Monitoring report form for CDM project activity
(Version 07.0)

MONITORING REPORT		
Title of the project activity	BRASCARBON Methane Recovery Project BCA-BRA-05, Brazil	
UNFCCC reference number of the project activity	Project 3455	
Version number of the PDD applicable to this monitoring report	05	
Version number of this monitoring report	02	
Completion date of this monitoring report	02/03/2020	
Monitoring period number	Second monitoring period of the second crediting period	
Duration of this monitoring period	01/01/2019 to 31/12/2019 (first and last days included)	
Monitoring report number for this monitoring period	N/A	
Project participants	Brascarbon Consultoria, Projetos e Representação Ltda Norwegian Ministry of Climate and Environment	
Host Party	Brazil	
Applied methodologies and standardized baselines	AMS-III.D version 20.1	
Sectoral scopes	Sectorial scope 13 – Waste handling and disposal	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	N/A	56,005 tCO_2e (365 days)
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	57,067 tCO_2e (365 days)	

SECTION A. Description of project activity

A.1. General description of project activity

The Project Activity involves the capture and combustion of biogas produced from the decomposing manure at swine confined animal feed operations located in Mato Grosso do Sul state, Brazil. It consists in the construction of a new covered in-ground anaerobic reactor (digester) that utilizes the manure previously treated in anaerobic open lagoons to produce biogas. The resulting biogas is measured and destroyed through a flaring system.

The result of this project is a significant reduction of GHG emissions compared to those emissions that would have occurred in the absence of the project and also promotion of sustainable swine production farms, bringing environmental and social benefits, moving from a high-GHG animal waste management system practice to anaerobic digester with capture and combustion of resulting biogas.

This project applies version 20.1 of the Methane Recovery methodology identified in Section III.D, of the Indicative Simplified Baseline and Monitoring Methodologies for Small-Scale CDM Project Activity Categories, to swine confined feed operations located in the state of Mato Grosso do Sul, Brazil.

The start of the first construction was 03/03/2008. All sites included in the PDD and the relevant dates of the project implementation for each site are described in the Section B1, because this project activity is composed of 14 different sites.

The project had the renewal of its crediting period and is currently under the second crediting period, approved on 3rd May 2018 for the period of 21/08/2017 until 20/08/2024.

The total emission reductions achieved in this monitoring period are 56,005 tCO_2e.

A.2. Location of project activity

The project is located in the several different cities in the state of Mato Grosso do Sul, Brazil. The detailed physical location for each project site is presented in Table A1.

Table A.1. – Detailed physical location and identification of project site

Farm / Site	Brascarbon ID	Address	Town / State	Contact	Phone	GPS Coord
Fazenda Dragão	BCA-032MS1-05	BR 163 - toward Cuiaba left	São Gabriel do Oeste - MS	Antonio Macari	+55 67 9611 8958	S 19,1547 W 54,7625
Lote 55 e 54	BCA-034MS1-05	BR 163 toward Coxim - Assentamento Campanário	São Gabriel do Oeste - MS	Antenor Barbosa de Oliveira Roque Luiz Busanello	+55 67 9962 2063	S 19,2911 W 54,6051
Lote 101	BCA-035MS1-05	BR 163 toward Coxim - Assentamento Campanário	São Gabriel do Oeste - MS	Leonildo Gama da Silva	+55 67 9936-7840	S 19,2683 W 54,5650
Lote 105	BCA-036MS1-05	BR 163 toward Coxim - Assentamento Campanário	São Gabriel do Oeste - MS	Vanderlei Carlos Shimit	+55 67 9934-0227	S 19,2644 W 54,5628
Lote 71	BCA-037MS1-05	BR 163 toward Coxim - Assentamento Campanário	São Gabriel do Oeste - MS	Airton José Borgmam	+55 67 9915-7335	S 19,2736 W 54,5942
Lote 82	BCA-038MS1-05	BR 163 toward Coxim - Assentamento Campanário	São Gabriel do Oeste - MS	João Ferreira dos Santos	+55 67 9962-1715	S 19,2714 W 54,5900
Lote 28 e 27	BCA-039MS1-05	BR 163 toward Coxim - Assentamento Campanário	São Gabriel do Oeste - MS	Hilário Valentini e Valderi Valentin	+55 67 8424-8682	S 19,2836 W 54,6264
Fazenda Bela Vista	BCA-040MS1-05	BR163 - Km 609 – country Road to Ponto Alto - left side	São Gabriel do Oeste - MS	Jair Antonio Borgman	+55 67 3295 5031	S 19,4414 W 54,5622
Granja Serra Dourada	BCA-041MS1-05	BR163 - Km 609 – country Road to Ponto Alto right side	São G. do Oeste - MS	Rainer Josef Ruiz de Goehr	+55 67.8122-35661	S 19,2647 W 54,5642
Fazenda Cachoeira	BCA-042MS1-05	BR163 - Km 609 – country Road to Ponto Alto - left side	São Gabriel do Oeste - MS	Valdir Scotton	+55 67 9962 1494	S 19,4364 W 54,5589
Granja Capivara	BCA-043MS1-05	BR163 - Km 609 – Country Road to Ponto Alto left	São G. do Oeste - MS	Zélio Antonio Pessato	+55 67 3295 1242	S 19,4269 W 54,5483
Fazenda Sorgatto	BCA-046MS1-05	BR 163 - Km 604 – toward south – right side 8 km from São Gabriel.do Oeste	São Gabriel do Oeste - MS	João Carlos Sorgatto	+55 67 9996 9990	S 19,4658 W 54,5256
Fazenda Bambú - Quinhão A	BCA-051MS1-05	Ponte Vermelha – District of São Gabriel do Oeste	São Gabriel do Oeste - MS	Ari Fernando Grando	+55 67 3295 1097	S 20,2939 W 54,6383
Fazenda Folleto	BCA-052MS1-05	Old BR163 - toward Ponto Alto	São G. do Oeste - MS	Jose Jorge Foletto	+55 67 9905 7306	S 19,5383 W 54,5208

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Brascarbon Consultoria, Projetos e Representação Ltda	No
Norway	Norwegian Ministry of Climate and Environment	No

The changes of the Parties and project participants for the project (voluntary withdrawal of Luso Carbon Fund as a project participant under Portugal and addition of Norwegian Ministry of Climate and Environment as a new project participant under Norway) have been approved by the UNFCCC and are visible on the project page.

A.4. References to applied methodologies and standardized baselines

The approved baseline and monitoring methodology applied is ***AMS-III.D - Methane recovery in animal manure management systems*** (version 20.1) – http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

The following tools were also used:
Methodological Tool: "Project and leakage emissions from anaerobic digesters" (version 02)
Methodological Tool: "Project emissions from flaring" (version 02)
Methodological Tool: "Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period" (version 03.0.1)

The choice of the selected simplified methodology is considered to be appropriate because the project activity meets each applicability conditions of the selected methodology AMS III-D (Version 20.1).

a) The livestock population in the farm is managed under confined conditions:
All farms included in this project activity are managed under confined conditions confirmed by the obligatory environmental licenses whose document releases the Confined Animals Feed Operation business. The environmental licenses can be found at Brascarbon and it´s available for validation and verification.

b) The manure, after treatment, will not be discharged into natural water resources:
The environmental legislation does not approve any manure or manure after treatment discharging into the natural water resources. Before releasing the environmental licenses by the Environmental Department, the Confined Animal Feed Operation activity is checked to confirm that all effluent after treatment is not discharged into the natural water resources. According item a) above, the environmental licenses can be found at Brascarbon an available for validation and verification.

c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C:
The annual average temperature verified in city of reference to the Mato Grosso do Sul state is 23-25°C, so higher than what the methodology states as a minimum: 5°C. This information can be verified through on INPE (National Institute of Space Research) web site.

d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and if anaerobic lagoons are used in the baseline, their depths are at least 1 m:
The retention time of waste in open anaerobic open lagoons has proven to be more than 1 month as recommended by EMBRAPA (from 30 to 40 days)[1]. The depth was higher than 1

[1] http://www.cnpsa.embrapa.br/down.php?tipo=publicacoes&cod_publicacao=186

meter, and has been verified by measurements taken on each farm. This information is available for validation and verification.

e) No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario;

The baseline scenario for all farms in this PDD is a Confined Animal Feed Operation with open anaerobic lagoons for the manure treatment system. No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario, which can be verified in each farm during validation. The project is new and does not involve capacity additions to the baseline scenario. This complies with para 7 and 8 of AMS-III.D version 20.1.

The project will also satisfy the following conditions:

a) The residual waste from the animal manure management system shall be handled aerobically, otherwise the related emissions shall be taken into account as per relevant procedures of AMS-III.AO "Methane recovery through controlled anaerobic digestion". In case of soil application, proper conditions and procedures (not resulting in methane emissions) must be ensured;

The final sludge will be handled aerobically. It will be applied in the soil, according with the proper conditions and procedures, being assured that no methane emissions are resulting from this application. The project involves the use of treated effluent for irrigation in farms and application of stabilized sludge on crops irrigation in farms, without any anaerobic conditions. The practice is to distribute the sludge over the field according the usual practice to improve the field fertilization. This complies with para 4(a) of AMS-III.D version 20.1.

b) Technical measures will be used ensuring that all biogas produced by the digester is used or flared:

The project involves facilities to burn (flaring) the biogas generated by the digester. This complies with para 4(b) of AMS-III.D version 20.1. An enclosed flare will be used in the project and also sized to support high temperatures. A continuous sparkling system is installed in the combustion chamber of the flare. In adequate conditions, the project activity will install electricity generator for in site electricity supply of farm needs according to conditions established on para 4 of AMS-III.H version 18.0, although no claims for emissions reductions by the electricity generation will be requested during the entire project activity, only by the emissions reductions of the biogas destroyed in the generators. This comply with para 6 of AMS-III.D version 20.1.

c) The storage time of the manure after removal from the animal barns, including transportation, will not exceed 45 days before being fed into the anaerobic digester:

This situation is assured due to the fact that the barns are directly connected to the biodigesters and considering the common farms practices where each day the barn is washed and all waste is removed by the water flushing system sent to the digester. This complies with para 4(c) of AMS-III.D version 20.1. The Confined Animal Feed Operation Practices follows recommendations from EMBRAPA (Empresa Brasileira de Agricultura e Agropecuária) to get high standards of sanitary conditions in the confined operations. These recommendations can be found at EMBRAPA web site where all producers use as a guideline.

Finally, the project doesn't involve any landfill activity. The project activity recovers methane generated in the treatment of swine manure by installing methane recovery and combustion systems (biodigester). This complies with para 5 of AMS-III.D version 20.1.

Utilization of the recovered biogas in one of the options detailed in AMS-III.H is also eligible under this methodology. The respective procedures in AMS-III.H shall be followed in this regard. If the recovered biogas is used to power auxiliary equipment of the project activity, it should be taken into account accordingly, using zero as its emission factor; however, energy used for such purposes is not eligible as an SSC CDM Type I project component.

New facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the "General guidelines for SSC CDM methodologies".

The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General guidelines for SSC CDM methodologies".

The project activity is a Type III: other project activities not included in Type I or Type II that result in GHG emission reductions not exceeding 60 kt CO2e per year in any year of the crediting period.

A.5. Crediting period type and duration

The renewable crediting period of 7 years ×3 is chosen. The project is currently under the second crediting period which starts from 21/08/2017 to 20/08/2024, approved on the 3rd of May of 2018.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The technology used is an anaerobic digestion process in which microorganisms break down biodegradable material in the absence of oxygen. The process is widely used to treat wastewater sludge and organic wastes because it provides volume and mass reduction of the input material.

The equipment is based on one ambient temperature storage covered cells which uses a single-piece liner affixed to a reinforced outer concrete frame. The outer cover consists of a synthetic vinyl membrane which is also fastened to the frame. The liner and cover are sealed together with bolts and iron plate frame. The system also includes a biogas collector piping, from the digester to the flare system. Since the starting of the project, no power generators were installed for in site electricity supply and all the biogas produced has been flared.

The flare is enclosed and a thermocouple installed in the flare measures the combustion temperature every minute. The thermocouple measures and sends the temperature information to a PLC (Programmable Logic Control) system where the minute by minute combustion temperature data is stored. The sparkling system in the flare is automatic. Every one second the system sparks. The biogas volume that is directed to the flare is measured cumulatively every minute by a flow meter and also controlled by the PLC, which stores the minute by minute cumulative volume data. The sparkling system, the PLC and the control panel are powered by a 12 volts battery charged by solar cells.

The treated effluent is discharged to the existent open lagoons and it is used for irrigation.

During the monitoring period, no electricity was consumed from the grid for the operation of the project facility. The technical parts of the project activity are powered by energy supplied by solar cells. The energy is also stored in 12 volts batteries in case of lack of sun.

The sludge from the digesters was not removed in the monitoring period.

Figure 1 presents a schematic flowchart of the project activity.

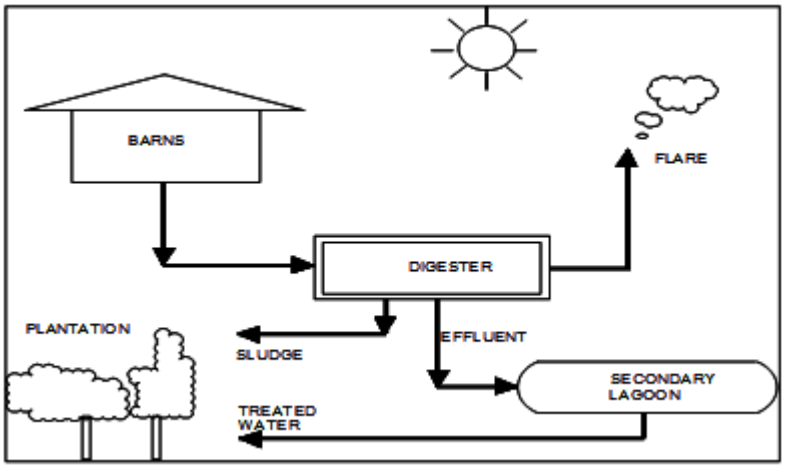


Figure 1- Flowchart of the treatment system

The original PDD was designed with 18 farms. In the renewal of the crediting period, 4 farms were removed since they have stopped their operation.

Table B.1. – Relevant dates of project implementation

Farm/Site Name	Brascarbon ID	Start Construction	Finish Construction	Start-up and Tests	Monitoring Start Date
Fazenda Dragão	BCA-032MS1-05	24/11/2008	27/04/2009	01/06/2009	08/07/2009
Lote 55 e 54	BCA-034MS1-05	10/11/2008	13/04/2009	25/05/2009	01/07/2009
Lote 101	BCA-035MS1-05	10/11/2008	13/04/2009	25/05/2009	01/07/2009
Lote 105	BCA-036MS1-05	10/11/2008	13/04/2009	25/05/2009	01/07/2009
Lote 71	BCA-037MS1-05	10/11/2008	13/04/2009	25/05/2009	01/07/2009
Lote 82	BCA-038MS1-05	10/11/2008	13/04/2009	25/05/2009	01/07/2009
Lote 28 e 27	BCA-039MS1-05	10/11/2008	13/04/2009	25/05/2009	01/07/2009
Fazenda Bela Vista	BCA-040MS1-05	03/03/2008	02/03/2009	06/04/2009	18/06/2009
Granja Serra Dourada	BCA-041MS1-05	03/03/2008	02/03/2009	06/04/2009	17/08/2009
Fazenda Cachoeira	BCA-042MS1-05	03/03/2008	02/03/2009	06/04/2009	01/06/2009
Granja Capivara	BCA-043MS1-05	03/03/2008	02/03/2009	06/04/2009	07/06/2009
Fazenda Sorgatto	BCA-046MS1-05	24/11/2008	27/04/2009	01/06/2009	11/07/2009
Fazenda Bambú - Quinhão A	BCA-051MS1-05	09/03/2009	10/08/2009	21/09/2009	29/10/2009
Fazenda Folleto	BCA-052MS1-05	24/11/2008	27/04/2009	01/06/2009	01/07/2009

During the current monitoring the project facilities (digester, flare, etc) were operational for all sites. No overhaul times nor downtimes of equipment have occurred and no exchange of equipment was done.

The main events that can be reported regard changes (increases or decreases) in the average number of animals per type and/or in the average animal weight per type reported in the monitoring period when compared to PDD ex-ante estimation. Because the animal population and its characteristics can vary significantly, the project facilities have all been dimensioned in order to accommodate significant variations in the swine population, so the reported changes have not affected the effective operation of the project facilities.

No events or situations that may impact the applicability of the applied methodology occurred during the monitoring period.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

No temporary deviations have been applied during this monitoring period.

B.2.2. Corrections

No corrections have been applied during this monitoring period.

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

No changes to the start date of the crediting period have been approved during this monitoring period or submitted with this monitoring report.

B.2.4. Inclusion of monitoring plan

No inclusion of a monitoring plan has been made.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

No permanent changes from the registered monitoring plan, applied methodologies or applied standardized baseline have been approved during this monitoring period or submitted with this monitoring report.

B.2.6. Changes to project design

No changes to the project design of the project activity have been approved during this monitoring period or submitted with this monitoring report.

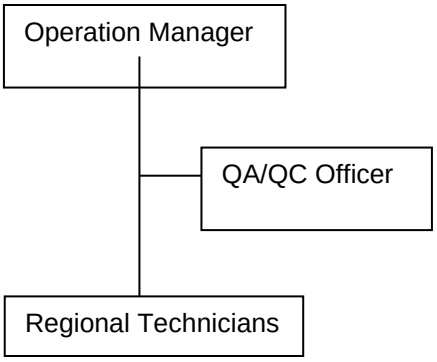
B.2.7. Changes specific to afforestation or reforestation project activity

Not applicable. The project activity is not an afforestation or reforestation project activity.

SECTION C. Description of monitoring system

In order to guarantee compliance with the monitoring plan, Brascarbon elaborated an Operational Procedure Manual composed of Monitoring Operational Procedures (POP) for each parameter to be monitored. Each POP includes detailed instructions to be followed for data collection, equipment handling, preventive/corrective actions to be taken and QA/QC procedures to be applied. If applicable, the POP also includes auxiliary forms that are used for the data collection, with examples and instructions on how they are to be fulfilled.

The organization structure of the Brascarbon Monitoring System is the presented below:



Operation Manager (OM): The OM is the overall responsible for the project operations, including maintenance and monitoring issues. The OM is in charge of divulging the Operational Procedures (POP) to the regional technicians, namely the instructions and procedures for measurement, data collection, site maintenance, preventive and corrective actions and safety and emergency issues. The OM also assures that all data and documents received from the field are filed in the office and is responsible to prepare an electronic copy of all the documents received and save it in the respective folder related to each PDD per farm, performing daily backups of the electronic documents in the server and weekly in an external drive. The OM is also responsible to assure the overall maintenance of the equipment to attend the monitoring system (following the equipment suppliers' recommendations) and, when necessary, provide equipment calibration, replacement or substitution.

Regional Technicians (RT): The RT is responsible for on-site measurements and data collection according to the procedures in the POP. During monitoring site visits for data collection the field technician also assures regular maintenance of the site considering the site area, instrumentation, equipment, cleaning and is trained to identify any problems in the operation of the equipment and proceed with standard repairs on-site. In case of fatal failure, the substitution of the equipment is required immediately by the field technician and the operation department is responsible to provide the immediately substitution of the failed equipment. For the avoidance of doubt, in the event of downtimes of equipment (thermocouple, flow meter, etc), no emission reductions are accounted for the downtime period. Every year and according to the procedures described in POP 11 (Operation General Training), which details, *inter alia*, the programmatic contents, all the RT have a training course (one of the days at a site), which focuses on monitoring, operation of the equipments, maintenance, safety and emergency issues.

Quality Assurance/Quality Control officer (QA/QC officer): The QA/QC officer is responsible to assure the quality control and check of the information collected. When the results are not satisfactory according to the expected, the QA/QC officer recommends additional instructions to be followed in the field such as checking eventual leaks, verifying the components of the flare, valves, batteries etc. This corrective action is implemented by the RT. The QA/QC officer is also responsible for the preparation of all documents related to the CDM project for verification, including elaboration of the monitoring report, emission reductions calculation and preparation of a CD with all relevant information for the verification process (certificates, formularies, POP, on-site official documents, etc). Finally, the QA/QC officer, in coordination with the OM, also controls the calibration of equipments, checking all the calibration certificates, expiration dates and suppliers´ recommendations, in order to guarantee the sound calibration of the equipments throughout the monitoring periods.

All documents associated with the monitoring system (POP, associated formularies, confined feed operation documents, calibration certificates, *interalia*) have been sent to the DOE for verification and are available at Brascarbon office for 2 years after the end of the crediting period.

For each parameter, the data generation, collection and reporting procedures, responsibilities and monitoring points are outlined below:

Flare Temperature (Tf)

Operational procedure:	POP 01
Formulary:	01.001 (converted xls from PLC dat file)
Monitoring point:	Inside the enclosed flare structure

The flare temperature is measured every minute by a thermocouple installed in the flare, which sends the temperature data to the PLC (Programmable Logic Control). The minute by minute data is stored in the PLC. The data is recovered monthly by downloading the file through a pen drive connection, and converted to the form 01.001.
In the monitoring period under verification, the thermocouples used in the project are ALUTAL. The thermocouples are calibrated by the supplier and the calibration frequency is according to the supplier requirements, which demands calibration every year of continuous operation counted from the date when the thermocouples are installed. The installation of the thermocouples is under the responsibility of the regional technicians.

Site Inspection, **$MS\%_{i,y}$; $Q_{manure,LT,y}$; All and ASH**

Operational procedure:	POP 02
Formulary:	02.001 (checklist for site inspection)
Monitoring point:	N/A

The 02.001 checklist for site inspection is the basic orientation to guide the technicians during inspection in the field to follow all items related to the project activity installation. Inspection concerns basic site and digester inspections in terms of lay-out, considering changes in the process flow which can compromise the biogas production and the residual water treatment. Also it controls if the site regulation where the digester is located is in conformity with legal requirements, when applicable. The $MS\%_{i,y}$ - Fraction of manure handled in the system during the year, is also included to be inspected during the farm visit. The information is inserted in the form 02.001. The site inspection takes place once every monitoring period, or at least once a year (also, monthly the regional technicians perform a site visit for data collection during which any abnormal situations are reported for further action and preventive maintenance is performed).

The remaining parameters (**Qmanure,LT,y; All and ASH)** are all related with the fraction of manure handled in the system during the year and will also be included to be inspected during the farm visit. The information is inserted in the form 02.001. The site inspection takes place once every monitoring period, or at least once a year (also, monthly the regional technicians perform a site visit for data collection during which any abnormal situations are reported for further action and preventive maintenance is performed).

Number of animals ($N_{LT,y}$, $N_{da,y}$ and $N_{p,y}$)

Operational procedure:	POP 03
Formulary:	03.001 and 03.003 (animal control system form)
Monitoring point:	N/A

The calculation of the average number of animals ($N_{LT,y}$) is done monthly. The form 03.003 (animal control system form) is fulfilled by the confined feed operation proprietary. It presents the daily records of animal entries (ex: purchase; births, internal transfer) and exit (ex: sale, death, internal transfer) and the final daily record of animals (number of animals on the day-1 + entrance on day – exit on day) per animal category (ex: nursery, finishers, gilts, sows, boars). The average number of animals per animal category is then calculated monthly in the same form through the monthly average of animals that have been recorded daily. Using this approach for calculating $N_{LT,y}$, it is not necessary to calculate separately an $N_{da,y}$ and an $N_{p,y}$, 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 implicitly considered in the daily records and taken into account when calculating $N_{LT,y}$. The form 03.001 is the input for the emission reduction calculation spreadsheet and aggregates the monthly average number of animals per animal category per farm for all farms included in the PDD. The forms 03.003 and 03.001 are checked by the QA/QC officer to guarantee consistency. Other on-site documents including, when available, animal purchase and sale records are used to cross-check the information reported.

Biogas Volume ($BG_{burnt, y}$ and $FV_{RG,h}$)

Operational procedure:	POP 04
Formulary:	01.001 (converted xls from PLC dat file) and 04.001 (field data collection)
Monitoring point:	In the connection pipe between the digester and the flare

The biogas volume that is directed to the flare is measured cumulatively every minute by the flow meter installed in the connection pipe, which sends the biogas volume data to the PLC. The minute by minute cumulative data is stored in the PLC. The data is recovered monthly by downloading the file through a pen drive connection and converted to form 01.001. During the monthly field collection data, the regional technician also inserts the information of biogas volume flow rate on form 04.001 (field data collection form) based on the 01.001 form information. The biogas volume is measured in wet basis.

The volumetric flow rate of the residual gas ($FV_{RG,h}$) used for the determination of Project Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$) is calculated in normal conditions, monthly dividing the total biogas volume in normal conditions directed to the flare in one month ($BG_{burnt,y\ normal}$) in the period by the total hours of operation in that month ($FV_{RG,h}$ = $BG_{burnt,y\ normal}$ / total $hours_{,y}$). This approach has been considered accurate for the calculation of $FV_{RG,h}$ since the biogas hourly flow is considered to be constant as there is no artificial blower or pump.

The flow meters used in the project are from ENDRESS+HAUSER, FLOW MONITOR, t- trend, ATT12-A99D314D1 MODEL, type: Thermal Mass Flow. In the monitoring period under verification, the flow meters were calibrated on-site by the Brascarbon Regional Technicians, which act as manufacturer representatives, as they were trained and certified by the supplier/manufacturer Endress Hauser to perform the on-site calibration. The calibration frequency is according to the supplier requirements, which demands calibration every two years.

Methane Content ($W_{CH4,y}$ and $fv_{CH4,RG,h}$)

Operational procedure:	POP 05
Formulary:	04.001 (field data collection)
Monitoring point:	In the connection pipe between the digester and the flare

The methane content is measured monthly by the regional technician with a portable digital analyzer (Biogas Check portable model from Geotech/Landtech). The equipment is connected through a hose to a purpose built device in the connection pipe. A biogas sample is taken and after a few seconds the instrument informs the methane content in the equipment panel. The information is inserted in the 04.001 form.

The methane content is measured in wet basis. The monthly monitoring frequency guarantees a 90/10 confidence/precision level (for details, please see Section D.3 – Implementation of sampling plan).

The methane content measured monthly ($W_{CH4,y}$) is used as an (average) $fv_{CH4,RG,h}$ and used for the determination of Project Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$). This approach has been considered accurate for the calculation of $PE_{flare,y}$ since the monthly monitored $W_{CH4,y}$ assures a 90/10 confidence/precision level in the methane concentration measurement.

The portable digital analyzer is calibrated by the supplier and the calibration frequency is according to the supplier requirements, which demands calibration every six months.

Biogas Temperature (T_{biogas})

Operational procedure:	POP 06
Formulary:	04.001 (field data collection)
Monitoring point:	In the connection pipe between the digester and the flare

The biogas temperature is monitored monthly by the regional technician with a portable digital analyzer (Biogas Check portable model from Geotech/Landtech). The equipment is connected through a temperature probe to a purpose built device in the connection pipe. After inserting the probe the instrument takes a few seconds to inform the biogas temperature. The information is inserted in the 04.001 form.

The Biogas Temperature is measured in wet basis. The monthly monitoring frequency guarantees a 90/10 confidence/precision level (for details, please see Section D.3 – Implementation of sampling plan).

The portable digital analyzer (and temperature probe attached) is calibrated by the supplier and the calibration frequency is according to the supplier requirements, which demands calibration every six months.

Methane Density (D_{CH4})
Operational procedure: POP 07
Formulary: 07.001
Monitoring point: N/A

The methane density for MD_y calculation is, according to version 20.1 of the AMS-III.D methodology, calculated ex-post, using the monitored data of biogas pressure and biogas temperature. The frequency of the calculation is monthly and it is done by the QA/QC officer. The information is inserted in the 07.001 form.

For BE_y calculation, the methane density considered is the one indicated in version 20.1 of the AMS-III.D methodology (0.00067 t/m^3); for the $TM_{RG,h}$ calculation, the methane density considered is the one indicated in EB 28 Annex 13 – Methodological "Tool to determine project emissions from flaring gases containing methane", step 5 (0.716 kg/m^3).

Flare Efficiency (FE)
Operational procedure: POP 08
Formulary: 08.001
Monitoring point: N/A

The (Hourly) Flare Efficiency (FE) it is the efficiency of the methane destruction in the hour h. The flare efficiency is considered 90% when the flare temperature is higher or equal to 500ºC for the respective hour (if the flare operation is operating according to the flare specification). If in any specific moment (minute) the flare operation is out of the specification then 50% efficiency is adopted for the respective hour. The flare efficiency is 0% for a specific hour when the flare temperature is less than 500ºC in any specific moment (minute) of that hour.

The information of the flare efficiency for each hour during 24 hours per day is registered in the formulary 08.001 and obtained through a macro applied to 01.001 form (form with minute by minute temperature and biogas volume data stored in the PLC). The flare operation is continuously monitored. The hourly flare efficiency is calculated considering the values of each minute of any giving hour. Hence in compliance with the requirements of the Tool for the project emissions from flaring which are also calculated according the minute by minute readings. If any minute of any hour the flare temperature is below 500ºC, the flare efficiency is 0% and the entire biogas volume of that hour is discounted.

If all the minutes of an hour are above 500ºC then the flare efficiency is 90%. According with the manufacturer specification the flare temperature when above 500ºC was always within its specifications so the 50% flare efficiency was never applied.

Hence, each hour either have 90% or 0%, depending on the flare temperature. The project emissions from flare are calculated based on the records of every hour and the correspondent flow of that hour.

To assure that the flare operates adequately a maintenance program is established to guarantee that the flare operation is according to the manufacturer specification

Digester Sludge Removal (QDM)
Operational procedure: POP 09
Formulary: 09.001
Monitoring point: N/A

The digester sludge is the heavier fraction of waste, composed by minerals and organic components, in liquid form. This material should be removed from digester and disposed outside the project boundary from time to time, not resulting in methane emissions. When the sludge is removed, the regional technician will follow the POP 09 to certify that the sludge will be spread aerobically in the field. The information is registered on 09.001 form.

Average animal weight (W_{site})
Operational procedure: POP 16
Formulary: 16.001
Monitoring point: N/A
The animal weight is monitored and controlled by a form 16.001 where each animal category is monitored during the year, according to the operational procedure POP 16 – Animal Weight Monitoring.

The data collection is realized quarterly by each farm owner, together with COOASGO (Cooperativa Agropecuária São Gabriel do Oeste) and provided to the PP. COOASGO is the Pig Producers Association to whom the farms contained in the PDD are associated; its main role is to act as a third party responsible for the assurance of all the logistics associated with the swine producers, providing the animal nutrition, genetics and all the overall animal weight.

The quarterly weight of the animals for each producer of the PDD is made following COOASGOs internal procedure, that is not under the PP's control – the association selects the animals based on a random sampling approach applied in each category, since it is infeasible to weight each animal individually in the farms belonging to the project (these farms can more than 5,000 animals each). In addition, each project site presents the actual animal weight by using Brascarbon form 16.001 after a cross-check by the PP, using the real information after each batch of animals exits each farm; the template was designed to quarterly report animal weight per category.

The current practice of swine farms in Brazil is that each farm receives new batches of animals every 5 to 6 months (which is also the average time that a batch stays in a farm) and the producer, together with COOASGO, performs regular and periodical visits to each farm in order to assess and evaluate the correct development of each batch in terms of growing/weighting of the animals (according with what is expected at each growing stage of a given batch). It is important to highlight that both the farm owners and COOASGO rely on the quality of the values measured since their sole professional occupation is the pig production and, therefore, it is within their best interests to have a correct and reliable way to assess the weighting of the animals (which is their business) based on their experience and internal procedures.

Every 5 to 6 months (depending on each batch and farm), the animal batches leave the farms and they are, in this specific situation, 100% weighted by the producers, together with COOASGO – this weighting is undertaken to the totality of animal presented in the batch since the profits associated with the animal production are weight based. According with COOASGO a possible range of +/- 5kg within the animal growing is considered a normal fluctuation and therefore admissible.

Each time a batch exits a farm, COOASGO provides the invoices to attest the feasibility of the figures adopted, allowing a complete and thorough cross-check by PP of all the data used for this parameter.

Quarterly the data from the feed operations are checked and transferred to the form.
Records available in the feed operations will be copied and filed at Brascarbon office and attached with the form 16.001.

The variable monitored: W site.

Emission Reductions – $ER_{y,ex\text{-}post}$
Operational procedure: POP 17
Formulary: 17.001 (CER calculation spreadsheet)
Monitoring point: N/A

The emission reductions achieved by the project activity are calculated monthly by the QA/QC officer. The equations can be found in the CER calculation spreadsheet and are detailed in Section E.

Formulated feed rations (FFR)
Operational procedure: POP 14
Formulary: 14.001
Monitoring point: N/A

The formulated feed rations used per animal category in the confined feed animal operations are monitored and controlled, to guarantee that the Bo and VS default values applied are accurate. Records available in the feed operations, namely regarding food composition and, when available, regarding food purchases are requested by the regional technician, copied and filed at Brascarbon office. This information is inserted in the formulary 14.001.

Pressure of the biogas at operation conditions (P_{biogas})
Operational procedure: POP 13
Formulary: 04.001
Monitoring point: In the connection pipe between the digester and the flare
The biogas pressure is measured monthly by the regional technician with a portable digital analyzer (Biogas Check portable model from Geotech/Landtech). The equipment is connected through a hose to a purpose built device in the connection pipe. After a few seconds after starting the instrument it informs the biogas pressure in its panel. The information is inserted in the 04.001 form.
The biogas pressure is measured in wet basis. The monthly monitoring frequency guarantees a 90/10 confidence/precision level (for details, please see Section D.3 – Implementation of sampling plan).

The portable digital analyzer is calibrated by the supplier and the calibration frequency is according to the supplier requirements, which demands calibration every six months.

GENETIC SOURCE
Operational procedure: POP 15
Formulary: 15.001
Monitoring point: N/A

The genetic source origin of the livestock in the confined feed animal operations is monitored and controlled, to guarantee that the Bo and VS default values applied are accurate. Records available in the feed operations, regarding the livestock genetic sources are requested (purchase notes if available), copied and filed at Brascarbon office. The genetic source information is inserted in the formulary 15.001.

Methane mass flow rate in the residual gaseous stream ($F_{CH4,m}$)

Operational procedure: POP 17
Formulary: 17.001 (CER calculation spreadsheet)
Monitoring point: N/A

$F_{CH4,m}$ is calculated according to the "Tool to determine project emissions from flaring gases containing methane". An operational procedure POP 17 includes the instruction to the calculation.

According with the step 1 – Determination of the methane mass flow in the residual gas of this tool, this parameter should be determined using another tool, namely *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*. In second tool, there are several options to determine the Mass flow rate of methane in the residual gaseous stream. Option 2 - Simplified calculation without measurement of the moisture content was chosen by the PP.

Within this option, option A will be applicable by the demonstration that the gaseous stream is dry. The PP will demonstrate that the temperature of the gaseous stream (Tt) is less than 60ºC (333.15 K) at the flow measurement point.

Hence this parameter will be calculated according with Equations 5 and 6 of the tool. This means:

$$F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,t}$$ Equation (5)

With:

$$\rho_{i,t} = \frac{P_t \times MM_i}{R_u \times T_t}$$ Equation (6)

Where:

$F_{i,t}$	=	Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m³ dry gas/h)
$v_{i,t,db}$	=	Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m³ gas *i*/m³ dry gas)
$\rho_{i,t}$	=	Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas *i*/m³ gas *i*)
P_t	=	Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i	=	Molecular mass of greenhouse gas *i* (kg/kmol)
R_u	=	Universal ideal gases constant (Pa.m³/kmol.K)
T_t	=	Temperature of the gaseous stream in time interval *t* (K)

Number of days where the treatment plant was operational (nd_y)

Operational procedure: POP 24
Formulary: 17.001 (CER Calculation spreadsheet)
Monitoring point: N/A

The number of days where the treatment plant is operational is monitored taking into account the number of temperature and biogas measurements stored in the CLP. As both the temperature and biogas volume are measured every minute, the information stored in the CLP allows for the calculation of the number of hours where the treatment plant was operation (H_{total}, obtained from form 08.001) and consequently the number of days (dividing the total hours of operation by the number of hours in the day – 24). The calculation is done every month.

Electricity consumed from the grid by the project (*GELT*), (*DELT), (UE), (EDLT), (EGy) and (EEy)*

Operational procedure: POP 22
Formulary: 22.001
Monitoring point: N/A

The entire project didn´t use energy from the grid in the current monitoring period. The eventual use of energy is monitored and registered in the formulary 22.001 by the regional technician. All energy demand consumed in the project is supplied by batteries charged by solar cells which is an advantage for sunny countries, like Brazil. The energy for the temperature controlling system PLC (Programmable Logic Controller) and the sparkling system is supplied by a 12 volts battery. The autonomy for the batteries is of 240 hours and each system works independently (PLC and sparkling system). There are no blowers, pneumatic or electric valves, pumps, compressors, etc, in the project. The flow system is operated by gravity and atmospherically.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/parameter:	$VS_{default}$
Unit	kg dry matter/animal/day
Description	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population
Source of data	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
Value(s) applied)	0.3 for Market Swine 0.46 for Breeding Swine 0.46 for Gilts
Choice of data or measurement methods and procedures	Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/ The genetic source of production operation is originated from Annex I; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed rations can be validated through on farm record keeping; The project specific animal weights are more similar to developed country IPCC default values. Used of factors as defined in IPCC2006, chapter 10, volume 4, since that there is no national data for the default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population.

Purpose of data	Baseline emissions
Additional comments	According to paragraph 10 (d) from AMS-III.D version 20.1, VS values applicable to developed countries can be used provided the following four conditions are satisfied: • *The genetic source of the livestock originates from an Annex I Party;* Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/ and also at COOASGO (Cooperativa Agropecuária São Gabriel do Oeste). The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. • *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;* The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement. • *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);* The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. • *The project specific animal weights are more similar to developed country IPCC default values.* The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. *Finishers* is the animal category that represents majority of all animals from the farms included in this PDD, more than 80% of the total number of animals (only three farms have other types of animals but not as significant as finishers). Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's. This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 16% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values. Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

Data / Parameter:	MCF_j
Unit:	%
Description:	Annual methane conversion factor for the baseline animal waste management system "j".
Source of data:	Obtained from IPCC2006, vol. 4, chapter 10, Tables 10.17.
Value(s) applied):	79%
Choice of data or measurement methods and procedures	N/A
Purpose of data:	Baseline emissions
Additional comment:	No comments

Data / Parameter:	$MS\%_{BL,j}$
Unit:	Fraction
Description:	Fraction of manure handled in baseline animal manure management system "j".
Source of data:	Project proponents
Value(s) applied):	1
Choice of data or measurement methods and procedures	N/A
Purpose of data:	Baseline emissions
Additional comment:	No comments

Data / Parameter:	GWP_{CH4}
Unit:	$tCO_2e/tCH4$
Description:	Global warming potential of CH4
Source of data:	EB69 Annex 3 (version 01.0) / IPCC Fourth Assessment Report: Climate Change 2007 (AR4)
Value(s) applied):	25
Choice of data or measurement methods and procedures	N/A
Purpose of data:	Baseline emissions and Project Emissions
Additional comment:	No comments

Data / Parameter:	$B_{0,LT}$
Unit:	m^3 CH_4/kg dm
Description:	Maximum methane producing potential of the volatile solid generated for animal type “LT”.
Source of data:	IPCC 2006, Tables 10-A7 and 10-A8.
Value(s) applied):	Sows (breeding swine more than 200 kg mass): 0.45 Finishers (market swine more than 50 kg mass): 0.45 Nursery: 0.45 Boars and Gilts (market swine more than 100 kg mass): 0.45
Choice of data or measurement methods and procedures	Default value according to IPCC 2006 in western Europe region. Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/ The genetic source of production operation is originated from Annex I; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed ratings can be validated through on farm record keeping; The project specific animal weights are more similar to developed country IPCC default values. Used of factors as defined in IPCC2006, chapter 10, volume 4, since that there is no national data for the Maximum methane producing potential of the volatile solid generated for animal type “LT”

Purpose of data:	Baseline emissions
Additional comment:	According to paragraph 10 (d) from AMS-III.D version 20.1, VS values applicable to developed countries can be used provided the following four conditions are satisfied: • *The genetic source of the livestock originates from an Annex I Party;* Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/ and also at COOASGO (Cooperativa Agropecuária São Gabriel do Oeste). The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. • *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;* The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement. • *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);* The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. • *The project specific animal weights are more similar to developed country IPCC default values.* The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. *Finishers* is the animal category that represents majority of all animals from the farms included in this PDD, more than 80% of the total number of animals (only three farms have other types of animals but not as significant as finishers). Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's. This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 16% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values. Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

Data / Parameter:	$W_{default}$
Unit:	Kg
Description:	Default average animal weight of a defined population at the project site.
Source of data:	IPCC 2006, Tables 10-A7 and 10-A8.
Value(s) applied):	Sows (breeding swine): 198 kg Finishers (market swine): 50 kg Nursery (market swine): 50 kg Boars (market swine): 50 kg Gilts (breeding swine): 198 kg
Choice of data or measurement methods and procedures	Default value according to IPCC 2006 in western Europe region. Genetics and nutrition adopted for these farms as so as in Western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/ The genetic source of production operation is originated from Annex I; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed ratings can be validated through on farm record keeping; The project specific animal weights are more similar to developed country IPCC default values. Used of factors as defined in IPCC2006, chapter 10, volume 4, since that there is no national data for the default average animal weight of a defined population at the project site.

Purpose of data:	Baseline emissions
Additional comment:	The four conditions to apply $W_{default}$ value of developed countries are fully applicable to developed countries can be used provided the following four conditions are satisfied: • *The genetic source of the livestock originates from an Annex I Party;* Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/ and also at COOASGO (Cooperativa Agropecuária São Gabriel do Oeste). The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. • *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;* The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement. • *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);* The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. • *The project specific animal weights are more similar to developed country IPCC default values.* The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. *Finishers* is the animal category that represents majority of all animals from the farms included in this PDD, more than 80% of the total number of animals (only three farms have other types of animals but not as significant as finishers). Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's. This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 16% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values. Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements..

Data / Parameter:	UF_b
Unit:	No unit applied
Description:	Model correction factor to account for model uncertainties
Source of data:	Reference: FCCC/SBSTA/2003/10/Add.2, page 25.
Value(s) applied):	0.94
Choice of data or measurement methods and procedures	N/A
Purpose of data:	Baseline emissions
Additional comment:	No comments

D.2. Data and parameters monitored

Data / Parameter:	T_f
Unit:	ºC
Description:	Combustion temperature of the flare
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 01.001)
Value(s) of monitored parameter:	The aggregate values of T_f (hours with Tf above 500º C and hours with Tf below 500ºC) can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *MDy-PEpower,y,ex-post.*
Monitoring equipment:	Thermocouple [1]

Farm name	Site ID	Thermocouple Serial Number [2]	Calibration Certification Number	Calibration Date	Instalation Date [3]	Expiration Date
Fazenda Dragão	BCA-032MS1-05	483441	CA-1421/18	08/01/18	27/03/18	26/03/19
		166925	CA-1586/19	05/03/19	20/03/19	19/03/20
Lote 55 e 54	BCA-034MS1-05	483442	CA-1422/18	08/01/18	27/03/18	26/03/19
		166926	CA-1587/19	05/03/19	20/03/19	19/03/20
Lote 101	BCA-035MS1-05	483443	CA-1423/18	08/01/18	27/03/18	26/03/19
		166927	CA-1588/19	05/03/19	20/03/19	19/03/20
Lote 105	BCA-036MS1-05	483444	CA-1424/18	08/01/18	27/03/18	26/03/19
		166928	CA-1589/19	05/03/19	20/03/19	19/03/20
Lote 71	BCA-037MS1-05	483445	CA-1425/18	08/01/18	27/03/18	26/03/19
		166929	CA-1590/19	05/03/19	20/03/19	19/03/20
Lote 82	BCA-038MS1-05	483447	CA-1426/18	08/01/18	27/03/18	26/03/19
		166930	CA-1591/19	05/03/19	20/03/19	19/03/20
Lote 28 e 27	BCA-039MS1-05	81339	CA-1427/18	08/01/18	27/03/18	26/03/19
		166931	CA-1592/19	05/03/19	20/03/19	19/03/20
Fazenda Bela Vista	BCA-040MS1-05	83889	CA-1428/18	08/01/18	28/03/18	27/03/19
		166932	CA-1593/19	05/03/19	20/03/19	19/03/20
Granja Serra Dourada	BCA-041MS1-05	83890	CA-1429/18	08/01/18	28/03/18	27/03/19
		166933	CA-1594/19	05/03/19	20/03/19	19/03/20
Fazenda Cachoeira	BCA-042MS1-05	83891	CA-1430/18	08/01/18	28/03/18	27/03/19
		166934	CA-1595/19	05/03/19	20/03/19	19/03/20
Granja Capivara	BCA-043MS1-05	83892	CA-1431/18	08/01/18	28/03/18	27/03/19
		166935	CA-1596/19	05/03/19	20/03/19	19/03/20
Fazenda Sorgatto	BCA-046MS1-05	83893	CA-1432/18	08/01/18	28/03/18	27/03/19
		166936	CA-1597/19	05/03/19	20/03/19	19/03/20
Fazenda Bambú - Quinhão	BCA-051MS1-05	83900	CA-1433/18	08/01/18	28/03/18	27/03/19
		166937	CA-1598/19	05/03/19	20/03/19	19/03/20
Fazenda Folleto	BCA-052MS1-05	83910	CA-1434/18	08/01/18	28/03/18	27/03/19
		166938	CA-1599/19	05/03/19	20/03/19	19/03/20

(1)	Monitoring equipment type:	Standard Thermocouple from ALUTAL
(2)	Accuracy class:	± 1.5°C or ± 0.25%
(3)	Calibration frequency:	Every year of continuous operation (counted from the date of installation)

Measuring/ Reading/ Recording frequency:	Every 1 minute measurement and registration by the PLC. Data is collected monthly from the field.
Calculation method (if applicable):	N/A
QA/QC procedures:	The information of the temperature is managed by the use of the form 01.001. The form 01.001 is extracted from the PLC, where the continuous information is stored and is further checked by the QA/QC officer. The calibration certificates are managed to guarantee the thermocouples are calibrated during all the monitoring period. The QA/QC officer checks one month before the expiration date, to proceed with the new calibration.
Purpose of data/parameter:	Baseline Emissions and Project Emissions
Additional comment:	No comments

Data / Parameter:	SITE INSPECTION
Unit:	Documents
Description:	Inspection on the site considering relevant regulation and the infra-structure of the site
Measured/ Calculated / Default:	Documented
Source of data:	Brascarbon Monitoring Report System (form 02.001)
Value(s) of monitored parameter:	During the current monitoring period all sites were inspected and no relevant changes were observed. Also, all the licenses and documents were in place and it was confirmed that all the manure produced ($MS\%_{i,y}$) has been directed to the project activity facilities.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually/Every monitoring period
Calculation method (if applicable):	N/A
QA/QC procedures:	The site inspection is monitored by the use of the form 02.001 to help the regional technician during the monitoring visit and is further checked by the QA/QC officer, together with the on-site documents and all documents received from the field, namely the confined animal production official documents.
Purpose of data/parameter:	N/A
Additional comment:	No comments

Data / Parameter:	$N_{LT,y}$
Unit:	Number
Description:	Annual average number of animals of type “LT” in year “y”
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System (forms 03.003 and 03.001)
Value(s) of monitored parameter:	The values of $N_{LT,y}$ can be found in the spreadsheet calculation file “CER Calculation MR08 - BCA-BRA-05” in the folder *BEy ex-post – PEy ex-post*.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	The calculation of the average number of animals ($N_{LT,y}$) is done monthly. The form 03.003 (animal control system form) is fulfilled by the confined feed operation proprietary. It presents the daily records of animal entries (ex: purchase; births, internal transfer) and exit (ex: sale, death, internal transfer) and the final daily record of animals (number of animals on the day-1 + entrance on day – exit on day) per animal category (ex: nursery, finishers, gilts, sows, boars). The average number of animals per animal category is then calculated monthly in the same form through the monthly average of animals that have been recorded daily. Using this approach for calculating $N_{LT,y}$, it is not necessary to calculate separately an $N_{da,y}$ and an $N_{p,y}$, 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 implicitly considered in the daily records and taken into account when calculating $N_{LT,y}$. The form 03.001 is the input for the emission reduction calculation spreadsheet and aggregates the monthly average number of animals per animal category per farm for all farms included in the PDD.
QA/QC procedures:	The forms 03.003 and 03.001 are checked by the QA/QC officer to guarantee consistency. Other on-site documents including, when available, animal purchase and sale records are used to cross-check the information reported.
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	$N_{da,y}$
Unit:	Number
Description:	Number of days animal is alive in the farm, in year “y”
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (forms 03.003 and 03.001)
Value(s) of monitored parameter:	Please see explanation in data/parameter $N_{LT,y}$
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Daily
Calculation method (if applicable):	N/A
QA/QC procedures:	Please see explanation in data/parameter $N_{LT,y}$
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	$N_{p,y}$
Unit:	Number
Description:	Number of animals produced annually of type “LT” in year “y”
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (forms 03.003 and 03.001)
Value(s) of monitored parameter:	Please see explanation in data/parameter $N_{LT,y}$
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Daily
Calculation method (if applicable):	N/A
QA/QC procedures:	Please see explanation in data/parameter NLT,y
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	$BG_{burnt,y}$
Unit:	m^3
Description:	Biogas flared or used as a fuel in the year y.
Measured/ Calculated / Default:	Measured on wet basis
Source of data:	Brascarbon Monitoring Report System (form 01.001)
Value(s) of monitored parameter:	The values of $BG_{burnt,y}$ can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder MDy-PEpower,y,ex-post.
Monitoring equipment:	**Flow Meter (1)(2) Calibration Control**

Farm name	Site ID	Flow Meter Serial Number	Calibration Certification Number	Instalation Calibration Date (3)	Expiration Date
Fazenda Dragão	BCA-032MS1-05	A700693412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 55 e 54	BCA-034MS1-05	A700613412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 101	BCA-035MS1-05	A700753412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 105	BCA-036MS1-05	A700663412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 71	BCA-037MS1-05	A700683412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 82	BCA-038MS1-05	A700633412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 28 e 27	BCA-039MS1-05	A700583412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Bela Vista	BCA-040MS1-05	A700623412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Granja Serra Dourada	BCA-041MS1-05	A700643412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Cachoeira	BCA-042MS1-05	A700553412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Granja Capivara	BCA-043MS1-05	A700563412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Sorgatto	BCA-046MS1-05	A700833412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Bambú - Quinhão A	BCA-051MS1-05	A700713412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Folleto	BCA-052MS1-05	A700573412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21

(1)	Monitoring equipment type:	Endress+Hauser thermal mass flow meter t-trend - ATT12
(2)	Accuracy class:	± 5% of factory full scale
(3)	Calibration frequency:	Every 2 years of continuous operation (counted from the date of installation)

Measuring/ Reading/ Recording frequency:	Every 1 minute measurement and registration by the PLC. Data is collected monthly from the field.
Calculation method (if applicable):	The biogas volume measurement is done on wet basis. As the flow meter registers the biogas that is directed to the flare cumulatively (and that is also the data registered in the PLC), the BGburnt,y for a certain period is calculated by differential with the previous biogas volume reading.
QA/QC procedures:	The information of the biogas volume is managed by the use of the form 01.001. The form 01.001 is extracted from the PLC, where the continuous information is stored and is further checked by the QA/QC officer. The calibration certificates are managed to guarantee the flow meters are calibrated during all the monitoring period. The QA/QC officer checks one month before the expiration date, to proceed with the new calibration.

Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	$W_{CH4,y}$
Unit:	Fraction
Description:	Methane content in biogas in the year "y"
Measured/ Calculated / Default:	Measured on wet basis
Source of data:	Brascarbon Monitoring Report System (form 04.001)
Value(s) of monitored parameter:	The values of $W_{CH4,y}$ can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder MDy-PEpower,y,ex-post.
Monitoring equipment:	**Biogas Analyser (1)(2) Calibration Control**

Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Certificate Number	Last Calibration Date (3)	Expiration Date
Fazenda Dragão	BCA-032MS1-05				
Lote 55 e 54	BCA-034MS1-05				
Lote 101	BCA-035MS1-05				
Lote 105	BCA-036MS1-05				
Lote 71	BCA-037MS1-05				
Lote 82	BCA-038MS1-05	BM 11043	BM11043_6/2620	18/07/2018	17/01/2019
Lote 28 e 27	BCA-039MS1-05	BM 11043	BM11043_7/4510	14/01/2019	13/07/2019
Fazenda Bela Vista	BCA-040MS1-05	BM 11043	BM11043_3/2470	07/07/2019	06/01/2020
Granja Serra Dourada	BCA-041MS1-05				
Fazenda Cachoeira	BCA-042MS1-05				
Granja Capivara	BCA-043MS1-05				
Fazenda Sorgatto	BCA-046MS1-05				
Fazenda Bambú - Quinhão A	BCA-051MS1-05				
Fazenda Folleto	BCA-052MS1-05				

(1)	Monitoring equipment type:	Biogas Check Portable Digital Analyzer from Geotech/Landtech
(2)	Accuracy class:	• **CH_4**: ± 0.5% from 0-5% CH_4 content; ± 1.0% from 5-15% CH_4 content; ± 3.0% from 15%-full scale CH_4 content • **Temperature**: ± 0.2ºC (Biogas check analyzer accuracy) ± 0.5ºC (temperature probe accuracy) • **Pressure**: ± 4mbar typically and ±15 mbar maximum
(3)	Calibration frequency:	Every 6 months

Measuring/ Reading/ Recording frequency:	The monitoring frequency is monthly and guarantees a 90/10 confidence/precision level (for details, please see Section D.3 – Implementation of sampling plan).
Calculation method (if applicable):	The methane content measurement is done on wet basis.
QA/QC procedures:	The information of the methane content is managed by the use of the form 04.001 (formulary for field data collection). The calibration certificates are managed to guarantee the portable analyzers are calibrated during all the monitoring period. The QA/QC officer checks one month before the expiration date stated in the calibration certificates to proceed with the new calibration.
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	T_{biogas}
Unit:	^oC
Description:	Temperature of the biogas at ambient conditions
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 04.001)
Value(s) of monitored parameter:	The values of T_{biogas} can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *MDy-PEpower,y,ex-post*.
Monitoring equipment:	**Biogas Analyser [1][2] Calibration Control**

Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Certificate Number	Last Calibration Date [3]	Expiration Date
Fazenda Dragão	BCA-032MS1-05				
Lote 55 e 54	BCA-034MS1-05				
Lote 101	BCA-035MS1-05				
Lote 105	BCA-036MS1-05				
Lote 71	BCA-037MS1-05				
Lote 82	BCA-038MS1-05	BM 11043	BM11043_6/2620	18/07/2018	17/01/2019
Lote 28 e 27	BCA-039MS1-05	BM 11043	BM11043_7/4510	14/01/2019	13/07/2019
Fazenda Bela Vista	BCA-040MS1-05	BM 11043	BM11043_3/2470	07/07/2019	06/01/2020
Granja Serra Dourada	BCA-041MS1-05				
Fazenda Cachoeira	BCA-042MS1-05				
Granja Capivara	BCA-043MS1-05				
Fazenda Sorgatto	BCA-046MS1-05				
Fazenda Bambú - Quinhão A	BCA-051MS1-05				
Fazenda Folleto	BCA-052MS1-05				

(1)	Monitoring equipment type:	Biogas Check Portable Digital Analyzer from Geotech/Landtech
(2)	Accuracy class:	• **CH_4**: ± 0.5% from 0-5% CH_4 content; ± 1.0% from 5-15% CH_4 content; ± 3.0% from 15%-full scale CH_4 content • **Temperature**: ± 0.2ºC (Biogas check analyzer accuracy) ± 0.5ºC (temperature probe accuracy) • **Pressure**: ± 4mbar typically and ±15 mbar maximum
(3)	Calibration frequency:	Every 6 months

Measuring/ Reading/ Recording frequency:	The monitoring frequency is monthly and guarantees a 90/10 confidence/precision level (for details, please see Section D.3 – Implementation of sampling plan)
Calculation method (if applicable):	N/A
QA/QC procedures:	The information of the biogas temperature is managed by the use of the form 04.001 (formulary for field data collection) and is further checked by the QA/QC officer. The calibration certificates are managed to guarantee the portable analyzers are calibrated during all the monitoring period. The QA/QC officer checks one month before the expiration date stated in the calibration certificates to proceed with the new calibration.
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	$D_{CH4,y}$
Unit:	t / m^3
Description:	Density of the methane combusted
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	The values of $D_{CH4,y}$ can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *MDy-PEpower,y,ex-post*.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	$D_{CH4,y} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} \times T_n}$ $D_{CH4,y}$: Density of methane in the biogas (kg/m^3) P_n: Pressure of biogas (Pa) R_u: Universal Gas Constant (8314 Pa.m^3/Kmol.K) MM_{RGh}: Molecular mass of methane (16.04 kg/kmol) T_n: Biogas temperature (K)
QA/QC procedures:	The density calculation is done by the QA/QC officer based on monitoring data and it is further confirmed if the calculated value is within the interval of standard density values reported for methane density.
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	FE
Unit:	%
Description:	Flare Efficiency
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System (form 08.001)
Value(s) of monitored parameter:	The aggregate monthly values of FE can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *MDy-PEpower,y,ex-post.* Please note that during the current monitoring period, the flare always operated within the range of manufacturer specifications when above 500ºC, hence the level of 50% flare efficiency has not been applied.
Monitoring equipment:	Enclosed flare is used in the entire project. All data and parameters that are required to monitor the flare operation within the range of operating conditions according to manufacturer´s specifications are continuously monitored.
Measuring/ Reading/ Recording frequency:	Monthly. Every 1 minute measurement and registration by a CLP of flare temperature and biogas flow rate. Data is recovered monthly for Flare Efficiency hourly calculation.
Calculation method (if applicable):	For the hourly flare efficiency calculation, the following is considered: • If flare temperature >=500ºC for all minutes in an hour, then 90% efficiency is considered for that hour; • If flare temperature >=500ºC but the flare is operating out of manufacturer specification in any minute, then 50% efficiency is considered for that hour; • If flare temperature <500ºC in any minute, then 0% efficiency is considered for that hour; The information of the flare efficiency for each hour during 24 hours per day is registered in the formulary 08.001 and obtained through a macro applied to 01.001 form (form with minute by minute temperature and biogas volume data stored in the PLC). The flare operation is continuously monitored. The hourly flare efficiency is calculated considering the values of each minute of any giving hour. Hence in compliance with the requirements of the Tool for the project emissions from flaring which are also calculated according the minute by minute readings. If any minute of any hour the flare temperature is below 500ºC, the flare efficiency is 0% and the entire biogas volume of that hour is discounted. If all the minutes of an hour are above 500ºC then the flare efficiency is 90%. According with the manufacturer specification the flare temperature when above 500ºC was always within its specifications so the 50% flare efficiency was never applied. Hence, each hour either have 90% or 0%, depending on the flare temperature. The project emissions from flare are calculated based on the records of every hour and the correspondent flow of that hour.
QA/QC procedures:	The information of the flare efficiency is managed by the use of the form 08.001 with hourly flare efficiency values and monthly calculated average and is further checked by the QA/QC officer The enclosed flare regularly undergoes a maintenance process subject to the appropriate industrial standards and/or manufacturer´s specifications in order to ensure measurement accuracy.
Purpose of data/parameter:	Baseline Emissions and Project Emissions
Additional comment:	No comments

Data / Parameter:	QDM
Unit:	N/A
Description:	Sludge soil application
Measured/ Calculated / Default:	N/A
Source of data:	Brascarbon Monitoring Report System (form 09.001)
Value(s) of monitored parameter:	N/A. Sludge was not removed during this monitoring period.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Defined according to the digester performance.
Calculation method (if applicable):	N/A
QA/QC procedures:	Check the registers in the generated documents. The PP performs the monitoring of the sludge production and eventual removal and soil application, according with its internal procedures (POP 09).
Purpose of data/parameter:	N/A
Additional comment:	No comments

Data / Parameter:	W_{site}
Unit:	Kg
Description:	Average animal weight of a defined livestock population at the project site in year
Measured/ Calculated / Default:	Measured
Source of data:	The data collection is realized quarterly by each farm owner, together with COOASGO (Cooperativa Agropecuária São Gabriel do Oeste) and provided to the PP. COOASGO is the Pig Producers Association to whom the farms contained in the PDD are associated; its main role is to act as a third party responsible for the assurance of all the logistics associated with the swine producers, providing the animal nutrition, genetics and all the overall animal weight.
Value(s) of monitored parameter:	The values of W_{site} can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *BEy ex-post – PEy ex-post*.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Quarterly (based on sampling following COOASGO's internal procedure) and at full weight of the batch of pigs every time it leaves the farms farms (each batch stays around 5 to 6 months per farm).
Calculation method (if applicable):	The quarterly weight of the animals for each producer of the PDD is made following COOASGO's internal procedure, that is not under the PP's control – the association selects the animals based on a random sampling approach applied in each category, since it is infeasible to weight each animal individually in the farms belonging to the project (these farms can more than 5,000 animals each). In addition, each project site presents the actual animal weight by using Brascarbon form 16.001 after a cross-check by the PP, using the real information after each batch of animals exits each farm; the template was designed to quarterly report animal weight per category.
QA/QC procedures:	Check of the site records and documents. The values of the quarterly weights presented by COOASGO (following the association's internal procedures) to the PP are cross-checked against two different credible sources: - reference figures from EMBRAPA (an undisputed Brazilian Agricultural Research Corporation nationally recognized for the these scope) for each category; and - the figures provided by COOASGO when each of the swine batches exits each farm (each batch stays around 5 to 6 months per farm), as explained below. Here COOASGO provides with 100% of the animals weight (and number), allowing a full cross-check with the weight values provided and assuring all the information is accurate. If the PP verifies during the cross-check any discrepancy between the values provided quarterly and the full weighting and counting of the animals in the invoices provided by COOASGO each time any batch exits a giving farm, those values will be updated accordingly with these real figures.
Purpose of data/parameter:	Baseline Emissions and project emissions

Additional comment:	The current practice of swine farms in Brazil is that each farm receives new batches of animals every 5 to 6 months (which is also the average time that a batch stays in a farm) and the producer, together with COOASGO, performs regular and periodical visits to each farm in order to assess and evaluate the correct development of each batch in terms of growing/weighting of the animals (according with what is expected at each growing stage of a given batch). It is important to highlight that both the farm owners and COOASGO rely on the quality of the values measured since their sole professional occupation is the pig production and, therefore, it is within their best interests to have a correct and reliable way to assess the weighting of the animals (which is their business) based on their experience and internal procedures. Every 5 to 6 months (depending on each batch and farm), the animal batches leave the farms and they are, in this specific situation, 100% weighted by the producers, together with COOASGO – this weighting is undertaken to the totality of animal presented in the batch since the profits associated with the animal production are weight based. According with COOASGO a possible range of +/- 5kg within the animal growing is considered a normal fluctuation and therefore admissible. Each time a batch exits a farm, COOASGO provides the invoices to attest the feasibility of the figures adopted, allowing a complete and thorough cross-check by PP of all the data used for this parameter. Monitoring operational procedure POP-016.

Data / Parameter:	$ER_{y,ex\text{-}post}$
Unit:	t CO_2e
Description:	Ex-post emission reductions achieved by the project activity based on monitored values for the year “y”.
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System (form 17.001 – CER calculation spreadsheet)
Value(s) of monitored parameter:	The values of $ER_{y,ex\text{-}post}$ can be found in the spreadsheet calculation file “CER Calculation MR08 - BCA-BRA-05” in the folder *ERy ex-post*.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Monthly and compounded annually

Calculation method (if applicable):	The calculation of the emission reductions is based on the equations used on the approved methodology AMS.III.D – Version 20.1 ***– "Methane recovery in animal manure management systems"*** and data from 2006 IPCC Guidelines for National GHG Inventories, volume 4, chapter 10. For baseline emissions calculation see section B.4 and all data is summarised in the section B.6.3, Table B.3 and Table B.4. The project emissions for this project activity are defined as the amount of methane that would be emitted to the atmosphere during the crediting period due to the project activity. In this case an anaerobic digester is considered the project activity and estimated emissions are determined as follows: **Step 1: Emission Reductions** **Equation B4** $ER_{y,estimated} = BE_y - PE_y$ Where $ER_{y,}$ Emission reductions in tCO_2e/year $BE_{y,}$ Baseline emissions in tCO_2e/year $PE_{y,}$ Project emissions in tCO_2e/year The emission reductions which will be achieved by the project activity ex post will be determined through direct measurement of the amount of methane flared. The emission reductions achieved in any year will be the lowest value of the following: $ER_{y,ex\text{-}post} = min[(BE_{y,ex\text{-}post} - PE_{y,ex\text{-}post}),(MD_y - PE_{power,y,ex\text{-}post})]$ Where $ER_{y,ex\text{-}post}$ Emission reductions achieved by the project activity based on monitored values for year y (tCO_2e) $BE_{y,ex\ post}$ Baseline emissions calculated using equation 1 and using ex post monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$ for year y (tCO_2e) $PE_{y,ex\ post}$ Project emissions calculated using equation 3 using ex post monitored values of $N_{LT,y}$, $MS\%_{i,y}$ and if applicable $VS_{LT,y}$ for year y (tCO_2e) MD_y Methane captured and destroyed or used gainfully by the project activity in year y (tCO_2e) $PE_{power,y,ex\ post}$ Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO_2e) Please see more details in Section E
QA/QC procedures:	The $ER_{y,ex\text{-}post}$ is calculated by the QC officer using the emissions reduction spreadsheet calculation. When the results are not accordant with the expected/projected, the QA/QC officer recommends additional corrective action to be checked and/or followed in the field.
Purpose of data/parameter:	N/A
Additional comment:	No comments

Data / Parameter:	FFR
Unit:	No data unit applied
Description:	Formulated feed rations
Measured/ Calculated / Default:	N/A
Source of data:	Brascarbon Monitoring Report System (form 14.001)
Value(s) of monitored parameter:	The monitoring of FFR during the monitoring period confirmed that the farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	N/A
QA/QC procedures:	The formulated feed rations used per animal category is controlled by the use of the form 14.001 and is further checked by the QA/QC officer, together with information and records obtained in the confined animal feed operation on food composition and, when available, on food purchases.
Purpose of data/parameter:	Baseline emissions (to validate Bo and VS values used)
Additional comment:	No comments

Data / Parameter:	P_{biogas}
Unit:	mbar
Description:	Pressure of the biogas at operation conditions
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 04.001)
Value(s) of monitored parameter:	The values of P_{biogas} can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *MDy-PEpower,y,ex-post*.
Monitoring equipment:	**Biogas Analyser [1][2] Calibration Control**

Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Certificate Number	Last Calibration Date [3]	Expiration Date
Fazenda Dragão	BCA-032MS1-05				
Lote 55 e 54	BCA-034MS1-05				
Lote 101	BCA-035MS1-05				
Lote 105	BCA-036MS1-05				
Lote 71	BCA-037MS1-05				
Lote 82	BCA-038MS1-05	BM 11043	BM11043_6/2620	18/07/2018	17/01/2019
Lote 28 e 27	BCA-039MS1-05	BM 11043	BM11043_7/4510	14/01/2019	13/07/2019
Fazenda Bela Vista	BCA-040MS1-05	BM 11043	BM11043_3/2470	07/07/2019	06/01/2020
Granja Serra Dourada	BCA-041MS1-05				
Fazenda Cachoeira	BCA-042MS1-05				
Granja Capivara	BCA-043MS1-05				
Fazenda Sorgatto	BCA-046MS1-05				
Fazenda Bambú - Quinhão A	BCA-051MS1-05				
Fazenda Folleto	BCA-052MS1-05				

(1)	Monitoring equipment type:	Biogas Check Portable Digital Analyzer from Geotech/Landtech
(2)	Accuracy class:	• **CH_4**: ± 0.5% from 0-5% CH_4 content; ± 1.0% from 5-15% CH_4 content; ± 3.0% from 15%-full scale CH_4 content • **Temperature**: ± 0.2ºC (Biogas check analyzer accuracy) ± 0.5ºC (temperature probe accuracy) • **Pressure**: ± 4mbar typically and ±15 mbar maximum
(3)	Calibration frequency:	Every 6 months

Measuring/ Reading/ Recording frequency:	The monitoring frequency is monthly and guarantees a 90/10 confidence/precision level (for details, please see Section D.3 – Implementation of sampling plan)
Calculation method (if applicable):	N/A
QA/QC procedures:	The information of the biogas pressure is managed by the use of the form 04.001 (formulary for field data collection) and is further checked by the QA/QC officer. The calibration certificates are managed to guarantee the portable analyzers are calibrated during all the monitoring period. The QA/QC officer checks one month before the expiration date stated in the calibration certificates to proceed with the new calibration.
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	GENETIC SOURCE
Unit:	No data unit applied
Description:	Genetic source from annex I party
Measured/ Calculated / Default:	N/A
Source of data:	Brascarbon Monitoring Report System (form 15.001)
Value(s) of monitored parameter:	The monitoring of Genetic Source during the monitoring period confirmed that the farms use Western Europe genetic
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures:	The genetic source used per animal category is controlled by the use of the form 15.001 and is further checked by the QA/QC officer, together with information and records obtained in the confined animal feed operation regarding the livestock genetic composition of each producer (purchase notes if available).
Purpose of data/parameter:	Baseline Emissions (to validate Bo and VS values used)
Additional comment:	No comments

Data / Parameter:	$MS\%_{i,y}$
Unit:	Fraction
Description:	Fraction of manure handled in system “i”, year “y”.
Measured/ Calculated / Default:	Estimated
Source of data:	Brascarbon Monitoring Report System (form 02.001)
Value(s) of monitored parameter:	During the site inspection, it was confirmed that no changes in the manure management system occurred and all the manure was handled in the project facilities. Value is therefore 1.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures:	The fraction of manure handled in in system is observed during the site visit and controlled by the use of the form 02.001 and is further checked by the QA/QC officer.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	$F_{CH4,m}$
Unit:	kg
Description:	Mass flow rate of methane in the residual gaseous stream in the minute m
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System (form 17.001 – CER calculation spreadsheet)
Value(s) of monitored parameter:	The values of $F_{CH4,m}$ can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder BEy ex-post – PEy ex-post.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	Calculated according to the "Tool to determine project emissions from flaring gases containing methane". An operational procedure POP 17 includes the instruction to the calculation. According with the step 1 – Determination of the methane mass flow in the residual gas of this tool, this parameter should be determined using another tool, namely Tool to determine the mass flow of a greenhouse gas in a gaseous stream. In second tool, there are several options to determine the Mass flow rate of methane in the residual gaseous stream. Option 2 - Simplified calculation without measurement of the moisture content was chosen by the PP. Within this option, option A will be applicable by the demonstration that the gaseous stream is dry. The PP will demonstrate that the temperature of the gaseous stream (Tt) is less than 60ºC (333.15 K) at the flow measurement point. Hence this parameter will be calculated according with Equations 5 and 6 of the tool. This means: $F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,t}$ Equation (5) With: $\rho_{i,t} = \frac{P_t \times MM_i}{R_u \times T_t}$ Equation (6) Where: $F_{i,t}$ = Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h) $V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h) $v_{i,t,db}$ = Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m^3 gas *i*/m^3 dry gas) $\rho_{i,t}$ = Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas *i*/m^3 gas *i*) P_t = Absolute pressure of the gaseous stream in time interval *t* (Pa) MM_i = Molecular mass of greenhouse gas *i* (kg/kmol) R_u = Universal ideal gases constant ($Pa.m^3$/kmol.K) T_t = Temperature of the gaseous stream in time interval *t* (K)

QA/QC procedures:	Check the registers sent from the field. Calculation of the parameter according to the procedures mentioned above.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	$FV_{RG,h}$
Unit:	m^3/h
Description:	Volumetric flow rate of the residual gas at normal conditions in hour h
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	The values of $FV_{RG,h}$ can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *BEy ex-post – PEy ex-post*.
Monitoring equipment:	**Flow Meter (1)(2) Calibration Control**

Farm name	Site ID	Flow Meter Serial Number	Calibration Certification Number	Instalation Calibration Date (3)	Expiration Date
Fazenda Dragão	BCA-032MS1-05	A700693412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 55 e 54	BCA-034MS1-05	A700613412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 101	BCA-035MS1-05	A700753412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 105	BCA-036MS1-05	A700663412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 71	BCA-037MS1-05	A700683412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 82	BCA-038MS1-05	A700633412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Lote 28 e 27	BCA-039MS1-05	A700583412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Bela Vista	BCA-040MS1-05	A700623412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Granja Serra Dourada	BCA-041MS1-05	A700643412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Cachoeira	BCA-042MS1-05	A700553412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Granja Capivara	BCA-043MS1-05	A700563412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Sorgatto	BCA-046MS1-05	A700833412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Bambú - Quinhão A	BCA-051MS1-05	A700713412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21
Fazenda Folleto	BCA-052MS1-05	A700573412A	EN 10204 - 2.1	13/04/17	12/04/19
				10/04/19	09/04/21

(1)	Monitoring equipment type:	Endress+Hauser thermal mass flow meter t-trend - ATT12
(2)	Accuracy class:	± 5% of factory full scale
(3)	Calibration frequency:	Every 2 years of continuous operation (counted from the date of installation)

Measuring/ Reading/ Recording frequency:	Monthly

Calculation method (if applicable):	The parameter $FV_{RG,h\ is}$ is calculated in normal (NTP) conditions (101.325 kPa and 273.15 K) as requested by the "Tool to determine project emissions from flaring gases containing methane" (EB 28, Annex 13). Hence, the measured $BG_{burnt,y}$ at measurement conditions (pressure and temperature) is converted to normal conditions using the following formula: $V_{\text{normal conditions}} = (PV/T)_{\text{measurement conditions}} * (T/P)_{\text{normal conditions}}$ Then, the calculation is made according to the formula below and based on monitored data of total biogas volume directed to the flare in a one month and the total hours of operation in that month. $FV_{RG,h}$ obtained is in wet basis (same basis as $BG_{burnt,y\ normal}$) $FV_{RG,h} = BG_{burnt,y\ normal}$ / Total hours This approach has been considered accurate for the calculation of $FV_{RG,h}$ since the biogas hourly flow is considered to be constant as there is no artificial blower or pump.
QA/QC procedures:	The $FV_{RG,h}$ calculation is done by the QA/QC officer based on monitored data and further checked. The calibration certificates are managed to guarantee the flow meters are calibrated during all the monitoring period. The QA/QC officer checks one month before the expiration date, to proceed with the new calibration.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	$fv_{CH4,RG,h}$
Unit:	Fraction
Description:	Volumetric fraction of methane content in the residual gas in hour h
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 04.001)
Value(s) of monitored parameter:	The values of $fv_{CH4,RG,h}$ can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *BEy ex-post – PEy ex-post*.
Monitoring equipment:	**Biogas Analyser [1][2] Calibration Control**

Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Certificate Number	Last Calibration Date [3]	Expiration Date
Fazenda Dragão	BCA-032MS1-05				
Lote 55 e 54	BCA-034MS1-05				
Lote 101	BCA-035MS1-05				
Lote 105	BCA-036MS1-05				
Lote 71	BCA-037MS1-05				
Lote 82	BCA-038MS1-05	BM 11043	BM11043_6/2620	18/07/2018	17/01/2019
Lote 28 e 27	BCA-039MS1-05	BM 11043	BM11043_7/4510	14/01/2019	13/07/2019
Fazenda Bela Vista	BCA-040MS1-05	BM 11043	BM11043_3/2470	07/07/2019	06/01/2020
Granja Serra Dourada	BCA-041MS1-05				
Fazenda Cachoeira	BCA-042MS1-05				
Granja Capivara	BCA-043MS1-05				
Fazenda Sorgatto	BCA-046MS1-05				
Fazenda Bambú - Quinhão A	BCA-051MS1-05				
Fazenda Folleto	BCA-052MS1-05				

(1)	Monitoring equipment type:	Biogas Check Portable Digital Analyzer from Geotech/Landtech
(2)	Accuracy class:	• **CH_4**: ± 0.5% from 0-5% CH_4 content; ± 1.0% from 5-15% CH_4 content; ± 3.0% from 15%-full scale CH_4 content • **Temperature**: ± 0.2ºC (Biogas check analyzer accuracy) ± 0.5ºC (temperature probe accuracy) • **Pressure**: ± 4mbar typically and ±15 mbar maximum
(3)	Calibration frequency:	Every 6 months

Measuring/ Reading/ Recording frequency:	The monitoring frequency is monthly and guarantees a 90/10 confidence/precision level (for details, please see Section D.3 – Implementation of sampling plan).
Calculation method (if applicable):	The methane content measured monthly ($W_{CH4,y}$) is used as an (average) $fv_{CH4,RG,h}$. This approach is considered accurate for the calculation of $PE_{flare,y}$ since the monthly monitored $W_{CH4,y}$ (measured on wet basis) assures a 90/10 confidence/precision level in the methane concentration measurement.
QA/QC procedures:	The information of the methane content is managed by the use of the form 04.001 (formulary for field data collection). The calibration certificates are managed to guarantee the portable analyzers are calibrated during all the monitoring period. The QA/QC officer checks one month before the expiration date stated in the calibration certificates to proceed with the new calibration.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	nd_y
Unit:	Number
Description:	Number of days in year "y" where the treatment plant was operational
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System (form 17.001 – CER Calculation spreadsheet)
Value(s) of monitored parameter:	The values of nd_y can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *BEy ex-post – PEy ex-post*.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	The number of days where the treatment plant is operational is monitored taking into account the number of temperature and biogas measurements stored in the CLP. As both the temperature and biogas volume are measured every minute, the information stored in the CLP allows for the calculation of the number of hours where the treatment plant was operation (H_{total}, obtained from form 08.001 from the Brascarbon Monitoring System) and consequently the number of days (dividing the total hours of operation by the number of hours in the day – 24).
QA/QC procedures:	The nd_y is calculated by the QC officer using the emissions reduction spreadsheet calculation. When the results are not accordant with the expected/projected, the QA/QC officer recommends additional corrective action to be checked and/or followed in the field.
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	$VS_{LT,y}$
Unit:	kg dry matter/animal/year
Description:	Volatile solids for livestock *LT* entering the animal manure management system in year *y*
Measured/ Calculated / Default:	Calculated
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	The values of VSLT,y can be found in the spreadsheet calculation file "CER Calculation MR08 - BCA-BRA-05" in the folder *BEy ex-post – PEy ex-post*.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually

Calculation method (if applicable):	According to paragraph 17 (d) from AMS-III.D version 20.1, B0 or VS values applicable to developed countries can be used provided the following four conditions are satisfied: -The genetic source of the livestock originates from an Annex I Party; Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação BrasileiradosCriadoresdeSuinos(BrazilianSwineAssociation) – http://www.abcs.org.br/. The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. -The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics; The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability to this requirement. -The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.); The formulated feed rations are part of the system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. -The project specific animal weights are more similar to developed country IPCC default values. The Wsite value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. Finishers is the animal category that represents the totality of all animals from the farms included in this PDD. Finishers are considered to be “market swine” and presented an average weight of 90kg among all farms included in the PDD by the time of the project’s registration (and this was the value adopted for the parameter Wsite). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, chapter 10, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe’s. Therefore, is fair to consider that “the project specific animal weights are more similar to developed country IPCC default values” condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.
QA/QC procedures:	Check the registers in the generated documents. Control and assure the correct calculation of the parameter.
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	$Q_{manure,j,LT,y}$
Unit:	Tonnes DM/year
Description:	Quantity of manure treated from livestock type LT at manure management system j
Measured/ Calculated / Default:	Estimated
Source of data:	Brascarbon Monitoring Report System (form 02.001)
Value(s) of monitored parameter:	During the site inspection, it was confirmed that no changes in the manure management system occurred and all the manure was handled in the project facilities. Value is therefore 1.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures:	The fraction of manure handled in in system is observed during the site visit and controlled by the use of the form 02.001 and is further checked by the QA/QC officer.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	$SVS_{j,LT,y}$
Unit:	tonnes VS/tonnes DM
Description:	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y
Measured/ Calculated / Default:	This parameter and the parameter VSLT,y are the same. Please refer to the QA/QC procedures from the parameter VSLT,y
Source of data:	Brascarbon Monitoring Report System (form 02.001)
Value(s) of monitored parameter:	This parameter and the parameter VSLT,y are the same. Please refer to the QA/QC procedures from the parameter VSLT,y
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	This parameter and the parameter VSLT,y are the same. Please refer to the QA/QC procedures from the parameter VSLT,y
Calculation method (if applicable):	This parameter and the parameter VSLT,y are the same. Please refer to the QA/QC procedures from the parameter VSLT,y
QA/QC procedures:	This parameter and the parameter VSLT,y are the same. Please refer to the QA/QC procedures from the parameter VSLT,y
Purpose of data/parameter:	Baseline Emissions
Additional comment:	No comments

Data / Parameter:	AI_l
Unit:	Days
Description:	Annual average interval between manure collection and delivery for treatment at a given storage device *l*
Measured/ Calculated / Default:	Estimated
Source of data:	Brascarbon Monitoring Report System (form 02.001)
Value(s) of monitored parameter:	During the site inspection, it was confirmed that no changes in the manure management system occurred and all the manure was handled in the project facilities. Value is therefore 1.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually, based on monthly records
Calculation method (if applicable):	N/A
QA/QC procedures:	The fraction of manure handled in in system is observed during the site visit and controlled by the use of the form 02.001 and is further checked by the QA/QC officer.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	GE_{LT}
Unit:	MJ/days
Description:	Daily average gross energy intake in MJ/day
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 22.001)
Value(s) of monitored parameter:	No electricity was consumed from the grid for the operation of the project facility in the monitoring period. Value is therefore 0.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	When used
Calculation method (if applicable):	N/A
QA/QC procedures:	If eventually electricity from the grid is used, the regional technician will follow the POP 22 and register the information of electricity consumption on form 22.001. All documents received from the field such as site records and documents are checked by the QA/QC.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	DE_{LT}
Unit:	%
Description:	Digestible energy of the feed in per cent
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 22.001)
Value(s) of monitored parameter:	No electricity was consumed from the grid for the operation of the project facility in the monitoring period. Value is therefore 0.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	When used
Calculation method (if applicable):	N/A
QA/QC procedures:	If eventually electricity from the grid is used, the regional technician will follow the POP 22 and register the information of electricity consumption on form 22.001. All documents received from the field such as site records and documents are checked by the QA/QC.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	UE
Unit:	Fraction of GE
Description:	Urinary energy expressed as fraction of *GE*
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 22.001)
Value(s) of monitored parameter:	No electricity was consumed from the grid for the operation of the project facility in the monitoring period. Value is therefore 0.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	When used
Calculation method (if applicable):	N/A
QA/QC procedures:	If eventually electricity from the grid is used, the regional technician will follow the POP 22 and register the information of electricity consumption on form 22.001. All documents received from the field such as site records and documents are checked by the QA/QC.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	***ASH***
Unit:	Fraction of the dry matter feed intake
Description:	Ash content of the manure calculated as a fraction of the dry matter feed intake
Measured/ Calculated / Default:	Estimated
Source of data:	Brascarbon Monitoring Report System (form 02.001)
Value(s) of monitored parameter:	During the site inspection, it was confirmed that no changes in the manure management system occurred and all the manure was handled in the project facilities. Value is therefore 1.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	Annually, based on monthly records
Calculation method (if applicable):	N/A
QA/QC procedures:	The fraction of manure handled in in system is observed during the site visit and controlled by the use of the form 02.001 and is further checked by the QA/QC officer.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	**ED_{LT}**
Unit:	MJ/kg DM
Description:	Energy density of the feed in MJ/kg fed to livestock type LT
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 22.001)
Value(s) of monitored parameter:	No electricity was consumed from the grid for the operation of the project facility in the monitoring period. Value is therefore 0.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	When used
Calculation method (if applicable):	N/A
QA/QC procedures:	If eventually electricity from the grid is used, the regional technician will follow the POP 22 and register the information of electricity consumption on form 22.001. All documents received from the field such as site records and documents are checked by the QA/QC.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	**EG_Y**
Unit:	MWh
Description:	Total electricity generated from the recovered biogas in year *y*
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 22.001)
Value(s) of monitored parameter:	No electricity was consumed from the grid for the operation of the project facility in the monitoring period. Value is therefore 0.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	When used
Calculation method (if applicable):	N/A
QA/QC procedures:	If eventually electricity from the grid is used, the regional technician will follow the POP 22 and register the information of electricity consumption on form 22.001. All documents received from the field such as site records and documents are checked by the QA/QC.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

Data / Parameter:	**EE_Y**
Unit:	%
Description:	Energy Conversion Efficiency of the project equipment
Measured/ Calculated / Default:	Measured
Source of data:	Brascarbon Monitoring Report System (form 22.001)
Value(s) of monitored parameter:	No electricity was consumed from the grid for the operation of the project facility in the monitoring period. Value is therefore 0.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	When used
Calculation method (if applicable):	N/A
QA/QC procedures:	If eventually electricity from the grid is used, the regional technician will follow the POP 22 and register the information of electricity consumption on form 22.001. All documents received from the field such as site records and documents are checked by the QA/QC.
Purpose of data/parameter:	Project Emissions
Additional comment:	No comments

D.3. Implementation of sampling plan

a) Sampling design

According to methodology AMS-III.D version 20.1 requirements, the parameter methane content in biogas will be measured with periodical measurements to attend 90% confidence level and 10% precision level.

In this case, since the biogas is flowing continuously, the study population can be thought of as all the possible methane content measurements in the monitoring period – so large as to be almost infinite.

The sampling method chosen is systematic sampling with a random start date. However, as the sampling times are sufficiently far apart (monthly sampling), the data can be regarded as a set of independent observations and considered simple random sampling.

Due to the similarities with the parameter to be measured in the current project (methane fraction in a continuous biogas flow), the sample size has been determined using the approach presented in paragraph 24 a) of the *Standard for sampling and surveys for CDM project activities and programme of activities" (version 05.0)*. All the detailed calculations for the sample size calculation are presented in the spreadsheet Sampling_plan_BCA_BRA_05_MR08.xls submitted to the DOE, folder *Sample Size*. Previous 1080 methane content measurements, temperature of biogas and pressure of biogas from 32 pig farms (farms from registered CDM projects BCA-BRA-05 and BCA-BRA-07), which are located in Brazilian Central Region (the same region as the one in the present PDD) were used to derive the necessary information about the characteristics of the population. The values obtained (62.0 of mean and 6.93 of standard deviation) are considered representative of the population, since daily, weekly and seasonal variations were taken into account (measurement period was around two years, with measurements in different days, seasons, hours, etc). In order to meet the required confidence/precision of 90/10, a sample size (n) of 6 units was obtained. According with the paragraph 110 of the above mentioned standard, for value of n below or equal to 12, a monthly measurement is required, in order to meet the confidence/precision levels required.

b) Collected data

For the current monitoring period of 365 days (from 1st January 2019 to 31st December 2019), monthly measurements of methane content were taken in each site included in the PDD. The collection of data is done by the Regional Technician (RT) with a portable digital analyzer (Biogas Check portable model from Geotech/Landtech) during the monthly site visit, which takes place between the 1st and 20th day of each month. The RT is trained on procedures for data collection, namely with regards methane content measurement (included in Brascarbon Operational Procedure POP 05). Each monthly collected value for each site is used for the emission reduction calculation of the respective month and site. The collected data is presented in the spreadsheet Sampling_plan_BCA_BRA_05_MR08.xls submitted to the DOE, folder Collected data.

c) Analysis of the collected data and compliance with the required confidence/precision level

The collected data for each site have been analysed in order to assess reliability, i.e., compliance with the 90/10 confidence/precision level. According to the analysis undertaken, the study is considered reliable, as the precision is within the pre-specified reliability precision. For the analysis of the collected data, the procedures specified in of the above-mentioned standard have been followed. The demonstration on the fulfilment of the required confidence/precision is presented in the spreadsheet Sampling_plan_BCA_BRA_05_MR08.xls submitted to the DOE, folder *Analysis.*

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

The baseline emission can be calculated as follows:

Equation 1

$$BE_y = GWP_{CH4} * D_{CH4} * UF_b * \sum MCF_J * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j}$$

Where:

BE_y	Baseline emissions in year "y" (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (25)
D_{CH4}	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
j	Index for animal waste management system
$MCFj$	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,y}$	Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system "j"
UF_b	Model correction factor to account for model uncertainties (0.94)

Where $VS_{LT,y}$ can be determined by scaling default IPCC values to adjust for a site-specific average animal weight according to Equation 2:

Equation 2

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

Where:

W_{site}	Average animal weight of a defined livestock population at the project site (kg)
$W_{default}$	Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg)
$VS_{default}$	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)
nd_y	Number of days in year "y" where the treatment plant was operational.

As explained in section D.1, the values used for the parameters B_0 and VS are those applied for Western Europe.

Table E.1. summarizes the $BE_{y,ex\ post}$ for each farm during the current monitoring period. The detailed calculations are available in the CER calculation spreadsheet (folder *BEy ex-post – PEy ex-post*).

Table E.1. – Baseline Emissions ($BE_{y,ex\ post)}$ in the current monitoring period

Site Name	Site ID	$BE_{y,ex\text{-}post}$ (t CO_2e)
Fazenda Dragão	BCA-032MS1-05	3,590
Lote 55 e 54	BCA-034MS1-05	4,403
Lote 101	BCA-035MS1-05	4,375
Lote 105	BCA-036MS1-05	4,416
Lote 71	BCA-037MS1-05	4,681
Lote 82	BCA-038MS1-05	4,354
Lote 28 e 27	BCA-039MS1-05	5,502
Fazenda Bela Vista	BCA-040MS1-05	7,847
Fazenda Cachoeira	BCA-042MS1-05	9,559
Granja Capivara	BCA-043MS1-05	5,659
Fazenda Sorgatto	BCA-046MS1-05	3,348
Fazenda Bambú - Quinhão A	BCA-051MS1-05	6,536
Fazenda Folleto	BCA-052MS1-05	4,332
Granja Serra Dourada	BCA-041MS1-05	5,958
Total $BE_{y,ex\text{-}post}$		**74,560**

E.2. Calculation of project emissions or actual net removals

According to the simplified baseline and monitoring methodology for a small-scale CDM project Type-III (AMS-III.D - version 20.1), project emissions consist of:

a) Physical leakage of biogas in the manure management systems, which includes production, collection and transport of biogas to the point of flaring/combustion or gainful use ($PE_{PL,y}$);
b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);
c) CO_2 emissions using fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$);
d) CO_2 emissions from incremental transportation distances ($PE_{transp,y}$);
e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

Equation 3

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y}$$

Where:

PE_y	Project emissions in year "y" (tCO_2e)
$PE_{PL,y}$	Emissions due to physical leakage of biogas in year "y" (tCO_2e)
$PE_{flare,y}$	Emissions from flaring or combustion of the biogas stream in the year "y" (tCO_2e)
$PE_{power,y}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year "y" (tCO_2e)
$PE_{transp,y}$	Emissions from incremental transportation in the year "y" (tCO_2e), as per relevant paragraph in AMS-III.F
$PE_{storage,y}$	Emissions from the storage of the manure in the year "y" (tCO_2e)

Where:

(A) Emissions due to physical leakage of biogas can be determinate as follows:

Equation 4

$$PE_{PL,y} = 0{,}10*GWP_{CH4}*D_{CH4}*\sum B_{0,LT}*N_{LT,y}*VS_{LT,y}*MS\%_{i,y}$$

Where:

$PE_{PL,y}$	Emissions due to physical leakage of biogas in year "y" (t CO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH4 (25)
DCH_4	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
I	Index for animal waste management system
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m3 (dm)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,y}$	Volatile solids for livestock "LT" entering the animal manure management system in year "y" (o matter weight basis, kg dm/animal/year)
$MS\%_{i,y}$	Fraction of manure handled in system "i" in year "y"

(B) Emissions from flaring determinate as follows:

Equation 5

$$PE_{flare\,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3}$$

Where

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y, tCO_2e
GWP_{CH4}	Global Warming Potential of methane valid for the committed period tCO_2e/t_{CH4}
$F_{CH4,\,RG,\,m}$	Mass flow rate of methane in the residual gas in the hour h, kg/h
$\eta_{flare,\,h}$	Flare efficiency in the hour h

(C) Emissions from use of fossil fuels or electricity for the operation:

No fossil fuel or electricity will be used in the project, therefore, $PE_{power,y}$ = zero.

(D) Emissions from incremental transportation:

No incremental transportation will occur in the project activity, and therefore, $PE_{transp,y} = 0$

(E) Emissions from storage of the manure:

The manure will not be stored in the entire project. Each day all the manure is washed and sent to the digester, therefore, $PE_{storage,y} = 0$.

Table E.2 summarizes the project emissions for the current monitoring period ($PE_{y,ex\text{-}post}$)and more detailed information can be obtained in the CER calculation spreadsheet (folder *BEy ex-post – PEy ex-post*).

Table E.2. – Project Emissions ($PE_{y,ex-post}$) in the current monitoring period

Site Name	Site ID	$PE_{y,ex-post}$ (t CO_2e)
Fazenda Dragão	BCA-032MS1-05	895
Lote 55 e 54	BCA-034MS1-05	1,065
Lote 101	BCA-035MS1-05	1,023
Lote 105	BCA-036MS1-05	1,110
Lote 71	BCA-037MS1-05	1,149
Lote 82	BCA-038MS1-05	1,070
Lote 28 e 27	BCA-039MS1-05	1,218
Fazenda Bela Vista	BCA-040MS1-05	1,661
Fazenda Cachoeira	BCA-042MS1-05	2,484
Granja Capivara	BCA-043MS1-05	1,310
Fazenda Sorgatto	BCA-046MS1-05	786
Fazenda Bambú - Quinhão A	BCA-051MS1-05	1,496
Fazenda Folleto	BCA-052MS1-05	1,028
Granja Serra Dourada	BCA-041MS1-05	1,505
	Total $PE_{y,ex-post}$	**17,803**

E.3. Calculation of leakage emissions

According with the methodology AMS.III.D version 20.1, the leakage should be determined by following the relevant procedure in the methodological tool "Project and leakage emissions from anaerobic digesters".

According with this tool, leakage emissions associated with the anaerobic digester (LEAD,y) depend on how the digestion is managed. Since the storage of digested or the composting of digested is occurring within the project boundary, these emissions were considered as part of the project emissions.

E.4. Calculation of emission reductions or net anthropogenic removals

The calculation of the emission reductions is based on the equations used on the approved methodology AMS.III.D – Version 20.1 – "Methane recovery in animal manure management systems" and data from 2006 IPCC Guidelines for National GHG Inventories, volume 4, chapter 10.

For baseline emissions calculation see section B.4 and all data is summarised in the section B.6.3, Table B.3 and Table B.4.

The project emissions for this project activity are defined as the amount of methane that would be emitted to the atmosphere during the crediting period due to the project activity. In this case an anaerobic digester is considered the project activity and estimated emissions are determined as follows:

Step 1: Emission Reductions

Equation 6

$$ER_{y,estimated} = BE_y - PE_y$$

Where:

$ER_{y,estimated}$	Emission reductions in tCO_2e/year
BE_y	Annual Baseline methane emissions in tCO_2e/year
$PE_{y,}$	Project emissions in tCO_2e/year

Equation 6.1

$$ER_{y,ex\text{-}post} = min[(BE_{y,ex\text{-}post} - PE_{y,ex\text{-}post}),(MD_y - PE_{power,y,ex\text{-}post})]$$

Where:

$ER_{y,ex\text{-}post}$	Emission reductions achieved by the project activity based on monitored values for year y (tCO_2e)
$BE_{y\ ex\ post}$	Baseline emissions calculated using equation 1 and using ex post monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$ for year y (tCO_2e)
$PE_{y,\ ex\ post}$	Project emissions calculated using equation 3 using ex post monitored values of $N_{LT,y}$, $MS\%_{i,y}$ and if applicable $VS_{LT,y}$ for year y (tCO_2e)
MD_y	Methane captured and destroyed or used gainfully by the project activity in year y (tCO_2e)
$PE_{power,y,ex\ post}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO_2e)

The flaring/combustion MD_y is measured using the conditions of the flaring process and according the following equation:

Equation 6.2

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$$

Where:

$BG_{burnt,\ y}$	Biogas flared or combusted in year *y* (m^3)
$W_{CH4,\ y}$	Methane content in biogas in the year *y* (volume fraction)
FE	Flare efficiency in the year *y* (fraction)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (25)
D_{CH4}	Density of methane at the temperature and pressure of the biogas in the year "y" (t/m^3).

Table E.3. summarizes the MD_y for each farm during the current monitoring period and Table E4. presents the $ER_{y,expost}$ calculated for the project activity, as per Equation 7. More detailed information can be obtained in the CER calculation spreadsheet (folder *BEy ex-post – PEy ex-post* and folder *ERy ex-post*).

Table E.3. – Methane captured and destroyed (MD_y) in the current monitoring period

Site Name	Site ID	MD_y (t CO_2e)
Fazenda Dragão	BCA-032MS1-05	3,711
Lote 55 e 54	BCA-034MS1-05	4,248
Lote 101	BCA-035MS1-05	3,901
Lote 105	BCA-036MS1-05	4,638
Lote 71	BCA-037MS1-05	4,667
Lote 82	BCA-038MS1-05	4,346
Lote 28 e 27	BCA-039MS1-05	4,294
Fazenda Bela Vista	BCA-040MS1-05	5,440
Fazenda Cachoeira	BCA-042MS1-05	10,781
Granja Capivara	BCA-043MS1-05	4,927
Fazenda Sorgatto	BCA-046MS1-05	3,019
Fazenda Bambú - Quinhão A	BCA-051MS1-05	5,543
Fazenda Folleto	BCA-052MS1-05	3,996
Granja Serra Dourada	BCA-041MS1-05	6,316
	Total MD_y	**69,827**

Table E.4. – $ER_{y,\ ex\text{-}post}$ in the current monitoring period

SITE ID:	SITE NAME	MD_y (t CO_2e)	$PE_{power,y,ex\text{-}post}$ (t CO_2e)	$MDy - PE_{power,y,ex\text{-}post}$ (t CO_2e)	$BE_{y,ex\text{-}post}$ (t CO_2e)	$PE_{y,ex\text{-}post}$ (t CO_2e)	$BE_{y,ex\text{-}post} - PE_{y,ex\text{-}post}$ (t CO_2e)	$ER_{y,ex\text{-}post}$ = min [($BE_{y,ex\text{-}post} - PE_{y,ex\text{-}post}$), ($MD_y - PE_{power,y,ex\text{-}post}$)] (t CO_2e)
BCA-032MS1-05	Fazenda Dragão	3,711	0	3,711	3,590	895	2,694	2,694
BCA-034MS1-05	Lote 55 e 54	4,248	0	4,248	4,403	1,065	3,337	3,337
BCA-035MS1-05	Lote 101	3,901	0	3,901	4,375	1,023	3,351	3,351
BCA-036MS1-05	Lote 105	4,638	0	4,638	4,416	1,110	3,305	3,305
BCA-037MS1-05	Lote 71	4,667	0	4,667	4,681	1,149	3,531	3,531
BCA-038MS1-05	Lote 82	4,346	0	4,346	4,354	1,070	3,284	3,284
BCA-039MS1-05	Lote 28 e 27	4,294	0	4,294	5,502	1,218	4,283	4,283
BCA-040MS1-05	Fazenda Bela Vista	5,440	0	5,440	7,847	1,661	6,185	5,440
BCA-042MS1-05	Fazenda Cachoeira	10,781	0	10,781	9,559	2,484	7,074	7,074
BCA-043MS1-05	Granja Capivara	4,927	0	4,927	5,659	1,310	4,349	4,349
BCA-046MS1-05	Fazenda Sorgatto	3,019	0	3,019	3,348	786	2,561	2,561
BCA-051MS1-05	Fazenda Bambú - Quinhão A	5,543	0	5,543	6,536	1,496	5,040	5,040
BCA-052MS1-05	Fazenda Folleto	3,996	0	3,996	4,332	1,028	3,304	3,304
BCA-041MS1-05	Granja Serra Dourada	6,316	0	6,316	5,958	1,505	4,452	4,452
TOTAL		69,827	0	69,827	74,560	17,803	56,750	56,005

The Table E.4. above presents all the components which are calculated for each farm in order to comply with the methodology requirements for emission reductions determination. Due to the amount of information and methodology particularities, and in order to improve the reading of each parameter for all the farms, it was decided to include the emission reduction table in a different format from the one stated in the Monitoring Report Form, Version 07.0 which is more designed for a one site only project activity.

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	**Project GHG emissions or actual net GHG removals (t CO_2e)**	**Leakage GHG emissions (t CO_2e)**	**GHG emission reductions or net anthropogenic GHG removals (t CO_2e)**		
				Before 01/01/2013	**From 01/01/2013**	**Total amount**
Total	74,560	17,803	0	0	56,005	56,005

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	**Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)**
56,005 tCO_2e	57,067 tCO_2e

A comparison between the actual emission reductions reached in the monitoring period and the estimated value in the PDD is presented for each farm in Table E.5. below.

Table E.5. Comparison between the $ER_{y, ex\text{-}post}$ and the PDD values, for the monitoring period

Site Name	Site ID	$ER_{y,ex\text{-}post}$ in the MP (t CO_2e)	PDD (t CO_2e)	% achieved	Variation
Fazenda Dragão	BCA-032MS1-05	2,694	2,576	105%	5%
Lote 55 e 54	BCA-034MS1-05	3,337	3,435	97%	-3%
Lote 101	BCA-035MS1-05	3,351	3,294	102%	2%
Lote 105	BCA-036MS1-05	3,305	3,294	100%	0%
Lote 71	BCA-037MS1-05	3,531	3,294	107%	7%
Lote 82	BCA-038MS1-05	3,284	3,294	100%	0%
Lote 28 e 27	BCA-039MS1-05	4,283	4,390	98%	-2%
Fazenda Bela Vista	BCA-040MS1-05	5,440	5,581	97%	-3%
Fazenda Cachoeira	BCA-042MS1-05	7,074	7,728	92%	-8%
Granja Capivara	BCA-043MS1-05	4,349	4,294	101%	1%
Fazenda Sorgatto	BCA-046MS1-05	2,561	2,811	91%	-9%
Fazenda Bambú - Quinhão A	BCA-051MS1-05	5,040	5,488	92%	-8%
Fazenda Folleto	BCA-052MS1-05	3,304	3,294	100%	0%
Granja Serra Dourada	BCA-041MS1-05	4,452	4,294	104%	4%
	Total	**56,005**	**57,067**	**128%**	**2%**

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

Annual emission reductions in ex-ante calculation of the registered CDM-PDD are 57,067 tCO_2e. Since the monitoring period is a closed and entire year, the calculation of the amount estimated ex ante for this monitoring period in the PDD is the same volume as the one presented in the registered PDD.

E.6. Remarks on increase in achieved emission reductions

The project activity achieved 98% of the PDD values during the monitoring period.

E.7. Remarks on scale of small-scale project activity

The project activity is a for small-scale project activity since the registered PDD is under 60ktCO2e/year. During the current monitoring period, the emission reductions achieved are within the reduction limit for this type of projects.

The actual emission reductions achieved during this monitoring period are 11% higher than the estimated value in the PDD. This slight increase is mainly due to the higher GWP of CH_4 (25 tCO_2e/tCH_4) used in the emission reduction calculation of this monitoring period compared to the one used in the PDD (21 tCO_2e/tCH_4) as per EB69 Annex 3, in compliance with relevant EB rules.

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Document information

Version	*Date*	*Description*
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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