

**MONITORING REPORT FORM (CDM-MR) \***  
**Version 01 - in effect as of: 28/09/2010**

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\* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

**MONITORING REPORT**  
**Version 01, 01/03/2011**

**BRASCARBON Methane Recovery Project BCA-BRA-05, Brazil.**

**Reference number: 3455**

**First Monitoring Period from 21/08/2010 to 31/01/2011**

**A.1. Brief description of the project activity:**

The Project Activity consists of the construction of a new covered in-ground anaerobic reactor (digester) that will utilize the organic material currently treated in the wastewater opened lagoon, from the confined animal operations to produce biogas.

The equipment is based on in one ambient temperature storage covered cells (lagoon) with sufficient capacity to create an adequate Hydraulic Retention Time (HRT). The resulting biogas will be measured and destroyed through enclosed flaring system.

The expected 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 proposes to apply 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 is 03/03/2008 for Fazenda Água Branca (Água Limpa), Fazenda Bela Vista, Fazenda Cachoeira, Fazenda Santa Catarina, Granja Serra Dourada and Granja Capivara. 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 making of 18 different sites. The start of crediting period is 21/08/2010 for all farms.

The total estimated emission reduction over the 7 years project period as documented in the PDD is 369.699 tonnes of CO<sub>2</sub> equivalent.

**A.2. Project Participants**

<b>Name of Party involved ((host) indicates a host Party)</b>	<b>Private and/or public entity(ies) project participants (as applicable)</b>	<b>Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)</b>
Brazil (host)	Brascarbon Consultoria, Projetos e Representação Ltda.	No
Portugal	Luso Carbon Fund	No

### A.3. Location of the project activity:

**Table A1. Detailed physical location and identification of project site.**

Farm / Site	Brascarbon ID	Address	Town / State	Contact	Phone	GPS Coord
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
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 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 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
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
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
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
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
Faz Rodeio – Gleba C	BCA-031MS1-05	Chácara Bairro jardim Gramado - Road to Cuiabá – left side	São G. do Oeste - MS	Alídio Biazus	+55 67 3295 1304	S 19,3772 W 54,6128
Fazenda Água Branca	BCA-030MS1-05	BR 163 - Km 592 – countryside – toward C. Grande -left	São G. do Oeste - MS	Delcio Guzzi	+55 67 9969 3706	S 19,5492 W 54,4331
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
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 Santa Catarina	BCA-047MS1-05	BR163 - Km 594 – country Road to Ponto Alto	São G. do Oeste - MS	Coasgo	+55 67 3295 1201	S 19,5600 W 54,3197
Faz Ponte Vermelha	BCA-068MS1-05	BR 163 - KM 586 – Road to Area da Ponte Vermelha - 3 km right	São G. do Oeste - MS	Valdinei Viviam	+55 67 3295 5345	S 19,4753 W 54,4061

### A.4. Technical description of the project

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. As part of an integrated waste management system, anaerobic digestion reduces the emission of the greenhouse gas into the atmosphere. Anaerobic digestion is a renewable energy source because the process produces a methane and carbon dioxide, rich biogas, suitable for energy

production helping replace fossil fuels. The nutrient-rich solids left after digestion can be used as fertilizer also (Figure 1).

The digestion process begins with bacterial hydrolysis of the input materials in order to break down insoluble organic polymers such as carbohydrates and make them available for other bacteria. Acidogenic bacteria then convert the sugars and amino acids into carbon dioxide, hydrogen, ammonia, and organic acids. Acetogenic bacteria then convert these resulting organic acids into acetic acid, along with additional ammonia, hydrogen, and carbon dioxide. Methanogenic bacteria finally are able to convert these products to methane and carbon dioxide. The equipment is based on in one ambient temperature storage covered cells (lagoon) with sufficient capacity to create an adequate Hydraulic Retention Time (HRT). The cell will use a single-piece liner affixed to a reinforced outer concrete frame. The outer cover consists of a synthetic vinyl membrane or High Density Polyethylene (HDPE)-, which is also fastened to the frame. The liner and cover will be sealed together with bolts and iron plate frame.

The system also includes a biogas collector piping, from the digester to the flare system.

The flare is enclosed and controlled by a data logger CLP –Controller Logic Programmable – where the combustion temperature is stored every one minute in the system.

This system will record every each minute the combustion temperature to determinate the flare efficiency according to the specification of the flare. A thermocouple installed in the flare is connected to the PLC to register the combustion temperature.

The sparking system in the flare is automatic. Every one second the system sparks.

The biogas flow rate will be also controlled by a CLP where every each minute the system records the flow rate.

The sparking system, the PLC and the control panel are powered by a 12 volts battery charged by solar cells.

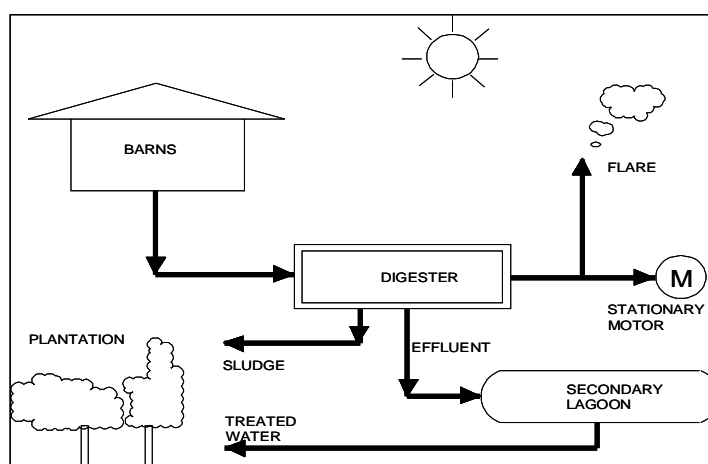
A derivation pipe will be installed before the flare and after the flow meter, for future proposals, to supply biogas to the electricity generators, for in site electricity supply where no claims for emissions reductions by the electricity generation will be requested during the entire project activity but rather by the emissions reductions of the biogas destroyed in the generators.. The treated effluent is discharged to the open lagoons where it is aerated as per the design of the original lagoon system.

The treated water can be then recycled and sent back to the farm proposals, or used for irrigation by the use of biogas pumps or electrical stationary pumps supplied by the biogas electricity generator.

No electricity will be consumed from the grid. The technical parts that will be powered by energy will be supplied by solar cells. The energy will be stored in 12 volts batteries.

The sludge from the digesters will be spread aerobically in the surface of the pasture or plantation as fertilizer in a depth less than 0,30 meters. The sludge will be pumped by a portable biogas pump.

Figure 1. Flowchart of the treatment system



**A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:**

The approved baseline and monitoring methodology is:

- Type III. D (reference AMS-III.D - Version 14 – “*Methane recovery in animal manure management systems*”).

**A.6. Registration date of the project activity:**

Registration date: 21/08/2010.

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

The crediting period is from 21/08/2010 to 20/08/2017 (renewable).

**A.8. Name of responsible person(s)/entity(ies):**

Responsible for completing the CDM-Monitoring Report Form	
Name Contact	Information Contact
Technical Responsibility Luiz Lasas	395 Dr. Gentil Leite Martins Street - ZIP CODE 04648-001 São Paulo - SP, Brazil Phone: +55 11 5523 7059 e-mail: luiz.lasas@brascarbon.com.br
Responsible for preparation of Monitoring Report David Vanni Jacob	395 Dr. Gentil Leite Martins Street - ZIP CODE 04648-001 São Paulo - SP, Brazil Phone: +55 11 5523 7059 e-mail: luiz.lasas@brascarbon.com.br

**SECTION B. Implementation of the project activity**
**B.1. Implementation status of the project activity**

The project implementation started on 03/03/2008, where the construction activity started. This project is making of 18 sites (farms) where each phase of the project implementation as so as the construction, start-up and continuous operation, was concluded in different dates which can be found in the table below:

Table B1. Relevant dates of project implementation.

Farm/Site Name	Brascarbon ID	Start Construction	Finish Construction	Start-up and Tests	Monitoring Start Date
Lote 28 e 27	BCA-039MS1-05	10/11/2008	13/04/2009	25/05/2009	01/07/2009
Lote 55 e 54	BCA-034MS1-05	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 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
Fazenda Bela Vista	BCA-040MS1-05	03/03/2008	02/03/2009	06/04/2009	18/06/2009
Fazenda Cachoeira	BCA-042MS1-05	03/03/2008	02/03/2009	06/04/2009	01/06/2009
Fazenda Dragão	BCA-032MS1-05	24/11/2008	27/04/2009	01/06/2009	08/07/2009
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
Faz Rodeio – Gleba C	BCA-031MS1-05	24/11/2008	27/04/2009	01/06/2009	16/07/2009
Fazenda Água Branca	BCA-030MS1-05	03/03/2008	02/03/2009	06/04/2009	09/06/2009
Granja Serra Dourada	BCA-041MS1-05	03/03/2008	02/03/2009	06/04/2009	17/08/2009
Granja Capivara	BCA-043MS1-05	03/03/2008	02/03/2009	06/04/2009	07/06/2009
Fazenda Santa Catarina	BCA-047MS1-05	03/03/2008	02/03/2009	06/04/2009	01/03/2009
Faz Ponte Vermelha	BCA-068MS1-05	24/11/2008	27/04/2009	01/06/2009	01/07/2009

During the monitoring period there were no special events such as overhaul times, downtimes of equipment, exchange of equipment, etc, neither situations or issues resulting from these events that would have impact on the applicability of the methodology used.

#### **B.2. Revision of the monitoring plan**

No revision of monitoring Plan has been submitted for the project activity up to date.

#### **B.3. Request for deviation applied to this monitoring period**

No request for deviation has been submitted for the project activity for this monitoring period up to date.

#### **B.4. Notification or request of approval of changes**

No notification or request of approval of changes has been requested for the project activity up to date.

## SECTION C. Description of the monitoring system

Table C1. Monitoring plan followed by Brascarbon in order to achieve certified emissions reductions process.

ID	DATA	Data Type	Data Unit	Data Variable	Frequency	Measured(m) Calculated(c) Estimated(e) Documented(d)	Proportion of the data to be monitored	How will the data be archived?	For how long is archived data to be kept?	Comment
1	T <sub>f</sub>	Temp	°C	Flare Temperature	Every 1 minute	M	100%	electronic	project +5years	Use for flare efficiency
2	Site Inspection	Document	----	----	Annually	D	100%	electronic	Duration of the project +5years	General Site Inspection
3	N <sub>LT,y</sub>	Number	-	Nr, Of heads	Monthly	M	100%	electronic	Duration of the project +5years	Used to quantify the methane generation potential
4	BG <sub>burnt,y</sub>	Volume	m <sup>3</sup>	Biogas produced	Monthly	M	100%	electronic	project +5years	Cumulative biogas production
5	W <sub>CH<sub>4</sub>,y</sub>	Fraction	%	Methane content	TBD(*)	M	100%	electronic	project +5years	Concentration in wet basis
6	T <sub>biogas</sub>	Temp	°C	Biogas Temperature	Monthly	M	100%	electronic	Duration of the project +5years	Use to biogas density calculation
7	D <sub>CH<sub>4</sub></sub>	Mass	Ton/m <sup>3</sup>	Density	Monthly	C	100%	electronic	Duration of the project +5years	Density
8	FE	Efficiency	%	Temperature	Monthly	C	100%	electronic	Duration of the project +5years	Efficiency determinate by the burning temp.
9	QDM	Supervision	--	---	Every Batch Disposed	E	100%	electronic	Duration of the project +5years	Sludge disposed outside project boundary
10	W <sub>site</sub>	Mass	kg	Average Animal weight	Quarterly	D	100%	electronic	Duration of the project +5years	Yearly methane potential generation
11	ER <sub>y,estimated</sub>	Mass	Ton	CO <sub>2</sub> e	Annually	C	100%	electronic	Duration of the project +5years	Yearly methane potential generation
12	FFR	-----	---	Feed Formulation	Monthly	D	100%	electronic	project +5years	Feed Formulation Rations
13	P <sub>biogas</sub>	Pressure	mbar	Biogas Pressure	Monthly	M	100%	electronic	project +5years	Feed Formulation Rations
14	Genetic Source	Document	-----	genetic	Annually	D	100%	electronic	project +5years	Genetic Source
15	MS% <sub>i,y</sub>	fraction	%	Manure handled	Annually	E	100%	electronic	project +5years	General Site Inspection
16	FV <sub>RG,h</sub>	volume	m <sup>3</sup> /h	volume	Monthly	M	100%	electronic	project +5years	Volume of residual gas
17	fV <sub>CH<sub>4</sub>,RG</sub>	fraction	%	Methane content	TBD(*)	M	100%	electronic	Duration of the project +5years	Volumetric methane fraction of the residual gas
18	TM <sub>RG,h</sub>	mass	Kg/h	Mass flow rate	Monthly	M	100%	electronic	Duration of the project +5years	Total mass flow rate of the residual gas
19	N <sub>day,y</sub>	number	days	days	Monthly	M	100%	electronic	project +5years	Nr. Of days animal is alive
20	N <sub>p,y</sub>	number	heads	Nr of heads	Monthly	M	100%	electronic	Duration of the project +5years	Nr. Of heads per category annually
21	E	KWh	Kw	power	When consumed	M	100%	electronic	Duration of the project +5years	Electricity consumed in the project activity

(\*) TBD: to be determinate to attend 95% confidence level

The monitoring plan will concentrate on ensuring the emission reductions are accurately accounted within the project boundary.

Brascarbon introduce some formularies to facilitate the monitoring system of the parameters described in the table above – Monitoring Plan.

A list of the formularies utilized to the monitoring control can be found in the files at Brascarbon and available for verification.

The monitored data are described below:

**-Flare Temperature (Tf):** The monitored flare temperature is registered every minute and stored in the programmable logic control system – PLC. A “THERMOCOUPLE” installed in the flare measures and sends the temperature information to the PLC. The data is stored in the PLC and recovered by down loading the file through a pen drive connection. The file data is recovered monthly to calculate the Flare Efficiency.

The thermocouple is calibrated periodically according to the supplier requirements and followed by Brascarbon.

Formulary 01.001 concerns about the temperature monitoring process for each farm during the monitoring period. The flare temperature monitoring procedure, developed by BRASCARBON, was verified by DOE during verification process. Documents to prove the monitoring control process are available at BRASCARBON office and copies of all documentation were sent to DOE.

**-Site Inspection:** This annual procedure establishes the basic conditions for 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. All sites were inspected during verification period and no changes were observed. The Site inspection information was registered in formulary 02.001 and presented to DOE during verification process.

**- Average number of animals ( $N_{LT,y}$ ,  $N_{day,y}$  and  $N_{p,y}$ ):** To calculate the average number of animals per category LT in the year y ( $N_{LT,y}$ ) the operational procedure has the form 03.002 in the operational procedure POP 3 (average number of animals) where it takes into account of the number of days the animal is alive in the year y ( $N_{day,y}$ ) and the number of animals produced per category LT in the year y ( $N_{p,y}$ ).

The days of animals alive and the total animal produced is also monitored with the same procedure and the form 03.002.

The formula used to the calculation is:

$$N_{LT,y} = N_{da,y} * (N_{p,y}/365)$$

Where:

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

**-Biogas Volume ( $BG_{burnt,y}$ ):** The data is collected monthly using the formulary 04.001 field data collection.

The biogas flow rate is also registered every minute in the PLC - programmable logic control system. The flow rate data is stored in the PLC and recovered by down loading the file through a pen drive connection. The file data is recovered monthly and analyzed by QA/QC officer.



The flow meter is calibrated according to the supplier requirements and followed by Brascarbon. The flow meter used in the project is from ENDRESS+HAUSER, FLOW MONITOR, t- trend, ATT12-A99D314D1 MODEL, type: Thermal Mass Flow.

**-Methane Content ( $W_{CH_4,y}$  and  $FV_{CH_4RG,y}$ ):** The methane content is measured by the equipment BIOGAS from Landtech. To measure the methane content the BIOGAS equipment is connected to the digester and takes a biogas sample by pumping the biogas through a connection hose and after a few seconds the instrument informs the methane content in the equipment panel. This information is registered by the field technician in the formulary for field data collection 04.001. The monitoring frequency is monthly and it uses a portable digital analyzer (Landtech – Biogas portable model). The calibration system is in accordance to the supplier recommendations and followed by Brascarbon.

**-Biogas Temperature ( $T_{biogas}$ ):** The monitored biogas temperature is monthly using the portable digital analyzer (Biogas portable model from Landtech). The probe from the instrument is inserted into the digester to obtain the temperature of the biogas. After inserting the probe in the especial device in the digester the instrument BIOGAS takes a few seconds to inform the biogas temperature. This information is registered by the field technician in the formulary for field data collection 04.001. The calibration system of the instrument is in accordance to the supplier recommendations and followed by Brascarbon.

**-Methane Density ( $D_{CH_4}$ ):** The methane density is based in the Attachment 13 – Methodological “Tool to determine project emissions from flaring gases containing methane”, step 1, determination of the mass flow rate of the residual gas that is flared, equation 2 for density. The methane density ex-post will be adjusted in accordance to the local pressure and temperature. The frequency of methane density calculation is monthly.

**-Flare Efficiency (FE):** It is the efficiency of the methane destruction in the hour  $h$  in the measured temperature. The flare efficiency is 90% when the flare temperature is higher or equal to 500°C for more than 40 minutes for the respective hour. The flare efficiency is 0% when the flare temperature is less than 500°C for the respective hour or if the flare operation is out of specification.

The frequency of flare efficiency monitoring is hourly. Monthly is prepared the formulary 08.001 containing all information of the flare efficiency. The calculation of the flare efficiency uses the flare temperature data stored in the PLC. The data is stored in the PLC and recovered by downloading the file through a pen drive connection. The file data is recovered monthly to calculate the Flare Efficiency.

The information of the flare efficiency for each hour during 24 hours per day is registered in the formulary 08.001, flare efficiency monitoring control. This formulary is available for revision and verification at BRASCARBON office. Documents to prove the flare efficiency control for each farm were presented to DOE during verification process.

**- Digester Sludge Removal (QDM):** 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 project boundary. When the sludge is removed, the field technician will follow the procedure to certify that the sludge will spread aerobically in the field. This information is registered in the formulary 09.001 and it is available for revision and verification at Brascarbon office.

The sludge was not removed during verification period.

**- Animal weight (W<sub>site</sub>):** The animal weight is monitored and controlled by a formulary 16.001 where each animal category is monitored during the year, according to the information obtained in the confined feed animal operation.

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

**-Emission Reductions – ER<sub>y, ex-post</sub>:** The emission reductions achieved by the project activity will be calculated with ex-post monitored data through direct measurement of the amount of methane fuelled, flared or gainfully used. The equations can be found in the “emission reduction spreadsheet” and it is available for validation and verification.

The emission reductions achieved in any year are the lowest value of the following:

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

Where:

ER <sub>y,ex-post</sub>	Emission reductions achieved by the project activity based on monitored values for year y (tCO <sub>2</sub> e)
BE <sub>y ex post</sub>	Baseline emissions calculated using equation B1 and using ex post monitored values of NLT <sub>y</sub> for year y (tCO <sub>2</sub> e)
PE <sub>y, ex post</sub>	Project emissions calculated using equation B5 using ex post monitored values of NLT <sub>y</sub> , MS% <sub>i,y</sub> for year y (tCO <sub>2</sub> e)
MD <sub>y</sub>	Methane captured and destroyed or used gainfully by the project activity in year y (tCO <sub>2</sub> e)
PE <sub>power,y,ex post</sub>	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 <sub>2</sub> e)

**-Formulated feed rations (FFR):** Monitoring and controlling of the formulated feed rations used per animal category per confined feed animal operation.

Records available in the feed operations will be copied and filed at Brascarbon office and attached with the formulary 14.001 that controls the formulated feed rations for each farm.

**-Biogas Pressure (P<sub>biogas</sub>):** The biogas pressure is measured by the equipment BIOGAS from Landtech. To obtain the biogas pressure the BIOGAS equipment is connected to the digester trough a hose connection and after a few seconds after starting the instrument it informs the biogas pressure in its panel. This information is registered by the field technician in the formulary of field data collection 04.001.

The measured pressure obtained in all farms are less than 1 atm (or 1013 mbar) due all farms are located above sea level. The monitoring frequency is monthly.

The calibration system is in accordance to the supplier recommendations and followed by Brascarbon.

**-Genetic Source:** Monitoring and controlling of the genetic source in the project activity per farm.

Records available in the feed operations will be copied and filed at Brascarbon office and attached with the formulary 15.001 that controls the genetic source for each farm.

- **Fraction of manure handled (MS%<sub>i,y</sub>):** is included to be inspected during every farm visit. No changes in the manure managing system will be permitted during the project activity. If changes occur in the manure management the information has to be described in the formulary 02.001.

- **Methane mass flow rate in the residual gas (TM<sub>RG,h</sub>):**

$$TM_{RG,h} = FV_{RG,h} * fv_{yCH4,RG,h} * \rho_{CH4,n}$$

TM <sub>RG,h</sub>	Mass flow rate of methane in the residual gas in the hour <i>h</i> (Kg/h)
FV <sub>RG,h</sub>	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour <i>h</i> (m <sup>3</sup> /h)
fv <sub>CH4,RG,h</sub>	Volumetric fraction of methane in the residual gas on dry basis in hour <i>h</i> (fraction).
ρ <sub>CH4,n</sub>	Density of methane at normal conditions (0.716)(Kg/m <sup>3</sup> )

- **Volumetric flow rate of the residual gas (FV<sub>RG,h</sub>) (m<sup>3</sup>/h):**

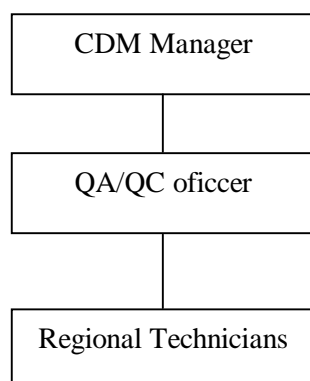
The volumetric flow rate is calculated dividing the total volume measured (BG<sub>burnt,y</sub>) in the period by the total hours of measurement.

$$FV_{RG,h} = BG_{burnt,y} / \text{total hours},y$$

- **Energy consumed from the grid by the project (E) (kwh):**

The entire project will not use energy from the grid. The eventual use of energy will be monitored and registered in the formulary 22.001 by the regional technician

The organizational structure for this monitoring system is:



**CDM Manager:** Engineer, responsible for the CDM operations and approval of the documents.

**Regional Technicians:** Technician, responsible for the monitoring and maintenance of the site projects according to the procedures in the Operations Procedure Manual.

For maintenance of the equipment to attend the monitoring system, BRASCARBON will use the practices recommended by the equipment supplier for repairs, calibration, etc...

Regular maintenance of the site considering the site area, instrumentation, equipment, cleaning etc., according to the Brascarbon Operation Procedures Manual

**Quality Assurance/Quality Control officer:** Responsible to assure the quality control of the information and the CDM project documents and also prepares the monitoring report. Also controls and checks all certificates of calibration and its expiration date and prepares all documents related to the CDM project for further validation and verification.

## **SECTION D. Data and parameters**

### **D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors**

<b>Data / Parameter:</b>	<i>VS default</i>
Data 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 used:	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
Value(s) :	0.3 for Market Swine 0,46 for Breeding Swine 0,46 for Guilts
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-----

<b>Data / Parameter:</b>	MCF <sub>j</sub>
Data unit:	%
Description:	Annual methane conversion factor for the baseline animal waste management system “j”.
Source of data used:	Obtained from IPCC2006, vol 4, chapter 10, Tables 10.17.
Value(s) :	79%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-----

<b>Data / Parameter:</b>	MS%Bl, <sub>j</sub>
Data unit:	Fraction
Description:	Fraction of manure handled in baseline animal manure management system “j”.
Source of data used:	Project proponents
Value(s) :	1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-----

<b>Data / Parameter:</b>	<b>GWP<sub>CH4</sub></b>
Data unit:	tCO <sub>2</sub> e/tCH <sub>4</sub>
Description:	Global warming potential of CH <sub>4</sub>
Source of data used:	IPCC 2006
Value(s) :	21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions and Project emissions
Additional comment:	-----

<b>Data / Parameter:</b>	<b>B<sub>0,LT</sub></b>
Data unit:	m <sup>3</sup> CH <sub>4</sub> /kg dm
Description:	Maximum methane producing potential of the volatile solid generated for animal type "LT".
Source of data used:	IPCC 2006, Tables 10-A7 and 10-A8.
Value(s) :	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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-----

<b>Data / Parameter:</b>	<b>W<sub>default</sub></b>
Data unit:	Kg
Description:	Default average animal weight of a defined population at the project site.
Source of data used:	IPCC 2006, Tables 10-A7 and 10-A8.
Value(s) :	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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-----

<b>Data / Parameter:</b>	<b>D<sub>CH4</sub></b>
Data unit:	t/m <sup>3</sup> at room temperature
Description:	Methane Density
Source of data used:	IPCC - 2006
Value(s) :	0.00067
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-----

<b>Data / Parameter:</b>	UF <sub>b</sub>
Data unit:	No unit applied
Description:	Model correction factor to account for model uncertainties
Source of data used:	Reference: FCCC/SBSTA/2003/10/Add.2, page 25.
Value(s) :	0.94
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-----

## D.2. Data and parameters monitored

Data / Parameter:	T f																																																																																																				
Data unit:	°C																																																																																																				
Description:	Combustion temperature of the flare																																																																																																				
Measured /Calculated /Default:	Measured																																																																																																				
Source of data:	Brascarbon Monitoring Report System																																																																																																				
Value(s) of monitored parameter:	Above 500°C																																																																																																				
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions																																																																																																				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<table><tr><th>Farm Name</th><th>Site ID</th><th>Termocouple Serial Number</th><th>Installation Date</th><th>Expiration Date</th></tr><tr><td>Lote 28 e 27</td><td>BCA-039MS1-05</td><td>TM-14492/6 021/10-6</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Lote 55 e 54</td><td>BCA-034MS1-05</td><td>TM-14492/7 021/10-7</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Lote 71</td><td>BCA-037MS1-05</td><td>TM-14492/5 021/10-5</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Lote 82</td><td>BCA-038MS1-05</td><td>TM-14492/11 021/10-10</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Lote 101</td><td>BCA-036MS1-05</td><td>TM 15036/9 062/10-5</td><td>11/05/09 17/05/10</td><td>15/06/10 14/05/12</td></tr><tr><td>Lote 105</td><td>BCA-035MS1-05</td><td>TM-14492/15 021/10-14</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Bela Vista</td><td>BCA-040MS1-05</td><td>TM-14492/2 021/10-2</td><td>09/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Cachoeira</td><td>BCA-042MS1-05</td><td>TM-14492/14 021/10-13</td><td>09/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Dragão</td><td>BCA-032MS1-05</td><td>TM-14502/01 021/10-17</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Sorgatto</td><td>BCA-046MS1-05</td><td>TM-14492/16 021/10-15</td><td>09/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Bambú - Quinhão A</td><td>BCA-051MS1-05</td><td>TM-14492/4 021/10-4</td><td>10/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Folleto</td><td>BCA-052MS1-05</td><td>TM-14492/12 021/10-11</td><td>09/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Agua Branca</td><td>BCA-030MS1-05</td><td>TM-14492/3 021/10-3</td><td>10/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Rodeio - Gleba C</td><td>BCA-031MS1-05</td><td>TM-14492/01-13 021/10-12</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Granja Serra Dourada</td><td>BCA-041MS1-05</td><td>TM-14492/9 021/10-8</td><td>11/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Granja Capivara</td><td>BCA-043MS1-05</td><td>TM-15036/16 062/10-10</td><td>09/05/09 17/05/10</td><td>15/06/10 14/05/12</td></tr><tr><td>Fazenda Santa Catarina</td><td>BCA-047MS1-05</td><td>TM-14492/17 021/10-16</td><td>10/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr><tr><td>Fazenda Ponte Vermelha</td><td>BCA-068MS1-05</td><td>TM-14492/10 021/10-9</td><td>10/05/09 23/03/10</td><td>01/04/10 20/03/12</td></tr></table> <p>Thermocouple From MAFS Type: TCK – 10X150 mm</p>						Farm Name	Site ID	Termocouple Serial Number	Installation Date	Expiration Date	Lote 28 e 27	BCA-039MS1-05	TM-14492/6 021/10-6	11/05/09 23/03/10	01/04/10 20/03/12	Lote 55 e 54	BCA-034MS1-05	TM-14492/7 021/10-7	11/05/09 23/03/10	01/04/10 20/03/12	Lote 71	BCA-037MS1-05	TM-14492/5 021/10-5	11/05/09 23/03/10	01/04/10 20/03/12	Lote 82	BCA-038MS1-05	TM-14492/11 021/10-10	11/05/09 23/03/10	01/04/10 20/03/12	Lote 101	BCA-036MS1-05	TM 15036/9 062/10-5	11/05/09 17/05/10	15/06/10 14/05/12	Lote 105	BCA-035MS1-05	TM-14492/15 021/10-14	11/05/09 23/03/10	01/04/10 20/03/12	Fazenda Bela Vista	BCA-040MS1-05	TM-14492/2 021/10-2	09/05/09 23/03/10	01/04/10 20/03/12	Fazenda Cachoeira	BCA-042MS1-05	TM-14492/14 021/10-13	09/05/09 23/03/10	01/04/10 20/03/12	Fazenda Dragão	BCA-032MS1-05	TM-14502/01 021/10-17	11/05/09 23/03/10	01/04/10 20/03/12	Fazenda Sorgatto	BCA-046MS1-05	TM-14492/16 021/10-15	09/05/09 23/03/10	01/04/10 20/03/12	Fazenda Bambú - Quinhão A	BCA-051MS1-05	TM-14492/4 021/10-4	10/05/09 23/03/10	01/04/10 20/03/12	Fazenda Folleto	BCA-052MS1-05	TM-14492/12 021/10-11	09/05/09 23/03/10	01/04/10 20/03/12	Fazenda Agua Branca	BCA-030MS1-05	TM-14492/3 021/10-3	10/05/09 23/03/10	01/04/10 20/03/12	Fazenda Rodeio - Gleba C	BCA-031MS1-05	TM-14492/01-13 021/10-12	11/05/09 23/03/10	01/04/10 20/03/12	Granja Serra Dourada	BCA-041MS1-05	TM-14492/9 021/10-8	11/05/09 23/03/10	01/04/10 20/03/12	Granja Capivara	BCA-043MS1-05	TM-15036/16 062/10-10	09/05/09 17/05/10	15/06/10 14/05/12	Fazenda Santa Catarina	BCA-047MS1-05	TM-14492/17 021/10-16	10/05/09 23/03/10	01/04/10 20/03/12	Fazenda Ponte Vermelha	BCA-068MS1-05	TM-14492/10 021/10-9	10/05/09 23/03/10	01/04/10 20/03/12
Farm Name	Site ID	Termocouple Serial Number	Installation Date	Expiration Date																																																																																																	
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Lote 55 e 54	BCA-034MS1-05	TM-14492/7 021/10-7	11/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Lote 71	BCA-037MS1-05	TM-14492/5 021/10-5	11/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
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Fazenda Bela Vista	BCA-040MS1-05	TM-14492/2 021/10-2	09/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Cachoeira	BCA-042MS1-05	TM-14492/14 021/10-13	09/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Dragão	BCA-032MS1-05	TM-14502/01 021/10-17	11/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Sorgatto	BCA-046MS1-05	TM-14492/16 021/10-15	09/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Bambú - Quinhão A	BCA-051MS1-05	TM-14492/4 021/10-4	10/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Folleto	BCA-052MS1-05	TM-14492/12 021/10-11	09/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Agua Branca	BCA-030MS1-05	TM-14492/3 021/10-3	10/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Rodeio - Gleba C	BCA-031MS1-05	TM-14492/01-13 021/10-12	11/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Granja Serra Dourada	BCA-041MS1-05	TM-14492/9 021/10-8	11/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Granja Capivara	BCA-043MS1-05	TM-15036/16 062/10-10	09/05/09 17/05/10	15/06/10 14/05/12																																																																																																	
Fazenda Santa Catarina	BCA-047MS1-05	TM-14492/17 021/10-16	10/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Fazenda Ponte Vermelha	BCA-068MS1-05	TM-14492/10 021/10-9	10/05/09 23/03/10	01/04/10 20/03/12																																																																																																	
Measuring/ Reading/ Recording frequency:	Every minute																																																																																																				
Calculation method (if applicable):	N/A																																																																																																				
QA/QC procedures applied:	Check the data for more accurate information.																																																																																																				

<b>Data / Parameter:</b>	SITE INSPECTION
Data unit:	Documents
Description:	Inspection on the site considering relevant regulation and the infra-structure of the site
Measured /Calculated /Default:	Brascarbon Monitoring Report System
Source of data:	Documents
Value(s) of monitored parameter:	N/A
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	N/A
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check of the monitoring documents prepared during the site visit

<b>Data / Parameter:</b>	$N_{LT,y}$
Data unit:	Number
Description:	Annual average number of animals of type “LT” in year “y”
Measured /Calculated /Default:	Measured
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	Number of heads
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	$N_{LT,y} = N_{da,y} * (N_{p,y}/365)$ <p>Where:  <math>N_{da,y}</math> =Number of days animal is alive in the farm in the year “y” (numbers)  <math>N_{p,y}</math> =Number of animals produced annually of type “LT” for the year “y” (numbers)</p>
QA/QC procedures applied:	Check of the site records and documents.

<b>Data / Parameter:</b>	$N_{\text{day,y}}$
Data 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
Value(s) of monitored parameter:	Number of days
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check of the site records and documents.

<b>Data / Parameter:</b>	$N_{\text{p,y}}$
Data 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
Value(s) of monitored parameter:	Number of heads
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check of the site records and documents.



Data / Parameter:	BG burnt,y					
Data unit:	m <sup>3</sup>					
Description:	Biogas flared or used as a fuel in the year y.					
Measured /Calculated /Default:	Measured					
Source of data:	Brascarbon Monitoring Report System					
Value(s) of monitored parameter:	to be measured during the monitoring period					
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions					
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Farm Name	Site ID	Flow meter Serial Number	Installation Date	Expiration Date	
	Lote 28 e 27	BCA-039MS1-05	A700583412A	11/05/09	11/05/11	
	Lote 55 e 54	BCA-034MS1-05	A700613412A	11/05/09	11/05/11	
	Lote 71	BCA-037MS1-05	A700633412A	11/05/09	11/05/11	
	Lote 82	BCA-038MS1-05	A700683412A	11/05/09	11/05/11	
	Lote 101	BCA-036MS1-05	A700663412A	11/05/09	11/05/11	
	Lote 105	BCA-035MS1-05	A700753412A	11/05/09	11/05/11	
	Fazenda Bela Vista	BCA-040MS1-05	A700553412A	09/05/09	09/05/11	
	Fazenda Cachoeira	BCA-042MS1-05	A700623412A	09/05/09	09/05/11	
	Fazenda Dragão	BCA-032MS1-05	A700693412A	11/05/09	11/05/11	
	Fazenda Sorgatto	BCA-046MS1-05	A700833412A	09/05/09	09/05/11	
	Fazenda Bambú - Quinhão A	BCA-051MS1-05	A700713412A	10/05/09	10/05/11	
	Fazenda Folleto	BCA-052MS1-05	A700573412A	09/05/09	09/05/11	
	Fazenda Rodeio - Gleba C	BCA-031MS1-05	A700703412A	11/05/09	11/05/11	
	Fazenda Agua Branca	BCA-030MS1-05	A700743412A	10/05/09	10/05/11	
	Granja Serra Dourada	BCA-041MS1-05	A700643412A	11/05/09	11/05/11	
	Granja Capivara	BCA-043MS1-05	A700563412A	09/05/09	09/05/11	
	Fazenda Santa Catarina	BCA-047MS1-05	A700593412A	10/05/09	10/05/11	
	Fazenda Ponte Vermelha	BCA-068MS1-05	A700653412A	10/05/09	10/05/11	
	From Endress+Hausaer Supplier Model ATT12-A99D31A4D1 Type: Thermal Mass Flow Frequency of calibration: every two years					
	Measuring/ Reading/ Recording frequency:	Monthly				
	Calculation method (if applicable):	N/A				
	QA/QC procedures applied:	Check the registers sent from the field. Control and assure the calibration program of the flow meter according manufacture recommendation.				

<b>Data / Parameter:</b>	W <sub>CH<sub>4</sub>,y</sub>
Data unit:	Fraction
Description:	Methane content in biogas in the year “y”
Measured /Calculated /Default:	Measured
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	To be measured during the monitoring period.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<b>Biogas Analyser</b>				
	Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Date	Expiration Date
	Lote 28 e 27	BCA-039MS1-05			
	Lote 55 e 54	BCA-034MS1-05			
	Lote 101	BCA-035MS1-05	BM 11042	20/02/09	20/08/09
	Lote 105	BCA-036MS1-05	BM 11043	28/09/09	28/03/10
	Lote 71	BCA-037MS1-05	BM 11043	29/03/10	29/09/10
	Lote 82	BCA-038MS1-05	BM 11043	02/08/10	01/02/11
	Fazenda Bela Vista	BCA-040MS1-05	BM 11043	23/10/10	22/04/11
	Fazenda Cachoeira	BCA-042MS1-05			
	Fazenda Dragão	BCA-032MS1-05			
	Fazenda Sogatto	BCA-046MS1-05			
	Fazenda Bambu –Quinhão A	BCA-051MS1-05			
	Fazenda Folleto	BCA-052MS1-05			
	Fazenda Rodeio – Gleba C	BCA-031MS1-05			
	Fazenda Agua Branca	BCA-030MS1-05			
	Granja Serra Dourada	BCA-041MS1-05			
	Granja Capivara	BCA-043MS1-05			
	Fazenda Santa Catarina	BCA-047MS1-05			
	Fazenda Ponte Vermelha	BCA-068MS1-05			
	Name: BIOGAS CDM				
	Supplier: Landtec System				
	Model: Biogas Portable:				
Measuring/ Reading/ Recording frequency:	Monthly				
Calculation method (if applicable):	N/A				
QA/QC procedures applied:	Check the registers in the generated documents. Control and assure the calibration program of the instrument.				

Data / Parameter:	T <sub>biogas</sub>							
Data unit:	°C							
Description:	Temperature of the biogas at ambient conditions							
Measured /Calculated /Default:	Measured							
Source of data:	Brascarbon Monitoring Report System							
Value(s) of monitored parameter:	According to the biogas conditions.							
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions							
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Biogas Analyser							
	Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Date	Expiration Date			
	Lote 28 e 27	BCA-039MS1-05	BM 11042 BM 11043 BM 11043 BM 11043	20/02/09 28/09/09 29/03/10 02/08/10	20/08/09 28/03/10 29/09/10 01/02/11			
	Lote 55 e 54	BCA-034MS1-05						
	Lote 101	BCA-035MS1-05						
	Lote 105	BCA-036MS1-05						
	Lote 71	BCA-037MS1-05	BM 11043	23/10/10	22/04/11			
	Lote 82	BCA-038MS1-05						
	Fazenda Bela Vista	BCA-040MS1-05						
	Fazenda Cachoeira	BCA-042MS1-05						
	Fazenda Dragão	BCA-032MS1-05						
	Fazenda Sorgatto	BCA-046MS1-05						
	Fazenda Bambú –Quinhão A	BCA-051MS1-05						
	Fazenda Folleto	BCA-052MS1-05						
	Fazenda Rodeio – Gleba C	BCA-031MS1-05						
	Fazenda Agua Branca	BCA-030MS1-05						
	Granja Serra Dourada	BCA-041MS1-05						
	Granja Capivara	BCA-043MS1-05						
	Fazenda Santa Catarina	BCA-047MS1-05						
	Fazenda Ponte Vermelha	BCA-068MS1-05						
	Name: BIOGAS CDM							
	Supplier: Landtec System							
	Model: Biogas Portable							
	Measuring/ Reading/ Recording frequency:	Monthly						

Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check the registers in the generated documents. Control and assure the calibration program of the instrument.

<b>Data / Parameter:</b>	$D_{CH_4,y}$
Data unit:	tones / m <sup>3</sup>
Description:	Density of the methane combusted at room temperature and pressure
Measured /Calculated /Default:	Calculated
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	Determined according the temperature and pressure of biogas
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	$D_{CH_4,y} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} \times T_n}$ <p> <math>D_{CH_4,y}</math>: Density of methane in the biogas kg/m<sup>3</sup>  <math>P_n</math>: Pressure of biogas (Pascal)  <math>R_u</math>: Universal Gas Constant (8314 Pa.m<sup>3</sup>/Kmol K)  <math>MM_{RG,h}</math>: Molecular mass of methane (16.04 kg / mol) </p>
QA/QC procedures applied:	Check and verify the density value calculation.

<b>Data / Parameter:</b>	FE
Data unit:	%
Description:	Flare Efficiency
Measured /Calculated /Default:	Calculated
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	If hourly temperature $\geq 500^{\circ}\text{C}$ - 90% efficiency If hourly temperature $< 500^{\circ}\text{C}$ - 0% efficiency
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Hourly
Calculation method (if applicable):	$\text{FE} = \frac{\sum H(\text{temp} \geq 500^{\circ}\text{C})}{H_t} * 0,9 * 100$ <p><b>FE:</b> Flare efficiency in 90% for the total of operational hours in the operational period, in %  <b>H(temp<math>\geq 500^{\circ}\text{C}</math>)</b> : Sum of hours total in the measured period in which the temperature is higher or equal to <math>500^{\circ}\text{C}</math> for longer than 40 minutes.  <b>Ht:</b> Total of hours in the measured period</p>
QA/QC procedures applied:	Check the registers in the generated documents.

<b>Data / Parameter:</b>	$Q_{DM}$
Data unit:	N/A
Description:	Sludge soil application
Measured /Calculated /Default:	N/A
Source of data:	Site inspection check list.
Value(s) of monitored parameter:	N/A
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	N/A
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Every Batch Disposed.
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check the registers in the generated documents.

<b>Data / Parameter:</b>	Wsite
Data unit:	Kg
Description:	Average animal weight of a defined livestock population at the project site in year
Measured /Calculated /Default:	Measured
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	Checking data and records in the confined feed animal operation
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check of the site records and documents

<b>Data / Parameter:</b>	$ER_{y,ex-post}$
Data unit:	Ton CO <sub>2</sub> e
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
Value(s) of monitored parameter:	To be determined according to the measured data.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	$ER_{y,ex-post} = \min[(BE_{y,ex-post} - PE_{y,ex-post}), (MD_y - PE_{power,y,ex-post})]$ <p><b>Where:</b>  <math>ER_{y,ex-post}</math> = Emission reductions achieved by the project activity based on monitored values for year y (tCO<sub>2</sub>e)  <math>BE_{y,ex-post}</math> = Baseline emissions calculated using equation B1 and using ex post monitored values of NLT,y for year y (tCO<sub>2</sub>e)  <math>PE_{y,ex-post}</math> = Project emissions calculated using equation B5 using ex post monitored values of NLT,y,MS% i,y for year y (tCO<sub>2</sub>e)  <math>MD_y</math> = Methane captured and destroyed or used gainfully by the project activity in year y (tCO<sub>2</sub>e)  <math>PE_{power,y,ex-post}</math> = 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<sub>2</sub>e)</p>
QA/QC procedures applied:	Check the registers in the generated documents.

<b>Data / Parameter:</b>	FFR
<b>Data unit:</b>	No data unit applied
<b>Description:</b>	Formulated feed rations
<b>Measured /Calculated /Default:</b>	N/A
<b>Source of data:</b>	Brascarbon Monitoring Report System
<b>Value(s) of monitored parameter:</b>	Check data and documents in the confined feed animal operation
<b>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</b>	N/A
<b>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</b>	N/A
<b>Measuring/ Reading/ Recording frequency:</b>	Monthly
<b>Calculation method (if applicable):</b>	N/A
<b>QA/QC procedures applied:</b>	Check the registers and/or food purchases records on the farm.

Data / Parameter:	P <sub>biogas</sub>					
Data unit:	mbar					
Description:	Pressure of the biogas					
Measured /Calculated /Default:	Measured					
Source of data:	Brascarbon Monitoring Report System					
Value(s) of monitored parameter:	Values obtained from measurement with portable local pressure instrument BIOGAS.					
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions					
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Biogas Analyser					
	Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Date	Expiration Date	
	Lote 28 e 27	BCA-039MS1-05				
	Lote 55 e 54	BCA-034MS1-05				
	Lote 101	BCA-035MS1-05	BM 11042	20/02/09	20/08/09	
	Lote 105	BCA-036MS1-05	BM 11043	28/09/09	28/03/10	
	Lote 71	BCA-037MS1-05	BM 11043	29/03/10	29/09/10	
	Lote 82	BCA-038MS1-05	BM 11043	02/08/10	01/02/11	
	Fazenda Bela Vista	BCA-040MS1-05	BM 11043	23/10/10	22/04/11	
	Fazenda Cachoeira	BCA-042MS1-05				
	Fazenda Dragão	BCA-032MS1-05				
	Fazenda Sorgatto	BCA-046MS1-05				
	Fazenda Bambú –Quinhão A	BCA-051MS1-05				
	Fazenda Folleto	BCA-052MS1-05				
	Fazenda Rodeio – Gleba C	BCA-031MS1-05				
	Fazenda Agua Branca	BCA-030MS1-05				
	Granja Serra Dourada	BCA-041MS1-05				
	Granja Capivara	BCA-043MS1-05				
	Fazenda Santa Catarina	BCA-047MS1-05				
	Fazenda Ponte Vermelha	BCA-068MS1-05				
	Name: BIOGAS CDM					
	Supplier: Landtec System					
	Model: Biogas Portable					
	Measuring/ Reading/	Monthly				

Recording frequency:	
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check the registers in the generated documents. Control and assure the calibration program of the instrument.

<b>Data / Parameter:</b>	GENETIC SOURCE
Data unit:	No data unit applied
Description:	Genetic source from annex I party
Measured /Calculated /Default:	N/A
Source of data:	Check data and documents in the confined feed animal operation
Value(s) of monitored parameter:	Western Europe
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check data on records of farm operation.

<b>Data / Parameter:</b>	MS% i,y
Data unit:	Fraction
Description:	Fraction of manure handled in project emissions in system “i”, year “y”.
Measured /Calculated /Default:	Measured
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A

applicable):	
QA/QC procedures applied:	Check of generated documents.

<b>Data / Parameter:</b>	$TM_{RG,h}$
Data unit:	Kg/h
Description:	Mass flow rate of methane in the residual gas in the hour h
Measured /Calculated /Default:	Calculated
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	To be calculated during the monitoring period
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	To be calculated according to the operational procedure. POP 17 includes the instruction to the calculation
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	$TM_{RG,h} = FV_{RG,h} * fv_{CH_4, RG,h} * 0,716$ <p>Where:  <math>FV_{RG,h}</math> : Biogas volume burned in the total monitored hours  <math>fv_{CH_4, RG,h}</math> : Volumetric fraction of methane (monitored value).</p> <p>0,716: Density of methane in normal conditions 9 default value indicated in EB 28, ANNEX 13, "Tool to determine project emissions from flaring gases containing methane", Page 9.</p>
QA/QC procedures applied:	Check the data and the calculation of the parameter.

<b>Data / Parameter:</b>	$FV_{RG,h}$
Data unit:	$m^3/h$
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h
Measured /Calculated /Default:	Calculated
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	To be calculated during the monitoring period.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions



Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Farm Name	Site ID	Flow meter Serial Number	Installation Date	Expiration Date
	Lote 28 e 27	BCA-039MS1-05	A700583412A	11/05/09	11/05/11
	Lote 55 e 54	BCA-034MS1-05	A700613412A	11/05/09	11/05/11
	Lote 71	BCA-037MS1-05	A700633412A	11/05/09	11/05/11
	Lote 82	BCA-038MS1-05	A700683412A	11/05/09	11/05/11
	Lote 101	BCA-036MS1-05	A700663412A	11/05/09	11/05/11
	Lote 105	BCA-035MS1-05	A700753412A	11/05/09	11/05/11
	Fazenda Bela Vista	BCA-040MS1-05	A700553412A	09/05/09	09/05/11
	Fazenda Cachoeira	BCA-042MS1-05	A700623412A	09/05/09	09/05/11
	Fazenda Dragão	BCA-032MS1-05	A700693412A	11/05/09	11/05/11
	Fazenda Sorqatto	BCA-046MS1-05	A700833412A	09/05/09	09/05/11
	Fazenda Bambú - Quinhão A	BCA-051MS1-05	A700713412A	10/05/09	10/05/11
	Fazenda Folleto	BCA-052MS1-05	A700573412A	09/05/09	09/05/11
	Fazenda Rodeio - Gleba C	BCA-031MS1-05	A700703412A	11/05/09	11/05/11
	Fazenda Agua Branca	BCA-030MS1-05	A700743412A	10/05/09	10/05/11
	Granja Serra Dourada	BCA-041MS1-05	A700643412A	11/05/09	11/05/11
	Granja Capivara	BCA-043MS1-05	A700563412A	09/05/09	09/05/11
	Fazenda Santa Catarina	BCA-047MS1-05	A700593412A	10/05/09	10/05/11
	Fazenda Ponte Vermelha	BCA-068MS1-05	A700653412A	10/05/09	10/05/11
	From Endress+Hausaer Supplier Model ATT12-A99D31A4D1 Type: Thermal Mass Flow Frequency of calibration: every two years				
Measuring/ Reading/ Recording frequency:	Monthly				
Calculation method (if applicable):	$FV_{RG,h} = BG_{burnt,y} / \text{Total hours}$ <p>Where:</p> <p><math>BG_{burnt,y}</math> : Biogas flared or used as a fuel in the year y.</p>				
QA/QC procedures applied:	Check the data and the calculation of the parameter.				

Data / Parameter:	fV <sub>CH4,RG</sub>						
Data unit:	Fraction						
Description:	Volumetric fraction of methane content in the residual gas on dry basis measured as 95% confidence level.						
Measured /Calculated /Default:	Measured						
Source of data:	Brascarbon Monitoring Report System						
Value(s) of monitored parameter:	To be measured during the monitoring period						
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions						
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Biogas Analyser						
	Farm Name	Site ID	Biogas Analyser Serial Number	Calibration Date	Expiration Date		
	Lote 28 e 27	BCA-039MS1-05	BM 11042 BM 11043 BM 11043 BM 11043 BM 11043	20/02/09 28/09/09 29/03/10 02/08/10 23/10/10	20/08/09 28/03/10 29/09/10 01/02/11 22/04/11		
	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					
	Fazenda Bela Vista	BCA-040MS1-05					
	Fazenda Cachoeira	BCA-042MS1-05					
	Fazenda Dragao	BCA-032MS1-05					
	Fazenda Sorqatto	BCA-046MS1-05					
	Fazenda Bambú –Quinhão A	BCA-051MS1-05					
	Fazenda Folleto	BCA-052MS1-05					
	Fazenda Rodeio – Gleba C	BCA-031MS1-05					
	Fazenda Agua Branca	BCA-030MS1-05					
	Granja Serra Dourada	BCA-041MS1-05					
	Granja Capivara	BCA-043MS1-05					
	Fazenda Santa Catarina	BCA-047MS1-05					
	Fazenda Ponte Vermelha	BCA-068MS1-05					
	Name: BIOGAS CDM						

	Supplier: Landtec System Model: Biogas Portable
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check of generated documents.

<b>Data / Parameter:</b>	E
Data unit:	Kwh
Description:	Electricity consumed from the grid by the project
Measured /Calculated /Default:	Measured
Source of data:	Brascarbon Monitoring Report System
Value(s) of monitored parameter:	0 Kwh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Check of generated documents.

## SECTION E. Emission reductions calculation

### E.1. Baseline emissions calculation

The baseline emission can be calculated as follows:

#### **Equation 1**

$$BE_y = GWP_{CH_4} * D_{CH_4} * UFB * \sum MCF_j * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j}$$

Where:

$BE_y$  Baseline emissions in year “y” (tCO<sub>2</sub>e)

$GWP_{CH_4}$  Global Warming Potential (GWP) of CH<sub>4</sub> (21)

$D_{CH_4}$  CH<sub>4</sub> density (0.00067 t/m<sup>3</sup> at room temperature (20 °C) and 1 atm pressure).

$LT$  Index for all types of livestock

$j$  Index for animal waste management system

$MCF_j$	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 <sup>3</sup> CH <sub>4</sub> /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)
$MS\%_{0Bl,j}$	Fraction of manure handled in baseline animal manure management system “j”
$UF_b$	Model correction factor to account for model uncertainties (0.94)

Where:

(A)  $VS_{LT,y}$  can be determinate by scaling default IPCC values to adjust for a site-specific average animal weight.

### **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.

And,

(B)  $N_{LT,y}$  , the annual average number of animals can be determinate as follows:

### **Equation 3**

$$N_{LT,y} = N_{da,y} * (N_{p,y}/365)$$

Where:

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

The following table summarized the Baseline emissions. The spreadsheet of the baseline emissions calculation is available for verification.

Table E1. Baseline Emissions

Baseline Emissions BE <sub>y</sub> (ton CO <sub>2</sub> e)		
Site Name	Site ID	Period from 21 August 2010 to 31 January 2011
Lote 27 / 28	BCA-039MS1-05	1.550
Lote 55 / 54	BCA-034MS1-05	1.213
Lote 71	BCA-037MS1-05	1.046
Lote 82	BCA-038MS1-05	633
Lote 101	BCA-035MS1-05	999
Lote 105	BCA-036MS1-05	786
Fazenda Bela Vista	BCA-040MS1-05	2.456
Fazenda Cachoeira	BCA-042MS1-05	3.313
Fazenda Dragão	BCA-032MS1-05	1.151
Fazenda Sorgatto	BCA-046MS1-05	1.911
Faz. Bambú - Quinhão A	BCA-051MS1-05	1.842
Faz. Folleto	BCA-052MS1-05	1.446
Faz. Rodeio - Gleba C	BCA-031MS1-05	1.635
Faz. Água Branca	BCA-030MS1-05	1.272
Granja Serra Dourada	BCA-041MS1-05	2.287
Granja Capivara	BCA-043MS1-05	2.025
Faz. Santa Catarina	BCA-047MS1-05	2.708
Faz. Ponte Vermelha	BCA-068MS1-05	633
<b>Total BE<sub>y</sub> - in ton CO<sub>2</sub>e</b>		<b>28.906</b>

## E.2. Project emissions calculation

According to the simplified baseline and monitoring methodology for a small-scale CDM project Type-III (AMS-III.D – version 14), 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<sub>2</sub> emissions using fossil fuels or electricity for the operation of all the installed facilities ( $PE_{power,y}$ ).

### Equation 4

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

Where:

- $PE_y$  Project emissions in year “y” (tCO<sub>2</sub>e)
- $PE_{PL,y}$  Emissions due to physical leakage of biogas in year “y” (tC.O<sub>2</sub>e)
- $PE_{flare,y}$  Emissions from flaring or combustion of the biogas stream in the year “y” (tCO<sub>2</sub>e)
- $PE_{power,y}$  Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year “y” (tCO<sub>2</sub>e)

**(A) Emissions due to physical leakage of biogas can be determinate as follows:****Equation 5**

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

Where:

$PE_{PL,y}$	Emissions due to physical leakage of biogas in year “y” (tCO <sub>2</sub> e)
$GWP_{CH4}$	Global Warming Potential (GWP) of CH <sub>4</sub> (21)
$D_{CH4}$	CH <sub>4</sub> density (0.00067 t/m <sup>3</sup> at room temperature (20 °C) and 1 atm pressure).
$LT$	Index for all types of livestock
$J$	Index for animal waste management system
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type “LT” (m <sup>3</sup> CH <sub>4</sub> /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)
$MS\%_{i,y}$	Fraction of manure handled in system “i” in year “y”

**(B) Emissions from flaring determinate as follows:****Equation 6**

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} * (1 - \eta_{flare,h}) * GWP_{CH4} / 1000$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y, tCO <sub>2</sub> e
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h , kg/h
$GWP_{CH4}$	Global Warming Potential of methane valid for the commitment period, tCO <sub>2</sub> e/tCH <sub>4</sub>
$\eta_{flare,h}$	Flare efficiency in the hour h

**Equation 7**

$$TM_{RG,h} = FV_{RG,h} * fV_{CH4,RG,h} * 0,716$$

Where:

$FV_{RG,h}$  : Biogas volume burned in the total monitored hours  
 $fV_{CH4,RG,h}$  : Volumetric fraction of methane (monitored value).  
 0,716: Density of methane in normal condtions 9 default value indicated in EB 28, ANNEX 13,  
 "Tool to determine project emissions from flaring gases containing methane", Page 9.

**(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.

### E.3. Leakage calculation

According to the simplified baseline and monitoring methodology AMS-III.D - version 14, no leakage calculation is required.

The following table summarized the Project emissions. The spreadsheet of the Project emissions calculation is available for verification.

Table E2. Project Emissions

Project Emissions (PE <sub>y,ex-post</sub> ) (ton CO <sub>2</sub> e)		
Site Name	Site ID	Period from 21 August 2010 to 31 January 2011
Lote 27 / 28	BCA-039MS1-05	373
Lote 55 / 54	BCA-034MS1-05	299
Lote 71	BCA-037MS1-05	267
Lote 82	BCA-038MS1-05	177
Lote 101	BCA-035MS1-05	250
Lote 105	BCA-036MS1-05	198
Fazenda Bela Vista	BCA-040MS1-05	655
Fazenda Cachoeira	BCA-042MS1-05	806
Fazenda Dragão	BCA-032MS1-05	331
Fazenda Sorgatto	BCA-046MS1-05	465
Faz. Bambú - Quinhão A	BCA-051MS1-05	484
Faz. Folleto	BCA-052MS1-05	388
Faz. Rodeio - Gleba C	BCA-031MS1-05	395
Faz. Água Branca	BCA-030MS1-05	392
Granja Serra Dourada	BCA-041MS1-05	627
Granja Capivara	BCA-043MS1-05	527
Faz. Santa Catarina	BCA-047MS1-05	846
Faz. Ponte Vermelha	BCA-068MS1-05	174
<b>Total PE<sub>y,ex-post</sub> - in ton CO<sub>2</sub>e</b>		<b>7.654</b>

### E.4. Emission reductions calculation / table

The emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of methane fuelled, flared or gainfully used. The emission reductions achieved in any year are the lowest value of the following:

#### Equation 8

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

#### Where:

ER <sub>y,ex-post</sub>	Emission reductions achieved by the project activity based on monitored values for year y (tCO <sub>2</sub> e)
BE <sub>y ex post</sub>	Baseline emissions calculated using equation B1 and using ex post monitored values of NLT,y for year y (tCO <sub>2</sub> e)

PE <sub>y, ex post</sub>	Project emissions calculated using equation B5 using ex post monitored values of NLT <sub>y</sub> , MS% <sub>i,y</sub> for year y (tCO <sub>2</sub> e)
MD <sub>y</sub>	Methane captured and destroyed or used gainfully by the project activity in year y (tCO <sub>2</sub> e)
PE <sub>power,y,ex post</sub>	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 <sub>2</sub> e)

The flaring/combustion MD<sub>y</sub> will be measured using the conditions of the flaring Process and MD<sub>y</sub> according the following equation:

### **Equation 9**

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

Where:

$BG_{burnt,y}$  = Biogas flared or combusted in year y (m<sup>3</sup>)

$W_{CH4,y}$  = 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<sub>4</sub> (21)

$D_{CH4}$  = CH<sub>4</sub> density (0.00067 t/m<sup>3</sup> at room temperature (20 °C) and 1 atm pressure).

The following table shows the MD<sub>y</sub> calculated for the project activity. The spreadsheet of the emissions reductions calculation is available for verification.

Table E.3. Methane captured and destroyed (MD<sub>y</sub>.)

Site Name	Site ID	MD <sub>y</sub> (ton CO <sub>2</sub> e)
Lote 27 / 28	BCA-039MS1-05	1.134
Lote 55 / 54	BCA-034MS1-05	995
Lote 71	BCA-037MS1-05	936
Lote 82	BCA-038MS1-05	686
Lote 101	BCA-035MS1-05	854
Lote 105	BCA-036MS1-05	682
Fazenda Bela Vista	BCA-040MS1-05	2.057
Fazenda Cachoeira	BCA-042MS1-05	2.638
Fazenda Dragão	BCA-032MS1-05	1.311
Fazenda Sorgatto	BCA-046MS1-05	1.527
Faz. Bambú - Quinhão A	BCA-051MS1-05	1.519
Faz. Folleto	BCA-052MS1-05	1.133
Faz. Rodeio - Gleba C	BCA-031MS1-05	1.224
Faz. Água Branca	BCA-030MS1-05	1.457
Granja Serra Dourada	BCA-041MS1-05	2.322
Granja Capivara	BCA-043MS1-05	1.749
Faz. Santa Catarina	BCA-047MS1-05	2.396
Faz. Ponte Vermelha	BCA-068MS1-05	<b>691</b>
<b>Total Emissions Reductions Calculated – (ton CO<sub>2</sub>e)</b>		<b>25.311</b>





**E.5. Comparison of actual emission reductions with estimates in the CDM-PDD**

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO <sub>2</sub> e)	22.696	21.193

**E.6. Remarks on difference from estimated value in the PDD**

The project activity achieved 93% of the PDD values during the monitoring period.

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**History of the document**

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Guideline, Form <b>Business Function:</b> Issuance		