




Verification and certification report form for CDM programme of activities
(version 01.0)

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

VERIFICATION AND CERTIFICATION REPORT

Title of the programme of activities (PoA)	Thailand Small Scale Livestock Waste Management Program	
UNFCCC reference number of the PoA	8027	
Version number(s) of the PoA-DD(s) applicable to this report	Version 14	
Version number of the verification and certification report	Version 2.0 Aa	
Completion date of the verification and certification report	05/04/2017	
Monitoring period number	1 st Monitoring period	
Duration of this monitoring period	09/11/2012 – 31/12/2014 (both days included)	
Number and version number of the monitoring report to which this report applies	Number of monitoring reports: 01 Version: 6.3 of 10/03/2017	
Coordinating/managing entity (CME)	Energy Research and Development Institute Nakornping of Chiang Mai University	
Host Party(ies)	Host Party(ies) of the PoA	Is this a host Party to a CPA covered in this report?(yes/no)
	Thailand	Yes
Sectoral scope(s)	13	
Selected methodology(ies)	AMS-III.D, version 18 - Methane recovery in animal manure management systems.	
Selected standardized baseline(s)	N/A	
Total estimated GHG emission reductions or net GHG removals for this monitoring period in the included CPA(s) covered in this report	119,487 tCO _{2e}	
Total certified GHG emission reductions or net GHG removals for this monitoring period for the included CPA(s) covered in this report	13,858 tCO _{2e}	
Name of DOE	RINA Services S.p.A. (RINA)	

Name, position and signature of the approver of the verification and certification report	Laura SEVERINO – Unit Manager Sustainability & Climate Change 
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SECTION A. Executive summary

>> Purpose and general description and location:

The PoA is developed by Energy Research and Development Institute – Nakhonping of Chiang Mai University (ERDI) also the CME of the PoA aims to reduce greenhouse gas emissions from piggyeries manure by converting anaerobic lagoons to flow closed anaerobic treatment digesters with biogas capture and power generation in Thailand. The treatment of livestock manure by way of anaerobic digester processes leads to the production of a biogas consisting of 60% methane (CH₄). The project will apply anaerobic digesters which will capture the biogas and use it to generate electricity for on farm consumption or sale to national grid.

The 'CPA 01' covered under this monitoring period involves manure management in three swine farms (Chokchaikansukorn farm- 14°52'25.3"N and 102°10'20.9", Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) -13°46'27.6"N and 101°24'37.4"E and Laemthong Hybrid Co., Ltd (Wang Noi Farm- 14°11'45.3"N and 100°39'28.7"E) to recover biogas, thereby reducing methane emissions and utilization of recovered biogas for electricity generation. Each of the farm installed digester of 3,750 m³ capacity which is equipped to gas generator to generate power and utilize the same for in-house consumption.

Verification scope:

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

The verification scope is:

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

Verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable UNFCCC criteria for CDM 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 assesses 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 The World Bank (The International Bank for Reconstruction and Development as Trustee of the Carbon Fund for Europe), has verified the greenhouse gas emission reductions reported for the CPA "Thailand Small Scale Livestock Waste Management Program CPA 01" in Thailand, CDM Registration Reference N° 8027-0001, for the period 09/11/2012 to 31/12/2014 (both days included), with regard to the relevant requirements for CDM PoA/CPA activities. The verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable CDM requirements in order to be certified.

The PoA was validated by DNV (validation report N° 2010-0125 issued on 12/10/2012) and it was registered on 09/11/2012 under the CDM registration reference N° 8027; the CPA was validated by DNV (validation report N° 2010-0114 issued on 12/10/2012) and it was registered on 09/11/2012 under the CDM registration reference N° 8027-0001.

The GHG emission reductions were calculated on the basis of the approved methodology AMS-III.D, version 18, 'Methane recovery in animal manure management systems' of 29/09/2011 and the monitoring plan included in the registered CPA Project Design Document, version 10 of 27/08/2012 and revised CPA DD version 14 dated 18/08/2016.

In conclusion, it is RINA's opinion that the CPA "Thailand Small Scale Livestock Waste Management Program CPA 01", in "Thailand", as described in the Monitoring Report version 6.3 of 10/03/2017, meets all relevant requirements for CDM PoA/CPA activities and all relevant host Party criteria and correctly applies the baseline and monitoring methodology "AMS-III.D", "Methane recovery in animal manure management systems", version 18 of 29/09/2011. In our opinion the GHG emission reductions reported for the project in the monitoring report are fairly stated.

SECTION B. Verification team, technical reviewer and approver

B.1. Verification team members

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 & Technical Expert (TA 13.2)	IR	Menon	Rekha	RINA India	√	√	√	√
2.	Verifier	IR	Buragohain	Champok	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	IR	Valoroso	Rita	RINA Central Office
2.	Technical Expert in TA 13.2	IR	Kudtarkar	Shruti	RINA India
3.	Approver	IR	Severino	Laura	RINA Central Office

SECTION C. Means of verification

C.1. Desk review

>>The monitoring report, version 01 of 11/02/2015, version 02 of 13/08/2015, version 03 of 21/01/2016, version 04 of 11/06/2016 and version 5 of 18/08/2016 and version 06.3 of 10/03/2017 /01/, the emission reduction calculations provided in the form of a spreadsheet (ERs calculation as Dec 2014.xls) version 01 of 11/02/2015, version 02 (ERs calculation_27AUG2015.xls) of 13/08/2015 and version 03 of (ERs calculation_7Jul2016_TDL10_095.xls) 18/08/2016 and version 04 (ERs calculation_10Mar2017) of 10/03/2017 /02/ were assessed as part of the verification. In addition the registered PoA DD, version 10 and revised PoA DD version 14 of 18/08/2016 /03/, registered CPA-DD for CPA 1 version 10 and revised CPA-DD version 14 of 18/08/2016 /04/, in particular the baseline estimations and the monitoring plan and the validation report /05/ for the project were reviewed.

The monitoring report version 01 of 11/02/2015 /01/ was made publicly available on the CDM UNFCCC website on 18/02/2015. Appendix 3 lists the documentation that was reviewed during the verification.

C.2. On-site inspection

Duration of on-site inspection: 04/03/2015 to 06/03/2016				
No.	Activity performed on-site	Site location	Date	Team member
1.	Assessment of the implementation and operation of the project activity as per the registered PoA framework and registered monitoring plan;	Swine farm of Khana Hybrid Co., Ltd. (Phanomsarakham Farm 1), Thailand.	04/03/2015	Rekha Menon & Champok Buragohain
	Monitoring arrangements and location of monitoring equipments (flow meter, energy meter, weighing scale etc.).			
	Interviews with relevant personnel to determine whether the operational and data collection procedures are implemented in accordance with the registered monitoring plan;	Chokchaikansukorn Farm, Thailand.	05/03/2015	
	Cross check between information provided in the monitoring report and data from plant records such as logbooks, inventories, purchase records, invoices, energy bills, calibration records or similar data sources;	Laemthong Hybrid Co., Ltd (Wang Noi Farm), Thailand	06/03/2015	
	A review of calculations and assumptions made in determining the GHG data and emission reductions and QA/QC procedures.			

C.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Seppala	Juha	The World Bank	04/03/2015-06/03/2015	Project implementation and operation, Institutional arrangement and Technical aspects project activity. Preparation of the Monitoring Report (MR), calculation of the ER. Information flows for generating, aggregating and reporting the monitoring parameters	Rekha Menon & Champok Buragohain
2	Ru	Jiang	The World Bank	04/03/2015-06/03/2015		
3	Zhou	Weiguo	The World Bank	04/03/2015-06/03/2015		
4	Siripat	Alongkon	ERDI	04/03/2015-06/03/2015	Information flows for generating, aggregating and reporting the monitoring parameters Cross-check of information in the monitoring report and data source Monitoring plan and monitoring parameters. Technical equipment, calibration and monitoring observation.	
5	Suntikunakorn	Amornpun	Phanomsarakham Farm 1	04/03/2015		
6	Chitcharaenthon	Ekkaphoom	Chokchaikan sukorn Farm	05/03/2015		
7	Laodee	Witoon	Laemthong Hybrid Co., Ltd (Wang Noi Farm)	06/03/2015		

C.4. Sampling approach

>>No sampling approach has been considered for the PoA. However, for monitoring of 'Average animal weight of a defined livestock population at the project site' (W_{site}), random sampling approach has been adopted at each CPA level and at each farm within the CPA for each of the swine category. The sampling plan has been detailed in the MR. 90/10 confidence precision has been considered by project participant and accordingly sample number in each swine category is determined for monitoring W_{site} for each swine type.

Every year, considering the total swine population under each swine category sample size to be determined considering 90/10 confidence precision. For this monitoring period (09/11/2012 to 31/12/2014) the CME and participating farms temporarily did not monitor the above parameter (W_{site}) from 09/11/2012 to 31/12/2013 and therefore considered this value as zero (as per appendix 1, paragraph 2 of project standard version 09). For the period 01/01/2014 to 31/12/2014 the sample size for each swine category at each farm results to 68 (except for Breed male in Chokchai farm results 54 samples).

The sample size of 68 in each swine category in each farm is deemed to be adequate due to the following reasons. With margin of error to be 10%, confidence level at 90% and 50% response distribution the maximum sample size results to be 68 /19/. Therefore, selected sample by CME is representative of each type of swine population as outlined in MR and meets the desired confidence precision /18/.

RINA considered to verify all 68 samples in each swine category at each farm for all the years covering the monitoring period during on-site visit. RINA's sample size of 68 swine for each swine category at each farm for onsite visit was deemed to be adequate due to the following reasons. RINA selected acceptable quality level at 10% (margin of error) and the proportion of discrepancies at a level of 20%. In line with paragraph 28 of the sampling standard /18/, the maximum discrepancy was fixed at 10% of the determined sample size. As per sampling plan in CPA-DD, sample size is calculated considering 90% confidence level and 10% margin

error /04/. Thus at 10% relative precision, 50% expected proportion and confidence level of 90% a sample size of only 55 swine for each swine type is determined following equation 1 of Appendix 1 of guidelines-sampling and surveys for CDM project activities and programmes of activities, Version 04 /36/.

Hence RINA's sample size of 68 swine for each swine type is deemed to be adequate and conservative. RINA's onsite visit of the sampled 68 swine for each swine type further revealed 0% samples with discrepancy which is under acceptable discrepancy level.

Hence, RINA confirms that the sampling size and the method of onsite verification was in line with the requirements of the sampling standard /18/.

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

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
General			
Compliance of the monitoring report with the monitoring report form	-	1	-
Remaining forward action requests from validation and/or previous verification	-	-	1
Specific-case CPA(s) considered for verification and covered in this report	-	-	-
Programme of activities			
Compliance of the programme implementation with the registered PoA-DD	-	1	-
Implementation and operation of the management system	-	-	-
Post-registration changes	-	-	-
<ul style="list-style-type: none"> Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline 	-	-	-
<ul style="list-style-type: none"> Corrections 	-	1 ¹	-
<ul style="list-style-type: none"> Inclusion of a monitoring plan in a registered PoA-DD (including its generic CPA-DD(s)) 	-	-	-
<ul style="list-style-type: none"> Permanent changes to the monitoring plan as described in the registered PoA-DD, applied methodology, or applied standardized baseline 	-	-	-
<ul style="list-style-type: none"> Changes to the programme design of the registered PoA-DD (including corresponding changes to project design of the generic CPA-DD(s)) and updates to the eligibility criteria for inclusion of specific-case CPAs in the PoA 	-	-	-
<ul style="list-style-type: none"> Types of changes specific to afforestation and reforestation activities 	-	-	-
Component project activity(ies)			
Compliance of the CPA implementation with the included CPA design document	-	-	-
Post-registration changes	-	-	-
<ul style="list-style-type: none"> Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline 	-	1	-
<ul style="list-style-type: none"> Corrections 	-	-	-
<ul style="list-style-type: none"> Changes to the start date of the crediting period 	-	-	-
<ul style="list-style-type: none"> Inclusion of a monitoring plan to an included CPA-DD 	-	-	-
<ul style="list-style-type: none"> Permanent changes to the monitoring plan as described in the included CPA-DD, applied methodology, or applied standardized baseline 	-	-	-
<ul style="list-style-type: none"> Changes to the programme design of the included CPA-DD 	-	-	-
<ul style="list-style-type: none"> Types of changes specific to afforestation and reforestation component project activities 	-	-	-

¹ Raised as issue under CAR 03 (Refer Appendix 4; since the CAR was included under CAR 03, the total number of CARs in Appendix 4 resulted to 6 whereas in above table total CARs shown as 07)

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	-
• Data and parameters fixed ex ante or at renewal of crediting period	-	-	-
• Data and parameters monitored	-	-	-
• Implementation of sampling plan	-	-	-
Compliance with the calibration frequency requirements for measuring instruments	-	1	-
Assessment of data and calculation of emission reductions or net removals	-	1	-
• Calculation of baseline GHG emissions or baseline net GHG removals by sinks	-	-	-
• Calculation of project GHG emissions or actual net GHG removals by sinks	-	-	-
• Calculation of leakage GHG emissions	-	-	-
• Summary of calculation of GHG emission reductions or net GHG removals by sinks	-	-	-
• Comparison of actual GHG emission reductions or net GHG removals by sinks with estimates in included specific-case CPA	-	-	-
• Remarks on difference from estimated value in registered PDD	-	-	-
Others (please specify) Training records of CDM personnel involved in monitoring of project activity.	1	-	-
Total	1	7	1

SECTION D. Internal quality control

>>The draft final verification report before being submitted to UNFCCC 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 E. Verification opinion

>> RINA Service Spa (RINA) has performed verification of the emission reductions reported for the CPA "Thailand Small Scale Livestock Waste Management Program CPA 01" in Country, CDM Registration Reference N° 8027, for the period 09/11/2012 – 31/12/2014, with regard to the relevant requirements for CDM activities included in the PoA "Thailand Small Scale Livestock Waste Management Program".

The project participants/CME of the "Thailand Small Scale Livestock Waste Management Program CPA 01" project are responsible for:

- the preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered project design document version 10 of 27/08/2012 and the revised PoA DD version 14 of 18/08/2016
- 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 CPA has been implemented and operated as per the CPA DD version 14 of 18/08/2016 and PoA-DD version 14 of 18/08/2016;
- 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 CPA DD version 14 of 18/08/2016 and PoA-DD version 14 of 18/08/2016;

- the monitoring plan in the CPA DD version 14 of 18/08/2016 and PoA-DD version 14 of 18/08/2016 is as per the applied baseline and monitoring methodology.

SECTION F. Certification statement

>>It is RINA's opinion that the GHG emission reduction stated in the monitoring report version 06.3 of 10/03/2017 for the "Thailand Small Scale Livestock Waste Management Program CPA 01" project in Country for the period 09/11/2012 to 31/12/2014 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology "AMS-III.D", "Methane recovery in animal manure management systems", version 18 of 29/09/2011 and the monitoring plan contained in the registered. Hence RINA is able to certify that the emission reductions from the project during the monitoring period 09/11/2012 to 31/12/2014 amount to 13,858 tCO_{2e}.

SECTION G. Verification findings - General**G.1. Compliance of the monitoring report with the monitoring report form**

Means of verification	Comparing the monitoring report /01/ with the monitoring report form provided by CDM EB listed in UNFCCC website /10/.
Findings	CAR 06 was raised to include brief description of the installed technology and equipments, project implementation details and technical specifications of digester and biogas electric generators to which PP has revised the MR incorporating the details as seen during site visit and consistent with registered CPA-DD. Hence, CAR was closed.
Conclusion	RINA confirms that the monitoring report used by the PP is compliance with the latest MR form available at UNFCCC website and is completed in accordance with the applicable instruction /10/.

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

>> Based on the review of validation report of PoA /05/, 1 FAR was raised during the PoA validation. The FAR has been successfully closed as described below:

FAR 1 stated "The coordinating entity should ensure that each farm has the necessary data (i.e. swine population etc.) for the crediting period as for the verification of emission reductions there needs to be reliable data at the farm". It has been verified from each farms log book records which represents the records of animal entries (purchase; births, internal transfer) and exit (ex: sale, death, internal transfer) and the final monthly record of animals per animal category (ex: nursery, farrow, fattening 1 and fattening 2, breeding male, breeding female, pregnant sow) /14/, /15/, /16/. Therefore, it is confirmed that each farm has reliable data for calculating emission reductions. Hence the FAR is closed.

Based on the review of specific CPA validation report /05/, no FAR was raised during the CPA validation.

G.3. Specific-case CPA(s) considered for verification and covered in this report

Reference number of the specific-case CPA included in the PoA as of the end of this monitoring period	Is the specific-case CPA considered for this verification? (yes/no)	Version number of the registered PoA-DD to which the specific-case CPA complies with	Confirmation that a request for issuance including the specific-case CPA has been published for the previous monitoring period (Y/N)
8027-0001	Yes	version 10 of 27/08/2012 and revised DD version 14 of 18/08/2016	N
8027-0002	No	version 05.1 of 25/11/2014 and revised DD version 09 of 18/08/2016	N
8027-0003	No	version 05.1 of 27/11/2014 and revised DD version 09 of 18/08/2016	N

SECTION H. Verification findings – Programme of activities**H.1. Compliance of the programme implementation with the registered programme design document**

Means of verification	<p>RINA has performed a site visit to assess that all physical features (technology, project equipment, and monitoring and metering equipment) of the CPA in the registered PoA-DD are in place and to verify the real implementation of the project against the description in its registered PoA-DD.</p> <p>The PoA involves, livestock manure management (in swine farms) and setting up anaerobic digester to recover biogas and utilize for power generation. This project plans to install anaerobic digestion technology designed by Energy Research and Development Institute (ERDI). The CPA under verification in this monitoring period involves three swine farms namely Chokchaikansukorn Farm, Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) and Laemthong Hybrid Co., Ltd (Wang Noi Farm). Each farm has installed anaerobic bio-digester of 3,750m³ and commissioned prior to the registration of the project activity under UNFCCC /05/. At Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) the digester is equipped with two gas engine of capacity 150kW each, at Chokchaikansukorn Farm the digester is equipped with two gas engine of capacity 200kW each and at Laemthong Hybrid Co., Ltd (Wang Noi Farm) the digester is equipped with two gas engine of capacity 150 kW each. The commissioning of digester and gas engine at each farm is verified from commissioning report of ERDI (technology supplier) /20/.</p>
Findings	N/A
Conclusion	RINA confirms that the implementation and operation of the registered PoA and included CPA that is taken for this verification has been conducted in accordance with the description contained in the registered PoA-DD and CPA-DD.

H.2. Implementation and operation of the management system

Means of verification	<p>RINA conducted documents review and on-site interview to assess implementation and operation of the management system are consistent with the PoA-DD and CPA-DD. The followings were accessed and confirmed.</p> <ul style="list-style-type: none"> - The CME (ERDI) is under overall responsibility for operation and implementation of the programme. ERDI conducts regular audit and records review at each farm for consistency of implementing and monitoring arrangements. - A monitoring structure was established. ERDI (CME) and participating each farm working on the monitoring work of this PoA. - The data collection and management process is finally under the control of CME. Each farm sends raw data to CME and CME transfer the same for the calculation of the emission reduction. <p>During on-site inspection, data management system was checked by the verification team. Raw data at each farm was cross checked against the complied data presented in the ER sheet. Therefore, RINA is able to confirm that the data management system were properly designed and operated, and operation was well followed.</p>
Findings	N/A
Conclusion	In conclusion, based on document review and interview, RINA confirms that the implementation and operation of the management system included in the CPA-DD are consistent with the registered PoA-DD and CPA-DD.

H.3. Post-registration changes**H.3.1. Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline**

>> N/A

H.3.2. Corrections

>> Correction is applied to include default values of $B_{0,LT}$ (Maximum methane producing potential of the volatile solid generate for animal type "LT") and $VS_{LT,y}$ (Volatile solids for livestock "LT" entering the animal manure management system in year "y") from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National

Greenhouse Gas Inventories volume 4 Chapter 10 for swine origin either from any of the region included in the above table. This is in line with the applicable methodology (AMS-III.D, version 18).

This correction does not affect the design of the PoA and hence do not require prior approval from CDM Executive Board as per Appendix 1 of project standard. Revised PoA-DD, version 14 of 18/08/2016 is submitted with validation report form for post-registration changes for CDM programme of activities version 1.0 of 30/08/2016 is submitted along with this issuance /34/.

H.3.3. Inclusion of a monitoring plan in a registered PoA-DD (including its generic CPA-DD(s))

>>N/A

H.3.4. Permanent changes to the monitoring plan as described in the registered PoA-DD, applied methodology, or applied standardized baseline

>> N/A.

H.3.5. Changes to the programme design of the registered PoA-DD (including corresponding changes to project design of the generic CPA-DD(s)) and updates to the eligibility criteria for inclusion of specific-case CPAs in the PoA

>>N/A.

H.3.6. Types of changes specific to afforestation and reforestation activities

>>N/A

SECTION I. Verification findings – Component project activity(ies)

I.1. Compliance of the CPA implementation with the included CPA design document

Means of verification	<p>RINA visited the project site of the implemented CPA to access at all physical features (technology, project equipment, and monitoring and metering equipment) of the included CDM CPA in this monitoring period are in places and the coordinating/managing entity have operated the CPA as per the PoA-DD and included CPA-DD.</p> <p>The CPA includes livestock manure management and setting up anaerobic digester to recover biogas and utilize for power generation in three swine farms namely Chokchaikansukorn Farm, Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) and Laemthong Hybrid Co., Ltd (Wang Noi Farm). Each farm has installed anaerobic bio-digester of 3,750m³ and commissioned prior to the registration of the project activity under UNFCCC /05/. At Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) the digester is equipped with two gas engine of capacity 150kW each although runs at a load of 130kW /21/, at Chokchaikansukorn Farm the digester is equipped with two gas engine of capacity 200kW each, although runs at a load of 150 kW /21/ and at Laemthong Hybrid Co., Ltd (Wang Noi Farm) the digester is equipped with two gas engine of capacity 150 kW each which runs at a load of 110 kW and 130 kW /21/. The commissioning of digester and gas engine at each farm is verified from commissioning report of ERDI (technology supplier) /20/. The biogas generation and its utilization (burning at gas engine and flaring) is monitored so as to estimate the methane avoidance. The generated power is used for internal consumption at farm. Biogas consumption in gas engines and at flaring are monitored continuously in separate mass flow meter in each farm. Other arrangements are in line with the registered CPA-DD.</p> <p>The change in biogas engine capacity from registered CPA-DD does not impact on additionality of the CPA or scale of the project and applicability of methodology.</p>
Findings	<p>CAR 1 was raised to submit commissioning certificates of digester and biogas engines at each farm to which PP has submitted commissioning report of each farm. The commissioning is prior to the date of crediting period start date. Response was accepted by assessment team. Further, clarification was sought on installed capacity of biogas electric generator at each farm as the registered CPA-DD states installed capacity of 200 kW, whereas in actual it is different as explained</p>

	above. PP has revised the CPA-DD as permanent change and justified that there is no impact on additionality, scale of the project and applicability of methodology due to this change. Therefore, the change is as per Appendix 1 of project standard which does not require prior EB approval. In summary, the CAR was closed
Conclusion	RINA confirms that the implementation and operation of the registered PoA and included CPA that is taken for this verification has been conducted in accordance with the description contained in the registered PoA-DD and CPA-DD; The change in project design proposed in the PoA and CPA-DD comply with Appendix 1 of the Project standard /07/ as explained in relevant sections.

I.2. Post-registration changes

I.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>> Temporary deviations have been applied for monitoring electricity consumed by the project from grid ($EC_{PJ,y}$). The CME could not monitor or provide evidence related to monitoring of the parameter for the monitoring period and therefor estimated assuming that the source of the GHG emissions operated at maximum capacity for entire monitoring period. This temporary deviation complies with Appendix 1 of project standard and hence, no prior approval from CDM Executive Board is required. Further, in line with paragraph 3 of Appendix 1 of project standard, 10% addition has been considered as transmission and distribution loss. The MR and emission reduction worksheet have been checked and found to be in line with the requirements /01/, /02/. Revised CPA-DD, version 14 of 18/08/2016 is submitted with validation report form for post-registration changes for CDM programme of activities version 1.0 of 30/08/2016 is submitted along with this issuance /34/. Similarly, CME and participating farms temporarily did not monitor the parameter (W_{site}) from 09/11/2012 to 31/12/2013 and therefore considered this value as zero for that period. This is as per Appendix 1, paragraph 2 of project standard version 09 /07/.

I.2.2. Corrections

>> N/A

I.2.3. Changes to the start date of the crediting period

>> N/A

I.2.4. Inclusion of a monitoring plan to an included CPA-DD

>> N/A

I.2.5. Permanent changes to the monitoring plan as described in the included CPA-DD, applied methodology, or applied standardized baseline

>> N/A

I.2.6. Changes to the programme design of the included CPA-DD

>> There has been change in design of the CPA-01 as the installed capacity of biogas electric generator at each farm as the registered CPA-DD was 200 kW, whereas in actual it is different. At Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) the digester is equipped with two gas engine of capacity 150kW each although runs at a load of 130kW /21/, at Chokchaikansukorn Farm the digester is equipped with two gas engine of capacity 200kW each, although runs at a load of 150 kW /21/ and at Laemthong Hybrid Co., Ltd (Wang Noi Farm) the digester is equipped with two gas engine of capacity 150 kW each which runs at a load of 110 kW and 130 kW /21/. With the post registration change in the CPA-DD-01 no adverse impact on the following have been envisaged as explained below:

- a) The applicability of the methodology: The only change is the installed capacity of biogas electric generator which has no impact on the applied methodology. The programme and the component

project still animal manure management in livestock farm (swine farm) as described in the registered CPA-DD. Hence, applied methodology AMS-III.D, version 18 is stands applicable.

- b) The additionality of the project activity: The additionality in the registered CPA-DD was assessed considering cost of biogas electric generation and biogas production and thereby saving in electricity purchase from grid /04/. With the change in installed capacity of biogas electric generation there is impact on biogas generation and saving in electricity purchase from grid which has impact on IRR of the CPA. However in the actual scenario, the operational capacity of gas engines are low as described above resulting less biogas generation and less saving in electricity purchase. This has been described in the revised CPA-DD and validation report /34/. Therefore, there is no adverse impact on additionality of the CPA due to the change in design.
- c) The scale of the project activity: Due to the change, the scale of the project is not changed as the expected annual emission reduction from the CPA is still less than 60kt CO_{2e}. Hence, there is no impact on project scale.

Considering the above, the change in design is as per paragraph 6 of Appendix 1 of project standard /07/ and hence does not require prior approval from EB. Revised CPA-DD, version 14 of 18/08/2016 is submitted with validation report form for post-registration changes for CDM programme of activities version 1.0 of 30/08/2016 is submitted along with this issuance /34/.

I.2.7. Types of changes specific to afforestation and reforestation component project activities

>> N/A

I.3. Compliance of monitoring plan with the monitoring methodology including applicable tool and standardized baseline

Means of verification	The registered monitoring plan is in compliance of AMS-III.D version 18 and applied 'tool to determine project emissions from flaring of gases containing methane' and all monitoring parameters ($N_{LT,y}$, $N_{da,y}$, $N_{p,y}$, W_{site} , BG_{burnt} , BG_{flare} , $EC_{PJ,y}$ and FFR) as per the registered monitoring plan found monitored during this monitoring period by each participating farm. The CME is responsible for compiling and keeping all records necessary for emission reduction of the project activity.
Findings	CAR 2 was raised to include sampling plan in the monitoring report in consistent with the registered monitoring plan of the CPA-DD to monitor average animal weight of a defined livestock population at the project site (W_{site}), to which PP has included the sampling plan being followed at site to monitor W_{site} . The verification team found the sampling plan to be consistent with the 'standard 'sampling and surveys for CDM project activities and programmes of activities' /18/ and hence accepted. Hence, CAR was closed. Further, monitoring of electricity consumed by the project from the grid ($EC_{PJ,y}$) in each farm was raised under CAR 3 to which PP has applied temporary deviation in line with Appendix 1 of project standard as explained under section I.2.1 above. Therefore, the issue was closed by the assessment team. Also CL 01 was raised to provide copies of records of training provided to employees on CDM monitoring system, operation of digester and gas engine to which PP has submitted the relevant records as verified during site visit. Hence, CL was closed.
Conclusion	RINA confirms that the monitoring plan of the included CPA-DD is in compliance with the monitoring methodology including applicable tool(s) /01/, /03/, /04/, /09/. Temporary deviation proposed for this monitoring period from the registered monitoring plan, applied methodology is in consistent with Appendix 1 of project standard /07/.

I.4. Compliance of monitoring activities with the registered monitoring plan

I.4.1. 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
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	Capacity / for each participating farm (kW)	Commissioning report of digester and biogas plant at each farm /20/	ChokchaiKansu Farm: 200kW*2 Khana Hybrid Farm: 150kW*2 Wang Noi Farm: 150kW*2	The value is cross checked from name plant and commissioning reports during site visit and confirmed to be correct. However, the actual operating load is 150kW in ChokchaiKansu Farm, 130kW in Khana Hybrid Farm and 110kW and 130 kW in Wang Noi Farm as confirmed during site visit and from operation reports from ERDI /21/. Hence, accepted the same in the revised CPA-DD.
	Fraction of manure being treated by the system ($MS\%_{BI,j}$)	Data based on registered CPA-DD /04/ and validation report /05/	100%	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE to follow the applied methodology and already approved by EB /04/, /05/.
	Global Warming Potential of Methane (GWP_{CH_4})	Data based on registered CPA-DD /04/ and validation report /05/	21 tCO_{2e}/tCH_4 for first commitment period upto 31/12/2012 and 25 from 01/01/2013 onwards.	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE and as per EB guideline /04/, /05/, /17/.
	Density of methane at room temperature (20°C) and 1 atm pressure (D_{CH_4})	Data based on registered CPA-DD /04/ and validation report /05/	0.00067 t/m^3	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE to follow the applied methodology and already approved by EB /04/, /05/.
	Annual methane conversion factor (MCF) for baseline animal waste management system "j" (MCF_j)	Data based on registered CPA-DD /04/ and validation report /05/	80%	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE to follow the applied methodology and already approved by EB /04/, /05/.
	Maximum methane producing potential of the volatile solid generate for animal type "LT" ($B_{0,LT}$)	IPCC Guidelines for National Greenhouse Gas Inventories Annex 10A.2 Tables 10A-7 and 10A-8 /22/	Default as per Annex 10A.2 Tables 10A-7 and 10A-8 /22/	The value as reported in revised CPA-DD is default value of IPCC /22/ and consistent with methodology requirement /09/. Hence, accepted by the verification team.

	Model correction factor to account for model uncertainties (UF_b)	Data based on registered CPA-DD /04/ and validation report /05/	0.94	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE to follow the applied methodology and already approved by EB /04/, /05/.
	Volatile solids for livestock "LT" entering the animal manure management system in year "y" ($VS_{LT,y}$)	IPCC Guidelines for National Greenhouse Gas Inventories Annex 10A.2 Tables 10A-7 and 10A-8 /22/	Default as per Annex 10A.2 Tables 10A-7 and 10A-8 /22/	The value as reported in revised CPA-DD is default value of IPCC /22/ and consistent with methodology requirement /09/. Hence, accepted by the verification team.
	Flare Efficiency (FE)	Data based on registered CPA-DD /04/ and validation report /05/	50%	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE to follow the applied methodology and tool and already approved by EB /04/, /05/.
	Emission coefficient of the electricity distribution system (CEF_{grid})	Data based on registered CPA-DD /04/ and validation report /05/	0.5661 tCO_2/MWh	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE to follow the applied methodology and already approved by EB /04/, /05/.
	Methane content in biogas in the year "y" on a dry basis (mass fraction) ($w_{CH_4,y}$)	Data based on registered CPA-DD /04/ and validation report /05/	60%	The value is as per the registered CPA-DD, which has been justified and validated by validation DOE to follow the applied methodology and already approved by EB /04/, /05/.
Findings	CAR 1 was raised on installed capacity of biogas electric generator at each farm as the registered CPA-DD states installed capacity of 200 kW at each farm whereas in actual it was different. PP has revised the CPA-DD as permanent change and justified that there is no impact on additionality, scale of the project and applicability of methodology due to this change. Therefore, the change is as per Appendix 1 of project standard which does not require prior EB approval. In summary, the CAR was closed. Under CAR 3, query was raised to provide supporting evidence to prove the genetic origin of swines from Annex-1 country to which PP has corrected the PoA-DD and CPA-DDs and accordingly modified the $B_{0,LT}$ and $VS_{LT,y}$ of each type of swine. The revised details are in consistent with IPCC default values and falls under correction to project information as per Appendix 1 of project standard /07/. Hence, CARs were closed by the assessment team.			
Conclusion	RINA confirms that all the ex-ante parameters have been correctly mentioned and justified in section G.1 of the MR and applied in the ER calculation process. The information of data and parameters fixed ex-ante provided in the monitoring report is compliance with the revised PoA-DD and revised CPA-DD /01/, /03/, /04/.			

I.4.2. Data and parameters monitored

Means of verification	Data/Parameter	Assessment																																																																																																											
	Data Unit	$N_{da,y}$; number																																																																																																											
	Description	Number of days animal is alive in the farm in the year y .																																																																																																											
	Source of data to be used	Farm record																																																																																																											
	Value of monitored parameter for the monitoring period	<p>$N_{da,y}$ is incorporated in monthly farm records for arriving total number of animals produced annually of type LT ($N_{LT,y}$). The farm record includes daily purchase (births, internal transfer) and exit (ex: sale, death, internal transfer). Therefore, $N_{LT,y}$ record implicitly consider $N_{da,y}$. Farm wise, $N_{LT,y}$ recorded value is provided below:</p> <p>Laemthong Hybrid (Wang Noi):</p> <table><tr><td></td><td>2012 (Nov-Dec)</td><td>2013</td><td>2014</td><td>Period Total</td></tr><tr><td>Nursery</td><td>29,999</td><td>154,430</td><td>153,347</td><td>337,776</td></tr><tr><td>Fattening 1</td><td>13,422</td><td>68,416</td><td>51,922</td><td>133,760</td></tr><tr><td>Fattening 2</td><td>4,649</td><td>32,934</td><td>55,619</td><td>93,202</td></tr><tr><td>Breed Male</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Breed Female</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Farrow</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table> <p>Chokchaikansukorn:</p> <table><tr><td></td><td>2012 (Nov-Dec)</td><td>2013</td><td>2014</td><td>Period Total</td></tr><tr><td>Nursery</td><td>9,916</td><td>39,256</td><td>46,568</td><td>95,740</td></tr><tr><td>Fattening 1</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Fattening 2</td><td>13,868</td><td>91,415</td><td>83,045</td><td>88,328</td></tr><tr><td>Breed Male</td><td>80</td><td>352</td><td>260</td><td>692</td></tr><tr><td>Breed Female</td><td>3,222</td><td>17,546</td><td>18,633</td><td>39,401</td></tr><tr><td>Farrow</td><td>7,458</td><td>30,372</td><td>27,544</td><td>65,374</td></tr></table> <p>Khana Hybrid (Phanom):</p> <table><tr><td></td><td>2012 (Nov-Dec)</td><td>2013</td><td>2014</td><td>Period Total</td></tr><tr><td>Nursery</td><td>15,032</td><td>136,194</td><td>141,881</td><td>293,107</td></tr><tr><td>Fattening 1</td><td>10,001</td><td>50,248</td><td>65,707</td><td>125,956</td></tr><tr><td>Fattening 2</td><td>12,219</td><td>55,606</td><td>52,175</td><td>120,000</td></tr><tr><td>Breed Male</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Breed Female</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Farrow</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table> <p>RINA cross-checked the monthly values used in the emission reduction calculation /02/ against the monthly records /14-16/ and found the report values to be</p>					2012 (Nov-Dec)	2013	2014	Period Total	Nursery	29,999	154,430	153,347	337,776	Fattening 1	13,422	68,416	51,922	133,760	Fattening 2	4,649	32,934	55,619	93,202	Breed Male	-	-	-	-	Breed Female	-	-	-	-	Farrow	-	-	-	-		2012 (Nov-Dec)	2013	2014	Period Total	Nursery	9,916	39,256	46,568	95,740	Fattening 1	-	-	-	-	Fattening 2	13,868	91,415	83,045	88,328	Breed Male	80	352	260	692	Breed Female	3,222	17,546	18,633	39,401	Farrow	7,458	30,372	27,544	65,374		2012 (Nov-Dec)	2013	2014	Period Total	Nursery	15,032	136,194	141,881	293,107	Fattening 1	10,001	50,248	65,707	125,956	Fattening 2	12,219	55,606	52,175	120,000	Breed Male	-	-	-	-	Breed Female	-	-	-	-	Farrow	-	-	-
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Monitoring equipment	N/A
Accuracy of the monitoring equipment	N/A
Measuring/Reading/Recording frequency	Recorded monthly and aggregated annually. This is as per registered monitoring plan.
Calculation method (if applicable)	N/A

Data/Parameter	Assessment																																																																	
Data Unit	$N_{p,y}$; number																																																																	
Description	Number of animals produced annually of type LT for the year y.																																																																	
Source of data to be used	Participating farm record																																																																	
Value of monitored parameter for the monitoring period	<p>$N_{p,y}$ is incorporated in monthly farm records for arriving total number of animals produced annually of type LT ($N_{LT,y}$). The farm record includes daily purchase (births, internal transfer) and exit (ex: sale, death, internal transfer). Therefore, $N_{LT,y}$ record implicitly consider $N_{p,y}$. Farm wise, $N_{LT,y}$ recorded value is provided below: Laemthong Hybrid (Wang Noi):</p> <table border="1"> <thead> <tr> <th></th><th>2012 (Nov-Dec)</th><th>2013</th><th>2014</th><th>Period Total</th></tr> </thead> <tbody> <tr> <td>Nursery</td><td>29,999</td><td>154,430</td><td>153,347</td><td>337,776</td></tr> <tr> <td>Fattening 1</td><td>13,422</td><td>68,416</td><td>51,922</td><td>133,760</td></tr> <tr> <td>Fattening 2</td><td>4,649</td><td>32,934</td><td>55,619</td><td>93,202</td></tr> <tr> <td>Breed Male</td><td>-</td><td>-</td><td>-</td><td>-</td></tr> <tr> <td>Breed Female</td><td>-</td><td>-</td><td>-</td><td>-</td></tr> <tr> <td>Farrow</td><td>-</td><td>-</td><td>-</td><td>-</td></tr> </tbody> </table> <p>Chokchaikansukorn:</p> <table border="1"> <thead> <tr> <th></th><th>2012 (Nov-Dec)</th><th>2013</th><th>2014</th><th>Period Total</th></tr> </thead> <tbody> <tr> <td>Nursery</td><td>9,916</td><td>39,256</td><td>46,568</td><td>95,740</td></tr> <tr> <td>Fattening 1</td><td>-</td><td>-</td><td>-</td><td>-</td></tr> <tr> <td>Fattening 2</td><td>13,868</td><td>91,415</td><td>83,045</td><td>88,328</td></tr> <tr> <td>Breed Male</td><td>80</td><td>352</td><td>260</td><td>692</td></tr> <tr> <td>Breed Female</td><td>3,222</td><td>17,546</td><td>18,633</td><td>39,401</td></tr> </tbody> </table>		2012 (Nov-Dec)	2013	2014	Period Total	Nursery	29,999	154,430	153,347	337,776	Fattening 1	13,422	68,416	51,922	133,760	Fattening 2	4,649	32,934	55,619	93,202	Breed Male	-	-	-	-	Breed Female	-	-	-	-	Farrow	-	-	-	-		2012 (Nov-Dec)	2013	2014	Period Total	Nursery	9,916	39,256	46,568	95,740	Fattening 1	-	-	-	-	Fattening 2	13,868	91,415	83,045	88,328	Breed Male	80	352	260	692	Breed Female	3,222	17,546	18,633	39,401
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	2012 (Nov-Dec)	2013	2014	Period Total
Nursery	15,032	136,194	141,881	293,107
Fattening 1	10,001	50,248	65,707	125,956
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Breed Male	-	-	-	-
Breed Female	-	-	-	-
Farrow	-	-	-	-

RINA cross-checked the monthly values used in the emission reduction calculation /02/ against the monthly records /14-16/ and found the report values to be correct. RINA cross-checked the number of livestock with indirect information like animal purchase and sales /23/. Although monitoring and measurement was done and values are reported from 09/11/2012 to 31/12/2013 the same is not used to claim baseline emissions for the this period due to temporary deviation applied for the parameter ' W_{site} ' for the period 09/11/2012 to 31/12/2013. Therefore, emission reduction is claimed only for the reported value from 01/01/2014 to 31/12/2014. Although project emissions are accounted for whole monitoring period (09/11/2012 to 31/12/2014). This is conservative approach and hence accepted.

Monitoring equipment	N/A
Accuracy of the monitoring equipment	N/A
Measuring/Reading/Recording frequency	Recorded monthly and aggregated annually. This is as per registered monitoring plan.
Calculation method (if applicable)	N/A

Data/Parameter	Assessment																												
Data Unit	W_{site} ; Kg																												
Description	Average animal weight of a defined livestock population at the project site (in kg)																												
Source of data to be used	Farm records of animal weight in each category in the farm annually.																												
Value of monitored parameter for the monitoring period	<table border="1"> <tr> <th>Type of animal</th><th>Chochaik ansukorn</th><th>Khana Hybrid (Phanom)</th><th>Wang Noi</th></tr> <tr> <td>Breeding (male)</td><td>198.08</td><td>-</td><td>-</td></tr> <tr> <td>Breeding (female)</td><td>170.02</td><td>-</td><td>-</td></tr> <tr> <td>Fattening 1</td><td>-</td><td>45.02</td><td>51.40</td></tr> <tr> <td>Fattening 2</td><td>87.40</td><td>90.37</td><td>90.18</td></tr> <tr> <td>Nursery</td><td>14.60</td><td>16.74</td><td>12.98</td></tr> <tr> <td>farrow</td><td>4.70</td><td>-</td><td>-</td></tr> </table> <p>Average value of all samples in the year is considered for emission reduction calculation.</p>	Type of animal	Chochaik ansukorn	Khana Hybrid (Phanom)	Wang Noi	Breeding (male)	198.08	-	-	Breeding (female)	170.02	-	-	Fattening 1	-	45.02	51.40	Fattening 2	87.40	90.37	90.18	Nursery	14.60	16.74	12.98	farrow	4.70	-	-
Type of animal	Chochaik ansukorn	Khana Hybrid (Phanom)	Wang Noi																										
Breeding (male)	198.08	-	-																										
Breeding (female)	170.02	-	-																										
Fattening 1	-	45.02	51.40																										
Fattening 2	87.40	90.37	90.18																										
Nursery	14.60	16.74	12.98																										
farrow	4.70	-	-																										

	Records of all samples were checked and average value is considered in emission reduction calculation. Further the reported values are only for the period from 01/01/2014 to 31/12/2014. Also for fattening 1 swine in Chochaikansukorn farm monitoring was not done for entire monitoring period for which PP has considered this value as zero as temporary deviation (in line with Appendix 1 of CDM project standard) and hence this is conservative.												
Monitoring equipment	<p>Type : Weighing scale</p> <table border="1"> <tr> <th>Farm</th><th>Make</th><th>Sl. No.</th></tr> <tr> <td>Wang Noi</td><td>WI-P</td><td>2013016</td></tr> <tr> <td>Chokchai</td><td>Commandor HP-05</td><td>0000719</td></tr> <tr> <td>Phanom</td><td>Jadever JIK-8CAB</td><td>IK2131237N 4785</td></tr> </table> <p>Accuracy class: 5%</p>	Farm	Make	Sl. No.	Wang Noi	WI-P	2013016	Chokchai	Commandor HP-05	0000719	Phanom	Jadever JIK-8CAB	IK2131237N 4785
Farm	Make	Sl. No.											
Wang Noi	WI-P	2013016											
Chokchai	Commandor HP-05	0000719											
Phanom	Jadever JIK-8CAB	IK2131237N 4785											
Accuracy of the monitoring equipment	The uncertainty measurement of 5% is as per equipment specifications /24-25/.												
Measuring/Reading/Recording frequency	Recorded annually for sample of swines in each category. Measuring and recording frequency is as per registered CPA-DD.												
Calculation method (if applicable)	Not applicable. However, calibration of weighing scales used for monitoring of the parameter were done after the end of the monitoring period; therefore PP has applied maximum error factor of the instrument (5%) for the duration of the monitoring period as per paragraph 395 of VVS, version 09 /08/, /14/. Corrected conservative values are reported in MR and emission reduction worksheet. Original weighing records were verified during site visit at each farm.												

Data/Parameter	Assessment																				
Data Unit	BG _{burnt,v} . Nm ³																				
Description	Biogas volume in year y																				
Source of data to be used	Monitored value as per flow meter																				
Value of monitored parameter for the monitoring period	<table border="1"> <tr> <th>Farm</th><th>2012 (Nov-Dec)</th><th>2013</th><th>2014</th><th>Period Total</th></tr> <tr> <td>Wang Noi</td><td>55,374</td><td>387,371</td><td>381,168</td><td>823,913</td></tr> <tr> <td>Chokchai</td><td>41,708</td><td>534,815</td><td>494,210</td><td>1,070,733</td></tr> <tr> <td>Phanom</td><td>97,762</td><td>677,347</td><td>555,994</td><td>1,331,103</td></tr> </table> <p>Although monitoring and measurement was done and values are reported from 09/11/2012 to 31/12/2013 the same is not used to claim emission reductions for the this period due to temporary deviation applied for the parameter 'W_{site}' for the period 09/11/2012 to 31/12/2013. Therefore, emission reduction is claimed only for the reported value from 01/01/2014 to 31/12/2014. Although project emissions are accounted for whole monitoring period (09/11/2012 to 31/12/2014). This is conservative approach and hence accepted.</p>	Farm	2012 (Nov-Dec)	2013	2014	Period Total	Wang Noi	55,374	387,371	381,168	823,913	Chokchai	41,708	534,815	494,210	1,070,733	Phanom	97,762	677,347	555,994	1,331,103
Farm	2012 (Nov-Dec)	2013	2014	Period Total																	
Wang Noi	55,374	387,371	381,168	823,913																	
Chokchai	41,708	534,815	494,210	1,070,733																	
Phanom	97,762	677,347	555,994	1,331,103																	

Monitoring equipment	Since, $BG_{burnt,y}$ is the summation value of $BG_{elec,y}$ and $BG_{flare,y}$. Monitoring equipment details of $BG_{elec,y}$ and $BG_{flare,y}$ are given in respective parameters.
Accuracy of the monitoring equipment	Refer for parameter $BG_{elec,y}$ and $BG_{flare,y}$.
Measuring/Reading/Recording frequency	Refer for parameter $BG_{elec,y}$ and $BG_{flare,y}$.
Calculation method (if applicable)	$BG_{burnt,y}$ is the summation value of $BG_{elec,y}$ and $BG_{flare,y}$.

Data/Parameter	Assessment																				
Data Unit	$BG_{elec,y}; Nm^3$																				
Description	Amount of biogas captured and used as fuel for the generator																				
Source of data to be used	Monitored value as per flow meter																				
Value of monitored parameter for the monitoring period	<table border="1"> <thead> <tr> <th>Farm</th><th>2012 (Nov-Dec)</th><th>2013</th><th>2014</th><th>Period Total</th></tr> </thead> <tbody> <tr> <td>Wang Noi</td><td>54,203</td><td>379,584</td><td>381,168</td><td>814,955</td></tr> <tr> <td>Chokchai</td><td>41,708</td><td>534,815</td><td>494,210</td><td>1,070,733</td></tr> <tr> <td>Phanom</td><td>97,230</td><td>671,004</td><td>554,175</td><td>1,322,409</td></tr> </tbody> </table> <p>The reported values are cross checked from log book records at each farm and found to be correct/14-16/. The total biogas used in generator was also cross checked from totalized value in the flow meter and found to be correct. The measurement, monitoring recording and QA/QC procedure is as per registered CPA-DD. Further, the emission reduction is claimed as per equation 9 of applied methodology; therefore a conservative approach has been followed.</p>	Farm	2012 (Nov-Dec)	2013	2014	Period Total	Wang Noi	54,203	379,584	381,168	814,955	Chokchai	41,708	534,815	494,210	1,070,733	Phanom	97,230	671,004	554,175	1,322,409
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Monitoring equipment	Endress-Hauser Proline t-mass 65, Thermal mass flowmeter. <table border="1"> <thead> <tr> <th>Farm</th><th>Serial Number</th><th>Installation Date</th></tr> </thead> <tbody> <tr> <td>Wang Noi</td><td>F5147D02000</td><td>30/10/2012</td></tr> <tr> <td>Chokchai</td><td>EC0A3E02000</td><td>28/10/2012</td></tr> <tr> <td>Phanom</td><td>F6006402000</td><td>31/10/2012</td></tr> </tbody> </table>	Farm	Serial Number	Installation Date	Wang Noi	F5147D02000	30/10/2012	Chokchai	EC0A3E02000	28/10/2012	Phanom	F6006402000	31/10/2012								
Farm	Serial Number	Installation Date																			
Wang Noi	F5147D02000	30/10/2012																			
Chokchai	EC0A3E02000	28/10/2012																			
Phanom	F6006402000	31/10/2012																			
Accuracy of the monitoring equipment	± 1.5 % of reading for 100 % to 10 % of range (at reference conditions) ± 0.15 % of full scale for 10 % to 1 % of range (at reference conditions).																				
Measuring/Reading/Recording frequency	Monitored continuously and aggregated monthly and reported annually. This is as per registered monitoring plan / 04/ .																				
Calculation method (if applicable)	N/A																				

Data/Parameter	Assessment
Data Unit	$BG_{flare,y}; Nm^3$
Description	Amount of biogas sent to flare
Source of data to be used	Monitored value as per flow meter

	Value of monitored parameter for the monitoring period	<table border="1"> <tr> <th>Farm</th> <th>2012 (Nov-Dec)</th> <th>2013</th> <th>2014</th> <th>Period Total</th> </tr> <tr> <td>Wang Noi</td> <td>1,171</td> <td>7,787</td> <td>0</td> <td>8,958</td> </tr> <tr> <td>Chokchai</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Phanom</td> <td>532</td> <td>6,343</td> <td>1,819</td> <td>8,694</td> </tr> </table> <p>The reported values are cross checked from log book records at each farm and found to be correct/14-16/. The total biogas flared at each farm was also cross checked from totalized value in the flow meter and found to be correct. The measurement, monitoring recording and QA/QC procedure is as per registered CPA-DD. Further, the emission reduction is claimed as per equation 9 of applied methodology; therefore a conservative approach has been followed.</p>	Farm	2012 (Nov-Dec)	2013	2014	Period Total	Wang Noi	1,171	7,787	0	8,958	Chokchai	0	0	0	0	Phanom	532	6,343	1,819	8,694
	Farm	2012 (Nov-Dec)	2013	2014	Period Total																	
	Wang Noi	1,171	7,787	0	8,958																	
	Chokchai	0	0	0	0																	
	Phanom	532	6,343	1,819	8,694																	
	Monitoring equipment	<p>Endress-Hauser Proline t-mass 65, Thermal mass flowmeter.</p> <table border="1"> <tr> <th>Farm</th> <th>Serial Number</th> <th>Installation Date</th> </tr> <tr> <td>Wang Noi</td> <td>F5147C02000</td> <td>30/10/2012</td> </tr> <tr> <td>Chokchai</td> <td>D3048402000</td> <td>10/10/2014</td> </tr> <tr> <td>Phanom</td> <td>F6006302000</td> <td>31/10/2012</td> </tr> </table>	Farm	Serial Number	Installation Date	Wang Noi	F5147C02000	30/10/2012	Chokchai	D3048402000	10/10/2014	Phanom	F6006302000	31/10/2012								
	Farm	Serial Number	Installation Date																			
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	Chokchai	D3048402000	10/10/2014																			
	Phanom	F6006302000	31/10/2012																			
Accuracy of the monitoring equipment	<p>±1.5 % of reading for 100 % to 10 % of range (at reference conditions)</p> <p>±0.15 % of full scale for 10 % to 1 % of range (at reference conditions).</p>																					
Measuring/Reading/Recording frequency	Monitored continuously and aggregated monthly and reported annually. This is as per registered monitoring plan / 04/ .																					
Calculation method (if applicable)	N/A																					
Data/Parameter	Assessment																					
Data Unit	Flare operation, Hours																					
Description	Flare operation in hour 'h'																					
Source of data to be used	As per farm records																					
Value of monitored parameter for the monitoring period	<p>Total operational hours during the monitoring period (09/11/2012 to 31/12/2014):</p> <table border="1"> <tr> <th>Farm</th> <th>Hours</th> </tr> <tr> <td>Wang Noi</td> <td>111</td> </tr> <tr> <td>Chokchai</td> <td>0</td> </tr> <tr> <td>Phanom</td> <td>111</td> </tr> </table>	Farm	Hours	Wang Noi	111	Chokchai	0	Phanom	111													
Farm	Hours																					
Wang Noi	111																					
Chokchai	0																					
Phanom	111																					
Monitoring equipment	<p>A thermocouple type K, Model TH-10 with SUS316L from IES ELECTRIC Co., Ltd., is used to measure temperature.</p> <table border="1"> <tr> <th>Farm</th> <th>Serial Number</th> </tr> <tr> <td>Wang Noi</td> <td>TH102459</td> </tr> <tr> <td>Chokchai</td> <td>TH101256</td> </tr> <tr> <td>Phanom</td> <td>TH103419</td> </tr> </table>	Farm	Serial Number	Wang Noi	TH102459	Chokchai	TH101256	Phanom	TH103419													
Farm	Serial Number																					
Wang Noi	TH102459																					
Chokchai	TH101256																					
Phanom	TH103419																					
Accuracy of the monitoring equipment	The accuracy of k type thermocouple is ± 2.2C% or ±.75% / 35/ .																					
Measuring/Reading/Recording frequency	The temperature and flaring time will be automatically recorded continuously. Daily flare operational hours recorded in each farm and																					

	monthly summarized value is presented in ER sheet. Monitoring is as per registered monitoring plan /04/.
Calculation method (if applicable)	N/A

Data/Parameter	Assessment																				
Data Unit	EC _{PJ,V} : kWh																				
Description	Quantity of electricity consumed by the project from the grid																				
Source of data to be used	As per electricity meter readings																				
Value of monitored parameter for the monitoring period	<p>Value is estimated considering source of GHG emissions operated at full capacity for the entire monitoring period for all farms and presented in MWh in below:</p> <table border="1"> <thead> <tr> <th></th><th>2012 (Nov-Dec)</th><th>2013</th><th>2014</th><th>Period total</th></tr> </thead> <tbody> <tr> <td>Wang Noi</td><td>24.46</td><td>146.73</td><td>146.73</td><td>317.92</td></tr> <tr> <td>Chokchai</td><td>21.02</td><td>126.14</td><td>126.14</td><td>273.31</td></tr> <tr> <td>Phanom</td><td>18.25</td><td>109.50</td><td>109.50</td><td>237.25</td></tr> </tbody> </table>		2012 (Nov-Dec)	2013	2014	Period total	Wang Noi	24.46	146.73	146.73	317.92	Chokchai	21.02	126.14	126.14	273.31	Phanom	18.25	109.50	109.50	237.25
	2012 (Nov-Dec)	2013	2014	Period total																	
Wang Noi	24.46	146.73	146.73	317.92																	
Chokchai	21.02	126.14	126.14	273.31																	
Phanom	18.25	109.50	109.50	237.25																	
Monitoring equipment	Temporary deviations from the registered monitoring plan is applied in this monitoring period as the project participant/CME have temporarily not monitored the parameter and therefore, in line with Appendix 1 of project standard version 09 /07/, managing entity estimated these parameters assuming that the source of the GHG emissions operated at maximum capacity for the full period. Since, the parameter is for project GHG emissions related to the consumption of electricity, the estimate included an addition of 10% to account for transmission and distribution losses. The installed equipments for consuming grid electricity were verified during site visit and therefore the estimation is correct.																				
Accuracy of the monitoring equipment	N/A																				
Measuring/Reading/Recording frequency	N/A																				
Calculation method (if applicable)	The installed equipments for consuming grid electricity were considered operated at full capacity and for entire period (8760 hours every year) and included an addition of 10% to account for transmission and distribution losses. This is in line with paragraph 2 (3) of Appendix 1 of project standard version 09 /07/.																				

Data/Parameter	Assessment
Data Unit	EG _{y,auxiliary} : kWh
Description	Renewable electricity generated by the project activity, consumed by auxiliary equipment
Source of data to be used	Farm record on the utilization of electrical appliances under the project activity, using renewable energy
Value of monitored parameter for the monitoring period	Value is considered zero for this monitoring period as entire electricity generated from produced bio-

	period	gas is used for in house consumption and there is no off-farm sale as verified during site visit. Therefore this is considered zero on conservative side.
	Monitoring equipment	Not applicable since this zero value is considered for this parameter
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	N/A
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	$FC_{i,y}; m^3/year$
	Description	Onsite combustion of fossil fuels of type I in process j during the year y
	Source of data to be used	Project participants farm record
	Value of monitored parameter for the monitoring period	Value is considered zero for this monitoring period as no fossil fuel found consumed in any of the participating farms during the monitoring period as verified during site visit. Grid electricity consumption has been taken for project emission calculation.
	Monitoring equipment	Not applicable since this zero value is considered for this parameter
	Accuracy of the monitoring equipment	Not applicable since this zero value is considered for this parameter
	Measuring/Reading/Recording frequency	Not applicable since this zero value is considered for this parameter
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	$NCV_{i,y}; GJ/m^3$
	Description	Net calorific value of fuel type I in year y
	Source of data to be used	Values from the fuel supplier will be used
	Value of monitored parameter for the monitoring period	Value is considered zero for this monitoring period as no fossil fuel found consumed in any of the participating farms during the monitoring period as verified during site visit. Grid electricity consumption has been taken for project emission calculation.
	Monitoring equipment	Not applicable since this zero value is considered for this parameter
	Accuracy of the monitoring equipment	Not applicable since this zero value is considered for this parameter
	Measuring/Reading/Recording frequency	Not applicable since this zero value is considered for this parameter
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	$EF_{CO_2,I,y}; tCO_2/GJ$
Description	CO_2 emission factor of fuel type I in year y	
Source of data to be used	Values from the fuel supplier will be used or IPCC default values	

	Value of monitored parameter for the monitoring period	Value is considered zero for this monitoring period as no fossil fuel found consumed in any of the participating farms during the monitoring period as verified during site visit. Grid electricity consumption has been taken for project emission calculation.
	Monitoring equipment	Not applicable since this zero value is considered for this parameter
	Accuracy of the monitoring equipment	Not applicable since this zero value is considered for this parameter
	Measuring/Reading/Recording frequency	Not applicable since this zero value is considered for this parameter
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	MS%
	Description	Fraction on manure handled in system I in the project activity in year y
	Source of data to be used	Farm Record
	Value of monitored parameter for the monitoring period	100%. All manure at each farm was found handled in the treatment system which is cross checked from farm records duly signed by farm manager on daily basis /26/.
	Monitoring equipment	Manure is collected daily or every other day by hose flushing all material through a series of collection channels, operating by gravity. Since, no manure was diverted during the monitoring period there was no weighing scale involved for the same.
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	N/A
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	nd; Days
	Description	Number of days that the animal manure management system was operational
	Source of data to be used	Farm Record
	Value of monitored parameter for the monitoring period	782 days. Log book records of operation of manure management system at each farm was checked during site visit /14-16/.
	Monitoring equipment	Log book records /14-16/.
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	Daily as verified from log book records /14-16/.
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	Proper soil application (not resulting in methane emissions) of the residual waste; %

	Description	Ratio of final sludge treated aerobically over total sludge treated
	Source of data to be used	Farm Record
	Value of monitored parameter for the monitoring period	100% of the sludge generated found treated aerobically as seen during site visit.
	Monitoring equipment	Log book records.
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	Daily and reported monthly as verified from log book records /14-16/.
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	Onsite inspections for each individual farm included in the project boundary
	Description	Onsite inspections of the project boundary
	Source of data to be used	Farm Record
	Value of monitored parameter for the monitoring period	N/A. Farm records for operational condition of all equipments, system, calibration status etc. are recorded at each farm /14-16/.
	Monitoring equipment	Farm record.
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	Annual recording.
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	Genetic source of the production operations livestock
	Description	Genetic source of the production operations livestock
	Source of data to be used	Farm Record
	Value of monitored parameter for the monitoring period	For this monitoring period PP has considered genetic source from Asia origin and accordingly considered VS _{LT} and Bo _{LT} default values from IPCC /22/. This is consistent with the applied methodology /09/.
	Monitoring equipment	Farm record.
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	Annual recording.
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	FFR
Description	Formulated Feed Rations	
Source of data to be used	Farm Record	

	Value of monitored parameter for the monitoring period	During the site visit it has been seen that formulated feed rations are being controlled according to internal operational procedures manual at each farms /27/. RINA also checked the formulae of food composition for each farm /23/
	Monitoring equipment	Farm record.
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	Annual recording.
	Calculation method (if applicable)	N/A
	Data/Parameter	Assessment
	Data Unit	$TDL_{i,y}$
	Description	Average technical transmission and distribution losses for providing electricity to source j in year y
	Source of data to be used	Ministry of Energy. Use recent, accurate and reliable data available in Thailand
	Value of monitored parameter for the monitoring period	6.10% as per Thailand Energy Statistics (Preliminary) 2013", published by DEDE, Ministry of Energy /28/. However, on a conservative side PP has applied 10% for this parameter to account project emission as per paragraph 2 (3) of Appendix 1 of project standard /07/.
	Monitoring equipment	N/A
	Accuracy of the monitoring equipment	N/A
	Measuring/Reading/Recording frequency	Annual as per registered monitoring plan /04/.
	Calculation method (if applicable)	N/A
Findings	CAR 03 was raised for not reporting monitored values of $N_{da,y}$, $N_{p,y}$, W_{site} , $BG_{burnt,y}$, $BG_{elec,y}$ and $BG_{flare,y}$ in the MR and provide justification for $EG_{y,auxiliary}$, $FC_{i,j,y}$, $NCV_{i,y}$ and $MS\%_{i,y}$ in the MR to which CME has revised the MR incorporating monitored value and wherever necessary proper justification. The same were cross checked by DOE and found consistent with site visit observation and records. Hence, CAR was closed.	
Conclusion	RINA is able to confirm that the monitoring has been implemented in compliance with the registered monitoring plan and as per provision of project standard.	

1.4.3. Implementation of sampling plan

Means of verification	Sampling plan is followed for monitoring of 'Average animal weight of a defined livestock population at the project site' (W_{site}) at each farm at CPA level. Random sampling approach has been adopted at each farm within the CPA for each of the swine category. 90/10 confidence precision has been considered by project participant and accordingly sample number in each swine category is determined for monitoring W_{site} for each swine type annually. During the monitoring period (09/11/2012 to 31/12/2014) 68 sample in each swine category at each farm (except for Breed male in Chokchai farm results 54 samples) resulted as per statically appropriate sampling calculation. At each participating farm weighing is conducted by sampling no more than six swine individuals for each type on monthly basis. The weight of each individual was recorded on a paper form and signed by the farm personnel who perform the weighing. Although, for the period from 09/11/2012 to 31/12/2013 temporarily monitoring at each farm was not maintained due to which CME considered to report this value as zero for all swine types for that period and for fattening 1 swine in Chochai farm zero for entire monitoring period as per Appendix 1 of project standard.
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	<p>The sample size of 68 in each swine category in each farm is deemed to be adequate due to the following reasons. With margin of error to be 10%, confidence level at 90% and 50% response distribution the maximum sample size results to be 68 /19/. Therefore, selected sample by CME is representative of each type of swine population as outlined in MR and meets the desired confidence precision /18/.</p> <p>RINA considered to verify all 68 samples in each swine category at each farm for all the years covering the monitoring period during on-site visit. RINA's sample size of 68 swine for each swine category at each farm for onsite visit was deemed to be adequate due to the following reasons. RINA selected acceptable quality level at 10% (margin of error) and the proportion of discrepancies at a level of 20%. In line with paragraph 28 of the sampling standard /18/, the maximum discrepancy was fixed at 10% of the determined sample size. As per sampling plan in CPA-DD, sample size is calculated considering 90% confidence level and 10% margin error /04/. Thus at 10% relative precision, 50% expected proportion and confidence level of 90% a sample size of only 55 swine for each swine type is determined following equation 1 of Appendix 1 of guidelines-sampling and surveys for CDM project activities and programmes of activities, Version 04 /36/.</p> <p>Hence RINA's sample size of 68 swine for each swine type is deemed to be adequate and conservative. RINA's onsite visit of the sampled 68 swine for each swine type further revealed 0% samples with discrepancy which is under acceptable discrepancy level.</p> <p>Hence, RINA confirms that the sampling size and the method of onsite verification was in line with the requirements of the sampling standard /18/.</p>
Findings	CAR 02 was raised to describe the sampling plan followed at each site as per the sampling approach to which PP has included the plan as followed at each site. Records of sample taken for weight were checked and the plan described in the MR is found acceptable. Hence, CAR is closed.
Conclusion	RINA confirms that the random sampling plan adopted by CME for the monitoring parameter representative of the entire population for the monitoring period.

I.5. Compliance with the calibration frequency requirements for measuring instruments

Means of verification	Data/Parameter	Assessment															
	Data Unit	W_{site} ; Kg															
	Description	Average animal weight of a defined livestock population at the project site (in kg)															
	Monitoring equipment	Type : Weighing scale <table border="1"> <tr> <th>Farm</th> <th>Make</th> <th>Sl. No.</th> </tr> <tr> <td>Wang Noi</td> <td>WI-P</td> <td>2013016</td> </tr> <tr> <td>Chokchai</td> <td>Commandor HP-05</td> <td>0000719</td> </tr> <tr> <td>Phanom</td> <td>Jadever JIK-8CAB</td> <td>IK2131237N4785</td> </tr> </table>	Farm	Make	Sl. No.	Wang Noi	WI-P	2013016	Chokchai	Commandor HP-05	0000719	Phanom	Jadever JIK-8CAB	IK2131237N4785			
	Farm	Make	Sl. No.														
	Wang Noi	WI-P	2013016														
	Chokchai	Commandor HP-05	0000719														
	Phanom	Jadever JIK-8CAB	IK2131237N4785														
	Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	As per registered monitoring plan the scale is calibrated according to the national standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years /04/. PP could not calibrate the scales as per defined frequency and hence applied maximum error factor as per paragraph 395 of VVS, version 09 /08/.															
	Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is 09/11/2012 to 31/12/2014. Calibration details are given below: <table border="1"> <tr> <th>Farm</th> <th>Serial Number</th> <th>Calibration Date</th> <th>Expiration Date</th> </tr> <tr> <td>Wang Noi</td> <td>2013016</td> <td>22/03/2016</td> <td>21/03/2019 (in 3 years)</td> </tr> <tr> <td>Chokchai</td> <td>0000719</td> <td>25/03/2016</td> <td>24/03/2019 (in 3 years)</td> </tr> <tr> <td>Phanom</td> <td>IK2131237N4785</td> <td>11/02/2016</td> <td>10/02/2019 (in 3 years)</td> </tr> </table> Since, calibration was done after the end of the monitoring period, PP has applied maximum error factor of the instrument for the entire duration of the monitoring period as per paragraph 395 of VVS, version 09 /08/.	Farm	Serial Number	Calibration Date	Expiration Date	Wang Noi	2013016	22/03/2016	21/03/2019 (in 3 years)	Chokchai	0000719	25/03/2016	24/03/2019 (in 3 years)	Phanom	IK2131237N4785	11/02/2016
Farm	Serial Number	Calibration Date	Expiration Date														
Wang Noi	2013016	22/03/2016	21/03/2019 (in 3 years)														
Chokchai	0000719	25/03/2016	24/03/2019 (in 3 years)														
Phanom	IK2131237N4785	11/02/2016	10/02/2019 (in 3 years)														
Calibration certificates	By Thai Calibration Services Co. Ltd. for Weighing scale (sl.no. 0000719 and for sl.no. 2013016) and by Northern Weights and Measures Centre (Chiang Mai) for Weighing scale (sl.no. IK2131237N4785) /24/, /25/.																
Does the calibration of meters have been done by an accredited person or institution?	Thai Calibration Services Co. Ltd. and Northern Weights and Measures Centre (Chiang Mai) are accredited Laboratories According to ISO/IEC 17025 /29/.																
Data/Parameter	Assessment																
Data Unit	$BG_{elec,y}$; Nm^3																
Description	Amount of biogas captured and used as fuel for the generator																

	Monitoring equipment	Endress-Hauser Proline t-mass 65, Thermal mass flowmeter.			
		Farm	Serial Number	Installation Date	
		Wang Noi	F5147D02000	30/10/2012	
		Chokchai	EC0A3E02000	28/10/2012	
		Phanom	F6006402000	31/10/2012	
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	As per registered monitoring plan the scale is calibrated according to manufacturer specifications /04/. As per manufacturer instruction calibration to be every two to three years /30/. PP has calibrated the same within three years frequency.				
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is 09/11/2012 to 31/12/2014. Calibration details are given below:				
	Farm	Serial Number	Calibration Date	Expiration Date	
	Wang Noi	F5147D02000	04/06/2012	29/10/2014	
			09/04/2014	08/04/2016	
	Chokchai	EC0A3E02000	28/10/2012	27/10/2014	
			10/04/2014	09/04/2016	
	Phanom	F6006402000	31/10/2012	30/10/2014	
			11/04/2014	10/04/2016	
	Hence, calibration cover the monitoring period.				
Calibration certificates	By Endress-Hauser /31/.				
Does the calibration of meters have been done by an accredited person or institution?	Endress-Hauser is the manufacturer of the instrument and hence credible for calibration of the equipment /29-30/.				
Data/Parameter	Assessment				
Data Unit	BG _{flare,yr} Nm ³				
Description	Amount of biogas sent to flare				
Monitoring equipment	Endress-Hauser Proline t-mass 65, Thermal mass flowmeter.				
	Farm	Serial Number	Installation Date		
	Wang Noi	F5147C02000	30/10/2012		
	Chokchai	D3048402000	10/10/2014		
	Phanom	F6006302000	31/10/2012		
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	As per registered monitoring plan the scale is calibrated according to manufacturer specifications /04/. As per manufacturer instruction calibration to be every two to three years /30/. PP has calibrated the same within three years frequency.				
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	The monitoring period is 09/11/2012 to 31/12/2014. Calibration details are given below:				
	Farm	Serial Number	Calibration Date	Expiration Date	
	Wang Noi	F5147C02000	30/10/2012	29/10/2014	
			09/04/2014	08/04/2016	
	Chokchai	D3048402000	10/10/2014	09/10/2016	
			22/10/2014	21/04/2016	
	Phanom	F6006302000	31/10/2012	30/10/2014	

		11/04/2014	10/04/2016								
	Hence, calibration cover the monitoring period.										
Calibration certificates	By Endress-Hauser /32/.										
Does the calibration of meters have been done by an accredited person or institution?	Endress-Hauser is the manufacturer of the instrument and hence credible for calibration of the equipment /29/, /32/.										
Data/Parameter	Assessment										
Data Unit	Flare operation, Hours										
Description	Flare operation in hour 'h'										
Monitoring equipment	A thermocouple type K, Model TH-10 with SUS316L from IES ELECTRIC Co., Ltd., is used to measure temperature. <table border="1"> <tr> <th>Farm</th><th>Serial Number</th></tr> <tr> <td>Wang Noi</td><td>TH102459</td></tr> <tr> <td>Chokchai</td><td>TH101256</td></tr> <tr> <td>Phanom</td><td>TH103419</td></tr> </table>			Farm	Serial Number	Wang Noi	TH102459	Chokchai	TH101256	Phanom	TH103419
Farm	Serial Number										
Wang Noi	TH102459										
Chokchai	TH101256										
Phanom	TH103419										
Calibration frequency/interval Is the calibration interval in line with the monitoring plan of the PDD?	As per registered monitoring plan the equipment to be calibrated according to manufacturer specifications /04/. As per manufacturer recommendation calibration not required for the thermocouple /33/. Hence PP has not calibrated the same as there was no error found with the thermocouple during the monitoring period.										
Does the calibration cover the monitoring period? Has the calibration frequency been respected?	N/A										
Calibration certificates	N/A										
Does the calibration of meters have been done by an accredited person or institution?	N/A										
Findings	CAR 04 was raised to include calibration details of monitoring equipments along with other details (make, serial number etc.) in the MR to which PP has included details as per the query. The verification team found the details consistent with site visit observations and calibration certificates and hence accepted. CAR is closed.										
Conclusion	RINA confirms that all applicable monitoring and measuring equipment have been calibrated by accredited agencies as per defined frequency of registered monitoring plan in consistent with applied methodology and appropriately maintained.										

I.6. Assessment of data and calculation of emission reductions or net removals

I.6.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification	<p>According to the applied methodology "AMS-III.D", "Methane recovery in animal manure management systems", version 18 /09/, and the registered CPA-DD /04/ the Baseline emissions (Bey) is calculated as below:</p> $B E_y = G W_C \cdot \frac{P}{4} D_C \cdot \frac{U}{4} F_b^* \sum_{j,L,T} M_j \cdot C^* B_{O,L} \cdot \frac{N}{T} N_{L,y}^* V_{L,y}^* M \% S_{B,y}$ <p>Where,</p>
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BE_y is the Baseline emissions in year “y” (tCO_{2e})

GWP_{CH₄} is the global warming potential for methane fixed ex-ante to apply 21 for the period upto 31/12/2012 and 25 from 01/01/2013 /17/.

D_{CH₄} is the density of methane fixed ex-ante to be 0.00067t/m³ as per applied methodology /09/.

UF_b is the model correction factor to account for model uncertainties is fixed ex-ante to be 0.94 as per the applied methodology /09/.

MCF_j is the annual methane conversion factor (MCF) for the baseline animal waste management is fixed ex-ante to be 80% as per the registered CPA-DD /04/.

Bo_{LT} is the maximum methane producing potential of the volatile solid generated for animal type “LT” (m³ CH₄/kg dm) which is also fixed ex-ante to be considered as per IPCC default values /22/ in the registered CPA-DD and revised CPA-DD /04/. During this monitoring period PP has considered default values from Asian origin from IPCC /22/.

VS_{LT} is the volatile solids for livestock “LT” entering the animal manure management system in year (on a dry matter weight basis, kg dm/animal/year) is calculated as below:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) * VS_{default} * nd_y$$

W_{site} (Average animal weight of a defined livestock population at the site (kg)) is monitored for each swine category following simple random sampling approach and records of each sample were verified during site visit /14-16/. It has been noted that CME temporarily did not monitor the W_{site} value for all swine type in each farm for the period 09/11/2012 to 31/12/2013 and for fattening 1 swine in Chochai farm for entire monitoring period. For this duration PP has considered zero value for this parameter in line with CDM project standard appendix 1.

W_{default} (Default average animal weight of a defined population) is fixed ex-ante from IPCC default values /04/, /22/.

VS_{default} is also fixed ex-ante to be considered as per IPCC default values /22/ in the registered CPA-DD and revised CPA-DD /04/. During this monitoring period PP has considered default values from Asian origin from IPCC /22/.

Nd_y is the number of days in year “y” where the animal manure management system is operational which is monitored daily and confirmed that during the monitoring period the manure management system at each farm was operational for 782 days as confirmed from log book records /14-16/.

MS% is the fraction of manure handled in baseline animal manure management system which is monitored and found that during the monitoring period 100% of the manure is handled in the manure management systems as confirmed from site visit and documents review /26/.

N_{LT,y} is annual average number of animals of type “LT” in year “y” (numbers) which is to be calculated as per below formula:

$$N_{LT,y} = N_{da,y} * \left(\frac{N_{p,y}}{365} \right)$$

Where,

N_{da,y} is Number of days animal is alive in the farm in the year y (numbers) and N_{p,y} is the Number of animals produced annually of type LT for the year y (numbers).

N_{da,y} and N_{p,y} is incorporated in monthly farm records for arriving total number of animals produced annually of type LT (N_{LT,y}). The farm record includes daily purchase (births, internal transfer) and exit (ex: sale, death, internal transfer). Therefore, N_{LT,y} record implicitly consider N_{da,y} and N_{p,y}. Farm wise, N_{LT,y} recorded value was cross checked from records /14-16/.

Thus, the baseline emission from the project activity (BE_y) has been correctly calculated as 19,029 tCO_{2e} for the period 09/11/2012 to 31/12/2014.

Findings	CAR 05 was raised for inconsistency in reporting monitored values of $N_{LT,y}$ and GWP in emission reduction worksheet to which PP has corrected the same and hence accepted. CAR was closed by the assessment team after cross checking the reported values in revised emission reduction worksheet.
Conclusion	RINA confirms that baseline emissions have been appropriately calculated and are consistent with site visit observations, the applied methodology, revised CPA-DD and registered monitoring plan /01/, /02/, /03/, /04/, /05/, /09/.

I.6.2. Calculation of project GHG emissions or actual net GHG removals by sinks

Means of verification	<p>Project emission as per the applied methodology and registered CPA-DD is as below:</p> $PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y}$ <p>Where, PE_y is the Project emissions in year “y” (tCO₂e) $PE_{PL,y}$ is the Emissions due to physical leakage of biogas in year “y” (tCO_{2e}) which is calculated as below:</p> $PE_{PL,y} = \sum_{i=1}^n \left(\frac{Q_{CH_4,i}}{V_{CH_4}} \right) \times GWP_{CH_4} \times \sum_{j=1}^n \left(\frac{B_{i,j}}{N_{LT,y}} \right) \times V_{LT,y} \times MS\%$ <p>Where, GWP_{CH_4} is the global warming potential for methane fixed ex-ante to apply 21 for the period upto 31/12/2012 and 25 from 01/01/2013 /17/. D_{CH_4} is the density of methane fixed ex-ante to be 0.00067t/m³ as per applied methodology /09/. Bo_{LT} is the maximum methane producing potential of the volatile solid generated for animal type “LT” (m³ CH₄/kg dm) which is also fixed ex-ante to be considered as per IPCC default values /22/ in the registered CPA-DD and revised CPA-DD /04/. During this monitoring period PP has considered default values from Asian origin from IPCC /22/. VS_{LT} is the volatile solids for livestock “LT” entering the animal manure management system in year (on a dry matter weight basis, kg dm/animal/year) is calculated as below:</p> $VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) \times VS_{default} \times nd_y$ <p>W_{site} (Average animal weight of a defined livestock population at the site (kg)) is monitored for each swine category following simple random sampling approach and records of each sample were verified during site visit /14-16/. It has been noted that CME temporarily did not monitor the W_{site} value for all swine type in each farm for the period 09/11/2012 to 31/12/2013 and for fattening 1 swine in Chochai farm for entire monitoring period. For this duration PP has considered zero value for this parameter in line with CDM project standard appendix 1. $W_{default}$ (Default average animal weight of a defined population) is fixed ex-ante from IPCC default values /04/, /22/. $VS_{default}$ is also fixed ex-ante to be considered as per IPCC default values /22/ in the registered CPA-DD and revised CPA-DD /04/. During this monitoring period PP has considered default values from Asian origin from IPCC /22/. Nd_y is the number of days in year “y” where the animal manure management system is operational which is monitored daily and confirmed that during the monitoring period the manure management system at each farm was operational for 782 days as confirmed from log book records /14-16/. $MS\%$ is the fraction of manure handled in baseline animal manure management system which is monitored and found that during the monitoring period 100% of the manure is handled in the manure management systems as confirmed from site visit and documents review /26/. $N_{LT,y}$ is annual average number of animals of type “LT” in year “y” (numbers) which is to be calculated as per below formula:</p>
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$$N_{LT,y} = N_{da,y} * \left(\frac{N_{p,y}}{365} \right)$$

Where,

$N_{da,y}$ is Number of days animal is alive in the farm in the year y (numbers) and $N_{p,y}$ is the Number of animals produced annually of type LT for the year y (numbers).

$N_{da,y}$ and $N_{p,y}$ is incorporated in monthly farm records for arriving total number of animals produced annually of type LT ($N_{LT,y}$). The farm record includes daily purchase (births, internal transfer) and exit (ex: sale, death, internal transfer). Therefore, $N_{LT,y}$ record implicitly consider $N_{da,y}$ and $N_{p,y}$. Farm wise, $N_{LT,y}$ recorded value was cross checked from records /14-16/.

Thus, the project emission from due to physical leakage of biogas ($PE_{PL,y}$) has been correctly calculated as **3,136 tCO_{2e}** for the period 09/11/2012 to 31/12/2014.

$PE_{flare,y}$ (project emissions from flaring of biogas stream) is calculated following 'Tool to determine project emissions from flaring gases containing Methane' as below:

$$PE_{flare,y} = \sum_{h=1}^8 T_{RG,h} * GWP_{CH_4} * (1 - \eta_{flow,h}) * \frac{G}{1} * \frac{W_C}{W_O}$$

Where,

GWP_{CH_4} is the global warming potential for methane fixed ex-ante to apply 21 for the period upto 31/12/2012 and 25 from 01/01/2013 /17/.

$\eta_{flow,h}$ is the flare efficiency in hour ' h ' which is fixed ex-ante to be 50% default for open flaring as per registered CPA-DD /03/. The flaring system in each farm found to be open and hence accepted.

$TM_{RG,h}$ is the mass flow rate of methane in the residual gas in the hour h (kg/h) calculated as below:

$$TM_{RG,h} = FV_{RG,h} * FV_{CH_4,RH,h} * \rho_{CH_4,n}$$

Where,

$FV_{RG,h}$ is the volumetric flow rate of the residual gas in dry basis at normal (Nm^3/h) conditions in hour h . Flow of residual gas for flaring (BG_{flare}) and operational hours of flare is monitored continuously; thereby, flow rate is calculated and summarized on monthly basis in the ER sheet /02/. The records of flow of biogas for flaring and operational hours of flare we cross checked for each farm and found the reported data to be correct /14-16/.

$FV_{CH_4,RH,h}$ is the volumetric fraction of methane in the residual gas on dry basis in hour h ; which is fixed ex-ante to be 60% /03/.

$\rho_{CH_4,n}$ is the density of methane which is fixed ex-ante to be 0.716kg/m³ as per the applied methodology /09/.

Accordingly, $PE_{flare,y}$ for all the three farms calculated to be **91 tCO_{2e}** for the period 09/11/2012 to 31/12/2014.

PE_{power} is the Project emissions from the use of fossil fuel or electricity for the operation of the installed facilities. However, since there was no fossil fuel consumption reported during the monitoring period PE_{power} is calculated for the electricity consumption from electricity ($PE_{EC,y}$).

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y})$$

Where,

$EC_{PJ,j,y}$ is the Quantity of electricity consumed by the project electricity consumption source j in the year y (MWh/yr). Grid is source of electricity consumption in all three farms during the monitoring period. However, the CME was unable to produce monitored data for this parameter and hence temporary deviation has been considered for this monitoring parameter and in line with Appendix 1 of project standard, the managing entity estimated assuming that the source of the GHG

	<p>emissions operated at maximum capacity for the full period. Since, the parameter is for project GHG emissions related to the consumption of electricity, the estimate included an addition of 10% to account for transmission and distribution losses. The installed equipments for consuming grid electricity were verified during site visit and therefore the estimation is correct. The installed equipments for consuming grid electricity were considered operated at full capacity and for entire period (8760 hours every year) and included an addition of 10% to account for transmission and distribution losses /02/. This is in line with paragraph 2 (3) of Appendix 1 of project standard version 09 /07/. Accordingly, $EC_{PJ,j,y}$ for all the three farms were calculated to be 828.48 MWh for the monitoring period /02/.</p> <p>$FE_{EL,j,y}$ is the emission factor for electricity generation for source j in year y (tCO_2/MWh) fixed ex-ante to be 0.5661 and $TDL_{j,y}$ is the technical transmission and distribution losses considered 10% as per Appendix 1 of project standard /07/.</p> <p>Accordingly, $PE_{power} = PE_{EC,y}$ is calculated to be 516 tCO_{2e} for the period 09/11/2012 to 31/12/2014.</p> <p>$PE_{transp,y}$ is the Emissions from incremental transportation in the year “y” (tCO_{2e}) is zero for this monitoring period as there was transporation involved for the manure management system and $PE_{storage,y}$ is the Emissions from storage of manure (tCO_{2e}) is also accounted zero since manure as generated is directly flowed to the manure management system.</p> <p>Therefore, project emission from the project activity (PE_y) has been correctly calculated as 3,743 tCO_{2e} (roundup value) for the period 09/11/2012 to 31/12/2014.</p>
Findings	CAR 05 was raised for inconsistency in reporting monitored values of $N_{LT,y}$ and GWP in emission reduction worksheet to which PP has corrected the same and hence accepted. CAR was closed by the assessment team after cross checking the reported values in revised emission reduction worksheet.
Conclusion	RINA confirms that project emissions for the monitoring period is consistent with site visit observations, the applied methodology, registered CPA-DD and registered monitoring plan /01/, /02/, /03/, /04/, /05/, /09/.

I.6.3. Calculation of leakage GHG emissions

Means of verification	As per the applied methodology and registered CPA-DD, no leakage emissions are to be accounted.
Findings	N/A
Conclusion	RINA confirms that zero leakage emissions for the monitoring period is consistent with site visit observations, the applied methodology, registered CPA-DD and registered monitoring plan /01/, /02/, /03/, /04/, /05/, /09/.

I.6.4. Summary of calculation of GHG emission reductions or net GHG removals by sinks

Means of verification	<p>As per applied methodology and registered CPA-DD, the emission reduction achieved in any year are the lowest value of the following:</p> $ER_{y,ex-post} = \min \{ (BE_{y,ex-post} - PE_{y,ex-post}), (MD_y - PE_{power,y,ex-post}) \}$ <p>$BE_{y,ex-post} - PE_{y,ex-post}$ is achieved during the monitoring period as described in section I.6.1 and I.6.2 is 15,892 tCO_{2e} (round down value).</p> <p>MD_y is calculated as below:</p> $MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$ <p>$BG_{burnt,y}$ is the Biogas flared or combusted in year y (Nm^3) which is summation of monitored value of combustion biogas ($BG_{elec,y}$) and monitored value of flaring biogas ($BG_{flare,y}$). Therefore, $BG_{burnt,y}$ for the project activity for the monitoring period is 3,225,749 Nm^3 as verified from log book records of each farm /14-16/. Although monitoring and measurement was done and values are reported from 09/11/2012 to 31/12/2013 the same is not used to claim emission reductions for the this period due to temporary deviation applied for the parameter ‘W_{site}’ for the period 09/11/2012 to 31/12/2013. Therefore, emission reduction is claimed only for the reported value from 01/01/2014 to 31/12/2014. Although project emissions are</p>
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	<p>accounted for whole monitoring period (09/11/2012 to 31/12/2014). This is conservative approach and hence accepted.</p> <p>D_{CH_4} is the density of methane fixed ex-ante to be 0.00067t/m³ as per applied methodology /09/.</p> <p>GWP_{CH_4} is the global warming potential for methane fixed ex-ante to apply 21 for the period upto 31/12/2012 and 25 from 01/01/2013 /17/.</p> <p>FE is the flare efficiency fixed ex-ante to be 50% for open flare /03/.</p> <p>Therefore, MD_y for the project activity for the monitoring period is calculated to be 14,376 tCO_{2e} /02/.</p> <p>PE_{Power,y,ex-post} is calculated to be 516 tCO_{2e} for the monitoring period as explained in section I.6.2 above.</p> <p>Therefore, MD_y – PE_{Power,y,ex-post} achieved during the monitoring period is 13,858 tCO_{2e} (round down value).</p> <p>Hence,</p> $ER_{y,ex-post} = \min \{ (BE_{y,ex-post} - PE_{y,ex-post}), (MD_y - PE_{power,y,ex-post}) \}$ $= \min \{ (15,892 \text{ tCO}_{2e}), (13,858 \text{ tCO}_{2e}) \}$ $= 13,858 \text{ tCO}_{2e}$ <p>Net emission reductions achieved from 09/11/2012 to 31/12/2012 is 0 tCO_{2e} and emission reductions achieved from 01/01/2013 to 31/12/2014 is 13,858 tCO_{2e}.</p>
Findings	CAR 05 was raised for inconsistency in reporting monitored values of N _{LT,y} and GWP in emission reduction worksheet to which PP has corrected the same and hence accepted. CAR was closed by the assessment team after cross checking the reported values in revised emission reduction worksheet.
Conclusion	The data presented in the monitoring report /01/ were assessed by reviewing in detail project documentation, collection of monitored data, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. Sufficient evidence was presented and verified by RINA for the reported emission reductions as listed above.

Specific-case CPA reference number	Baseline emissions or baseline net GHG removals by sinks (tCO _{2e})	Project emissions or actual net GHG removals by sinks (tCO _{2e})	Leakage (tCO _{2e})	GHG emission reductions or net GHG removals by sinks (tCO _{2e})		
				Results achieved in the period up to 31 December 2012	Results achieved in the period from 1 January 2013 onwards	Results achieved in the entire monitoring period
8027-0001	14,376	516	0	0	13,858	13,858
Total	14,376	516	0	0	13,858	13,858

I.6.5. Comparison of actual GHG emission reductions or net GHG removals by sinks with estimates in included specific-case CPA

Means of verification	The emission reductions from the project for the monitoring period as reported in the monitoring report revision 6.3 of 10/03/2017 /01/ is equivalent to 13,858 tCO _{2e} . The reported emission reductions estimated as per registered CPA-DD works out to be 119,487 tCO _{2e} for the period /02/.
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 CPA-DD /03/.

Specific-case CPA reference number	Value estimated in ex ante calculation in the included specific-case CPA-DD(s)	Actual values achieved by the specific-case CPA(s) during this monitoring period
8027-0001	119,487 tCO _{2e}	13,858 tCO _{2e}
Total	119,487 tCO _{2e}	13,858 tCO _{2e}

I.6.6. Remarks on difference from estimated value in registered PDD

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

Appendix 1. Abbreviations

Abbreviations	Full texts
BE	Baseline Emissions
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM-PCP	Clean Development Mechanism Project Cycle Procedure
CDM-PS	Clean Development Mechanism Project Standard
CDM-VVS	Clean Development Mechanism Validation and Verification Standard
CDM M&P	Modalities and Procedures CDM
CER(s)	Certified Emission Reduction(s)
CH ₄	Methane
CL	Clarification Request
CME	Coordinating and Managing Entity
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
CP	Certification Program
CPA	Component Project Activity
CPA-DD	Component Project Activity Design Document
DD	Design Document
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EIA	Environmental Impact Assessment
ER	Emission Reductions
ERDI	Energy Research and Development Institute- Nakornping of Chiang Mai University
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of Approval
MoV	Means of Verification
MP	Monitoring Plan
MR	Monitoring Report
NGO	Non-governmental Organization
ODA	Official Development Assistance
PDD	Project Design Document
PE	Project Emission
PoA	Programme of Activities
PoA-DD	CMD Programme of Activities Design Document
PP(s)	Project Participant(s)
Ref.	Document Reference
RINA	RINA Services Spa
SS(s)	Sectoral Scope(s)
TA(s)	Technical Area(s)

UNFCCC	United Nations Framework Convention on Climate Change
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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 come¹:
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
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

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

RINA Services S.p.A. è accreditata 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

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RINA

CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE

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

Champak Buragohain

è qualificato come¹:
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

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.2	Renewables	1
2.1	Electricity distribution	2
13.1	Solid waste and wastewater	13
13.2	Manure	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	19-01-2011	-
10	22-12-2014	Updated according to AS ver 6.0

Il Resp. QPT
Head of QPT

¹ Legend:

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

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

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

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GHG_QUAL_CERT_EN_04_12

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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

Rita Valoroso

¹ Legend:

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

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

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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:

Shruti Kudtarkar

è qualificato come¹:
is qualified as:

CDM -TEC, -VAL, -VER, -TL

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

1.2, 13.1, 13.2

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.2	Renewables	1
13.1	Solid Waste and wastewater	13
13.2	Manure	13

in accordo alle istruzioni del Settore Sostenibilità, Ambiente & Cambiamenti Climatici.
in accordance with the instructions of the Sustainability, Environment & Climate Change Sector.

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	03/12/2012	-
5	10/11/2015	New revision of IS-QPT-GHG-20

Il Resp. QPT
Head of QPT

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Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	The World Bank	Monitoring report for project activity “Thailand Small Scale Livestock Waste Management Program CPA 01” in Thailand	version 01 of 11/02/2015, version 02 of 13/08/2015, version 03 of 21/01/2016, version 04 of 11/06/2016, version 05 of 18/08/2016, version 06.2 of 07/03/2017 and version 6.3 of 10/03/2017	CME
2	The World Bank	Emission reduction worksheet	version 01 of 11/02/2015, version 02 of 13/08/2015 and version 03 of 18/08/2016 and version 04 of 10/03/2017	CME
3	The World Bank	PoA-DD for project activity “Thailand Small Scale Livestock Waste Management Program”	version 10 of 27/08/2012 and revised DD version 12 of 28/07/2015, version 13 of 02/05/2016 and version 14 of 18/08/2016	CME
4	The World Bank	CPA-DD for project activity “Thailand Small Scale Livestock Waste Management Program CPA 01” in Thailand	version 10 of 27/08/2012 and revised PCA-DD version 11.1 of 12/01/2016, version 12 of 02/05/2016, version 13 of 12/06/2016 and version 14 of 18/08/2016	CME
5	DNV	PoA Validation report (report N° 2010-0125) CPA validation report (report N° 2010-0114)	version 01 issued on 12/10/2012 version 01 issued on 12/10/2012	Others
6	CDM Executive Board	Clean Development Mechanism Project Cycle Procedure	version 09 of 20/02/2015	Others
7	CDM Executive Board	Clean Development Mechanism Project Standard	version 09 of 20/02/2015	Others
8	CDM Executive Board	Clean Development Mechanism Validation and Verification Standard	version 09 of 20/02/2015	Others
9	CDM Executive Board	Baseline and monitoring methodology “AMS-III.D”, “Methane recovery in animal manure management systems”	version 18 of 29/09/2011	Others
10	CDM Executive Board	Monitoring Report Form for CDM programme of activities (CDM-PoA-MR-FORM) and ‘Instructions for filling out the monitoring report form for CDM programme of activities’	version 01.0 of 01/04/2015	Others
11	CDM Executive Board	Tool to calculate the emission factor for an electricity system, version 02.2.1	annex 19, EB 63 dated 29/09/2011	Others
12	CDM Executive Board	Tool to determine project emission from flaring	version 01, annex 13, EB28	Others

		gases containing methane		
13	CDM Executive Board	Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion	version 2, annex 11, EB 41	Others
14	ERDI	Log book records of for swine population, biogas collected (burnt in generator and flare), flare operation hours, swine weight for each category, non-operational hours of manure management system, sludge records for Chokchaikansukorn farm for the period of 01/11/2012 to 31/12/2014	Log book records	CME
15	ERDI	Log book records of for swine population, biogas collected (burnt in generator and flare), flare operation hours, swine weight for each category, non-operational hours of manure management system, sludge records for Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) for the period of 01/11/2012 to 31/12/2014	Log book records	CME
16	ERDI	Log book records of for swine population, biogas collected (burnt in generator and flare), flare operation hours, swine weight for each category, non-operational hours of manure management system, sludge records for Laemthong Hybrid Co., Ltd (Wang Noi Farm) for the period of 01/11/2012 to 31/12/2014	Log book records	CME
17	CDM Executive Board	Standard for the application of the global warming potentials to clean development mechanism project activities and programme of activities for the second commitment period of the Kyoto Protocol	version 1, Annex 3 of EB 69 dated 13/09/2012	Others
18	CDM Executive Board	Standard 'sampling and surveys for CDM project activities and programmes of activities'	version 05.0 dated 16/10/2015	Others
19	Raosoft	Sample size calculator	Website http://www.raosoft.com/samplesize.html in English language retrieved on 27/05/2016	Others
20	ERDI	Commissioning report of digester and biogas plant at each farm	Commissioning report dated September 2010, November 2010 and July 2011	CME

21	ERDI	Operation details of bio-gas engines at each farm (Khana Hybrid Co., Ltd., Chokchaikansukorn Farm and Wang Noi Farm)	Ref. No. MOE 6393(27)/2/026 dated 20/04/2015 Ref. No. MOE 6393(27)/2/028 dated 20/04/2015 Ref. No. MOE 6393(27)/2/027 dated 20/04/2015	CME
22	IPCC	Emissions from livestock and manure management, IPCC 2006	IPCC Guidelines for National Greenhouse Gas Inventories Annex 10A.2 Tables 10A-7 and 10A-8	Others
23	Khana Hybrid Co., Ltd., Chokchaikansukorn Farm and Wang Noi Farm	Sample of invoices of animal purchase and animal sales, invoices of purchase of food and formulae of food composition for the period November 2012 to December 2014	Sales/purchase records	CME
24	Thai Calibration Services Co. Ltd.	Calibration certificate of Weighing scale (sl.no. 0000719 and for sl.no. 2013016) dated 25/03/2016	Calibration certificate	Others
25	Northern Weights and Measures Centre (Chiang Mai)	Calibration certificate of Weighing scale (sl.no. IK2131237N4785) dated 11/02/2016	Calibration certificate	Others
26	ERDI	Log book records of manure utilization in digester system for Khana Hybrid Co., Ltd (Phanomsarakham Farm 1) for the period of 01/11/2012 to 31/12/2014	Log book records	CME
27	ERDI	Operational manual for swine farming at each farms	Operational manual	CME
28	DEDE, Ministry of Energy	Thailand Energy Statistics (Preliminary) 2013	http://www.dede.go.th/download/stat58/statistics2556r_p.pdf	Others
29	Thai Industrial Standard	List of Accredited Laboratories According to ISO/IEC 17025	http://app.tisi.go.th/lab/calibrate/class_e.html	Others
30	Endress-Hauser	Operating Instructions-Proline t-mass 65 (thermal mass flow meter)	BA00111D/06/EN/13.14	Others
31	Endress-Hauser	a) Calibration certificate for flow meter sl.no. F5147D02000 dated 09/04/2014 b) Calibration certificate for flow meter sl.no. EC0A3E02000 dated 10/04/2014 c) Calibration certificate for flow meter sl.no. F6006402000 dated 11/04/2014	a) Certificate no: 4409089374-02/05 b) Certificate no. 4409089374-03/05 c) Certificate no. 4409089374-05/05	Others
32	Endress-Hauser	a) Calibration certificate for flow meter sl.no. F5147C02000	a) Certificate no: 4409089374 01/05 b) Certificate no. SV2014-237 c) Certificate no. 4409089374-	Others

		dated 09/04/2014 b) Calibration certificate for flow meter sl.no. D3048402000 dated 22/04/2014 c) Calibration certificate for flow meter sl.no. F6006302000 dated 11/04/2014	04/05	
33	IES Electric Co. Ltd.	Letter for calibration requirement and technical specification of thermocouple type K, Model TH-10	Letter dated 28/12/2015	Others
34	RINA	Validation report form for post-registration changes for CDM project activities	Version 1 of 30/08/2016	DOE
35	Thermometric	Specification of K type thermocouple	http://www.thermometriccorp.com/thertypk.html	Others
36	UNFCCC	Guideline: Sampling and surveys for CDM project activities and programme of activities	Version 04 of 16/10/2015	Others

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

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

FAR ID	01	Section no.	G.2	Date: 20/03/2015
Description of FAR				
The coordinating entity should ensure that each farm has the necessary data (i.e. swine population etc.) for the crediting period as for the verification of emission reductions there needs to be reliable data at the farm				
CME response				Date: 18/08/2016
Each farms considered during this monitoring period has necessary data records for arriving emission reductions as per the registered PoA and methodology requirement.				
Documentation provided by the CME				
Log book records and other records shown at site and revised CPA-DD				
DOE assessment				Date: 31/08/2016
It has been verified from each farms log book records which represents the records of animal entries (purchase; births, internal transfer) and exit (ex: sale, death, internal transfer) and the final monthly record of animals per animal category (ex: nursery, farrow, fattening 1 and fattening 2, breeding male, breeding female, pregnant sow. Therefore, it is confirmed that each farm has reliable data for calculating emission reductions. Hence the FAR is closed				

Table 2. CL from this verification

CL ID	01	Section no.	I.3	Date: 20/03/2015
Description of CL				
PP is also requested to provide records of training provided to employees on CDM monitoring system, operation of digester and gas engine.				
CME response				Date: 18/08/2016
Relevant supporting documents were included in this verification package.				
Documentation provided by the CME				
Training records				
DOE assessment				Date: 31/08/2016
The CME of the PoA, ERDI also the technology supplier organize trainings related to monitoring and operation of the digester and biogas engine time to time and maintain records for the same. Records of training and progress report verified and conforms to the monitoring requirements. Hence, response is accepted and CL is closed .				

Table 3. CAR from this verification

CAR ID	01	Section no.	I.4.1	Date: 20/03/2015
Description of CAR				
PP is requested to respond the following:				
<ol style="list-style-type: none"> 1. The installed generator capacity at each farm is not correct which was validated in CPA-DD 2. Copy of commissioning certificates of digester and gas engine for all the three farms needs to be provided. 3. Model correction factor to account for model uncertainties (UFB) is not included in the MR. 				
CME response				Date: 18/08/2016
<p>1. Confirmed statements of installed and operating generator capacity were provided to the DOE.</p> <p>2. In the ERDI commissioning report of each farm (all provided), there is a summary of system operation. The commission date is of the overall project: wastewater treatment and biogas utilization. The reports show the performance of both wastewater treatment and biogas utilization. The gas engines were generally installed a few months prior to the commissioning date referred in the reports.</p> <p>3. The parameter UFB is now included in the MR.</p> <p>The change being submitted is not described as a deviation from the project design, as it is not of a temporal nature but rather a permanent one; therefore it is being submitted as a permanent change that does not require prior approval by the CDM EB, as per guidance under Appendix 1 of the CDM Project Standard, v09.0, paragraph 6. As indicated by the Appendix, the changes can be submitted given that they do not adversely impact i) the applicability of the methodology, ii) the addittonality nor the iii) scale of the project. The changes of actual installed capacities in all three CPA 1 farms lead to lower IRR compared with the planned set-up envisioned at the time of registration due to lower actual operating capacity of generators, higher investment cost and fewer actual operating hours. Thus the changes in generator numbers and installed capacities do not need prior approval from the EB, as financial analysis still leads to the projects not achieving the benchmark IRR (in fact, they would achieve lower IRR wirthout CDM). CPA-DD has been revised to include mention of actual capacities and to note that the additionality is not affected.</p> <ul style="list-style-type: none"> - Chokchaikansukorn IRR assumed 12.08% without CDM and in reality 7.90%. - Phanomsarakham IRR assumed 10.75% without CDM and in reality 4.88%. - Wang Noi IRR assumed 9.64% without CDM and in reality -3.67%. 				
Documentation provided by the CME				
Revised MR and revised CPA-DDs				
DOE assessment				Date: 31/08/2016

Farm Chokchaikansukorn has installed two biogas electric generator with capacity 200 kW each out of which one is used as standby.

Phanomsarakham Farm 1 has installed two biogas electric generator with capacity 150 kW each and operated at 130 kW each.

Wang Noi Farm has installed two biogas electric generator with capacity 150 kW each and operated at 130 kW and 100 kW.

This is further confirmed from the letter issued by ERDI (the technology provider) and justifies the site visit observation. The revised CPA-DD is also transparently presents this scenario.

The digester and gas engine of Chokchaikansukorn farm commissioned by September 2010, for Phanomsarakham Farm in November 2010 and for Wang Noi Farm in July 2011 as confirmed from commissioning report of ERDI (technology supplier).

The parameter UF_b (Model correction factor to account for model uncertainties) is now included in the revised MR.

For Chokchaikansukorn farm, although two biogas electric generator has been installed (2*200 kW) compared to one (200 kW) during CPA inclusion, one is kept as standby and actual operating capacity is also low for the operational generator (150 kW). This has led to higher investment cost compared to project conceptualization and lower output. Therefore, as presented in revised MR, the actual IRR is lower than envisaged during CPA inclusion stage.

For Phanomsarakham farm, although two biogas electric generator has been installed (2*150 kW) compared to one (200 kW) during CPA inclusion stage, one runs at 130 kW capacity and the other runs only 2 hours per day as verified during site visit. Therefore, in actual scenario, it has led to higher investment cost compared to project conceptualization stage and lower output. Therefore, as presented in revised MR, the actual IRR is lower than envisaged during CPA inclusion stage.

For Wang Noi farm, although two biogas electric generator has been installed (2*150 kW) compared to one (200 kW) during CPA inclusion stage, one runs at 130 kW capacity and the other runs at 100 kW capacity. The actual run hours found to be 12 hours as compared to 24 hours as envisaged. Therefore, in actual scenario, this has led to higher investment cost compared to project conceptualization stage and lower output. Therefore, as presented in revised MR, the actual IRR is lower than envisaged during CPA inclusion stage.

Inclusion, response is accepted and **CAR is closed**

CAR ID	02	Section no.	I.3	Date: 20/03/2015
Description of CAR				
PP has applied sampling approach to monitor average animal weight of a defined livestock population at the project site. However, the sampling plan is not described in the MR.				
CME response				Date: 18/08/2016
The sampling plan is now described in Section D.3. of the MR				
Documentation provided by the CME				
Revised MR and revised CPA-DDs				
DOE assessment				Date: 31/08/2016
The sampling plan is explained in the revised MR. The sampling plan and sample size meets the desired precision as per 'standard for sampling and surveys for CDM project activities and programme of activities'. Hence, response is accepted and CAR is closed .				

CAR ID	03	Section no.	I.4.2	Date: 20/03/2015
Description of CAR				
<p>Following needs to be addressed:</p> <ol style="list-style-type: none"> 1. The monitored value for number of days animal is alive in the farm ($N_{da,y}$) during the monitoring period for each farm and each category is not provided in the MR. 2. The monitored value for number of animals produced annually of type LT ($N_{p,y}$) during the monitoring period for each farm and each category is not provided in the MR. 3. The monitored value for average animal weight of a defined livestock population at the project site (W_{site}) during the monitoring period for each farm and each category is not provided in the MR. 4. The monitored value for total amount of biogas collected ($BG_{burnt,y}$) in each farm during the monitoring period is not provided in the MR. 5. The monitored value for total amount of biogas captured and used as fuel in generator ($BG_{elec,y}$) in each farm during the monitoring period is not provided in the MR. Also the details (serial number, make, calibration date, calibrating agency etc.) of flow meters are also not provided for each farm in the MR. 6. The monitored value for total amount of biogas sent to flare ($BG_{flare,y}$) in each farm during the monitoring period is not provided in the MR. Also the details (serial number, make, calibration date, calibrating agency etc.) of flow meters are also not provided for each farm in the MR. 7. The monitored value for flare operation hours in each farm during the monitoring period is not provided in the MR. Also the details (serial number, make, operation and maintenance as per manufacturer specifications) of flame detector are also not provided for each farm in the MR. 8. The monitored value for electricity consumed by the project from the grid ($EC_{PJ,y}$) in each farm during the monitoring period is not provided in the MR. Also the details (serial number, make, calibration date and calibrating entity) of energy meters are also not provided for each farm in the MR. It was noted during site visit that each farm is connected with grid to receive power supply whenever required and a dedicated energy meter (sealed and controlled by govt. entity) monitor and records total power supply to the farm and there is no separate energy meter to monitor and record power consumed from grid specific to the project activity in each farm. In that case, PP is requested to clarify how the electricity consumed from grid by the project activity is accounted during the monitoring period. 9. It is not explained in MR why the monitored value for $EG_{y,auxiliary}$ is reported zero (0) for the monitoring period. Further, additional comment presented for this parameter is applicable for validated CPA. 10. It is not explained in MR why the monitored value for $FC_{i,j,y}$ is reported zero (0) for the monitoring period. Further, additional comment presented for this parameter is applicable for validated CPA. 11. It is not explained in MR why the monitored value for $NCV_{i,y}$ is reported zero (0) for the monitoring period. 12. The monitored value for $EF_{iCO2/GJ}$ in each farm during the monitoring period is not provided in the MR. Explanation is required if the reported value is zero for the monitoring period. 13. The explanation provided for monitoring equipment against $MS\%_{i,y}$ is not correct. 14. The monitored value for number of days that the animal manure management system was operational (nd_y) during the monitoring period for each farm and each category is not provided in the MR 15. PP is requested to provide supporting document to prove the genetic source of the production operations livestock. 16. The monitored value or justification of ex-post monitoring for Formulated Feed Rations for each farm and each category is not provided in the MR. 17. PP is requested to justify how the reported value for $TDL_{i,y}$ is monitored annually or represent the most recent value 				
CME response				Date: 18/08/2016

1 & 2. PE proposes an alternative way of calculating $NLT_{y,y}$ based on practise followed at the participating farms as per the proposition in the revised PoA-DD. Thus, it is not necessary to calculate separately an $N_{da,y}$ and $N_{p,y}$.

3. The monitored value of parameter W_{site} during the monitoring period for each farm and each category is provided in the MR.

PP response 2: The monitored value for W_{site} at Chokchai farm for "Fattening 1" is the same as for "Fattening 2", i.e.92 kg. This was omitted by mistake and has now been included in the attached version of the MR.

PP response 3: Details on weighing scales now provided in MR. The calibration certificates by an independent third-party auditor have been provided for all three farms. Even though reported values have been adjusted by the maximum uncertainty of measurement (5%) due to a delayed calibration, there is no adjustment on Emission Reductions for delayed calibration applied, due to ERs claimed being a result of BG burnt.

4 & 5. The monitored value of parameter $BG_{burnt,y}$ and $BG_{elec,y}$ in each farm during the monitoring period for each farm and each category is provided in the MR.

PP Response 2: Please find attached to this submission the manufacturer Operating Instructions for Endress-Hauser flowmeter, where a recalibration interval of every 2 to 3 years is recommended (p.68). Flow meter initial calibration certificates have now been provided to the DOE.

6. The monitored value of parameter $BG_{flare,y}$ in each farm during the monitoring period and details of flow meters are provided in the MR. Relevant supporting documents were included in this verification package.

PP Response 2: Please find attached to this submission the manufacturer Operating Instructions for Endress-Hauser flowmeter, where a recalibration interval of every 2 to 3 years is recommended (p.68). Zero flaring in Chokchai is due to the fact that all recovered gas was supplied to the two gensets and no gas was available for flaring. Flow meter initial calibration certificates have now been provided to the DOE.

7. The monitored value for flare operation hours in each farm during the monitoring period and details of flame detector were provided in the MR. Relevant supporting documents were included in this verification package.

8. Since the electricity consumed by the project cannot be isolated from the overall farm electricity consumption, $EC_{PJ,y}$ was derived from applying the assumption that electrical appliances are continuously utilized, and a corresponding value applied. This approach was proposed and accepted during the PRC process and included in the revised PoA-DD.

PP response 2: This deviation from the monitoring plan falls under Appendix 1 of the Project Standard v09.0 paragraph 3, i.e. Temporary deviations from the registered monitoring plan, applied methodology or applied standardized baseline, given that conservative estimates have been carried out for this period assuming that the source of the GHG emissions (electricity consumption) are operated at maximum capacity for the full period, and given that transmission losses have also been accounted for. These therefore are identified as per the Appendix as changes that do not require prior CDM EB approval. It is to be noted that the intention of the project is for this to be monitored in other periods, that is why this approach is only temporal.

9. All energy generated at the farm was utilized at the farm with no off-farm sale. As it is not possible to isolate the consumption of renewable energy for auxiliary equipment from the total energy used at the farm, it has been left at zero (0). Further explanation provided in the MR.

10. There was no fossil fuel combustion in the project site; thus, $FC_{i,j,y}$ was reported zero (0) for the monitoring period. Explanation is provided in the MR.

11 and 12. Since there was no fossil fuel used in the project activities, $NCV_{i,y}$ and $EF_{IC02/GJ}$ was not reported in the MR.

13. All manure was collected daily or every other day by hose flushing all material through a series of collection channels, operating by gravity. This was explained in the MR.

14. The monitored value of parameter nd_y during the monitoring period for each farm and each category was provided in the MR.

15. The PP proposes to use the most conservative IPCC global value for Phanom and Wang Noi farms to resolve the outstanding issue regarding genetic source. This has been revised in the MR.

16. The supporting document for FFR of each farm was included in this verification package.

17. The parameter $TDL_{j,y}$ is generally available from the annual report produced by the Ministry of Energy. However, in the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.

PP response 2: The TDL used (6.10%) is for the year 2013 from "Thailand Energy Statistics (Preliminary) 2013", Ministry of Energy, The source will be corrected in the MR.

Documentation provided by the CME	
Revised MR, revised ER sheet, revised CPA-DDs and supporting documents	
DOE assessment	Date: 31/08/2016
<p>1 & 2. PP has proposed permanent changes in monitoring of $N_{LT,y}$ as per farm practice which consider daily animal entries (purchase; births, internal transfer) and exit (ex: sale, death, internal transfer) and summarize monthly records of animals per category (nursery, farrow, fattening 1 and fattening 2, breeding male, breeding female, pregnant sow). Using this approach, it is not necessary to calculate separately an $N_{da,y}$ and $N_{p,y}$, since the number of days the animal is alive ($N_{da,y}$) and the number of animals produced per category LT ($N_{p,y}$) are already considered in the daily records and taken into account when calculating $N_{LT,y}$. Hence, the proposed practice of monitoring approach is in line with the applied methodology and considering appendix 1 of project standard version 09 prior approval from Board is not required.</p> <p>3. Monitored value of W_{site} and calibration details of weighing scale at each farm is provided in the MR.</p> <p>4. Monitored value of $BG_{burnt,y}$ at each farm has been provided in the MR. The value is the sum of biogas used in generator ($BG_{elec,y}$) and biogas flared ($BG_{flare,y}$). The reported values are cross checked against the monitored values of $BG_{elec,y}$ and $BG_{flare,y}$ and found to be correct.</p> <p>5. The monitored value of $BG_{elec,y}$ in each farm during the monitoring period is provided monthwise in the ER sheet. The same is found to be consistent with log book records at site. The monitoring and recording is as per the registered monitoring plan. Further, the details of flow meter used for monitoring $BG_{elec,y}$ at each farm is also provided and conforms to the actual scenario. However, PP is requested to provide manufacturer recommendation (supporting document) for frequency of calibration of the flow meter. Also provide documentary evidence of initial installation/testing for each flow meter.</p> <p>6. The monitored value of $BG_{flare,y}$ in each farm during the monitoring period is provided monthwise in the ER sheet. The same is found to be consistent with log book records at site. The monitoring and recording is as per the registered monitoring plan. Further, the details of flow meter used for monitoring $BG_{flare,y}$ at each farm is also provided and conforms to the actual scenario. As per manufacturer (Endress+Hauser) of flow meter for $BG_{flare,y}$ recalibration interval of every 2 to 3 years is recommended. Also initial calibration records verified.</p> <p>7. The flare operational hours at each farm has been provided in the revised MR along with the details of flame detector. As per letter from IES Electronic Co. Ltd. (manufacturer of thermocouple) dated 28/12/2015, the thermocouples installed at each farm does not require any specific maintenance or calibration. Hence, QA/QC for flare operation has been accepted.</p> <p>8. Since, project participant have not monitored the grid electricity consumption in the project as per the monitoring plan, PP has accounted project GHG emission considering the source of GHG emissions operated at maximum capacity for the full monitoring period. This approach is conservative. The states deviation is included under temporary deviation which is inline with Appendix 1 of CDM project standard version 09 and do not require prior approval from Board.</p> <p>9. Explanation is provided in MR. Further, the electricity generation under the project is not sold to other party and used for inhouse. No emission reduction is claimed for use of electricity. Hence, response is accepted.</p> <p>10. As confirmed during site visit from log book records and energy consumption records of the farm, no fossil fuel has been consumed during the monitoring period. Hence, zero value has been reported for the monitoring period.</p> <p>11 & 12. It is accepted that since no fossil fuel has been used during the monitoring period, $NCV_{i,y}$ and $EF_{tCO2/GJ}$ is not reported in the MR. The MR is revised and hence accepted.</p> <p>13. As confirmed from site visit, 100% of the manure is handled in the system. All the manure is flushed into the treatment system. Hence, response is accepted.</p> <p>14. As part of daily monitoring procedure number of non-operational days of the animal manure management system is recorded in log books and the same is referred in the MR. Hence, response is accepted.</p> <p>15. For genetic source of production operations livestock, PP has taken asian origin and IPCC default values of VS_{LT} and Bo_{LT} accordingly. Revised CPA-DD, MR and ER sheet found consistent.</p> <p>16. It has been verified during site visit and from the submitted documents that each farm has documented procedure for feeding formulated rations according to age, weight, category and stage of growth. The same is being followed at site as verified from plant records. Hence, response is accepted.</p> <p>17. The MR transparently provide the reference (year, weblink) of the value used for $TDL_{j,y}$.</p> <p>Hence, CAR is closed.</p>	

CAR ID	04	Section no.	I.5	Date: 20/03/2015
Description of CAR				
The monitoring equipment details (serial number, make, accuracy, calibration details and calibrating agency) for monitoring of $BG_{elec,y}$, $BG_{flare,y}$, Flare operation, $EC_{PJ,y}$, weigh scale for monitoring W_{site} are not provided in the MR respective to each farm. Also justify how the calibration requirement for the monitoring period is maintained as per registered CPA-DD with evidences of manufacturer specifications				
CME response				Date: 18/08/2016
Details on weighing scales now provided in MR. The calibration certificates by an independent third-party auditor have been provided for all three farms. Even though reported values have been adjusted by the maximum uncertainty of measurement (5%) due to a delayed calibration, there is no adjustment on Emission Reductions for delayed calibration applied, due to ERs claimed being a result of BG burnt.				
Please find attached to this submission the manufacturer Operating Instructions for Endress-Hauser flowmeter, where a recalibration interval of every 2 to 3 years is recommended (p.68). Flow meter initial calibration certificates have now been provided to the DOE.				
Documentation provided by the CME				
Revised MR and calibration certificates.				
DOE assessment				Date: 31/08/2016
The verification team found the details consistent with site visit observations and calibration certificates and hence accepted. CAR is closed.				

CAR ID	05	Section no.	I.6.1	Date: 20/03/2015
Description of CAR				
kindly address the followings:				
<ol style="list-style-type: none"> 1. Section E.1 of the MR does not explain the ex-post consideration of emission reduction which is considered under section E.7.2 of the registered PoA-DD. 2. Section E.1, E.2 and E.3 of the MR does not provide calculation applying actual values which is required as per Instructions for filling out the monitoring report form. 3. GWP of methane is not considered correctly for Phanom farm respective to its commitment period. 4. The value for $N_{LT,y}$ (Nursery, Fattening 1, Fattening 2) for the November 2012 is not matching with log book records for Wang Noi farm. 5. The value for $N_{LT,y}$ (Nursery, Farrow, Fattening1, Fattening 2, Breeding female and male) for the November 2012 is not taken the net number from log book records for Chokchaikansukorn Farm. 6. The calculation of $BE_{y,ex-post}$ and $PE_{y,ex-post}$ for the month of January 2013 is not correct for Chokchaikansukorn Farm. 7. $BG_{burnt,y}$ value for the month of November 2012 has been taken for the full month for Chokchaikansukorn Farm and Phanom farm whereas the monitoring period starts from 09/11/2012. 8. $BG_{burnt,y}$ value for August 2013 is not matching with log book records for Phanom Farm. 9. The value of $N_{LT,y}$ for nursery in Phanom farm in the months of December 2012, January 2013, March 2013 and April 2013 is not matching with log book records. 10. BG_{flare} is not consistent in ER sheet with log books for Phanom farm for the months of July 2013, August 2013, April 2014 and June 2014 				
CME response				Date: 18/08/2016
<ol style="list-style-type: none"> 1. The ex-post consideration of emission reduction was included in Section E.1 of the MR. 2. The calculation applying actual values (2014 data of Wang Noi) was completed and illustrated in Sections E.1, E.2 and E.3 of the MR. <p>PP response 2: The correct GWP values for up to 2012 (21) and post 2012 (25) have been used in calculations and are noted better on the updated ER spreadsheet attached to this submission.</p> <ol style="list-style-type: none"> 3. Corrected accordingly. 4-10. All data mismatching was corrected in the ER sheet and reflected in the MR. <p>PP response 2: These have now been revised and updated accordingly.</p>				
Documentation provided by the CME				
Revised MR and ER sheet.				
DOE assessment				Date: 31/08/2016

1. Ex-post consideration of emission reduction as per registered PoA-DD and in line with the applied methodology is included in section E.1 of the revised MR. Response is accepted.

2 & 3. Actual emission reduction as per applied methodology is now included in the revised MR. GWP of methane is transparently presented specific to commitment period. Hence accepted..

4-10. Wang Noi farm: Necessary corrections in the ER worksheet has ben done. Monitored data presented are found to be consistent with actual records.

Chokchaikansukorn Farm: Necessary corrections in the ER worksheet has ben done. Monitored data presented are found to be consistent with actual records.

Phanom Farm: Necessary corrections in the ER worksheet has ben done. Monitored data presented are found to be consistent with actual records.

The calculation of $BE_{y,ex-post}$ and $PE_{y,ex-post}$ for the month of January 2013 is corrected for Chokchaikansukorn Farm.

Hence, response is accepted and **CAR is closed.**

CAR ID	06	Section no.	G.1	Date: 20/03/2015
Description of CAR				
As per the instruction for completing the monitoring report form the following are not transparent:				
1. Brief description of the installed technology and equipment is missing in section A.1 of the MR.				
2. Section A.1 of the MR does not include the project implementation details farm wise.				
3. Technical specifications s of digester, engine and flare not clear in section B.1				
The title of the MR mention all three CPAs whereas the monitoring report is specific to the CPA 8027-0001				
CME response				Date: 18/08/2016
The description of the installed technology and equipment was introduced in Section A.1 of the MR.				
2. The project implementation details farm wise were presented in Table 1 of the MR.				
3. The technical specifications were illustrated in Table 3 of the MR.				
The title of the MR was changed to "Thailand Small Scale Livestock Waste Management Program CPA 01" to be specific only to CPA 8027-0001.				
Documentation provided by the CME				
Revised MR				
DOE assessment				Date: 31/08/2016
Technology description is included in the revised MR section A.1. Further, the project implementation dates are mentioned in the revised MR. The dates are cross checked with commissioning reports and found to be correct.				
Also the details of digester, biogas gas electricity generator and fare at each farm is included in the revised MR.				
The title of the MR is corrected considering verification of one CPA during this monitoirng period				
Hence, response is accepted and CAR is closed.				

Table 4. FAR from this verification

FAR ID	xx	Section No.		Date: DD/MM/YYYY
Description of FAR				
CME response				Date: DD/MM/YYYY
Documentation provided by the CME				
DOE assessment				Date: DD/MM/YYYY

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
01.0	5 June 2015	Initial publication.
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