Verification and certification report form for CDM project activities

(Version 01.0)

Complete this form in accordance with the "Attachment: Instructions for filling out the verification and certification report form for CDM project activities" at the end of this form.

VERICATION AND CERTIFICATION REPORT	
Title of the project activity	Chao Khun Argo Biogas Energy Project
Reference number of the project activity	2138
Version number of the verification and certification report	2.0 Aa
Completion date of the verification and certification report	26/10/2016
Monitoring period number and duration of this monitoring period	Fifth monitoring period 01/11/2014 – 29/02/2016
Version number of monitoring report to which this report applies	03.1
Crediting period of the project activity corresponding to this monitoring period	09/03/2009 – 08/03/2019
Project participant(s)	Thai Biogas Energy Company Swedish Energy Agency
Host Party	Kingdom of Thailand
Sectoral scope(s), selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral scope 13: Waste handling and disposal and 01: Energy industries (renewable - / non-renewable sources) AM0022: Avoided Wastewater and On-site Energy Use Emission in the Industrial Sector, Version 04
Estimated GHG emission reductions or net anthropogenic GHG removals for this monitoring period in the registered PDD	64,134 tCO_2e annual average
Certified GHG emission reductions or net anthropogenic GHG removals for this monitoring period	77,635 tCO_2e
Name of DOE	RINA Services S.p.A
Name, position and signature of the approver of the verification and certification report	Laura SEVERINO – Sector Manager Sustainability, Environment & Climate Change 

SECTION A. Executive summary

Purpose and general description of the project activity.

As detailed in the registered PDD /03/, the Chao Khun Agro Biogas Energy Project was developed by Thai Biogas Energy Company Ltd. It is an industrial anaerobic wastewater treatment project, which treats wastewater from the cassava processing factory owned by Chao Khun Agro Products located in Saraburi, Thailand.

The purpose of the project activity is to reduce greenhouse gas emission from the anaerobic open lagoons used for wastewater treatment. The Covered In-Ground Anaerobic Reactor (CIGAR) will remove the organic material in the wastewater, thus reducing the Chemical Oxygen Demand (COD) and subsequent fugitive methane emissions. Biogas produced in the CIGAR will be used in the Chao Khun Agro Products factory to dry the wet starch cake to the final dry starch product, thereby displacing the fuel oil currently employed to dry the starch product. Surplus biogas, where produced, will be flared rather than released to the atmosphere. Therefore, the project activity reduces the greenhouse gas emission from direct methane emission and by replacing the fossil fuel used for heat generation.

Scope of verification

Verification is the periodic independent review and ex-post determination by a DOE of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period. Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified. The objective of this verification is to verify and certify emission reductions reported for the "Chao Khun Argo Biogas Energy Project" for the period 01/11/2014 – 29/02/2016.

The scope of verification is to verify that:

- The project activity has been implemented and operated in accordance with the registered PDD or any approved revised PDD;
- The monitoring plan complies with the monitoring methodology and the actual monitoring complies with the monitoring plan, including compliance with any guidance provided by the Board regarding deviations from the provisions of a registered plan and/or methodology;
- The data and calculation of GHG emission reductions have been assessed to correctly support the emission reductions being claimed.

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified.

Verification process.

Verification is conducted using RINA procedures in line with the requirements specified in the latest version of the CDM Validation and Verification Standard, relevant decisions of the CDM EB and applying standard auditing techniques. RINA assess and determines that the implementation and operation of the project activity, and steps taken to report emission reductions comply with the CDM criteria and relevant guidance provided by the Board. The verification assessment involved a document review of relevant documentation and the on-site visit.

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.

Conclusion.

RINA Services S.p.A. (RINA), commissioned by Thai Biogas Energy Company, has verified the greenhouse gas emission reductions reported for the project activity "Chao Khun Argo Biogas Energy Project" in the "Kingdom of Thailand", CDM Registration Reference N° 2138, for the period 01/11/2014 – 29/02/2016, with regard to the relevant requirements for CDM activities. The project was validated by Det Norske Veritas Certification (DNV) (validation report N° 2005-1475, revision 02, issued on 20/02/2009) and it was registered on 09/03/2009 under the CDM registration reference N° 3880.

The GHG emission reductions were calculated on the basis of the approved methodology AM0022, version 04, 'Avoided Wastewater and On-site Energy Use Emission in the Industrial Sector' of 21/12/2006 and the monitoring plan included in the registered Project Design Document, version 04 of 19/02/2009. In our opinion

the GHG emission reductions reported for the project in the monitoring report version 03.1 of 11/07/2016 are fairly stated.

SECTION B. Verification team, technical reviewer and approver

B.1. Verification team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk review	On-site inspection	Interview(s)	Verification findings
1.	Team Leader	IR	Menon	Rekha	RINA India	✓			✓
2.	CDM Verifier & Technical Expert TA 13.1	IR	Augustus Arokiasamy	Cyril	RINA India	✓	✓	✓	✓

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer TA 13.1	IR	Valoroso	Rita	RINA Central Office
2.	Approver	IR	Severino	Laura	RINA Central Office

SECTION C. Application of materiality

C.1. Consideration of materiality in planning the verification

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Human error	Minimal	This is the fifth verification period; personnel are familiar with the monitoring systems. The monitoring period is 16 months.	The verification results were as envisaged. The emission reduction calculation as per the version 01 of the MR was 80,680 tCO_2e. The ERs as per the MR submitted for issuance version 03.1 of 11/07/2016 is 77,635 tCO_2e, thus the change is less than 4%, which is due to error in calculation and there is no change in the monitored values. Hence the identified risks and response are appropriate and consistent with the Guidelines for application of materiality in verifications /01/ /25/
2.	Data management and transfer of information from meters / log books to emission reduction computation sheet	Minimal	As detailed in section C.2 below, data required for emission reduction calculation is metered and 100% verifiable against totalizer values.	

C.2. Consideration of materiality in conducting the verification

The project activity happens at a single site and 100% data is available for verification. Waste water quantities are measured continuously using flow meters. As both input and outputs flows are measured, this was cross checked and deemed accurate. Chemical Oxygen Demand and Quantity of chemical oxidising agents entering the treatment system is measured daily at in-house lab using spectrophotometer and COD is cross verified and adjusted based weekly analysis at external accredited labs. Biogas quantities are measured continuously using flow meters. NCV of biogas is measured through accredited lab once per year. Methane concentration in biogas is measured continuously annually through external accredited labs. Combustion efficiency of boiler is measured through online gas analysers. The overall possible biogas generation estimated as per the registered PDD, based on load entering the treatment system is compared with the overall biogas combusted and the most conservative value is used for emission reduction calculations. Hence as per para 410 and section 11.2.3 of the CDM Validation and Verification standard /19/ no significant reporting risks to the materiality of the verification were envisaged while planning for the verification and were not identified during the verification process.
In conclusion RINA confirms the data set to be free from material errors.

SECTION D. Means of verification

D.1. Desk review

The monitoring report, version 03.1 of 11/07/2016 and its previous versions /**01**/, the emission reduction calculations provided in the form of a spreadsheet (CKA-ERv03.1.xlsx) version 3.1 of 20/06/2016 and its previous versions /**02/**, were assessed as part of the verification. In addition the Project Design Document (PDD) /**03**/ in particular the baseline estimations and the monitoring plan, the first verification report No: 11CDMTH010005-11/422 of 18/06/2013, second verification report revision No. SQAS-CDM-ET07850004, third verification report revision No: MY-PVer 14/05 – 13/201 of 24/06/2014 /**04**/ and the fourth verification report revision No: MY-PVer 14/30 – 14/153 of 04/06/2014 /**16**/ and the validation report, revision 02 (No: 2005-1475) issued on 20/02/2009 /**05**/ for the project were reviewed.

The monitoring report version 01 of 04/03/2016 /**01**/ was made publicly available on the CDM UNFCCC website on 08/-3/2016 /**06**/. Appendix 3 lists the documentation that was reviewed during the verification.

D.2. On-site inspection

Duration of on-site inspection: 07/04/2016				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	During the on-site assessment of the project RINA assessed the implementation and operation of the proposed project activity, the monitoring equipment and systems, 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. There were no hindrances or barriers that were faced by the verification team while carrying out the site visits all equipment and processes of the project activity were accessible.	Project facility at Chao Khun Agro Products Project, 44 Moo 2, Songkorn, Kaengkoi, Saraburi, 18110, Thailand.	07/04/2016	Cyril Augustus Arokiasamy

D.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Sirisareewan	Pasu	TBEC – HQ QESH and CDM Manager	07/04/2016	Project implementation and operation. Technical equipment, calibration and monitoring observation. Management of the monitoring equipment and data collection. Monitoring plan and monitoring parameters.	Cyril Augustus Arokiasamy
2.	Kulsitthichaiya	Weeravit	TBEC – HQ CDM Officer	07/04/2016		Cyril Augustus Arokiasamy
3.	Laojaturapith	Naruchit	TBEC – CKA Plant Manager	07/04/2016	Management of the whole CDM project activity. Implementation of the project activity.	Cyril Augustus Arokiasamy
4.	Janjang	Chalong	TBEC – CKA Shift leader	07/04/2016	Technical equipment, calibration and monitoring observation. Information flows for generating, aggregating and reporting the monitoring parameters. Cross-check of information in the monitoring report and data source.	Cyril Augustus Arokiasamy
5.	Pormsuwan	Pornthip	TBEC – CKA Lab Technician	07/04/2016		Cyril Augustus Arokiasamy
6	Padbueng	Aumpa	TBEC – CKA Admin	07/04/2016		Cyril Augustus Arokiasamy
7	Poonrat	Eakburin	TBEC – CKA Maintenance	07/04/2016		Cyril Augustus Arokiasamy

D.4. Sampling approach

The project activity happens at a single site and 100% data is available for verification. Hence no sampling was required.

D.5. Clarification requests, corrective action requests and forward action requests raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form		1	
Compliance of the project implementation with the registered PDD			
Post-registration changes			
Compliance of the monitoring plan with the monitoring methodology including applicable tool and standardized baseline			
Compliance of monitoring activities with the registered monitoring plan	1	2	

Compliance with the calibration frequency requirements for measuring instruments			
Assessment of data and calculation of emission reductions or net removals		3	
Others (please specify)			
Total	1	6	

SECTION E. Verification findings

E.1. Compliance of the monitoring report with the monitoring report form

Means of verification	The Monitoring Report for the project activity "Chao Khun Argo Biogas Energy Project", in "Kingdom of Thailand", version 03.1 of 11/07/2016 and the previous versions /01/ submitted by Thai Biogas Energy Company have been the basis for the verification process and is based on the currently valid MR template /08/.
Findings	N/A
Conclusion	RINA confirms that the above MR is based on the currently valid MR template /**08/** and is completed in accordance with the applicable instruction **/07**/.

E.2. Remaining forward action requests from validation and/or previous verification

Based on the review of validation report **/05**/, no FAR was raised during the validation and there were no FAR raised during the previous verifications for this project activity **/04/ /16/**.

E.3. Compliance of the project implementation with the registered project design document

Means of verification	***Actual implementation of the registered project activity*** RINA has performed a site visit to verify the real implementation of the project against the description in its registered PDD **/01/** and found that the project implementation is in accordance with the registered PDD /**01/**. The project activity was commissioned on 16/12/2006 as confirmed from the registered PDD **/01/**. The primary emissions reduction component stems from capturing fugitive methane emissions through a Covered In-Ground Anaerobic Reactor (CIGAR) of capacity 41,000 m^3, a type of anaerobic digester, which consists of a series of baffled reactors connected only by overflow weirs. The CIGAR consists of a piping system that moves the biogas from the digester to the flare and dual fuel burner. The generated biogas is fired in a Loos boiler with capacity 15 ton steam per hour at 195°C and 13 bar. The burner is WKGMS70/2-A from Weishaupt. Both the boiler and burner are sourced from Germany **/22/.** Excess biogas is sent 2000 Nm^3 per hour flare from Organics Ltd. The flame is detected by a UV sensor **/23/.** During the site visit, no changes have been observed or identified which may impact the additionality as there was no change in the effective output capacity, no addition of component nor extension of technology, no addition nor removal of project sites since there is only one site of the project activity, no change of values of the actual operational parameter relevant to determination of emission reductions which are within the control of the PP; no change has been observed or identified that may impact the scale of the project activity or applicability of baseline and monitoring methodology AM0022, version 04 **/11**/. There are no data and variables provided in the monitoring report that is different from that stated in the registered PDD which has caused an increase in estimates of the emission reductions in the current monitoring period or is highly likely to increase the estimates of emission reductions in the future monitoring periods.
Findings	CAR 1.1: PP is requested to submit copy of the process flow diagram of the project activity giving details of the project equipment and the position of monitoring equipment. CAR 1.2: PP is requested to provide the technical specification sheet for all monitoring equipment.

	Please refer to Appendix 4 of this report. This finding was closed appropriately.
Conclusion	In conclusion, RINA is able to confirm that the implementation and operation of the project during the fifth monitoring period is consistent with the registered PDD/03/; the information provided in the MR /01/ is also in accordance with the description of the registered PDD.

E.4. Post-registration changes

N/A

E.4.1. Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline

N/A

E.4.2. Corrections

N/A

E.4.3. Changes to the start date of the crediting period

N/A

E.4.4. Inclusion of a monitoring plan to a registered project activity

N/A

E.4.5. Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline

N/A

E.4.6. Changes to the project design of a registered project activity

N/A

E.4.7. Types of changes specific to afforestation and reforestation project activities

N/A

E.5. Compliance of monitoring plan with the monitoring methodology including applicable tool and standardized baseline

Means of verification	During this monitoring period, the validated and registered monitoring plan was found to be in accordance with the applied methodology, AM0022, version 04 /**11/**
Findings	N/A
Conclusion	RINA confirms that the registered monitoring plan is in accordance with the approved methodology and applicable methodological tools.

E.6. Compliance of monitoring activities with the registered monitoring plan

The monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD. The following tables describe for each parameter which is to be measured according to the monitoring plan and how RINA has verified that the actual monitoring complies with the monitoring plan and that data have been assessed to correctly support the emission reductions being claimed.

E.6.1. Data and parameters fixed ex ante or at renewal of crediting period

Means of verification				
	DATA/PARAMETER Unit	Source of data	Reported value for the project period	Assessment/Observation

Methane emission factor **(EF_{CH4})**	Data based on registered PDD /03/ and validation report /05/	0.21kgCH_4/kg COD	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
Global Warming Potential for methane **(GWP_{CH4})**	Data based on registered PDD /03/ and validation report /05/ and IPCC fourth assessment report /20/	25 tCO_{2e}/tCH_4	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB. As per Annex 3, EB 69, following decision 4/CMP.7 the GWP of CH_4 for the second commitment period (from 01/01/2013) is applied.
Amount of organic material degraded aerobically in the lagoon system **($M_{lagoon\_aerobic}$)**	Data based on registered PDD /03/ and validation report /05/	254 Kg COD/ha/day	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
Total organic material removal ratio of the lagoon **(R_{lagoon})**	Data based on registered PDD /03/ and validation report /05/	96%	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
Organic material deposition ratio of the lagoon ($R_{deposition}$)	Data based on registered PDD /03/ and validation report /05/	1.78%	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
Net calorific value of fuel oil ($NCV_{fuel,oil}$)	Data based on registered PDD /03/ and validation report /05/	39.996 x 10^{-6} TJ/dm^3	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
Carbon emission factor of the fuel oil ($EF_{fuel,oil}$)	Data based on registered PDD /03/ and validation report /05/	77.367 tCO_2/TJ	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
Total lagoon area (Lagoon surface area)	Data based on registered PDD /03/ and validation report /05/	2.09 Ha	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.

	Flare efficiency for open flare (**Flare efficiency**)	Data based on registered PDD /03/ and validation report /05/	50%	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
	Reduction factor for SO_4^{2-} oxidative substance ($R_{SO4^{2-}}$)	Data based on registered PDD /03/ and validation report /05/	651 Kg/tonne (kg COD/ tSO_4^{2-})	The value is ex-ante fixed for the crediting period as per the registered PDD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB.
Findings	CAR2: The unit for GWP is not consistent with the one available in the registered PDD /01/ Please refer to Appendix 4 of this report. This finding was closed appropriately.			
Conclusion	Hence, RINA is able to confirm that the Data and parameters fixed ex ante have been implemented in full compliance with the registered monitoring plan, with the applied methodology and methodological tools and that they are the same used at the validation stage and in the previous verifications.			

E.6.2. Data and parameters monitored

Means of verification

Data/Parameter	Assessment
Data Unit	$WW_{input;}$ m^3
Description	Daily wastewater flows entering system boundary.
Source of data to be used	Measured values, from daily reports by SCADA.
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014 — Total m^3: 129,971 Period: 01/01/2015 – 31/12/2015 — Total m^3: 798,244 Period: 01/01/2016 – 29/02/2016 — Total m^3: 149,577
Monitoring equipment	Tag No: FT01 Manufacturer: ABB Type/Model: Process Master Serial No.: 3K672012180487 /27/
Accuracy of the monitoring equipment	The meter is of accuracy ±0.40%. /42/
Measuring/Reading/Recording frequency	Continuously monitored and daily recording.
Calculation method (if applicable)	Not applicable
Data/Parameter	Assessment
Data Unit	$WW_{output;}$ m^3
Description	Daily wastewater flow leaving treatment system
Source of data to be used	Measured values, from daily reports by SCADA.
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014 — Total m^3: 129,866 Period: 01/01/2015 – 31/12/2015 — Total m^3: 802,001 Period: 01/01/2016 – 29/02/2016 — Total m^3: 150,112
Monitoring equipment	Tag No: FT05 Manufacturer: ABB Type/Model: Process Master

	Serial No.: 3K672012180486 Period of Use: 01/11/2014 - 17/02/2015 /**13**/ Manufacturer: ABB Type/Model: XEDE43F Serial No.: 6710090063 Period of Use: from 18/02/2015 /**13**/
Accuracy of the monitoring equipment	Meter Serial No.: 3K672012180486 is of accuracy ±0.40% /42/ and Meter Serial No.: 6710090063 is of accuracy ±0.50% /51/. The PDD does not state the accuracy of the meter. The meter changed by PP is of comparable accuracy, hence accepted.
Measuring/Reading/Recording frequency	Continuously monitored and daily recording.
Calculation method (if applicable)	Not applicable.

Data/Parameter	Assessment
Data Unit	**COD_{input}**; KgCOD/m^3
Description	Wastewater organic material concentration entering the project boundary
Source of data to be used	Analysed daily at in-house quality control lab, lab records.
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014; Average kgCOD/ m^3: 13.613 Period: 01/01/2015 – 31/12/2015; Average kgCOD/ m^3: 17.814 Period: 01/01/2016 – 29/02/2016; Average kgCOD/ m^3: 11.780
Monitoring equipment	Manufacturer: Hach Type/Model: Spectrophotometer / DR2800 Serial No.: 1156884 Period of Use: 01/11/2014 - 04/02/2015 /**13**/ Manufacturer: Merck Type/Model: Spectrophotometer / Pharo 100 Serial No.: 141410128 Period of Use: from 05/02/2015 /**13**/ Manufacturer: Hach Type/Model: COD Reactor / DRB200 Serial No.: 10110C0201
Accuracy of the monitoring equipment	Meter with Serial No.: 1156884 is of accuracy ±1.5nm meter /44/ and Meter with Serial No.: 141410128 is of accuracy ±1.0nm meter /45/. The PDD does not state the accuracy of the meter. The meter changed by PP is of comparable accuracy, hence accepted. The COD reactor with Serial No.: 10110C0201 is of ± 1°C accuracy /43/.
Measuring/Reading/Recording frequency	Measured by lab technician daily at in-house lab and daily recording. The PDD /03/ requires

	weekly testing by external accredited lab for cross checking and accuracy. This has been carried out /17/ and the COD values have been conservatively adjusted /02/ as per the registered PDD /03/.
Calculation method (if applicable)	The test result is reported in mg COD/l. This unit is converted to kg COD/m^3 by simple unit conversion.

Data/Parameter	Assessment
Data Unit	**COD_{output}**; KgCOD/m^3
Description	Wastewater organic material concentration leaving the treatment facility
Source of data to be used	Analysed daily at in-house quality control lab, lab records.
Value of monitored parameter for the monitoring period	Period: Average kgCOD/ m^3 01/11/2014 – 31/12/2014: 5.994 01/01/2015 – 31/12/2015: 5.029 01/01/2016 – 29/02/2016: 3.873
Monitoring equipment	Manufacturer: Hach Type/Model: Spectrophotometer / DR2800 Serial No.: 1156884 Period of Use: 01/11/2014 - 04/02/2015 /**13**/ Manufacturer: Merck Type/Model: Spectrophotometer / Pharo 100 Serial No.: 141410128 Period of Use: from 05/02/2015 /**13**/ Manufacturer: Hach Type/Model: COD Reactor / DRB200 Serial No.: 10110C0201
Accuracy of the monitoring equipment	Meter with Serial No.: 1156884 is of accuracy ±1.5nm meter /44/ and Meter with Serial No.: 141410128 is of accuracy ±1.0nm meter /45/. The PDD does not state the accuracy of the meter. The meter changed by PP is of comparable accuracy, hence accepted. The COD reactor with Serial No.: 10110C0201 is of ± 1°C accuracy /43/.
Measuring/Reading/Recording frequency	Measured by lab technician daily at in-house lab and daily recording. Measured by lab technician daily at in-house lab and daily recording. The PDD /03/ requires weekly testing by external accredited lab for cross checking and accuracy. This has been carried out /17/ and the COD values have been conservatively adjusted /02/ as per the registered PDD /03/.
Calculation method (if applicable)	The test result is reported in mg COD/l. This unit is converted to kg COD/m^3 by simple unit conversion.

Data/Parameter	Assessment
Data Unit	**Vheat**; Nm^3
Description	Volume of biogas sent to facility heaters.
Source of data to be used	Measured values, from daily reports by SCADA.
Value of monitored parameter for the monitoring period	Period: Total Nm^3 01/11/2014 – 31/12/2014: 1,022,456 01/01/2015 – 31/12/2015: 5,738,038 01/01/2016 – 29/02/2016: 573,706
Monitoring equipment	Tag No: FT02 Manufacturer: ABB Type/Model: Sensyflow FMT500 IG Serial No.: 00000124
Accuracy of the monitoring equipment	The meter is of accuracy ±0.95% /46/
Measuring/Reading/Recording frequency	Continuously monitored and daily recording.
Calculation method (if applicable)	Not applicable.

Data/Parameter	Assessment
Data Unit	$\mathbf{V_{flare}}$ (also $FV_{FG,h}$); Nm^3
Description	Biogas sent to flare
Source of data to be used	Measured values, from daily reports by SCADA.
Value of monitored parameter for the monitoring period	Period: Total Nm^3 01/11/2014 – 31/12/2014: 0 01/01/2015 – 31/12/2015: 0 01/01/2016 – 29/02/2016: 0
Monitoring equipment	Tag No: FT04 Manufacturer: ABB Type/Model: Sensyflow FMT500 IG Serial No.: 00000294
Accuracy of the monitoring equipment	The meter is of accuracy ±0.95% /46/
Measuring/Reading/Recording frequency	Continuously monitored and daily recording.
Calculation method (if applicable)	Not applicable.

Data/Parameter	Assessment
Data Unit	$\mathbf{C_{so_4^{2-}\ in}}$; Tonnes/$m^3$
Description	Amount of chemical oxidising agents entering system boundary.

Source of data to be used	Analysed daily at in-house quality control lab, lab records.
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014, Average Tonnes / m^3: 0.000185 Period: 01/01/2015 – 31/12/2015, Average Tonnes / m^3: 0.000373 Period: 01/01/2016 – 29/02/2016, Average Tonnes / m^3: 0.000520
Monitoring equipment	Manufacturer: Hach Type/Model: Spectrophotometer / DR2800 Serial No.: 1156884 Period of Use: 01/11/2014 - 04/02/2015 /**13**/ Manufacturer: Merck Type/Model: Spectrophotometer / Pharo 100 Serial No.: 141410128 Period of Use: from 05/02/2015 /**13**/ Manufacturer: Hach Type/Model: COD Reactor / DRB200 Serial No.: 10110C0201
Accuracy of the monitoring equipment	Meter with Serial No.: 1156884 is of accuracy ±1.5nm meter /44/ and Meter with Serial No.: 141410128 is of accuracy ±1.0nm meter /45/. The PDD does not state the accuracy of the meter. The meter changed by PP is of comparable accuracy, hence accepted. The COD reactor with Serial No.: 10110C0201 is of ± 1°C accuracy /43/.
Measuring/Reading/Recording frequency	Measured by lab technician daily at in-house lab and daily recording.
Calculation method (if applicable)	The test result is reported in mg/l. This unit is converted to tonnes/m^3 by simple unit conversion.

Data/Parameter	Assessment
Data Unit	$C_{SO_4^{2-}\ out}$; Tonnes/m^3
Description	Amount of chemical oxidizing agents out of the digester
Source of data to be used	Analysed daily at in-house quality control lab, lab records.
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014, Average Tonnes / m^3: 0.000007 Period: 01/01/2015 – 31/12/2015, Average Tonnes / m^3: 0.000035 Period: 01/01/2016 – 29/02/2016, Average Tonnes / m^3: 0.000074
Monitoring equipment	Manufacturer: Hach Type/Model: Spectrophotometer / DR2800 Serial No.: 1156884 Period of Use: 01/11/2014 - 04/02/2015 /**13**/ Manufacturer: Merck Type/Model: Spectrophotometer / Pharo 100

	Serial No.: 141410128 Period of Use: from 05/02/2015 /**13**/ Manufacturer: Hach Type/Model: COD Reactor / DRB200 Serial No.: 10110C0201
Accuracy of the monitoring equipment	Meter with Serial No.: 1156884 is of accuracy ±1.5nm meter /44/ and Meter with Serial No.: 141410128 is of accuracy ±1.0nm meter /45/. The PDD does not state the accuracy of the meter. The meter changed by PP is of comparable accuracy, hence accepted. The COD reactor with Serial No.: 10110C0201 is of ± 1°C accuracy /43/.
Measuring/Reading/Recording frequency	Measured by lab technician daily at in-house lab and daily recording.
Calculation method (if applicable)	The test result is reported in mg/l. This unit is converted to tonnes/m^3 by simple unit conversion.

Data/Parameter	Assessment
Data Unit	**$WW_{bypassing}$**; m^3
Description	Flow of wastewater directly to the current water treatment system and bypassing the new wastewater treatment facility.
Source of data to be used	Measured values, from daily reports by SCADA.
Value of monitored parameter for the monitoring period	Period: Total m^3 01/11/2014 – 31/12/2014: 0 01/01/2015 – 31/12/2015: 0 01/01/2016 – 29/02/2016: 0
Monitoring equipment	Tag No: FT06 Manufacturer: ABB Type/Model: Process Master Serial No.: 3K672011450101
Accuracy of the monitoring equipment	The meter is of accuracy ±0.40%. /42/
Measuring/Reading/Recording frequency	Continuously monitored and daily recording.
Calculation method (if applicable)	Not applicable

Data/Parameter	Assessment
Data Unit	**Biogas loss from pipeline: %**
Description	Loss of biogas from pipeline
Source of data to be used	Hydrostatic pressure test is done for the biogas pipeline once per year to ensure that the pipeline is leak free /12/.

Report No.	Date	Validity	Testing agency
RP-P51-	25/12/2015	24/12/2016	STIC

	160112 | | | | RP-P51-140932 | 04/08/2014 | 03/08/2015 | STIC
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014, Total m^3: 0 Period: 01/01/2015 – 31/12/2015, Total m^3: 0 Period: 01/01/2016 – 29/02/2016, Total m^3: 0
Monitoring equipment	The biogas pipeline pressure test has been carried out by accredited third party. The credentials of the tester is available as part of the report /12/.
Accuracy of the monitoring equipment	Not applicable.
Measuring/Reading/Recording frequency	Integrity of biogas pipeline for losses of biogas methane is tested annually by accredited external agencies through pressurizing the system and establishing pressure drop through leakage. Consistent with the registered PDD /03/. The tests carried out do not cover the period between 03/08/2015 and 25/12/2015 /12/. The amount of methane expressed in (tCO_2e) contained in the biogas collected from anaerobic treatment facility (ECH_{4_coll}) is measured and the conservative value is used for emission reductions, also the PP conducts daily (using gas detectors) and weekly (using soap water) leak test to ensure that the biogas pipeline is leak free, hence it is deemed that the emission reductions achieved are conservative.
Calculation method (if applicable)	Not applicable.

Data/Parameter	Assessment
Data Unit	**NCV_{biogas}**; J/Nm^3
Description	Biogas calorific value
Source of data to be used	Measured through Accredited lab /14/ once per year. Report No. COA-EX-1309-00143, Date 29/08/2013, Validity 28/08/2014, Testing agency PTTGC Report No. COA-EX-1412-01640, Date 15/12/2014, Validity 14/12/2015, Testing agency PTTGC Report No. LAR-EX-1601-00992, Date 08/01/2016, Validity 07/01/2017, Testing agency PTTGC
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014, NCV_{biogas} (J/Nm^3): 21,125,796 Period: 01/01/2015 – 31/12/2015, NCV_{biogas} (J/Nm^3): 19,672,728 Period: 01/01/2016 – 29/02/2016, NCV_{biogas} (J/Nm^3): 19,896,253
Monitoring equipment	NCV of biogas has been measured through accredited lab /21/. The measurement cover the entire monitoring period

Accuracy of the monitoring equipment	Not applicable.
Measuring/Reading/Recording frequency	Measurements are done once annually. Found to cover the entire monitoring period. Consistent with the registered PDD /03/
Calculation method (if applicable)	The values in the test reports are available in btu/ft^3 and converted to J/Nm^3. Calculations are available in ER sheet and found appropriate /02/.

Data/Parameter	Assessment
Data Unit	**PE_{flare}; tCO_2e**
Description	Project emissions from flaring of the residual gas stream
Source of data to be used	Calculated and available in the ER sheet /02/
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014; PE_{flare} (tCO_2e): 0 Period: 01/01/2015 – 31/12/2015; PE_{flare} (tCO_2e): 0 Period: 01/01/2016 – 29/02/2016; PE_{flare} (tCO_2e): 0
Monitoring equipment	Not applicable.
Accuracy of the monitoring equipment	Not applicable.
Measuring/Reading/Recording frequency	Not applicable.
Calculation method (if applicable)	Following the "Tool to determine project emissions from flaring gases containing methane" /11/ as detailed in the registered PDD /03/

Data/Parameter	Assessment
Data Unit	**F; dm^3**
Description	Fossil fuel volume equivalent to generate the same amount of heat generated from the biogas collected in anaerobic treatment facility
Source of data to be used	Calculated and available in the ER sheet /02/
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014; F (dm^3): 540,059 Period: 01/01/2015 – 31/12/2015; F (dm^3): 2,822,354 Period: 01/01/2016 – 29/02/2016; F (dm^3): 285,394
Monitoring equipment	Not applicable.
Accuracy of the monitoring equipment	Not applicable.
Measuring/Reading/Recording frequency	Not applicable.

Calculation method (if applicable)	Calculated from V_{heat}, NCV_{biogas} and NCV_{fuel}. Consistent with registered PDD /03/.

Data/Parameter	Assessment
Data Unit	**C_{CH4}** (also $FV_{CH4,y}$); % of Nm^3/Nm^3
Description	Biogas methane concentration
Source of data to be used	Measured values, from daily reports by SCADA.
Value of monitored parameter for the monitoring period	Period: 01/11/2014 – 31/12/2014; Average (% of Nm^3/Nm^3): 58.19 Period: 01/01/2015 – 31/12/2015; Average: 58.04 Period: 01/01/2016 – 29/02/2016; Average: 58.09
Monitoring equipment	Tag No: XT01 Manufacturer: ANRI Type/Model: CAM-3L Serial No.: LFB-028 Period of Use: 01/11/2014 – 09/04/2015 /**13**/ Manufacturer: JE Type/Model: Gas analyser Serial No.: 35286 Period of Use: 10/04/2015 – 27/11/2015 /**13**/ Manufacturer: Edinburgh Type/Model: Guardian NG Serial No.: 8008 Period of Use: From 28/11/2015 /**13**/
Accuracy of the monitoring equipment	The meter is of accuracy ±2% /47-49/
Measuring/Reading/Recording frequency	Continuously monitored and daily recording.
Calculation method (if applicable)	Only CH_4 is monitored, remaining part is considered as N_2 (simplified approach as per tool applied in registered PDD /03/). The monitored value is multiplied by CH_4 density of 0.0007168 tCH_4/m^3CH_4 from ACM0001 at normal conditions to obtain value of CCH_4 in tCH_4/Nm^3. Consistent with the registered PDD

Data/Parameter	Assessment
Data Unit	**F_{heat}; %**
Description	Heating system combustion efficiency
Source of data to be used	Measured through accredited laboratories once per year /50/

	Value of monitored parameter for the monitoring period	<table><tr><th>Period</th><th>F_{heat} (%)</th></tr><tr><td>01/11/2014 – 31/12/2014</td><td>91.41</td></tr><tr><td>01/01/2015 – 31/12/2015</td><td>90.87</td></tr><tr><td>01/01/2016 – 29/02/2016</td><td>90.87</td></tr></table>
	Monitoring equipment	Not applicable.
	Accuracy of the monitoring equipment	Not applicable.
	Measuring/Reading/Recording frequency	Measurements are done once annually. Consistent with the registered PDD /03/. The PDD also refers that "There will be 2 boilers used: Bertrams Konus (f_{heat}=87) and Wieslock (f_{heat}=89.5). The average of the two boilers will be considered as overall f_{heat}". These boilers are not present at site. The combustion efficiency of the Loos boiler with capacity 15 ton steam per hour at 195°C and 13 bar is measured. The burner is WKGMS70/2-A from Weishaupt. Both the boiler and burner are sourced from Germany /22/. This information is consistent with the PDD and the previous verification reports /04//16/ and site visit observations.
	Calculation method (if applicable)	Not applicable.

	Data/Parameter	Assessment
	Data Unit	**$M_{removed}$;** tCOD
	Description	Organic material removed from wastewater facility
	Source of data to be used	Calculated and available in the ER sheet /02/
	Value of monitored parameter for the monitoring period	<table><tr><th>Period</th><th>$M_{removed}$ (tCOD)</th></tr><tr><td>01/11/2014 – 31/12/2014</td><td>991</td></tr><tr><td>01/01/2015 – 31/12/2015</td><td>10,187</td></tr><tr><td>01/01/2016 – 29/02/2016</td><td>1,181</td></tr></table>
	Monitoring equipment	Not applicable.
	Accuracy of the monitoring equipment	Not applicable.
	Measuring/Reading/Recording frequency	Not applicable.
	Calculation method (if applicable)	Calculated from COD_{input} and COD_{output} and WW_{input} and WW_{output}. Consistent with registered PDD /03/.
Findings.	CAR 3.1 : Value of the parameter WW_{input} for the period 01/01/2015 – 31/12/2015 provided in the MR is not consistent with the ER sheet provided /02/. CAR 3.2: The Serial number of the Merck Spectrophotometer model Pharo 100 as mentioned in the MR is not consistent with the site visit observations and the calibration records /26/ CAR 3.3: The registered PDD requires weekly testing by external accredited lab for cross checking and accuracy. However the information of analysis, cross check and accuracy correction, if any is not available in the report. PP is requested to submit copies of the analysis report.	

	Please refer to CAR 1.2 in Appendix 4 of this report. CL 1.1: The test report details provided in the MR to estimate the loss of biogas from pipeline does not cover the monitoring period. CL 1.2: Values of NCV of biogas in the test reports are available in btu/ft^3 and converted to J/Nm^3. However the MR in the place specified for calculation method does not give any information on this conversion. CL 1.3: The model number of ANRI gas analyser as mentioned in the MR is not consistent with the calibration report submitted. CL 1.4: Details of F_{heat} test reports are not available in the MR. PP is requested to submit copy of the test reports. Please refer to Appendix 4 of this report. Findings raised above were closed appropriately.
Conclusion	RINA confirms: - that all the parameters listed in the registered MP have been monitored**;** - The responsibilities and authorities for monitoring and reporting are in accordance with those states in the registered monitoring plan; - The monitoring results are consistently recorded as per the approved frequency; - Quality assurance and quality control procedure have been applied in accordance with the registered PDD.

E.6.3. Implementation of sampling plan

Means of verification	N/A
Findings	N/A
Conclusion	N/A

E.7. Compliance with the calibration frequency requirements for measuring instruments

Means of verification

Data/Parameter	Assessment
Data Unit	$WW_{input;}$ m^3
Description	Daily wastewater flows entering system boundary.
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Once in 2 years. The PDD does not give the calibration frequency for this flow meter, however the same was found consistent with previous verification reports /04/ /16/ and the respective calibration report.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The flow meter was calibrated on 18/07/2014 (with validity till 17/07/2016) /27/. Hence, it covers the monitoring period.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>3K672012180487</td><td>By MIT dated 18/07/2014; certificate no. L1407-292 valid until 17/07/2016 /27/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or institution?	MIT (the calibrating agency) is an accredited laboratory /21/.

Data/Parameter	Assessment
Data Unit	$WW_{output;}$ m^3
Description	Daily wastewater flow leaving treatment system

Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Once in 2 years. The PDD does not give the calibration frequency for this flow meter, however the same was found consistent with previous verification reports /04/ /16/ and the respective calibration report.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The flow meter of Serial No.: 3K672012180486 was calibrated on 07/05/2014 (with validity till 06/05/2015) /28/. The flow meter of Serial No.: 6710090063 was calibrated on 12/02/2015 (with validity till 11/02/2017) /29/. Hence, it covers the monitoring period. The calibration frequency of all the meters were checked with the previous calibrations records and found that the calibration frequency has been respected.
Calibration certificates	

Meter no.	Calibration details
3K672012180486	By MIT dated 07/05/2014; certificate no. L1405-137 valid until 06/05/2016 /28/.
6710090063	By MIT dated 12/02/2015; certificate no. L1502-307 valid until 11/02/2017 /29/.

Does the calibration of metershave be done by an accredited person or institution?	MIT (the calibrating agency) is an accredited laboratory /21/.

Data/Parameter	Assessment
Data Unit	**COD_{input}**; KgCOD/m^3
Description	Wastewater organic material concentration entering the project boundary
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once per year. The PDD does not give the calibration frequency for the spectrophotometer and the COD reactor, however the same was found consistent with previous verification reports /04/ /16/ and the respective calibration report.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The spectrophotometer of Serial No.: 1156884 was calibrated on 17/09/2014 (with validity till 16/09/2015) /30/. The spectrophotometer of Serial No.: 141410128 was calibrated on 30/01/2015 (with validity till 29/01/2016) /32/ and on 27/01/2016 (with validity till 26/01/2017) /31/. Hence, it covers the monitoring period. The COD reactor of Serial No.: 10110C0201 was calibrated on 17/09/2014 (with validity till 15/09/2016) /33/ and on 16/09/2015 (with validity till 15/09/2016) /33/. Hence, it covers the monitoring period. The calibration frequency of all the meters were checked with the previous calibrations

	records and found that the calibration frequency has been respected.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>1156884</td><td>a) By SPC dated 17/09/2014; certificate no. C0140337 valid until 16/09/2015 /30/.</td></tr><tr><td>141410128</td><td>b) By SPC dated 27/01/2016; certificate no. C06160085 valid until 26/01/2017 /31/. c) By Bangkok High Lab dated 30/01/2015; certificate no. S2015/060 valid until 29/01/2016/32/.</td></tr><tr><td>10110C0201</td><td>a) By SPC dated 17/09/2014; certificate no. C17140093 valid until 16/09/2015 /33/. b) By SPC dated 16/09/2015; certificate no. C17150124 valid until 15/09/2016 /33/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or institution?	SPC and Bangkok High Lab (the calibrating agencies) are accredited laboratories /21/.

Data/Parameter	Assessment
Data Unit	**COD_{output}**; KgCOD/m^3
Description	Wastewater organic material concentration leaving the treatment facility.
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once per year. The PDD does not give the calibration frequency for the spectrophotometer and the COD reactor, however the same was found consistent with previous verification reports /04/ /16/ and the respective calibration reports.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The spectrophotometer of Serial No.: 1156884 was calibrated on 17/09/2014 (with validity till 16/09/2015) /30/. The spectrophotometer of Serial No.: 141410128 was calibrated on 30/01/2015 (with validity till 29/01/2016) /32/ and on 27/01/2016 (with validity till 26/01/2017) /31/. Hence, it covers the monitoring period. The COD reactor of Serial No.: 10110C0201 was calibrated on 17/09/2014 (with validity till 15/09/2016) /33/ and on 16/09/2015 (with validity till 15/09/2016) /33/. Hence, it covers the monitoring period. The calibration frequency of all the meters were checked with the previous calibrations records and found that the calibration

	frequency has been respected.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>1156884</td><td>By SPC dated 17/09/2014; certificate no. C0140337 valid until 16/09/2015 /30/.</td></tr><tr><td>141410128</td><td>a) By SPC dated 27/01/2016; certificate no. C06160085 valid until 26/01/2017 /31/. b) By Bangkok High Lab dated 30/01/2015; certificate no. S2015/060 valid until 29/01/2016/32/.</td></tr><tr><td>10110C0201</td><td>a) By SPC dated 17/09/2014; certificate no. C17140093 valid until 16/09/2015 /33/. b) By SPC dated 16/09/2015; certificate no. C17150124 valid until 15/09/2016 /33/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or institution?	SPC and Bangkok High Lab (the calibrating agencies) are accredited laboratories /21/.

Data/Parameter	Assessment
Data Unit	**V_{heat}**; Nm^3
Description	Volume of biogas sent to facility heaters.
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once in 3 years. The PDD does not give the calibration frequency for this flow meter, however the same was found consistent with the previous verification reports /04/ /16/ and the respective calibration reports.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The flow meter was calibrated on 25/11/2011 (with validity till 24/11/2014) /34/ and on 17/11/2014 (with validity till 16/11/2017) /35/. Hence, it covers the monitoring period.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>00000124</td><td>a) By ABB dated 25/11/2011; certificate no. 0184-D-K-15081-01-00-2011-11valid until 24/11/2014/34/. b) By MIT dated 17/11/2014; certificate no. L1411-310 valid until 16/11/2017/35/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or	MIT (the calibrating agency) is an accredited laboratory /21/. ABB is the manufacturer of the monitoring instrument.

institution?	

Data/Parameter	Assessment
Data Unit	$\mathbf{V_{flare}}$ (also $FV_{FG,h}$); Nm^3
Description	Biogas sent to flare
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once in 3 years. The PDD does not give the calibration frequency for this flow meter, however the same was found consistent with the previous verification reports /04/ /16/ and respective calibration reports.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The flow meter was calibrated on 12/12/2014 (with validity till 11/12/2017) /37/ and on 15/12/2011 (with validity till 14/12/2014) /36/. Hence, it covers the monitoring period.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>00000294</td><td>a) By ABB dated 15/12/2011; certificate no. 0186-D-K-15081-01-00-2011-12 valid until 14/12/2014 /36/. b) By MIT dated 12/12/2014; certificate no. L1412-263 valid until 11/12/2017 /37/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or institution?	MIT (the calibrating agency) is an accredited laboratory /21/. ABB is the manufacturer of the monitoring instrument.

Data/Parameter	Assessment
Data Unit	$\mathbf{C_{SO_4^{2-}\ in}}$; Tonnes/$m^3$
Description	Amount of chemical oxidising agents entering system boundary.
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once per year. The PDD does not give the calibration frequency for the spectrophotometer and the COD reactor, however the same was found consistent with previous verification reports /04/ /16 and the respective calibration reports.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The spectrophotometer of Serial No.: 1156884 was calibrated on 17/09/2014 (with validity till 16/09/2015) /30/. The spectrophotometer of Serial No.: 141410128 was calibrated on 30/01/2015 (with validity till 29/01/2016) /32/ and on 27/01/2016 (with validity till 26/01/2017) /31/. Hence, it covers the monitoring period. The COD reactor of Serial No.: 10110C0201 was calibrated on 17/09/2014 (with validity till 15/09/2016) /33/ and on 16/09/2015 (with validity till 15/09/2016) /33/. Hence, it covers the monitoring period.

	The calibration frequency of all the meters were checked with the previous calibrations records and found that the calibration frequency has been respected.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>1156884</td><td>a) By SPC dated 17/09/2014; certificate no. C0140337 valid until 16/09/2015 /30/.</td></tr><tr><td>141410128</td><td>a) By SPC dated 27/01/2016; certificate no. C06160085 valid until 26/01/2017 /31/. b) By Bangkok High Lab dated 30/01/2015; certificate no. S2015/060 valid until 29/01/2016/32/.</td></tr><tr><td>10110C0201</td><td>a) By SPC dated 17/09/2014; certificate no. C17140093 valid until 16/09/2015 /33/. b) By SPC dated 16/09/2015; certificate no. C17150124 valid until 15/09/2016 /33/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or institution?	SPC and Bangkok High Lab (the calibrating agencies) are accredited laboratories /21/.

Data/Parameter	Assessment
Data Unit	$C_{so_4^{2-}\ out}$; Tonnes/m^3
Description	Amount of chemical oxidizing agents out of the digester
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once per year. The PDD does not give the calibration frequency for the spectrophotometer and the COD reactor, however the same was found consistent with previous verification reports /04/ /16/ and the respective calibration reports.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The spectrophotometer of Serial No.: 1156884 was calibrated on 17/09/2014 (with validity till 16/09/2015) /30/. The spectrophotometer of Serial No.: 141410128 was calibrated on 30/01/2015 (with validity till 29/01/2016) /32/ and on 27/01/2016 (with validity till 26/01/2017) /31/. Hence, it covers the monitoring period. The COD reactor of Serial No.: 10110C0201 was calibrated on 17/09/2014 (with validity till 15/09/2016) /33/ and on 16/09/2015 (with validity till 15/09/2016) /33/. Hence, it covers the monitoring period. The calibration frequency of all the meters were checked with the previous calibrations

	records and found that the calibration frequency has been respected.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>1156884</td><td>a) By SPC dated 17/09/2014; certificate no. C0140337 valid until 16/09/2015 /30/.</td></tr><tr><td>141410128</td><td>b) By SPC dated 27/01/2016; certificate no. C06160085 valid until 26/01/2017 /31/. c) By Bangkok High Lab dated 30/01/2015; certificate no. S2015/060 valid until 29/01/2016/32/.</td></tr><tr><td>10110C0201</td><td>a) By SPC dated 17/09/2014; certificate no. C17140093 valid until 16/09/2015 /33/. b) By SPC dated 16/09/2015; certificate no. C17150124 valid until 15/09/2016 /33/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or institution?	SPC and Bangkok High Lab (the calibrating agencies) are accredited laboratories /21/.

Data/Parameter	Assessment
Data Unit	**$WW_{bypassing}$**; m^3
Description	Flow of wastewater directly to the current water treatment system and bypassing the new wastewater treatment facility.
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once in 2 years. The PDD does not give the calibration frequency for this flow meter, however the same was found consistent with the previous verification reports /04/ /16/ and the respective calibration reports.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The flow meter was calibrated on 12/11/2015 (with validity till 11/11/2017) /38/ and on 14/11/2013 (with validity till 13/11/2015) /38/. Hence, it covers the monitoring period.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>3K672011450101</td><td>a) By MIT dated 12/11/2015; certificate no. L1511-318 valid until 11/11/2017/38/. b) By MIT dated 14/11/2013; certificate no. LC1311-326 valid until 13/11/2015 /38/.</td></tr></table>

Does the calibration of metershave be done by an accredited person or institution?	MIT (the calibrating agency) is an accredited laboratory /21/. ABB is the manufacturer of the monitoring instrument.

Data/Parameter	Assessment
Data Unit	**Biogas loss from pipeline: %**
Description	Loss of biogas from pipeline
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Results are based on hydrostatic pressure test done by external agencies once a year, hence not applicable.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Not applicable
Calibration certificates	Not applicable.
Does the calibration of metershave be done by an accredited person or institution?	Not applicable.

Data/Parameter	Assessment
Data Unit	**$NCV_{biogas;}$** J/Nm^3
Description	Biogas calorific value
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Measured through Accredited lab /14/ once per year, hence not applicable.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Not applicable
Calibration certificates	Not applicable.
Does the calibration of metershave be done by an accredited person or institution?	Not applicable.

Data/Parameter	Assessment
Data Unit	**PE_{flare}; tCO_2e**
Description	Project emissions from flaring of the residual gas stream
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calculated parameter from other monitored parameters, hence not applicable.

Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Not applicable
Calibration certificates	Not applicable.
Does the calibration of metershave be done by an accredited person or institution?	Not applicable.

Data/Parameter	Assessment
Data Unit	**F; dm^3**
Description	Fossil fuel volume equivalent to generate the same amount of heat generated from the biogas collected in anaerobic treatment facility
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calculated parameter from other monitored parameters, hence not applicable.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Not applicable
Calibration certificates	Not applicable.
Does the calibration of metershave be done by an accredited person or institution?	Not applicable.

Data/Parameter	Assessment
Data Unit	**C_{CH4}** (also $FV_{CH4,y}$); % of Nm^3/Nm^3
Description	Biogas methane concentration
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calibrated once per year. The PDD does not give the calibration frequency, however the same was found consistent with previous verification reports /04/ /16/ and respective calibration reports
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is from 01/11/2014 to 29/02/2016. The Gas analyzer of Serial No.: LFB-028 was calibrated on 17/04/2014 (with validity till 16/04/2015) /39/. The Gas analyzer of Serial No.: 35286 was calibrated on 08/04/2015 (with validity till 07/04/2016) /40/. The Gas analyzer of Serial No.: 8008 was calibrated on 27/11/2015 (with validity till 26/11/2016) /41/. Hence, it covers the monitoring period. The calibration frequency of all the meters were checked with the previous calibrations

	records and found that the calibration frequency has been respected.
Calibration certificates	<table><tr><th>Meter no.</th><th>Calibration details</th></tr><tr><td>LFB-028</td><td>By Entech dated 17/04/2014; certificate no. G570127 valid until 16/04/2015 /30/.</td></tr><tr><td>35286</td><td>By Entech dated 08/04/2015; certificate no. G580136 valid until 07/04/2016 /40/.</td></tr><tr><td>8008</td><td>By Bangkok High Lab dated 27/11/2015; certificate no. G580523 valid until 26/11/2016 /41/.</td></tr></table>
Does the calibration of metershave be done by an accredited person or institution?	Entech is an accredited laboratory /21/.

Data/Parameter	Assessment
Data Unit	**F_{heat}; %**
Description	Heating system combustion efficiency
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Sourced from test reports by accredited laboratories once a year, hence not applicable.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Not applicable
Calibration certificates	Not applicable.
Does the calibration of metershave be done by an accredited person or institution?	Not applicable.

Data/Parameter	Assessment
Data Unit	**$M_{removed}$;** tCOD
Description	Organic material removed from wastewater facility
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	Calculated parameter from other monitored parameters, hence not applicable.
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	Not applicable
Calibration certificates	Not applicable.

	Does the calibration of metershave be done by an accredited person or institution?	Not applicable.
Findings	Please refer to CL 1 in Appendix 4 of this report. Above findings were appropriately closed.	
Conclusion	Applicable meters included in the Monitoring plan have been calibrated by accredited agencies and the calibration of the measuring equipment has been conducted at the frequency which represent the good monitoring practice since the registered PDD does not specify the calibration frequency.	

E.8. Assessment of data and calculation of emission reductions or net removals

E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification

Baseline emissions (E_{BL}) is calculated as follows:

$$\boldsymbol{E}_{BL}=\boldsymbol{E}_{CH4\_lagoon\_BL}+\boldsymbol{E}_{CO2\_heat\_BL}+\boldsymbol{E}_{CO2\_power\_BL}$$

Where;

E_{BL}	=	total baseline emissions (tCO_2e)
$E_{CH4\_lagoons\_BL}$	=	the fugitive methane emissions from lagoons in the baseline case (tCO_2e)
$E_{CO2\_heat\_BL}$	=	CO_2 emissions from on-site fossil heat in the baseline case (tCO_2e) that are displaced by generation based on biogas collected in the anaerobic treatment facility.
$E_{CO2\_power\_BL}$	=	CO_2 emissions from on-site power generation in the baseline case (tCO_2e) that are displaced by generation based on biogas collected in the anaerobic treatment facility. Value applied is '0' as there is no power generation component in the project activity.

$$\boldsymbol{E}_{CO2\_heat}=\boldsymbol{F}\times\boldsymbol{NCV}\times\boldsymbol{EF}$$

Where;

F	=	the corresponding amount of fossil fuel displaced by the use of biogas for the generation of on-site heat (dm_3). This is estimated as product of: (1) Average specific fuel consumption for the output of the facility and (2) The annual production.
NCV	=	the net calorific value of the fossil fuel consider (TJ/unit).
EF	=	the carbon emission factor of the fossil fuel considers (tCO_2/TJ).

According to heat balance equation, the corresponding amount of fossil fuel displaced by the use of biogas for the generation of on-site heat is calculated as:

$$\boldsymbol{F}_{fueloil}\times\boldsymbol{NCV}_{fueloil}=\boldsymbol{F}_{biogas}\times\boldsymbol{NCV}_{biogas}$$

$$\boldsymbol{F}_{fueloil}=\boldsymbol{F}_{biogas}\times\boldsymbol{NCV}_{biogas}/\boldsymbol{NCV}_{fueloil}$$

then;

$$\boldsymbol{E}_{CO2\_heat}=(\boldsymbol{F}_{biogas}\times\boldsymbol{NCV}_{biogas}/\boldsymbol{NCV}_{fueloil})\times\boldsymbol{NCV}_{fuel\ \ il}\times\boldsymbol{EF}$$

As equation above, the CO_2 emissions from on-site heat displaced by biogas collected in the anaerobic treatment, the use of fossil fuels is considered as:

$$\boldsymbol{E}_{CO2\_heat}=\boldsymbol{F}_{biogas}\times\boldsymbol{NCV}_{biogas}\times\boldsymbol{EF}$$

Hence $\boldsymbol{E}_{CO2\_heat}$ is calculated to be:

Period	$\boldsymbol{E}_{CO2\_heat}$ (tCO_2e)
01/11/2014 – 31/12/2014	1,671
01/01/2015 – 31/12/2015	8,733
01/01/2016 – 29/02/2016	883

The Volume of biogas sent to facility heaters and NCV of biogas are measured values and verification of the same is detailed in section E.6.2 above. Emission factor of fossil fuel is fixed ex-ante as confirmed from the registered PDD **/03/**.

$$\boldsymbol{M}_{lagoon\_input\_BL} = \boldsymbol{M}_{input\_total}$$

Where;

$M_{lagoon\_input\_BL}$ = the value used to specify the amount of organic material flowing into the lagoon system from the CIGAR in the project scenario equation (kg COD).

M_{input_total} = the total amount of organic material fed into the baseline wastewater treatment facility (kg COD). It is same amount as fed into the project water treatment facility.

As detailed in the PDD /03/ in the baseline, organic material from the facility enters directly into the lagoon system with no degradation of the wastewater before entering the lagoon system and all organic material to be treated enters the lagoon system. The pond based fugitive methane emissions are quantified by determining;

- How much material enters the lagoon system;
- How much is lost through aerobic and oxidative processes;
- How much is lost through sedimentation in the lagoon system; and
- How much is removed through anaerobic process.

Emission factors, surface aerobic losses of organic material, aerobic degradation, deposition or removal as well as chemical oxidation are determined for the project scenario. Hence, the equation to determine the fugitive methane emission from lagoons for project emissions has been applied for baseline scenario according to the methodology.

Fugitive methane emission from lagoons in baseline scenario

$$\boldsymbol{E}_{CH4\_lagoon\_BL} = \boldsymbol{M}_{lagoon\_anaerobic} \times \boldsymbol{EF}_{CH4} \times \boldsymbol{GWP}_{CH4} \div \mathbf{1000}$$

Where;

$E_{CH4\_lagoon\_BL}$ = the methane emission from the lagoons (tCO_2)

$M_{lagoon\_anaerobic}$ = the amount of organic material removed by anaerobic processes in the lagoon system (kg COD).

EF_{CH4} = the methane emission factor (kg CH_4 / kg COD)

GWP_{CH4} = the Global Warming Potential of methane (GWP_{CH4} = 25)

The values applied for the parameters EF_{CH4} and GWP_{CH4} are determined ex-ante and consistent with the PDD /03/.

$M_{lagoon\_anaerobic}$ is determined as below, as detailed in the PDD/03/:

$$\boldsymbol{M}_{lagoon_{anaerobic}} = \boldsymbol{M}_{lagoon_{total}} - \boldsymbol{M}_{lagoon_{aerobic}} - \boldsymbol{M}_{lagoon_{chemicalox}} - \boldsymbol{M}_{lagoon_{deposition}}$$

Where;

$M_{lagoon\_anaerobic}$ = the amount of organic material removed by anaerobic processes in the lagoon system (kg COD).

M_{lagoon_total} = the total amount of organic material removed in the lagoon system

$M_{lagoon\_aerobic}$ = the amount of organic material degraded aerobically in the lagoon

system (kg COD). Surface aerobic losses of organic material in pond-based systems equal to 254 kg COD per hectare of pond surface area and per day and is assumed to be lost through aerobic processes. PP has calculated the number of operational days; this is found consistent with operational records /15/ /18/. In response to the issue raised during information check by CDM EB dated 20/10/2016, RINA confirms that, there were 4 days in which wastewater was treated with effective COD removal (i.e., 05/01/2015, 30/03/15, 18/04/15 and 05/01/16), these days were also counted as operation days in the emission reduction calculation as it is the days in which the treatment plant received effluent from the host factory. However, the monitored data for biogas flow to heaters / flare for these four days were reported to be zero as the generated gas is accumulated in the lagoon for continuous operation on subsequent days. Both biogas and effluent treated are continuously monitored through online flowmeters as confirmed in section E.6.2 of this report. Biogas readings are recorded only when the biogas is sent to heaters or flare. It is also noted that on there is no inflow of effluent in to the treatment plant on 26/12/2014, however the biogas accumulated at the lagoon was used in the heater, the same is not counted as a day of operation of the treatment plant. The number of operational days considered in both baseline emissions and project emissions are the same, hence conservative. The above information was checked during site visit with the operational records /15/ /18/ and found to be consistent with the ER sheet. The area of the pond and surface aerobic loses are determined ex ante. The values applied are consistent with the registered PDD /03/.

$M_{lagoon\_chemical\_ox}$ = the amount of organic material lost through chemical oxidation in the lagoon system (kg COD)

$M_{lagoon\_deposition}$ = the amount of organic material lost through deposition in the lagoon system (kg COD)

Hence $M_{lagoon\_aerobic}$ is calculated to be:

Period	$M_{lagoon\_aerobic}$ (kg COD).	Number of operational days
01/11/2014 – 31/12/2014	29,197.30	55
01/01/2015 – 31/12/2015	184,739.28	348
01/01/2016 – 29/02/2016	30,259.02	57

In order to assess the amount of COD actually entering the anaerobic system (the lagoons) the amount of COD removed as a result of the new wastewater treatment facility is determined. This is set out in equation below.

Project organic material entering lagoon system from new anaerobic water treatment system is:

$$\boldsymbol{M}_{lagoon\_input} = \boldsymbol{M}_{input\_total} \times (\mathbf{1} - \boldsymbol{R}_{NAWTF})$$

Where;

M_{lagoon_input} = the input of organic material from the new project anaerobic wastewater treatment facility into the lagoon system (kg COD).

M_{inout_total} = the total amount of organic material fed into the new project water treatment facility (kg COD)

R_{NAWTF} = the total organic material removed efficiency of the new project water treatment facility, value applied is '0' as it is baseline and the project is not installed.

Total material removal in lagoon system is:

$$\boldsymbol{M}_{lagoon\_total} = \boldsymbol{M}_{lagoon\_input} \times \boldsymbol{R}_{lagoon}$$

Where;

M_{lagoon_total} = the total amount of organic material removed in the lagoon system through various routes (kg COD).

M_{lagoon_input} = is the total amount of organic material fed into the new project water treatment facility (kg COD). This is calculated from the water entering the lagoons and its COD. The values are justified in section E.6.2 above.

R_{lagoon} = the total organic material removal ratio of the lagoon, which is an ex ante determined parameter. Value applied is consistent with the registered PDD/03/

Hence M_{lagoon_total} is calculated to be:

Period	M_{lagoon_total} (kg COD).
01/11/2014 – 31/12/2014	1,698,492.58
01/01/2015 – 31/12/2015	13,561,477.53
01/01/2016 – 29/02/2016	1,691,544.11

Material lost through chemical oxidation in lagoon system

$$\boldsymbol{M}_{lagoon\_chemical\_ox} = \boldsymbol{C}_{SO4in}{}^{2-} \times \boldsymbol{R}_{SO4}{}^{2-}$$

Where;

$M_{lagoon\_chemical\_ox}$ = the total amount of organic material lost through chemical oxidation in lagoon system (kg COD).

$C_{SO4in}{}^{2-}$ = the concentration of sulphate is absorbed (tSO_4^{2-}). This is a monitored parameter and has been justified in section E.6.2 above, calculations made are adequately made in the ER sheet /02/

$R_{SO4}{}^{2-}$ = reduction factor for SO_4^{2-} oxidative substance, which is an ex ante determined parameter. Value applied is consistent with the registered PDD/03/

Hence $M_{lagoon\_chemical\_ox}$ is calculated to be:

Period	$M_{lagoon\_chemical\_ox}$ (kg COD).
01/11/2014 – 31/12/2014	15,629.98
01/01/2015 – 31/12/2015	193,920.11
01/01/2016 – 29/02/2016	50,619.43

Material deposition in lagoon system is:

$$\boldsymbol{M}_{lagoon\_deposition} = \boldsymbol{M}_{lagoon\_input} \times \boldsymbol{R}_{deposition}$$

Where;

$M_{lagoon\_deposition}$ = the total amount of organic material lost through deposition in the lagoon system (kg COD).

M_{lagoon_input} = the input of organic material from the new project anaerobic wastewater treatment facility into the lagoon system (kg COD). This is calculated from the water entering the lagoons and its COD. The values are justified in section E.6.2 above.

$R_{deposition}$ = the organic material deposition ratio of the lagoon, which is an ex ante determined parameter. Value applied is consistent with the registered PDD/03/

Hence $M_{lagoon\_deposition}$ is calculated to be:

Period	$M_{lagoon\_deposition}$ (kg COD).
01/11/2014 – 31/12/2014	31,492.88
01/01/2015 – 31/12/2015	253,121.15
01/01/2016 – 29/02/2016	31,364.05

Hence $M_{lagoon\_anaerobic}$, $E_{CH4\_lagoon\_BL}$ and E_{BL} are calculated to be:

	<table><tr><th>Period</th><th>M lagoon_anaerobic (kg COD).</th><th>ECH4_lagoon_BL (tCO2)</th><th>EBL (tCO2e)</th></tr><tr><td>01/11/2014 – 31/12/2014</td><td>1,622,172.41</td><td>8,516</td><td>10,187</td></tr><tr><td>01/01/2015 – 31/12/2015</td><td>13,019,697.00</td><td>68,353</td><td>77,086</td></tr><tr><td>01/01/2016 – 29/02/2016</td><td>1,579,301.61</td><td>8,291</td><td>9,174</td></tr></table>
Findings	CAR4.1: The notation in the formula M $lagoon\_total$ and description given therein is not consistent with the registered PDD /03/ CAR4.2: The description for the notation M $input\_total$ in the MR is not consistent with the PDD Please refer to Appendix 4 of this report. Above findings were appropriately closed.
Conclusion	RINA confirms that the calculation of baseline emissions have been appropriately carried out in accordance with the formulae and methods described in the /02/ applied methodology /11/, registered PDD /03/ and the previous verification reports **/4/ /16/,** and are consistent with site visit observations.

E.8.2. Calculation of project GHG emissions or actual net GHG removals by sinks

Means of verification	Total project emissions: $$\boldsymbol{E}_{project}=\boldsymbol{E}_{CH4\_lagoons}+\boldsymbol{E}_{CH4\_NAWTF}+\boldsymbol{E}_{CH4IC+Leaks}$$ Where; $E_{project}$ = the amount of methane expressed in (tCO_2e) contained in the biogas collected from the anaerobic treatment facility. $E_{CH4\_lagoons}$ = the fugitive methane emissions from lagoons (tCO_2e) E_{CH4_NAWTF} = the fugitive methane emissions from the new anaerobic wastewater treatment facility (tCO_2e), value applied is zero as there no leakages from the treatment facility as verified by hydro pressure tests /12/. Consistent with previous verification reports /04/ /16/ and PDD /03/ $E_{CH4\_IC+Leaks}$ = the methane emissions from inefficient combustion and leaks (tCO_2e) **Fugitive methane emission from lagoons in the project scenario** $$\boldsymbol{E}_{CH4\_lagoon\_BL}=\boldsymbol{M}_{lagoon\_anaerobic}\times\boldsymbol{EF}_{CH4}\times\boldsymbol{GWP}_{CH4}\div\mathbf{1000}$$ Where; $E_{CH4\_lagoon\_BL}$ = the methane emission from the lagoons (tCO_2) $M_{lagoon\_anaerobic}$ = the amount of organic material removed by anaerobic processes in the lagoon system (kg COD). EF_{CH4} = the methane emission factor (kg CH_4 / kg COD) GWP_{CH4} = the Global Warming Potential of methane (GWP_{CH4} = 25) The values applied for the parameters EF_{CH4} and GWP_{CH4} are determined ex-ante and consistent with the PDD /03/. $M_{lagoon\_anaerobic}$ is determined as below, as detailed in the PDD/03/: $$\boldsymbol{M}_{lagoon_{anaerobic}}=\boldsymbol{M}_{lagoon_{total}}-\boldsymbol{M}_{lagoon_{aerobic}}-\boldsymbol{M}_{lagoon_{chemicalox}}-\boldsymbol{M}_{lagoon_{deposition}}$$ Where; $M_{lagoon\_anaerobic}$ = the amount of organic material removed by anaerobic processes in the lagoon system (kg COD). M_{lagoon_total} = the total amount of organic material removed in the lagoon system $M_{lagoon\_aerobic}$ = the amount of organic material degraded aerobically in the lagoon system (kg COD). Surface aerobic losses of organic material in pond-based systems equal to 254 kg COD per hectare of pond surface area and per day and is assumed to be lost through aerobic processes. PP has calculated the number of operational days; this is found consistent with operational records /15/ /18/. The area of the pond and surface aerobic loses are determined ex ante. The values applied are consistent with the registered PDD /03/. $M_{lagoon\_chemical\_ox}$ = the amount of organic material lost through chemical oxidation in

the lagoon system (kg COD)

$M_{lagoon\_deposition}$ = the amount of organic material lost through deposition in the lagoon system (kg COD)

Hence $M_{lagoon\_aerobic}$ is calculated to be:

Period	$M_{lagoon\_aerobic}$ (kg COD).	Number of operational days
01/11/2014 – 31/12/2014	29,197.30	55
01/01/2015 – 31/12/2015	184,739.28	348
01/01/2016 – 29/02/2016	30,259.02	57

In order to assess the amount of COD actually entering the anaerobic system (the lagoons) the amount of COD removed as a result of the new wastewater treatment facility is determined. This is set out in equation below.

Project organic material entering lagoon system from new anaerobic water treatment system is:

$$\boldsymbol{M}_{lagoon\_input} = \boldsymbol{M}_{input\_total} \times (\mathbf{1} - \boldsymbol{R}_{NAWTF})$$

Where;

M_{lagoon_input} = the input of organic material from the new project anaerobic wastewater treatment facility into the lagoon system (kg COD).

M_{input_total} = the total amount of organic material fed into the new project water treatment facility (kg COD)

R_{NAWTF} = the total organic material removed efficiency of the new project water treatment facility, calculated as a ratio of COD input to COD output as per page 31 of the methodology applied /11/.

Hence R_{NAWTF} is calculated to be:

Period	R_{NAWTF}
01/11/2014 – 31/12/2014	0.724
01/01/2015 – 31/12/2015	0.754
01/01/2016 – 29/02/2016	0.691

Total material removal in lagoon system is:

$$\boldsymbol{M}_{lagoon\_total} = \boldsymbol{M}_{lagoon\_input} \times \boldsymbol{R}_{lagoon}$$

Where;

M_{lagoon_total} = the total amount of organic material removed in the lagoon system through various routes (kg COD).

M_{lagoon_input} = the input of organic material from the new project anaerobic wastewater treatment facility into the lagoon system (kg COD). This is calculated from the water entering the lagoons and its COD. The values are justified in section E.6.2 above.

R_{lagoon} = the total organic material removal ratio of the lagoon, which is an ex ante determined parameter. Value applied is consistent with the registered PDD/03/

Hence M_{input_total}, M_{lagoon_input} and M_{lagoon_total} are calculated to be:

Period	M_{input_total} (kg COD)	M_{lagoon_input} (kg COD)	M_{lagoon_total} (kg COD)
01/11/2014 – 31/12/2014	778,423.43	215,025.95	206,424.91
01/01/2015 – 31/12/2015	4,033,621.82	991,478.60	951,819.45
01/01/2016 – 29/02/2016	581,367.97	179,658.92	172,472.56

Material lost through chemical oxidation in lagoon system

$$\boldsymbol{M}_{lagoon\_chemical\_ox} = \boldsymbol{C}_{SO4in}{}^{2-} \times \boldsymbol{R}_{SO4}{}^{2-}$$

Where;

$M_{lagoon\_chemical\_ox}$	=	the total amount of organic material lost through chemical oxidation in lagoon system (kg COD).
$C_{SO4in}{}^{2-}$	=	concentrate of oxidative substance $SO_4{}^{2-}$ at the effluent of the digester ($tSO_4{}^{2-}$). This is a monitored parameter and has been justified in section E.6.2 above, calculations made are adequately made in the ER sheet /02/
$R_{SO4}{}^{2-}$	=	reduction factor for $SO_4{}^{2-}$ oxidative substance, which is an ex ante determined parameter. Value applied is consistent with the registered PDD/03/

Hence $M_{lagoon\_chemical\_ox}$ is calculated to be:

Period	$M_{lagoon\_chemical\_ox}$ (kg COD).
01/11/2014 – 31/12/2014	599.49
01/01/2015 – 31/12/2015	18,360.61
01/01/2016 – 29/02/2016	7,241.60

Material deposition in lagoon system is:

$$\boldsymbol{M}_{lagoon\_deposition} = \boldsymbol{M}_{lagoon\_input} \times \boldsymbol{R}_{deposition}$$

Where;

$M_{lagoon\_deposition}$	=	the total amount of organic material lost through deposition in the lagoon system (kg COD).
M_{lagoon_input}	=	the input of organic material from the new project anaerobic wastewater treatment facility into the lagoon system (kg COD). This is calculated from the water entering the lagoons and its COD. The values are justified in section E.6.2 above.
$R_{deposition}$	=	the organic material deposition ratio of the lagoon, which is an ex ante determined parameter. Value applied is consistent with the registered PDD/03/

Hence $M_{lagoon\_deposition}$ is calculated to be:

Period	$M_{lagoon\_deposition}$ (kg COD).
01/11/2014 – 31/12/2014	3,827.46
01/01/2015 – 31/12/2015	17,648.32
01/01/2016 – 29/02/2016	3,197.93

Hence $M_{lagoon\_anaerobic}$, and $E_{CH4\_lagoon\_BL}$ are calculated to be:

Period	$M_{lagoon\_anaerobic}$ (kg COD).	E_{CH4_lagoon} (tCO_2)
01/11/2014 – 31/12/2014	172,800.66	908
01/01/2015 – 31/12/2015	731,071.24	3,839
01/01/2016 – 29/02/2016	131,774.02	692

Methane emissions from Inefficient Combustion Emissions

Methane emissions from incomplete or inefficient combustion is calculated as a sum of measured values of methane emissions at Biogas flaring, Biogas use in heating system and Biogas use for on-site electricity generation

However, in this project activity as there is no electricity generated from biogas as available in the registered PDD /03/; and that there has been no flaring for this monitoring period as detailed in section E.6.2 above, methane emissions from incomplete or inefficient combustion is calculated as:

	$\boldsymbol{E}_{CH4\_IC+Leak}=\boldsymbol{E}_{CH4\_heat}$ Hence for this project : $\boldsymbol{E}_{CH4\_heat}=\boldsymbol{V}_{heat}\times\boldsymbol{C}_{CH4\_heat}\times(1-f_{heat})\times\boldsymbol{GWP}_{CH4}$, and calculated to be: Period: $\boldsymbol{E}_{CH4\_heat}$ (tCO_2e) 01/11/2014 – 31/12/2014: 915.58 01/01/2015 – 31/12/2015: 5,448.82 01/01/2016 – 29/02/2016: 545.21 The overall project emissions are calculated to be: Period: $E_{Project}$ (tCO_2e) 01/11/2014 – 31/12/2014: 1,824 01/01/2015 – 31/12/2015: 9,288 01/01/2016 – 29/02/2016: 1,238
Findings	CAR 5.1: The unit applied for R_{NAWTF} in the project scenario is not consistent with the methodology applied /11/. CAR 5.2: In section where M_{lagoon_input} is determined the notation applied in the table is not consistent with the values applied and the calculations available in the ER sheet /02/ CAR 5.3: The value of $M_{lagoon\_aerobic}$ for the period 01/11/2014 – 31/12/2014 in project emissions is not consistent with the ER sheet submitted. CAR 5.4: The value of $M_{lagoon\_anaerobic}$ for the period 01/01/2015 – 31/12/2015 is not available in international numbering format (separated by commas for millions and thousands). Please refer to Appendix 4 of this report. Above findings were appropriately closed.
Conclusion	RINA confirms that the calculation of the project emissions have been appropriately carried out /02/ in accordance with the formulae and methods described in applied methodology /11/, registered PDD /03/ and the previous verification reports **/4/ /16/**, and are consistent with site visit observations.

E.8.3. Calculation of leakage GHG emissions

Means of verification	Leaks in the biogas system include leaks from any anaerobic digester and leaks from the biogas pipeline delivery system. A conservative value of 1% was included in the ex-ante emissions reductions calculation. As confirmed from the biogas pipeline hydrostatic pressure test /12/ no leakage is accounted for this monitoring period. The CIGAR is being operated under sub atmospheric pressure and as confirmed during the site visit observations and interviews, the biogas delivery pipe to the off-taker site is also less than 2km. Hence accepted.
Findings	N/A
Conclusion	RINA confirms that no leakage is accounted for this monitoring period which is consistent with site visit observations.

E.8.4. Summary of calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

Means of verification	According to the applied methodology "AM0022", "Avoided Wastewater and On-site Energy Use Emission in the Industrial Sector", version 04 of 21/12/2006 **/11/**, the emission reductions have been calculated based on the following formula: $ER = E_{BL} - E_{project}$ Where, Emission reductions, ER ($t\ CO_2e$) are calculated as the difference between baseline (E_{BL}) and project ($E_{project}$) emissions. Leakage is considered to be negligible. To verify that the equation delivers a conservative estimate of emission reductions, the equation below is taken into account: $\boldsymbol{E}_{CH4\_lagoon\_BL}-(\boldsymbol{E}_{CH4\_lagoon}+\boldsymbol{E}_{CH4\_NAWTF}+\boldsymbol{E}_{CH4\_coll})$

Where;

E_{CH4_coll} = the amount of methane expressed in (tCO_2e) contained in the biogas collected from the anaerobic treatment facility.

E_{CH4_coll} is obtained from the equation:

$$\boldsymbol{E}_{CH4\_coll} = ((\boldsymbol{V}_{heat} + \boldsymbol{V}_{elec} + \boldsymbol{V}_{flare}) \times \boldsymbol{C}_{CH4} \times \boldsymbol{\rho}_{CH4} \times \boldsymbol{GWP}_{CH4})$$

Since there is no electricity generation from biogas and has there been no flaring during this monitoring period, E_{CH4_coll} is calculated from the V_{heat} and C_{CH4} values monitored (justified in section E.6.2 above) and ex-ante determined values of density of methane and its GWP.

Hence is E_{CH4_coll} calculated to be:

Period	E_{CH4_coll} (tCO_2e)
01/11/2014 – 31/12/2014	10,662
01/01/2015 – 31/12/2015	59,680
01/01/2016 – 29/02/2016	5,972

Substituting the values of $\boldsymbol{E}_{CH4\_lagoon} + \boldsymbol{E}_{CH4\_NAWTF}$ from the project emission calculations the difference is found to be positive, hence the conservative estimate of Baseline emissions are calculated to be:

Period	Conservative Baseline emissions (tCO_2e)
01/11/2014 – 31/12/2014	10,187
01/01/2015 – 31/12/2015	72,252
01/01/2016 – 29/02/2016	7,546
Total	89,985

Emission reductions are calculated to be:
To verify that the equation delivers a conservative estimate of emission reductions, the equation below is taken into account:

$$\boldsymbol{E}_{CH4\_lagoon\_BL} - (\boldsymbol{E}_{CH4\_lagoon} + \boldsymbol{E}_{CH4\_NAWTF} + \boldsymbol{E}_{CH4\_coll})$$

Where;

E_{CH4_coll} = the amount of methane expressed in (tCO_2e) contained in the biogas collected from the anaerobic treatment facility.

E_{CH4_coll} is obtained from the equation:

$$\boldsymbol{E}_{CH4\_coll} = ((\boldsymbol{V}_{heat} + \boldsymbol{V}_{elec} + \boldsymbol{V}_{flare}) \times \boldsymbol{C}_{CH4} \times \boldsymbol{\rho}_{CH4} \times \boldsymbol{GWP}_{CH4})$$

Since there is no electricity generation from biogas and has there been no flaring during this monitoring period, E_{CH4_coll} is calculated from the V_{heat} and C_{CH4} values monitored (justified in section E.6.2 above) and ex-ante determined values of density of methane and its GWP.

Hence is E_{CH4_coll} calculated to be:

Period	E_{CH4_coll} (tCO_2e)
01/11/2014 – 31/12/2014	10,662
01/01/2015 – 31/12/2015	59,680
01/01/2016 – 29/02/2016	5,972

Substituting the values of $\boldsymbol{E}_{CH4\_lagoon} + \boldsymbol{E}_{CH4\_NAWTF}$ from the project emission calculations the difference is found to be positive, hence the conservative estimate of Baseline emissions are calculated to be:

	<table><tr><td>Period</td><td>Emission reductions (tCO_2e)</td></tr><tr><td>01/11/2014 – 31/12/2014</td><td>8,363</td></tr><tr><td>01/01/2015 – 31/12/2015</td><td>62,964</td></tr><tr><td>01/01/2016 – 29/02/2016</td><td>6,308</td></tr><tr><td>Total</td><td>77,635</td></tr></table> **Availability of the data** The data for all the monitoring parameters have been correctly measured, recorded according to the applied monitoring methodology AM0022, version 04 /**11**/ and the registered PDD /**03**/. All the data are available for this monitoring period. **Cross-check reported data** No significant reporting risks have been identified for the data reported. All continuously monitored data is recorded on SCADA /15/. All the data required for emission reduction calculations is recorded in the plant log books and aggregated daily /18/. These are then transferred to excel spread sheets /02/ which has been used for emission reduction calculations. Besides these parameters, other parameters that are required as per the requirements of the monitoring plan of the registered PDD /03/ have also been monitored and detailed /01/. The calibration of monitoring equipment has been done on regular basis and same has been verified by RINA /14/, /16/ /26-41/. RINA has been able to verify the data from the plant log books /15/ /18/ during the site visit and confirms it has been transferred correctly. RINA also confirms that the project equipment operated within the operational limits and has not exceeded the rated capacity during the current monitoring period /15/. RINA is of the opinion that the emission factors that have been applied in the calculations are conservative and justified based on the validated PDD /**03/ /05/**. Data was collected based on a data management procedure as described in the registered PDD /**03**/. The monitoring and reporting of required data is in accordance with well-established operational procedures. The site visit confirmed that the management system for the CDM project is in place and can be traced, such as the organizational structure with responsibilities, monitoring procedure and monitoring management, emergency treatment procedure and competence criteria of CDM personnel involved in the CDM project. The organizational structure, responsibilities have been detailed in the MR for the project activity and were found to be adequate as confirmed during the site visit. Thus, the management and operational system: the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan.
Findings	CAR 6: The final emission reduction value has not been rounded down and has reference to CAR 3 and 4 above. Please refer to Appendix 4 of this report. Above finding was appropriately closed.
Conclusion	RINA confirms: - All the data and parameters were monitored in accordancw with the monitoring plan in the registered PDD; - The data reported were cross-checked with the data recorded in the raw data and the values reported in the monitoring report were verified against the data presented by the PP; - The calcualtion of emission reductions have been carried out in accordance with the formulae and methods described in the registered PDD, the applied methodology and methodological tools; - Emission factor and default values have been applied in the calculation in accordance to the registered PDD.

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Means of verification	The emission reductions from the project for the monitoring period as reported in the monitoring report revision 03.1 of 11/07/2016 /**01**/ is equivalent to **77,635** tCO_{2e}. The reported emission reductions are 21.05% higher than the estimated emission reduction of 64,134 tCO_{2e} for the period as per the registered PDD /**03**/.
Findings	N/A
Conclusion	The emission reduction calculations provided in the spreadsheet /**02**/ have been verified to be correct and in line with the registered PDD /**03**/.

E.8.6. Remarks on difference from estimated value in registered PDD

Means of verification	The reported emission reductions are 21.05% higher than the estimated emission reduction due increase in operational load from host factory and adaptation of GWP values of second commitment period for methane /20/. Both the reasons are out of the control of PP, it was confirmed during site visit observations and interview that there has been no deviations in the implementation of the project against that detailed in the registered PDD /03/.
Findings	N/A
Conclusion	The emission reduction calculations provided in the spreadsheet /**02**/ have been verified to be correct and in line with the registered PDD /**03**/.

E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Means of verification	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	NA	77,635 tCO_2e
Findings	N/A	
Conclusion	The actual monitoring period does not fall into the first commitment period.	

SECTION F. Internal quality control

The draft final verification report before being submitted to UNFCCC for request of issuance was 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 CDM validation and verification.

SECTION G. Verification opinion

RINA Service Spa (RINA) has performed verification of the emission reductions reported for the project activity “Chao Khun Argo Biogas Energy Project” in the “Kingdom of Thailand”, CDM Registration Reference N° 2138, for the period 01/11/2014 – 29/02/2016, with regard to the relevant requirements for CDM activities.

The project participants of the “Chao Khun Argo Biogas Energy Project” project are responsible for:

- the preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered project design document revision 02 (No: 2005-1475) issued on 20/02/2009
- the development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project

It is the responsibility of RINA to express an independent verification opinion about the project’s conformity with the requirements of paragraph 62 of the CDM modalities 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 PDD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable CDM requirements;
- the monitoring is in place as per the applied baseline and monitoring methodology;
- the monitoring complies with the monitoring plan in the registered PDD;

the monitoring plan in the registered PDD is as per the applied baseline and monitoring methodology.

SECTION H. Certification statement

It is RINA’s opinion that the GHG emission reduction stated in the monitoring report version 03.1 of 11/07/2016 for the “Chao Khun Argo Biogas Energy Project” in the “Kingdom of Thailand”, CDM Registration Reference N° 2138, for the period 01/11/2014 – 29/02/2016 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology “AM0022”, “Avoided Wastewater and On-site Energy Use Emission in the Industrial Sector”, version 04 of 21/12/2006 and the monitoring plan contained in the registered PDD.

Hence RINA is able to certify that the emission reductions from the project during the monitoring period 01/11/2014 – 29/02/2016 amount to 77,635 tCO_2e.

Appendix 1. Abbreviations

Abbreviations	Full texts
BE	Baseline Emissions
BHL	Bangkok High Lab Co., Ltd.
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM M&P	Modalities and Procedures CDM
CDM-PCP	Clean Development Mechanism Project Cycle Procedure
CDM-PS	Clean Development Mechanism Project Standard
CDM-VVS	Clean Development Mechanism Validation and Verification Standard
CER(s)	Certified Emission Reduction(s)
CH_4	Methane
CIGAR	Covered In-Ground Anaerobic Reactor
CKA	Chao Khun Argo
CL	Clarification Request
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CRT	Coordination and Technical Control Staff
DCI	Certification Division of RINA Services Spa
DG	Diesel Generator
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
Entech	Entech Associate Co., Ltd.
ER	Emission Reductions
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of Approval
MIT	Miracle International Technology Company Limited
MoV	Means of Verification
MR	Monitoring Report
NA	Not Applicable
NGO	Non-governmental Organization
ODA	Official Development Assistance
PDD	Project Design Document
PE	Project Emission
PP(s)	Project Participant(s)
PTTGC	PTT Global Chemical Public Company Limited
Ref.	Document Reference
RINA	RINA Services Spa
SCADA	Supervisory Control And Data Acquisition
SCI	SCI ECO Servises Co., Ltd

SIRIM	SIRIM QAS International Sdn. Bhd.
SPC	SPC Calibration Center Company Limited
SS(s)	Sectoral Scope(s)
STIC	Siwa Testing Inspection and Consulting Co., Ltd.
TA(s)	Technical Area(s)
TBEC	Thai Biogas Energy Company
TISI	National Accreditation System of Thailand
UNFCCC	United Nations Framework Convention on Climate Change

Appendix 2. Competence of team members and technical reviewers

RINA

CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra: *We declare that Mr/Mrs/Ms:*	**Rekha Menon**
è qualificato come[1]: *is qualified as:*	**CDM–TEC, –VAL, -VER, -TL**
per le seguenti aree tecniche: for the following technical areas:	**1.2, 2.1, 13.1, 13.2, 14.1**

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.2	Renewables	1
2.1	Energy Demand	2
13.1	Solid Waste and wastewater	13
13.2	Manure	13
14.1	Afforestation and reforestation	14

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	-
10	22-12-2014	Update qualification according to AS ver.6.0

Il Resp. QPT
Head of QPT

[1] Legend:

VAL:	Validator	CDM: Clean Development Mechanism
VER:	Verifier	VCS : Verified Carbon Standard
TEC:	Technical Expert	GS: Gold Standard
TL:	Team Leader	SCS: SocialCarbon Standard
FIN-EXP:	Financial Expert	JI: Joint Implementation
DET:	Determiner	

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

GHG_QUAL_CERT_EN_04_12 Page 1 of 1

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 come[1]: **CDM-TEC, CDM-VAL, CDM-VER, CDM-TL,**
is qualified as:

per le seguenti aree tecniche: **1.1, 1.2, 3.1, 5.1, 13.1**
for the following technical areas:

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.1	Thermal energy generation	1
1.2	Renewables	1
3.1	Energy Demand	3
5.1	Chemical industry	5
13.1	Solid Waste and wastewater	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	-
12	22/12/2014	Updated qualification according to AS ver.6.0

Il Resp. QPT
Head of QPT

1
Legend:

VAL:	Validator	CDM: Clean Development Mechanism
VER:	Verifier	VCS : Verified Carbon Standard
TEC:	Technical Expert	GS: Gold Standard
TL:	Team Leader	SCS: SocialCarbon Standard
FIN-EXP:	Financial Expert	JI: Joint Implementation
DET:	Determiner	

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

GHG_QUAL_CERT_EN_04_12 Page 1 of 1

RINA

CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra: *We declare that Mr/Mrs/Ms:*	**Rita Valoroso**
è qualificato come1: *is qualified as:*	**CDM -TEC, -VAL, -VER, -TL TECHNICAL REVIEWER**
per le seguenti aree tecniche: for the following technical areas:	**1.2, 3.1, 13.1**

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.2	Renewables	1
3.1	Energy demand	3
13.1	Solid Waste and waste water	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	18-01-10	-
10	06/04/2016	Update qualification TA 3.1

Il Resp. QPT
Head of QPT

Rina Saruno

[1] Legend:

VAL:	Validator	CDM: Clean Development Mechanism
VER:	Verifier	VCS : Verified Carbon Standard:
TEC:	Technical Expert	GS: Gold Standard
TL:	Team Leader	SCS: SocialCarbon Standard
FIN-EXP:	Financial Expert	JI: Joint Implementation
DET:	Determiner	

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

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	TBEC	Fifth monitoring report for project activity "Chao Khun Argo Biogas Energy Project" in Thailand	version 03.1 of 11/07/2016 version 03 of 17/06/2016 version 02 of 09/05/2016 version 01 of 04/03/2016	PP
2	TBEC	Emission reduction calculation spreadsheet	"CKA-ERv03.1" version 3.1 of 20/06/2016 "CKA-ERv02" version 2.0 of 09/05/2016 "CKA - ER.xls" version 01 of 04/03/2016	PP
3	TBEC	Registered CDM-PDD for project activity "Chao Khun Argo Biogas Energy Project" in Thailand	revision 02 (No: 2005-1475) issued on 20/02/2009	Others
4	TÜV NORD CERT GmbH JI/CDM Certification Program	First Verification/Certification report for the project activity "Chao Khun Argo Biogas Energy Project" in Thailand	Report No: 11CDMTH010005-11/422 of 18/06/2013	Others
	SIRIM	Second Verification/Certification report for the project activity "Chao Khun Argo Biogas Energy Project" in Thailand	Report No. SQAS-CDM-ET07850004	
	TÜV NORD CERT GmbH JI/CDM Certification Program	Third Verification/Certification report for the project activity "http://cdm.unfccc.int/Issuance/MonitoringReports/mr_for_date.html?date=2016/03/08	Report No: MY-PVer 14/05 – 13/201 of 24/06/2014	
5	DNV	CDM validation report of activity "Chao Khun Argo Biogas Energy Project" in Thailand	revision 02 (No: 2005-1475) issued on 20/02/2009	Others
6	UNFCCC website Project 2138	"Chao Khun Argo Biogas Energy Project" in Thailand	http://cdm.unfccc.int/Projects/DB/DNV-CUK1218616482.16/view , in English language, retrieved on 08/04/2016	Others
		Monitoring Report published linkage on UNFCCC website Project 2138	http://cdm.unfccc.int/Issuance/MonitoringReports/mr_for_date.html?date=2016/03/08 , English language, retrieved on 08/04/2016	Others
7	CDM Executive Board	Instruction for filling out the monitoring report form	Attachment to CDM-MR-FORM, version 05.1 of 04/05/2015	Others
8	CDM Executive Board	Monitoring Report Form	(CDM-MR-FORM), version 05.1 of 04/05/2015	Others

9	CDM Executive Board	Clean Development Mechanism Project Cycle Procedure	version 09.0 of 20/02/2015	Others
10	CDM Executive Board	Clean Development Mechanism Project Standard	version 09.0 of 20/02/2015	Others
11	CDM Executive Board	Baseline and monitoring methodology "AM0022", "Avoided Wastewater and On-site Energy Use Emission in the Industrial Sector" Methodological "Tool to determine project emissions from flaring gases containing methane"	version 04 of 21/12/2006 EB 28 Meeting report Annex 13	Others Others
12	STIC	Biogas pipeline pressure test reports	a) Report No. RP-P51-140932 dated 04/08/2014 valid till 03/08/2015 b) Report No. RP-P51-160112 dated 25/12/2015 valid till 24/12/2016	PP
13	TBEC	Instrument history sheets for the meters with Tag numbers: FT05, SM01, XT01	Submitted by the PP on 08/04/2016.	PP
14	PTTGC	Biogas Calorific Values	a) Report No. COA-EX-1309-00143 of 29/08/2013 b) Report No. COA-EX-1412-01640 of 15/12/2014 c) Report No. COA-EX-1601-00992 of 08/01/2016	PP
15	TBEC	SCADA reports "Midnight Reports	for the period from 01/11/2014 – 29/02/2016	PP
16	TÜV NORD CERT GmbH JI/CDM Certification Program	FourthVerification/Certification report for the project activity "Chao Khun Argo Biogas Energy Project" in Thailand	Report No: MY-PVer 14/30 – 14/153 of 04/06/2014	Others
17	TBEC	Waste water analysis reports by external accredited labs SPC and BHL	for the period from 01/11/2014 – 29/02/2016	PP
18	TBEC	Liquid phase daily check sheets and Gas phase daily check sheets	for the period from 01/11/2014 – 29/02/2016	PP
19	CDM Executive Board	Clean Development Mechanism Validation and Verification Standard	version 09.0 of 20/02/2015	Others
20	IPCC	Global Warming Potential as per fourth assessment report, 2007	https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14, available in English, retrieved on 08/04/2016	Others
21	TISI	Accreditation for laboratories for calibration and testing.	For MIT available in English http://app.tisi.go.th/lab/calibrate/clb52_e.html , retrieved on 08/04/2016. For PTTGC, available in English at http://app.tisi.go.th/lab/testing/test342e.html , retrieved on 08/04/2016. For SPC available in English	Others

			http://app.tisi.go.th/lab/calibrate/clb87_e.html , retrieved on 08/04/2016. For BHL available in English http://app.tisi.go.th/lab/calibrate/clb229e.html , retrieved on 08/04/2016. For Entech available in English http://app.tisi.go.th/lab/calibrate/clb157e.html , retrieved on 08/04/2016. For SCG available in English http://app.tisi.go.th/lab/testing/test425e.html , retrieved on 08/04/2016.	
22	Department of Industries	Technical specification of Boiler: Boiler certificate	of 2016 valid till 2017, submitted by PP on 08/04/2016	PP
23	Organics Ltd	Technical specification of flare	submitted by PP on 08/04/2016	PP
24	CDM Executive Board	General guideline on leakage in biomass project activities Leakage in biomass small-scale project activities	version 03, Annex 28, EB 47. version 04.0, of 16/04/2015	Others
25	CDM Executive Board	Guideline on the application of materiality in verifications	Version 02.0, of 20/02/2015	Others
26	BHL	Calibration reports for Merck Spectrophotometer Model Pharo 100	Certificate No.: S2015/060 of 30/01/2015 valid till 29/01/2016	PP
27	MIT	Calibration certificate for equipment Serial No. 3K672012180487	Certificate no. L1407-292 dated 18/07/2014valid until 17/07/2016	PP
28	MIT	Calibration certificate for equipment Serial No. 3K672012180486	Certificate no. L1405-137 dated 07/05/2014 valid until 06/05/2016	PP
29	MIT	Calibration certificate for equipment Serial No. 6710090063	Certificate no. L1502-307 dated 12/02/2015 valid until 11/02/2017	PP
30	SPC	Calibration certificate for equipment Serial No. 1156884	Certificate no. C0140337 dated 17/09/2014 valid until 16/09/2015	PP
31	SPC	Calibration certificate for equipment Serial No. 141410128	Certificate no. C06160085 dated 27/01/2016 valid until 26/01/2017	PP
32	BHL	Calibration certificate for equipment Serial No. 141410128	Certificate no. C06160085 dated 31/01/2015 valid until 29/01/2016	PP
33	SPC	Calibration certificate for equipment Serial No. 10110C0201	Certificate no. C17140093 dated 17/09/2014 valid until 16/09/2015 Certificate no. C17150124 dated 16/09/2015 valid until 15/09/2016	PP PP
34	ABB	Calibration certificate for equipment Serial No. 00000124	Certificate no. 0184-D-K-15081-01-00-2011-11 dated 25/11/2011 valid until 24/11/2014	PP
35	MIT	Calibration certificate for equipment Serial No. 00000124	Certificate no. L1411-310 dated 17/11/2014 valid until	PP

			16/11/2017	
36	ABB	Calibration certificate for equipment Serial No. 00000294	Certificate no. 0184-D-K-15081-01-00-2011-11 dated 15/12/2011 valid until 14/12/2014	PP
37	MIT	Calibration certificate for equipment Serial No. 00000294	Certificate no. L1411-310 dated 12/12/2014 valid until 11/12/2017	PP
38	MIT	Calibration certificate for equipment Serial No. 3K672011450101	Certificate no. L1511-318 dated 12/11/2015 valid until 11/11/2017 Certificate no. LC1311-326 dated 14/11/2013 valid until 13/11/2015	PP PP
39	Entech	Calibration certificate for equipment Serial No. LFB-028	Certificate no. G570127 dated 17/04/2014 valid until 16/04/2015	PP
40	Entech	Calibration certificate for equipment Serial No. 35286	Certificate no. G580136 dated 08/04/2015 valid until 07/04/2016	PP
41	Entech	Calibration certificate for equipment Serial No. 8008	Certificate no. G580523 dated 27/11/2015 valid until 26/11/2016	PP
42	ABB	Specification sheet of Eletromagnetic Flowmeter ABB (ProcessMaster-FEP311) (FT01,FT05,FT06)	Submitted on 13/05/2016	PP
43	HACH	Specification sheet of COD Reactor Hach (DRB200)	Submitted on 13/05/2016	PP
44	HACH	Specification sheet of Spectrophotometer Hach (DR2800)	Submitted on 13/05/2016	PP
45	MERCK	Specification sheet of Spectrophotometer Merck (Pharo100)	Submitted on 13/05/2016	PP
46	ABB	Specification sheet of Thermal Mass Flowmeter ABB (Sensyflow FMT500IG) (FT02,FT04)	Submitted on 13/05/2016	PP
47	ANRI	Specification sheet of Gas Analyser ANRI (CAM-3L)	Submitted on 13/05/2016	PP
48	Edinburgh Sensors	Specification sheet of Gas Analyser Edinburgh (Guardian NG)	Submitted on 13/05/2016	PP
49	Jiampattana Energy International Company Litd	Specification sheet of Gas Analyser JE (Guardian Plus)	Submitted on 13/05/2016	PP
50	Thai Burner Industrial Heat Company	Combustion efficiency analysis of Boiler	Dated 20/05/2014 and 30/04/2015	PP
51	ABB	Specification sheet of Electromagnetic Flowmeter ABB (XEDE43F) (FT05)	Submitted on 13/05/2016	PP

Appendix 4. Clarification requests, corrective action requests and forward action requests

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

FAR ID	xx	**Section no.**	xx	**Date:** DD/MM/YYYY
Description of FAR				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 2. CL from this verification

CL ID	1.1	**Section no.**	E.6.2	**Date:** 13/04/2016
Description of CL				
The test report details provided in the MR to estimate the loss of biogas from pipeline does not cover the monitoring period.				
Project participant response (1st round)				**Date:** 09/05/2016
In the MR, version02, the detail of the biogas loss from pipeline has been updated to cover this monitoring period (01/11/2014 – 29/02/2016; both dates are included)				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
The modification made does not cover the period between 03/08/2015 and 25/12/2015. CL1.1 open				
Project participant response (2nd round)				**Date:** 17/06/2016
Apart from external inspection of the biogas loss from pipeline. TBEC also did the internal inspection on the biogas leakage daily by using the gas detector and visualizing by TBEC staff. Also, once a week TBEC staff will inspect the biogas leakage from pipeline by using the soap water to check the for gas leak at the pipeline connector.				
Documentation provided by project participant				
TBEC Biogas Leakage Inspection Form (August to December)				
DOE assessment (2nd round)				**Date:** 27/06/2016
The amount of methane expressed in (tCO2e) contained in the biogas collected from anaerobic treatment facility (ECH4_coll) is measured and the conservative value is used for emission reductions, also the PP conducts daily (using gas detectors) and weekly (using soap water) it is deemed that the emission reductions achieved are conservative, hence accepted. CL 1.1 is closed.				

CL ID	1.2	**Section no.**	E.6.2	**Date:** 13/04/2016
Description of CL				
Values of NCV of biogas in the test reports are available in btu/ft^3 and converted to J/Nm^3. However the MR in the place specified for calculation method does not give any information on this conversion.				
Project participant response (1st round)				**Date:** 09/05/2016
In the MR, version02, the conversion factor of btu/ft^3 to J/Nm^3 is 1 btu/ft^3 equal to 37,258.9 J/Nm^3 has been added under the calculation method.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
The test report does not specify whether it is standard or normal cubic feet, in this scenario, PP to clarify on how this conversion of btu/ft^3 to J/Nm^3 is considered appropriate. CL1.2 open				
Project participant response (2nd round)				**Date:** 17/06/2016
According to the NCV value in the test report from accredited laboratory (Test Method – ASTM D3588-98(2011)), the value is show in the btu/ft^3 unit. Thus, the unit has been converted to J/Nm^3 by a simple unit conversion as shown below: • 1 btu = 1.055.056 J[1] • 1 Nm^3 = 35.31467 ft^3[2] therefore, • 1 btu/ft^3 = 37,258.9 J/Nm^3 (1) Geankoplis, C. (1993). *Transport processes and unit operations*. 3rd ed. Engelwood Cliffs, N.J.: PTR Prentice Hall, p.852. (2) Brown, J. (1999). *Foseco non-ferrous foundryman's handbook*. 11th ed. Oxford [England]: Butterworth-Heinemann, p.2.				
Documentation provided by project participant				
• Transport Processes and Unit Operations Book • Foseco Non-Ferrous Foundryman's Handbook				
DOE assessment (2nd round)				**Date:** 27/06/2016
Justification by PP, consistent with ER sheet submitted, hence accepted. CL 1.2 is closed.				

CL ID	1.3	Section no.	E.6.2	Date: 13/04/2016
Description of CL				
The model number of ANRI gas analyser as mentioned in the MR is not consistent with the calibration report submitted.				
Project participant response (1st round)				**Date:** 09/05/2016
MR, version02, the model of the ANRI gas analyser has been revised from guardian plus to CAM-3L.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
Revised appropriately, consistent with onsite observations and the corresponding calibration report submitted. CL 1.3 is closed				

CL ID	1.4	Section no.	E.6.2	Date: 13/04/2016
Description of CL				
Details of F_{heat} test reports are not available in the MR. PP is requested to submit copy of the test reports.				
Project participant response (1st round)				**Date:** 09/05/2016
The detail of f_{heat} has been updated in the MR, version02.				
Documentation provided by project participant				
The f_{heat} test report for 2014 and 2015.				
DOE assessment (1st round)				**Date:** 06/06/2016
Records have been submitted along with response. MR has been appropriately revised. CL1.4 is closed.				

Table 3. CAR from this verification

CAR ID	1.1	**Section no.**	E.3	**Date:** 13/04/2016
Description of CAR				
PP is requested to submit copy of the process flow diagram of the project activity giving details of the project equipment and the position of monitoring equipment.				
Project participant response (1st round)				**Date:** 09/05/2016
The process flow diagram of the project activity with all details of project equipment has been submitted.				
Documentation provided by project participant				
CKA Project Process Flow Diagram				
DOE assessment (1st round)				**Date:** 06/06/2016
PP has submitted process flow diagram, however this does not meet the requirement as per Attachment to CDM-MR-Form. Instructions for filling out the monitoring report form, which requires this to be part of the monitoring report. CL 1.1 is open.				
Project participant response (2nd round)				**Date:** 17/06/2016
The revised version of CKA process flow diagram of the project activity with all the detail of monitoring point of project equipment has been submitted.				
Documentation provided by project participant				
CKA – Process Flow Diagram				
DOE assessment (2nd round)				**Date:** 27/06/2016
MR has been appropriately revised, hence accepted. CAR 1.1 closed				
CAR ID	1.2	**Section no.**	E.3	**Date:** 13/04/2016
Description of CAR				
PP is requested to provide the technical specification sheet for all monitoring equipment.				
Project participant response (1st round)				**Date:** 09/05/2016
The technical specification sheet of all monitoring equipments have been submitted.				
Documentation provided by project participant				
Technical Specification Sheet: • ABB - Electromagnetic Flowmeter (ProcessMaster FEP311) • ABB - Electromagnetic Flowmeter (XEDE43F) • ABB - Thermal Mass Flowmeter (Sensyflow FMT500 IG) • Merck – Spectrophotometer (Pharo100) • Hach – Spectrophotometer (DR2800) • Hach – COD Reactor (DRB200) • ANRI – Gas Analyser (CAM-3L) • JE – Gas Analyser (Guardian Plus) • Edinburgh – Gas Analyser (Guardian NG)				
DOE assessment (1st round)				**Date:** 06/06/2016
Specification sheets have been submitted as required. CAR 1.2 is closed.				

CAR ID	2	**Section no.**	E.6.1	**Date:** 13/04/2016
Description of CAR				
The unit for GWP is not consistent with the one available in the registered PDD				
Project participant response (1st round)				**Date:** 09/05/2016
In the MR version 02, the unit of the GWP_{CH4} has been revised to "tCO_2/tCH_4" as in the registered PDD.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
MR is corrected appropriately. However pages unit for GWP has not been given in pages 28 and 29 of the MR. CAR 2 is open.				
Project participant response (2nd round)				**Date:** 17/06/2016
In the MR version 03, the unit of GWP_{CH4} (tCO_2/tCH_4) has been given in the page 28 and 29.				
Documentation provided by project participant				
-				
DOE assessment (2nd round)				**Date:** 27/06/2016

MR has been revised appropriately, hence accepted. CAR 2 closed

CAR ID	3.1	**Section no.**	E.6.2	**Date:** 13/04/2016
Description of CAR				
Value of the parameter WW_{input} for the period 01/01/2015 – 31/12/2015 provided in the MR is not consistent with the ER sheet provided.				
Project participant response (1st round)				**Date:** 09/05/2016
In the MR, version02, the total value of WW_{input} for the period of 01/01/2015 – 31/12/2015 has been revised to be consistent with the ER sheet (798,244 m^3 – revised value).				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
MR has been revised appropriate. Consistent with onsite observations and supportive records. CAR 3.1 is closed.				

CAR ID	3.3	**Section no.**	E.6.2	**Date:** 13/04/2016
Description of CAR				
The registered PDD requires weekly testing by external accredited lab for cross checking and accuracy. However the information of analysis, cross check and accuracy correction, if any is not available in the report. PP is requested to submit copies of the analysis report.				
Project participant response (1st round)				**Date:** 09/05/2016
In the ER, version02, the value of the COD_{in} and COD_{out} from the internal laboratory and the external accredited laboratory has been cross-checked in the "COD Comparison" sheet				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
However subsequent calculations are done only based on actual values and not based on adjusted values deduced from external analysis. CAR 3.3 open.				
Project participant response (2nd round)				**Date:** 17/06/2016
In the MR version 03, the adjusted values of the COD_{input} and COD_{output} have been applied and the emissions reduction calculation has been revised.				
Documentation provided by project participant				
-				
DOE assessment (2nd round)				**Date:** 27/06/2016
The MR and the ER sheets have been appropriately revised, hence accepted. CAR 3.3 is closed.				

CAR ID	4.1	**Section no.**	E.8.1	**Date:** 13/04/2016
Description of CAR				
The notation in the formula M_{lagoon_total} and description given therein is not consistent with the registered PDD				
Project participant response (1st round)				**Date:** 09/05/2016
The notation in the formula M_{lagoon_total} and description given therein has been revised to be consistent with the registered PDD, version03, page 27.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
MR has been appropriately revised. CAR4.1 is closed				

CAR ID	4.2	**Section no.**	E.8.1	**Date:** 13/04/2016
Description of CAR				
The description for the notation M_{input_total} in the MR is not consistent with the PDD				
Project participant response (1st round)				**Date:** 09/05/2016
In the MR, version02, the description of the notation M_{input_total}, has been revised to be consistent with the registered PDD, version03, page 32.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:06/06/2016**
MR has been appropriately revised. CAR4.2 is closed				

CAR ID	5.1	Section no.	E.8.2	Date: 13/04/2016
Description of CAR				
The unit applied for R_{NAWTF} in the project scenario is not consistent with the methodology applied				
Project participant response (1st round)				**Date:** 09/05/2016
The unit applied for R_{NAWTF} in the project scenario of MR, version02, has been revised to be consistent with the methodology AM0022, version04, page 4.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
MR has been appropriately revised. CAR5.1 is closed				

CAR ID	5.2	Section no.	E.8.2	Date: 13/04/2016
Description of CAR				
In section where M_{lagoon_input} is determined the notation applied in the table is not consistent with the values applied and the calculations available in the ER sheet				
Project participant response (1st round)				**Date:** 09/05/2016
The value of the M_{lagoon_input} applied in the MR, version01, section E.2, were consistent with the ER, version 01, PE sheet.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
MR has been appropriately revised. CAR5.2 is closed				

CAR ID	5.3	Section no.	E.8.2	Date: 13/04/2016
Description of CAR				
The value of $M_{lagoon\_aerobic}$ for the period 01/11/2014 – 31/12/2014 in project emissions is not consistent with the ER sheet submitted				
Project participant response (1st round)				**Date:** 09/05/2016
In MR, version02, the value of $M_{lagoon\_aerobic}$ for the period 01/11/2014 – 31/12/2014 in the project emission has been revised to be consistent with the ER sheet (29,197.30 – revised value).				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
MR has been appropriately revised. . CAR5.3 is closed				

CAR ID	5.4	Section no.	E.8.2	Date: 13/04/2016
Description of CAR				
The value of $M_{lagoon\_anaerobic}$ for the period 01/01/2015 – 31/12/2015 is not available in international numbering format (separated by commas for millions and thousands).				
Project participant response (1st round)				**Date:** 09/05/2016
In the MR, version02, Section E.2, the value of $M_{lagoon\_anaerobic}$ for the period of 01/01/2015 – 31/12/2015 has been revised to be in the international numbering format.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
MR has been appropriately revised. . CAR5.4 is closed				

CAR ID	6	Section no.	E.8.4	Date: 13/04/2016
Description of CAR				
The final emission reduction value has not been rounded down.				
Project participant response (1st round)				**Date:** 09/05/2016
The value of final emission reduction in both MR version 02 and ER sheet 02 has been rounded down. Moreover, the value of the final emission reduction has been revised in the MR, version02 and ER, version02.				
Documentation provided by project participant				
-				
DOE assessment (1st round)				**Date:** 06/06/2016
Final emission reduction in both MR version 02 and ER sheet 02 has been rounded down. CAR 6 closed.				

Table 4. FAR from this verification

FAR ID	NA	**Section No.**	NA	**Date:** NA
Description of FAR				
Based on the review of the monitoring report version 01 of 04/03/2016 **/01/** no FAR is raised during this monitoring period.				
Project participant response				**Date:** NA
NA				
Documentation provided by project participant				
NA				
DOE assessment				**Date:** NA
NA				

- - - - -

Document information

Version	*Date*	*Description*
01.0	23 March 2015	Initial publication.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: project activities, verifying and certifying