



SD BIOSUPPLY WASTEWATER TREATMENT AND BIOGAS UTILIZATION PROJECT



Document Prepared By

LGA Technological Center S.A. (Applus+ Certification)

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Client	SD Biosupply Co., Ltd.
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Summary:

Verification purpose: LGAI Technological Center S.A. (Applus+ Certification) (Hereafter referred as Applus+ Certification) has been appointed by “SD Biosupply Co., Ltd.” to perform the 5th verification (01-May-2021 to 31-October-2022) of the “SD Biosupply Wastewater Treatment and Biogas Utilization Project” (VCS ID 416). The main purpose of this verification activity is to have an independent third-party assessment of the monitoring report to ensure a thorough assessment of the project activity implementation against the applicable VCS requirements.

The project activity involves the installation of an Upflow Anaerobic Sludge Blanket (UASB) biogas reactor continues to flow to a series of remaining eight cascading lagoons. The implementing system enables recovery of biogas that would have been released into the atmosphere and utilise it for thermal. In the case of thermal energy generation, the captured biogas has been co-fired in existing heat generating devices for the process of drying the wet starch (displacing fuel oil under the previous system).

The monitoring period for this VCS verification is 01-May-2021 to 31-October-2022 (including both days) and the project activity achieved 68,840 tCO₂e emission reductions during this monitoring period.

The scope of the verification is the independent and objective review of the Monitoring Report/^{6/}. The MR/^{6/}is reviewed against the relevant criteria (see above) and decisions by the CDM Executive Board and VCS executive board, including the approved baseline and monitoring methodology. The verification was based on the guidance given in the CDM validation and verification standard for project activities, version 03.0, review against registered PD/^{4/}and final validation report, VCS program Guide version 4.4 and VCS standard version 4.7.

A risk-based approach has been followed to perform this verification activity. In the course of verification, 01 Corrective Action request (CAR) and 01 Clarification Requests (CLs) were raised and successfully closed. No FAR was raised during this verification. The review of the Monitoring report and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and PP have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

The assessment team has employed a risk-based approach to assess the completeness and accuracy of the claims and conservativeness of the assumptions in the MR/^{6/}. The main focus of the assessment team is to identify the significant risks for the project implementation and the generation

of VERs. The verification is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring report combined.

The only purpose of the verification is its usage during the issuance process as part of the VCS project cycle. Therefore, LGAI Technological Center S.A. (Applus+ Certification) can't be held liable by any party for decisions made or not made based on the verification opinion, which will go beyond that purpose.

The verification has been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS. The project is registered under VCS as on 06/05/2010. The first crediting period was from 28/03/2006 to 27/03/2016, while the second crediting period is from 28/03/2016 to 27/03/2026. This is the fifth monitoring period under the second crediting period, which started from 01/05/2021 to 31/10/2022. The total emission reductions achieved in this monitoring period is 68,840 tCO₂e. The project contribution in 3 three SDS: SDG 07 (77.42 TJ by replacing the use of fossil fuel), SDG 8 (9 job opportunities created) and SDG 13 (Emission reduction of 68,840 tCO₂e) during this monitoring period. No sampling procedure applied for document verifications. The entire documents checked verification conducted to arrive at positive verification conclusions.

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1 INTRODUCTION

1.1 Objective

LGAI Technological Center S.A. (Applus+ Certification) (Hereafter referred as Applus+ Certification) has been appointed by “SD Biosupply Co., Ltd.” to perform the 5th verification of the “SD Biosupply Wastewater Treatment and Biogas Utilization Project” under VCS Program Guide version 4.4 and VCS standard version 4.7. The objective of this verification activity is to have an independent third party for the assessment of the project design, Monitoring Report and Final Verification report and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- The project’s monitoring plan is assessed against “AMS-III.H version 18”
- The project's baseline is assessed against “AMS-I.C version 20”
- The projects compliance with the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS Program Guide v.4.4 and VCS standard v.4.7^{/10/}.
- CDM validation and verification standard for project activities, Version 03.0^{/16/}
- VCS program Guide v.4.4^{/10/}
- VCS standard version v.4.7^{/10/}

1.2 Scope and Criteria

The scope is defined as an independent and objective review of the Monitoring report MR^{/6/} prepared as per the registered PD^{/4/} and registered approved methodology AMS III H Version 18.0. The MR is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board, VCS Program Guide v.4.4, VCS standard v.4.7 including the approved applied methodology AMS I.C Version 20.0^{/16/}. The verification was based on the requirements in the CDM validation and verification standard for project activities, Version 03.0, and VCS program Guide version 4.4 and standard version 4.7^{/10/}.

The verification is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the Monitoring report. In line with Guidelines for Application of materiality in verifications Version 03, the verification team has conducted a complete verification of all the information presented in the monitoring report and data monitored as presented in the emission reduction calculation spread sheet. It follows the paper trail back to the raw data such as meter

reading records and invoices. There are no material errors, overestimation of Emission Reductions, omission or misstatement. Verification team conducted Onsite audit via video conferencing to verify metering/monitoring arrangement. The verification team has reviewed all the documents like commissioning certificates/^{1/}, technical specification/^{17/}, O&M practices/^{8/}, Invoices/^{10/}, grievance register/^{13/} etc.

1.3 Level of Assurance

Applus+ Certification has planned and performed the verification by obtaining evidence and other information and explanations that assessment team considers necessary to give reasonable assurance that reported estimated GHG emission reductions are fairly stated. All documentary evidences were checked during Onsite audit by the assessment team.

In our opinion, the estimated GHG emissions reductions were calculated correctly on the basis of the approved baseline and monitoring methodology “AMS I.C Version 20.0” & AMS-III H. version 18, of the VCS standard v.4.7

1.4 Summary Description of the Project

The project involves the installation of UASB digesters to capture methane to utilise as fuel for thermal generation by boilers for starch drying process replacing fossil fuel in the Somdej starch factory. Via Onsite document review and interview of project owner and project technology provider, it is confirmed the project activity is a wastewater treatment with installation of UASB digesters to capture biogas and utilized as fuel for the boilers to generate heat for starch drying to replace fossil fuel at the Somdej starch factory. /RA1/RA2/02/03/09/ The project reduces greenhouse gas (GHG) emissions by an estimated 51,316 tCO₂e per year during the 2nd crediting period. /PD1/VAL/ The project start date was defined as 16-September-2005 based on the date when emission reductions began. As per VCS standard, the start date of crediting period is defined as 28-March-2006. The 1st crediting period was from 28-March-2006 to 27-March-2016. This is the 2nd crediting period of ten years starts from 28-March-2016 to 27-March-2026. The expected operational life time of project activity is 15 years as describe in the initial approved PD. This is verified by means of review of the technical specifications provided by the project owner and interview of the project technology provider. /E5/PD1/ By means of documents review, verified photos provided and interview with project owner and project technology provider, the Verification Team was able to confirm that the project implementation is in accordance with the project description contained in the registered and approved revised project description. There are no any material discrepancies between project implementation and the project description. On the basis on the reviewed project documentation, interview conducted it can be confirmed that w.r.t. the realized technology, the project equipment, as well as the monitoring and metering equipment, the project has been implemented and operated as applied monitoring methodology and monitoring plan described in the registered and approved revised PD. This verification covers the period from 01-May-2021 to 31-October-2022 (including both days). The

net emission reductions achieved during this monitoring period is 68,840 tCO₂e Via Onsite interview with the project owner and local communes, it is verified that the project contributes the sustainable development through the following aspects as describe in the MR.

Reduces GHG emission through the avoidance of methane emission from the existing open lagoon;

- Captures biogas for energy generation purpose; thereby reduced bad odor and improved air quality;
- Reduces GHG emission and other air pollutants such as Nox, CO, Sox through reducing the combustion of fossil fuels;
- Employment and training of locals to manage the project to enhance work skills.
- Utilization of renewable energy and contributes thereby to energy security.

The project site is located at 99 Moo 10, Somdej-Khuchinarai Road, Kambong sub-district, Huai Phueng district from Bangkok. The project coordinates are 16° 40'40.20"N and 103° 48' 19.67"E. The project is already registered under VCS (VCS Ref. No: 416¹) and the project was fully operational during the second crediting period from 28-March-2016 to 27-March-2026.

The location and geo-coordinates of the project site is verified through google earth. /ge/ Basic technical details of the project are summarized in below which has been verified during documents and photos reviewed.

VVB concluded that the project is implemented as per the requirement of the registered VCS MR/⁶/and approved monitoring plan. During the current monitoring period, it was observed that no unforeseen incident/event evolved which can impact the operation of the project activity which was verified from breakdown records. The project undergone continuous operation and only scheduled maintenance is observed as per the manufacture's specification as evident from records.

VVB confirmed that there is no proposed or actual change to the project design during this monitoring period. The project design as mentioned in the registered PD/⁴/ is implemented and thus the same is acceptable to the assessment team. All required monitoring equipment's and procedures as mentioned in the registered PD/⁴/are available and implemented in an appropriate manner.

Description	Unit of measure
Acidification Pond	
Technology Provider	Papop Co Ltd
No. of Unit	1

¹Verra Search Page

Capacity	6,000 m ³
UASB Digester	
Technology Provider	Papop Co Ltd
No. of unit	1
Capacity	5,000 m ³ per Day
Thermal Boiler	
Manufacturer	Sherrer
Capacity	3.780 MWth
No. of Unit	1
Thermal Boiler	
Manufacturer	Vega
Capacity	3.489 MWth
No. of unit	1
Open Flare System	
Manufacturer	Papop Co. Ltd
Capacity	Combustion rate 750 Nm ³ /hr
No. of unit	1

The organisational role and responsibility as mentioned in the registered PD/^{4/} is followed onsite. All the emergency preparedness as mentioned in the registered PD/^{4/} is followed onsite and no discrepancies were found regarding the same. Meters are calibrated as per calibration frequency in registered VCS PD/^{4/}. All the emergency preparedness as mentioned in the registered VCSPD/^{4/} is followed onsite and no discrepancies were found regarding the same. Thus, completeness of the monitoring plan confirmed and there are no any material discrepancies between the actual monitoring system and the plan provided in the registered PD/^{4/}.

Assessment team confirms following during the verification onsite audit:

1. Start date of the project activity is 16th September 2005 as mentioned in the registered VCS MR/^{6/}.
2. An undertaking letter dated 03-November-2023 has been submitted by PP for no double counting with any other GHG program. PP also has given a written declaration that project has not claimed other form of GHG credit for the concerned monitoring period.

3. VVB team confirms that this is the 5th verification under VCS and covers the activity from 01-May-2021 to 31-October-2022 (inclusive of both dates). The project activity adopts renewable crediting period of 10 years period and can be renewed for maximum 2 times. 28-March-2016 is the start date and 27-March-2026 will be end date of the crediting period.

The GHG credits from 01-May-2021 to 31-October-2022 will be claimed under VCS only. At any point of time during the crediting period, the project proponent will abide by the “No Double Counting”.

4. Assessment team checked and found that the Project proponent of the project activity is as below for the current monitoring period:

Organization name	SD Biosupply Co., Ltd.
Contact person	Mr. Sivaroj Suralaertrungsri
Title	Managing Director
Address	113 Soi Chokchaijonjamrern, Rama III Road, Bangpongpan, Yannawa, Bangkok 10120, Thailand
Telephone	+66 2 683 1900-7
Email	mdroj_2work@somdej.co.th

5. Assessment team also checked the details of other entity and found correct. The details are as below:

Organization name	South Pole Carbon Asset Management Ltd.
Role in the Project	Project developer for development of emission reduction through the Voluntary Carbon Standard
Contact person	Dr. Daniel Klier
Title	CEO
Address	Technoparkstrasse 1, Zurich, Switzerland, 8005
Telephone	+41 43 501 35 50
Email	registration@southpole.com

6. The quantified emission reduction calculation for the monitoring period is correct and conservative. Assessment team also compared actual VER with the estimated VER and found that the actual VCUs is 68,840 tCO₂e which is 10.81% lower than the estimated emission reductions 77,185 tCO₂e during this monitoring period due to the actual emission reductions during this monitoring period was lower than the ex-ante figure. The operation days of this monitoring period is 245 days in year 2021 and 304 days in year 2022. Therefore, the ex-ante emission is based on 201.37 days in year 2021² and 249.86 days in year 2022³.

² Operation days of ex-ante emission reductions in year 2021, 201.37 days, is based on [245 days*(300/365 days)].

³ Operation days of ex-ante emission reductions in year 2022, 249.86 days, is based on [304 days*(300/365 days)].

The reason of the lower emission reduction came from lower COD load for this monitoring period⁴ which is 9,820.46 tCOD/year as compared to baseline estimation⁵ of 12,221.19 tCOD/year (-19.64%). It may also happen that in the future, the quantity and quality of wastewater entering the system may go up. Thus, acceptable to VVB.

2 VERIFICATION PROCESS

2.1 Method and Criteria

Verification Process: The project assessment is based on the “CDM validation and verification standard for project activities, Version 03.0, “VCS Program Guide v.4.4 and VCS standard v.4.7” and is conducted using standard auditing techniques to assess the correctness of the information provided by the project participants. Before the assessment begins, members of the team covering the technical scope(s), sectoral scope(s), and relevant host country experience for evaluating the VCS project activity are appointed.

Once the project is received by the assessment team, the members of the assessment team carried out: -

1. A desk review of the Monitoring report against the registered PD/⁴/and final validation report;
2. Follow-up interviews with project participant;
3. The resolution of outstanding issues and the issuance of the final verification report and opinion.

The prepared verification report and other supporting documents then undergo an internal quality control at the HQ (Accredited office) before being submitted to the VCS executive board.

In order to ensure transparency, assumptions must be clear and stated explicitly and background material must also be referenced. Applus+ Certification has developed a specific checklist customized for the project. The checklist demonstrates, in a transparent manner, the project criteria (requirements), discussion on each criterion by the assessment team, and the results from validating the identified criteria.

Appointment of the assessment team

According to the sectoral scope / technical area and experience in the sectoral or national business environment, Applus+ Certification has composed a project assessment team in accord

⁴ Average quantity of annual wastewater in the monitoring period is 316,272.00 m³ (average of 286,688 m³ in 2021 & 345,856 m³ in 2022). Average COD_{ww, untreated, y} is 31,050.69 mg/l (average between 31,570.47 mg/l in 2021 & 30,530.91 mg/l in 2022). Annual COD load [(316,272.00 * 31,050.69 mg) / 1,000,000] = 9,820.46 tCOD/year.

⁵ Average quantity of annual wastewater in the baseline estimation is 532,003.56 m³ (average of 474,830.14 m³ in 2021 and 589,176.99 m³ in 2022), Average COD_{ww, untreated, y} is 22,972 mg/l. Annual COD load [(532,003.56 * 22,972.00 mg) / 1,000,000] = 12,221.19 tCOD/year.

ance with the appointment rules in the internal Quality Management System of Applus+ Certification.

The composition of audit team shall be approved by the Applus+ Certification ensuring that the required skills are covered by the team.

The four qualification levels for team members that are assigned by formal appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A) / Auditor in Training (AiT).
- Technical Expert (TE).
- Technical Reviewer (TR).

The sectoral scope / technical area knowledge linked to the applied methodology/ies shall be covered by the assessment team.

Name	Role	SS Coverage	TA Coverage	Financial Aspect	Host country Experience
Vivek Kumar Ahirwar	LA/TE	YES	YES	NA	YES
Simon Shen	TR	YES	YES	NA	NA

The detail regarding the assessment team is provided below in this report as Appendix 3

Document review

The Monitoring report 01 submitted by the PP was reviewed against the approved methodology, registered PD^{4/}, final validation report and other relevant criteria to verify the correctness, credibility, and interpretation of the presented information.

Furthermore, a cross-check between information provided and information from other sources has been done. A complete list of all documents and evidence material reviewed is included in this report below in section 2.2

Follow-up interviews

A Onsite audit is conducted by Applus+ Certification. Audit team performed interviews, via video/telephone conferences with project stakeholders to confirm selected information and to resolve issues identified in the document review. The detail is provided in this report.

Resolution of Clarification and Corrective Action Request

The objective of this phase of the Verification was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for Applus+ Certification positive conclusion on the Monitoring report. The Corrective Action Requests and Clarification Requests raised by Applus+ Certification were resolved during communications

between the Client and Applus+ Certification to guarantee the transparency of the verification process, the concerns raised and responses given are summarized below in the Appendix 2.

The final MR/⁶/ submitted by PP serves as the basis for the final assessment presented. Additional changes to the project during the verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Internal quality control

As final step of a verification of the final documentation including the verification report and the checklist have to undergo an internal quality control by the technical review committee, i.e. each report has to be finally approved either by the head of the technical review committee or the deputy. In case one of these two persons is part of the assessment team approval can only be given by the other one to avoid any conflict of Interest.

After confirmation of the PP the positive verification opinion and relevant documents are submitted to the VCS board through the VCS web-platform.

2.2 Document Review

During the document review, Applus+ Certification has applied standard auditing techniques to assess the quality of information provided. The verification was performed primarily based on the review of the monitoring report (MR) **Final version 03 dated 16-May-2024**, were assessed as part of the verification

The emission reduction (ER) calculations spreadsheet final version 03 dated **16-May-2024**, received from PP were assessed along with the monitoring reports as part of the verification. In addition, the registered Project Documents, VCS PD in particular the baseline estimations and the monitoring plan for the project was reviewed. The following table lists the documentation that was reviewed during the verification:

No.	Author	Title	References to the document	Provider
1.	NA	COD	-	Project Participant
2.	NA	Contract of the project participant with the DOE	Contract document signed between PP and DOE	Project Participant
3.	NA	The operational lifetime of the project activity from the manufacturer = (Technical specifications)	Manufacturer technical specifications	Project Participant

No.	Author	Title	References to the document	Provider
		SCHERRER INDUSTRIES: Technical Specifications of Boiler 1 & Boiler 2		
4.	NA	VCS PD Verra Search Page	NA	Project Participant
5.	NA	Calibration Certificates of Wastewater Flow meter Spectrophotometer Biogas flow meter Weighing scale Portable gas analyser	-	Project Participant
6.	NA	MR version 01(Initial) MR version 03 (Final)	31-January-2023 16-May-2024	Project Participant
7.	NA	Emission reduction sheet version 01 Emission reduction sheet version 03	31-January-2023 16-May-2024	Project Participant
8.	NA	O & M Agreement (Amended)	-	Project Participant
9.	NA	Provincial Electricity Authority (PEA)	dated 20/02/2009	Project Participant
10.	NA	Tools/ guidelines used in the project activity - VCS standard V.4.7 - VCS Program Guide V.4.4	VCS web site	VERRA
11.	NA	Daily monitoring log sheets : a) Wastewater flow meter readings b) Methane content c) COD measurement of wastewater d) Biogas consumption in boiler e) Biogas consumption in generator f) Biogas consumption for flare g) Quantity of starch produced h) Quantity of furnace oil consumed	01-May-2021 to 31-October-2022	Project Participant

No.	Author	Title	References to the document	Provider
12.	NA	Declaration regarding no participation in other GHG program for the concerned monitoring period	-	Project Participant
13.	NA	Breakdown details for the monitoring period	-	Project Participant
14.	NA	Employment records for plant persons	-	Project Participant
15.	NA	Grievance Register maintained at site	-	Project Participant
16.	NA	CDM validation and verification standard for project activities, Version 03.0	-	UNFCCC
17.	NA	Applied Methodology - AMS-III.H version 18 - AMS-I.C version 20	-	UNFCCC
18.	NA	Onsite photographs	-	Project Participant

2.3 Interviews

An Onsite audit was conducted on from 01-February-2023 to 02-February-2023.

During the onsite audit, the PP representatives were questioned about the implementation of the project activity. Several topics like the verification of commissioning date of meters, the generation, recording, and monitoring of the data and the error accountability were discussed. To cross check the information provided by PP, various documents like technical specifications, commissioning certificates/^{1/}, Power Purchase Agreement PPA/^{9/}, Generation sheets/^{11/}, invoice/^{11/}, calibration certificates/^{5/}etc. were also verified.

The names of the persons interviewed during onsite audit are given below.

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	-	THIRANUN	SD Biosupply Co., Ltd. (Managing Director)	01-February-2023 to 02-February-2023	Project implementation, O&M, JMR, Calibration, Sustainable monitoring, LSC etc. Management practices, trainings, salaries etc.	Vivek Kumar Ahirwar

2.	-	SUPHAN EE	SD Biosupply Co., Ltd. (Biogas Supervisor)		Management practices, data storage, QA/QC	
3.	PRASA RTMAL TOL	GAKADR AI	PAPOP (Biogas Technology Supplier)			
4.	ITTISA KSAKU L	PANCHA NIT	JR. PROJECT COORDINAT OR, SWISS CARBON VALUE LTD		Monitoring Report, QA/QC Emission Reductions calculation	
5.	RUKW ONGTR AKOOL	SUWIPA	SWISS CARBON VALUE LTD.			
6.	RAYA	SIRINUT	SR. PROJECT COORDINAT OR, SWISS CARBON VALUE LTD.			
7.	WITTH AYANU KOOL	APIRAT	Senior Project Coordinator , SWISS CARBON VALUE LTD.			
8.	SANGU ANPIYA PAN	KORAKO J	SR. PROJECT MANAGER, SWISS CARBON VALUE LTD.			
9.	SRITAV AT	CHOLNA PA	Local Villager		Stakeholder meeting- Employment opportunities, Pollution aspects, Standard of Livings etc.	
10.	PHOKH AOW	CHAWEE WAN	Local Villager			
11.	WATLV KSHA	YUPIN	Local Villager			
12.	FAKLA NG	SUPHAN EE	Local Villager			

2.4 Site Visits

Duration of Onsite audit: 01-February-2023 to 02-February-2023			
Activity performed on-site	Site location	Date	Team member
Assessment team checked the implementation of the project, Baseline emission, Emission reduction calculation, technical description of the project and Monitoring. Assessment team also checked that whether the monitoring plan as described in the VCS PD & VCS Monitoring period ^{4/} is actually practised onsite. Also assessment team checked any change in host country criteria which may affect the baseline of the project activity.	Project Site	01-February-2023 to 02-February-2023	Vivek Kumar Ahirwar

2.5 Resolution of Findings

The objective of the Verification was to resolve the requests for corrective actions and clarification and any other outstanding issues from validation which need to be clarified for Applus+ Certification's positive conclusion on the Monitoring report. The Corrective Action Requests and Clarification Requests raised by Applus+ Certification were resolved during communications between the Client and Applus+ Certification to guarantee the transparency of the verification process, the concerns raised and responses given are summarized below in the Appendix 2.

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 previous assessment i.e., in validation or verification report to be cross 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.

A forward action request (**FAR**) is also raised in cases where any required deviation/information is not fulfilled in current verification and thus needs to be taken up in consequent verification for better transparency thus holding the applicability of the methodology eligible to the project activity and there is no impact of the same on additionality, baseline scenario & emission reduction calculation of project.

The final MR (Version 03)^{6/} submitted by PP serves as the basis for the final assessment presented. Additional changes to the project during the verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Areas of validation and verification findings	No. of CL	No. of CAR	No. of FAR
Project design document and Monitoring report	00	00	00
Description of project activity	01	01	00
Application of selected baseline and monitoring methodology and selected standardized baseline			
Applicability of methodology and standardized baseline	00	00	00
Deviation from methodology	00	00	00
Clarification on applicability of methodology, tool and/or standardized baseline	00	00	00
Project boundary	00	00	00
Establishment and description of baseline scenario	00	00	00
Demonstration of additionality	00	00	00
Emission reductions	00	00	00
Calibration details	00	00	00
Monitoring plan	00	00	00
No Net harm assessment	00	00	00
Local stakeholder consultation	00	00	00
Others (REC)	00	00	00
Total	01	01	00

The list findings and the resolution are presented in Appendix 2 of this report

2.5.1 Forward Action Requests

This is 5th periodic verification of the project activity and no FAR was raised from validation or previous verification.

2.6 Eligibility for Validation Activities

This section is not applicable for present verification, as Applus+ holds the necessary accreditation to perform validation activities under this Sectoral Scope.

3 VALIDATION FINDINGS

3.1 Methodology Deviations

Deviations applied for second crediting period

Determination of $EG_{thermal}$

Formula that is deviated from the applied methodology is described below.

As per paragraph 33, AMS I.C version 20, for steam/heat produced using fossil fuels, the baseline emission is calculated as;

$$BE_{thermal,CO2,y} = (EG_{thermal,y} / \eta_{BL, thermal}) \times EF_{FF, CO2}$$

As per the measurement requirement of monitoring parameter $EG_{thermal,y}$, heat generation is determined as the difference of the enthalpy of the hot fluid or thermal fluid generated by the heat generation equipment and the sum of the enthalpies of the feed-fluid. The respective enthalpies should be determined based on the mass (or volume) flows and the temperatures.

Deviated approach or formula / Deviated approach in this monitoring period:

The project proponent is not able to conduct the measurement of temperature (in and out) and the flow of the thermal fluid as per the applied methodology. Therefore, the deviated approach is introduced as following.

The monitoring parameter of $EG_{thermal,y}$ can be estimated based on production historical data and actual fuel energy input. By considering historical data, the estimation is considered from heat requirements per tonne of starch prior the implementation of project activity. The approach estimates the thermal energy delivered by the project activity based on historical fuel oil consumption and starch production for the given year. The conservative approach is ensured by comparing the total energy delivered by the fuels burnt in the project activity and thermal energy estimate based on historical fuel oil consumption values. The conservativeness of the historical data: the historical data of Somdej Flour Mill Co., Ltd is available for 3 years (2002-2004) on starch production and heavy oil consumption as follows:

Year	Dry starch (tonne)	Heavy oil (litre)	Litre of HFO/ tonne of dry starch
2002	64,830	2,187,940	33.8
2003	66,347	2,303,060	34.7
2004	57,837	2,111,970	36.5
Average			35.0

Based on the historical data, the project has considered the most conservative specific energy consumption during 2002-2004, which is 33.8 litre of HFO/tonne of dry starch in year 2002.

The calculation formula is determined as following:

$$EG_{\text{thermal}, y} = \min (EG_{\text{thermal}, \text{historical}}, EG_{\text{thermal}, \text{energy input}})$$

Historical production approach:

$$EG_{\text{thermal}, \text{historical}} = Q_{\text{starch}} \times q_{\text{HFO}, \text{starch}} \times D_{\text{HFO}} \times NCV_{\text{HFO}}$$

Where:

Parameter	Details
$EG_{\text{thermal}, \text{historical}}$	Net quantity of thermal energy supplied by the project during year y (TJ)
Q_{starch}	Quantity of starch production in year y (tonne)
$q_{\text{HFO}, \text{starch}}$	Specific energy consumption (HFO/tonne)
D_{HFO}	Density of HFO (tonne/litter)
NCV_{HFO}	NCV of fossil fuel (HFO) used in the process (0.0404 TJ/tonne)

Fuel energy input approach:

$$EG_{\text{thermal}, \text{energy input}} = BG_{\text{combusted}, y} \times W_{\text{CH}_4} \times D_{\text{CH}_4} \times NCV_{\text{CH}_4}$$

Where:

Parameter	Details
$EG_{\text{thermal}, \text{energy input}}$	Net quantity of thermal energy supplied by the project during year y (TJ)
$BG_{\text{combusted}, y}$	Amount of biogas sent to boiler in year y (Nm ³)
W_{CH_4}	Methane content in the biogas in the year y (%)
D_{CH_4}	Density of methane at normal condition (tonne/Nm ³)
NCV_{CH_4}	NCV of methane (TJ/tonne)

Justification for deviation:

When compared to the industrial research as per published data at Thai Tapioca Starch Association website⁶, the average of 33.6 litre of HFO/ tonne of dried starch (range: 25.9-39.4) is found. The lowest historical data of 33.8 l/t is considered, as it is the most conservative and precise value based on the applied technology and equipment at Somdej starch plant

⁶Source: http://www2.diw.go.th/PIC/download/Guidelines/TTSA_MIS_Thai.pdf

3.2 Project Description Deviations

Project Participant had sought deviation during the validation report as described below:

Deviation 1

Description

The AMS-I.C methodology deviation relies on two approaches, the historical and the fuel energy input approach. The amount of biogas combusted, and starch produced, in the project scenario, at any given year are to be monitored for calculating the project scenario thermal energy generation. Meanwhile, the quantity of starch produced for any given year is applied to calculate the historical thermal energy.

Start date

During the monitoring period, 1st January 2020 onwards, a new monitoring parameter had been introduced, the $Q_{\text{starch},y}$ under section 4.2 of the MR, which is not included in the registered project description.

Justification

Additional of the parameter does not have an impact on the applicability of the methodology, additionality, nor the appropriateness of the baseline scenario. The deviation should be followed in all subsequent monitoring period as per paragraph 3.21.2, sub-paragraph 2 of the VCS Standard version 4.7.

Deviation 2

Description

Deviation involves a change in the procedures for measurement and monitoring of the parameter Flame_m . As per the registered project description, the parameters should be measured using an equipment with frequency of monitoring/ recording for the flame on/ off in minute.

Start date

It was noted during the verification assessment from 01st January 2020 onwards, that there was no flame detector installed in the project activity. The value taken for the parameter Flame_m has been taken as "0", zero. Referring to the tool to calculate project emission from flaring, the duration of flame detected in minute would be used for the identification of the flare efficiency. Since the value from Flame_m is 0, the flare efficiency used for the project activity could not be monitored.

Justification

Since the flame detector was not installed, the 0% of flare efficiency has been taken. This approach is conservative and the change in procedures for measurement and monitoring of the parameter does not have an impact on the applicability of the methodology, additionality, nor the appropriateness of the baseline scenario. The deviation should be followed in all subsequent monitoring period as per paragraph 3.21.2, sub-paragraph 2 of the VCS Standard version 4.7

3.3 New Project Activity Instances in Grouped Projects

This project is not a grouped project.

3.4 Baseline Reassessment

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes ☒ No

4 VERIFICATION FINDINGS

4.1 Project Details

Item	Evidence gathering activities, evidence checked, and assessment conclusion:				
Audit history	Audit type	Period	Program	Validation/verification body name	Number of years
	Validation	28/03/2006 to 27/03/2016	VCS	SGS Climate Change Programme	10 years
	Verification	28/03/2006 to 31/12/2008	VCS	SGS Climate Change Programme	2 years 9 months 6 days
	Verification	01/01/2009 to 31/05/2012	VCS	Germanischer Lolyd Certification GmbH	3 years 5 months
	Verification	01/06/2012 to 14/09/2014	VCS	RINA Services S.p.A (RINA)	2 years 3 months 15 days
	Verification	15/09/2014 to 27/03/2014	VCS	RINA Services S.p.A (RINA)	1 years 6 months 13 days
	Validation	28/03/2016 to 27/03/2026	VCS	RINA Services S.p.A (RINA)	10 years

	Verification	28/03/2016 to 31/12/2016	VCS	KBS Certification Services Pvt. Ltd.	9 months 5 days
	Verification	01/01/2017 to 31/12/2019	VCS	KBS Certification Services Pvt. Ltd.	3 years
	Verification	01/01/2020 to 02/03/2020	VCS	TUV NORD CERT GmbH	2 months 2 days
	Verification	03/03/2020 to 30/04/2021	VCS	TUV NORD CERT GmbH	1 year 1 months 27 days
	Verification	01/05/2021 to 31/10/2022	VCS	LGA Technological Center, S.A. (Applus+ Certification)	1 year 6 months 2 days
	Total	28/03/2006 to 31/10/2022			16 years 7 months 5 days
Double counting and participation under other GHG programs	The project has not applied under any other GHG program except VCS for current monitoring period, 01-May-2021 to 31-October-2022 (Inclusive of both the dates). The project is registered under VCS only with project ID 416. This was confirmed by checking VERRA registry website and similar exercise was performed for others registries with similar project title/capacity and Project Proponents but the assessment team was not able to trace any such project registered under any of the above stated registries or under any other similar mechanisms. An undertaking letter dated 03-November-2023 has been submitted by PP for no double counting with any other GHG program. The assessment team has also cross-checked the issuance records available on the Verra website and thus confirmed & ensured that the emission reduction generated from the project activity are not & will not be double counted hence accepted by the assessment team				

No double claiming with emissions trading programs or binding emission limits	The project is not included in an emissions trading program or any other mechanism that includes GHG allowance trading. The PP declares through the declaration that Net GHG emission reductions generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits any specific monitoring period under two mechanisms. The assessment team confirms that the GHG emission reductions or removals generated by the project have not been included in any emissions trading program or any other mechanism that includes GHG allowance trading
No double claiming with other forms of environmental credit	The assessment team cross-checked the issuance records available on the Verra website and thus confirmed & ensured that the emission reduction generated from the project activity are not & will not be double counted hence accepted by the assessment team. PP also has given a written declaration that project has not claimed other form of GHG credit for the concerned monitoring period
Supply chain (scope 3) emissions double claiming	This project activity does not involve any supply chain in the project such as manufacturers, wholesalers, distributors and retailers. So, no indirect upstream and downstream GHG emissions are involved in the project activity. Thus, the Scope 3 emissions are not applicable in this project activity Hence this section is not applicable.
Sustainable development contributions	During this monitoring period, the project activities implemented has contributed to several Sustainable Development Goals such as the SDG 7, 8 and 13. This installation reduces the amount of greenhouse gas released into the atmosphere, which corresponds to the improvement of the SDG 13, Climate Action. The generated biogas was also utilized for replacing heavy fuel oil and therefore reducing dependence on fossil-fuel-based energy sources which corresponds to the improvement of the SDG 7, Affordable and Clean Energy. Moreover, the operation of the project activity ensures the employment of local residents, contributing to the SDG 8, Decent Work and Economic Growth. Summary of Net Impact on SDG Indicators <u>SDG 7: Affordable and Clean Energy</u>

	MP no of Crediting Period	Current Monitoring Period	Baseline contribution (TJ)	Project contribution (TJ)	Net benefit (TJ)
	5 th MP of 2 nd Crediting Period	01-May-2021 to 31-October-2022	0	77.42	77.42
	<u>SDG 8 Decent Work and Economic Growth</u>				
	MP no of Crediting Period	Current Monitoring Period	Baseline contribution (number)	Project contribution (number)	Net benefit (number)
	5 th MP of 2 nd Crediting Period	01-May-2021 to 31-October-2022	0	9	9
	<u>SDG 13 Climate Action</u>				
	MP no of Crediting Period	Current Monitoring Period	Baseline contribution (tCO₂e)	Project contribution (tCO₂e)	Net benefit (tCO₂e)
	5 th MP of 2 nd Crediting Period	01-May-2021 to 31-October-2022	69,745	905	68,840
	VVB referred previous verification reports, monitoring report for the current period, and emission reduction sheet. VVB concluded that the claimed tonnes of greenhouse gas emissions avoided is correct				
Additional information relevant to the project	The assessment team confirms that as per information provided in the monitoring report submitted by the PP to the VVB no commercially sensitive information has been excluded from the public versions of project documents & thus conforms with the VCS Program requirements on what may be excluded. The information was cross-checked by interviewing the PP representative during the personal interviews.				

4.2 Safeguards and Stakeholder Engagement

4.2.1 Stakeholder Identification

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Stakeholder identification	All potential stakeholders are identified by considering any individuals or groups who have an interest in the project. The list of stakeholders is further categorized to the group who have a direct impact and indirect impact as follows. - Direct impact - o Employees - o Nearby communities (Huai Phueng District) - o Cassava farmers (Kham Bong Subdistrict) - Indirect impact - o Governmental agency (Huai Phueng District Administrative Organization and Regional Environmental Office) This is confirmed by onsite audit and performing site personnel and stakeholders' interviews The accuracy and comprehensiveness of the information gathered through the Stakeholder Analysis were verified by cross-checking with interview/focussed group discussions with relevant experts and stakeholder representatives volunteered during the onsite audit conducted by the VVB
Legal or customary tenure/access rights	The stakeholders have no customary tenure/ access rights to territories and resources of the projects
Stakeholder diversity and changes over time	Huai Phueng District has a total population ⁷ of 30,955 people, divided into 15,497 males, accounting for 51%, and 15,458 females, accounting for 49%. The population density is 120 people per square

⁷ Reference: <https://district.cdd.go.th/huaiphueng/about-us/ประวัติความเป็นมา/>

	kilometer. The majority of the population is engaged agricultural such as cassava plantation, rice plantation and sugar cane plantation.
Expected changes in well-being	Compared to baseline scenario, which is open lagoon wastewater treatment without biogas capturing, the project implementation could create jobs for local community, improve air quality and remove odor from biogas capturing. There will be no changes in ecosystem services identified as important to stakeholders as the treated wastewater will be utilized within the project boundary.
Location of stakeholders	In the area of Huai Phueng District Municipality, natural water sources obtained from rainwater and underground water. There is no canal or stream. Most of the population relies on water for consumption and agricultural from regional water supply systems. As the effluent from wastewater treatment system is to be used on-site for irrigation, there will be no discharged wastewater. The wastewater treatment facility is designed to achieve a Chemical Oxygen Demand (COD) of less than the national water standard for industrial effluents. The standard, however, does not apply to the project as there will be no discharge from the facility
Location of resources	The geography of Huai Phueng District has the water channel flows through the mountain creek, creating the rich-mineral soil in the surrounding area. With these conditions, most of the population turns to do agriculture as their main occupation. Overall, in Huai Phueng District, there is no severe environmental problem that significantly impact to the municipality. There is no large industrial factory within the area. Only a few medium-sized and small factories, located within the district, that have some minor environmental impact regarding waste disposal, air quality

4.2.2 Stakeholder Consultation and Ongoing Communication

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Ongoing consultation	The project activity has the grievance mechanism in place. The local stakeholder can either report to the security guard when they have any issue which want to be raised to the plant or report the issue to the head of their village, then the head of the village would gather all the information and raise it to the plant.

	During this monitoring period, there was no complaint raised against the project activity. This could be confirmed during the remote audit.
Date(s) of stakeholder consultation	No stakeholder consultation was held during this monitoring period.
Communication of monitored results	No stakeholder consultation was held during this monitoring period.
Consultation records	If the stakeholder consultation was organized, the meeting would be recorded as a minute of meeting (MOM).
Stakeholder input	No stakeholder consultation was held during this monitoring period.

4.2.3 Free, Prior, and Informed Consent

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Consent	This project does not involve indigenous people thus this section is not applicable. Hence this section is not applicable
Outcome of FPIC discussion	This project does not involve indigenous people thus this section is not applicable. Hence this section is not applicable

4.2.4 Grievance Redress Procedure

The project activity has the grievance mechanism in place. The local stakeholder can either report to the security guard when they have any issue which want to raise to the plant or report the issue to the head of their village, then the head of the village would gather all the information and raise it to the plant.

However, there was no complaint raised against the project activity during this monitoring period.

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Grievance received and steps taken to resolve the grievance including the outcomes of the resolution	Not Applicable

Grievance redress procedure	Not Applicable
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4.2.5 Public Comments

The overall response to the project, from all invited stakeholders, were encouraging and positive to local environment and social-economic conditions by cleaning the wastewater in a more efficient way, avoiding the odor emissions from the lagoons, and also creating new jobs.

In all, no adverse comments have been received during the Stakeholder Consultation process. The project participants did not recognize and need to make changes to the project design or monitoring plan.

Comments received	Actions taken by the project proponent	Evidence gathering activities, evidence checked, and assessment conclusion
No comments received during the stakeholder consultation and the 30 days listing period.	NA	As this is the fifth verification of second crediting period and overall, nine periodic verifications of the project activity, it is concluded that para 4.1.5, 4.1.6, 4.1.7 are not applicable for the current monitoring period for the given project activity

4.2.6 Risks to Local Stakeholders and the Environment

4.2.6.1 Management Experience

The Stakeholder Consultation has been conducted by the project owner, SD Biosupply Co., Ltd with an assistance from other entity, South Pole Carbon Asset Management Limited (SPCAM, Switzerland based company responsible for VCS project development). SPCAM is also responsible for project design.

SPCAM has experienced in developing carbon project under Verified Carbon Standard. For example, CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation project (VCS 2261), VP Biosupply wastewater treatment and biogas utilization project (VCS 415) and Banpong tapioca flour industrial wastewater treatment and biogas utilization project (VCS 405). With all these experiences, it can be assured that communities engaging, and project activities implementation were done professionally.

4.2.6.2 Risk Assessment

Item	Evidence gathering activities, evidence checked, and assessment conclusion
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Natural and human induced risks to stakeholders' wellbeing	Water quality - People are concerned about the wastewater being discharged into natural water resources. However, PP informed that the effluent is to be used on-site for irrigation, so no wastewater will be discharged. This shall be monitored periodically to ensure to villagers. Onsite audit: by performing stakeholders' interviews - Assessed the potential risks to stakeholder participation in the project activities. - Verified the measures taken by the project proponent (PP) to ensure open and transparent dialogue with stakeholders Evidence Checked: Interviews and log book sheet Assessment conclusion:- - No risks to stakeholder participation were identified in the project activities. - Meaningful consultations were conducted with affected local communities, including project-affected persons. - All aspects of the project, environmental and social impacts, and mitigation measures were discussed during these consultations
Risks to stakeholder participation	No risk identified: The project involves no risk to the stakeholder participation.
Working conditions	Occupational health and safety: Provide safety plan, awareness, and enforcement. Provide worker health program. Prepare emergency procedures. Onsite audit: by performing stakeholders' interviews, health and safety policy. - Reviewed the working conditions, safety protocols, training programs Evidence Checked: Grievance register, interview During onsite audit, assessment team conducted focussed group discussion and Personnel interviews with the designated team heads to conclude the following: - Safety protocols and risk mitigation measures - Training records - Employment records

	Assessment conclusion: Based on the evidence gathered during the onsite visit and reviewed, it is confirmed that: The project proponent (PP) has diligently maintained exemplary working conditions, ensuring the safety, health, and well-being of all employees involved. The same was observed during physical site observation by AT
Safety of women and girls	No risk identified: The project does not involve specifically safety of women and girls
Safety of minority and marginalized groups, including children	No risk identified: The project does not involve specifically the marginalized group
Pollutants (air, noise, discharges to water, generation and release of hazardous materials and chemical pesticides and fertilizers)	1. Wastewater discharge: 1.1 As the effluent is to be used on-site for irrigation, there will not be any discharged wastewater. 1.2 The wastewater treatment facility is designed to achieve a Chemical Oxygen Demand (COD) not exceeding the national water standard for industrial effluents. 2. Air pollutant emissions from boilers: 2.1 Ensure proper operation and maintenance of scrubbers. 3. Odor nuisance : 3.1 Proper maintenance of wastewater lagoon and HDPE sheet. 3.2 Provision of adequate storage areas and capacities on-site for sludge. Onsite audit: by performing stakeholders' interviews and site observations made by assessment team Assessed the potential risks related to pollutants, including air emissions, noise pollution, water discharges, waste generation, and hazardous material releases. Evidence Checked: Onsite interview, Environmental and social Policy, site observation and daily log sheet /11/. As per the onsite interview, the project improves air quality and produces no pollution as compared to the baseline. Hence, it is concluded that there is no risk associated with pollutant emissions caused by project activity.

4.2.7 Respect for Human Rights and Equity

4.2.7.1 Labor and Work

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Discrimination	There is no discrimination according to the law of Thailand which the project follows. Hence this section is not applicable
Sexual harassment	There is no sexual harassment according to the law of Thailand which the project follows. Hence this section is not applicable
Gender equity in labor and work	Gender equity in labor and work has been respected by the project proponent. Employee payment has been paid by following the Thai Labor Protection Act. Hence this section is not applicable
Forced labor	There is no forced labor in the project activity as it follows the Thai Labor Protection Act. Hence this section is not applicable
Child labor	There is no child labor in the project activity as it follows the Thai Labor Protection Act. Hence this section is not applicable
Human trafficking ⁸	There is no human trafficking in the project activity as it follows the Thai Labor Protection Act. Hence this section is not applicable

4.2.7.2 Human Rights

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
No risk identified	This project does not involve IPs, LCs, and customary rights holders as its location is the property of the project owner. Hence this section is not applicable

4.2.7.3 Indigenous Peoples and Cultural Heritage

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
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⁸ The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor, and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

No risk identified	This project does not involve cultural heritage as its location is the property of the project owner. It is concluded that the given project activity area has not involved the Indigenous People and any cultural Heritage
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4.2.7.4 Property Rights

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
No risk identified	No property rights are violated due to this project activity as per the interviews conducted during the onsite visit. Hence, no land/property of the stakeholders, IPs, LCs, and customary rights holders has been incorporated. Additionally, the project activity has obtained the free, prior and informed consent of local stakeholders. This ensures that their lands are property rights are protected and respected

4.2.7.5 Benefit Sharing

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Summary of the benefit sharing plan	This project activity does not involve the property rights. Thus, this section is not applicable.
Benefit sharing during the monitoring period	This project activity does not involve the property rights. Thus, this section is not applicable.

4.2.8 Ecosystem Health

Item	Evidence gathering activities, evidence checked, and assessment conclusion
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Impacts on biodiversity and ecosystems	No risk identified - The project activity does not involve impacts on biodiversity and ecosystems.
Soil degradation and soil erosion	No risk identified - The project activity does not involve impacts on soil degradation and soil erosion.
Water consumption and stress	No risk identified - The project activity does not involve water consumption and stress.

4.2.8.1 Rare, Threatened, and Endangered species

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Species or habitat	The project has not adversely impact habitats and areas needed for habitat connectivity for rare, threatened, or endangered species during the monitoring period.
Areas needed for habitat connectivity	The project has not adversely impact habitats and areas needed for habitat connectivity for rare, threatened, or endangered species during the monitoring period.

	Evidence gathering activities, evidence checked, and assessment conclusion
Habitats for rare, threatened, and endangered species	The project has not adversely impact habitats and areas needed for habitat connectivity for rare, threatened, or endangered species during the monitoring period.
Areas for habitat connectivity	The project has not adversely impact habitats and areas needed for habitat connectivity for rare, threatened, or endangered species during the monitoring period.

4.2.8.2 Introduction of Species

Species introduced	Evidence gathering activities, evidence checked, and assessment conclusion
No Species Introduced	The project has not adversely impact habitats and areas needed for habitat connectivity for rare, threatened, or endangered species during the monitoring period.

Existing invasive species	Evidence gathering activities, evidence checked, and assessment conclusion
No Existing invasive species	The project has not adversely impact habitats and areas needed for habitat connectivity for rare, threatened, or endangered species during the monitoring period.

Evidence gathering activities, evidence checked, and assessment conclusion	
Invasive species	The project has not adversely impact habitats and areas needed for habitat connectivity for rare, threatened, or endangered species during the monitoring period.

4.2.8.3 Ecosystem conversion

Item	Evidence gathering activities and evidence checked
Ecosystem conversion	Since the project activity is not an Afforestation and Reforestation (ARR) project, Agroforestry and Agro-silvopastoral Systems (ALM) project, Wetland Restoration and Conservation (WRC) project, nor an Avoided Conversion of Grasslands and Shrublands (ACOGS) project. The information related to these specific project types is not applicable. This means that the project does not fall under any of these categories and therefore does not need to be evaluated based on the criteria specific to these types of projects. Hence this section is not applicable

4.3 Accuracy of Reduction and Removal Calculations

The verification team assessed whether the data and calculations of GHG emission reductions achieved resulting from the VCS MR /6/. The verification team has checked whether calculations of baseline GHG emissions, project GHG emissions and leakage GHG emissions have been carried out in accordance with the formulae and methods described in the monitoring plan of the VCS PD/4/.

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

DATA/PARAMETER Unit	Source of data	Reported value for the project period	VVB Observation
Global Warming Potential for Methane (GWPC _{H4}) in tCO _{2e} /tCH ₄	Data based on registered VCS PD /02/	28	The value is ex-ante fixed for 10 years crediting

			period as per the registered PD. The value is as per IPCC fourth assessment report. Hence, correct value is considered.
Methane producing capacity of the wastewater (Bo,ww); kg CH ₄ /kg COD	Data based on registered PD /02/ and validation report	0.25	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.
Model correction factor to account for model uncertainties (UFBL)	Data based on registered PD /02/ and validation report /11/	0.89	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 (UFPJ)	Data based on registered PD /02/ and validation report /11/	1.12	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/
$\eta_{COD,BL,I}$ or COD removal efficiency-baseline Chemical oxygen demand removal efficiency of baseline treatment system; %	Data based on registered PD /02/ and validation report /11/	87.62%	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/.

CFE _{ww} Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (CFE _{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/
EF _y emission factor for grid power (EF _y); tCO ₂ /MWh	Data based on registered PD /02/ and validation report /11/	0.56375	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/.
η _{BL,thermal} (Efficiency of the boiler using fossil fuel that would have been used in the absence of the project activity.)	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/.
Density of methane gas at reference conditions (DCH ₄); kg/m ³	Data based on registered PD /02/	0.716	The value is ex-ante fixed for 10 years crediting

	and validation report /11/		period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /11/.
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Data parameters monitored:

Data/Parameter	VVB Assessment		
Data Unit	Qy,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)	
		Lower	Higher
	01-May-2021 to 31-December-2021	286,625	286,751
	01-January-2022 to 31-October-2022	345,856	345,856
Monitoring equipment	There were a replacement of the wastewater flow meters both (FM1) since 20 April 2017. The meter has been replaced with the similar type/ brand. The detail of the instrument and the period of installation are as follow.		
Accuracy of the monitoring equipment	±0.50%		
Measuring/Reading/Recording frequency	Annually		

Calculation method (if applicable)	Not applicable		
Calibration			
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	Calibration frequency is defined least annually. This is consistent with registered monitoring plan and with calibration certificate submitted by project proponent.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected	The calibration gap was taken during 18-May-2021 to 20-Jun-2021.		
Calibration certificates	Serial Number	6B00F220000	
	Manufacturer	Endress+Hauser	
	Model	Promag 10W	
	Accuracy	+/- 0.50%	
	Installation	20/04/2017 until now	
	Calibration frequency	annually	
	Calibration	Cal. date	Validity
		18/05/2020	17/05/2021
		21/06/2021	20/06/2022
		08/06/2022	07/06/2023
The calibration gap is taken during 18/05/2021 to 20/06/2021. The error applied during the gap period is 0.50%.			
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	COD _{ww, untreated, y;}
Data Unit	t COD/m ³
Description	The chemical oxygen demand of the wastewater entering the UASB system
Source of data to be used	Measured – Colorimetric analysis

Value of monitored parameter for the monitoring period	Monitoring period	Average value*	
		Lower	Higher
	01-May-2021 to 31-December-2021	0.0311	0.0320
	01-January-2022 to 31-October-2022	0.0300	0.0311
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			
Monitoring equipment	Serial Number	041090C53333	
	Manufacturer	HACH	
	Model	DR890	
	Accuracy	0.24% (±0.005 A @1.0 ABS Nominal)	
	Calibration frequency	Once in two years	
	Calibration	Cal. date	Validity
		09/03/2021	08/03/2023
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment.		
Measuring/Reading/Recording frequency	VVB team conform that, 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.		

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 VCS PD	Calibration frequency is defined least once in two 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	VVB team verified that, 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	
	041090C53333	09-March-2021 to 08-March-2023	
Whether calibration done by an accredited person or institution?	HACH which is the manufacture of the equipment.		

Data/Parameter	VVB Assessment		
Data Unit	COD _{ww,treated,yt} COD/m ³		
Description	The chemical oxygen demand of the wastewater coming out of the UASB system.		
Source of data to be used	Measured – Colorimetric method		
Value of monitored parameter for the monitoring period	Monitoring period	Average value*	
		Lower	Higher
	01-May-2021 to 31-December-2021	0.0010	0.0011
	01-January-2022 to 31-October-2022	0.0012	0.0013
VVB team verified that, 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.		
Monitoring equipment	Serial Number	041090C53333	
	Manufacturer	HACH	
	Model	DR890	
	Accuracy	0.24% (±0.005 A @1.0 ABS Nominal)	
	Calibration frequency	Once in two years	
	Calibration	Cal. date	Validity
	09/03/2021	08/03/2023	
Accuracy of the monitoring equipment	VCS PD does not specify the accuracy of monitoring equipment.		
Measuring/Reading/Recording frequency	VVB team verified that, 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 job 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 VCS PD	Calibration frequency is defined least once in two 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	VVB team would verify that, 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	<table> <tr> <td>Serial no.</td><td>Calibration details</td></tr> <tr> <td>041090C53333</td><td>09-March-2021 to 08-March-2023</td></tr> </table>	Serial no.	Calibration details	041090C53333	09-March-2021 to 08-March-2023
Serial no.	Calibration details				
041090C53333	09-March-2021 to 08-March-2023				
Whether calibration done by an accredited person or institution?	HACH which is the manufacture of the equipment.				

Data/Parameter	VVB Assessment						
Data Unit	$Q_{\text{starch},y}$, tonnes						
Description	Quantity of dry starch produced						
Source of data to be used	Based on operational log sheet at starch plant						
Value of monitored parameter for the monitoring period	<table> <tr> <th>Monitoring period</th><th>Average value*</th></tr> <tr> <td>01-May-2021 to 31-December-2021</td><td>27,684.05</td></tr> <tr> <td>01-January-2022 to 31-October-2022</td><td>33,370.66</td></tr> </table> Reported values in the MR and ER sheet were found to be consistent with plant records.	Monitoring period	Average value*	01-May-2021 to 31-December-2021	27,684.05	01-January-2022 to 31-October-2022	33,370.66
Monitoring period	Average value*						
01-May-2021 to 31-December-2021	27,684.05						
01-January-2022 to 31-October-2022	33,370.66						
Monitoring equipment	The measurement equipment are two weighbridges. The quality of starch product is controlled by the operator. During normal operation, operators transfer production data that pass QA/QC process into the log sheet of starch factory. In this monitoring period, two weight scales measure the starch product, please see following details. <table> <tr> <td>S/N</td><td>2015024</td></tr> <tr> <td>Equipment type</td><td>Weight bridge</td></tr> </table>	S/N	2015024	Equipment type	Weight bridge		
S/N	2015024						
Equipment type	Weight bridge						

	Manufacturer	Linear Instrument	
	Model	D2002	
	Max. Capacity	80,000 kg.	
	Repeatability	±10 kg.	
	Date of installation	28/02/2017 to present	
	Calibration	Cal. date	Validity
		05/12/2019	04/12/2021
		04/02/2021	03/02/2023
	S/N	2015003	
	Equipment type	Weight bridge	
	Manufacturer	Linear Instrument	
	Model	PM7	
	Max. Capacity	80,000 kg.	
	Repeatability	±10 kg.	
	Date of installation	Commissioning to present	
	Calibration	Cal. date	Validity
		05/12/2019	04/12/2021
		06/09/2021	05/09/2023
Accuracy of the monitoring equipment	Accuracy in the monitoring parameter can be assured since it is the main income source of the starch plant.		
Measuring/Reading/Recording frequency	A proper record of all starch produced was maintained at the project site. In recording this parameter, the plant’s operators should first manually archive the monitored data onto log sheets. The archive was done daily. Recorded on daily basis, and the monthly data was taken for the calculation		
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 VCS PD	The calibration frequency would be calibrated at least once every two years based on relevant national requirement. This is consistent with calibration certificate and previous verifications and hence accepted.
Does the calibration cover the monitoring period? Has the calibration frequency been respected	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	VVB team verified that, PP has submitted the calibration certificate and it is found to be consistent and error free.
Whether calibration done by an accredited person or institution?	The calibrations were conducted by the Central Bureau of Weights and Measures according to the national standard.

Data/Parameter	VVB Assessment	
Data Unit	S _{final,PJ,y} tonnes	
Description	Amount of dry matter in the sludge	
Source of data to be used	Weighing equipment that is available at the site are used. Plant records every time sludge is removed from the system.	
Value of monitored parameter for the monitoring period	Monitoring period	Total value (tons)
	01-May-2021 to 31-December-2021	0
	01-January-2022 to 31-October-2022	0
	VVB team verified that, weighbridge was maintained by the project proponent and it was calibrated as per monitoring records and it is found it consistent and error free.	
Monitoring equipment	Meter tag	Weighbridge
	Serial number	2015024
	Brand	Liner Instrument
	Type	D2002

	Accuracy	0.01%	
	Calibration frequency	Once in 2 years	
	Calibration	Cal. Date	Validity
		16/05/2019	15/05/2021
		04/02/2021	03/02/2023
	Serial Number	2015003	
	Manufacturer	Liner Instrument	
	Model	PM7	
	Accuracy	0.01%	
	Installation	Commissioning to now	
	Calibration frequency	Once in two years	
	Calibration	Cal. date	Validity
		16/05/2019	15/05/2021
06/09/2021		05/09/2023	
Accuracy of the 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.		
Calculation method (if applicable)	Values as recorded in weight-bridge is taken and no calculation method is applied.		
Calibration			
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	The weighbridge meter is calibrated at least once every 2 years as per registered monitoring plan		
Does the calibration cover the monitoring period? Has the calibration frequency been respected	Hence, calibration cover the monitoring period		
Calibration certificates	Monitoring equipment details are provided above and it is found consistent and as per calibration certificate and accepted.		

Whether calibration done by an accredited person or institution?	The calibrations were conducted by the Central Bureau of Weights and Measures according to the national standard.
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Data/Parameter	VVB Assessment		
Data Unit	BG _{burnt,y} Nm ³		
Description	Amount of biogas combusted for gainful use		
Source of data to be used	Calculated from a summation of total biogas utilized in boilers and flare.		
Value of monitored parameter for the monitoring period	VVB team verified that, The amount of biogas combusted was the summation of the volume of biogas sent to boilers.		
	Monitoring period		Applied value*
	01-May-2021 to 31-December-2021	2,592,730	
	01-January-2022 to 31-October-2022	3,120,672	
	The biogas was monitored using a continues flow meter. The volumetric flow meters have been automatically measured temperature and pressure, expressing biogas volumes in normalized cubic meters (Nm ³).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	9A070602000	
	Manufacturer	Endress+Hauser	
	Model	T-mass 65	
	Accuracy	±0.50%	
	Calibration frequency	Once in two years	
	Calibration	Cal. date	Validity
		07-June-2019	06-June-2021
		19-May-2020	18-May-2022

		22-June-2021	21-June-2023
		09-June-2022	08-June-2024
Accuracy of the 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.		
Calculation 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 VCS PD	The flow meter is calibrated at least once every 2 years as per registered monitoring plan.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected	VVB team verified that, Calibration cover the monitoring period.		
Calibration certificates	VVB team, verified that, calibration details are found consistent with submitted calibration certificate.		
Whether calibration done by an accredited person or institution?	-		

Data/Parameter	VVB Assessment		
Data Unit	WCH ₄ ,y%		
Description	Methane content in biogas		
Source of data to be used	Measured – Gas analyzer system to monitor % of methane in biogas		
Value of monitored parameter for the monitoring period	Monitoring period	Methane content	
		Lower	Upper

	01-May-2021 to 31-December-2021		54.37%	66.85%
	01-January-2022 to 31-October-2022		57.05%	61.83%
	During the monitoring period, as the online monitoring equipment was not available for continuous measurement, the portable gas analyzer was used for periodic measurement and the measured values were applied at a 90% confidence level. The lower and upper values were used for the calculation of the baseline and project emissions in a conservative manner.			
Monitoring equipment	Serial Number	ARAM-0090		
	Manufacturer	Draeger		
	Model	X-am 7000		
	Accuracy	0-5 vol%		
	Calibration frequency	Every 6 months		
	Calibration	Cal. date	Validity	
		28-October-2020	27-April-2021	
		09-September-2021	08-March--2022	
05-November-2021		04-May-2022		
02-December-2022		01-June-2023		
Accuracy of the monitoring equipment	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 90 % confidence interval which is consistent with the applied methodology.			
Calculation 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 VCS PD	The analyser is calibrated at least once every 6 Months as per registered monitoring plan.			

Does the calibration cover the monitoring period? Has the calibration frequency been respected	VVB team verified that there is calibration Gap: The error has been applied as per below: 01/05/21 to 08/09/2021 with 6.0% error 05/05/22 to 31/10/22 with 4.0%error In ER sheet and found to be correct, hence accepted.
Calibration certificates	VVB team, verified that, calibration details are found consistent with submitted calibration certificate.
Whether calibration done by an accredited person or institution?	-

Data/Parameter	VVB Assessment		
Data Unit	BG _{combusted,y} Nm ³		
Description	Amount of biogas that is sent to boiler		
Source of data to be used	Measured using biogas flow meter: GM2		
Value of monitored parameter for the monitoring period	Monitoring period		Applied value
	01-May-2021 to 31-December-2021		2,583,932
	01-January-2022 to 31-October-2022		3,111,215
	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	EA033D02000	
	Manufacturer	Endress+Hauser	
	Model	T-mass 65	
	Accuracy	±0.50%	
	Calibration frequency	Once in two years	
	Calibration date	Cal. date	Validity
		07-June-2019	06-June-2021
		19-May-2020	18-May-2022

		22-June-2021	21-june-2023
		09-June-2022	08-june-2024
Accuracy of the monitoring equipment	The accuracy of the meter is as per industry standard.		
Measuring/Reading/Recording frequency	Continuous monitoring and daily recording.		
Calculation 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 VCS PD	The flow meter is calibrated at least once every 2 years as per registered monitoring plan.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected	VVB team verified that, the monitoring period is from 01-May-2021 to 31-October-2022. Hence calibration cover the monitoring period.		
Calibration certificates	VVB team, verified that, calibration details are found consistent with submitted calibration certificate.		
Whether calibration done by an accredited person or institution?	-		

Data/Parameter	VVB Assessment		
Data Unit	EC _y MWh/y		
Description	Quantity of electricity consumed by the project electricity consumption source j in year y		
Source of data to be used	The monitoring was done by the import power meter.		
Value of monitored parameter for the monitoring period	Monitoring period		Applied value
	01-May-2021 to 31-December-2021		694.863

	01-January-2022 to 31-October-2022		799.432
Monitoring equipment	PEA Number	6001693334	
	Manufacturer	TTC	
	Spec	110V	
	Phase	3-WIRE	
	Model	ST-33TL	
	Accuracy	Class 0.5s	
Accuracy of the monitoring equipment	The electricity meter is under the ownership of the PEA and under PEA jurisdiction.		
Measuring/Reading/Recording frequency	Continuous monitoring by electricity meter of the PEA.		
Calculation method (if applicable)	Not applicable		
Calibration			
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	The electricity meter is under the ownership of the PEA and under PEA jurisdiction.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected	The meter maintenance is not under the jurisdiction of project proponent.		
Calibration certificates	The meter maintenance is not under the jurisdiction of project proponent.		
Whether calibration done by an accredited person or institution?	The meter maintenance is not under the jurisdiction of project proponent.		

Data/Parameter	VVB Assessment	
Data Unit	V_{RG,hNm^3}	
Description	Volumetric flow of the residual gas on dry basis at normal conditions in the minute <i>m</i> .	
Source of data to be used	Measured using biogas flow meter: GM3	
Value of monitored parameter for the monitoring period	Monitoring period	Applied value
	01-May-2021 to 31-December-2021	1,831

	01-January-2022 to 31-October-2022		2,979	
Monitoring equipment	Serial Number	N413E702000		
	Manufacturer	Endress+Hauser		
	Model	T-mass 65		
	Accuracy	±0.50%		
	Calibration frequency	Once in two years		
	Installation	12/07/2018 until now		
	Calibration	Cal. date	Validity	
		07/06/2019	06/06/2021	
		19/05/2020	18/05/2022	
22/06/2021		21/06/2023		
	09/06/2022	08/06/2024		
Accuracy of the monitoring equipment	±0.075%&1%R + 0.2%FS			
Measuring/Reading/Recording frequency	The accuracy of the meters is as per industry standard.			
Calculation 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 VCS PD	The flow meter is calibrated at least once every 2 years as per registered monitoring plan.			
Does the calibration cover the monitoring period? Has the calibration frequency been respected	VVB team verified that, calibration cover the complete current monitoring period			
Calibration certificates	VVB team, verified that, calibration details are found consistent with submitted calibration certificate.			
Whether calibration done by an accredited person or institution?	–			

Data/Parameter	VVB Assessment
Data Unit	FC _{HFO,y}

Description	Quantity of fuel type i (HFO) combusted in process j during the year y			
Source of data to be used	Plant data			
Value of monitored parameter for the monitoring period	Monitoring period		Applied value	
	01-May-2021 to 31-December-2021	0		
	01-January-2022 to 31-October-2022	0		
Monitoring equipment	There are two fuel oil meters used in this monitoring period. A proper record of all the fossil fuel consumed was maintained at the project site. The OM2 meter was replaced with a new one (Aquametro) on 1 st October 2022.			
	OM1 (SCHERRER)			
	Serial Number	92093 ID: TMC-4-1-0068-44		
	Manufacturer	ABB		
	Model	ABB 25 RC		
	Accuracy	1.0%		
	Calibration frequency	Once in two years		
	Calibration	Cal. date	Validity	
		10/06/2019	09/06/2021	
		22/05/2020	21/05/2022	
		25/06/2021	24/06/2023	
		13/06/2022	12/06/2024	
	OM2 (VEGA) – stop using			
	Serial Number	4164890 ID: TMC-0157-43		
	Manufacturer	ABB		
	Model	ABB 25 RC		
	Accuracy	1.0%		
Calibration frequency	Once in two years			

	Calibration date	Cal. date	Validity
		10/06/2019	09/06/2021
		22/05/2020	21/05/2022
		25/06/2021	24/06/2023
	OM2 – NEW (installed on 1 st October 2022)		
	Serial Number	5857704	
	Manufacturer	Aquametro Oil & Marine	
	Model	VZO 25 RC 130/16	
	Accuracy	1.0%	
	Calibration frequency	Once in two years	
	Calibration date	Cal. date	Validity
01/07/2021		30/06/2023	
Accuracy of the monitoring equipment	1.0%		
Measuring/Reading/Recording frequency	The fuel oil consumption is monitored using the fuel oil meter directly.		
Calculation 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 VCS PD	The meter was calibrated at least once in two years or as per the manufacturer’s recommendations to maintain the measuring accuracy.		
Does the calibration cover the monitoring period? Has the calibration frequency been respected	VVB team verified that, the monitoring period is from 01-May-2021 to 31-October-2022. Hence calibration cover the monitoring period.		
Calibration certificates	VVB team, verified that, calibration details are found consistent with submitted calibration certificate.		
Whether calibration done by an accredited person or institution?	-		

Data/Parameter	VVB Assessment
Data Unit	EG _{thermal,y} TJ/year

Description	Net quantity of thermal energy supplied by the project activity during the year y		
Source of data to be used	Plant records”		
Value of monitored parameter for the monitoring period	Monitoring period		Applied value (TJ)
	01-May-2021 to 31-December-2021		50.30
	01-January-2022 to 31-October-2022		63.55
	Historical Production Approach		
	Monitoring period	Value applied (TJ)	
	01-May-2021 to 31-December-2021	35.10	
	01-January-2022 to 31-October-2022	42.31	
	The thermal oil flow rate and the temperature difference of the thermal oil before and after the boiler should be monitored. In case the monitoring equipment is not available, the methodology deviation approach is applied. The approach estimates the thermal energy delivered by the project activity based on historical fuel oil consumption and starch production for the given year. The conservative approach is ensured by comparing the total energy delivered by the fuels burnt in the project activity and thermal energy estimate based on historical fuel oil consumption values. Therefore, the amount of dry starch and quantity of biogas utilised are the monitored parameters in order to determine the thermal energy required in the project activity.		
Monitoring equipment	The monitoring equipment is referred to monitoring parameter BG _{combusted} , and Q _{starch} . The value applied is based on the calculation as per the deviation approach.		
Accuracy of the monitoring equipment	This section is referred to parameter BG _{combusted} , and Q _{starch} .		
Measuring/Reading/Recording frequency	Continuous monitoring, aggregated annually		

	During this monitoring period the deviation has been introduced, please refer to the frequency of $BG_{\text{combusted}}$, and Q_{starch}
Calculation method (if applicable)	Calculation method is based on the measurement of historical production data and energy input. The deviation approach is provided in section 3.2.1 of Monitoring Report.
Calibration	
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	Not Applicable
Does the calibration cover the monitoring period? Has the calibration frequency been respected	Not Applicable
Calibration certificates	Not Applicable
Whether calibration done by an accredited person or institution?	Not Applicable

Data/Parameter	VVB Assessment
Data Unit	NCV_{HFO}
Description	Weighted average net calorific value of fuel type i (HFO) in year y
Source of data to be used	IPCC 2006 default value for residual fuel oil, Volume 2, Chapter 1, 1.23
Value of monitored parameter for the monitoring period	0.0404
Monitoring equipment	-
Accuracy of the monitoring equipment	Default value as per IPCC
Measuring/Reading/Recording frequency	Default value as per IPCC
Calculation method (if applicable)	Default value as per IPCC

Calibration	
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	Default value as per IPCC
Does the calibration cover the monitoring period? Has the calibration frequency been respected	Default value as per IPCC
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.

Data/Parameter	VVB Assessment
Data Unit	EF _{FF,HFO}
Description	Emission factor of fossil fuel replaced-residual fuel oil
Source of data to be used	IPCC 2006 default value for residual fuel oil, Volume 2, Chapter 1, 1.23
Value of monitored parameter for the monitoring period	77.4
Monitoring equipment	-
Accuracy of the monitoring equipment	Default value as per IPCC
Measuring/Reading/Recording frequency	Default value as per IPCC
Calculation method (if applicable)	Default value as per IPCC
Calibration	
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	Default value as per IPCC

Does the calibration cover the monitoring period? Has the calibration frequency been respected	Default value as per IPCC
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.

Data/Parameter	VVB Assessment
Data Unit	η Flare-h, %
Description	Flare efficiency in the minute m
Source of data to be used	Default value for open flares as per tool “project emission from flaring” The flare efficiency of 50% in the minute m is applied when the flare is detected in the minute m ($Flame_m$). If these conditions are not met, 0% default value has been used for this period.
Value of monitored parameter for the monitoring period	0
Monitoring equipment	-
Accuracy of the monitoring equipment	-
Measuring/Reading/Recording frequency	-
Calculation method (if applicable)	-
Calibration	
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	-

Does the calibration cover the monitoring period? Has the calibration frequency been respected	-
Calibration certificates	-
Whether calibration done by an accredited person or institution?	-

Data/Parameter	VVB Assessment	
Data Unit	TDL _{j,y} , %	
Description	Average technical transmission and distribution losses for providing electricity to source j in year y	
Source of data to be used	World bank database (Thailand 2014) This is annual average value based on the most recent data available within the host country	
Value of monitored parameter for the monitoring period	Monitoring period	Value applied (%)
	01/05/2021 to 31/12/2021	7.74
	01/01/2022 to 31/10/2022	6.93
	The supportive document for the TDL calculation and the references of all the values used have been prepared and submitted during the verification. The TDL value is based on the average technical transmission and distribution losses of year 2020 ⁹ .	
Monitoring equipment	-	
Accuracy of the monitoring equipment	Default value as per World bank database (Thailand 2014)	
Measuring/Reading/Recording frequency	This is annual average value based on the most recent data available within the host country	
Calculation method (if applicable)	-	
Calibration		

⁹ https://www.dede.go.th/ewt_news.php?nid=47341

Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the VCS PD	-
Does the calibration cover the monitoring period? Has the calibration frequency been respected	-
Calibration certificates	-
Whether calibration done by an accredited person or institution?	-

Baseline Emissions for AMS-III.H Version 18

(a) Methane destruction component (AMS.III.H, Version 18)

According to the paragraph 27 of AMS III.H, Version 18, baseline emissions for the systems affected by the project activity may consist of:

- a) Emissions on account of electricity or fossil fuel used ($BE_{power,y}$);
- b) Methane emissions from baseline wastewater treatment systems ($BE_{ww,treatment,y}$);
- c) Methane emissions from baseline sludge treatment systems ($BE_{s,treatment,y}$);
- d) Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/ lake/ sea ($BE_{ww,discharge,y}$);
- e) Methane emissions from the decay of the final sludge generated by the baseline treatment systems ($BE_{s,final,y}$).

Baseline emissions (BE_y)

The baseline emissions are calculated as follows.

$$BE_y = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\} \quad (1)$$

Where:

Parameter	Details	Quantification
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BE _y	Baseline emissions in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 30,884 <u>01-January-2022 to 31-October-2022</u> = 38,861
BE _{power, y}	Baseline emissions from electricity or fuel consumption in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
BE _{ww, treatment, y}	Baseline emissions of the wastewater treatment systems affected by the project activity in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 38,967 <u>01-January-2022 to 31-October-2022</u> = 45,314
BE _{s, treatment, y}	Baseline emissions of the sludge treatment systems affected by the project activity in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
BE _{ww, discharge, y}	Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (tCO _{2e}).	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0

BE _{s, final, y}	Baseline methane emissions from anaerobic decay of the final sludge produced in year y (tCO ₂ e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term would be neglected.	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
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Baseline emissions of the wastewater treatment systems affected by the project activity (BE_{ww, treatment, y}):

Methane emissions from the baseline wastewater treatment systems affected by the project (BE_{ww, treatment, y}) are determined using the methane generation potential of the wastewater treatment systems as per the paragraph 29 of AMS III.H version 18. The following equation is used.

$$BE_{ww, treatment, y} = \sum Q_{ww, i, y} * COD_{ww, untreated, y} * \eta_{COD, BL, i} * MCF_{ww, treatment, BL, i} * B_{0, ww} * UF_{BL} * GWP_{CH4} \quad (2)$$

Where:

Parameter	Details	Quantification
BE _{ww, treatment, y}	Baseline emissions of the wastewater treatment systems affected by the project activity in year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 38,967 <u>01-January-2022 to 31-October-2022</u> = 45,314
Q _{ww, i, y}	Volume of wastewater treated in baseline wastewater treatment system i in year y (m ³)	<u>01-May-2021 to 31-December-2021</u> = 286,624 <u>01-January-2022 to 31-October-2022</u> = 345,856
COD _{ww, untreated, y}	Chemical oxygen demand of the wastewater inflow to the baseline treatment system i in year y. Average	<u>01-May-2021 to 31-December-2021</u>

	value may be used through sampling with the confidence/precision level 90/10 (t/m ³). Lower value from section 4.2 were selected for the calculation.	= 0.0311 <u>01-January-2022 to 31-October-2022</u> = 0.0300
$\eta_{\text{COD, BL, i}}$	COD removal efficiency of the baseline treatment system i	87.62%
$\text{MCF}_{\text{ww, treatment, BL, i}}$	Methane correction factor for the baseline anaerobic wastewater treatment i (MCF values as per table III.H.2)	0.8
i	Index for baseline wastewater treatment system	-
$B_{\text{o, ww}}$	Methane producing capacity of the wastewater (IPCC lower value for domestic wastewater of 0.25 kg CH ₄ /kg COD) ¹⁰	0.25
UF_{BL}	Model correction factor to account for model uncertainties (0.89) ¹¹	0.89
GWP_{CH_4}	Global Warming Potential for methane (value of 28)	<u>01-May-2021 to 31-December-2021</u> = 28 <u>01-January-2022 to 31-October-2022</u> = 28

The parameter $\eta_{\text{COD, BL, i}}$ is based on the historical COD measurement of the baseline system prior implementation of project activity. The measurement campaign of 11 days was conducted

³ The IPCC default value of 0.25 kg CH₄/kg COD was corrected to take into account the uncertainties. Project activities may use the default value of 0.6 kg CH₄/kg BOD, in case the parameter BOD_{5,20} is used to determine the organic content of the wastewater. In this case, baseline and project emissions calculations shall use BOD instead of COD in the formulas, and the monitoring of the project activity shall be based in direct measurements of BOD_{5,20}, i.e., the estimation of BOD values based on COD measurements is not allowed.

⁴ Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

in order to determine the COD removal efficiency. This is in line with paragraph 39 (b) of AMS. III-H, Version 18.

Baseline emission from electricity and fuel consumptions ($BE_{power, y}$)

The only electricity consumption devices used in the baseline wastewater treatment systems are pumps for pumping the wastewater from the starch factory into the open anaerobic lagoons. There is no consumption of fossil fuels for the operation of the baseline system. Please note that consumption of fossil fuels for heat generation at the starch plant are considered in the emission reduction component as per AMS.I.C, Version 20.

For the sake of simplification and conservativeness, baseline emissions from electricity and fuel consumptions ($BE_{power, y}$) are assumed to be zero.

$$BE_{power, y} = 0$$

Baseline emission from wastewater discharge ($BE_{ww, discharge, y}$)

In the baseline scenario, treated wastewater is not discharged into sea/lake/river, therefore methane emissions from degradable organic carbon in treated wastewater discharged ($BE_{ww, discharge, y}$) in e.g. a river, sea or lake in the baseline situation is assumed to be zero.

$$BE_{ww, discharge, y} = 0$$

Baseline emissions of the sludge treatment systems affected by the project ($BE_{s, treatment, y}$)

There is no sludge treatment system in the baseline scenario, only a wastewater treatment system based on open anaerobic lagoons, hence baseline emissions from sludge treatment are not taken into consideration.

$$BE_{s, treatment, y} = 0$$

Baseline emissions from final sludge disposal ($BE_{s, final, y}$)

For the sake of conservativeness, it is assumed that the sludge is used for soil application in the baseline scenario. Therefore, baseline methane emissions from anaerobic decay of the final sludge ($BE_{s, final, y}$) produced is also neglected.

$$BE_{s, final, y} = 0$$

Furthermore, it was noted in paragraph 45 – 46 of AMS III.H, Version 18 that the ex-post emission reduction should be based on the lowest value of the following:

- (a) The amount of biogas recovered and fueled or flared (MD_y) during the crediting period, that is monitored ex post; MD approach.
- (b) Ex post calculated baseline, project and leakage emissions based on actual monitored data for the project activity: COD approach.

Emission reductions achieved on any year are the lowest value of the following;

$$ER_{y, \text{ ex-post}} = \min (BE_{y, \text{ ex-post}} - PE_{y, \text{ ex-post}} - LE_{y, \text{ ex-post}}), (MD_y - PE_{\text{power}, y} - LE_{y, \text{ ex-post}}) \quad (3)$$

As per paragraph 47 in AMS III.H., Version 18, in case of flaring/combustion MD_y was measured using the conditions of the flaring process:

$$MD_y = BG_{\text{burnt}, y} * W_{\text{CH}_4, y} * D_{\text{CH}_4} * FE * GWP_{\text{CH}_4} \quad (4)$$

Where:

Parameter	Details	Quantification
MD_y	Methane captured and destroyed/gainfully used by the project activity in the year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 28,167 <u>01-January-2022 to 31-October-2022</u> = 35,586
$BG_{\text{burnt}, y}$	Biogas flared/combusted in year y (m ³)	$BG_{\text{combusted}, y}$ <u>01-May-2021 to 31-December-2021</u> = 2,583,932 <u>01-January-2022 to 31-October-2022</u> = 3,111,215 $V_{\text{RG}, h} \text{ OR } BG_{\text{flared}, y}$ <u>01-May-2021 to 31-December-2021</u> = 1,831 <u>01-January-2022 to 31-October-2022</u> = 2,979
W_{CH_4}	Methane content in the biogas in the year y (mass fraction)	<u>01-May-2021 to 31-December-2021</u> =0.5437

	The lower value as per section 4.2 is selected for the calculation.	<u>01-January-2022 to 31-October-2022</u> = 0.5705
GWP _{CH4}	Global Warming Potential for methane	<u>01-May-2021 to 31-December-2021</u> = 28 <u>01-January-2022 to 31-October-2022</u> = 28
D _{CH4}	Density of methane at the temperature and pressure of the biogas in the year y (tonnes/m ³)	0.000716
FE	Flare efficiency in year y (fraction) If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100 per cent may be applied.	0

(b) Thermal energy production component AMS.I.C:

As per paragraph 33 of AMS I.C, Version 20, for steam/heat produced using fossil fuels the baseline emissions are calculated as follows:

$$BE_{thermal,CO2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO2} \quad (5)$$

Where:

Parameters	Details	Quantification
BE _{thermal,CO2,y}	the baseline emissions from steam/heat displaced by the project activity during the year y in tCO _{2e}	<u>01-May-2021 to 31-December-2021</u> = 2,717 <u>01-January-2022 to 31-October-2022</u> = 3,275

EG _{thermal,y}	the net quantity of steam/heat supplied by the project activity during the year y in TJ. (The value achieved from EG_{thermal,historical} was selected for the calculation as it is the minimum between 2 approaches as described in section 3.2.1 methodology deviation)	EG_{thermal,y} (historical - selected) <u>01-May-2021 to 31-December-2021</u> = 35.10 <u>01-January-2022 to 31-October-2022</u> = 42.31 EG_{thermal,y} (energy input) <u>01-May-2021 to 31-December-2021</u> = 50.30 <u>01-January-2022 to 31-October-2022</u> = 63.55
EF _{FF,CO2}	the CO₂ emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO₂/TJ), obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used.	77.40
η _{BL,thermal}	the efficiency of the plant using fossil fuel that would have been used in the absence of the project activity	100%

In the ex-post calculations, the amount of energy delivered by the dual fuel fired boiler is used to estimate the baseline emissions. This is based on the methodology deviation provided in section 2.2. In order to estimate the replacement of fossil fuel. The project proponent uses a conservative approach based on amount of heat required for starch drying, which in turn is estimated on historic heat requirements per tonne of starch and compensating heat energy supplied by HFO and the amount of biogas delivered to the starch factory. The details as following;

1. EG_{thermal} : Determination based on historical data of starch production:

$$EG_{\text{thermal, historical}} = (Q_{\text{starch}} * q_{\text{FO, starch}}) * D_{\text{HFO}} * NCV_{\text{HFO}}$$

2. EG_{thermal} : Determination based on monitored value of biogas delivered to starch factory:

$$EG_{\text{thermal, energy input}} = BG_{\text{combusted, y}} * W_{\text{CH}_4} * D_{\text{CH}_4} * NCV_{\text{CH}_4}$$

$$EG_{\text{thermal, y}} = \min(EG_{\text{thermal, historical}}, EG_{\text{thermal, energy input}})$$

Where:

Parameter	Details	Quantification
$EG_{\text{thermal, historical}}$	The net quantity of steam/heat supplied by the project activity during the year y (TJ) – based on historical data of starch production	<u>01-May-2021 to 31-December-2021</u> = 35.10 <u>01-January-2022 to 31-October-2022</u> = 42.31
$EG_{\text{thermal, energy input}}$	The net quantity of steam/heat supplied by the project activity during the year y (TJ) – based on monitored value of biogas delivered to starch factory	<u>01-May-2021 to 31-December-2021</u> = 50.30 <u>01-January-2022 to 31-October-2022</u> = 63.55
$BG_{\text{combusted, y}}$	Amount of biogas sent to boiler in year y (Nm ³)	<u>01-May-2021 to 31-December-2021</u> = 2,583,932 <u>01-January-2022 to 31-October-2022</u> = 3,111,215

W_{CH_4}	Methane content in the biogas in the year y (%) Lower value as per section 4.2 was selected for the calculation.	<u>01-May-2021 to 31-December-2021</u> = 54.37% <u>01-January-2022 to 31-October-2022</u> = 57.05%
$Q_{starch,y}$	Quantity of dry starch produced in year y (tonnes)	<u>01-May-2021 to 31-December-2021</u> = 27,684.05 <u>01-January-2022 to 31-October-2022</u> = 33,370.66
$q_{HFO,starch}$	Quantity of fossil fuel per unit of dry starch (liter/tonne)	33.75
NCV_{HFO}	Net calorific value of the fuel oil (TJ/tonne)	0.04
D_{HFO}	Density of fuel oil in the year y (tonnes/m ³)	0.93
NCV_{CH_4}	Net calorific value of methane (TJ/tonne)	0.05
D_{CH_4}	Density of methane at the temperature and pressure of the biogas in the year y (kg/m ³)	0.72

Project Emission: -

Methane Avoidance Component (AMS-III.H, Version 18)

As per the paragraph 41 of AMS III.H, Version 18, Project activity emissions from the systems affected by the project activity are:

- CO₂ emissions from electricity and fuel used by the project facilities ($PE_{power,y}$);
- Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{ww,treatment,y}$);
- Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{s,treatment,y}$);

- d) Methane emissions on account of inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater ($PE_{ww\ discharge\ y}$);
- e) Methane emissions from the decay of the final sludge generated by the project activity treatment systems ($PE_{s, final, y}$);
- f) Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive\ y}$);
- g) Methane emissions due to incomplete flaring ($PE_{flaring, y}$);
- h) Methane emissions from biomass stored under anaerobic conditions which does not take place in the baseline situation ($PE_{biomass, y}$).

$$PE_{,y} = \{PE_{power, y} + PE_{ww, treatment} + PE_{s, treatment} + PE_{ww\ discharge, y} + PE_{s, final, y} + PE_{fugitive, y} + PE_{biomass, y} + PE_{flaring, y}\} \quad (6)$$

Where:

Parameter	Details	Quantification
PE_y	Project emissions in year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 7,923 <u>01-January-2022 to 31-October-2022</u> = 9,773
$PE_{power, y}$	Emissions from electricity or fuel consumption in the year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 423 <u>01-January-2022 to 31-October-2022</u> = 482
$PE_{ww, treatment, y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 1,896 <u>01-January-2022 to 31-October-2022</u> = 2,777
$PE_{s, treatment, y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 0

		<u>01-January-2022 to 31-October-2022</u> = 0
PE _{ww, discharge, y}	Methane emissions from degradable organic carbon in treated wastewater in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
PE _{s, final, y}	Methane emissions from anaerobic decay of the final sludge produced in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
PE _{fugitive, y}	Methane emissions from biogas release in capture systems in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 5,579 <u>01-January-2022 to 31-October-2022</u> = 6,477
PE _{biomass, y}	Methane emissions from biomass stored under anaerobic conditions (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
PE _{flaring, y}	Methane emissions due to incomplete flaring in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 25 <u>01-January-2022 to 31-October-2022</u> = 37

Emissions from electricity consumption ($PE_{y, power} = PE_{EC,y}$)

As per paragraph 41, these emissions were calculated using “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. The energy consumption data of all equipment/devices is required in the project activity wastewater and sludge treatment systems and systems for biogas recovery and flaring/gainful use.

$$PE_{Power, y} = EC_{PJ, j, y} * EF_{EF, j, y} * (1 + TDL_{j, y}) \quad (7)$$

Where:

Parameters	Details	Quantification
PE _{y, power}	Emissions from electricity consumption in the year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 423 <u>01-January-2022 to 31-October-2022</u> = 482
EC _y	Electricity from the grid consumed by the project activity (wastewater treatment, biogas recovery and biogas utilisation/flaring systems) (MWh)	<u>01-May-2021 to 31-December-2021</u> = 694.86 <u>01-January-2022 to 31-October-2022</u> = 799.43
TDL _{j, y}	Average technical transmission and distribution losses for providing electricity to source j in year y (%)	<u>01-May-2021 to 31-December-2021</u> = 7.74% <u>01-January-2022 to 31-October-2022</u> = 6.93%
EF _y	Thailand National Grid emission factor (tCO _{2e} /MWh)	0.56375

The project activity consumes power from the national grid system. In this monitoring period under the second crediting period, the emission factor of the project is referred to the published value announced by Thai DNA. This is in line with paragraph 17 of Tool 7 version 05, EB87 Annex 9.

Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation (PE_{ww,treatment, y})

Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation are calculated as per equation 2 of

paragraph 29 in AMS.III.H, Version 18 using an uncertainty factor of 1.06. The following equation is used.

$$PE_{ww, treatment, y} = \sum (Q_{ww, y} * COD_{ww, treated, y} * \eta_{PJ, k, y} * MCF_{ww, treatment, PJ, k}) * B_{o, ww} * UF_{PJ} * GWP_{CH4} \quad (8)$$

Where:

Parameter	Details	Quantification
$PE_{ww, treatment, y}$	Emissions from degradable organic carbon in treated wastewater in year y (tCO _{2e})	<u>01-May-2021 to 31-December-2021</u> = 1,896 <u>01-January-2022 to 31-October-2022</u> = 2,777
$Q_{ww, y}$	Volume of wastewater treated in project activity (m ³)	<u>01-May-2021 to 31-December-2021</u> = 286,751.30 <u>01-January-2022 to 31-October-2022</u> = 345,856.00
$COD_{ww, treated, y}$	The chemical oxygen demand of the wastewater after the treatment system affected by the project activity (t/m ³) The higher values from the monitored parameter in section 4.2 have been selected for the calculation 2021: 1,054/ 10 ⁶ = 0.0011 t/m ³ 2022: 1,573/ 10 ⁶ = 0.0016 t/m ³	<u>01-May-2021 to 31-December-2021</u> = 0.0011 <u>01-January-2022 to 31-October-2022</u> = 0.0013
$\eta_{COD, PJ, k, y}$	COD removal efficiency of the project wastewater treatment system k in year y (t/m ³) measured based on inflow COD and outflow COD in system k (%)	100
$MCF_{ww, treatment, PJ, k}$	Methane correction factor for the project wastewater treatment system k (MCF values as per table 2 in AMS III.H. version 18)	0.8

$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value for domestic wastewater of 0.25 kg CH ₄ /kg COD) ¹²	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
GWP_{CH_4}	Global warming potential for methane (value of 28)	<u>01-May-2021 to 31-December-2021</u> = 28 <u>01-January-2022 to 31-October-2022</u> = 28

Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery ($PE_{s,treatment,y}$)

The project activity does not include sludge treatment system, therefore the emission from sludge treatment system is not taken into consideration.

$$PE_{s,treatment,y} = 0$$

Methane emissions from degradable organic carbon in treated wastewater ($PE_{ww,discharge,y}$)

In the project activity the treated wastewater has been discharged in existing open lagoons and there was no discharge to river, sea or lake. Hence, emissions from this component have not been included in the assessment.

$$PE_{ww,discharge,y} = 0$$

Methane emissions from the decay of the final sludge produced ($PE_{s,final,y}$)

No final sludge has been removed from the digester during this monitoring period. If there were some sludge being removed from the digester, the project proponent would have applied final sludge for field application as fertilizer and the final disposal of the sludge should be monitored during the crediting period. Therefore, as suggested by the AMS III.H, the emission from anaerobic decay from the final sludge produced can be omitted.

$$PE_{s,final,y} = 0$$

Methane emissions from biogas release in capture systems ($PE_{fugitive,y}$)

⁵ The IPCC default value of 0.25 kg CH₄/kg COD was corrected to take into account the uncertainties. Project activities may use the default value of 0.6 kg CH₄/kg BOD, in case the parameter BOD_{5,20} is used to determine the organic content of the wastewater. In this case, baseline and project emissions calculations shall use BOD instead of COD in the formulas, and the monitoring of the project activity shall be based in direct measurements of BOD_{5,20}, i.e., the estimation of BOD values based on COD measurements is not allowed.

Project activity emissions from methane release in capture systems are determined as per paragraph 42 of AMS III.H, Version 18 as given below.

$$PE_{\text{fugitive, y}} = PE_{\text{fugitive, ww, y}} + PE_{\text{fugitive, s, y}} \quad (9)$$

Where:

Parameter	Details	Quantification
$PE_{\text{fugitive, y}}$	Methane emissions from methane release in capture and utilization/combustion/flare systems in year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 5,579 <u>01-January-2022 to 31-October-2022</u> = 6,477
$PE_{\text{fugitive, ww, y}}$	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 5,579 <u>01-January-2022 to 31-October-2022</u> = 6,477
$PE_{\text{y, fugitive, s}}$	Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0

a) Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment ($PE_{\text{fugitive, y}}$)

These emissions are calculated as follows:

$$PE_{\text{fugitive ww, y}} = (1 - CEF_{\text{ww}}) * MEP_{\text{ww, treatment, y}} * GWP_{\text{CH}_4} \quad (10)$$

Where:

Parameter	Details	Quantification
CEF_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 was used)	0.9
$MEP_{\text{treatment, y}}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y (tonne)	<u>01-May-2021 to 31-December-2021</u>

		= 1,992.32 <u>01-January-2022 to 31-October-2022</u> = 2,313.19
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$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} \quad (11)$$

Where:

Parameter	Details	Quantification
$Q_{ww,y}$	Volume of wastewater treated in project wastewater treatment system k in year y (m3/year)	<u>01-May-2021 to 31-December-2021</u> = 286,751.30 <u>01-January-2022 to 31-October-2022</u> = 345,856.00
$B_{o,ww}$	Methane producing capacity of the wastewater	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
$COD_{removed,PJ,k,y}$	The chemical oxygen demand removed by the treatment system k of the project activity equipped with biogas recovery in the year y (tonnes/m³) This was calculated based on the difference between COD_{ww,untreated,y} & COD_{ww,treated,y}. $(COD_{ww,untreated,y} (higher) - COD_{ww,treated,y} (lower)) \div 10^6$ For 2021: 0.0320 - 0.0011 = 0.0309 For 2022: 0.0299 - 0.0013 = 0.0286	<u>01-May-2021 to 31-December-2021</u> = 0.0310 <u>01-January-2022 to 31-October-2022</u> = 0.0299
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for the project wastewater treatment system k equipped with biogas recovery equipment (MCF values as per table III.H.2)	0.8

b) Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year y ($PE_{y, \text{fugitive}, s}$) :

Sludge would be used only for land application, therefore no sludge treatment envisaged in the project activity. Therefore, emission from sludge treatment is not taken into consideration.

$$PE_{y, \text{fugitive}, s} = 0$$

Methane emissions due to incomplete flaring ($PE_{\text{flaring}, y}$)

Methane emissions due to incomplete flaring in year y were calculated as per the methodological tool “Project emissions from flaring”.

$$PE_{\text{flare}, y} = GWP_{CH_4} * \sum F_{CH_4, RG, m} * (1 - \eta_{\text{flare}}) * 10^{-3} \quad (12)$$

Where:

Parameter	Details	Quantification
$PE_{\text{flare}, y}$	Project emissions from flaring of the residual gas in year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 25 <u>01-January-2022 to 31-October-2022</u> = 37
GWP_{CH_4}	Global warming potential of methane valid for the commitment period (tCO ₂ e/tCH ₄)	<u>01-May-2021 to 31-December-2021</u> = 28 <u>01-January-2022 to 31-October-2022</u> = 28
$F_{CH_4, RG, m}$	Mass flow of methane in the residue gas in the minute m (kg)	<u>01-May-2021 to 31-December-2021</u> = 876.40 <u>01-January-2022 to 31-October-2022</u> = 1,318.88
$\eta_{\text{flare}, m}$	Flare efficiency in minute m	0%

Methane emissions from biomass stored under anaerobic conditions which does not take place in the baseline situation ($PE_{\text{biomass}, y}$).

Biomass storage is not envisaged in the project activity. Therefore, methane emissions from biomass stored under anaerobic conditions are not taken into consideration.

$$PE_{\text{biomass}, y} = 0$$

Thermal energy production (AMS.I.C, Version 20):

According to paragraph 66 of AMS-I.C, Version 20, CO₂ emissions from on-site consumption of fossil fuels due to the project activity was calculated using the latest version of “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”. As per paragraph 6 of the tool, the formula is determined as below.

$$PE_{FC,j,y} = \sum FC_{HFO,y} * COEF_{i,y} \quad (13)$$

In compliance with paragraph 7 of the methodology, the option B is selected for determination of COEF_{i,y}. The calculation is based following formula;

$$COEF_{i,y} = NCV_{HFO} * EF_{HFO,CO2} \quad (14)$$

Where:

Parameter	Details	Quantification
NCV _{HFO}	NCV of fossil fuel used in the process (TJ/tonne)	0.0404
EF _{HFO,CO2}	Emission factor of Heavy fuel oil as per IPCC (tCO ₂ /TJ)	77.4

By considering equation (13) and (14), parameter PE_{FC,j,y} can be determined as following

$$PE_{FC,j,y} = \sum FC_{HFO,y} * NCV_{HFO} * EF_{HFO,CO2} \quad (15)$$

Where:

Parameter	Details	Quantification
PE _{FC,y}	Project emissions due to combustion of fossil fuel in year y (tCO ₂ e)	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
FC _{HFO,y}	Amount of fossil used in the boiler in ton/yr	<u>01-May-2021 to 31-December-2021</u> = 0 <u>01-January-2022 to 31-October-2022</u> = 0
NCV _{HFO}	NCV of fossil fuel used in the process (TJ/tonne)	0.0404
EF _{HFO,CO2}	Emission factor of Heavy fuel oil as per IPCC (tCO ₂ /TJ)	77.4

- ER achieved from AMS-III.H, Version 18 COD approach is equal to 33,761tCO₂e in 2021 and 38,816tCO₂e in 2022.
- ER achieved from AMS-III.H, Version 18 MD approach is equal to 30,461tCO₂e in 2021 and 38,379tCO₂e in 2022.

The most conservative value of the ER under AMS-III.H is based on MD approach for both monitoring periods.. The total emission reduction project claims during this monitoring period; 01-May-2021 to 31-October-2022, is **68,840 tCO₂e**.

CL 01 and CAR 01 was raised during the verification process and closed successfully. Please refer Appendix 2 of this report for the detail closure of the CAR

4.4 Quality of Evidence to Determine Reductions and Removals

Verification team has checked the calibration certificates^{/5/} and confirmed that meters used to monitor the parameter, meters are found calibrated as per calibration frequency. All the meters are of accuracy class as per the requirement of the registered PD. The same is checked during on-site visit and calibration certificates^{/5/}.

Project activity is in continuous operation no major breakdown was found during the current monitoring period. No unforced error was observed. No sampling procedure applied for monitoring of the data parameter and entire documents were checked by the assessment team to arrive at positive verification conclusions. The monitoring plan is followed at the project site.

The meters were calibrated by third party entity to carry out the testing of the meters which is as per the host country regulation and thus traceability of the Calibration is also confirmed by the verification team. There is no delay in no delay in calibration of meters. Thus, verification team concluded that the evidences are sufficient in quantity, and appropriate for the quality, to determine the GHG reductions and removals.

VVB team verified that, CAR 01 was raised and closed successfully, kindly refer appendix 4 for further clarification.

4.5 Non-Permanence Risk Analysis

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
NA	NA	NA	NA	NA

There is no non-permanence risk that could lead to material errors, omissions or misstatements rating determined by the project proponent for the project activity and no risk was identified in the audit/verification plan hence not applicable.

5 VERIFICATION OPINION

5.1 Verification Summary

Applus+ Certification has been engaged by SD Biosupply Co., Ltd. to perform the 5th verification of the “SD Biosupply Wastewater Treatment and Biogas Utilization Project”.

The project participants are responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project’s monitoring plan in the registered VCS PD/^{4/} and the applied methodology AMS-III.H. version 18/^{17/}, AMS-I.C. version 20/^{17/}

Our verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakesh accord, as well as those defined by the CDM Executive Board. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. Further, the verification has been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS. No sampling procedure applied for document verifications. The entire documents checked/Power plant verification conducted to arrive at positive verification conclusions. The verification team can confirm that:

- the project is operated as planned and described in the project document;
- the monitoring plan is as per the applied methodology/^{17/};
- the monitoring process in Monitoring Report is as per the VCS PD/^{4/}
- the development and maintenance of records and reporting procedures are in accordance with the monitoring plan;
- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements.
- A Reasonable Level of assurance was achieved as planned, during verification process.
- Project has been implemented in accordance with the project description and subsequently validated variations

5.2 Verification Conclusion

As per VCS Standard Version 4.7, clause 4.1.23, 4.1.24 and 4.1.25 Applus+ Certification hereby concludes that the GHG emission reduction stated in the monitoring report version 3.0 of 16-May-2024 for the “SD Biosupply Wastewater Treatment and Biogas Utilization Project,” in Thailand for the monitoring period 01-May-2021 to 31-October-2022 (Inclusive of both the dates) are fairly stated

Verification period: 01-May-2021 to 31-October-2022

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

Vintage period	Baseline emissions (tCO _{2e})	Project emissions (tCO _{2e})	Leakage emissions (tCO _{2e})	Reduction VCU's (tCO _{2e})	Removal VCU's (tCO _{2e})	Total VCUs (tCO _{2e})
01-May-2021 to 31-Dec-2021	30,884	423	0	30,461	0	30,461
01-Jan-2022 to 31-Oct-2022	38,861	482	0	38,379	0	38,379
Total	69,745	905	0	68,840	0	68,840

SDG Contribution (01-May-2021 to 31-Oct-2022):

SDG Target	SDG Indicator	Net impact on SDG Indicator	Current Project contributions	Contributions over lifetime
7.2	7.2.1 Renewable energy share in the total final energy consumption	Implemented activities to increase	The project activity has utilized 77.42 TJ by replacing the use of fossil fuel during this monitoring period.	The project activity has utilized 1,076.51 TJ by replacing the use of fossil fuel for project lifetime.
8.5	8.5.2 Unemployment rate, by sex, age and persons with disabilities	Implemented activities to increase	The project activity has created 9 job opportunities during this monitoring period.	The project activity has provided full employment to 9 people per year.
13.2	13.2.2 Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to decrease	Prevented emitting of 68,840 tCO _{2e} into the atmosphere during the monitoring period.	The project activity has prevented emitting of total 570,879 tCO _{2e} s into the atmosphere.

The GHG emission reductions are calculated on the basis of approved methodology AMS-III.H. version 18/17/, AMS-I.C. version 20/17/and the monitoring plan included in the registered VCS PD /03/

Hence Applus+ Certification is able to certify that the emission reduction from the project during the monitoring period 01-May-2021 to 31-October-2022 (Inclusive of both the dates) amounts to 68,840 tCO_{2e} is in line with the applicable VCS requirements set out in section 3.15 of VCS Standard version 4.7.

The VVB hereby issues a resolutely positive and unmodified opinion meticulously drafted in strict accordance with ISO 14064-3:2019, Section 09, and the precise provisions of Clause 9.7.1.6 & 9.7.2 of ISO 14065:2020. This opinion stands in full alignment with the exacting requirements delineated in ISO/IEC 17029:2019, Section 9.7.

Our verification process provides a robust and reasonable level of assurance regarding the veracity of the reported GHG emission reduction data. This data is devoid of any material misstatements and is steadfastly supported by the evidence furnished by the Project Proponent (PP), comprehensively presented in Reference Table of this report.

5.3 Ex-ante vs Ex-post ERR Comparison

Vintage period	Ex-ante estimated reductions/removals	Achieved reductions/removals	Percent difference	Explanation for the difference
01-May-2021 to 31-Dec-2021	34,445	30,461	-11.57%	During this monitoring period, the ex-ante calculation is equal to 77,185 tCO₂e, which is higher than the ex-post emission reduction. The operation days of this monitoring period is 245 days in year 2021 and 304 days in year 2022. Therefore, the ex-ante emission is based on 201.37 days in year 2021¹³ and 249.86 days in year 2022¹⁴. The reason of the lower emission reduction came from lower COD load for this monitoring period ¹⁵ which is 9,820.46tCOD/year as compared to baseline estimation ¹⁶ of 12,221.19 tCOD/year (-19.64%). It may also happen that in the future, the quantity and quality of wastewater entering the system may go up. Therefore, it can be concluded that the decrease in emission reductions is not permanent but dependent on various factors, which can neither be controlled nor predicted in advance. It may happen that due to the variation in the raw material, the project may achieve lower emission reduction in the future. Thus, acceptable to VVB.
01-Jan-2022 to 31-Oct-2022	42,740	38,379	-10.20%	
Total	77,185	68,840	-10.81%	-

¹³ Operation days of ex-ante emission reductions in year 2021, 201.37 days, is based on [245 days*(300/365 days)].

¹⁴ Operation days of ex-ante emission reductions in year 2022, 249.86 days, is based on [304 days*(300/365 days)].

¹⁵ Average quantity of annual wastewater in the monitoring period is 316,272.00 m³ (average of 286,688 m³ in 2021& 345,856 m³ in 2022). Average COD_{ww, untreated,y} is 31,050.69mg/l (average between 31,570.47mg/l in 2021 & 30,530.91mg/l in 2022). Annual COD load [(316,272.00*31,050.69mg)/1,000,000] = 9,820.46tCOD/year.

¹⁶ Average quantity of annual wastewater in the baseline estimation is 532,003.56 m³(average of 474,830.14 m³ in 2021 and 589,176.99 m³ in 2022), Average COD_{ww,untreated,y} is 22,972 mg/l Annual COD load [(532,003.56*22,972.00mg)/1,000,000] = 12,221.19 tCOD/year.

APPENDIX 1: COMMERCIALLY SENSITIVE INFORMATION

<i>Section</i>	<i>Information</i>	<i>Justification</i>	<i>Assessment method and conclusion</i>
N/A	N/A	N/A	N/A

APPENDIX 2: CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS (CAR/CL/FAR)

Table 1. Remaining FAR from validation and/or previous verification

FAR ID	Section no.	Date :
Description of FAR		
NA.		
Project participant response		Date :DD-Month-YYYY
-		
Documentation provided by project participant		
-		
DOE assessment		Date: DD-Month-YYYY
-		

Table 2. CL from this verification

CL ID	01	Section no.	MR	Date :12/02/2023
Description of CL				
1. The PP is requested to provide Declaration confirming project registered under other GHG schemes along with there would not be double counting of credits. 2. PP requested to submit supporting company policies/CSR documents for Elimination of All Forms of Discrimination against Women. 3. Supporting documents: • No. of trainings provided to the employees; technical & soft skills • Employment generated due to project activity • The employment records/Salary slips • Records of hazardous waste inventory & disposal(if any) • Project Grievance register/ Or supporting documents for ongoing communication with the local stakeholder • PP shall provide copy of HR and HSE Policy of the company.				
Project participant response				Date: 28-November-2023

1. The required document is provided as per attachment. 2. The required documents are provided as per attachment. 3. The required documents are provided as per attachment. The documents that have not been provided are listed below; - Records of hazardous waste inventory and disposal because it is not applicable. - Salary slips because it is a confidential information. The employee list who is responsible for biogas plant is provided instead.	
Documentation provided by project participant	
CL01-1_Attachment_Declaration Confirming	
CL01-2_Attachment_Elimination of All Forms	
CL01-3_Attachment_Training Plan and History	
CL01-3_Attachment_Training Document	
CL01-3_Attachment_Employee List	
CL01-3_Attachment_Complaint Records	
CL01-3_Attachment_HSE deed executed	
WB assessment	Date:08-December-2023
1. PP submit the declaration regarding no double accounting. 2. VVB team verify that PP submit company policies/CSR documents for Elimination of All Forms of Discrimination against Women. 3. PP had submitted following documents:- • No. of trainings provided to the employees; technical & soft skills • Employment generated records • The employment records/Salary slips • Records of hazardous waste inventory & disposal(if any) • Project Grievance register/ Or supporting documents for ongoing communication with the local stakeholder • PP has provided the copy of HR and HSE Policy of the company. CL is closed.	

Table 3. CAR from this verification

CAR ID	01	Section no.	MR	Date : 12/02/2023
Description of CAR				

- During site visit it was observed that OM2 meter used for monitoring of oil flow was replaced with new meter, however MR listed only old meter details, please clarify? - Also, old OM2 meter details are not correct mentioned in MR. Please check and correct the same as per actual site condition. - GWP_{CH4} value is considered as 28 tCO₂e/CH₄ in MR and ER sheet whereas the same is mentioned as 25 tCO₂e/CH₄ in registered PDD version 02 dated 23/11/2017; please clarify this deviation in applied value in MR? - The parameter "Volume of wastewater treated in year y" Q_{ww,y} value from 01-June-2021 to 30-June-2021, 01-July-2021 to 14-July-2021, 17-18 July 2021 and 26 July 2021 is not mentioned in ER sheet without any re-mark comment, please clarify the reason. - Why the totalizer value of Q_{ww,y} is zero whereas the last value recorded as 448132 as on 30-May-2021. - MR mention parameter S_{final,PJ,y} value as zero for reported Monitoring Period, however there is no information provide in ER sheet, please clarify? - The parameter V_{RG,h} value as zero (totalizer value) on 26 July 2022, however there is no information provide in ER sheet, please clarify? - There is no information for value of WCH₄ % for 1-May-2021, please clarify? - The value of OM2 is not reported in for some period in ER sheet, please clarify? - The calibration details for ECy meter sr. no. 6001693334 is not provided in MR. Please provide the same along with calibration certificate. - The calculation of TDL need to provided in ER sheet as same can't be traceable or reproducible without details information.	
Project participant response	Date: 28/11/2023
- The details of new meter of OM2 have been added in the MR. Information of new OM2 meter is also attached. - The old OM2 meter details have been updated to be accordance to the site condition. - According to VCS Standard V4.5, published on August 29, 2023, Clause 3.15.4 has stated that Projects that complete validation on or before 31 July 2021 may use GWP values from AR4 for ex-ante emission reduction estimates, though such projects shall use GWP values from AR5 for ex-post calculations. Therefore, we have used GWP of 28 in this monitoring report. - There was a plant shut down on those mentioned dates as per the attachment. Remarks are added within the ER sheet. - Because of the long plant shut down since 30-May-2021 to 14-July-2021, PP reset the totalizer value of many meters on the 15-July-2021. The evidence can be found in the log sheet from CAR 01 number 4. - There is no sludge being discharged from the project activity during the monitoring period. Therefore, the information of S_{final,PJ,y} has been updated in the ER Sheet. - PP reset the meter (GM3) on the mentioned day as per the attachment. - There is no information for WCH₄ % because there was a plant shut down on that day as per the attachment. No information was gathered on that day. - The Value of OM2 has been updated in the ER sheet. The totalizer value shows zero value every day. - As per mentioned in MR, the meter is under the ownership of the PEA under PEA jurisdiction. Also, the meter maintenance is not under the jurisdiction of the PP. - The calculation of TDL has been updated in the ER sheet.	
Documentation provided by project participant	

CAR01-1_Attachment_New OM2 Calibration Certificate

CAR01-4_Attachment_Log Sheet for Meter (FM1)

CAR01-7_Attachment_Log Sheet for Meter (GM3)

CAR01-8_Attachment_Log Sheet for Meter (WCH4)

CAR01-10_Attachment_PEA Regulation

VB assessment

Date:08-December-2023

1. PP has updated the monitoring report and details of new meter updated and evidence is submitted by PP to verify the same, it is found accepted by VVB team.
2. Details of old OM2 meter details are now mentioned in MR. calibration certificate is submitted which is accepted by VVB team.
3. PP has provided the justification in monitoring report the deviation is provided in monitoring report, According to VCS Standard V4.5, published on August 29, 2023, Clause 3.15.4 has stated that Projects that complete validation on or before 31 July 2021 may use GWP values from AR4 for ex-ante emission reduction estimates, though such projects shall use GWP values from AR5 for ex-post calculations. Therefore, we have used GWP of 28 in this monitoring report.
4. VVB verified that, plant shut down on those mentioned dates as per the attachment. Remarks are added within the ER sheet. Same is found consistent with breakdown log-sheet.
5. VVB team verified that, due to long plant shut down since 30-May-2021 to 14-July-2021, PP reset the totalizer value of many meters on the 15-July-2021. The evidence can be found in the log sheet from CAR 01 number 4.
6. PP has reset the meter (GM3) on the mentioned day as per the attachment. Same is found accepted by VVB.
7. There was a plant shut down on that day as per the attachment. Thus, VVB team verified that, No information was gathered on that day.
8. The Value of OM2 has been updated in the ER sheet. The totalizer value shows zero value every day. Same is found consistent and accepted by VVB.
9. Monitoring meter is under the ownership of the PEA under PEA jurisdiction. Also, the meter maintenance is not under the jurisdiction of the PP.
10. VVB team verified that, The calculation of TDL has been updated in the ER sheet. CAR is closed in this section

Table 4. FAR from this verification

FAR ID	01	Section No.	E.4.4	Date:31-October-2023
Description of FAR				
Project participant response				Date:DD-Month-YYYY
-				
Documentation provided by project participant				
-				
DOE assessment				Date:DD-Month-YYYY
-				

APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

According to the sectoral scope / technical area and experience in the sectoral or national business environment, Applus+ Certification has composed a project assessment team in accordance with the appointment rules in the internal Quality Management System of Applus+ Certification.

The composition of audit team shall be approved by the Applus+ Certification ensuring that the required skills are covered by the team.

The four qualification levels for team members that are assigned by formal appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A) / Auditor in Training (AiT).
- Technical Expert (TE).
- Technical Reviewer (TR).

The sectoral scope / technical area knowledge linked to the applied methodology/ies shall be covered by the assessment team.

Name	Qualification	Coverage of scope	Coverage of technical Area	Financial aspect	Host country Experience	Attendance to the On-Site Assessment
Vivek Kumar Ahirwar	Lead Auditor (LA) & Technical Expert (TE)	Yes (3)	Yes (3.1)	N/A	Yes	Yes
Simon Shen	Technical Reviewer (TR)	Yes (3)	Yes (3.1)	N/A	N/A	N/A

The curriculum vitae of the DOE's team members are provided below:

Vivek Kumar Ahirwar is a BEE-Certified Energy Auditor by Govt of India with over eight years of relevant experience in energy efficiency, energy audit, thermal and electrical energy generation technology from renewable source and energy conservation in energy intensive industries, designated consumers and commercial buildings, implementation of energy conservation building codes, research, process and green building projects. He is a certified lead auditor for ISO 14001 EMS and 14064. He has experience under various categories of projects stating from renewable to waste to supercritical projects and WCD. He has successfully audited more than 100 GHG (CDM/VCS/GS) projects in different states across the India. He has done Master in Technology (Energy Management) from a premier institute, School of Energy & Environmental Studies, DAVV, Indore (M.P.), India and Bachelor of Engineering (Mechanical Engineering) from Govt. Engineering college, Rewa, RGPV, India.

Simon Shen (Master Degree in Thermal Energy Engineering, Bachelor Degree in Environmental Engineering) is a Lead Auditor appointed by Applus+ LGAI for the GHG project assessment. He is based in Shanghai. He has several years of work experience in environmental protection field. Before he joined Applus+ LGAI, he had been worked for TÜV SÜD as a GHG Validator/Verifier and ISO 9001/14001 Lead Auditor for 3.5 years.

APPENDIX 4: ABBREVIATIONS

Abbreviations	Full texts
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CEA	Central Electricity Authority
CL	Clarification request
CM	Combined Margin
CMS	Central Monitoring system
CO ₂	Carbon dioxide
CO _{2e}	Carbon dioxide equivalent
DNA	Designated National Authority
DOE	Designated Operational Entity
DR	Document Review
EF	Emission Factor
EIA	Environmental Impact Assessment
ER	Emission Reductions
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming potential
PP	Project Participant