

FINAL VERIFICATION REPORT FOR “P.S.C STARCH WASTEWATER TREATMENT AND BIOGAS UTILIZATION PROJECT”

**RINA**

Document Prepared By RINA Services S.p.A. (RINA)

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Summary:

RINA Services S.p.A. (RINA), commissioned by Swiss Carbon Value Limited, has verified the greenhouse gas emission reductions reported for the project activity “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, VCS Registration Reference N° 417, for the period 01-December-2009 to 31-August-2013, with regard to the relevant requirements for VCS and CDM activities. The verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable VCS / CDM requirements in order to be certified.

The project was validated by TÜV NORD CERT GmbH (validation report N° 53219108-08/509 issued on 18-November-2009) and it was registered under the VCS registration reference N° 417.

The GHG emission reductions were calculated on the basis of the approved methodology AMS-III.H version 13, Methane Recovery in Wastewater Treatment of 17-July-2009 and the monitoring plan included in the registered Project Design Document, version 3.1 of 18-November-2009.

In conclusion 01 Corrective Action Requests (CARs) and 08 Clarification Requests (CLs) are identified related to the monitoring, implementation or operations of the VCS project activity (Monitoring Report version 01 of 17-September-2013) in relation to all relevant VCS and UNFCCC requirements for the VCS and CDM and the applied baseline and monitoring methodologies and these CARs and CLs are successfully closed after necessary corrections/clarifications by the client.

In conclusion, it is RINA’s opinion that the project activity “P.S.C Starch Wastewater Treatment and Biogas Utilization Project”, in Thailand, as described in the latest Monitoring Report, version 05 of 10-October-2014, meets all relevant requirements for VCS/CDM activities and all relevant host Party criteria and correctly applies the baseline and monitoring methodologies, AMS-III.H, “Methane recovery in wastewater treatment”, version 13 of 17-July-2009 and AMS-I.D., Grid connected renewable electricity generation, version 14 of 31-July-2009. Hence, RINA is able to certify that the emission reductions from the project during the monitoring period 01-December-2009 to 31-August-2013 amounts to 6,532 tCO₂e in 2009 , 36,973 tCO₂e in 2010, 44,730 tCO₂e in 2011, 44,613 tCO₂e in 2012, 42,085 tCO₂e in 2013

Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
BE	Baseline Emissions
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM-VVS	Clean Development Mechanism Validation and Verification Standard
CH ₄	Methane
CL	Clarification Request
CL1,2,3	Covered Lagoon 1, 2 and 3.
CO ₂	Carbon dioxide
COD	Chemical Oxygen Demand
CO ₂ e	Carbon dioxide equivalent
DEDE	Department of Alternative Energy Development and Efficiency
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
ER	Emission Reductions
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
MP	Monitoring Plan
MR	Monitoring Report
NCV	Net Calorific Value
PD	Project Document
PE	Project Emission
PP(s)	Project Participant(s)
Ref.	Document Reference
RINA	RINA Services Spa
SS(s)	Sectoral Scope(s)
UASB	Up-flow Anaerobic Sludge Blanket
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VER	Voluntary Emission Reduction

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1 INTRODUCTION

1.1 Objective

The objective of the verification is to have an independent review ex post determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emission that have occurred as a result of registered VCS project activity during a defined monitoring period. Certification is the written assurance by the DOE that, during a specific time period, a proposed VCS project activity achieved the reductions in anthropogenic emissions by sources of GHGs as verified.

The objective of this verification/certification was to verify and certify emission reductions and effective implementation of the monitoring of sustainable development indicators and mitigation measures, reported for the “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand for the period of 01-December-2009 to 31-August-2013.

1.2 Scope and Criteria

The verification scope is:

- to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan;
- to evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement;
- to verify that reported GHG emission data is sufficiently supported by evidence;
- to evaluate whether all the mitigation measures have been effectively put in place according to the monitoring plan and that all the sustainable development indicators have been correctly monitored.

Verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable VCS Version 3 requirements, which refer to CDM rules, in order to be certified.

UNFCCC criteria for CDM refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, and the subsequent decisions by the CDM Executive Board.

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

1.3 Level of Assurance

All the revisions of the verification report before being submitted to the client were subjected to an independent internal technical review to confirm that all verification activities had been completed according to the pertinent RINA instructions. The technical review was performed by a technical reviewer(s) qualified in accordance with RINA's qualification scheme for VCS and CDM validation and verification.

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

Role	Last Name	First Name	Country
Team Leader	Menon	Rekha	India
Technical Expert & Verifier	Arokiasamy Amalorpavanathan	Cyril Augustus	India
Technical Review (DVRP)	Raghavan Nair	Reghu Kumar	India
Technical Review (FVR)	Timuroglu	Isil	Turkey
Technical Review (FVR)	Krishnan	Praveen Kumar	India

1.4 Summary Description of the Project

As available in the registered VCS PD /1/ and as witnessed during the site visit, the project site is located on the site of the project site is located in the compound of the P.S.C. Starch factory located at 999 Nongyai-Bothong Road, Nongyai, Chonburi about 150 km southeast of Bangkok with geographical coordinates: Latitude 13° 18' 6.50" N Longitude 101° 21' 49.47" E.

As available in the registered VCS PD /1/, the project activity involves biogas recovery and its utilization as a fuel in hot oil boiler and steam boilers. The project involves wastewater generation from two different manufacturing units turning out three products (i.e. starch, sweetener and ethanol). The project was implemented at P.S.C Starch Products Public Company Limited on 28-April-2005 (project start date). In the baseline, wastewater generated was treated in cascading open anaerobic lagoons. The project activity involves an intertwined network of anaerobic treatment systems, which consists of UASB system and covered lagoons. The newly constructed covered lagoon 1 (CL1) pre-treats the wastewater before feeding to UASB. Later, in June 2006, a covered sheet at the existing first open anaerobic lagoon was installed to collect the biogas generated. This covered lagoon (CL2) was designed to receive wastewater from sweetener factory together with the effluent from the UASB reactor. In October 2009, a new ethanol plant started operation in line with these existing facilities. Thus the biogas generated by the overall system (UASB + CL1 + CL2 + CL3) will be used in 7 boilers. The components of electricity production and fuel replacement will not be claimed for emission reduction.

As per the registered VCD PD /1/, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation). Waste water from Ethanol plant is taken in to

covered lagoon 3 (CL3) and to open ponds for disposal/ reuse. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators.

As per the monitoring report /2/, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation and reuse). Waste water from Ethanol plant is taken in to covered lagoon 3 and then the same is diverted to covered lagoon 1 and is treated in tandem with waste water from starch factory. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators. This was confirmed during site visit.

The expected emission reduction from the project activity as estimated in the VCS PD is 36,973 tCO₂e per year. The project activity contributes to sustainable development of the local community with environmental and economic benefits. The project activity is at Nongyai District, Chonburi Province, Thailand. The physical location has been confirmed during the site visit. The project activity is in operation stage.

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

Project Participant(s)	P.S.C. Starch Products Public Company Limited and Swiss Carbon Value Limited		
Project Title	P.S.C Starch Wastewater Treatment and Biogas Utilization Project		
Location of the project	The project site is located in the compound of the P.S.C. Starch factory located at 999 Nongyai-Bothong Road, Nongyai, Chonburi about 150 km southeast of Bangkok		
Methodology(ies)	AMS-III.H., "Methane recovery in wastewater treatment", version 13 of 17-July-2009 /10/ and AMS-I.D., Grid connected renewable electricity generation, version 14 of 31-July-2009 /11/		
Sectoral Scope(s)	13 ,01	RINA's Technical Area(s)	13.1, 1.1 and 1.2
Registered VCS PD	Version 3.1 of 18-November-2009 /1/		
Date of VCS registration	07-May-2010	VCS Registration Reference N°	417
Starting date of the crediting period	01-December-2009 (as confirmed through the VCS-PD /1/)		
Project's crediting period	01-December-2009 to 30-November-2019 (both days included)		
Project documentation link	https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp?Tab=Projects&a=2&i=417&lat=13%2E301806&lon=101%2E363742&bp=1		

2 VERIFICATION PROCESS

The project was validated by TÜV NORD CERT GmbH (VCS validation report (report number 53219108-08/509), dated 18-November-2009) and it was registered under the VCS registration reference No-417. This is the first verification assessment for the monitoring period 01-December-2009 to 31-August-2013 by RINA S.p.A. There are some deviations in the project description, which is also assessed and explained in detail in section 3.3. of this report.

2.1 Method and Criteria

Verification was conducted using RINA procedures in line with the requirements specified in the VCS Version 3 Requirements, CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques.

The verification consisted of the following three phases:

- Document review;
- On-site assessment;
- The resolution of outstanding issues and the issuance of the final verification report and certification.

2.2 Document Review

The monitoring report (MR), version 05 of 10-October-2014 and its previous versions /02/, the emission reduction calculations spread sheet “493_ER cal_rev 04.xls” submitted on 29-July-2014 and its previous versions /03/, were assessed as part of the verification. In addition the registered Project Design Document (VCS PD)/01/ in particular the baseline estimations and the monitoring plan, and the registered VCS validation report, report number 53219108-08/509, dated 18-November-2009 for the project were reviewed.

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

/1/	P.S.C. Starch Products Public Company Limited and Swiss Carbon Value Ltd.: Registered VCS PD for “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, Version 3.1 of 18-November-2009, available at weblink: https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp?Tab=Projects&a=2&i=417&lat=13%2E301806&lon=101%2E363742&bp=1 , Language: English, last retrieved on 14-November-2013.
/2/	P.S.C. Starch Products Public Company Limited and South Pole Carbon Asset Management Ltd: Monitoring Report for “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, version 01 of 17-September-2013. Monitoring Report for “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, version 02 of 20-December-2013. Monitoring Report for “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, version 03 of 23-June-2014. Monitoring Report for “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, version 04 of 29-July-2014. Monitoring Report for “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, version 05 of 10-October-2014.

/3/	P.S.C. Starch Products Public Company Limited and South Pole Carbon Asset Management Ltd: Emission Reduction Calculation Spread Sheet "493_ER cal_rev 01_170913.xlsx" version 1 of 17-September-2013. Emission Reduction Calculation Spread Sheet "493_ER cal_rev 02.xls" submitted on 20-December-2013. Emission Reduction Calculation Spread Sheet "493_ER cal_rev 03.xls" submitted on 23-June-2014. Emission Reduction Calculation Spread Sheet "493_ER cal_rev 04.xls" submitted on 29-July-2014.
/4/	TÜV NORD CERT GmbH: Validation Report for "P.S.C Starch Wastewater Treatment and Biogas Utilization Project", report number 53219108-08/509, dated 18-November-2009.
/5/	VCS Verified Carbon Standard: VCS Program Guide, VCS Version 03, v3.5 of 08-October-2013.
/6/	VCS Verified Carbon Standard: VCS Standard, VCS Version 03, v3.4 of 08-October-2013.
/7/	VCS Verified Carbon Standard: VCS Verification Report Template Version 3.3 of 08-October-2013.
/8/	VCS Verified Carbon Standard: VCS Guidance, Validation and Verification Manual, Version 3.1 of 08-October-2013.
/9/	VCS Verified Carbon Standard: VCS Monitoring Report Template Version 3.3 of 08-October-2013.
/10/	CDM Executive Board: Baseline and monitoring methodology "AMS-III.H.", "Methane recovery in wastewater treatment", version 13 of 17-July-2009.
/11/	CDM Executive Board: Baseline and monitoring methodology "AMS-I.D", Grid connected renewable electricity generation version 14 of 17-July-2009.
/12/	P.S.C. Starch Products Public Company Limited: Production details for the month of December-2009, the years 2010, 2011 and 2012 as provided by the PP during the site visit on 17-October-2013.
/13/	CDM Executive Board: Clean Development Mechanism Project Standard, Version 05.0 of 04-October-2013. CDM Executive Board: Clean Development Mechanism Project Standard, Version 07.0 of 01-June-2014.
/14/	CDM Executive Board: Tool to determine project emissions from flaring gases containing methane", version 1 of EB 28 Annex 13
/15/	CDM Executive Board: "Tool to calculate the emission factor for an electricity system" version 1.1 of 29-July-2008
/16/	IPCC: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, available at weblink http://www.ipcc-nggip.iges.or.jp/public/2006gl/ in English, last retrieved on 15-November-2013.
/17/	P.S.C. Starch Products Public Company Limited: Log books /sheets for the years 2009, 2010, 2011, 2012 and 2013, for all the parameters monitored. Daily reports for all the monitoring parameters (Rpt_meter.xls) for the monitoring period 01/12/2009 to 31/08/2013, submitted on 20_October-2013.
/18/	P.S.C Starch Products Public Company Limited: Work Instructions for the Operation of wastewater treatment plant, emergency plan for biogas leakage, COD test and waste water sampling, submitted on 22/10/2013.
/19/	ABB: Specification of water flow meters model FEV 11 (FM1 and FM2) available at weblink http://www.dftme.com/media/docs/docs2/ABB_WaterMaster_Datasheet.pdf in

	English, last retrieved on 15-November-2013.
/20/	Yokogawa: Specification of water flow meters model AFX1500 (FM3) available at weblink http://www.yokogawa.com/fld/pdf/AXF/TI01E20A01-20E.pdf in English, last retrieved on 15-November-2013.
/21/	Fluid Components International LLC: Specification of gas flow meters model ST51 (GM1, and GM2) available at weblink http://www.fluidcomponents.com/Industrial/Library/manuals/Flowmeters/ST50,%20ST51,%20ST75%20Guides%20&%20Manuals/ST51%20Guide%20(06EN003389-).pdf in English, last retrieved on 15-November-2013
/22/	Wuhan Cubic Optoelectronics Co., Ltd: Specification of Gas analyzer Gasboard-3200 available at weblink http://www.gassensor.com.cn/index_en.html in English, last retrieved on 15-November-2013.
/23/	Department of Industrial Work Thailand: Operational license issued to the unit on 21-June-2002 and 01-February-2008
/24/	ABB: Calibration records of flow meter FM1 with serial number 3K220000021352 dated 16-January-2009.
/25/	Miracle International Technology Co Ltd.: Calibration records of flow meter FM1 with serial number 3K220000021352 dated 10-March-2012
/26/	ABB: Calibration records of flow meter FM2 with serial number 3K220000021353 dated 16-January-2009.
/27/	Miracle International Technology Co Ltd: Calibration records of flow meter FM2 with serial number 3K220000021353 dated 10-March-2012
/28/	Yokogawa: Calibration records of flow meter FM3 with serial number S5G802553736 dated 12-January-2009
/29/	Miracle International Technology Co Ltd: Calibration records of flow meter FM3 with serial number S5G802553736 dated 29-March-2012
/30/	Yokogawa: Calibration records of flow meter FM3 with serial number S5G802553736 dated 12-March-2013
/31/	Fluid Components International LLC: Calibration records of Gas flow meter GM1 with serial number 301123 dated 17-February-2009
/32/	Miracle International Technology Co Ltd: Calibration records of Gas flow meter GM1 with serial number 301123 dated 13-March-2012
/33/	Fluid Components International LLC: Calibration records of Gas flow meter GM2 with serial number 301122 dated 16-February-2009
/34/	Miracle International Technology Co Ltd: Calibration records of Gas flow meter GM2 with serial number 301122 dated 13-March-2012
/35/	Wuhan Cubic Optoelectronics Co., Ltd: Calibration record for the gas analyser model Gasboard-3200 with serial number 10903240261000000019 dated 15-March-2009
/36/	Techtronic Co., Ltd: Calibration record for the gas analyser model Gasboard-3200 with serial number 10903240261000000019 dated 10-January-2012
/37/	P.S.C Starch Products Public Company Limited: EIA report of P.S.C Starch Products prepared by ENCAD Consultants Limited dated May, 2007.
/38/	P.S.C Starch Products Public Company Limited: Attendance sheets for the training conducted in the plant on biogas & lab, dated 14/09/2010.
/39/	Analysis Report, The Service of Quality Environmental Analysis Programme: Test Reports 2009:

	Effluent from sweetener and ethanol plant, analysis no. AR158/52 dated 06/12/2009 Effluent from starch plant, analysis no. AR110/52 dated 19/08/2009 Test Reports 2010: Effluent from raw waste water, analysis no. AR032/53 dated 01/08/2010 Effluent from last open lagoon, analysis no. AR048/53 dated 22/02/2010 Effluent from lagoon no.8, analysis no. AR060/53 dated 19/03/2010 Effluent from pond 8 & 11, analysis no. AR077/53 dated 27/05/2010 Test Reports 2011: Effluent from CL 1, analysis no. AR073/54 dated 08/06/2011 Effluent from last open lagoon, analysis no. AR068/54 dated 19/05/2011 Test Reports 2012: Effluent from inlet to CL1 and outlet to UASB1, analysis no. AR015/56 dated 02/10/2012 Effluent from inlet to CL2, outlet to CL2 and lagoon no.8 no. AR031/55 dated 25/01/2012 Test Reports 2013; Effluent from lagoon no.8, report no. 038219732 dated 21/06/2013
/40/	Reference Link for emission factor estimation, http://www2.dede.go.th/cdm/520126_GridEmission2007.pdf Language: English, Retrieved on 11/06/2014.
/41/	Reference link for Net Calorific Value(NCV) of fuel oil, http://www.dede.go.th/dede/fileadmin/usr/wpd/static/thai_ene_2005/41Convers.pdf Language: English, Retrieved on 11/06/2014.
/42/	Reference link for the density of methane , http://cdm.unfccc.int/EB/028/eb28_repan13.pdf Language: English, Retrieved on 11/06/2014.
/43/	Reference link for flare efficiency , http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-06-v1.pdf Language: English, Retrieved on 11/06/2014.
/44/	Reference link for destruction efficiency of biogas combustion for gainful use, http://cdm.unfccc.int/filestorage/V/N/W/VNWAGY8MS92ZXDKUHEF5LB07QICT1P/Response%20WG%20provided.pdf?t=bmR8bjcxZ2owfDCUBcesxyevgNUz4IEzQNYE Language: English, Retrieved on 12/06/2014.
/45/	CDM Executive Board: Standard for application of the global warming potentials to Clean Development Mechanism project activities and programmes of activities for the second commitment period of the Kyoto protocol, Annex 3 of EB 69, dated 13/09/2012.
/46/	Reference link for IPCC Fourth Assessment Report: Climate Change 2007, http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html Language: English, Retrieved on 28/07/2014.
/47/	CDM Executive Board: Clean Development Mechanism Validation and Verification Standard, version 07.0 of 01/10/2013
/48/	"The Examination of water and wastewater", 1st Ed 2005 and Wastewater analysis manual from Environmental Engineering Association , Thailand , 3rd Ed. 1997
/49/	CDM Executive Board: Guidelines on assessment of different types of changes from the project activity as described in the registered PDD' EB 48, Annex 67, version 1 of 17-July-

	2009
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2.3 Interviews

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

	Date	Name and Role	Organization	Topic
1	16/10/2013 and 17/10/2013	Mr. Santhosh Kumar Singh Head of Implementation (CDM Consultant)	Southpole Carbon Asset Management	Project description, evidences for proof of title, Monitoring plan, ownership of GHG emission reductions, Project Start Date, Commercially Sensitive Information, Other Programs (if any)
2	16/10/2013 and 17/10/2013	Ms.Nattaya Lonawan M & V Project Manager	Southpole Carbon Asset Management	Implementation status of the project activity. Monitoring plan & QA/QC procedures
3	16/10/2013 and 17/10/2013	Mr. Sarun Sereethoranakul Assistant Managing Director	P.S.C. Starch Products Public Company Limited	Implementation status of the project activity. Monitoring plan & QA/QC procedures
4	16/10/2013 and 17/10/2013	Ms.Chanakar Sookserm Environment Management	P.S.C. Starch Products Public Company Limited	Implementation status of the project activity. Monitoring plan & QA/QC procedures
5	16/10/2013 and 17/10/2013	Ms. Sukanda Kuakitkul Quality Control / Quality Assurance	P.S.C. Starch Products Public Company Limited	Implementation status of the project activity. Monitoring plan & QA/QC procedures

2.4 Site Inspections

On 16-October-2013 and 17-October-2013, RINA visited the P.S.C. Starch factory located at 999 Nongyai-Bothong Road, Nongyai, Chonburi about 150 km southeast of Bangkok, Thailand. During the on-site assessment of the project, there were no hindrance and all the equipments and the systems were accessible. RINA assessed the implementation and operation of the proposed project activity, reviewed the information flows for generating, aggregating and reporting the monitoring parameters, interviewed key personnel of the plant to confirm the operational and data collection procedures, cross-checked between information provided in the monitoring report and data plant, checked the monitoring equipment including calibration performance, reviewed calculations and assumptions made in determining the GHG data and emission reductions,

checked the quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

2.5 Resolution of Findings

The objective of this phase of the verification is to resolve any outstanding issues, which need to be clarified for RINA's positive conclusion on the monitoring report and emission reductions.

To guarantee transparency a verification protocol has been customized for the project. The protocol shows in a transparent manner the requirements, means of verification and the results from verifying the identified criteria. The verification protocol consists of three tables; the different columns in these tables are described in the figure below (see Figure 1). The completed verification protocol is enclosed in Appendix A to this report.

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

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

A clarification request (CR) is raised if information is insufficient or not clear enough to determine whether the applicable VCS requirements, which refer to CDM rules, have been met.

CARs, CRs identified are included in the verification protocol in Appendix A of this report.

Figure 1 Verification protocol tables

Verification Protocol, Table 1 - Requirement checklist					
Checklist Question	Ref.	MoV	Comments	Draft Conclusion	Final Conclusion
Checklist questions organized in seven different sections.	Makes reference to documents where the answer to the checklist question or item is found.	Explain how conformance with the checklist question is investigated. Examples are document review (DR), interview or any other follow-up actions (I), cross checking (CC) with available information relating to projects, (N/A) means not applicable.	The discussion on how the conclusion is arrived at and the conclusion on the compliance with checklist question so far.	For CAR, CR and FAR see the definitions above.	OK is used if the information and evidence provided is adequate to demonstrate compliance with VCS requirements which refer to CDM rules.

Verification Protocol, Table 2: Resolution of Corrective Action Requests and Clarification			
Corrective action requests and/or clarification requests	Reference to Table 1	Response by project participants	Verification Conclusion
The CAR and/or CRs raised in table 1 are repeated here.	Reference to the checklist question number in Table 1 where the CAR or CR is explained.	The responses given by the project participants to address the CARs and/or CRs.	The verification team's assessment and final conclusion of the CARs and/or CRs.

Verification Protocol, Table 3 - Forward Action Requests		
Forward action request	Reference to Table 1	Response by project participants Verification Conclusion
The FAR raised in table 1 is repeated here.	Reference to the checklist question number in Table 1 where the FAR is explained.	Response by the project participants on how forward action request will be addressed.

2.5.1 Forward Action Requests

There is no forward request raised during this verification assessment for the proposed project activity.

2.6 Eligibility for Validation Activities

The project activity is registered under VCS registration reference Number 417 /1/, hence this section is not applicable.

3 VALIDATION FINDINGS

The project was validated by TÜV NORD CERT GmbH (VCS validation report (report number 53219108-08/509), dated 18-November-2009) and it was registered under the VCS registration reference No-417. This is the first verification assessment for the monitoring period 01-December-2009 to 31-August-2013 by RINA S.p.A. There are some deviations in the project description, which is also assessed and explained in detail in section 3.3. of this report.

3.1 Participation under Other GHG Programs

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

3.2 Methodology Deviations

Not applicable.

3.3 Project Description Deviations

The project activity involves an intertwined network of anaerobic treatment systems, which consists of UASB system and covered lagoons. The newly constructed covered lagoon 1 (CL1) pre-treats the wastewater before feeding to UASB. Later, in June 2006, a covered sheet at the existing first open anaerobic lagoon was installed to collect the biogas generated. This covered lagoon (CL2) was designed to receive wastewater from sweetener factory together with the effluent from the UASB reactor. In October 2009, a new ethanol plant started operation in line with these existing facilities. Thus the biogas generated by the overall system (UASB + CL1 + CL2 + CL3) will be used in 7 boilers. The components of electricity production and fuel replacement are not claimed for emission reduction.

As per the registered VCS PD, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation). Waste water from Ethanol plant is taken in to covered lagoon 3 and then in to open ponds for disposal/ reuse. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators

As per the monitoring report and site visit observation it is noted that, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting

from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation and reuse). Waste water from Ethanol plant is taken in to covered lagoon 3 and then the same is diverted to covered lagoon 1 and is treated in tandem with waste water from starch factory. Due to this change, there is a change in the COD_{ww,discharge.PJ.y}. Though additional amount of biogas could be generated from treating effluent at CL1+UASB+CL2, this gets nullified as ER ex-post is calculated as per equation 13 of the methodology based on COD measurements and methane destruction and taking the most conservative estimate, the same is made transparent in the MR also, hence accepted. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators.

3.4 Grouped Project

This project is not a grouped project. Hence, this section is not applicable.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The findings of the verification related to the monitoring period from 01-December-2009 to 31-August-2013 as documented and described in the VCS monitoring report version 05 of 10-October-2014 /02/ are stated in the following sections. The verification requirements, the means of verification and the results from verifying the identified criteria are documented in more detail in the verification protocol in Appendix A.

RINA performed a physical site visit on 16-October-2013 and 17-October-2013 to verify the actual implementation of the project against the description provided in the registered VCS PD/01/ and noted that the project was already implemented and started its operations from 01-December-2009 as per the Validation Report /04/.

During the site visit, it was noted that there are some deviations in the project design against the description mentioned in the registered VCS-PD, version 3.1 of 18-November-2009.

The COD_{ww,discharge.PJ.y} is the COD of water discharged from CL3 as per the registered VCS PD /01/ this is now changed to be the discharge from CL2. As per the monitoring report and site visit observation it is noted that, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation and reuse). Waste water from Ethanol plant is taken in to covered lagoon 3 and then the same is diverted to covered lagoon 1 and is treated in tandem with waste water from starch factory. Due to this change, there is a change in the COD_{ww,discharge.PJ.y}. Though additional amount of biogas could be generated from treating effluent at CL1+UASB+CL2, this gets nullified as ER ex-post is calculated as per equation 13 of the methodology based on COD measurements and methane destruction and taking the most conservative estimate, the same is made transparent in the MR also. Hence, this change /deviation has no effect to the achieved emission reductions in this monitoring period

The project activity is in operation stage as evidenced by the physical verification of the site. The project started its operations from 01-December-2009 as per the registered Validation Report.

Based on the review of registered VCS validation report /04/, no FAR was raised during the validation and/or there was no FAR to be addressed during this verification period.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

Baseline emissions:

$$BE_y = BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}$$

(Equation 1)

Where :

BE_y	Baseline emission in year y (tCO ₂ e)
$BE_{power,y}$	Baseline emission from electricity or fuel consumption in year y (tCO ₂ e)
$BE_{ww,treatment,y}$	Baseline emission of the wastewater systems affected by the project activity in year y (tCO ₂ e)
$BE_{s,treatment,y}$	Baseline emissions of the sludge treatment systems affected by the project activity in year y (tCO ₂ e)
$BE_{ww,discharge,y}$	Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (tCO ₂ e). The value of this term is zero for the case 1 (ii)
$BE_{s,final,y}$	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 scenarios, this term shall be neglected.

It is noted that the formula and calculation used for baseline calculation in the monitoring report and ER sheet is in compliance with the registered VCS PD. The default values and data used in the monitoring report /02/ is in-line with the registered PD/01/. Hence, accepted.

Project Emissions:

Project activity emissions from the systems affected by the project activity are:

$$PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{y,ww,discharge} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y}$$

(Equation 4)

Where :

PE_y	Project activity emission in year y (tCO ₂ e)
$PE_{power,y}$	Emission from electricity or fuel consumption in year y (tCO ₂ e)
$PE_{ww,treatment,y}$	Methane emission from the wastewater systems affected by the project activity and not equipped with biogas recovery, in year y (tCO ₂ e)
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity and not equipped with biogas recovery, in year y (tCO ₂ e)
$PE_{y,ww,discharge}$	Methane emissions from degradable organic carbon in treated wastewater in year y (tCO ₂ e).
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year y (tCO ₂ e).
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year y (tCO ₂ e).

$PE_{\text{flaring},y}$	Methane emissions due to incomplete flaring in year y (tCO ₂ e).
$PE_{\text{biomass},y}$	Methane emissions from biomass stored under anaerobic conditions in year y (tCO ₂ e).

The same above formula is followed in the registered VCS PD/01/ and it is compliance with the method set out for project emission calculation in the registered PD. Hence accepted.

Leakage:

As per the methodology AMS-III.H and as defined in the registered VCS PD no leakage is considered in the project activity and the same is followed in this monitoring period also. Thus, it is in compliance with the registered VCS PD.

Net GHG Emission Reductions and Removals

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

(Equation 13)

Where :

$ER_{y,expost}$	Emission reductions achieved by the project activity based on monitored values for year y (tCO ₂ e)
$BE_{y,expost}$	Baseline emission calculated as per paragraph ex-post monitored values
$PE_{y,expost}$	Project emission calculated as per paragraph ex-post monitored values
MD_y	Methane captured and destroyed/gainfully used by the project activity in year y

The emission reduction calculated during this monitoring period amounts to 174,933 tCO₂e as reported in the Monitoring Report (MR)/02/.

It is noted that emission reductions have been increased during this monitoring period as against the registered VCS PD. As noted during site visit and as available in the Monitoring report, while the production values remain the same corresponding waste water generation is almost double of the design value, hence resulting in an increased emission reduction of about 26% against the registered VCS PD /01/. Monitoring report /02/ mentions that the primary reason is that the performance of the sweetener plant is not as per the design specification. The ex-ante emission reductions were estimated to be 36,973 tCO₂e / year. During the current monitoring period, the actual emission reductions have increased but the increase in year 2010 is most significant. As per the CDM 'Guidelines on assessment of different types of changes from the project activity as described in the registered PDD' EB 48, Annex 67 /49/. The changes in the project activity does not affect additionality as there is no change in the installation capacity or the number of treatment units and there is no change in the treatment system. The difference is due to use of more water in the sweetener plant than estimated in the EIA /37/. There is no addition of component or extension of technology. It is not a multiple site project. The project has used barrier analysis for demonstrating additionality. There is no change in scale of the project activity and the methodology is still applicable. Also, the as matter of abundant caution, the PP has proposed to cap the 2010 emission reductions to the value in the registered VCS PD, hence accepted.

Additionally, there is increased in emission reduction in 2013 due to the application of new GWP value for the monitoring period from January 2013 onwards as per Annex 3 of EB 69 /38/.

The emission reductions achieved:

The emission reductions calculation reported in the Monitoring Report /02/ and ER calculation spreadsheet /03/ have been verified to be correct and in line with the registered VCS PD /01/. The emission reductions by the project activity for the monitoring period from 01-December-2009 to 31-August-2013 are equivalent to 174,933 tCO₂e, as reported in the VCS monitoring report /01/. The data presented in the VCS MR /02/ and in the ER worksheet/03/ was assessed by reviewing in detail project documentation, collection of monitored data, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. Sufficient evidence was presented and verified by RINA for the reported emission reductions as listed in the above.

RINA also compared the actual emission reductions with the estimates in the registered VCS PD /01/ as follows:

The reported emission reductions are equivalent to 174,933 tCO₂e during the monitoring period from 01-December-2009 to 31-August-2013. According to the registered VCS PD/01/, the estimated emission reductions are equivalent to 369,730 tCO₂e over 10 years of crediting period, on average 36,973 tCO₂e per year. The emission reduction calculated during this monitoring period is 174,933 tCO₂e /y which is higher than ex-ante value mentioned in the registered PD /01/.

The following parameters were available at validation as per the registered VCS PD/01/ and the validation report /04/:

DATA/PARAMETER	Source of data	Reported value for the this monitoring period	Assessment/Observation
Global warming potential of methane gas (GWP _{CH4})	As per the applied methodology AMS-III.H./10/	21(from 2007 to 2012) 25 (2013)	The verification team has verified the value with the methodology and registered PD/01/ and found to be inline. As per annex 3 of EB 69 /45/, All monitoring, verifications and requests for issuance of certified emission reductions (CERs) in respect of emission reductions and removals achieved by CDM project activities and PoAs in the second commitment period (from 1 January 2013) shall be calculated using the GWPs as applied by decision 4/CMP.7. Hence,from January-2013 onwards,the value 25 is taken for emission reduction

			calculation as per the IPCC fourth assessment report /45/.
Methane generation capacity of COD in wastewater($B_{o,ww}$)	As per the applied methodology AMS-III.H./10/	0.21 kg CH ₄ / kg COD	The verification team has verified the value with the methodology and registered PD/01/ and found to be inline.
Model correction factor to account for model uncertainties(UF_{BL})	As per the applied methodology AMS-III.H./10/	0.94	The verification team has verified the value with the methodology and registered PD/01/ and found to be inline.
Model correction factor to account for model uncertainties(UF_{PJ})	As per the applied methodology AMS-III.H./10/	1.06	The default value has been verified with the methodology and registered VCS PD/01/ and found to be inline.
Methane correction factor for the baseline anaerobic wastewater treatment system (MCF _{ww,treatment,BL,lagoon})	As per the applied methodology AMS-III.H./10/	0.8	The default value has been verified with the methodology and registered VCS PD /01/ and found to be inline.
Methane correction factor for the project wastewater treatment system k equipped with the biogas recovery (MCF _{ww,treatment,PJ,k})	As per the applied methodology AMS-III.H./10/	0.8	The default value has been verified with the methodology and registered VCS PD /01/ and found to be inline.
CO ₂ emission factor of the grid(EF_y)	Emission factor for an electricity system in Thailand 2007 , published by Department of Alternative Energy Development and Efficiency , Ministry of Energy , 26 January 2009 /40/	0.5057 tCO ₂ /MWh	The verification team has confirmed that the national default value mentioned in the registered VCS PD/01/ , is used in this monitoring report. Hence,accepted.
Methane correction factor for the project wastewater treatment system not equipped with biogas recovery(MCF _{ww,treatment,PJ,lagoon})	As per the applied methodology AMS-III.H./10/	0.8	The verifiction has verified the value with methodology/10/ and registered VCS PD/01/ and found to be inline
Methane correction factor based on discharge pathway in the project situation (MCF _{AMS-III.H./10/})	As per the applied methodology AMS-III.H./10/	0.8	The verifiction has verified the value with methodology/10/ and registered VCS PD/01/ and

ww,PJ,discharge) Capture and utilization/combustion/flare efficiency of the methane recovery and combustion/utilization equipment in the wastewater treatment. (CFE _{ww})	As per the applied methodology AMS-III.H./10/	0.9	found to be inline The verification has verified the value with methodology/10/ and registered VCS PD/01/ and found to be inline
COD removal efficiency of baseline wastewater treatment system for the starch and sweetener plants ($\eta_{BL,starch}$)	Historical data /01/	98.61%	This value is based on measured COD value for the baseline system before the implementation of the project activity, inline with the registered VCS PD /01/. Hence, accepted.
COD removal efficiency of baseline wastewater treatment system for the ethanol plants ($\eta_{BL,ethanol}$)	Historical data /01/	87.76%	This value is based on measured COD value for the baseline system before the implementation of the project activity, inline with the registered VCS PD /01/. Hence, accepted.
Total electrical capacity of the equipment installed in the project activity(P _{el})	Historical data /03//17/	245.1 kW	Maximum rated consumption is calculated by multiplying total electrical capacity with 8,760 hours and 10% additional factor to be conservative. This value is defined in the registered VCS PD /01/, however the installed capacity is updated. Since the value available during the validation is the installed capacity of UASB only. The new actual value /03/ is more conservative since it results in higher project emission. The verification team has verified the registered PD /01/ and equipment list sheet /03/ and name plate details. Conservative hence accepted.
Flare efficiency(FE)	Tool to determine project emissions from flaring gases containing methane /14/	50%	The verification team has verified the value with the tool and registered PD/01/ and found to be inline.

Data and parameters monitored ex-post:

DATA/PARAMETER	$Q_{y,ww,starch}$												
Data Unit	m^3												
Description	Volume of wastewater treated in the year y from the starch plant												
Source of data to be used	Measured - Volumetric flow meter: FM1, Measured using volumetric flow meter FM1. Readings cross checked with log sheets at site /17/.												
Value data for the monitoring period	The value applied for this monitoring period as verified with the ER sheet/03/: <table><tr><td>Year</td><td>Value (m^3)</td></tr><tr><td>2009</td><td>70,035</td></tr><tr><td>2010</td><td>425,171</td></tr><tr><td>2011</td><td>658,470</td></tr><tr><td>2012</td><td>859,378</td></tr><tr><td>2013</td><td>287,895</td></tr></table>	Year	Value (m^3)	2009	70,035	2010	425,171	2011	658,470	2012	859,378	2013	287,895
Year	Value (m^3)												
2009	70,035												
2010	425,171												
2011	658,470												
2012	859,378												
2013	287,895												
Measuring frequency	Continuous												
Reporting frequency and recording procedure	Daily basis. As per the monitoring report /02/, the operators shall archive the monitored data manually into the log sheets /17/ and then, upload and transfer the same to the electronic storage.												
Type of monitoring equipment	Flow meter (FM1) for monitoring the waste water flow /19/. <table><tr><td>Meter</td><td>Serial No.</td><td>Model</td><td>Manufacturer</td></tr><tr><td>Flow meter</td><td>3K220000021352</td><td>FEV11</td><td>ABB</td></tr></table>	Meter	Serial No.	Model	Manufacturer	Flow meter	3K220000021352	FEV11	ABB				
Meter	Serial No.	Model	Manufacturer										
Flow meter	3K220000021352	FEV11	ABB										
Is accuracy of the monitoring equipment as stated in the PDD?	Volumetric Flow meters (FM1) to monitor the flow of waste water is of 0.4% accuracy class, against 1% mentioned in the registered VCS PD. Hence accepted. Based on the calibration reports, it is noted that determination of the maximum error of the meter is found at 0.31% of full scale and the same results are identified in the calibration reports /25/ also. Hence, it can be concluded that the error is less than the permissible limit guaranteed and verified by the manufacturer.												
Calibration frequency/interval	Once in three years												
Is the calibration interval in line with the monitoring plan of the PDD?	The verification team has cross verified the calibration interval with the registered PD/01/ and found that there is a delay of calibration in 2012. Therefore monitored values during 12-Jan-12 to 28-Mar-12 are deducted by 0.4% for conservativeness as per the												

	latest version of CDM validation and verification standard /47/. Hence accepted
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD/01/. The verification sheet has checked the log sheets /17/ to check the correctness of the value mentioned in the monitoring report/02/ and found to be matching.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.

DATA/PARAMETER	$Q_{v,ww,sweetener}$															
Data Unit	m^3															
Description	Volume of wastewater treated in the year y from the sweetener plant															
Source of data to be used	Measured using volumetric flow meter FM2. Readings cross checked with log sheets at site /17/.															
Value data for the monitoring period	The value applied for this monitoring period as verified with the ER sheet/03/:															
	<table><tr><td>Year</td><td>Value (m^3)</td></tr><tr><td>2009</td><td>96,746</td></tr><tr><td>2010</td><td>1,039,834</td></tr><tr><td>2011</td><td>851,433</td></tr><tr><td>2012</td><td>1,377,196</td></tr><tr><td>2013</td><td>957,514</td></tr></table>				Year	Value (m^3)	2009	96,746	2010	1,039,834	2011	851,433	2012	1,377,196	2013	957,514
Year	Value (m^3)															
2009	96,746															
2010	1,039,834															
2011	851,433															
2012	1,377,196															
2013	957,514															
Measuring frequency	Continuous															
Reporting frequency and recording procedure	Daily basis. As per the monitoring report/02/, the operators shall archive the monitored data manually into the log sheets /17/ and then, upload and transfer the same to the electronic storage.															
Type of monitoring equipment	Flow meter (FM2) /19/															
	<table><tr><td>Meter</td><td>Serial No.</td><td>Model</td><td>Manufacturer</td></tr><tr><td>Flow meter</td><td>3K220000021353</td><td>FEV11</td><td>ABB</td></tr></table>				Meter	Serial No.	Model	Manufacturer	Flow meter	3K220000021353	FEV11	ABB				
Meter	Serial No.	Model	Manufacturer													
Flow meter	3K220000021353	FEV11	ABB													

Is accuracy of the monitoring equipment as stated in the PDD?	Volumetric Flow meters (FM2) to monitor the flow of waste water is of 0.4% accuracy class, against 1% mentioned in the registered VCS PD. Hence accepted. Based on the calibration reports, it is noted that determination of the maximum error of the meter is found at 0.3% of full scale and the same results are identified in the calibration reports /27/ also. Hence , it can be concluded that the error is less than the permissible limit guaranteed and verified by the manufacturer.
Calibration frequency/interval	Once in three years
Is the calibration interval in line with the monitoring plan of the PDD?	The verification team has cross verified the calibration interval with the registered PD/01/ and found that a there is a delay of calibration in 2012. Therefore monitored values during 12-Jan-12 to 28-Mar-12 are deducted by 0.4% for conservativeness as per the latest version of CDM validation and verification standard /47/. Hence accepted
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD/01/. The verification sheet has checked the log sheets/17/ to check the correctness of the value mentioned in the monitoring report/02/ and found to be matching.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.

DATA/PARAMETER	$Q_{y,ww,Ethanol}$
Data Unit	m^3
Description	Volume of wastewater treated in the year y from the ethanol plant
Source of data to be used	Measured using volumetric flow meter FM3. Readings cross checked with log sheets at site /17/
Value data for the monitoring period	The value applied for this monitoring period as verified with the ER sheet/03/:

	<table><tr><td>Year</td><td>Value (m³)</td></tr><tr><td>2009</td><td>37,137</td></tr><tr><td>2010</td><td>369,088</td></tr><tr><td>2011</td><td>419,120</td></tr><tr><td>2012</td><td>287,847</td></tr><tr><td>2013</td><td>343,649</td></tr></table>	Year	Value (m ³)	2009	37,137	2010	369,088	2011	419,120	2012	287,847	2013	343,649
Year	Value (m ³)												
2009	37,137												
2010	369,088												
2011	419,120												
2012	287,847												
2013	343,649												
Measuring frequency	Continuous												
Reporting frequency and recording procedure	Daily basis. As per the monitoring report/02/, the operators shall archive the monitored data manually into the log sheets /17/ and then, upload and transfer the same to the electronic storage.												
Type of monitoring equipment	Volumetric flow meter: FM3. /20/ <table><tr><td>Meter</td><td>Serial No.</td><td>Model</td><td>Manufacturer</td></tr><tr><td>Flow meter</td><td>S5G02553736</td><td>AXF1500</td><td>Yokogawa</td></tr></table>	Meter	Serial No.	Model	Manufacturer	Flow meter	S5G02553736	AXF1500	Yokogawa				
Meter	Serial No.	Model	Manufacturer										
Flow meter	S5G02553736	AXF1500	Yokogawa										
Is accuracy of the monitoring equipment as stated in the PDD?	Volumetric Flow meters (FM3) to monitor the flow of waste water is of 0.35% accuracy class, against 1% mentioned in the registered VCS PD. Hence accepted. Based on the calibration reports, it is noted that determination of the maximum error of the meter is found at 0.3% of full scale and the same results are identified in the calibration reports /29/ also. Hence , it can be concluded that the error is less than the permissible limit guaranteed and verified by the manufacturer.												
Calibration frequency/interval	Once in three years												
Is the calibration interval in line with the monitoring plan of the PDD?	The verification team has cross verified the calibration interval with the registered PD/01/ and found that a there is a delay of calibration in 2012. Therefore monitored values during 12-Jan-12 to 28-Mar-12 are deducted by 0.4% (0.4% used instead of 0.35% for simplification in calculations, conservative, hence accepted). This is consistent with the latest version of CDM validation and verification standard /47/. Hence accepted.												
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD/01/. The verification sheet has checked the log sheets /17/ to check the correctness of the value mentioned in the monitoring report/02/ and found to be matching.												
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.												

If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.
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DATA/PARAMETER	COD _{y,ww,untreated, starch}												
Data Unit	mg/l												
Description	COD of wastewater discharged from starch plant												
Source of data to be used	Measured using Titrimetric analysis. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /48/. The same is in-line with the applied methodology /10/. Hence, accepted.												
Value data for the monitoring period	The value applied for this monitoring period as verified with the ER sheet/03/ : <table> <tr> <th>Year</th><th>Value (mg/l)</th></tr> <tr> <td>2009</td><td>21,949</td></tr> <tr> <td>2010</td><td>18,555</td></tr> <tr> <td>2011</td><td>12,940</td></tr> <tr> <td>2012</td><td>12,658</td></tr> <tr> <td>2013</td><td>14,101</td></tr> </table>	Year	Value (mg/l)	2009	21,949	2010	18,555	2011	12,940	2012	12,658	2013	14,101
Year	Value (mg/l)												
2009	21,949												
2010	18,555												
2011	12,940												
2012	12,658												
2013	14,101												
Measuring frequency	Daily basis												
Reporting frequency and recording procedure	Daily basis. As per the monitoring report/02/, The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of wastewater from starch plant before entering CL1, as verified during the site visit and found to be consistent with the registered PD /01/.												
Type of monitoring equipment	Using titrimetric analysis at on site laboratory.												
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable												
Calibration frequency/interval	The Registered VCS PD requires calibration generally once in 3 years, This is not applicable for this parameter as the PP has used titrimetric analysis which does not involve any such instrument. The												

	closed reflux titrimetric method is well documented and well accepted by international standards /48/.
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets /17/ as mentioned in the registered PD/01/. The verification sheet has checked the log sheets /17/ to check the correctness of the value mentioned in the monitoring report /02/ and found to be matching.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.

DATA/PARAMETER	COD _{y,ww,untreated, sweetener}												
Data Unit	mg/l												
Description	COD of wastewater discharged from sweetener plant												
Source of data to be used	Measured using Titrimetric analysis. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /48/. The same is in-line with the applied methodology /10/. Hence, accepted.												
Value data for the monitoring period	The value applied for this monitoring as verified with the ER sheet/03/ <table border="1"> <thead> <tr> <th>Year</th><th>Value (mg/l)</th></tr> </thead> <tbody> <tr> <td>2009</td><td>13,483</td></tr> <tr> <td>2010</td><td>13,001</td></tr> <tr> <td>2011</td><td>9,948</td></tr> <tr> <td>2012</td><td>7,541</td></tr> <tr> <td>2013</td><td>8,357</td></tr> </tbody> </table>	Year	Value (mg/l)	2009	13,483	2010	13,001	2011	9,948	2012	7,541	2013	8,357
Year	Value (mg/l)												
2009	13,483												
2010	13,001												
2011	9,948												
2012	7,541												
2013	8,357												
Measuring frequency	Daily basis												
Reporting frequency and recording procedure	Daily basis. As per the monitoring report/02/, The COD content is analyzed using a titration method in												

	the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of wastewater from sweetener plant before entering CL2 as verified during the site visit.
Type of monitoring equipment	Using the titrimetric analysis at on site laboratory.
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable
Calibration frequency/interval	Not applicable
Is the calibration interval in line with the monitoring plan of the PDD?	The Registered VCS PD requires calibration generally once in 3 years, This is not applicable for this parameter as the PP has used titrimetric analysis which does not involve any such instrument. The closed reflux titrimetric method is well documented and well accepted by international standards /48/.
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD /01/. The verification sheet has checked the log sheets /17/ to check the correctness of the value mentioned in the monitoring report /02/ and found to be matching.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.

DATA/PARAMETER	COD _{y,ww,untreated, Ethanol}
Data Unit	mg/l
Description	COD of wastewater discharged from ethanol plant
Source of data to be used	Measured using Titrimetric analysis. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /48/. The same is in-line with the applied methodology /10/. Hence, accepted.
Value data for the monitoring period	The value applied for this monitoring period as verified with the ER sheet/03/

	<table> <tr> <th>Year</th><th>Value (mg/l)</th></tr> <tr> <td>2009</td><td>34,267</td></tr> <tr> <td>2010</td><td>35,171</td></tr> <tr> <td>2011</td><td>15,662</td></tr> <tr> <td>2012</td><td>15,643</td></tr> <tr> <td>2013</td><td>24,069</td></tr> </table>	Year	Value (mg/l)	2009	34,267	2010	35,171	2011	15,662	2012	15,643	2013	24,069
Year	Value (mg/l)												
2009	34,267												
2010	35,171												
2011	15,662												
2012	15,643												
2013	24,069												
Measuring frequency	Daily basis												
Reporting frequency and recording procedure	Daily basis. As per the monitoring report/02/, The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of wastewater from ethanol plant before entering CL3 as verified during the site visit.												
Type of monitoring equipment	Using the titrimetric analysis at on site laboratory.												
Is accuracy of the monitoring equipment as stated in the PDD?	The Registered VCS PD requires calibration generally once in 3 years, This is not applicable for this parameter as the PP has used titrimetric analysis which does not involve any such instrument. The closed reflux titrimetric method is well documented and well accepted by international standards /48/.												
Calibration frequency/interval	Not applicable												
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable												
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD/01/. The verification sheet has checked the log sheets/17/ to check the correctness of the value mentioned in the monitoring report/02/ and found to be matching.												
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.												
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.												

DATA/PARAMETER	COD _{y,ww,treated,CL2}
Data Unit	mg/l
Description	COD of wastewater exiting the covered lagoon 2 treatment process

Source of data to be used	Measured using Titrimetric analysis. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /48/. The same is in-line with the applied methodology /10/. Hence, accepted.												
Value data for the monitoring period	The value applied for this monitoring period as verified with the ER sheet/03/: <table border="1"> <thead> <tr> <th>Year</th><th>Value (mg/l)</th></tr> </thead> <tbody> <tr> <td>2009</td><td>6,688</td></tr> <tr> <td>2010</td><td>4,793</td></tr> <tr> <td>2011</td><td>3,121</td></tr> <tr> <td>2012</td><td>2,629</td></tr> <tr> <td>2013</td><td>3,745</td></tr> </tbody> </table>	Year	Value (mg/l)	2009	6,688	2010	4,793	2011	3,121	2012	2,629	2013	3,745
Year	Value (mg/l)												
2009	6,688												
2010	4,793												
2011	3,121												
2012	2,629												
2013	3,745												
Measuring frequency	Daily basis												
Reporting frequency and recording procedure	Daily basis. As per the monitoring report/02/, The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of CL2 before entering the open lagoons as verified during the site visit.												
Type of monitoring equipment	Using the titrimetric analysis at on site laboratory.												
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable												
Calibration frequency/interval	The Registered VCS PD requires calibration generally once in 3 years, This is not applicable for this parameter as the PP has used titrimetric analysis which does not involve any such instrument. The closed reflux titrimetric method is well documented and well accepted by international standards /48/.												
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable												
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD /01/. The verification sheet has checked the log sheets /17/ to check the correctness of the value mentioned in the monitoring report /02/ and found to be matching.												
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.												
If only partial data are available because activity levels or non-activity	There is no deviation in the monitoring paramter for this monitoring period.												

parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	
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DATA/PARAMETER	COD _{y, ww, treated, CL3}												
Data Unit	mg/l												
Description	COD of wastewater exiting the covered lagoon 3 treatment process												
Source of data to be used	Measured using Titrimetric analysis. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /48/. The same is in-line with the applied methodology /10/. Hence, accepted.												
Value data for the monitoring period	The value applied for this monitoring period as verified with the ER sheet /03/: <table border="1"> <thead> <tr> <th>Year</th><th>Value (mg/l)</th></tr> </thead> <tbody> <tr> <td>2009</td><td>9,611</td></tr> <tr> <td>2010</td><td>9,245</td></tr> <tr> <td>2011</td><td>4,584</td></tr> <tr> <td>2012</td><td>3,161</td></tr> <tr> <td>2013</td><td>16,422</td></tr> </tbody> </table>	Year	Value (mg/l)	2009	9,611	2010	9,245	2011	4,584	2012	3,161	2013	16,422
Year	Value (mg/l)												
2009	9,611												
2010	9,245												
2011	4,584												
2012	3,161												
2013	16,422												
Measuring frequency	Daily basis												
Reporting frequency and recording procedure	Daily basis. As per the monitoring report /02/, The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of CL3 as verified during the site visit.												
Type of monitoring equipment	Using the titrimetric analysis at on site laboratory.												
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable												
Calibration frequency/interval	The Registered VCS PD requires calibration generally once in 3 years, This is not applicable for this parameter as the PP has used titrimetric analysis which does not involve any such instrument. The closed reflux titrimetric method is well documented and well accepted by international standards /48/.												
Is the calibration interval in line with	Not applicable												

the monitoring plan of the PDD?	
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD/01/. The verification sheet has checked the log sheets/17/ to check the correctness of the value mentioned in the monitoring report/02/ and found to be matching.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.

DATA/PARAMETER	W _{CH4}														
Data Unit	%														
Description	Methane content in biogas														
Source of data to be used	Measured using online methane analyzer. Readings cross checked with log books /17/ at site, consistent.														
Value data for the monitoring period	The values applied for this monitoring period as verified with the ER sheet/03/ <table><tr><td>Year</td><td>Value %</td></tr><tr><td>2009</td><td>42.06</td></tr><tr><td>2010</td><td>50.17</td></tr><tr><td>2011</td><td>50.64</td></tr><tr><td>2012</td><td>50.13</td></tr><tr><td>2013</td><td>54.48</td></tr></table>			Year	Value %	2009	42.06	2010	50.17	2011	50.64	2012	50.13	2013	54.48
Year	Value %														
2009	42.06														
2010	50.17														
2011	50.64														
2012	50.13														
2013	54.48														
Measuring frequency	Continuous														
Reporting frequency and recording procedure	Daily basis. As per the monitoring report /02/, the operators shall archive the monitored data manually into the log sheets /17/ and then, upload and transfer the same to the electronic storage.														
Type of monitoring equipment	Online gas analyzer /22/ <table><tr><td>Meter</td><td>Serial No.</td><td>Manufacturer</td></tr><tr><td>Gas analyzer</td><td>10903240261000000019</td><td>Wuhan</td></tr></table>			Meter	Serial No.	Manufacturer	Gas analyzer	10903240261000000019	Wuhan						
Meter	Serial No.	Manufacturer													
Gas analyzer	10903240261000000019	Wuhan													
Is accuracy of the monitoring equipment as stated in the PDD?	The accuracy of the online gas analyser as mentioned in the monitoring report /02/ is 2% and the same is verified with the technical specification /22/ provided														

	by the manufacturer and found to be consistent with the registered PD /01/.
Calibration frequency/interval	Once in three years
Is the calibration interval in line with the monitoring plan of the PDD?	The verification team has cross verified the calibration interval /35/,/36/ with the registered PD/01/ and found to be in-line.
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD/01/. The verification sheet has checked the log sheets/17/ to check the correctness of the value mentioned in the monitoring report/02/ and found to be matching.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring parameter for this monitoring period.

DATA/PARAMETER	BG _{combusted,y}												
Data Unit	Nm ³												
Description	Amount of biogas combusted for gainful use in the year y												
Source of data to be used	Measured using biogas flow meter GM1 and GM2, the value is available in Nm ³ . Readings cross checked with log books /17/ for flow meters GM 1 and GM 2 at site												
Value data for the monitoring period	The value applied for the monitoring period as verified with the ER sheet/03/ <table border="1"> <thead> <tr> <th>Year</th><th>Value Nm³</th></tr> </thead> <tbody> <tr> <td>2009</td><td>1,048,975</td></tr> <tr> <td>2010</td><td>10,904,210</td></tr> <tr> <td>2011</td><td>8,499,159</td></tr> <tr> <td>2012</td><td>6,077,491</td></tr> <tr> <td>2013</td><td>4,397,158</td></tr> </tbody> </table>	Year	Value Nm ³	2009	1,048,975	2010	10,904,210	2011	8,499,159	2012	6,077,491	2013	4,397,158
Year	Value Nm ³												
2009	1,048,975												
2010	10,904,210												
2011	8,499,159												
2012	6,077,491												
2013	4,397,158												
Measuring frequency	Continuous												
Reporting frequency and recording procedure	Daily. As per the monitoring report/02/, the operators shall archive the monitored data manually into the log												

	sheets and then, upload and transfer the same to the electronic storage.			
Type of monitoring equipment	Gas flow meters /21/ to monitor the bio gas flow.			
	Meter	Serial No.	Model	Manufacturer
	Gas flow meter GM1	301123	ST51	FCI
	Gas flow meter GM2	301122	ST51	FCI
Is accuracy of the monitoring equipment as stated in the PDD?	The accuracy of the flow meter is mentioned monitoring report /02/ is 2% and the same was verified with the calibration report /32/ /34/ and found to be inline with the registered VCS PD /01/			
Calibration frequency/interval	Once in 18 months /21/			
Is the calibration interval in line with the monitoring plan of the PDD?	The verification team has cross verified the calibration interval with the registered PD/01/ and found that a there is a delay of calibration in the monitoring period. Therefore monitored values are deducted by 2% for conservativeness as per the latest version of CDM validation and verification standard /47/. Hence accepted			
How were the values in the monitoring report verified and cross-checked?	The values will be recorded in the log sheets as mentioned in the registered PD/01/. The verification sheet has checked the log sheets/17/ to check the correctness of the value mentioned in the monitoring report/02/ and found to be matching.			
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.			
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	There is no deviation in the monitoring paramter for this monitoring period.			

DATA/PARAMETER	EC _y
Data Unit	MWh
Description	Electricity consumption by wastewater treatment system and biogas plant in year y
Source of data to be used	Maximum rated consumption is calculated by

	multiplying total electrical capacity with 8,760 hours and 10% additional factor (for transmission losses) to be conservative. This value is defined in the registered VCS PD /01/, however the installed capacity has been updated as per actuals. Since the value available during the validation is the installed capacity of UASB only. The new actual value /03/ is more conservative since it results in higher project emission. This list was verified during site visit against name plate details.												
Value data for the monitoring period	The value applied for the monitoring period as verified with the ER sheet/03/. <table border="1"> <thead> <tr> <th>Year</th><th>Value (MWh)</th></tr> </thead> <tbody> <tr> <td>2009</td><td>201</td></tr> <tr> <td>2010</td><td>2,361</td></tr> <tr> <td>2011</td><td>2,361</td></tr> <tr> <td>2012</td><td>2,361</td></tr> <tr> <td>2013</td><td>1,572</td></tr> </tbody> </table>	Year	Value (MWh)	2009	201	2010	2,361	2011	2,361	2012	2,361	2013	1,572
Year	Value (MWh)												
2009	201												
2010	2,361												
2011	2,361												
2012	2,361												
2013	1,572												
Measuring frequency	Not applicable												
Reporting frequency and recording procedure	Calculated based on the rated capacity.												
Type of monitoring equipment	Not applicable.												
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable.												
Calibration frequency/interval	Not applicable.												
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable.												
How were the values in the monitoring report verified and cross-checked?	Not applicable. It is the calculated value based on the rated capacity of the equipments . Hence, it is deemed to be conservative.												
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.												
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically	It is not applicable.												

possible been applied or has a request for deviation been approved?	
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4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

The waste water generation, biogas combusted and flared are monitored by the flow meters of accuracy level 0.4% and gas flow meters of accuracy level 2% on continuous basis and the monitored data are recorded into the log sheets on daily basis by the operators manually. These data are then archived into electronic storage. The verification team has cross checked the daily log sheets /17/ to verify the data and found to be reliable. Further, it is noted that flow meters (FM1, FM2, FM3) and Gas flow meters (GM1, GM2) are calibrated appropriately as verified with the calibration reports /24/ to /34/ and registered VCS PD. The data management is found to be reliable, which will ensure the correct transfer of data and reporting of emission reductions as verified with registered VCS PD /01/, monitoring report/02/ and site visit.

COD values are measured using the titrimetric analysis at the onsite laboratory. The methane content in the biogas is measured using online gas analyzer of accuracy level 2% and recorded for calculation. The gas analyzer has been calibrated appropriately as verified with the calibration reports /35/ /36/ and the same is in line with the registered VCS PD/01/.

As detailed in the registered VCS PD /01/, electricity consumption is calculated as the maximum rated consumption is calculated by multiplying total electrical capacity with 8,760 hours and 10% additional factor to be conservative. This value is defined in the registered VCS PD /01/, however the installed capacity has been updated. Since the value available during the validation is the installed capacity of UASB only, the new actual value /03/ is more conservative since it results in higher project emission. The verification team has verified the registered PD /01/ and equipment list sheet /03/ and name plate details. Conservative hence accepted.

RINA was able to verify all the documented evidence listed above during the verification process and can confirm that data and supporting evidences are complete and accurate. Further, RINA confirms that the data and evidences used to calculate the emission reductions are found to be reliable.

4.4 Non-Permanence Risk Analysis

Not applicable as it is a non-AFOLU project.

5 VERIFICATION CONCLUSION

RINA Service S.p.A (RINA) has performed verification of the emission reductions reported for the project activity “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand, VCS Registration Reference ID - 417, for the VCS monitoring period from 01-December-2009 to 31-August-2013, with regard to the relevant requirements for VCS and CDM rules.

The project participants P.S.C. Starch Products Public Company Limited. and Swiss Carbon Value Limited. of the project “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” is responsible for:

- The preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered VCS Registration Reference ID - 417, for the VCS monitoring period from 01-December-2009 to 31-August-2013.
- The development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project.

It is the responsibility of RINA to express an independent verification opinion about the project's conformity with the VCS requirements and procedures and on the reported greenhouse gas emission reductions from the project.

Based on documented evidence and corroborated by an on-site assessment RINA can confirm that:

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

It is RINA's opinion that the GHG emission reduction stated in the VCS monitoring report version 05 of 10-October-2014 for the “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in Thailand for the period 01-December-2009 to 31-August-2013 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the baseline and monitoring methodology, AMS-III.H., “Methane recovery in wastewater treatment”, version 13 of 17-July-2009.

Hence, RINA is able to certify that the emission reductions from the project during the monitoring period 01-December-2009 to 31-August-2013 amount to 174,933 tCO₂e.

Reporting period: From [01-December-2009] to [31-August-2013]

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

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
Year 2009	6,633	102	0	6,532
Year 2010	107,790	43,838	0	36,973
Year 2011	74,668	29,938	0	44,730
Year 2012	45,807	1,195	0	44,613
Year 2013	42,880	796	0	42,085
Total	277,778	75,869	0	174,933

APPENDIX A

VERIFICATION PROTOCOL

TABLE 1 REQUIREMENTS CHECK LIST

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
A Monitoring Report						
A.1	Does the used project title clearly enable the reader to identify the unique VCS activity? Is there an indication of a revision number, the date of the revision and the monitoring period?	/1/,/2/	/DR/,/CC/	Yes; the title of the project activity is “P.S.C Starch Wastewater Treatment and Biogas Utilization Project” in the Monitoring Report version 01 of 17-September-2013, which enables the reader to identify the unique VCS activity. The title is also in line with the validated VCS PD and Validation Report. The monitoring period for the project activity is 01-December-2009 to 31-August-2013.		OK
A.2	Does the project comply with the applicable requirements for completing the Monitoring Reports (latest version available)?	/1/,/2/, /5/,/6/, /7/,/8/, /9/	/DR/,/CC/	No, the project doesn't comply with the applicable requirements for completing the Monitoring Report. The Monitoring report is not in line with the VCS Monitoring Report Template (v 3.3), VCS version 3, dated 08/10/2013. PP is requested to follow the latest MR template as per the VCS website.	CAR1	OK
A.3	Does the MR comply with the template available (latest version)?	/1/,/2/, /5/,/6/, /7/,/8/, /9/	/DR/,/CC/	The PP has not used the latest MR template available. Please refer to section A.2.	CAR1	OK
B Description of Project Activity						
A.1	Title of the project activity, revision number and date of Monitoring Report	/1/,/2/,	/DR/,/CC/	The title of the project activity is “P.S.C Starch Wastewater Treatment and Biogas Utilization		OK

¹ MoV: DR document review, I interview, CC cross checking

Checklist Question	Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
			Project" version 01,dated 17-September-2013 and the same is found to be in line with the registered VCS PD.		
A.2	Is the actual implementation and operation of the proposed project activity in accordance with the project activity in the registered VCS-PD?	/1/,/2/,/4/ /5/,/6/, /7/,/8/, /9/, /10/, /24/	DR//CC RINA team comprising Ms. Rekha and Mr. Cyril have performed a site visit on 16-October-2013 and 17-October-2013 to verify the real implementation of the project against the description in the registered VCS PD. The project activity involves an intertwined network of anaerobic treatment systems, which consists of UASB system and covered lagoons. The newly constructed covered lagoon 1 (CL1) pre-treats the wastewater before feeding to UASB. Later, in June 2006, a covered sheet at the existing first open anaerobic lagoon was installed to collect the biogas generated. This covered lagoon (CL2) was designed to receive wastewater from sweetener factory together with the effluent from the UASB reactor. In October 2009, a new ethanol plant started operation in line with these existing facilities. Thus the biogas generated by the overall system (UASB + CL1 + CL2 + CL3) will be used in 7 boilers. The components of electricity production and fuel replacement will not be claimed for emission reduction. As per the registered VCS PD, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water	~~CL1~~	OK

Checklist Question	Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
			exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation). Waste water from Ethanol plant is taken in to covered lagoon 3 and then in to open ponds for disposal/ reuse. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators As per the monitoring report and site visit observation it is noted that, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation and reuse). Waste water from Ethanol plant is taken in to covered lagoon 3 and then the same is diverted to covered lagoon 1 and is treated in tandem with waste water from starch factory. Due to this change, there is a change in the COD_{ww,discharge.PJ.y}. Though additional amount of biogas could be generated from treating effluent at CL1+UASB+CL2, this gets nullified as ER_{expost} is calculated as per equation 13 of the methodology based on COD measurements and methane destruction and taking the most conservative estimate, the same is made transparent in the MR also, hence accepted. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators.		

Checklist Question	Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
			PP is requested to clarify the following: 1. <i>Diversion of the outlet of covered lagoon 3 to the inlet of covered lagoon 1. Thus the waste water from ethanol plant treated through covered lagoon 3 undergoes treatment through Covered lagoon 1 + UASB + Covered lagoon 2 and then diverted to open ponds and gets subsequently disposed / reused. As per the MR the above change is applicable for the entire monitoring period. However PP is requested to make it clear in the MR on the day when this revised treatment scheme for the treatment of waste water from ethanol plant was commissioned and submit its evidence.</i> 2. <i>As noted during site visit and as available in the Monitoring report, while the production values remain the same corresponding waste water generation is almost double of the design value. MR mentions that the primary reason is that the performance of the sweetener plant is not as per the design specification. However as per the VCS PD, it is noted that the sweetener plant was commissioned well before the commissioning of the project activity and hence sufficient performance data should be available. PP is requested to clarify the reasons for considering the design values</i>		

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
				and not the actual historical value. Also PP is requested to clarify on how this increased biogas generation does not affect the additionality of the project activity. 3. PP is requested to clarify on the authority who issued the operational license as it is not available in English.		
A.3	Methodology applied for the registered project activity	/1/, /2/, /3/, /7/	DR/CC	Project activity applies the methodology AMS-III.H., "Methane recovery in wastewater treatment", version 13 of 17-July-2009. This methodology is applicable to the project activity as the project activity involves recovery of biogas from the wastewater released from the Starch, Sweetener and ethanol production facilities using UASB and covered lagoons and utilizing the same to produce thermal energy, thereby replacing the fossil fuel used in the baseline for internal energy requirements and to produce electricity to partially replace electricity import from the grid. The components of electricity production and fuel replacement will not be claimed for emission reduction.		OK
B Monitoring						
B.1 Monitoring plan						
B.1	Is the actual implementation and operation of the proposed project activity in accordance with the project activity in the registered VCS-PD?	/1/, /2/, /5/, /6/, /7/, /8/, /9/, /10/, /11/	DR/CC	The project was commissioned prior to the registration of the VCS PD. However there is a change in the treatment scheme for waste water from Ethanol plant which is now taken in to covered lagoon 3 and then the same is diverted to	CL1	OK

Checklist Question	Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
			covered lagoon 1 and is treated in tandem with waste water from starch factory. Please refer to section B (A.2) above.		
B.2	In case of deviation between the registered project and the actual implementation/operation, do they comply with the requirements of the Project Standards?	/1/,/2/,/5/,/6/,/7/,/8/,/9/,/10/,	DR//CC Please refer section B.1 above.	CL1	OK
B.3	For project activity that consist of more than one site: - describe the status of the implementation and starting date of operation of each site; For project activity with phased implementation: - describe the progress of the proposed project activity achieved in each phase number; - if the phased implementaion is delayed, described the reasons and the expected impenetation dates.	/1/,/2/,/5/,/6/,/7/,/8/,/9/,/10/	DR//CC The project activity is located at 999 Nongyai-Bothong Road, Nongyai, Chonburi about 150 km southeast of Bangkok. The physical location has been confirmed during the site visit. The project activity is in operation stage as evidenced by the physical verification of the site. The project started its operations from 28-April-2005 due to insufficiency of monitoring system the crediting period starts from 01-December-2009. <i>PP is requested to transparently mention the name of the country in section 1.7 of Monitoring Report.</i> <i>Please refer to section B(A.2) above.</i>	CL2, CL1	OK
B.4	Methodology and methodological tool applied for the registered project activity	/1/,/2/,/5/,/6/,/7/,/8/,/9/,/10/,/11/-,/14/	DR//CC The methodology used for the project activity is AMS-III.H., "Methane recovery in wastewater treatment", version 13 of 17/07/2009, AMS-I.C., Thermal energy production with or without electricity, version 15 of 17/07/2009 and AMS. III.H. refers to:		OK

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
				- “AMS-I.D”, Grid connected renewable electricity generation version 14 of 17-July-2009. AMS.I.D. refers to: - “Tool to calculate the emission factor for an electricity system” version 1.1.		
C Compliance of the monitoring activities with the registered monitoring plan / Compliance of the monitoring plan with the monitoring methodology and methodological tool						
C.1 Monitoring plan						
C.1.1	Does the monitoring plan included in the registered VCS project activity comply with the applied methodology?	/1/,/2/, /5/,/6/, /7/,/8/, /9/,/10/ ,/11/-/14/	DR/CC	Yes. The monitoring plan included in the registered VCS-PD complies with the applied methodologies as the plan includes all the monitoring parameters as required by the methodologies and tool applied.		OK
C.1.2	Does the monitoring comply with the monitoring plan in the registered VCS-PD?	/1/,/2/, /5/,/6/, /7/,/8/, /9/,/10/ ,/11/-/18/	DR/CC	<i>The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards, hence accepted. However the work instruction on measurement of COD provide by the PP mentions that the COD measurement follows standards : Standard Methods for the Examination of water and wastewater" , 1st Ed 2005 and Wastewater analysis manual from Environmental Engineering Association , Thailand , 3rd Ed. 1997, this is inconsistent with the information in the Monitoring report, PP is requested to clarify.</i>	CL1,CL3	OK

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
				Please refer to section B (A.2) above.		
C.2 Data and parameters fixed ex-ante or at renewal crediting period						
C.2.1	Which parameters were available at validation and how were they verified?	/1/,/2/, /3/, /4/,/5/,/6/, /7/,/8/, /9/,/10/, /11-/15/	DR/CC/I	The parameters available at the time of validation were as follows: 1) GWP_{CH_4} - Global warning potential of methane gas. The value used is 21 $tonCO_2/tonCH_4$ from IPCC and consistent with the registered VCS PD. 2) Bo_{ww} - Methane generation capacity of COD in wastewater. The value used is 0.21 $kg CH_4/kg COD$, IPCC default value and consistent with the registered VCS PD. 3) UF_{BL}-Model correction factor to account for model uncertainties. The value used is 0.94, consistent with the applied methodology AMS-III.H and the VCS PD. 4) UF_{PJ}-Model correction factor to account for model uncertainties The value used is 1.06, consistent with the applied methodology AMS-III.H and the VCS PD. 5) $MCF_{ww, treatment, BL, lagoon}$ -Methane correction factor for the baseline anaerobic wastewater treatment system The value used is 0.8, consistent with the applied methodology AMS-III.H and VCS PD.		OK

Checklist Question	Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
			6) $MCF_{ww, treatment, PJ, k}$ - Methane correction factor for project wastewater treatment system k equipped with biogas recovery. Where K is UASB and Covered Lagoons 1, 2 and 3 The value used is 0.8, for the parameters consistent with the applied methodology AMS-III.H and the registered VCS-PD. 7) $MCF_{ww, treatment, PJ, lagoon}$ - Methane correction factor for project wastewater treatment system not equipped with biogas recovery. The value used is 0.8, consistent with the applied methodology AMS-III.H and the registered VCS-PD. 8) $MCF_{ww, PJ, discharge}$ - Methane correction factor based on discharge pathway in the project situation. The value used is 0.8, consistent with the applied methodology AMS-III.H and the registered VCS-PD. 9) CFE_{ww} - Capture and utilization/combustion/flare efficiency of the methane recovery and combustion/utilization equipment in the wastewater treatment. The value used is 0.9, consistent with the applied methodology AMS-III.H and the registered VCS-PD. 10) η_{BL}, Starch - COD removal efficiency of		

Checklist Question	Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
			baseline wastewater treatment system for the starch and sweetener plants The value used is 98.61%, based on the measured COD values for baseline wastewater treatment system for the starch and sweetener plants before implementation of the project activity, consistent with the registered VCS PD. 11) $\eta_{BL, \text{ ethanol}}$ - COD removal efficiency of baseline wastewater treatment system for the ethanol plant The value used is 87.76%, as per the registered VCS PD, this value is based on the COD removal efficiency based on COD values for open lagoons system(historical data) multiplied by 0.89, consistent with the methodology applied and the registered VCS-PD. 12) FE - Flare efficiency. The value applied is 50%, default value for open flare sourced as per the methodological tool "Tool to determine project emissions from flaring gases containing methane" consistent with the methodology applied and the registered VCS-PD. 13) P_{el} - Total electrical capacity of the equipments installed in the project activity. The value applied is 209.2 kW, sourced from the name plate details of the electrical equipments of the project activity. The capacity mentioned in the monitoring report is consistent with the registered VCS-PD, hence accepted. 14) EF_y -CO₂ emission factor for grid power		

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion												
				The value used is 0.5057, calculated as per the tool to calculate the emission factor for an electricity system, the value is obtained from the Department of Alternative Energy Development and Efficiency, Ministry of Energy (DEDE), consistent with the methodologies applied and the registered VCS – PD.														
C.2.2	What default data were selected and applied?	/1/,/2/, /3/, /4/,/5/,/6/, /7/,/8/, /9/,/10/, /11/-/15/	DR/CC/I	Please refer sector C.2.1 above		OK												
C.3 Data and parameters monitored ex-post																		
C.3.1	Which parameter have been monitored during the monitoring period? (Data/Parameter monitored / Data unit / Description / Source of data to be used / Value data for the monitoring period)	/1/,/2/, /3/, /4/,/5/,/6/, /7/,/8/, /9/,/10/, /11/-/18/	DR/CC/I	Data/ Parameter Monitored as per the Monitoring Report: 1) $Q_{y,ww, starch}$ - Volume of wastewater treated in year y from the starch plant, value applied: <table><tr><th>Year</th><th>Value (m3)</th></tr><tr><td>2009</td><td>70,035</td></tr><tr><td>2010</td><td>425,171</td></tr><tr><td>2011</td><td>658,470</td></tr><tr><td>2012</td><td>859,378</td></tr><tr><td>2013</td><td>287,895</td></tr></table> Measured using volumetric flow meter FM1. Readings cross checked with log sheets at site, the value for dates 14-December-2011 and 31-December-2011 were not consistent with the ER sheet. PP	Year	Value (m3)	2009	70,035	2010	425,171	2011	658,470	2012	859,378	2013	287,895	CL4, CL3	OK
Year	Value (m3)																	
2009	70,035																	
2010	425,171																	
2011	658,470																	
2012	859,378																	
2013	287,895																	

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion																								
				is requested to correct this information and revise the ER sheet as appropriate. 2) $Q_{y,ww, \text{ sweetener}}$ - Volume of wastewater treated in year y from the sweetener plant, value applied: <table><tr><th>Year</th><th>Value (m3)</th></tr><tr><td>2009</td><td>96,746</td></tr><tr><td>2010</td><td>1,039,834</td></tr><tr><td>2011</td><td>852,633</td></tr><tr><td>2012</td><td>1,377,196</td></tr><tr><td>2013</td><td>959,635</td></tr></table> Measured using volumetric flow meter FM2. Readings cross checked with log sheets at site, the value for dates 02-October-2011 and 16-August-2013 were not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. 3) $Q_{y,ww, \text{ Ethanol}}$ - Volume of wastewater treated in year y from the ethanol plant, value applied: <table><tr><th>Year</th><th>Value (m3)</th></tr><tr><td>2009</td><td>37,137</td></tr><tr><td>2010</td><td>369,088</td></tr><tr><td>2011</td><td>418,120</td></tr><tr><td>2012</td><td>287,847</td></tr><tr><td>2013</td><td>343,781</td></tr></table>	Year	Value (m3)	2009	96,746	2010	1,039,834	2011	852,633	2012	1,377,196	2013	959,635	Year	Value (m3)	2009	37,137	2010	369,088	2011	418,120	2012	287,847	2013	343,781		
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Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion												
				Measured using volumetric flow meter FM3. Readings cross checked with log sheets at site, the value for dates 24-June-2010, 02-October-2011 and 07-May-2013 were not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Also the description for the parameter $Q_{y,ww, Ethanol}$ – is mentioned in the Volume of wastewater treated in year y from the <u>starch</u> (typo error) plant. PP is requested to correct the same. 4) $COD_{y,ww, untreated, starch}$ - COD of waste water from starch plant in year y, value applied: <table><tr><th>Year</th><th>Value (mg/l)</th></tr><tr><td>2009</td><td>21,949</td></tr><tr><td>2010</td><td>18,555</td></tr><tr><td>2011</td><td>12,935</td></tr><tr><td>2012</td><td>12,658</td></tr><tr><td>2013</td><td>14,101</td></tr></table> Measured using titrimetric analysis. Readings cross checked with log sheets at site. Reading for the date 28-December-2011 was not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above. 5) $COD_{y,ww, untreated, sweetener}$ - COD of waste	Year	Value (mg/l)	2009	21,949	2010	18,555	2011	12,935	2012	12,658	2013	14,101		
Year	Value (mg/l)																	
2009	21,949																	
2010	18,555																	
2011	12,935																	
2012	12,658																	
2013	14,101																	

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion																								
				water from sweetener plant in year y, value applied: <table><tr><th>Year</th><th>Value (mg/l)</th></tr><tr><td>2009</td><td>13,483</td></tr><tr><td>2010</td><td>13,001</td></tr><tr><td>2011</td><td>9,938</td></tr><tr><td>2012</td><td>7,541</td></tr><tr><td>2013</td><td>8,357</td></tr></table> Measured using titrimetric analysis. Readings cross checked with log sheets at site and found to be consistent. Please refer to section C.1.2 above. 6) <i>COD_{y,ww, untreated, ethanol} - COD of waste water from ethanol plant in year y, value applied:</i> <table><tr><th>Year</th><th>Value (mg/l)</th></tr><tr><td>2009</td><td>34,267</td></tr><tr><td>2010</td><td>35,171</td></tr><tr><td>2011</td><td>15,601</td></tr><tr><td>2012</td><td>15,643</td></tr><tr><td>2013</td><td>24,069</td></tr></table> Measured using titrimetric analysis. Readings cross checked with log sheets at site. Reading for the date 21-November-2011, 08,15,19,20 and 31-October-2011 were not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above.	Year	Value (mg/l)	2009	13,483	2010	13,001	2011	9,938	2012	7,541	2013	8,357	Year	Value (mg/l)	2009	34,267	2010	35,171	2011	15,601	2012	15,643	2013	24,069		
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Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion																								
				7) $COD_{y,ww, treated, CL2}$ - COD of waste water exiting the covered lagoon 2 treatment process in year y, value applied: <table><tr><th>Year</th><th>Value (mg/l)</th></tr><tr><td>2009</td><td>6,688</td></tr><tr><td>2010</td><td>4,793</td></tr><tr><td>2011</td><td>3,123</td></tr><tr><td>2012</td><td>2,629</td></tr><tr><td>2013</td><td>3,745</td></tr></table> Measured using titrimetric analysis. Readings cross checked with log sheets at site. Reading for the date 28-December-2011 was not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above. 8) $COD_{y,ww, treated, CL3}$ - COD of waste water exiting the covered lagoon 3 treatment process in year y, value applied: <table><tr><th>Year</th><th>Value (mg/l)</th></tr><tr><td>2009</td><td>9,611</td></tr><tr><td>2010</td><td>9,245</td></tr><tr><td>2011</td><td>4,566</td></tr><tr><td>2012</td><td>3,161</td></tr><tr><td>2013</td><td>16,422</td></tr></table> Measured using titrimetric analysis. Readings cross checked with log sheets at	Year	Value (mg/l)	2009	6,688	2010	4,793	2011	3,123	2012	2,629	2013	3,745	Year	Value (mg/l)	2009	9,611	2010	9,245	2011	4,566	2012	3,161	2013	16,422		
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Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion																								
				site. Reading for the date 28-December-2011 was not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above. 9) W_{CH_4} – Methane content in biogas in year y, value applied: <table><tr><th>Year</th><th>Value %</th></tr><tr><td>2009</td><td>42.06</td></tr><tr><td>2010</td><td>50.17</td></tr><tr><td>2011</td><td>50.64</td></tr><tr><td>2012</td><td>50.13</td></tr><tr><td>2013</td><td>54.48</td></tr></table> Measured using online methane analyzer. Readings cross checked with log books at site, consistent. 10) $BG_{combusted,y}$ – Amount of biogas for gainful use in the year y, value applied: <table><tr><th>Year</th><th>Value Nm^3</th></tr><tr><td>2009</td><td>1,070,383</td></tr><tr><td>2010</td><td>11,118,855</td></tr><tr><td>2011</td><td>8,672,611</td></tr><tr><td>2012</td><td>6,201,192</td></tr><tr><td>2013</td><td>4,486,896</td></tr></table> Measured using biogas flow meter GM1 and GM2, the value is available in Nm^3. Readings cross checked with log books for	Year	Value %	2009	42.06	2010	50.17	2011	50.64	2012	50.13	2013	54.48	Year	Value Nm^3	2009	1,070,383	2010	11,118,855	2011	8,672,611	2012	6,201,192	2013	4,486,896		
Year	Value %																													
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2012	6,201,192																													
2013	4,486,896																													

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion												
				flow meters GM 1 and GM 2 at site. For GM1 reading for the date 30-January-2010, 02-September-2010, 15-September-2012, 23-June-2012 were not consistent with the ER sheet. For GM2 reading for the date 18-February-2010, 24-June-2010, 02-September-2010 and 15-September-2012, were not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. 11) EC_y – Electricity consumption by wastewater treatment system and biogas plant in year y, value applied: <table><tr><th>Year</th><th>Value (MWh)</th></tr><tr><td>2009</td><td>171</td></tr><tr><td>2010</td><td>2,016</td></tr><tr><td>2011</td><td>2,016</td></tr><tr><td>2012</td><td>2,016</td></tr><tr><td>2013</td><td>1,342</td></tr></table> Maximum rated consumption is calculated by multiplying total electrical capacity with operational hour with 10% additional factor as available in the registered VCS PD.	Year	Value (MWh)	2009	171	2010	2,016	2011	2,016	2012	2,016	2013	1,342		
Year	Value (MWh)																	
2009	171																	
2010	2,016																	
2011	2,016																	
2012	2,016																	
2013	1,342																	
C.3.2	Is the measurement equipment described? Is the accuracy of the measurement equipment addressed and deemed appropriate?	/1/,/2/, /3/, /4/,/5/,/6/, /7/,/8/, /9/,/10/, /11-/22/	DR/CC/I	The following monitoring equipments are used in the project activity and the same is described in the monitoring report: 1) Volumetric Flow meters (FM1, FM2 and FM3) to monitor the flow of waste water are of 0.4%, 0.4% and 0.35% accuracy class		OK												

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
				respectively, against 1% mentioned in the registered VCS PD. 2) Biogas Flow meters GM1 and GM2 to monitor the amount of biogas sent to Boiler, genset. The flow meters are of 2% OR + 0.5%FS accuracy class, VCS PD does not define the accuracy of biogas flow meter. 3) Portable Gas analyser – To monitor the methane content in Biogas. The instrument is of 2% accuracy, consistent with the VCS PD.		
C.3.3	Is the measuring/reading/recording frequency adequate for all monitoring parameters? Is it in line with the registered monitoring plan?	/1/,/2/, /3/, /4/,/5/,/6/, /7/,/8/, /9/,/10/, /11/-/22/	DR/CC/I	1) $Q_{y,ww, starch}$ - Volume of wastewater treated in year y from the starch plant, continuously monitored with data recording on daily basis. Consistent with VCS PD. 2) $Q_{y,ww, sweetener}$ - Volume of wastewater treated in year y from the sweetener plant, continuously monitored with data recording on daily basis. Consistent with VCS PD. 3) $Q_{y,ww, Ethanol}$ - Volume of wastewater treated in year y from the ethanol plant continuously monitored with data recording on daily basis. Consistent with VCS PD. 4) $COD_{y,ww, untreated, starch}$ - COD of waste water from starch plant in year y, measured and recorded daily. Sample taken from the outlet of waste water from starch plant	CL5	OK

Checklist Question	Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
			before entering covered lagoon 1. Consistent with VCS PD. 5) $COD_{y,ww, untreated, sweetener}$ - COD of waste water from sweetener plant in year y, measured and recorded daily. Sample taken from the outlet of waste water from sweetener plant before entering covered lagoon 2. Consistent with VCS PD. 6) $COD_{y,ww, untreated, ethanol}$ - COD of waste water from ethanol plant in year y, measured and recorded daily. Sample taken from the outlet of waste water from ethanol plant before entering covered lagoon 3. Consistent with VCS PD. 7) $COD_{y,ww, treated, CL2}$ - COD of waste water exiting the covered lagoon 2 treatment process in year y, measured and recorded daily. The sampling point mentioned in the MR is inconsistent with the one available in the VCS PD. PP is requested to clarify. 8) $COD_{y,ww, treated, CL3}$ - COD of waste water exiting the covered lagoon 3 treatment process in year y, measured and recorded daily. The sampling point mentioned in the MR is inconsistent with the one available in the VCS PD. PP is requested to clarify		

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
				9) W_{CH_4} – Methane content in biogas in year y, continuously monitored with data recording on daily basis. Consistent with VCS PD. 10) $BG_{combusted,y}$ – Amount of biogas for gainful use in the year y, continuously monitored with data recording on daily basis. Consistent with VCS PD. 11) EC_y – Electricity consumption by wastewater treatment system and biogas plant in year y, Maximum rated consumption is calculated by multiplying total electrical capacity with operational hour with 10% additional factor as available in the registered VCS PD. Conservative hence accepted, however <i>PP is requested to submit the current list of auxiliaries.</i>		
C.4 Calibration requirements						
C.4.1	Are the requirements for maintenance and calibration of measurement equipment described and deemed appropriate?	/1/, /2/, /4/, /5/, /6/, /7/, /8/, /9/, /10/, /24/, /36/	DR/CC/I	The calibration frequency for all the monitoring equipments except for the gas flow meters (GM 1 and GM2) is mentioned as once in three years, in the registered VCS PD. 1. <i>Volumetric flow meters FM1 and FM2 have been calibrated on 16-January-2009 and 10-March-2012, hence not calibrated within 3 years. PP is requested to clarify.</i>	CL6	OK

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
				2. Volumetric flow meter FM3 has been calibrated on 12-January-2009 and 29-March-2012 and 12-March-2013, hence not calibrated within 3 years. PP is requested to clarify. 3. Gas flow meter GM1 has been calibrated on 17-February-2009 and 13-March-2012, hence not calibrated within 3 years. PP is requested to clarify. 4. Gas flow meter GM2 has been calibrated on 16-February-2009 and 13-March-2012, hence not calibrated within 3 years. PP is requested to clarify. 5. Gas analyser has been calibrated on 15-March-2009 and 10-January-2012, hence has been calibrated once in 3 years. 6. Also the gas flow meters are to be calibrated as per the manufacturer's specification, PP is requested to clarify on how this requirement has been adhered to.		
C.4.2	Does the calibration cover the monitoring period?	/1/, /2/ /4/, /5/, /6/, /7/, /8/, /9/, /10/, /24/- /36/	DR/CC/I	Please refer to C.4.1.	CL6	OK
C.4.3	Has the calibration frequency been respected?	/1/, /2/ /4/, /5/, /6/, /7/, /8/, /9/	DR/CC/I	Please refer to C.4.1.	CL6	OK

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
		/10/, /24/- /36/				
C.4.4	In case of delay, describe the applied maximum permissible error	/1/, /2/ /4/, /5/, /6/, /7/, /8/, /9/, /10/, /24/- /36/	DR/CC/I	Please refer to C.4.1.	CL6	OK
C.5 Monitoring of the sustainable indicators						
C.5.1	Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host Country?	/1/, /2/, /4/ /5/, /6/,	DR/CC	<i>Monitoring of sustainable development indicators are not legislated in the host country. PP is requested to submit the environment clearances obtained from the host country for this monitoring period.</i>	CL7	OK
C.6 Management system and quality control						
C.6.1	How has it been assessed that the monitoring arrangements described in the monitoring plan are feasible within the project design?	/1/, /2/ /4/, /5/, /6/, /7/, /8/, /9/, /10/, /25/- /37/	DR/ I/CC	During the site visit the verification team has checked the monitoring procedures followed at site the same was consistent with what is mentioned in the registered VCS PD and the monitoring report. Please refer to the clarifications raised in section C.3 above.	CL3, CL4, CL5	OK
C.6.2	Are procedures identified for day-to-day record handling (including what records to keep, storage area of records and how to process performance documentation)? Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this	/1/, /2/, /4/ /5/, /6/, /10/	DR/I/CC	MR clearly mention the procedures for daily internal record handling; and PP will retain all monitoring data required for verification and issuance for two years after the end of the crediting period, for this project activity.		OK

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
	project activity, whichever occurs later?					
C.6.3	Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified?	/1/,/2/, /5/,/6/, /7/,/8/, /9/,/10/	DR/I /CC	Yes. The data management, quality assurance and quality control procedures followed at site ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified.		OK
C.6.4	Are the responsibilities and authorities for monitoring and reporting in accordance with the responsibilities and authorities stated in the monitoring plan?	/1/,/2/, /4/, /5/,/6/, /10/- /12/, /46/- /48/	DR/I /CC	1. <i>The Organisation chart in the MR has been revised; PP is requested to submit the recent approved organisation chart explaining the CDM monitoring plan functions.</i> <i>PP is requested to provide details of the training planned and provided during this monitoring period and submit relevant records</i> <i>PP is requested to provide the records of internal audits conducted on the CDM monitoring system.</i>	CL8	OK
C.6.5	Does data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	/01/,/02/, /05/,/06/, /07/,/08/, /09/,/10/, /11/,/12/	DR/I /CC	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions. The records and the field records were checked at site and found to be consistent.		OK
D.1 Assessment of data and calculation of emission reductions/Accuracy of emission reduction calculations						
D.1.1	How were the values in the monitoring report verified and cross-checked?	/01/,/02/, /03/, /24/	DR/I /CC	The values mentioned in the MR is cross verified with the daily logs and other records available at the site, discrepancies found have been recorded	CL3, CL4	OK

Checklist Question		Reference	MoV ¹	Comments	Draft Conclusion	Final Conclusion
				in section C.3.1 above.		
D.1.2	If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	/01/,/02/, /03/, /24/	DR// CC	All necessary data for the entire monitoring period were available and the most conservative assumption has been made. However, please refer to section C.4.1 above.	~~CL6~~	OK
D.1.3	Emission reductions reported	/01/,/02/, /03/, /24/	DR// CC	The total amount of ER for this period (1 st verification) is mentioned as 197,334 tCO ₂ e. This is consistent with the ER sheet. However, please refer to section B.(A.2), C.3.1 and C.4.1 above	~~CL1, CL4,~~ ~~CL6~~	OK
D.1.4	Difference between the emission reductions estimated in the registered PDD and the emission reductions reported for the monitoring period.	/01/,/02/,/10/,/11/,/17/, /03/	DR// CC	As per the registered VCS-PD the annual emission reduction is estimated to be 36,973 tCO ₂ e. The monitoring period is from 01-December-2009 to 31-August-2013, hence the emission reductions for the monitoring period as per the registered VCS PD is 138,648 tCO ₂ e. The actual emission reductions reported for the 1 st verification period is 197,334 tCO ₂ e. Please refer to section B.(A.2) above.	~~CL1~~	OK

TABLE 2 RESOLUTION OF CORRECTIVE ACTION REQUESTS AND CLARIFICATION REQUESTS

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
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Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
CAR 1 The Monitoring report is not in line with the VCS Monitoring Report Template (v 3.3), VCS version 3, dated 08/10/2013. PP is requested to follow the latest MR template as per the VCS website.	A (A.2), A(A.3)	The MR is revised to template version 3.3.	PP has revised MR to version 3.3 template, hence accepted. CAR 1 is closed after review of 1st response.
CL1 PP is requested to clarify the following: 1. Diversion of the outlet of covered lagoon 3 to the inlet of covered lagoon 1. Thus the waste water from ethanol plant treated through covered lagoon 3 undergoes treatment through Covered lagoon 1 + UASB + Covered lagoon 2 and then diverted to open ponds and gets subsequently disposed / reused. As per the MR the above change is applicable for the entire monitoring period. However PP is requested to make it clear in the MR on the day when this revised treatment scheme for the treatment of waste water from ethanol plant was commissioned and submit its evidence. 2. As noted during site visit and as available in the Monitoring report, while the production values remain the same corresponding waste water generation is almost double of the design value. MR mentions that the primary reason is that the performance of the sweetener plant is not as per the design specification. However as per the VCS PD,	B(A.2), B.1, B.2, B.3, C.1.2, D.1.3, D.1.4	1. The implementation information is added in section 2.1 of MR. The bypass of treated wastewater from CL3 to CL1 was happened one week after starting the operation of CL3 in Oct-09 and the PO noticed about no biogas production as well as high temperature problem in this lagoon. 2. The wastewater volume has increased due to the increase in the volume of wastewater from the Sweetener plant. In the VCS-PD, the wastewater from sweetener was taken as 320m3/day. This was taken from EIA report issued in May-2007. As per the letter from P.S.C. issued	1. The information now provided in the MR is consistent with the site visit observation, hence accepted. 2. PP has clarified the reason behind taking the EIA values instead of actual historical data. PP has submitted relevant pages of the EIA report of May 2007 prepared by ENCAD consultants Limited . The information provided in the response is consistent with the EIA report.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
it is noted that the sweetener plant was commissioned well before the commissioning of the project activity and hence sufficient performance data should be available. PP is requested to clarify the reasons for considering the design values and not the actual historical value. Also PP is requested to clarify on how this increased biogas generation does not affect the additionality of the project activity.		during the validation , the production capacity of sweetener plant during that period was at <i>150 – 180 t/d for 300 d/y and planned to extend to 240 t/d.</i> The EIA report was done for the requisition for capacity extension to <i>260 t/d.</i> The existing capacity of sweetener plant is 260 t/d , increased from 240 t/d in the registered PD. The actual data for 180 t/d was available during tha validation. But the data for 260 t/d was not available. Thus the source ex-ante values is from EIA report. Referring to the Summary report for project development , issued in Jan-08 by P.S.C. , the quantity of wastewater from main source (sweetener) plant is 6,000 m³/d. Due to this increasing, there is an increase in the biogas production. The ex-ante emission reductions were estimated to be 36,973 / year. During the current monitoring period, the actual emission reductions have increased but the increase in year 2010 is most significant. The baseline or the applicability of the methodology is not affected. The additionality was demonstrated using	a. PP has submitted relevant pages of the Summary report for project development , issued in Jan-08 by P.S.C. As per the registered VCS PD the waste water from sweetner plant is 320 m³/day however in actual it is at an average of 4000 m³/day going up more than 6000 m³/day also. PP is requested to justify this wide deviation. b. While there is no change in the baseline practice, inaccordance with section 3.6 of the VCS standard, the PP is requested to demonstrate that this deviation does not have a significant impact on the additionality of the project for the volumes handled during the monitoring period.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
3. PP is requested to clarify on the authority who issued the operational license as it is not available in English. 4. PP is further requested to clarify that they have not applied or will apply for any other GHG programme after the registration of the VCS-PD, which may lead to double counting.		barrier analysis. The barriers are still valid as the project is using wastewater from three sources. The starch and Ethanol plant have not shown any significant increase in volume of wastewater. In fact, the project owner has faced technical issues due to the high wastewater temperature from the ethanol which lead to reconfiguration. 3. The operation licenses are issued by Department of Industrial Work , Thailand. 4. The PP does not apply any other GHG programme after the registration of the VCS-PD.	3. Noted and accepted. 4. Noted and cross checked with CDM and GS website, no conflicts noticed, hence accepted. CL 1 is open after review of 1st response.
		<u>Second response:</u> a). On the issue of large variation between waste water volume between ex-ante and ex-post figure, it seems that the wastewater production from Sweetner plant is much greater than what was estimated ex-ante in the EIA. There is no clear reasoning behind this but the plant operators have said that this is due to internal operation of the sweetner plant. In PP's opinion, the emission reductions in the year 2010 significantly exceed	Second response: a) As per the CDM 'Guidelines on assessment of different types of changes from the project activity as described in the registered PDD' EB 48, Annex 67. The changes in the project activity does not affect additionality as there is no change in the installation capacity or the number of treatment units and there is no change in the treatment system. There is no addition of component or extension of technology. It is not a multiple site project. The project

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
		those in other years. We would therefore propose to cap the 2010 claimed emission reductions to the value in the registered VCS PD. 2. As mentioned above, the additionality of the project was demonstrated using barrier analysis which included technical barriers, investment barrier, institutional barriers and lack of common practice in the region. The increase in wastewater volume from the sweetener plant does not impact additionality as the significant increase in the emission reduction occurs only the year 2010.	has used barrier analysis for demonstrating additionality. There is no change in scale of the project activity and the methodology is still applicable. Also, the as matter of abundant caution, the PP has proposed to cap the 2010 emission reductions to the value in the registered VCS PD, hence accepted. 2. Accepted, as above. CL1 has been closed after review of 2nd response.
CL2 PP is requested to transparently mention the name of the country in section 1.7 of Monitoring Report.	B.3	The country name is added in section 1.7 of MR.	The information requested has now been made transparent in section 1.7 of the MR, hence accepted. CL 2 is closed after review of 1st response.
CL3 The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards, hence accepted. However the work	C.1.2, C.3.1,C.6.1,D.1.1,	The <i>Examination of water and wastewater" , 1st Ed 2005 and Wastewater analysis manual from Environmental Engineering Association , Thailand , 3rd Ed. 1997</i> is the standard wastewater manual in Thai language. This manual is translated from the <i>Standard Methods for Examination of</i>	Accepted, however PP is requested to make this transparent in the MR.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
instruction on measurement of COD provide by the PP mentions that the COD measurement follows standards : Standard Methods for the Examination of water and wastewater" , 1st Ed 2005 and Wastewater analysis manual from Environmental Engineering Association , Thailand , 3rd Ed. 1997, this is inconsistent with the information in the Monitoring report, PP is requested to clarify.		<i>Water and Wastewater by APHA, AWWA and WEF</i> , it is determined as the reference of standard of water and wastewater analysis method in Thai's regulations concerns wastewater's parameter analysis.	CL 3 is open after review of 1 st response.
		<u>Second response:</u> This information is added in the revised MR.	Second response: This information is added in the revised MR, hence accepted. CL3 is closed after review of 2nd response.
CL4 1) $Q_{y,ww, starch}$ - Volume of wastewater treated in year y from the starch plant Measured using volumetric flow meter FM1. Readings cross checked with log sheets at site, the value for dates 14-December-2011 and 31-December-2011 were not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. 2) $Q_{y,ww, sweetener}$ - Volume of wastewater treated in year y from the sweetener plant. Measured using volumetric flow meter FM2. Readings cross checked with log sheets at site, the value for dates 02-October-2011 and 16-August-2013 were not consistent with the ER sheet.	C.3.1, C.6.1,D.1.1, D.1.3	The readings from flow meters are 100% rechecked , the new log file from meters is submitted. The COD results are rechecked. The ER calculation sheet is revised for inconsistent values.	1. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted. 2. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
PP is requested to correct this information and revise the ER sheet as appropriate. 3) $Q_{y,ww, Ethanol}$ - Volume of wastewater treated in year y from the ethanol plant Measured using volumetric flow meter FM3. Readings cross checked with log sheets at site, the value for dates 24-June-2010, 02-October-2011 and 07-May-2013 were not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Also the description for the parameter $Q_{y,ww, Ethanol}$ - is mentioned in the Volume of wastewater treated in year y from the <u>starch</u> (typo error) plant. PP is requested to correct the same. 4) $COD_{y,ww, untreated, starch}$ - COD of waste water from starch plant in year y, Measured using titrimetric analysis. Readings cross checked with log sheets at site. Reading for the date 28-December-2011 was not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above. 5) $COD_{y,ww, untreated, ethanol}$ - COD of waste water from ethanol plant in year y Measured using titrimetric analysis. Readings cross checked with log sheets at site. Reading for the date 21-November-2011, 08,15,19,20 and 31-October-2011 were not consistent with			3. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted. The typo error in the description for the parameter $Q_{y,ww, Ethanol}$ has been corrected appropriately, hence accepted. 4. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted. 5. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above. 6) $COD_{y,ww, treated, CL2}$ - COD of waste water exiting the covered lagoon 2 treatment process in year y. Measured using titrimetric analysis. Readings cross checked with log sheets at site. Reading for the date 28-December-2011 was not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above 7) $COD_{y,ww, treated, CL3}$ - COD of waste water exiting the covered lagoon 3 treatment process in year y Measured using titrimetric analysis. Readings cross checked with log sheets at site. Reading for the date 28-December-2011 was not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate. Please refer to section C.1.2 above. 8) $BG_{combusted,y}$ – Amount of biogas for gainful use in the year y Measured using biogas flow meter GM1 and GM2, the value is available in Nm^3. Readings cross checked with log books for flow meters GM 1 and GM 2 at site. For GM1 reading for the date 30-January-2010, 02-September-2010, 15-September-2012, 23-June-2012 were not consistent with			6. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted. 7. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted. 8. The MR and ER sheet has been revised, consistent with site visit observations, hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
the ER sheet. For GM2 reading for the date 18-February-2010, 24-June-2010, 02-September-2010 and 15-September-2012, were not consistent with the ER sheet. PP is requested to correct this information and revise the ER sheet as appropriate.			CL 4 is closed after review of 1 st response.
CL5 1) COD_{y,ww, treated, CL2} - COD of waste water exiting the covered lagoon 2 treatment process in year y, measured and recorded daily. The sampling point mentioned in the MR is inconsistent with the one available in the VCS PD. PP is requested to clarify. 2) COD_{y,ww, treated, CL3} - COD of waste water exiting the covered lagoon 3 treatment process in year y, measured and recorded daily. The sampling point mentioned in the MR is inconsistent with the one available in the VCS PD. PP is requested to clarify 3) EC_y – Electricity consumption by wastewater treatment system and biogas plant in year y, Maximum rated consumption is calculated by multiplying total electrical capacity with operational hour with 10% additional factor as available in the registered VCS PD. Conservative hence accepted, however PP is requested to submit the current list	C.3.3, C.6.1,	1) The monitoring description in section 3.2 of MR is revised. 2) The monitoring description in section 3.2 of MR is revised. 3) The installed capacity is updated. Since the value available during the validation is the installed capacity of UASB only. The new actual value is more conservative since it results in higher project emission. The update list of equipments is provided.	1. MR has been corrected appropriately, consistent with the VCS PD and site visit observations, hence accepted. 2. Though the correction done now is consistent with the VCS PD, the outlet from CL3 is no longer directly left in to open ponds, PP is requested to correct the MR with respect to the practice adopted during this monitoring period. 3. The updated list is provided, consistent with site visit observations, hence accepted. CL 5 is open after review of 1st response.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
of auxiliaries.			
		<u>Second response:</u> This information in MR is revised.	Second response: MR has been updated appropriately, hence accepted. CL5 is closed after review of 2nd response.
CL6 1. Volumetric flow meters FM1 and FM2 have been calibrated on 16-January-2009 and 10-March-2012, hence not calibrated within 3 years. PP is requested to clarify. 2. Volumetric flow meter FM3 has been calibrated on 12-January-2009 and 29-March-2012 and 12-March-2013, hence not calibrated within 3 years. PP is requested to clarify.	C.4.1, C.4.2, C.4.3,C.4.4, D.1.2, D.1.3	(1),(2),(3),(4) The monitored values are adjusted by deducting the error from readings for calibration delay between the due date of calibration and the exact calibration date . This is the conservative approach which in line with Annex60 of EB52 because it gives the lower baseline emissions. - FM1,FM2,FM3 : the deductions by maximum error of 0.4% are applied during 12-Jan-09 to 28-Mar-09. - GM1,GM2 : the deductions by maximum error of 2% are applied during 16-Feb-09 to 09-Mar-09.	1. From the calibration reports, it is transparent that the flow meters FM1 and FM2 have continued to be in operation, hence the approach used by PP is conservative. Accuracy of the flowmeters were confirmed during the preparation of the draft report. However the guidelines referred are obsolete, PP is requested to correct as appropriate, also the monitoring period taken for error correction is not appropriate with the period falling outside the validity of calibration. PP is requested to correct the response. Also the corrections done are not evident in the ER sheet, PP is requested to clarify on how this correction is incorporated in the ER sheet. 2. From the calibration reports, it is transparent that the flow meters FM3 was in continued operation, hence the approach used by PP is conservative. Accuracy of the flowmeter was confirmed during the preparation of the draft report. However the guidelines referred are obsolete, PP is requested to correct as appropriate, also the monitoring period taken for error correction is not appropriate with the period falling outside the validity of

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
3. Gas flow meter GM1 has been calibrated on 17-February-2009 and 13-March-2012, hence not calibrated within 3 years. PP is requested to clarify. 4. Gas flow meter GM2 has been calibrated on 16-February-2009 and 13-March-2012, hence not calibrated within 3 years. PP is requested to clarify.			calibration. PP is requested to correct the response. Also the corrections done are not evident in the ER sheet, PP is requested to clarify on how this correction is incorporated in the ER sheet. 3. From the calibration reports, it is transparent that the flow meters GM1 was in continued operation, hence the approach used by PP is conservative. Accuracy of the flowmeter was confirmed during the preparation of the draft report. However the guidelines referred are obsolete, PP is requested to correct as appropriate, also the monitoring period taken for error correction is not appropriate with the period falling outside the validity of calibration. PP is requested to correct the response. Also the corrections done are not evident in the ER sheet, PP is requested to clarify on how this correction is incorporated in the ER sheet. 4. From the calibration reports, it is transparent that the flow meters GM2 was in continued operation, hence the approach used by PP is conservative. Accuracy of the flowmeter was confirmed during the preparation of the draft report. However the guidelines referred are obsolete, PP is requested to correct as appropriate, also the monitoring period taken for error correction is not appropriate with the period falling outside the validity of calibration. PP is requested to correct the response. Also the corrections

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
5. Also the gas flow meters are to be calibrated as per the manufacturer's specification, PP is requested to clarify on how this requirement has been adhered to.		5. The manufacturer's specification is not available. The calibration frequency of every three years is chosen as per General Guidelines to SSC CDM methodologies (Version 17) , clause 17.C ² .	done are not evident in the ER sheet, PP is requested to clarify on how this correction is incorporated in the ER sheet. 5. PP is requested to apply the latest version of the guideline. CL 6 is open after review of 1 st response.
		<u>Second response:</u> 4) The reference guideline is changed to the latest version of CDM-EB65-A04-STAN : CDM validation and verification standard. - FM1,FM2 : the calibration is expired on 16-Jan-12 and re-calibrated on 10-Mar-12 - FM3 : the calibration is expired on 12-Jan-12 and re-calibrated on 29-Mar-12 The period to apply error correction during 12-Jan-12 to 28-Mar-12. Which is appropriate as per the above guideline and already done in sheet data_2012 cell O21 to O97 with blue letter.	Second response: 4. ER sheet and MR corrected appropriately, hence accepted.

² http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid06.pdf

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
		GM1 : the calibration is expired on 17-Feb-12 and re-calibrated on 13-Mar-12 GM2 : the calibration is expired on 16-Feb-12 and re-calibrated on 13-Mar-12 The period to apply error correction is done for the whole monitoring period. Which is appropriate as per the above guideline and already done in sheet ERs cell I23 to M23 with blue letter. 5) The calibration frequency is changed to every 18 months as per recommendation from manufacturer.³	5) MR and ER sheet corrected appropriately, hence accepted. CL6 is closed after review of 2nd response.

3

[http://www.fluidcomponents.com/Industrial/Library/manuals/Flowmeters/ST50,%20ST51,%20ST75%20Guides%20&%20Manuals/ST51%20Guide%20\(06EN003389-\).pdf](http://www.fluidcomponents.com/Industrial/Library/manuals/Flowmeters/ST50,%20ST51,%20ST75%20Guides%20&%20Manuals/ST51%20Guide%20(06EN003389-).pdf)

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
CL7 1. PP has Monitoring of sustainable development indicators are not legislated in the host country. PP is requested to submit the environment clearances obtained from the host country for this monitoring period.	C.5.1	The environmental clearances are not available for this project activity. The operating licenses are provided.	OK, this is consistent with the interview had during site visit. Also the validation team on verifying with publicly available sources such as internet, could not find any environmental clearances required for the recovery and use of biogas from waste water treatment from Tapioca starch industries in Thailand, hence accepted. CL 7 is closed after review of 1st response.
CL8 1. The Organisation chart in the MR has been revised; PP is requested to submit the recent approved organisation chart explaining the CDM monitoring plan functions. 2. PP is requested to provide details of the training planned and provided during this monitoring period and submit relevant records 3. PP is requested to provide the records of internal audits conducted on the CDM monitoring system.	C.6.4	1. The orgaization chart in section 3.3 of MR is revised. 2.The training records are submitted. The training plan is not established. However , as per the information from MD , the training will be provided for new staff and refresh by the supervisor within a proper period. 3. The internal audit report by consultant is provided.	1. The organisation chart has been updated , consistent with site visit observations, hence accepted. 2. Training records of September 2010 and February 2012 have been provided. 3. The internal audit report has been provided however the date of the template and the date of internal audit contradict, PP is requested to clarify on the date and frequency of conduct of internal audits. CL 8 is open after review of 1st response.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
		<u>Second response:</u> The new audit report is submitted. The internal audit will be conducted at least 1 year before starting the verification , depended on the status of the project.	Second response: PP has provided the internal audit report dated 11-Nov-2012, appropriate, hence accepted. CL8 is closed after review of 2nd response.

TABLE 3 FORWARD ACTION REQUEST

Forward action request	Reference to Table 2	Response by project participants	Verification Conclusion
No FAR raised			



RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Rekha Menon

è qualificato come¹:
is qualified as:

**CDM/GS/VCS/JI/SC –TEC
CDM/VCS/GS/ACR –VAL, -VER, TL
TECHNICAL REVIEWER**

per le seguenti aree tecniche:
for the following technical areas:

1.2, 13.1, 13.2, 14.1, 15.2

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.2	Energy generation from renewable energy sources	1
13.1	Waste Handling and Disposal	13
13.2	Animal waste management	13
14.1	Forestry	14
15.2	Animal waste management	15

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	06-03-2008	-
9	03/06/2014	Update qualification according to IS-QPT-GHG-00 REV13

Il Resp. QPT
Head of QPT

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS: Verified Carbon Standard
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports



RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:

Amalorpavanathan Cyril Augustus Arokiasamy

We declare that Mr/Mrs/Ms:

è qualificato come¹:
is qualified as:

**CDM-TEC, CDM-VAL, CDM-VER, CDM-TL,
GS-TEC, GS-VAL, GS-VER, GS-TL,
SCS-TEC
VCS-TEC, VCS-VAL, VCS-VER, VCS-TL,
JI-TEC
TECHNICAL REVIEWER**

per le seguenti aree tecniche:
for the following technical areas:

1.1, 1.2, 3.1, 13.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.1	Thermal energy generation from fossil fuel and biomass including thermal electricity from solar	1
1.2	Energy generation from renewable energy sources	1
3.1	Energy Demand	3
13.1	Waste Handling and Disposal	13

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	30/06/2010	-
11	23/04/2014	Updated qualification according to IS-QPT-GHG-00 REV 13

Il Resp. QPT
Head of QPT

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS : Verified Carbon Standard:
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports



RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Reghu Raghavan Nair Kumar

è qualificato come¹:
is qualified as:

CDM-TEC, CDM-VAL, CDM-VER, CDM-TL, CDM-FIN-EXP
VCS-TEC, VCS-VAL, VCS-VER, VCS-TL, VCS-FIN-EXP
GS-TEC, GS-VAL, GS-VER, GS-TL, GS-FIN-EXP
SCS-TEC, SCS-VAL, SCS-VER, SCS-TL, SCS-FIN-EXP
JI-TEC, JI-FIN-EXP

per le seguenti aree tecniche:
for the following technical areas:

1.1, 1.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1, 6.1, 11.1, 13.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.1	Thermal energy generation from fossil fuel and biomass including thermal electricity from solar	1
1.2	Energy generation from renewable energy sources	1
4.3	Iron and steel	4
4.4	Refinery	4
4.5	Rubber and Plastics	4
4.6	Electrical/electro technical products	4
4.7	Coke/coal/char-coal production	4
4.8	Pulp and paper production	4
5.1	Chemical process industries	5
6.1	Construction	6
11.1	Chemical process industries	11
13.1	Waste Handling and Disposal	13

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	31-08-2009	-
7	03-06-2013	Annual revision

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Head of QPT

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RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Isil Timuroglu

è qualificato come¹:
is qualified as:

GS-TEC, GS-VAL, GS-VER, GS-TL,
VCS-TEC, VCS-VAL, VCS-VER, VCS-TL,
SCS-TEC, SCS-VAL, SCS-VER, SCS-TL,
Local expert (Turkish language),
CDM-TEC, CDM-VAL, CDM-VER, CDM-TL

per le seguenti aree tecniche:
for the following technical areas:

1.2, 13.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.2	Energy generation from renewable energy sources	1
13.1	Waste handling and disposal	13

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
-	13/02/2012	-
4	12/09/2013	Annual revision

Il Resp. QPT
Head of QPT

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RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Kumar Praveen Krishnan

è qualificato come¹:
is qualified as:

**CDM/GS/VCS/JI/SC-TEC,
CDM/VCS/GS -VAL, -VER**

per le seguenti aree tecniche:
for the following technical areas:

1.1

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.1	Thermal energy generation from fossil fuel and biomass including thermal electricity from solar	1

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	09-12-2010	-
8	21-05-2014	Updated qualification according to IS-QPT-GHG-00 REV13

Il Resp. QPT
Head of QPT

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