



VOLUNTARY CARBON STANDARD 2007.1

VERIFICATION REPORT

CHOL CHAROEN GROUP WASTEWATER TREATMENT WITH BIOGAS SYSTEM I (CHOLBURI)

**Monitoring Period: 2007-01-01 to 2008-12-31
(incl. both days)**

Report No: 53208109-08/510 V 01

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TÜV NORD CERT GmbH
JI/CDM Certification Program
Langemarckstraße, 20
45141 Essen, Germany
Phone: +49-201-825-3335
Fax: +49-201-825-3290
www.tuev-nord.de
www.global-warming.de

Name of Verification company:	Date of the issue:
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Report Title:	Approved by:
Chol Charoen Group Wastewater Treatment with Biogas System I(Cholburi)	Rainer Winter
Client:	Project Title:
South Pole Carbon Asset Management Ltd.	Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)
Summary:	
The M/s South Pole Carbon Asset Management Ltd. on behalf of M/s Chol Chareon Co. Ltd. has commissioned the TÜV NORD JI / CDM Certification Program to carry out the verification (along with validation) of the Project “Chol Charoen Group Wastewater Treatment with Biogas System I Cholburi” in Banbung district of Cholburi province, Thailand with regard to the requirements of VCS 2007.1 Standard. The project activity involves recovery of methane from wastewater treatment and combustion of methane for onsite utilisation and flaring, thereby reducing the baseline methane emissions; and baseline grid emission due to power generation. An additional claim for grid electricity displacement is made. Reporting period: From 2007-01-01 to 2008-12-31 In the course of the verification Six (6) Corrective Action Requests (CARs) were successfully closed and Two (2) Forward Action Requests (FARs) will be verified during the subsequent periodic verification. The verification is based on the draft monitoring report^{/MR1//MR2/}, revised monitoring report^{/MR2/}, the monitoring plan as set out in the validated PD^{/PD/}, the validation report^{/VR/}, emission reduction calculation spreadsheet^{/XLS1//XLS2/} and supporting documents^{/LOG//CAL/} made available to the TÜV NORD JI/CDM CP by the project participant. Two deviations from the validated monitoring plan have also been approved. Deviations are taken on monitoring requirement of parameter COD_{y, removed, PJ, k} for calculation of Methane emissions from the wastewater treatment systems affected by the project activity, and not equipped with biogas recovery (PE_{ww, treatment, y}) and for calculation of PE_{ww, treatment, y} and PE_{fugitive, y}. As the result of the 1st periodic (initial) verification, the verifier confirms that the GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner. TÜV NORD JI/CDM CP herewith confirms that the project has achieved emission reductions in the above mentioned reporting period as follows:	

Emission reductions 24,710 t CO₂ equivalents	
Work carried out by:	Number of pages:
Mr. Archak Pattanaik (TL) Mr. Abhishek Kumar Srivastava (TE) Mr. Lokesh Chandra Dube (TM) Mr. Vishnu Patidar (T) Ms. Saowalak Thongsong (TM)	45

Abbreviations

AFFR	Anaerobic fixed film reactor
BAU	Business as usual
CA	Corrective Action / Clarification Action
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CO₂	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
CP	Certification Program
CL	Clarification Request
DNA	Designated National Authority
EB	CDM Executive Board
EIA	Environmental Impact Assessment
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
QC/QA	Quality control/Quality assurance
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VCS - PD	VCS - Project Description
VCU	Voluntary Carbon Unit
VVM	Validation and Verification Manual

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1 INTRODUCTION

The M/s South Pole Carbon Asset Management Ltd. on behalf of M/s Chol Chareon Co. Ltd. has commissioned the TÜV NORD JI/CDM Certification Program to carry out the verification of the project:

“Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)”
with regard to the relevant requirements of the Voluntary Carbon Standard 2007.1^{/VCS/}. The verifiers have reviewed the implementation of the monitoring plan (MP) in the registered VCS project for the monitoring period 2007-01-01 to 2008-12-31,

The applied monitoring methodologies are

- AMS III.H/Version 13: “Methane Recovery in Wastewater Treatment”,
- AMS I.C/Version 15: “Thermal energy production with or without electricity”
- AMS I.D/Version 14: “Grid Connected Renewable Electricity Generation”

1.1 Objective

The purpose of this verification, by independent checking of objective evidence, is as follows:

- to verify that the project is implemented as described in the project design document;
- to assess the implementation of the monitoring plan (MP) content in the VCS-PD;
- to assess the project’s compliance with other relevant rules, including the host country (India) legislation;
- to confirm that the monitoring system is implemented and fully functional to generate voluntary emission reductions (VERs / VCU) without any double counting; and
- to establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation.

1.2 Scope and Criteria

The verification of this project is based on the validated project design document^{/VCS-PD/}, the monitoring report^{/MR/}, emission reduction calculation spread sheet^{/XLS/}, supporting documents made available to the verifier and information collected

through performing interviews and during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

The TÜV NORD JI/CDM CP has employed a risk-based approach in the verification, focusing on the identification of significant risks and reliability of project monitoring and generation of emission reductions.

1.3 VCS Project Description

1.3.1 Project Characteristics

Essential data of the project is presented in the following Table 1-1.

Table 1-1: Project Characteristics

Item	Data
Project title	Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)
Project owner	M/s Chol Chareon Co. Ltd.
Any specific project categories	☐ Mega project ($> 10^6$ t CO _{2eq} / a) ☒ Project (> 5000 t CO _{2eq} / a and $< 10^6$ t CO _{2eq} / a) ☐ Micro project (< 5000 t CO _{2eq} / a) ☐ AFOLU project ☐ Grouped project ☐ No specific project category
VCS PD dated	Draft: 2009-07-16 Final: 2009-11-06
Applied Methodologies	AMS III.H/Version 13; AMS I.C/Version 15; AMS I.D/Version 14
Project starting date	2006-01-07
Crediting period	☐ Renewable Crediting Period (7 y) ☒ Fixed Crediting Period (10 y)
Start of crediting period	2007-01-01

1.3.2 Project Location

The details of the project location are given in table 1-2:

Table 1-2: Project Location

No.	Project Location
Host Country	Thailand
Region:	Cholburi province; District: Banbung
Project location address:	204 Moo 3 Nongchak, Banbung, Cholburi, 20170, Thailand
Latitude:	13° 17.736'N
Longitude:	101° 09.108'E

1.3.3 Technical Project Description

Chol Chareon Co. Ltd., Tapioca starch factory located at in Banbung district of Cholburi province, Thailand. The starch factory started starch production in January 1980.

Wastewater from 240 TPD Tapioca Starch Processing was being treated by 13 cascading open anaerobic deep lagoons (of average depth of 6m) before methane capture and destruction/ utilization project was implemented.

The operating days of the starch production is approximately 315 days^{/LOG/}. Baseline fuel for hot oil boiler was Fuel oil and the baseline electricity for starch factory is grid. The lagoon treated wastewater was used for onsite land disposal and tapioca washing purposes within local pollution control norms. The final sludge is used for soil applications by the local farmers.

The 2,400 m³ of waste water per production day is being treated (since January 2006) by 2 Anaerobic Fixed Film Reactor (AFFR) systems (minimum of 80% COD removal efficiency) in parallel before being discharged into existing lagoon system (10). 3 open lagoons were redesigned and converted to covered lagoons in order to store recovered biogas at the outlet of AFFRs. 3 no. of gas engines of total capacity 1952 kW was commissioned in phased manner. Phase-I (952 kW) was commissioned in December 2006 and the phase-II (500 kW) was commissioned in April 2007 and the phase-III (500 kW) in December 2007. A fuel oil fired hot boiler is retrofitted, in order to utilise recovered biogas from the proposed project activity on 7th January 2006.

The starting date of the project, i.e., 1st emission reduction happened on 7 January 2006. This is the date on which retrofitted hot oil boiler become operational on biogas.

The destruction/utilisation of the biogas was being carried out through following devices:

- Enclosed flare
- one hot oil boiler (Fuel oil and Biogas)
- 3 Biogas engines (total capacity 1952 kW).

Additional claim for grid electricity displacement is made due to biogas utilization for electricity generation, which currently meets the partial demand of the starch factory and in future the excess electricity will be supplied to the grid. Furthermore the project also made a claim for fuel oil displacement due to biogas utilisation for thermal energy generation.

There is no additional sludge treatment in the project activity. The final sludge disposal continued to be soil application in the project scenario^{/SDR/}.

The key parameters of the project are given in table 1-3:

Table 1-3a: Technical data of the project

Parameter	Unit	Value
COD reduction efficiency of AFFR system	%	80
Designed volumetric capacity of AFFR system	m ³	10,000
Biogas consumption capacity of boiler	Nm ³ /hr	834
Number of Gas engine	-	3
Electricity generation capacity of two gas engines	MW _e	0.5 X 2= 1.0
Electricity generation capacity of one gas engine	MW _e	0.952
Collective Electricity generation capacity of three gas engines	MW _e	1.952
Biogas consumption capacity of Gas engines	Nm ³ /hour	926
Maximum operation capacity of flare	Nm ³ /hr	250
Operating days of starch production	days	315
Wastewater generation	m ³ /production day	2,400
Plant production capacity	TPD	240

Table 1-3b: Parameters confirmed during verification

Parameter	Name	Unit	Value	
			2007	2008
HR _{ww, y}	Running hours of the wastewater pumps	Hour	6,585	4,739
Q _{ww, y}	Volume of wastewater treated in the year	m ³ /yr	214,024	154,030
COD _{ww, untreated, y}	COD of wastewater entering the treatment plant	mg/L	26,273	34,175
COD _{out, AFFR-1, y}	COD of wastewater exiting the the AFFR system-1	mg/L	3,499	3,522
COD _{out, AFFR-2, y}	COD of wastewater exiting the the AFFR system-2	mg/L	4,066	3,478
MEP _{ww, treatment, y}	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y	tonnes	459.04	760.22
BG _{combusted, y}	Amount of biogas combusted for gainful use	m ³	2,907,077	3,552,741
BG _{TOFlare, y}	Amount of biogas flared	m ³	0	0
W _{CH4}	Methane content in biogas	%	51.45%	48.51%
q _{FO, y}	Quantity of fossil fuel used in boiler	L	59,830	687,350
Q _{starch, y}	Quantity of dry starch produced	tonne	37,397	43,847
EG _y	Net electricity production by the generators	MWh	3,429	2,684
EC _y	Electricity consumption by auxiliary equipments	MWh	1,118	1,118
Sludge	Sludge removed	t	7512	

Parameter	Name	Unit	Value
removed			

1.3.4 Appointment of team members and technical reviewer

On the basis of a competence analysis and individual availabilities a verification team was appointed. Furthermore also the personnel for the technical review and the final approval was determined.

The list of involved personnel, the tasks assigned and the qualification status are summarized in the table 1-4 below.

Table 1-4: Involved Personnel

	Name	Company	Function ¹⁾	Qualification Status ²⁾	Scheme competence	Technical competence ⁴⁾	Host country Competence	Team Leading competence
☒ Mr. ☐ Ms.	Archak Pattanaik	TUV India Pvt. Ltd.	TL	A	☒	AD	☐	☒
☒ Mr. ☐ Ms.	Abhishek Kumar Srivastava	TUV India Pvt. Ltd.	TM	E	☒	G	☐	☐
☒ Mr. ☐ Ms.	Lokesh Chandra Dube	TUV India Pvt. Ltd.	TM	E	☒	U	☐	☐
☒ Mr. ☐ Ms.	Vishnu Patidar	TUV India Pvt. Ltd.	-	T	☐	-	☐	☐
☐ Mr. ☒ Ms.	Saowalak Thongsong	TUV Thailand	TM	E	☒	-	☒	☐
☒ Mr. ☐ Ms.	Ingo Klein	TUV Nord Germany	TR ³⁾	A	☐	U	☐	☒
☒ Mr. ☐ Ms.	Rainer Winter	TUV Nord Germany	FA ³⁾	SA	☒	U,G	☐	☒

¹⁾ TL: Team Leader; TM: Team Member; TR: Technical review; FA: Final approval

²⁾ GHG Auditor Status: A: Assessor; E: Expert; SA: Senior Assessor; T: Trainee; TE: Technical Expert

³⁾ No team member

⁴⁾ As per S01-MU03 or S01-VA070 A2 (such as A, B, C.....)

1.4 Level of Assurance

The verification has been planned and organized to achieve a

- ☒ reasonable level of assurance
- ☐ limited level of assurance.

2 METHODOLOGY

The verification of the project consisted of the following steps:

- Contract review
- Appointment of team members and technical reviewers
- Publication of the monitoring report
- Desk review of the Monitoring Report^{/MR1/} submitted by the client and additional supporting documents.
- Verification planning,
- On-Site assessment,
- Background investigation and follow-up interviews with personnel of the project developer and its contractors,
- Draft verification reporting
- Resolution of corrective actions (if any)
- Final verification reporting
- Technical review
- Final approval of the verification.

The sequence of the verification is given in the table 2.1 below:

Table 2.1: Verification sequence

Topic	Time
Assignment of verification	2008-11-18
On-site visit	2009-06-17
Draft reporting finalised	2009-07-16
Final reporting finalised	2010-02-22
Technical review on final reporting finalised	2010-11-18
Final corrections	2010-11-18

The main verification steps are described below.

2.1 Review of Project Documentation

The VCS MR ^{/MR1/} and supporting background documents related to the project implementation, project design and baseline were reviewed.

Furthermore, the verification team used additional documentation by third parties like host party legislation, technical reports referring to the project design or to the basic conditions and technical data.

The references used in the course of this verification are summarized in section 5.

2.2 On-Site Assessment

2.2.1 Review of Performance Records

The project proponent furnished performance records of the project in form of data logs, registers and other documents^{/LOG/}. VER Calculation sheet^{/XLS1/} was checked thoroughly by the verification team for correctness of calculation approach. Data input values were also checked from the records maintained by the project proponents. Result of calculations reported in the monitoring report^{/MR1/} was checked against data values/ figures as available from the project proponent in VER calculation sheet^{/XLS1/}. These data values and other information related to project performance including calibration and meter testing details are available in the form of data logs and records duly archived and maintained as per the quality assurance/quality control procedure specified as a part of monitoring plan given in the validated VCS PD^{/PD/}.

However CARs 3.4-1, 3.4-2 and 3.4-3 were raised and successfully closed.

2.2.2 Follow-up Interviews

The verification team has carried out interviews in order to assess the information included in the project documentation and to gain additional information regarding the compliance of the project with the relevant criteria applicable for the VCS.

During verification the verification team has performed interviews to confirm selected information and to resolve issues identified in the document review. The main topics of the interviews are summarized in Table 2-2.

Table 2-2: Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
Project proponent representatives ^{/IM01/} Mr. Narin Ka-jon-cha-lerm-sak	- General aspects of the project - Technical equipment and operation - Changes since validation

Interviewed Persons / Entities	Interview topics
- Ms. Pavinee Soparak - Ms. Kamoltorn Chenchom - Mr.Panya Visetchart - Mr.Phonpharadon Nampichai Project consultant^{/IM02/} - Ms. Pathathai Tonsuwonnont - Mr. Sithisakdi Apichatthanapath Stake Holder^{/IM03/} - Mr. Pradit Pongpan	- Monitoring and measurement equipment - Remaining issues from validation / previous verifications - Calibration procedures - Quality management system - Involved personnel and responsibilities - Training and practice of the operational personnel - Implementation of the monitoring plan - Monitoring data management - Data uncertainty and residual risks - GHG calculation - Procedural aspects of the verification - Maintenance - Environmental aspects - Editorial issues of the Monitoring Report

A comprehensive list of all interviewed persons is part of section 5 'References'.# table 5-4.

2.2.3 Collection of Measurements

Measurements of the data parameters used for calculation of emission reductions in the project are undertaken by the project proponents as per the approved monitoring plan given in the validated VCS PD^{/PD/}.

The verification team checked data measurement procedures including metering arrangements, collection, reporting/recording and archiving of data at the time of site visit and found the practices were in compliance with approved monitoring plan as contained in validated PD^{/PD/}. However CARs 3.3-1 and 3.3-2 were raised and successfully closed.

2.2.4 Observation of established practices and testing of the accuracy of monitoring equipment

Accuracy of monitoring equipment in the project is maintained by means of periodic testing and other measures by the project proponent as specified in the QA/QC procedures given in approved monitoring plan of validated VCS PD^{/PD/}. The established practices and testing of accuracy of the monitoring equipment was checked at the site by means of calibration certificates and other documentary evidences furnished by the project proponent^{/CAL/} on site and were found appropriate.

2.3 Determination of the reductions in GHG emissions

Emission reductions have been transparently calculated as per the approach approved in the Validated PD^{/PD/}. The PP has used monitored data and ex ante fixed data including default values as mandated/ permitted by the applied methodologies. The values used for calculation of GHG emission reductions have been thoroughly checked by the verification team and was found appropriate and correct. The spreadsheet has been submitted by the PP which clearly and transparently mentions value of each data parameter used for calculation. The calculations are traceable and follow logical steps. The input values have been verified from the reliable and authentic sources including monitoring records, literature, approved PD and applied methodology.

However CARs 3.4-1, 3.4-2 and 3.4-3 were raised on calculation of GHG emission reductions and were successfully closed out.

2.4 Review of additional data from other sources if appropriate

Additional data from other sources e.g data from other similar kind of projects was checked to cross verify the reliability of monitored data. Basically this was done just to be further assured of data value by comparing them to that of other similar kind of projects. This is done through reviewing data of similar industries as available in public domain. The verification team has carried out interviews in order to assess the information included in the project documentation and to gain additional information regarding the compliance of the project with the relevant criteria applicable for the VCS.

2.5 Review of monitoring results and verification of the correct application of monitoring methodologies

The verification team checked monitoring report and VER calculation sheet for any material misstatements from the project description as provided in the validated VCS PD and project records. Monitoring results were found in line with the requirements of applied monitoring methodologies as stipulated in the validated PD and validation report including deviations and adjustments. However two deviations from monitoring plan were identified and reported in the monitoring report which was assessed and accepted as a part of section 3.3 completeness of monitoring in this report.

It was concluded that monitoring methodologies AMS III.H version 13, AMS I.D version 14 and AMS I.C version 15 are correctly applied with deviations accepted as a part of validation report. However, two deviations are requested by the project proponents and accepted as a part of this verification report after assessment. Justification of the same is provided in the Appendix I of this report.

2.6 Resolution of any material discrepancy

Material discrepancies identified in the course of the verification are addressed either as CARs, CLs or FARs.

A **Corrective Action Request (CAR)** is established where:

- mistakes have been made in assumptions, application of the methodology or the project documentation which will have a direct influence the project results,
- the requirements deemed relevant for verification of the project with certain characteristics have not been met or
- there is a risk that the project would not be registered or that emission reductions would not be able to be verified and certified.

A **Clarification Request (CL)** will be issued where information is insufficient, unclear or not transparent enough to establish whether a requirement is met.

A **Forward Action Request (FAR)** will be issued when certain issues related to project implementation should be reviewed during the first verification.

A detailed list of the CARs CLs and FAR raised and discussed in the course of this verification is included in the next section 3 of this report.

3 VERIFICATION FINDINGS

In this section the assessments and findings from the desk review of the VCS PD, site visit, interviews and supporting documents as well as the final assessments are summarised. Table 3-1 includes an overview of all raised CARs, CLs and FARs.

Table 3-1: Overview of CARs, CLs and FARs issued

No.	Topic / Chapter	CAR	CL	FAR
3.1	Remaining issues, including any material discrepancy	-	-	-
3.2	Project implementation	1	-	1
3.3	Completeness of monitoring	2	-	3
3.4	Accuracy of emission reduction calculations	3	-	-
3.5	Quality of evidence to determine emission reductions	-	-	-
3.6	Management and operational system	-	-	-
-	SUM	6	0	4

3.1 Remaining issues, including any material discrepancy, from previous validation

Description

In the validation report^{VR/} three forward actions (FAR D1 and FARs M3, M4) were requested. These FARs were requested for future verification events as this (present) verification was conducted along with validation (Please see Chapter 1.1 of validation report). The FARs are not necessarily to be complied in the current monitoring period. However the FARs are also included in the relevant sections of this verification report. Please refer to the FARs 3.2-1, 3.3-4 and 3.3-5 and DOE assessments thereon.

Thus the verification team concludes that the monitoring report^{MR2/} is found to be in compliance with validated VCS PD^{PD/} and Validation report^{VR/}. However one deviation from monitoring plan has been taken which is assessed as a part of completeness of monitoring in section 3.3 of this report.

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☐ The following finding(s) have been addressed:

Please refer to the FARs 3.2-1, 3.3-4 and 3.3-5 and DOE assessments thereon.

Final Assessment

No remaining issues found. MR^{/MR2/} is in compliance with validated PD^{/PD/} except for a deviation which is addressed as part of completeness of monitoring.

☒ No Finding identified.

3.2 Project implementation

Description

In the project, existing open anaerobic lagoon-based process is converted into a closed anaerobic system i.e. Anaerobic Fixed Film Reactor (AFFR). Also the three open lagoons are re-designed at the outlet of the AFFRs and converted to covered lagoons. Biogas produced is consumed in three ways. One line goes to a retrofitted boiler for steam generation. Another line goes to three gas engines having collective electricity generation capacity of 1.952MW. Residual gas is sent to flare. The steam and power produced by the captured biogas are used for the thermal energy and electricity requirement of the plant. In the future power may be fed to national grid upon successful execution of power purchase agreement.

At the time of onsite assessment the status of the project implementation was evaluated by the verification team. It was found that the project has been implemented as per the project description provided in the PD^{/PD/}. However certain monitoring equipments namely waste water flow meter, separate biogas flow meter for open flare and online methane analyser was procured but was not installed. A deviation was taken regarding the above which have been assessed as part of Annex I of this report.

Related Findings

☐ No CARs, CLs or FARs have been identified in this context

☒ The following finding(s) have been addressed:

Finding:	3.2-1		
Classification	☐ CAR	☐ CL	☒ FAR

Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Marking of flow direction and name of the fluid on all HDPE pipelines (wastewater, biogas gas) within the project boundary are requested to facilitate easy traceability during next verifications.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Action will be taken according to this recommendation prior to next verification site visit.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	As per the corrective action and in light of Validation report, PP will mark the flow direction and name of the fluid on all HDPE pipelines (wastewater, biogas gas) within the project boundary before the next (Second) periodic verification.
Conclusion <i>Tick the appropriate checkbox</i>	☒ To be checked during the next periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Additional action should be taken ☐ The project complies with the requirements

Finding:	3.2-2		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Since the monitoring report ^{/MR1/} is developed based on the methodology AMS III.H ver.9, please update the monitoring report ^{/MR1/} as per approved VCS PD including applied version of the methodology. Also respond to all the findings in this DVR for coherence with revised monitoring report and justify compliance with applied version of the methodology as per the validation report ^{/VR/} .		

Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The monitoring report has now been updated in accordance to the validated PD, and now takes into account the change in the methodology version. The respond in all the findings herein will be ensured to be consistent with the validation report of the project. The major impact is observed in the estimation of emission reductions as listed below: - Introduction of model correction factors for baseline and project emissions. - The project emissions ($PE_{ww, treatment, y}$) are estimated for system without biogas recovery i.e. open lagoon system. - Project emissions are excluded for the methane dissolved in wastewater. - Project emissions for flaring are included as per the tool for estimating flare emissions. - The baseline emissions are estimated on the basis of lagoon efficiency before the implementation of the project. The emission reductions in the monitoring report are estimated as per para 31 of AMS III. H., version 13. Estimations based on methane destruction approach and COD reduction approach, are compared and the conservative values are chosen. The same is transparently demonstrated in the revised MR and the corresponding calculation sheet.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The monitoring report^{/MR2/} is now revised as per the validated VCS PD, which is based on the AMS III.H ver. 13, AMS ID Ver.14, AMS IC Ver.15. However there are few deviations taken for the monitoring period, which were validated but compliance to those deviations were not described in the Monitoring report. Also refer to the CAR 3.3-1. Moreover the calculation approach for $COD_{removed, PJ, k, y - lagoon}$ is not as per the applied methodology. Pl. refer to the #5 of CAR 3.4-3.

Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Compliance to all deviations as per validated PD is now described throughout the revised MR. ER calculation approach has also been done step-wise to demonstrate how the deviations have been adopted. Moreover, in the absence of regular COD records (daily or weekly) at the outlet of the last open lagoon, one additional deviation has been made for the calculation of $PE_{ww, treatment, y}$. The deviation assumes that the post-treatment open lagoon system (system k) has the same COD removal capability/efficiency as the baseline open lagoon system (98.1%). This approach is conservative considering that the baseline system has 13 open lagoons, whereas the post-treatment system only involves 10 lagoons (3 have been converted into covered lagoons). Thus by assuming the same COD removal efficiency, we are in fact increasing our project emissions and thus can be assured that such deviated approach does not result in a negative impact on the conservativeness in calculating emission reductions. Further elaboration on the justification is exhibited in Annex 2 of the revised MR. Note that #5 of CAR 3.4-3 has been responded in similar manner.
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Compliance to all accepted deviations as per validated PD are found satisfactorily described in the annex 2 of the monitoring report Version 3.2 MR^{MR2/}. A new deviation is requested regarding COD removal from the treatment system not equipped with biogas recovery (open lagoon system). This parameter is to be measured as difference between COD inflow and outflow per the para 26 of applied methodology AMS III.H ver 13. Since regular records of COD at the outlet of the last open lagoon are not available, the PP has proposed that the COD out will be calculated based on COD in and COD removal efficiency of the baseline open lagoon system (98.1%). This approach is comparable with the approach as described in para 20 of AMS III.H ver 13 for parameter COD removed, i, y. This approach is also conservative as it takes into account the efficiency of baseline lagoon system consisting of 13 open lagoons, whereas in the project scenario open lagoon system consists of only 10 lagoons. This assessment is also elaborated in the Appendix 1 of this report. The deviation is thus accepted and CAR is closed out.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

Final Assessment

The project is largely implemented as described in validated VCS PD^{/PD/}. Deviations from approved monitoring plan are assessed in the Appendix I of this report and found acceptable. Compliance to the accepted deviations and deviation to the validated PD is correctly and transparently described in the monitoring report^{/MR2/} and assessed as part of section 3.3 completeness of monitoring.

3.3 Completeness of monitoring

Description

The reporting procedures reflect the requirements of the monitoring plan of the validated PD^{/PD/}. The monitoring parameters are recorded as per the monitoring plan and methodology. However a deviation is taken in the monitoring plan for this monitoring period and is assessed by the verification team. The deviation is listed in the Annex 3 of the monitoring report^{/MR2/}. The same is assessed in Appendix I of this verification report.

Following metering and measurement was verified during onsite visit:

- 3 point COD measurements (in and out of AFFR circuits). Sampling points were verified and the COD measurement lab was found to be in place. The records of COD measurement were recorded on daily basis. The wastewater from final lagoon is analysed on monthly basis.
- 3 point running hour meter (into AFFR system) for estimation of waste water flow and corresponding records were evidenced during the onsite assessment. However for future monitoring periods flow meters will be used which were found to be procured during site visit.^{/LOG/}
- 2 point gas flow meter (into hot oil boiler and gas engine-common meter for 3 gas engines) was verified. The meter displays volume data in m3, and same is found to be recorded in log sheet.^{/LOG/}
- 3 point electricity generation meters were installed to measure electricity generated by the 3 gas engines.^{/LOG/}
- CH₄% in biogas (vol, dry basis) is measured from the sample collected from the inlet of the steam boiler through a portable CH₄ analyser. The respective record was verified and collected.^{/LOG/}
- Final sludge disposal is being monitored by the PP and relevant records are maintained. Through interviews with stakeholders it was evidenced that the final sludge is being used for soil application.^{/SDR/}
- Ambient Temp data is obtained from the metrological department.^{/MET/}

The calibration records^{/CAL/} of the measurement instruments were made available to the verification team. None of the meters have been changed or reset during the reported monitoring vintage. However, calibration of gas flow meters was not found to be done as per section 3.3 of the validated PD^{/PD/} for the first monitoring period. Nevertheless gas flow meters were calibrated on 2009-06-10 (after the first

verification period) and the copy of the calibration certificates^{/CAL/} were submitted to the DOE. Since the calibration of gas flow meters were not carried out during the verification period the data of the bio-gas consumption in boiler and gas engines are adjusted for 0.55 % error margin as per the EB 52, annex 60. As per the delayed calibration certificates the maximum % error is arrived at 0.25%, which is well within the maximum permissible error as per the specifications of the meter^{/TD/}. Thus § 4 (a) of the EB 52, annex 60 is applied. The calculation spread sheet^{/XLS2/} was thoroughly checked by the verification team and found to be conservative and appropriate. A CAR (3.4-2 was raised related to this issue and successfully closed during course of verification.

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

Finding:	3.3-1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Any deviation/ adjustment from/ with the Monitoring Methodology and Monitoring Plan should be elaborated in the MR with justification. 1. The flow of waste water $Q_{y,ww}$ is calculated instead of monitoring. (Cp Para 35 of AMS III.H, Ver.09) 2. Since $Q_{y,ww}$ is calculated based on running hours and rated capacity of pump, running hours shall be considered as a separate monitoring parameter. Moreover the back up calculation shall be clearly and transparently presented in MR and ER excel worksheets. 3. Flaring of biogas is not being measured. 4. As the statistical analysis methane is not carried out, the CH₄ % values to be reported and lower value is to be applied for conservative emission reduction calculation. 5. The compliance of the para 34 of AMS III.H version 9 is not properly addressed. 6. Auxiliary electricity consumption by the plant is calculated instead of direct measurement.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	All the deviations applied in the monitoring report have been justified and validated on the basis of conservativeness, and are all exhibited in PD: 1) Calculation of $Q_{ww, y}$ has been elaborated and justified		

	section 4.1 in the final PD under deviation 1. This results in a reduction of VERs from the excel sheet presented in the 1st submission. In future monitoring periods (second verification onwards), the values shall be monitored using new meters to be in compliance with AMS III. H., monitoring methodology. 2) Running hour of the water pumps is now included as a monitoring parameter in section 3.3 of the validated PD. The monitoring report refers to the PD for detailed description of fixed and monitored parameters used in the emission reduction calculations. Back up calculation of wastewater flow is now transparently featured in both the monitoring report and the corresponding excel sheet. 3) The biogas has not been sent to flare for more than 2 years (since 3rd June 2006). This was also presented to DOE during an interview with project owner and evidenced in log sheets. This is because there is insufficient amount of biogas to be utilised in the boiler of $\approx 3.78\text{MWth}$ capacity and gas engine sets with capacity of $\approx 2\text{MWe}$. This is in fact confirmed by ex-post data in which total electricity generated in both 2007 (3,429 MWh) and 2008 (2,684 MWh) is much lower than its potential as per total installed capacity of $\approx 2\text{MW}$ (i.e. around 15 to 20% PLF). As well, the fact that 3 open lagoons have been converted into covered lagoons has increased the gas storage capacity of the project activity, thus in the case that the biogas utilisation devices are not under operation, the biogas can still be stored for a considerable period. 4) For the 1st verification, periodical measurements of %CH₄ has been made and determined at 95% confidence level; the ER sheet is revised accordingly. For subsequent verifications monitoring of this parameter will be made using the already incorporated online gas analyser by the generation sets. Hence, the project is now being line with AMS III. H. (Version 13). 5) The project proponent has employed guideline as per Para 31 of AMS III. H., version 13, to estimate emission reductions. This approach is the equivalence of that referenced in para 34 of AMS III. H., version 9, in which the emission reductions calculation is taken as the most conservative value between the methane destruction approach and the COD reduction approach. The same is very transparently described and demonstrated in the PD, monitoring report and the corresponding excel sheet. 6) Based on the change in the applied AMS III. H., methodology to version 13, the approach in determining PE_{power, y} is no longer a deviation and is found to be in accordance with para 35 of the applied methodology.
DOE Assessment #1	1) The deviation is transparently described in the validated

<i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	PD^{/PD/} and thoroughly assessed and accepted in the validation report^{/VR/} by the DOE. However the compliance to the deviation needs to be described in the Monitoring report. 2) Corrective action has been taken appropriately and the monitoring report and calculation spread sheets are in line with the validated PD^{/PD/}. However the sample log sheets need to be submitted for the running hours. 3) The corrective action is thoroughly assessed by the DOE during the validation and found to be acceptable^{/VR/}. Also refer to FAR 3.3-3. Proposed action deemed appropriate. 4) The corrective action in principle is accepted by the DOE during the validation. The calculation approach and calculation spread sheet is checked^{checked} by the verification team and found to be in line with § 36 of AMS III.H ver.13 and validated monitoring plan as well. CAR point is closed out in light of the deviation accepted as apart of validation report^{/VR/}. 5) The calculation approach is in line with the validated PD and also satisfies the requirements of para 31 of AMS III.H ver.13. However the calculation approach needs to be clearly and transparently described in the monitoring report. 6) The calculation approach is in line with the validated PD and also satisfies the requirements of para 35 of AMS III.H ver.13. However the calculation approach needs to be clearly and transparently described in the monitoring report. Moreover the backup calculation/data need to be provided in the calculation spread sheet.
Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	1) Description of all deviations and their compliances is now demonstrated transparently in the revised MR. 2) Sample log sheets have been submitted to substantiate the same. 3) NA 4) NA 5) The calculation approach is now clearly and transparently shown in the revised MR. 6) The calculation approach is now clearly and transparently shown in the revised MR. In addition, back up data and calculation are now included in the calculation sheet.
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	1) Compliance to deviation have been described in the revised MR and found appropriate. CAR point is closed out. 2) Sample log sheets for running hours have been assessed and found matching with the values entered in the worksheet^{/XLS2/}. CAR point is closed out. 3) Already closed. 4) Already closed. 5) The calculation approach is found transparently mentioned

	with equations in the revised MR ^{/MR2/} . CAR point is closed. 6) Back up data and calculation for $PE_{power, y}$ are found included in the revised calculation sheet ^{/XLS2/} . CAR point is closed.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☐ The project complies with the requirements

Finding:	3.3-2		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Comparison of the actual emission reduction claimed in the monitoring period with the estimate in the validated PD needs to be described in MR. (Cp EB 48 Annex 68)		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Quantitative and qualitative comparison of ex-ante and ex-post emission reductions are now included in the revised MR.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Comparison of the actual net GHG emission reductions by sources as calculated ex-post and as claimed ex ante are found appropriately mentioned in the revised MR ^{/MR2/} . It is satisfactorily explained in the VCS MR that actual ex post emission reductions are lesser than the ex ante calculated value due to variation in starch production and conservative approach maintained in ex post calculations.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☐ The project complies with the requirements		

Finding:	3.3-3		
Classification	☐ CAR	☐ CL	☒ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	The following flow meters need to be installed for the next verification periods. – Gas flow meter for the measurement of open flare – Waste water flow meters		

Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	- A new gas flow meter (GM3) has now been installed at the gas line going into gas engines. It displaces the existing meter, GM2, which has now been shifted to monitor biogas sent to flare, in rare case that there is excess biogas. - 3 new wastewater flow meters have just been installed and will be used to measure flow of wastewater into the biogas system, the necessary for the calculation of emission reductions from second verification period onwards. Recently received calibration records for these meters are attached along with the submission of revised monitoring report to substantiate their availability.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	- The proposed corrective action deemed appropriate. A deviation relating to wastewater flow meter is already approved Validation report of the project^{VR/}.
Conclusion <i>Tick the appropriate checkbox</i>	☒ To be checked during the next periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Additional action should be taken ☐ The project complies with the requirements

3.3-4	
Classification	☐ CAR ☒ FAR ☐ CL
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	The operational condition of the retrofitted dual fuel boiler, need to be verified during the subsequent verifications. In case it is found that the existing boiler is replaced with a new one during any verification no emission reductions shall be granted for heat displacement.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	During verification, the assessment of the presence of the baseline boiler equipment shall be verified and the same shall be included in the monitoring report.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The proposed corrective action by the PP deemed appropriate.
Conclusion <i>Tick the appropriate checkbox</i>	☒ To be checked during the next periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Additional action should be taken ☐ The project complies with the requirements

3.3-5	
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Classification	☐ CAR ☒ FAR ☐ CL
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Flame detection system and temperature monitoring device need to be in place as per the requirement of the flare tool for the closed flare for the subsequent verifications and record of the same need to be maintained.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The PP assures to install necessary flame detection and temperature monitoring device and necessary records will be maintained.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The proposed corrective action by the PP deemed appropriate and will be checked during next verification.
Conclusion <i>Tick the appropriate checkbox</i>	☒ To be checked during the next periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Additional action should be taken ☐ The project complies with the requirements

Final Assessment

The Validation team concludes that the reporting ^{/MR2/ /XLS2/} is majorly in line with the requirements of the validated monitoring plan as well as with the applied methodology AMS III.H version 13.

Five deviations from the applied methodologies AMS III.H version 13, AMS I.D version 14 and AMS I.C version 15 were already approved as a part of validation report. These deviations and their successful closure on the basis of validation report have also been reiterated and as a part of CARs 3.3-1.

However, one deviation was found in the actual project implemented on site and the monitoring plan of the validated PD^{/PD/} which is addressed as a part of Appendix I of this report.

3.4 Accuracy of emission reduction calculations

Description

The formulas and factors used in the calculations of emission reductions are in accordance to the approved baseline methodologies AMS III.H, version 13, AMS I.D version 14 and AMS I.C version 15. All aspects related to the direct and indirect GHG emissions relevant to the project have been addressed and calculations are presented in a transparent manner and in line with the applied methodologies, tools and validated PD^{/PD/}.

Baseline and project activity emissions have been calculated appropriately whereas no leakage is involved in the project activity.

The set of calculations for the actual emission reduction of the 1st verification period are transparently computed and presented in the spread sheet of VER calculation^{/XLS2/} with the reference sources of data. Correct and appropriate assumptions; default values; correction factors in accordance with AMS III.H version 13 (including grid emission factor for project emission in accordance with AMS I.D version 14), AMS I.C version 15 and AMS I.D version 14 have been appropriately applied. The sources of project specific original data were cross-checked and found to be correct based on the evidences provided by the project proponent. The same is listed in table 5-1 of reference section of this report.

The verification team has checked the underlying input values as well as the computation in the spreadsheet^{/XLS2/}. The estimation of the baseline emission, project emission was realized in a transparent and conservative manner. The VER sheet contains the actual emission reduction under 1st verification (carried out in combination with validation) for 01/01/07 to 31/12/2008 of 24,710.

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

Finding:	3.4-1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	The COD value for PE _{y,ww,treated} calculation should corresponds to final lagoon not the outlet from AFFR system (Cp para 14 eqn. (2) of AMS III.H Ver. 9)		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	In light of CAR 3.2-2, the applied parameter, PE _{y, ww, treated} , from AMS III. H., version 9, is termed as PE _{ww, discharge, y} in version 13 of the same methodology. Since there is no discharge of wastewater in sea/river/lake, PE _{ww, discharge, y} has been neglected as per the applied methodology. Thus, from the view of the PP, this finding does not necessitate further action.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The above corrective action is already assessed and accepted as the part of closure of CAR C1 of the Validation report ^{/VR/} . The project emission calculation in the calculation spread sheet ^{/XLS2/} is found to be in line with the methodology AMS III.H Ver.13 and the validated PD. The CAR is closed.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Finding:	3.4-2		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Calibration certificates of all existing and new meters to be installed shall be made available to the DOE.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Calibration certificates are submitted to the DOE along with respond to this DVR.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Calibration certificates for periodic calibrations of waste water flow meter, HFO meter, COD measurement by spectrophotometer, Bio gas flow meter, Methane analyzer etc. have been submitted to DOE ^{/CAL/} . However the monitoring report needs to include the details of calibration throughout the monitoring period. (Cp EB 48 Annex 68)		
Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Monitoring report has been revised and details of calibration have been inserted.		
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Calibration records ^{/CAL/} have been submitted by the PP. Calibration details are found correctly included in the revised monitoring report ^{/MR/} and found acceptable. A delay in calibration of Gas flow meter was observed which has been duly accounted for in the calculation of emission reductions ^{/XLS2/} . CAR is thus closed out.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Finding:	3.4-3		
Classification	☒ CAR	☐ CL	☐ FAR

Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	A consolidated CAR is raised on the revised Calculation spread sheet^{/XLS2/}. 1. Back up calculation/formula for COD removal efficiency (98.1 %) need to be provided in the GHG ER calculation sheet. 2. Back up calculations/data for P_{el} (for the calculation of PE power, y) needs to be provided in the file. 3. Running hour of water pumps to be supported by log sheets ($HR_{ww, y}$). 4. Simple average of COD values of both the AFFRs is not acceptable. Flow weighted average of COD needs to be calculated. Moreover the backup calculation/data for the same shall be provided in the calculation spread sheet. 5. The calculation approach for $COD_{removed, PJ, k, y - lagoon}$ is not as per the applied methodology. Deviation should be taken against the monitoring of the $COD_{removed, PJ, k, y - lagoon}$ for project emission calculation (i.e. COD of the wastewater before and after the treatment system k, not equipped with biogas recovery). Moreover the description of the primary monitoring parameters (i.e. $COD_{out, lagoon, PJ, y}$ and $COD_{out, biogas, PJ, y}$) to calculate $COD_{removed, PJ, k, y}$ (for calculation of $PE_{ww, treatment, y}$ and $PE_{fugitive, y}$) needs to be clearly and transparently described in the monitoring report(also refer to FAR 3.4-4). 6. The data for % CH_4 in Biogas (original) provided in calculation spread sheet^{/XLS2/} is not matching with data from log sheet^{/LOG/}.e.g. ▪ In Cell M20 in work sheet “monitoring parameter 2007” (59.7) The average of 12 test results in the log sheet for the 12 Jan 2007 is 55.28. ▪ In cell M17 in “monitoring parameter 2008” (48.7) the average of 6 test results in the log sheet for the 9 Jan 2008 is 42.
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Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	1. Back up data/formula for the calculation of COD removal efficiency is now included in the calculation excel sheet. 2. Back up calculation for $PE_{power, y}$ is now included in the calculation excel sheet. 3. Log sheets are being submitted to substantiate running hours of the pump 4. Flow weighted average of COD has now been used in the calculation of emission reductions (COD approach). Back up calculation of the same has also been included in the excel sheet. 5. In the absence of regular COD records (i.e. daily or weekly) at the outlet of last open lagoon, a deviation has been made for the calculation of $PE_{ww, treatment, y}$. The deviation assumes that the post-treatment open lagoon system (system k) has the same COD removal capability/efficiency as the baseline open lagoon system (98.1%). This approach is conservative considering that the baseline system has 13 open lagoons, whereas the post-treatment system only involves 10 lagoons (3 have been converted into covered lagoons). Thus by assuming the same COD removal efficiency, we are in fact increasing our project emissions and thus can be assured that such deviated approach does not result in a negative impact on the conservativeness in calculating emission reductions. The parameters $COD_{out, lagoon, PJ, y}$ and $COD_{out, biogas, PJ, y}$ are not used in current monitoring period. The COD loads in tonnes are estimated based on daily COD concentrations and waste water volumes which is subsequently used to estimate the $PE_{ww, treatment, y}$ and $PE_{fugitive, y}$. The calculation is transparently explained in the monitoring report. 6. Data inputted in the previous excel sheet is based on any single reading in a day as opposed to the average value of the whole day. For greater transparency as well as to provide the most accurate representation, average values for all the days monitored have been calculated and now included in the revised MR.
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DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	1. Back up calculation for COD removal efficiency is found provided in the emission reduction calculation sheet^{/XLS2/}. CAR point is closed. 2. Back up calculation for PE_{power, y} is found correctly included in the revised calculation sheet^{/XLS2/}. CAR point is closed. 3. Sample log sheets^{/LOG/} for running hours of the pump as provided by the project proponent was assessed and found correctly used for input in calculation sheet^{/XLS2/}. CAR point is closed out. 4. Flow weighted average of COD has been used in the calculation of emission reductions (COD approach). Back up calculation of the same has also been included in the excel sheet. CAR point is closed out. 5. The deviation is clearly and transparently described in the Annex 3 of the mentoring report and is found justifiable on as it does not lead to the overestimation of VERs. The same is assessed in the Appendix I of this report. CAR point is closed out. Also refer to FAR 3.4-4. 6. The excel sheet is found corrected for average values instead of randomly picked individual values of methane percentage. However, the PP is requested to make entry of the input values of methane percentage and show calculation of average value in the sheet. CAR point is open.
Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	In light of pending #6 of the above request, the PP has entered input values of %CH₄ measured over the monitoring period. Calculation of average value is also included in the calculation sheet.
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	%CH₄ measured over the monitoring period is found correctly entered in the calculation sheet^{/XLS2/}. This has been checked from methane % test reports^{/LOG/}. CAR point is thus closed out. Since all CAR points are satisfactorily addressed by the PP, the consolidated CAR is closed out.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

Finding:	3.4-4		
Classification	☐ CAR	☐ CL	☒ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	In continuation to #5 of CAR 3.4-3, the primary monitoring parameters i.e. COD _{out, lagoon, PJ, y} and COD _{out, biogas, PJ, y} needs to be clearly and transparently described in the monitoring report and monitored accordingly as a part of subsequent verifications.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The parameter COD _{out, lagoon, PJ, y} shall be included as a parameter in the future monitoring reports and for current monitoring period, a conservative approach as per the deviation explained in the Monitoring report. The parameter COD _{out, biogas, PJ, y} is a calculated parameter and need not be included in Monitoring report. The total COD load entering the lagoon system is estimated based on daily COD readings out of AFFR1 and AFFR2, multiplied by respective waste water quantities into the AFFRs. The parameter is explained in the Annex-3 of Monitoring report and shall be included in the future monitoring reports. .		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The proposed corrective action is deemed appropriate. Compliance to the requirement as laid in the MR will be checked in future verifications.		
Conclusion <i>Tick the appropriate checkbox</i>	☒ To be checked during the next periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Additional action should be taken ☐ The project complies with the requirements		

Final Assessment

Following CARs as described above, mistakes identified during the verification in the ER calculation were appropriately and satisfactorily corrected by the PP. The excel sheets were rigorously cross checked with the archived monitored data and no discrepancies were found. All the formulae have been found to be correctly applied in the emission reduction calculations. No factual error including manual or electronic mistakes has been found. Thus it is confirmed that the ER calculation is overall correct.

3.5 Quality of evidence to determine emission reductions

Description

Evidences produced to determine emission reductions^{/LOG/LAB/} as listed in table 5-1 were found correct and authentic. Most of the documented evidences furnished by the PP were in national language of the host country (Thai) which were translated wherever

possible for better and wider understanding of the verification team. Moreover the verification team also includes GHG auditors with Thai language competence. These documents were verified through site visit interviews and found to be authentic. By the interview it was found that the laboratory staff, maintenance staff and supervisors are properly trained for the work assigned to them^{/TR/}. Verification Team has also verified on site the way of taking measurements and samples therefore. All the log sheet^{/LOG/} are checked during site visit and reported values are found consistent with them.

In addition to this, verification team has cross verified the entered values of the project activity monitoring parameters with the log records from the submitted documents^{/LOG/} and found that all input data values are correctly applied in the calculations of the emission reductions^{/XLS2/}.

Related Findings

- ☒ No CARs, CLs or FARs have been identified in this context
- ☐ The following finding(s) have been addressed:

Final Assessment

Evidenced submitted to the DOE e.g. Commissioning certificates^{/CR/} process log sheets^{/LOG/} calibration certificates^{/CAL/}, laboratory reports of waste water characteristics^{/LAB/} etc. used for emission reduction calculation were assessed and found to be reliable and authentic.

3.6 Management and operational system

Description

DOE has done site visit and interviewed^{/IM01/} the site personnel involved in the monitoring and operation of project and thus concludes that management and operation system maintained by the PP on site was found to be as planned in the VCS project description^{/PD/}. Also, it was found that the laboratory staff, maintenance staff and supervisors are properly trained for the work assigned to them^{/TR/}. Data collection, measurement, calibration, recording and archiving was found to be carried out as per the monitoring plan as described in the validated PD^{/PD/}.

Related Findings

- ☒ No CARs, CLs or FARs have been identified in this context
- ☐ The following finding(s) have been addressed:

Final Assessment

Based on organisational structure^{/ORG/} and onsite assessment the verification team concluded that the project participant have an adequate management and operational system in place related to the project activity. No discrepancy was identified from the designed management and operation system as described in the validated PD^{/PD/} of the VCS project during onsite interviews.

4 VERIFICATION STATEMENT

M/s South Pole Carbon Asset Management Ltd. on behalf of M/s Chol Chareon Co. Ltd. has commissioned the TÜV NORD JI / CDM Certification Program to carry out the verification of the Project "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)" in Banbung district of Cholburi province, Thailand with regard to the requirements of VCS 2007.1 Standard.

The project activity involves recovery of methane from wastewater treatment and combustion of methane for onsite utilisation and flaring, thereby reducing the baseline methane emissions; and baseline grid emission due to power generation. An additional claim for grid electricity displacement is made.

Reporting period: From 2007-01-01 to 2008-12-31

In the course of the verification Six (6) Corrective Action Requests (CARs) were successfully closed and Two (2) Forward Action Requests (FARs) will be verified during the subsequent periodic verification.

The verification is based on the draft monitoring report^{/MR1/}, revised monitoring report^{/MR2/}, the monitoring plan as set out in the validated PD^{/PD/}, the validation report^{/VR/}, emission reduction calculation spreadsheet^{/XLS1/XLS2/} and supporting documents^{/LOG/CAL/} made available to the TÜV NORD JI/CDM CP by the project participant.

In detail the conclusions can be summarised as follows:

- All operations of the project are implemented and installed as planned and described in the validated project description.
- The monitoring plan is in accordance with the applied approved methodology, i.e., AMS III.H version 13, AMS I.D version 14 and AMS I.C version 15.
- The installed equipment essential for measuring parameters required for calculating emission reductions is calibrated appropriately.
- The monitoring system is in place and functional. The project has generated GHG emission reductions.
- Two deviations from the validated monitoring plan have also been approved. Deviations are taken on monitoring requirement of parameter COD_{y, removed, PJ, k} for calculation of Methane emissions from the wastewater treatment systems affected by the project activity, and not equipped with biogas recovery (PE_{ww, treatment, y}) and for calculation of PE_{ww, treatment, y} and PE_{fugitive, y}.

As the result of the 1st periodic verification, the verifier confirms that the GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner. TÜV NORD JI/CDM CP herewith confirms that the project has achieved emission reductions in the above mentioned reporting period as follows:

Project emissions	7,505 t CO ₂ equivalents
Baseline emissions	32,215 t CO ₂ equivalents
Total Emission reductions	24,710 t CO₂ equivalents

Yearwise Emission reduction:

Year	Emission reduction (t CO ₂ equivalents)
2007 (01.01. to 31.12.)	11,056
2008 (01.01. to 31.12.)	13,654



New Delhi, 2010-11-03

A handwritten signature in black ink, appearing to read 'Archak Pattanaik', written in a cursive style.

Archak Pattanaik
TUV India Pvt. Ltd.
Verification Team Leader

Essen, 2010-11-18

A handwritten signature in black ink, appearing to read 'Rainer Winter', written in a cursive style.

Rainer Winter
TÜV NORD JI/CDM Certification Program
Final Approval

APPENDIX- I

**Table- 4.1: ASESSMENT OF DEVIATION/CHANGES FROM MONITORING PLAN
AS CONTAINED IN APPROVED VCS PD OF THE PROJECT**

Data/Parameters/Variables/	Reference of methodology and Validated VCS PD	Description of Deviations/ Changes	Assessment by Verification Team
Chemical oxygen demand removed by project wastewater treatment system k (COD _{y, removed, PJ, k}) for calculation of Methane emissions from the wastewater treatment systems affected by the project activity, and not equipped with biogas recovery (PE _{ww, treatment, y})	AMS III.H version 13, para 26, equation (8) Data parameter COD _{y, removed, PJ, k} as contained in the section 3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals of the validated VCS PD	COD concentration of wastewater at the outlet of the last open lagoon is being calculated based on COD removal efficiency of the baseline treatment system instead of monitored in the calculation of PE _{ww, treatment, y} . This deviation is requested regarding COD removal from the treatment system not equipped with biogas recovery (open lagoon system). This parameter is to be measured as difference between COD inflow and outflow per the para 26 of applied methodology AMS III.H ver 13. Since regular records of COD at the outlet of the last open lagoon are not available, the PP has proposed that the COD out will be calculated based on COD in and COD	This approach is comparable with the approach as described in para 20 of AMS III.H ver 13 for parameter COD _{removed, i, y} . This approach is also conservative as it takes into account the efficiency of baseline lagoon system consisting of 13 open lagoons, whereas in the project scenario open lagoon system consists of only 10 lagoons. Keeping the above description in the background the verification team has reached to the conclusion that the deviation is conservative and thus is acceptable. Moreover the deviation satisfies the requirements of para 5.3 of the standard VCS 2007.1.

		removal efficiency of the baseline open lagoon system (98.1%).	
COD _{removed, PJ, k, y} (for calculation of PE _{ww, treatment, y} and PE _{fugitive, y})		The primary monitoring parameter i.e. COD _{out, lagoon, PJ, y} to calculate COD _{removed, PJ, k, y} (for calculation of PE _{ww, treatment, y} and PE _{fugitive, y}) is clearly and transparently described in the Annex3 of the revised monitoring report ^{/MR2/} which is lacking in the monitoring plan of the validated PD. The above parameter shall be monitored accordingly for the future monitoring periods and reported clearly in the corresponding MRs in subsequent verifications.	The changes/additions in the monitoring plan is carried out only to bring clarity and transparency in the calculation of the emission reductions and its no way affecting the conservativeness of the emission reduction calculations. The changes do not lead to the overestimation of emission reductions. Thus it is concluded that the changes are in line with the requirements of the para 5.3 of the standard VCS 2007.1 and thus is acceptable to the verification team. The same will be verified during subsequent verifications.
COD _{ww, untreated, y} (The chemical oxygen demand of the wastewater before the treatment system k, affected by the project activity, monitoring required as per the para 34 b of AMS III.H version 13)	As per the approved monitoring plan contained in the validated PD, COD measurements are required to be made on a daily basis, In case the COD value is not available for a	Monitoring values are not available for all the days in monitoring period. PP has presented an alternative method to estimate COD _{ww, untreated, y} for the days where monitored data is not available. In the proposed statistical approach, missing COD values are	The proposed statistical approach applies student's t-distribution which is assessed to be appropriate as Student's t-distribution is a continuous probability distribution that arises in the problem of estimating the mean of a normally

	particular day, the same shall be estimated in a conservative manner or ignored out of emission reduction estimation.	estimated at 95% confidence level. Since the number of samples is low, Student-t distribution approach is used. Values of lower end (average COD - standard error at 95%confidence level) are taken for estimating $COD_{ww,untreated,y}$ (COD of wastewater entering the treatment plant) and values of upper end (average COD + standard error at 95%confidence level) are taken for estimation of $COD_{out,AFFR1,y}$ and $COD_{out,AFFR2,y}$ (COD out of AFFR1 and 2). This approach makes the estimation conservative. Moreover, for some months (May, June, July, August, September in 2007 and May, Jun in 2008) no readings of $COD_{ww,untreated,y}$; $COD_{out,AFFR1,y}$ and $COD_{out,AFFR2,y}$ are available for a single day. These months are neglected out of emission reduction calculation.	distributed population when the sample size is small. The approach also applies 95% confidence level and COD data is demonstrated to be of 8% and 6% precision for 2007 and 2008 respectively. This confidence interval and precision limit is found to give conservative estimation of emission reduction than that with 90% confidence interval and 10% precision as recommended by Annex 30/EB 50. Also those months are found neglected from ER calculation where no COD readings are available. Thus, the approach regarding estimation of the parameter $COD_{ww,untreated,y}$ is in line with the requirement of the approved monitoring plan contained in the validated PD as in case the COD value is not available for a particular day, the same has been estimated in a conservative manner or ignored out of emission reduction estimation.
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5 REFERENCES

Table 5-1: Documents provided by the project participant

Reference	Document
/BR/	Breakdown/annual maintenance record of the plant covering the monitoring period.
/CAL/	Calibration records for the key instruments and measuring devices: - New Wastewater Flow meters FM1, FM2 and FM3 at the inlet of the biogas system, dated 18 December 2009. - Biogas Flow meter GM1 to measure the biogas sent to the boiler, GM2 to measure biogas to gas engines, dated 15 June 2009 and GM2 to measure biogas to flare, dated on 03 July 2009. - COD Spectrophotometer for COD measurement dated on 8 June 2009. - Electricity meter for the electricity generated from 3 gas engines. - HFO flow meter for hot oil boiler - CH₄ analyser dated 10/09/2008.
/CRI/	Commissioning report of equipments used in project activity (AFFR, Flaring equipment, Gas fired boiler, gas engines).
/CON/	The signed contract between TUV-NORD and South pole to carry out the validation and verification job on 18 Nov'2008.
/DC/	Undertaking from the project participant that the project is not applied for any other environmental credits.
/FS/	Flare specification on the type and efficiency of flare system provided by the flare manufacturer.
/LAB/	Sample Lab reports related to the project activity: - Daily and weekly analysis report of the COD_{inlet} and COD_{outlet} done inside the Plant's laboratory. - Analysis report for methane content in biogas taken periodically
/COMP-CERT/	Competency certificate of the methane analyser.
/LOG/	Extract of log of monitored data of the project activity: Log of gas flow meters with highlighted initial and end readings for

Reference	Document
	each calendar year during monitoring period. • Log sheet indicating first date of gas engine electricity generation. • Log records of wastewater treated • Log of grid electricity consumption. • Extract of the COD measurements at inlet and outlet of AFFR system and final lagoon discharge. • Operational log of all gas destruction/ utilisation devices (Biogas boiler, Biogas engine)
/MET/	Local met data on annual average ambient temperature.
/PHOTO/	Photograph of the project activity site, major equipment installed and baseline activity.
/MR1/	Draft MR version 1 which forms the basis for verification.
/MR2/	Final MR version 3.2 which forms the basis of TÜV NORD certification report.
/PDI/	Project design document validated by TÜV Nord Cert GmbH
/PO/	Purchase order for the following monitoring equipment needs to be submitted to DOE- - Gas flow meter for the measurement of open flare - Waste water flow meters - HFO (fuel oil meter)
/ORG/	Organisation chart describing the project activity
/QA-QC/	The QA-QC procedure on data acquisition and storage
/MS/	Copy of national, international standards or the established local industrial procedures followed for metering and lab measurements.
/SDR/	Sludge Disposal Record
/SLDI/	Single line diagram for metering system and electricity flow for the project activity
/TDI/	- Technical specification of fuel oil meter (HFO meter). - Technical details of waste water pumps as provided by the supplier - Technical specification of gas flow meter (model no.: 7MF4433)
/TRI/	Training and maintenance record of the plant personal to operate.
/VR/	Validation report No. 53208109-08/510, dated 2009/11/14

Reference	Document
/XLS1/	Supporting Excel sheets for calculation of emission reduction related to MR1
/XLS2/	Supporting Excel sheets for calculation of emission reduction related to MR 2 (version 3.2)

Table 5-2: Background investigation and assessment documents

Reference	Document
/AMS.III.H./	SSC-CDM methodology “Methane Recovery in Wastewater Treatment” Ver13.
/AMS.I.C/	SSC-CDM methodology “ Thermal energy production with or without electricity” ver 15.
/AMS.I.D/	SSC-CDM methodology “Grid Connected Renewable Electricity Generation” ver 14.
/CPM/	TÜV NORD JI / CDM CP Manual (incl. CP procedures and forms)
/IPPC/	1. 1996 IPCC Guidelines for National Greenhouse Gas Inventories: work book 2. 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book
/ISO 14064/	Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions
/ISO14065/	Greenhouse gases -- Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition
/VCS/	Voluntary Carbon Standard 2007.1
/VVM/	Validation and Verification Manual (Version 1.1 as per EB 51)

Table 5-3: Websites used

Reference	Link	Organisation
/cd4cdm/	www.cd4cdm.org	UNEP Riso Centre
/ipcc/	www.ipcc-nggip.iges.or.jp	IPCC publications
/vcs/	www.v-c-s.org	VCSA
/unfccc/	http://cdm.unfccc.int	UNFCCC

Table 5-4: List of interviewed persons

Reference	Mol ¹		Name	Organisation / Function
/IM01/	V	☒ Mr. ☐ Ms.	Narin Ka-jon-cha- Ierm-sak	Managing Director, Chol Chareon Co. Ltd.,
/IM01/	V	☐ Mr. ☒ Ms.	Pavinee Soparak	Deputy Managing Director, Chol Chareon Co. Ltd.,
/IM01/	V	☐ Mr. ☒ Ms.	Kamolporn Chenchom	QC Supervisor, Chol Chareon Co. Ltd.
/IM01/	V	☒ Mr. ☐ Ms.	Panya Visetchart	Biogas Operator, Chol Chareon Co. Ltd.
/IM01/	V	☒ Mr. ☐ Ms.	Phonpharadon Nampichai	Genset Controller, Chol Chareon Co. Ltd.
/IM02/	V	☐ Mr. ☒ Ms.	Pathathai Tonsuwonnont	CDM Country Manager, South Pole Carbon Asset Management Limited
/IM02/	V	☒ Mr. ☐ Ms.	Sithisakdi Apichatthanapath	CDM Project Manager, South Pole Carbon Asset Management Limited
/IM03/	V	☒ Mr. ☐ Ms.	Pradit Pongpan	Member of Nong Chak Sub-district.

¹⁾ Means of Interview: (Telephone, E-Mail, Visit)