		
Calculation method (if applicable)	Since no value is considered during the monitoring period and no calculation method is applicable.		
Calibration			
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Calibration frequency is once in a three years.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The energy meters are not calibrated during the entire monitoring period and hence PP has considered conservatively zero value for the parameter		
Calibration certificates	Calibration was not done during the monitoring period.		
Whether calibration done by an accredited person or institution?	Calibration was not done during the monitoring period.		

Data/Parameter	Assessment	
Data Unit	EC _y ; MWh	
Description	Electricity consumption by wastewater treatment plant in year y	
Source of data to be used	Maximum rated consumption is calculated by multiplying total electrical capacity with actual operational days and 24 hours each day and 10% additional factor to be conservative.	
Value of monitored parameter for the monitoring period	Period	Total value (MWh)
	01/01/2019 to 14/07/2019	2,358
	The load factor of 10% has been added to actual rated capacity of equipments connected to the project activity which is as per registered VCS-PD.	
Monitoring equipment	A default approach is applied and hence no monitoring equipment is needed.	
Accuracy of the monitoring equipment	A default approach is applied and hence no monitoring equipment is needed.	

Measuring/Reading/Recording frequency	A default approach is applied and hence no monitoring is done.
Calculation method (if applicable)	Maximum rated consumption is calculated by multiplying total electrical capacity with actual operational days and 24 hours each day and 10% additional factor to be conservative.
Calibration	
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Since, no monitoring equipment is used, no calibration is applicable.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Since, no monitoring equipment is used, no calibration is applicable.
Calibration certificates	Since, no monitoring equipment is used, no calibration is applicable.
Whether calibration done by an accredited person or institution?	Since, no monitoring equipment is used, no calibration is applicable.

Data/Parameter	Assessment
Data Unit	Sludge removed and its application; ton
Description	The quantity of organic material / sludge removed from treatment plant and its application
Source of data to be used	Weighing equipment available at the site are used
Value of monitored parameter for the monitoring period	Zero (0). Sludge was not removed during the monitoring period. This is confirmed based on off-site interviews.
Monitoring equipment	Weighing scale. Serial Number: 0008666 Type: HP-05K
Accuracy of the monitoring equipment	Accuracy of weighing bridge is ± 20 kg.
Measuring/Reading/Recording frequency	Whenever the sludge is removed, the quantity shall be recorded and documented. However, no sludge was removed during the monitoring period.
Calculation method (if applicable)	Zero value is reported and no calculation method is applied.

Calibration		
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Calibration frequency is once in two years.	
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/01/2019 to 14/07/2019. The weighing scales were calibrated on 18/05/2017 (valid until 17/05/2019) and on 04/06/2019 (valid until 03/06/2021). Therefore, calibration cover the monitoring period.	
Calibration certificates	Serial no.	Calibration details
	0008666	Calibrated by Central Bureau of Weights and Measures on 18/05/2017 and on 04/06/2019 /14(j)/.
Whether calibration done by an accredited person or institution?	Central Bureau of Weights and Measures is government entity to calibrate weighing scales.	

Data/Parameter	Assessment
Data Unit	$\eta_{\text{Flare-h}}$; %
Description	Flare efficiency
Source of data to be used	Default value as per "Tool to determine project emissions from flaring gases containing methane".
Value of monitored parameter for the monitoring period	The flare efficiency shall be determined based on the flame detection period. According to the monitoring plan of the VCS PD, "The default factor of 50% might be only applied if a flame is detected at the flare for more than 20 minutes in hour h, whenever biogas is sent to the flare system. If these conditions are not met, 0% default value should be used for this period". Since no flaring was done during the monitoring period, 0% flare efficiency is considered conservatively as per the tool.
Monitoring equipment	Default approach is applied and no monitoring equipment is applicable.
Accuracy of the monitoring equipment	Default approach is applied and no monitoring equipment is applicable.
Measuring/Reading/Recording frequency	Default approach is applied and no monitoring equipment is applicable.
Calculation method (if applicable)	Default value is applied.

Calibration	
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PD?	Since a default value is applied, no calibration is applicable for the parameter.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Since a default value is applied, no calibration is applicable for the parameter.
Calibration certificates	Since a default value is applied, no calibration is applicable for the parameter.
Whether calibration done by an accredited person or institution?	Since a default value is applied, no calibration is applicable for the parameter.

4.2 Safeguards

4.2.1 No Net Harm

The project involves treatment of wastewater and capture of biogas from wastewater treatment system. Generated biogas is used in boiler and gas engine which replaces HFO consumption. Therefore, the project results in avoidance of methane emissions and CO₂ emissions which otherwise would have been there without the project activity. Therefore, there is no negative environmental impact from the project activity. In addition, due to the project activity, jobs are created in local level as verified during off-site interview and raw materials are procured from local area which has improved socio-economic impacts in the project area. Therefore, there is no net harm from the project activity.

4.2.2 Local Stakeholder Consultation

Local stakeholder consultation is not applicable for the project proponent during verification. PP organized stakeholder consultation during validation of the project activity which was validated by the validation agency/11/. Carbon Check team has interacted local stakeholders during off site assessment via video call and details are summarized in section 2.3 of this report. There was no negative comment or feedback from local stakeholders as recorded by Carbon Check.

4.3 AFOLU-Specific Safeguards

The project is a non-AFOLU projects, this section is not required.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

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

The emission reduction due to methane capturing and utilisation in onsite boilers and generators was estimated by measuring the required parameters using appropriate monitoring equipment and using the formulae described in the methodologies; AMS III.H version 13, AMS I.C version 15 and AMS-I.D version 14 and the VCS PD except the deviations described in the above section 3.2. Emission reductions pertaining to electricity generation as per AMS-I.D is excluded from emission reduction calculation due to calibration gap of energy meters. All the ex-ante parameters which are used in the calculation of emission reduction are presented in section 4.1 of this report. It is confirmed that all the ex-ante parameters have been correctly used in the emission reduction calculation. 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.

Baseline emissions related to methane avoidance as per AMS-III.H is calculated as below:

$$BE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} \times COD_{removed,i,y} \times MCF_{ww,treatment,BL,i}) \times B_{o,ww} \times UF_{BL} \times GWP_{CH_4}$$

Volume of wastewater treated in baseline wastewater treatment system i ($Q_{ww,i,y}$) in year y (m^3). The reported value during the monitoring period from 01/01/2019 to 14/07/2019 is 368,579 m^3 . The verification team has verified the values in the monitoring report **/01/** against the daily recording of volume of the wastewater treated **/13(a)/**, which is in line with the requirements of the registered monitoring plan **/02/** and the applied monitoring methodology. Daily wastewater flow to digester is recorded in log books as per readings in flow meter totalizer (difference of previous days reading and the reporting day). When the mill does not operate the reported value is kept as zero and the emission reduction worksheet represents the same **/03/**. Hence, verification team was able to determine that all data applied in the emission reduction calculation spread sheet **/03/** and monitoring report **/01/** were correct and from the original data.

Chemical oxygen demand removed by baseline treatment system i in year y ($COD_{removed,i,y}$) in tonnes/ m^3 , measured as the difference between inflow COD and the outflow COD in system i. In line with the methodology and registered VCS PD, $COD_{removed,y}$ is estimated considering ex-post monitored value of $COD_{ww,untreated,y}$ and COD removal efficiency of 87.16% determined ex-ante considering COD campaign data **/02/**. This is as per registered VCS-PD and applied methodology **/02/,/03/,/06/**. $COD_{ww,untreated,y}$ is analyzed daily (Colorimetric method) in in-house laboratory from sample of wastewater entering digesters and average value is reported in ER sheet. The verification team has verified the values in the monitoring report **/01/** against the Original test reports of the $COD_{ww,untreated,y}$, **/13(c)/** which is in line with the requirements of the registered monitoring plan **/02/** and the applied monitoring methodology AMS-III.H **/06/**.

Methane correction factor for baseline wastewater treatment system i ($MCF_{ww,treatment,BL,i}$) has been fixed ex-ante as 0.8 for anaerobic deep lagoon **/02/**.

Methane producing capacity of the wastewater ($B_{o,ww}$) (IPCC default value for domestic wastewater of 0.21 kg CH₄/kg COD as per applied methodology /06/.

Model correction factor to account for model uncertainties (UF_{BL}) is 0.94 /02/. Global Warming Potential for methane (GWP_{CH_4}) is 25 as per IPCC /02/.

Therefore, $BE_{ww,treatment,y}$ for the monitoring period from 01/01/2019 to 14/07/2019 is **41,639 tCO₂e**.

Baseline emissions related to heat generation as per AMS-I.C, is calculated as below:

As explained in section 3.2 of this report (deviation 2), $BE_{thermal,CO_2,y}$ is determined from the amount of fossil fuel consumed in boiler for starch production and quantity of starch production. Quantity of starch produced during the period from 01/01/2019 to 14/07/2019 is 39,886 ton as verified from daily log book records /13(g)/. Quantity of FO consumed in boiler is 68,566 liter for the period from 01/01/2019 to 14/07/2019 /13(h)/.

NCV of FO is 42.76 GJ/ton and density is 0.93 kg/liter fixed ex-ante in the registered VCS-PD. Accordingly, $BE_{thermal,y}$ from biogas consumption is calculated for the monitoring period to be **3,538 tCO₂e**.

Emission reductions as part of electricity generation as per AMS-I.D is not claimed during this monitoring period.

Project Emissions:

Project emissions related to methane avoidance component as per AMS-III.H is calculated as below:

$$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{fugitive,y} + PE_{flaring,y}$$

Emissions from electricity consumption in the year y ($PE_{power,y}$) is calculated as follows:

$$PE_{power,y} = \sum P_{el} * (100\% + TDL_{j,y}) * 8,760 \text{ hours} * EF_y / 1,000$$

Electricity consumed by biogas system is considered as per AMS-III.H considering maximum connected load and monitoring period for 24 hours each day. Accordingly, electricity consumption during the monitoring period from 01/01/2019 to 14/07/2019 is 2,358 MWh which accounts 10% transmission and distribution loss. Grid emission factor is 0.5057 tCO₂e/MWh /02/. Therefore $PE_{power,y}$ is estimated to be 1,193 tCO₂e.

Emissions from wastewater treatment system affected by the project activity and not equipped with biogas recovery system and are calculated as per AMS-III.H and as follows:

$$PE_{ww,treatment,y} = Q_{ww,k,y} * COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} * B_{o,ww} * UF_{PJ} * GWP_{CH_4}$$

Volume of wastewater treated in baseline wastewater treatment system i ($Q_{ww,i,y}$) in year y (m^3). The reported value during the monitoring period from 01/01/2019 to 14/07/2019 is 368,579 m^3 . Carbon Check has verified the values in the monitoring report /01/ against the daily recording of volume of the wastewater treated /13(a)/, which is in line with the requirements of the registered monitoring plan /02/ and the applied monitoring methodology. Daily wastewater flow to digester is recorded in log books as per readings in flow meter totalizer (difference of previous days reading and the reporting day) /13(a)/. When the mill does not operate the reported value is kept as zero and the emission reduction worksheet represents the same /03/. Hence, Carbon Check was able to determine that all data applied in the emission reduction calculation spread sheet /03/ and monitoring report /01/ were correct and from the original data.

$COD_{removed,PJ,k,y}$: $COD_{untreated}$ and COD_{out} are analysed daily from sample of wastewaters and average value is reported in ER sheet. Carbon Check has verified the values in the monitoring report /01/ against the Original test reports /13(c)/ which is in line with the requirements of the registered monitoring plan /02/ and the applied monitoring methodology /06/.

Methane correction factor for baseline wastewater treatment system i ($MCF_{ww,treatment,BL,i}$) has been fixed ex-ante as 0.8 for anaerobic deep lagoon /02/.

Methane producing capacity of the wastewater ($B_{o,ww}$) (IPCC default value for domestic wastewater of 0.21 kg CH_4 /kg COD as per applied methodology /06/.

Model correction factor to account for model uncertainties (UF_{PJ}) is 1.06 /02/. Global Warming Potential for methane (GWP_{CH_4}) is 25 as per IPCC /02/.

Accordingly, $PE_{ww,treatment,y}$ for the monitoring period is **1,705 tCO₂e**.

Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive,y}$) are determined as per AMS-III.H and as follows:

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$$

It is confirmed from document review that there was no sludge treatment during the monitoring period. Hence, $PE_{fugitive,s,y}$ is considered zero in this monitoring period.

Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y ($PE_{fugitive,ww,y}$) is estimated as follows:

$$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH_4}$$

Capture efficiency of the biogas recovery equipment in the wastewater treatment (CFE_{ww}) is fixed ex-ante to be 0.9 as per registered VCS-PD /02/. Global Warming Potential for methane (GWP_{CH_4}) is fixed 25 as per IPCC /02/.

Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y ($MEP_{ww,treatment,y}$) is calculated as follows:

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$$

Flow of wastewater treated in the year y ($Q_{ww,y}$) during the monitoring period is 368,579 m³ as explained in above. Methane producing capacity of the wastewater ($B_{o,ww}$) (IPCC default value for domestic wastewater of 0.21 kg CH₄/kg COD as per applied methodology /06/.

Model correction factor to account for model uncertainties (UF_{PJ}) is 1.06 /02/. Global Warming Potential for methane (GWP_{CH4}) is 25 as per IPCC /02/.

Methane correction factor for wastewater treatment system k equipped with biogas recovery ($MCF_{ww,treatment,PJ,CL}$) is fixed ex-ante to be 0.8 as per registered PD /02/. $COD_{removed,PJ,CL,y}$ is calculated as the difference between $COD_{ww,untreated,y}$ and $COD_{ww,treated,y}$ /03/. $COD_{ww,untreated,y}$ and $COD_{ww,treated,y}$ is analyzed daily from sample of wastewater entering digesters and leaving the digester and average value of samples on daily basis is reported in ER sheet /03/. Carbon Check has verified the values in the monitoring report /01/ against the Original test reports /13(c)/ which is in line with the requirements of the registered monitoring plan /02/ and the applied monitoring methodology AMS-III.H /06/. $MEP_{ww,treatment,y}$ for the monitoring period is **2,073** tonnes for the monitoring period and $PE_{fugitive,ww,y}$ for the monitoring period is **5,184** tCO_{2e} /03/.

Project Emissions from flaring is zero as there was no flaring during the monitoring period.

Leakage Emissions:

In line with applied methodologies and registered VCS-PD, there is no leakage emissions. Hence, LE_y is zero.

Emission Reductions:

The emission reduction (ER) is the sum of the ER from type I component ($BE_{thermal,y}$) and the ER achieved from the type III component of the project activity ($BE_{y,ex post}$). ER from the type I component ($BE_{thermal,y}$) for the monitoring period is 3,538 tCO_{2e}.

As per applied methodologies AMS-III.H and registered VCS-PD, the emission reductions achieved from type III component ($ER_{y,ex post}$) in any year are the lowest value of the following:

$$ER_{y,ex post} = \min((BE_{y,ex post} - PE_{y,ex post} - LE_{y,ex post}), (MD_y - PE_{power,y} - LE_{y,ex post}))$$

For the current monitoring period the achieved $BE_{y,ex post} = BE_{ww,treatment,y}$ is 41,639 tCO_{2e}, achieved $PE_{y,ex post}$ is 8,082 tCO_{2e} and $LE_{y,ex post}$ is zero as explained in above.

As per AMS-III.H, in case of flaring/combustion MD_y will be measured using the conditions

of the flaring process.

$$MD_y = W_{CH_4} * D_{CH_4} * GWP_{CH_4} * [(BG_{toflare,y} * FE) + (BG_{combusted,y} * DE)]$$

$BG_{toflare}/FV_{RG,h}$ during the monitoring period is 0 Nm³ and $BG_{combusted,y}$ is 3,262,040 Nm³.

Carbon Check has verified the values in the monitoring report /01/ against the daily recording of the amount of biogas flared ($BG_{toflare}/FV_{RG,h}$) and biogas fired in boiler & generator ($BG_{combusted,y}$) /13(d),(e)/, which is in line with the requirements of the registered monitoring plan /02/ and the applied monitoring methodology AMS-III.H /06/. Density of methane at normal condition (D_{CH_4}) is fixed ex-ante to be 0.716 kg/m³ as per the 'Tool to determine project emissions from flaring gases containing methane'. Global Warming Potential for methane (GWP_{CH_4}) is fixed 25 as per IPCC /02/. Flare efficiency in hour 'h' ($FE/\eta_{flare,h}$) is 0% for the current monitoring period in line with the tool as explained in section 4.1 of this report. This is considered conservative approach. Methane fraction (W_{CH_4}) is as per continuous measurement and daily records /13(b)/.

Therefore, MD_y achieved during the monitoring period amounts to **30,649** tCO₂ equivalent /03/.

$$\begin{aligned} ER_{y,ex\ post} &= \min((BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}), (MD_y - PE_{power,y} - LE_{y,ex\ post})) \\ &= \min((33,557), (29,455)) \\ &= 29,455\ tCO_2e \end{aligned}$$

Considering Type I emission reduction of 3,538 tCO₂e, total emission reductions achieved during the monitoring period is 32,993 tCO₂e

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

During the verification, 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. Inlet and outlet COD into the wastewater treatment system, quantity of wastewater through the treatment system, biogas consumption in boilers & generators, biogas consumption for flaring, methane concentration of biogas etc. were verified with the log book values to ensure that there is no over estimation of the VCUs. The provided data was found to be of adequate quality.

All records needed for monitoring are archived in line with the requirements of the registered monitoring plan. No significant, lack of evidence and missing data were detected during the 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.

All the meters (wastewater flow meter, biogas flow meters, fuel oil meters and gas analyser) were calibrated at appropriate calibration frequency (described in section 4.1) to ensure the quality of the data. No calibration delay observed during the monitoring period.

It was verified through off-site 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.

Carbon Check is of the opinion that this method of estimation is accurate and results in conservative estimation of emission reduction and is line with the applicable VCS requirements. The achieved emission reductions of 27,243 tCO₂e is 2.18% higher than ex-ante estimation of 26,662 tCO₂e for the same monitoring period.

4.6 Non-Permanence Risk Analysis

There is no non-permanence risk rating determined by the project proponent.

5 VERIFICATION CONCLUSION

Carbon Check (India) Pvt. Ltd. has performed verification of the emission reductions reported for the project activity “Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)” in Thailand, VCS Registry Project ID 427, for the period 01/01/2019 to 14/07/2019, with regard to the relevant requirements for VCS activities. The project participants of the “Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)” project are responsible for:

- the preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered project design document version 03.1 of 13/11/2009.
- the development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project.

It is the responsibility of Carbon Check to express an independent verification opinion about the project's conformity with the requirements of VCS Standard version 4 and GHG program applied, on the reported greenhouse gas emission reductions from the project.

Based on documented evidence and corroborated by an off-site assessment, Carbon Check can confirm that:

- the project has been implemented and operated as per the registered VCS-PD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS Standard version 4 requirements;
- the monitoring is in place as per the applied baseline and monitoring methodology;
- the monitoring plan in the registered VCS-PD is as per the applied baseline and monitoring methodology.

It is Carbon Check's opinion that the GHG emission reduction stated in the monitoring report version 03 of 11/06/2020 for the "Chol Charoen Group Wastewater Treatment with Biogas System I (Khonkaen)" in Thailand for the period 01/01/2019 to 14/07/2019 are fairly stated. The GHG emission reductions are calculated on the basis of approved methodology AMS-III.H version 13, AMS-I.D version 14 and AMS-I.C version 15 and the monitoring plan included in the registered Project Design Document, version 03.1 of 13/11/2009.

Hence Carbon Check is able to certify that the emission reduction from the project during the monitoring period 01/01/2019 to 14/07/2019 is amount to 32,993 tCO₂.

Verification period: From 01/01/2019 to 14/07/2019

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01/01/2019 to 14/07/2019	34,187	1,193	0	32,993
Total	34,187	1,193	0	32,993

APPENDIX A: ABBREVIATIONS

Abbreviations	Full texts
BE	Baseline Emissions
CAR	Corrective Action Request
CC IPL	Carbon Check India Pvt. Ltd.
CDM	Clean Development Mechanism
CDM M&P	Modalities and Procedures CDM
CER(s)	Certified Emission Reduction(s)
CH ₄	Methane
CL	Clarification Request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EF	Emission Factor
ER	Emission Reductions
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
HFO	Heavy Fuel Oil
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of Approval
MoV	Means of Verification
MR	Monitoring Report
NGO	Non-governmental Organization
ODA	Official Development Assistance

PDD	Project Design Document
PE	Project Emission
PEA	Provincial Electricity Authority
PP(s)	Project Participant(s)
Ref.	Document Reference
SS(s)	Sectoral Scope(s)
TA(s)	Technical Area(s)
TPD	Tons per day
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCU	Verified Carbon Unit
VER	Voluntary Emission Reductions
VVS	Validation and Verification Standard

APPENDIX B: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUEST

Table 1. CL from this verification

CL ID	01	Section no.	4.1	Date: 16/04/2020
Description of CL				

PP is requested to submit the followings:

1. The last verification report.
2. Copy of latest boiler inspection report
3. Copy of log book records for daily monitoring of wastewater volume, COD measurement, Biogas combusted in boiler and generators, methane analysis, HFO consumption and starch production
4. Copy of calibration certificates of all monitoring equipments covering the monitoring period.
5. Third party lab reports for COD measurement.

Project participant response

Date: 04/06/2020

The following documents have been provided to the VVB.

1. Final verification report for the monitoring period from 12/05/2016 – 31/12/2018 by KBS Certification Services Pvt. Ltd.
2. Boiler inspection report of boiler no.1 and boiler no.2 in 2019
3. Sample of log book records for daily monitoring of wastewater volume, COD measurement, Biogas combusted in boiler and generators, methane analysis, HFO consumption and starch production
4. Calibration reports of all monitoring equipments covering the monitoring period
5. Wastewater analysis reports by external accredited laboratory in 2019

Documentation provided by project participant

Folder CL 01_1:

- Final verification report ID VCS.19.VER.002 for the previous monitoring period

Folder CL 01_3:

- Samples of log book for wastewater volume
- Samples of log book for boiler 1 containing biogas combusted, HFO consumption and methane analysis
- Samples of log book for boiler 2 containing biogas combusted, HFO consumption and methane analysis
- Samples of log book for biogas combusted in gas engines
- Samples of log book for COD measurement
- Record for daily starch production

Folder CL 01_4:

- Calibration reports for flow meter (GM1) for biogas combusted in boiler 1 in 2016 and 2018
- Calibration reports for flow meter (GM4) for biogas combusted in boiler 2 in 2016 and 2018
- Calibration report for flow meter (GM2) for biogas combusted in flare in 2016
- Calibration reports for flow meter (GM3) for biogas combusted in gas engines in 2016 and 2018
- Calibration report for flow meter (FM1) for wastewater sent to CL 1 in 2017
- Calibration report for flow meter (FM2) for wastewater sent to CL 2 in 2017
- Calibration reports for methane analyser in 2016 and 2018
- Calibration reports for COD meter in 2016 and 2018
- Calibration reports for oil meter for boiler 1 in 2016 and 2018
- Calibration reports for oil meter for boiler 2 in 2016 and 2018
- Calibration reports for scale indicator for starch quantity in 2018 and 2019
- Calibration reports for weighbridge for sludge removed quantity in 2017 and 2019

DOE assessment
Date: 15/06/2020

PP has submitted required documents which are consistent with details provided in the monitoring report and emission reduction worksheet. Hence, CL is closed.

CL ID	02	Section no.	4.1	Date: 16/04/2020
Description of CL				

1. The emission reduction worksheet shows two input for methane fraction analysis. Please clarify this and how the appropriate value is considered. 2. It is noted that some days there is no wastewater flow recorded whereas COD measurement is done (e.g. 10/01/2019, 12/01/2019- 15/01/2019). Please clarify. 3. ER sheet shows in some cells are marked as 'Fixed HDPE sheet'. What does this mean?	
Project participant response	Date: 05/06/2020
1. There were two measurement points for methane fraction in which the measurement was taken at gas pipeline to two boilers. However, as per the methodology deviation 1, the values of biogas combusted in boiler 1 was excluded in emission calculation from thermal generation component. Therefore, the methane fraction applied for the calculation was only based on measurement taken at gas pipeline to boiler 2. 2. There was wastewater fed into CL2 during the mentioned days, i.e. 10/01/2019, 12/01/2019 – 15/01/2019. However, the reading monitor of flow meter (FM2) was not working properly during the period 06/01/2019 – 12/03/2019. Therefore, no wastewater flow was recorded. 3. The HDPE is the type of plastic used for covering the covered lagoon. During the period 11/03/2019 – 18/03/2019, the HDPE sheet covering CL1 was under repair as it torn.	
Documentation provided by project participant	
Revised VCS MR, version 2	
Revised ER calculation sheet, version 2	
DOE assessment	Date: 15/06/2020
PP's clarifications are accepted and details are consistent with records provided. MR and ER sheet is found consistent and hence CL is closed.	

Table2: CAR for this verification:

No CAR raised.

Table3: FAR from this verification:

No FAR raised.