CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1. Title of the small-scale project activity:

BRASCARBON Methane Recovery Project BCA-BRA-15.
Version 3, 21th June, 2011, Brazil.

A.2. Description of the small-scale project activity:

Purpose: The purpose of this project is to mitigate and recover animal effluent related Greenhouse Gas (GHG) by improving the Animal Waste Management System practices in the confined animal feed operations in the city of Cerqueira Cesar, located at São Paulo state, southwest Brazil, developed by BRASCARBON. In Brazil the agricultural operations related to the confined animals operations are very wide and grow progressively and intensive to attend the worldwide food demand.

There are three types of Confined Animal Operation for this project: finishing, breeding and nursery.
The confined animal wastewater operation consists of transporting wastewater, which consists of fresh water mixed with manure and urine that accumulates in pits under or beside the barns, to one open lagoon for evaporation, fed by gravity pipeline systems. The organic material degraded in the primary treatment lagoon is digested, thereby producing significant amounts of methane.

These systems emit methane (CH_4) resulting from anaerobic decomposition process. The swine livestock operations create profound environmental consequences, such as greenhouse gas emissions, odour, and water/land contamination that result from storing animal waste. Therefore this operation is not sustainable due to its sever environmental pollution.

The Project Activity consists in the construction of a new covered in-ground anaerobic reactor (digester) that will use the organic material currently treated in the wastewater opened lagoon, from the confined animal operations to produce biogas. All manure will be sent daily directly to digester not exceeding 24 hours in the barns and also no dry matter content of the manure is removed from the barns. Also no dry matter content of the manure will be removed during the entire project.

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 at São Paulo state, in Brazil. 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.

Contribution to sustainable development:

According to Brazil's Inter-Ministerial Commission on Global Climatic Change[1], manure management is an important issue that needs to be solved. The swine waste storage and

[1] http://www.ambientebrasil.com.br

treatment systems in Brazil consist of open tanks, open digesting and ponds (anaerobic lagoons) once is the most economic and viable system approved to manage the manure in confined animals feed operations. Economic barriers are very common because producers invest in the confined feed operations only and not in waste management systems. Financial resources are always used to maintain the confined feed operation. Additionally, open lagoons are systems that don't need technology and therefore need less employees and technicians for operation and maintenance. Also for these reasons the project is additional and more details can be found in the section B.5. Very few bio-digesters exist or the producer invests to have a modern waste management system. The material cumulated in the open lagoons is normally distributed by pumps or gravity and applied to crops and pastures. EMBRAPA[2] stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina, which was pioneer in the country, defined instructions and publications to help the producers and agro-industries implementing projects or systems to control the animal waste and therefore protecting the eco-system. These guidelines were then generalized to the entire country as a good practices guide which is currently adopted by producers.[3].

Failure to do so will enhance existing problems (as insect pest populations) and also problems with allergies and livestock disease. In order to solve this problems, Brazil has in recent years, required all confined animals feed operations to change from single to multi-lagoon systems, introducing Good Practices in confined animal feed operations and, even more recently, has required them to line the bottom of their primary sedimentation lagoon to prevent effluent infiltration.[4]

In 2005, the swine population in São Paulo state was 1.707.000.[5] [6] Considering that a typical hog produces 4.9 kilograms of effluent daily (Table A1)[2], annually we have about 8.4 million metric tons of hog waste produced in this state. Introducing a progressive animal waste management practices throughout this region of Brazil could result in an annual reduction of approximately 2.9 million tonnes[7] of carbon dioxide equivalent (CO_2e/year).

Table A1. Daily production of effluent by type of swine production

Stage	Manure kg/day	Manure and Urine kg/day	Volume litres/day
25-100 kg	2.3	4.9	7.0
Gestating sows	3.6	11.0	16.0
Nursing sows	6.4	18.0	27.0
Boar pig	3.0	6.0	9.0
Piglet	0.35	0.95	1.4

Source: PNMA-II – Environmental Degradation Control Project resulting from swine activities in Santa Catarina, coordinated by Mr. Paulo Armando Vitoria de Oliveira, Concordia – SC, EMBRAPA Swine and Poultry, 2004;

http://www.cnpsa.embrapa.br/pnma/pdf_doc/doc_pnma.pdf

[2] PNMA-II – Projecto de Controlo da Degradação Ambiental Decorrente da Suinocultura em Santa Catarina, coordenado pelo Sr. Paulo Armando Vitoria de Oliveira, Concordia – SC, EMBRAPA Suinos e Aves, 2004; http://www.cnpsa.embrapa.br/pnma/pdf_doc/doc_pnma.pdf
[3] http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_k5u59t7m.pdf
[4] http://www.agricultura.gov.br/pls/portal/url/ITEM/C90C773459FBB52AE0300801FD0AF827
[5] IBGE – Pesquisa Pecuária Municipal (www.ibge.gov.br).
[6] www.agricultura.gov.br
[7] Approximate calculation using IPCC model and emission factors

Socio-Economic Sustainability

• Improvement in air quality (e.g. – reduction of Volatile Organic Compounds [VOCs]) and worker safety;

• Elimination of odors in surrounding areas, which will improve living standards of neighbors communities;

• Proper handling of the animal waste ensuring an adequate level of protection of human health and the environment;

• By improving the waste management system at the farm, the project will support the continued production of pork in order to meet the consumption needs of the growing global population.

Economic Sustainability

- An increase in local employment of skilled labor for the manufacturing, installation, Operation and maintenance of equipment;
- Additional employment opportunities in the agro-industrial sector, specifically from the use of recycled water from the waste management system on the farms for agricultural activities in surrounding land;
- Infrastructure improvement is in direct alignment with the national goals and objectives for agriculture, livestock, rural development, fishing and nutrition.

Environmental Sustainability

- An overall decrease in the amount of Greenhouse Gases (GHGs) emitted into the atmosphere;
- Improvement in the quality of the water used in the waste management system and its potential use as water for irrigation;
- Avoiding potential dumping of waste into clean sources of water.

Technological Sustainability

• This project will promote a model for the reduction of GHG's produced by Confined Animal Operation and promote a transfer of technology for methane production and capture through anaerobic digestion and combustion.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	• Brascarbon Consultoria, Projetos e Representação S/A (private entity)	No
Portugal	• Luso Carbon Fund – Fundo Especial de Investimento Fechado (private entity)	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

The project is located in Brazil, at the province of São Paulo state.

A.4.1.1. Host Party(ies):

The host party for this project activity is Brazil.

A.4.1.2. Region/State/Province etc.:

Southwest region / State of São Paulo.

A.4.1.3. City/Town/Community etc:

City of Cerqueira Cesar.

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project sites are shown in Figure A3 with specifics detailed in Table A2.

Table A2. Detailed physical location and identification of project site

Farm/Site Name	Brascarbon ID	Address	Town/State	Contact	Phone	GPS Coord
Sitio Barreiro	BCA-221SP1-15	Rodovia SP 261 - Cerqueira Cesar Jurumirim - KM 16; CEP 18-760-000	Cerqueira César	Edmar	(14) 3714 1919	S 23º 11´24.9´´ W 049º 12´ 04.3´´
Sitio Santa Rosa Dos Ventos	BCA-227SP1-15	Rodovia SP 261 - KM 10 - Povoado Macuco; CEP 18-760-000	Cerqueira César	Edmar	(14) 3714 1919	S 23º 08´ 01.3´´ W 049º 10´26.3´´
Sitio Mirante do Macuco	BCA-225SP1-15	Rodovia SP 261 - KM 10 - Bairro Macuco; CEP 18-760-000	Cerqueira César	Edmar	(14) 3714 1919	S 23º 09´ 00.3´´ W 049º 10´36.2´´
Fazenda São Francisco	BCA-228SP1-15	Rodovia SP 261 - KM 10 - Via Bairro Macuco; CEP 18-760-000	Cerqueira César	Edmar	(14) 3714 1919	S 23º 09´47.9´´ W 049º 10´39.1´´
Fazenda Bom Retiro	BCA-222SP1-15	Rodovia SP 261 - Cerqueira Cesar Jurumirim - KM 12 - Entrada a esquerda; CEP 18-760-000	Cerqueira César	Edmar	(14) 3714 1919	S 23º 09´ 54.8´´ W 049º 12´04.3´´
Sitio Agua Do Rosario	BCA-224SP1-15	Estrada Cerqueira Cesar Bairro Jacutinga; CEP 18-760-000	Cerqueira César	Edmar	(14) 3714 1919	S 23º 00´ 10.4´´ W 049º 04´58.0´´
Granja Colorado	BCA-223SP1-15	Estrada Municipal Cerqueira Cesar a Iaras; CEP 18-760-000	Cerqueira César	Edmar	(14) 3714 1919	S 23º 05´ 58.4´´ W 049º 06´10.5´´

Valdomiro Rossetto has seven sites ate Cerqueira Cesar city: Sitio Barreiro, Sitio Santa Rosa dos Ventos, Sitio Mirante do Macuco, Fazenda São Francisco, Fazenda Bom Retiro , Sitio Agua do Rosário and Granja Colorado. Each site uses one primary open lagoon for animal waste storage. Waste from the barns is removed via the pull plug method and then routed to the open lagoon. The methods of effluent disposition used are surface spread and irrigation.

	GRANJA	TYPE OF OPERATION
1	Sitio Barreiro	Breading swine
2	Sitio Santa Rosa dos Ventos	Breading swine
3	Sitio Mirante do Macuco	Breading swine
4	Faz São Francisco	Nursering and finishing swine
5	Fazenda Bom Retiro	Nursering and finishing swine
6	Sitio Agua do Rosario	Nursering and finishing swine
7	Granja Colorado	Nursering and finishing swine

Figure A3 State of São Paulo, Brazil – city location of the project sites

A.4.2. Type and category (ies) and technology/measure of the small-scale project activity:

The project activity is a Type III. The project is a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 60 kt CO_2eq.

• Type III.D (reference AMS-III.D) / Version 17 – *"**Methane recovery in animal manure management systems** "*.

The simplified methodology is appropriate because the project activity site is considered an agro-industry and GHG emissions calculations can be estimated using internationally accepted IPCC 2006 guidance.

The project activity will capture and combust methane gas produced from the decomposing manure at swine confined animal feed operation located in São Paulo state, Brazil. This simplified baseline methodology is applicable to this project activity because without the proposed project activity, methane from the existing animal waste management system would continue to be emitted into the atmosphere.

Anaerobic digestion

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 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. 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. Afterwards, acetogenic bacteria converts these resulting organic acids into acetic acid, along with additional ammonia, hydrogen, and carbon dioxide. Methanogenic bacteria finally are able to convert these products into methane and carbon dioxide.

The equipment is based 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 in 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.

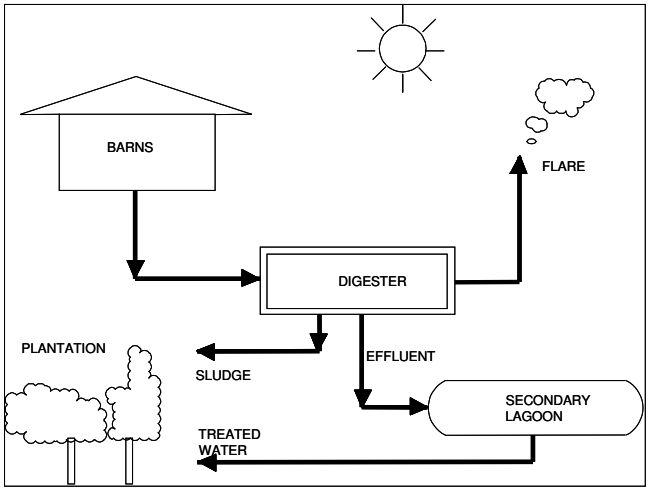
The flare is enclosed and controlled by a data logger CLP –Controller Logic Programmable – where the combustion temperature is stored every one minute in the system. This system will record each minute the combustion temperature to determinate the flare efficiency according to the specification of the flare. A thermocouple installed in the flare is connected to the PLC to register the combustion temperature. The sparkling system in the flare is automatic. Every one second the system sparks. The biogas flow rate will be also controlled by a CLP where each

minute the system records the flow rate. 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 open lagoons where it is aerated as per the design of the original lagoon system. The treated water can be then recycled and used for irrigation by the farmer. 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 fertiliser in a depth less than 0.30 meters. The sludge will be pumped by a portable biogas pump.

Figure A2. Flowchart of the treatment system



Each farm will have one biodigestor which will send the biogas through a pipe where it will be located the flow meter. The biogas will then be burned in an enclosed flare and all data stored in a Control Logic Program (CLP). The projected biodigesters are different for each farm as each one has different characteristics and therefore different dimensions, which will be presented next.

Farm	Site ID	Width (m)	Length (m)	Height (m)	Slope
Sitio Barreiro	BCA-221SP1-15	13	40	5	60º
Fazenda Bom Retiro	BCA-222SP1-15	15	50	5	60º
Granja Colorado	BCA-223SP1-15	11	40	4	60º
Sitio Agua Do Rosario	BCA-224SP1-15	15	50	5	60º
Sitio Mirante do Macuco	BCA-225SP1-15	13	45	5	60º
Santa Rosa Dos Ventos	BCA-227SP1-15	13	40	5	60º
Fazenda São Francisco	BCA-228SP1-15	14	45	5	60º

The project uses current available technology in the country for methane capture and destruction and the project design engineering reflect current good practices. The biodigestor technology results in a significantly better performance than the open lagoons used in the baseline scenario. The implementation of biodigester instead of open lagoon needs special skills with respect to design of the facility and operation and maintenance of flare and operation control (pressure, temperature, flow etc) that will be provided by specialized technicians.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

THE TOTAL ESTIMATE OF EMISSIONS REDUCTIONS OVER THE 7 YEARS PROJECT PERIOD

Table A3 – Total estimated reductions per year.

Years	Annual estimation of emission reductions in tonnes of CO2e
2012	**53,170**
2013	**53,170**
2014	**53,170**
2015	**53,170**
2016	**53,170**
2017	**53,170**
2018	**53,170**
Total estimated reductions (tonnes of CO2e)	**372,190**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions **(tonnes of CO2e)**	**53,170**

A.4.4. Public funding of the small-scale project activity:

There is no public funding in this project. All funding was provided by the PPs which are private entities. All the information regarding the funding used for the project is detailed in section B.5 (Tables B.2.1 and B.2.2).

A.4.5. Confirmation that the small-scale project activity is not a de-bundled component of a large scale project activity:

Based on paragraph 2 of Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities[8], this project is not de-bundled. There are no other registered small-scale CDM project activities with the same project participants, in the same project category and technology/measure, registered within the previous 2 years and whose project boundary is within 1 km of another proposed small-scale activity.

[8] http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The approved baseline and monitoring methodology is:
• Type III.D (reference AMS-III.D) / Version 17 – **"Methane recovery in animal manure management systems".**

• EB 28 Meeting Report – Annex 13 **"Tool to determine project emissions from flaring gases containing methane".**

• EB 61 Report – Annex 21 **" Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories - General Guidelines to SSC CDM methodologies,** Version 17**".**

B.2. Justification of the choice of the project category:

The simplified methodologies are appropriate because the project activity site is considered an agro-industry and GHG emissions calculations can be estimated using internationally accepted IPCC guidance. The project activity will capture and combust methane gas produced from the decomposing manure at swine Confined Animals Feed Operations located in São Paulo state, Brazil. This simplified baseline methodology is applicable to this project activity because:

a) **The livestock population in the farm is managed under confined conditions;**
All farms included in this project activity are managed under confined conditions as stated in the methodology AMS III-D version 17. The state of São Paulo does not have any requirements in terms of environmental licenses for the development of this type of projects. Therefore, all the farms were visited by Brascarbon before included in the PDD to assure the applicability of the methodology.

b) **Manure or the streams obtained after treatment, will not be discharged into natural water resources;**
Like it was stated in item a), the state of São Paulo does not have any specific environmental legislation for the handling of manure. Nevertheless all manure will be applied in the soil, as part of the project scope. Brascarbon will assure that no manure or the streams obtained after treatment will be discharged in natural water resources, following the EMBRAPA good practice guide for swine production. [9]

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 in the São Paulo state is 23-25°C, 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.

[9] http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_k5u59t7m.pdf

d) In the baseline scenario the anaerobic lagoons have depths which are at least 1 m;
The retention time of waste in open anaerobic open lagoons has proven to be more than 1 month as required by the methodology. The depth was higher than 1 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 each farm (which can be verified during validation).

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.

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

All biogas produced by the digester will be flared. 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. Only one pipe from digester to flare will be installed. Also the PVC digester cover is sealed in the concrete frame and fixed with bolts in a stainless steel plate to prevent any biogas leakage.

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 common farms practices where each day all the manure is washed and sent to the digester. 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.

The dry matter content of the manure is not removed from the barns. The barn is daily washed an all waste is removed by the water flushing system to the digester.

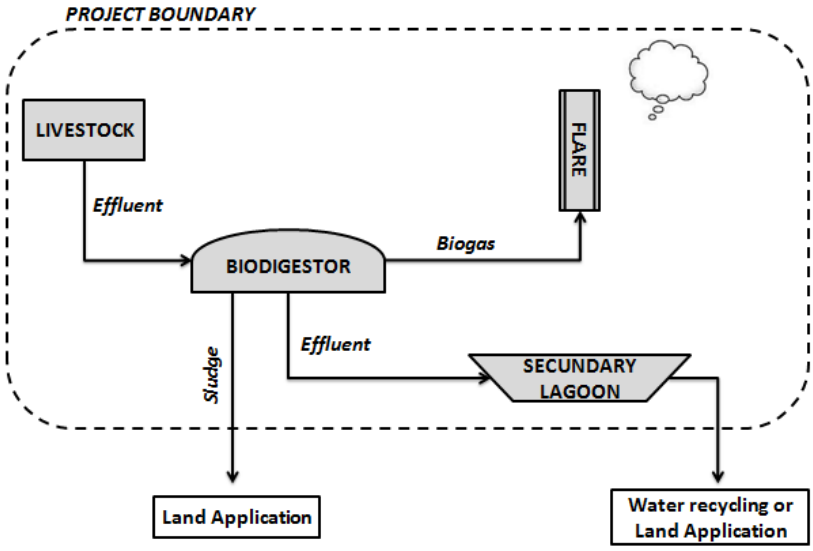
Also, the project is a small scale project because it comprises methane recovery from agro-industries, and emission reductions are less than 60 kt CO_2eq.

The starting date for this activity was 15/06/2011 when Brascarbon signed the construction contract of the sites. The project activity schedule was prepared considering all steps of the project development and construction and it´s available for review.

B.3. Description of the project boundary:

According to version 17 of the AMS-III.D methodology, the project boundary is defined as the physical, geographical site of the livestock, of the manure generation and management systems and of the equipment installed which recover and flare the methane. Thus, the project boundary is defined as the livestock, the treatment system that will be installed (biodigestor and secondary lagoons) and the biogas flare system. Figure B1, below, shows the boundary of the project activities schematically:

Figure B1 - Project Boundary



B.4. Description of baseline and its development:

This section is based on the equations used on the approved methodology AMS.III.D version 17 and data from 2006 IPCC Guidelines for National GHG Inventories, volume 4, chapter 10.

The amount of methane that would be emitted to the atmosphere in the absence of the project activity can be estimated by referring to the equation B1 – Baseline emissions from manure management, according to the methodology AMS.III.D – version 17.
The final draft of this baseline section was completed on 13/05/2011. The name of entity determining the baseline is Brascarbon. Brascarbon is a project participant, as well as the project developer.

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

Step 1: Animal Population.

Animal populations for the project activity sites are described in this section (table B2).

Step 2: Baseline Emissions.

Baseline emissions (BEy) are calculated by using one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (B_o);

(b) Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (SVS) content.

Option a) was chosen.

Equation B1

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

Where:

BE_y	Baseline emissions in year "y" (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
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
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^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)[1]

Where:

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

Equation B2

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

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 B3

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

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)

Table B1 - Parameters and factors for the applying baseline equations

Parameter/Factor	Value	Source/Comment
Baseline		
$VS_{default}$	Annex 3	Obtained from IPCC 2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
GWP_{CH4}	21	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
$B_{0,LT}$	0.45	Obtained from 2006 IPCC, Table 10A-7, p.10.80 and Table 10A-8, p.10.81.
D_{CH4}	0.00067	CH4 density at room temperature 20°C and 1 atm pressure.
MCF_J	79%	Obtained from 2006 IPCC, Chp.10 vol 4 - Table 10.17, p.10.45
$N_{LT,y}$	Table B2	Annual average number of animals of type "LT " in year "y"(numbers)
$MS\%_{Bl,j}$	100%	Fraction of manure handled in system "j".
$W_{default}$	198 kg breeding and 50 kg market	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
UF_B	0.94	Model correction factor to account for model uncertainties.

Table B2 - Parameters and factors for the specific animal category

ID	Farm/Site	Annual Average Number of Animals of Type LT in year y - $N_{LT,y}$					Total
		Sows	Finishers	Nursery/ Weaners	Boars	Gilts	
1	Sitio Barreiro	3,300	-	-	15	660	**3,975**
2	Sitio Santa Rosa dos Ventos	3,000	-	-	15	600	**3,615**
3	Sitio Mirante do Macuco	3,200	-	-	15	1,000	**4,215**
4	Faz São Francisco	-	12,400	11,000	-	-	**23,400**
5	Fazenda Bom Retiro	-	16,400	10,000	-	-	**26,400**
6	Sitio Agua do Rosario	-	20,000	8,000	-	-	**28,000**
7	Granja Colorado	-	7,300	5,300	-	-	**12,600**
TOTAL		**9,500**	**56,100**	**34,300**	**45**	**2,260**	**102,205**

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

In the absence of the project activity the methane resulting from the decomposition of animal wastes in the anaerobic lagoons is released into the atmosphere. Proof of an early consideration of CDM is available since:

- In March 2010 it was signed the Emission Reduction Purchase Agreement (ERPA) between both PPs;
- In May 2010 the PDD has been published for global stakeholder consultation;

- The contracts between the project developer and the owner of the pig farms especially mention the project implementation under the context of CDM.

In absence of this project activity, the swine producers would not change their animal waste management system practices. They have no motivations or financial resources to implement a different waste treatment as open anaerobic lagoons. The swine waste storage and treatment systems in Brazil consists in open tanks, open digesting process and ponds (anaerobic lagoons), due to the most economic and viable system approved to manage the manure in confined animal feed operations. Also, the approved waste treatment used in the farms involves less technology, as open lagoons, and need less employees and technicians for operation and maintenance.

Economic barriers are very common in the confined animals feed operations because producers invest only in the confined feed operations to be more competitive in the market. Financial resources are always used to maintain the confined feed operation working. This is one of the reasons of the additionality of the project activity.

The proposed project activity intends to improve current animal waste management system practices. These changes will result in the mitigation of anthropogenic GHG emissions by controlling the lagoon's decomposition processes and collecting and combusting the biogas. Also the proposed project activity will be sized to accommodate each farm's maximum expected animal capacity.

In accordance with paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in Appendix B may be used if project participants can demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in attachment A of Appendix B. It was used the *Non-binding best practice examples to demonstrate additionality for SSC project activities* (EB 35, Annex 34) to show that the project activity would not have occurred anyway due to the existence of some identified barriers. For the identified CDM project, the following barriers have been overcome during project planning and execution:

Investment Barrier:

In the economic point of view, Brazilian pork producers face the same challenges as farmers in other nations due to increased worldwide pork production and low operating margins. Farm owners focus on the bottom line and odour benefits and water quality enhancements are rarely a strong motive to upgrade to an expensive advanced animal waste management system. Also, in the producer´s point of view the animal waste is outside of the production process and has difficult financing challenges that should be undertaken. Even banks have been unwilling to finance such activities without government guarantees or other incentives. The anaerobic digester requires a much higher investment than an anaerobic lagoon. Therefore, this last one is the most likely alternative and can be considered as the baseline scenario.

To demonstrate the existence of an investment barrier, that prevents the implementation of the project without the revenue of the carbon credits, the project proponent has undertaken an investment analysis of the project activity (without the revenue of the carbon credits), considering two scenarios:
I: Baseline Scenario: the installation of an anaerobic lagoon;
II: Project Scenario: the installation of the anaerobic digester plus flare.

In both scenarios the Internal Return Rate (IRR) cannot be calculated hence the analysis is based on the NPV, using the discount rate of 11.67% - Brazilian bonds (SELIC tax - http://www.bcb.gov.br/?SELICDIA). Brascarbon decided to make the NPV calculation considering 21 years as the period of the project, that is the maximum period of the Small Scale project life cycle, instead of what is mentioned in the Annex 45 of the EB 41 (max period 20 years).
In both scenarios (table B. 2.1 and B.2.2) there are only negatives cash flows, as no revenue will be expected from the implementation of the project activity.

Although in the initial version of the PDD the investment analysis has been referenced to November 2009, the data has been further updated to take into account the effective date on which the investment decision was made, which was 12th of April 2011. The following assumptions were considered:

Premises adopted for the investment analysis calculation

Exchange Rate (*)	BR/USD	1.5870	BR/USD
Brazilian bonds (SELIC tax) (**)		11.67	%

(*) 1,5870 on 12/April/2011
(**) Selic Tax on 12/Abril/2011 - Brazilian bonds (SELIC tax - http://www.bcb.gov.br/)

The data concerning values for equipment, installation and O&M costs refers to the proposals requested to A&P Pezzato Construções Ltda – E.P.P. as detailed below:

	COST	COMPANY	DATE *	REFERENCE
SCENARIO I	Equipment	A&P Pezzato Construções Ltda – E.P.P.	11th November 2009	Orçamento 013/09
	Installation	A&P Pezzato Construções Ltda – E.P.P.	11th November 2009	Orçamento 013/09
	Maintenance	A&P Pezzato Construções Ltda – E.P.P.	11th November 2009	Orçamento 013/09
SCENARIO II	Equipment	A&P Pezzato Construções Ltda – E.P.P.	11th November 2009	Orçamento 012/09
	Installation	A&P Pezzato Construções Ltda – E.P.P.	11th November 2009	Orçamento 012/09
	Maintenance	A&P Pezzato Construções Ltda – E.P.P.	11th November 2009	Orçamento 011/09

* Proposal valid during 2 years

In the following tables it is represented the investment analysis for the Scenarios I and II:

Table B.2.1 – Financial Analysis for Baseline Scenario (open lagoon) (US$)

ID	FARM/SITE	Equipment costs (anaerobic open lagoon)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues			NPV (US$) (11,67% interest rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Sitio Barreiro	-48,633	-4,171	0	-1,103	-1,103	-1,103	0	0	0	-61,215	UNDEFINED
2	Sitio Santa Rosa dos Ventos	-82,461	-2,405	0	-1,103	-1,103	-1,103	0	0	0	-93,276	UNDEFINED
3	Sitio Mirante do Macuco	-71,646	-3,568	0	-1,103	-1,103	-1,103	0	0	0	-83,624	UNDEFINED
4	Faz São Francisco	-49,894	-2,405	0	-1,103	-1,103	-1,103	0	0	0	-60,709	UNDEFINED
5	Fazenda Bom Retiro	-40,684	-3,568	0	-1,103	-1,103	-1,103	0	0	0	-52,662	UNDEFINED
6	Sitio Agua do Rosario	-58,771	-2,309	0	-1,103	-1,103	-1,103	0	0	0	-69,491	UNDEFINED
7	Granja Colorado	-46,607	-3,563	0	-1,103	-1,103	-1,103	0	0	0	-58,580	UNDEFINED

Table B.2.2 – Financial Analysis for Project Scenario (digester + flare) (US$)

ID	FARM/SITE	Equipment costs (digester and flare)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues			NPV (US$) (11,67% interest rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Sitio Barreiro	-77,442	-20,413	0	-17,207	-17,207	-17,207	0	0	0	-229,089	UNDEFINED
2	Sitio Santa Rosa dos Ventos	-113,258	-33,695	0	-17,207	-17,207	-17,207	0	0	0	-278,188	UNDEFINED
3	Sitio Mirante do Macuco	-109,378	-31,955	0	-17,207	-17,207	-17,207	0	0	0	-272,567	UNDEFINED
4	Faz São Francisco	-68,765	-18,234	0	-17,207	-17,207	-17,207	0	0	0	-218,234	UNDEFINED
5	Fazenda Bom Retiro	-74,551	-21,008	0	-17,207	-17,207	-17,207	0	0	0	-226,794	UNDEFINED
6	Sitio Agua do Rosario	-89,753	-25,826	0	-17,207	-17,207	-17,207	0	0	0	-246,813	UNDEFINED
7	Granja Colorado	-77,442	-20,413	0	-17,207	-17,207	-17,207	0	0	0	-229,089	UNDEFINED

As we can see from the tables above there are only negative cash-flows and Scenarios I and II have a global NPV of -479,556 US$ and -1,700,774 US$ respectively. There is an investment barrier that prevents the implementation of the anaerobic open lagoon, but it is the most economical option. Additionally, this is the option approved by the environment department to the waste management system to the confined feed animal operation.

In the table B2.3 it can be seen the summary of the investment analysis for each farm where the 1st scenario (continuation with the baseline scenario) is the most attractive option due the less investment involved (but with high emissions).

Table B 2.3. NPV Comparison for the two scenarios (US$)

ID	FARM/SITE	NPV (1st SCENARIO) ANAEROBIC OPEN LAGOON	NPV (2nd SCENARIO) DIGESTER + FLARE	IRR(%)
1	Sitio Barreiro	-61,215	-229,089	UNDEFINED
2	Sitio Santa Rosa dos Ventos	-93,276	-278,188	UNDEFINED
3	Sitio Mirante do Macuco	-83,624	-272,567	UNDEFINED
4	Faz São Francisco	-60,709	-218,234	UNDEFINED
5	Fazenda Bom Retiro	-52,662	-226,794	UNDEFINED
6	Sitio Agua do Rosario	-69,491	-246,813	UNDEFINED
7	Granja Colorado	-58,580	-229,089	UNDEFINED

A sensitivity analysis of the Project Scenario (Digester + Flare) was undertaken, considering the variations of 10% (decrease) as recommended by the Guidelines on the Assessment of Investment Analysis (Annex 5 of the EB 62):

- Alternative A: Investment Cost: decrease in 10%
- Alternative B: Maintenance Cost: decrease in 10%

The results are presented in the table B.2.4 and it can be seen that in both alternatives considered, the project is still not viable with a global NPV of -1,622,561 US$ or -1,608,910 US$, for Alternatives A and B, respectively.

Table B 2.4. Sensitivity analysis summary (US$)

ID	FARM/SITE	ALTERNATIVE A	ALTERNATIVE B
		CONSIDERING 10% INVESTMENT COST REDUCTION	CONSIDERING 10% MAINTENANCE COST REDUCTION
1	Sitio Barreiro	-219,304	-215,966
2	Sitio Santa Rosa dos Ventos	-263,492	-265,064
3	Sitio Mirante do Macuco	-258,434	-259,444
4	Faz São Francisco	-209,534	-205,110
5	Fazenda Bom Retiro	-217,238	-213,670
6	Sitio Agua do Rosario	-235,255	-233,690
7	Granja Colorado	-219,304	-215,966

Considering the analysis undertaken, it is determined that the project is "additional" from an economic perspective, as it is only viable with the revenues of the carbon credits.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

This section is based on the equations used on the approved methodology AMS.III.D version 17 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 for the project activity and the estimated emissions are determined as follows:

Step 1: Emission Reductions.

Equation B4

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

Where:
$ER_{y\ ex\ post}$ – Emission reductions achieved by the project activity based on monitored values for year y (tCO_2e)
$BE_{y\ ex\ post}$ – Baseline emissions calculated for year y (tCO_2e)
$PE_{y\ ex\ post}$ – Project emissions calculated 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)

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

Where:
$BG_{burnt,y}$ – biogas flared or combusted in year y (m^3)
$W_{CH4,y}$ – methane content in the biogas in the year "y" (volume fraction).
D_{CH4} – methane density in biogas operational conditions in the year "y" (tones/m^3).
FE – flare efficiency in the year "y" (fraction)
GWP_{CH4} – methane global warming potential (21)

Step 2: Baseline Emissions.

According to the Equation B1 section B.4

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

Where:

BE_y	Baseline emissions in year "y" (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
D_{CH4}	CH_4 density (0.00067 t/m^3at room temperature (20 ºC) 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^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)

Step 3: Project Emissions.

According to the simplified baseline and monitoring methodology for a small-scale CDM project Type-III (AMS.III.D – version 17), 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_2emissions from use of fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$).

(d) CO_2 emissions from incremental transportation distances;

(e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

Equation B5

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

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)
$PE_{trasnsp,y}$	Emissions from incremental transportation in the year y (tCO2e), as per relevant paragraph in AMS-III.F
$PE_{storage,y}$	Emissions from the storage of the manure (tCO_2e)

Where:

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

Equation B6

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

Where:

$PE_{PL,y}$	Emissions due to physical leakage of biogas in year "y" (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
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
$B_{0,LT}$	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)
$MS\%_{i,y}$	Fraction of manure handled in system "i" in year "y"

(B) Emissions from flaring determinate as follows:

Equation B7

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

Where:

Variable	SI Unit	Description
$PE_{flare,y}$	tCO_2e	Project emissions from flaring of the residual gas stream in year *y*
$TM_{RG,h}$	kg/h	Mass flow rate of methane in the residual gas in the hour *h*
$\eta_{flare,h}$	-	Flare efficiency in hour *h*
GWP_{CH4}	tCO_2e/tCH_4	Global Warming Potential of methane valid for the commitment period

According annex 13 *"Tool to determine project emissions from flaring gases containing methane"*:

$$TM_{FG,h} = \frac{TV_{n,FG,h} * fv_{CH4,FG,h}}{1000000}$$

Where:

Variable	SI Unit	Description
$TM_{FG,h}$	kg/h	Mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour *h*
$TV_{n,FG,h}$	m^3/h exhaust gas	Volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour *h*
$fv_{CH4,FG,h}$	mg/m^3	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in hour *h*

Brascarbon also adopted 90% default value for the flare efficiency in compliance with manufacturer's specification.

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

No fossil fuel or electricity will be used in the project, therefore, $PE_{power,y} = 0$.

(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 storage in the entire project, also the accumulation and transportation will not exceed 24 hours, therefore, $PE_{storage,y} = 0$.

Step 4: Leakage.

According to the simplified baseline and monitoring methodology AMS.III.D / version 17, no leakage calculation is required.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	MCFj
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 applied:	79%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Average temperature of southwest region, mainly where the project sites are located is 23 to 25 Celsius during the year, according to CPTEC/INPE/EMBRAPA and INMET http://bancodedados.cptec.inpe.br http://www.inmet.gov.br/html/clima.php
Any comment:	

Data / Parameter:	MS%Bl,j
Data unit:	Fraction
Description:	Fraction of manure handled in baseline animal manure management system "j".
Source of data used:	Project proponents
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	100% of the manure will be handled per category T, system S and climate region k.
Any comment:	

Data / Parameter:	*VS default*
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 applied:	0.3 for Market Swine 0.46 for Breeding Swine 0.46 for Guilts
Justification of the choice of data or description of measurement methods and procedures actually applied :	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. Used of factors as defined in IPCC2006, chapter 10, volume 4, since that there is no national data for gross energy calculation.

Any comment:	

Data / Parameter:	**GWP** CH_4
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data used:	IPCC 2006
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Conversion factor for metric tons of CH_4 to metric tons of CO_2 equivalent.
Any comment:	

Data / Parameter:	$\mathbf{B_{0,LT}}$
Data unit:	m^3 CH_4/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 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
Justification of the choice of data or description of measurement methods and procedures actually applied :	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.
Any comment:	

Data / Parameter:	$W_{default}$
Data 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 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
Justification of the choice of data or description of measurement methods and procedures actually applied :	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
Any comment:	

Data / Parameter:	UF_b
Data unit:	Fraction
Description:	Model correction factor to account for model uncertainties
Source of data:	FCCC/SBSTA/2003/10/Add.2, page 25.
Value applied:	0.94
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value according to the last version of the methodology (version 17).
Any comment:	

B.6.3. Ex-ante calculation of emission reductions:

(i) According to the baseline description in the section B.4, the results from the equations are summarized in the following table B3:

Table B3 – Baseline emissions for the first year – 2012

ID	Farm/Site	Baseline Emissions per Annual Average Number of Animals Type "LT", in t CO_2e/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Sitio Barreiro	2,895	-	-	37	579	**3,511**
2	Sitio Santa Rosa dos Ventos	2,631	-	-	37	526	**3,194**
3	Sitio Mirante do Macuco	2,807	-	-	37	877	**3,721**
4	Faz São Francisco	-	11,491	2,265	-	-	**13,756**
5	Fazenda Bom Retiro	-	15,198	2,059	-	-	**17,257**
6	Sitio Agua do Rosario	-	18,534	1,648	-	-	**20,182**
7	Granja Colorado	-	6,765	1,091	-	-	**7,856**

TOTAL	**8,333**	**51,988**	**7,063**	**111**	**1,982**	**69,477**

Table B4 – Total baseline emission per year

ID	Farm/Site	Baseline Emissions per year, in t CO_2e / year							Total
		2012	2013	2014	2015	2016	2017	2018	
1	Sitio Barreiro	3,511	3,511	3,511	3,511	3,511	3,511	3,511	**24,577**
2	Sitio Santa Rosa dos Ventos	3,194	3,194	3,194	3,194	3,194	3,194	3,194	**22,358**
3	Sitio Mirante do Macuco	3,721	3,721	3,721	3,721	3,721	3,721	3,721	**26,047**
4	Faz São Francisco	13,756	13,756	13,756	13,756	13,756	13,756	13,756	**96,292**
5	Fazenda Bom Retiro	17,257	17,257	17,257	17,257	17,257	17,257	17,257	**120,799**
6	Sitio Agua do Rosario	20,182	20,182	20,182	20,182	20,182	20,182	20,182	**141,274**
7	Granja Colorado	7,856	7,856	7,856	7,856	7,856	7,856	7,856	**54,992**
TOTAL		**69,477**	**69,477**	**69,477**	**69,477**	**69,477**	**69,477**	**69,477**	**486,339**

(ii) According to the project emissions description in the section B.6 and equation B5:

Table B5 – Total project activity emissions for the first year – 2012

ID	Farm/Site	Project Emissions per Annual Average Number of Animals Type "LT", in t CO_2e/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Sitio Barreiro	680	-	-	9	136	**825**
2	Sitio Santa Rosa dos Ventos	617	-	-	9	124	**750**
3	Sitio Mirante do Macuco	659	-	-	9	206	**874**
4	Faz São Francisco	-	2,696	532	-	-	**3,228**
5	Fazenda Bom Retiro	-	3,567	483	-	-	**4,050**
6	Sitio Agua do Rosario	-	4,349	387	-	-	**4,736**
7	Granja Colorado	-	1,588	256	-	-	**1,844**
TOTAL		**1,956**	**12,200**	**1,658**	**27**	**466**	**16,307**

Table B6 – Total project activity emissions per year

ID	Farm/Site	Project Emissions per year, in t CO_2e/year							Total
		2012	2013	2014	20145	2016	2017	2018	
1	Sitio Barreiro	825	825	825	825	825	825	825	**5,775**
2	Sitio Santa Rosa dos Ventos	750	750	750	750	750	750	750	**5,250**
3	Sitio Mirante do Macuco	874	874	874	874	874	874	874	**6,118**
4	Faz São Francisco	3,228	3,228	3,228	3,228	3,228	3,228	3,228	**22,596**
5	Fazenda Bom Retiro	4,050	4,050	4,050	4,050	4,050	4,050	4,050	**28,350**
6	Sitio Agua do Rosario	4,736	4,736	4,736	4,736	4,736	4,736	4,736	**33,152**
7	Granja Colorado	1,844	1,844	1,844	1,844	1,844	1,844	1,844	**12,908**
TOTAL		**16,307**	**16,307**	**16,307**	**16,307**	**16,307**	**16,307**	**16,307**	**114,149**

(iii) According to the project emissions reduction in the section B.6, the results of the estimation of the emissions reduction, equation B4 are summarized in the following table B7:

Table B7 – Total Emission Reductions

Description	Year						
	2012	2013	2014	2015	2016	2017	2018
Total Baseline Emissions – $BE_{y,}$,in ton CO_2e/year	69,477	69,477	69,477	69,477	69,477	69,477	69,477
Total Project Emissions – $PE_{y,}$ in ton CO_2e/year	16,307	16,307	16,307	16,307	16,307	16,307	16,307
Total Emission Reductions – $ER_y = BE_y – PE_y$ (in ton CO_2e/year)	53,170	53,170	53,170	53,170	53,170	53,170	53,170

B.6.4. Summary of the ex-ante estimation of emission reductions:

Table B8 – Summary of the Total Ex-ante Emissions Reductions

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2012	16,307	69,477	0	53,170
2013	16,307	69,477	0	53,170
2014	16,307	69,477	0	53,170
2015	16,307	69,477	0	53,170
2016	16,307	69,477	0	53,170
2017	16,307	69,477	0	53,170
2018	16,307	69,477	0	53,170
Total (ton de CO_2 e)	114,149	486,339	0	372,190

B.7. Application of a monitoring methodology and description of the monitoring plan:

The methodology applied to this project activity is AMS-III.D./version 17, ***Methane recovery in animal manure management systems***. The simplified monitoring methodologies are applicable to this project activity because they provide a method to accurately measure and record the GHG emissions that will be captured and combusted by the project activity.

Each individual farm will be monitored independently according with the parameters described in the following section B.7.1 and monitored according with the monitoring plan described in the section B.7.2.

All data monitored and required for verification and issuance is kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity,

whichever occurs later. All parameters are deeply controlled by operational procedures developed by Brascarbon. A list and the procedures contained in the Brascarbon Operational Procedures Manual are mentioned in the Annex 4.

Brascarbon trained several regional technicians who will be responsible for the maintenance and the monitoring system based in ISO 9000 (Brascarbon Operational Procedure Manual).

Details of the monitoring system can be found in the section B.7.2.

B.7.1. Data and parameters monitored:

Data / Parameter:	T_f
Data unit:	^oC
Description:	Combustion temperature of the flare
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	According to the Monitoring Operational Procedure POP-01
Monitoring frequency	Every 1 minute measurement and registration by a Control Logic Program (CLP) which will be able to store the burning temperature every minute
QA/QC procedures	Check the data for more accurate information
Any comment:	Monitoring operational procedure POP-01 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	W_{site}
Data unit:	Kg
Description:	Average animal weight of a defined livestock population at the project site in year
Source of data:	Brascarbon Monitoring Report System
Value of data:	Sows(breeding swine): 220 kg Finishers(market swine): 90 kg Nursery (market swine): 20 kg Boars (market swine): 240 kg Gilts (breeding swine): 220 kg
Measurement procedures (if any):	Checking data and records in the confined feed animal operation
Monitoring frequency	Quarterly
QA/QC procedures	Check of the site records and documents
Any comment:	Monitoring operational procedure POP-016

Data / Parameter:	SITE INSPECTION
Data unit:	n.a.
Description:	Inspection on the site considering relevant regulation and the infra-structure of the site
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	Annual follow-up of the documentation to check the expiration date, changes in the production lay-out and surroundings of the digester. Use of the annex attached at the operational procedure POP-02
Monitoring frequency	Annually
QA/QC procedures	Check of the confined animal production official documents
Any comment:	Monitoring operational procedure POP-02 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$N_{LT,y}$
Data unit:	Number
Description:	Annual average number of animals of type "LT" in year "y"
Source of data:	Brascarbon Monitoring Report System
Value of data:	Table B.2 in section B.4
Measurement procedures (if any):	Checking of the documentation located at the confined animal production and use of the table annexed at the operational procedure POP-03. Use of the Equation B3 established in the section B4 step 2 item B – determination of the annual average number of animals.
Monitoring frequency	Monthly
QA/QC procedures	Check of the site records and documents.
Any comment:	Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$BG_{burnt,y}$
Data unit:	m^3
Description:	Biogas flared or combusted in the year y.
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	Recover the data registered in the data logger (CLP) of the volume in the local control panel according to the operational procedure POP-04.
Monitoring frequency	Monthly
QA/QC procedures	Check the registers sent from the field. Control and assure the calibration program of the flow meter.
Any comment:	Monitoring operational procedure POP-04 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$W_{CH4,y}$
Data unit:	Fraction
Description:	Methane content in biogas in the year "y"
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	Use of methane concentration analysis instrument on dry basis in the sampling point at piping to the flare.
Monitoring frequency	Periodical. To assure that the monitoring frequency provides a 90% confidence level, the adequate frequency will be determined through a statistical analysis of the methane fraction variation, based on methane fraction data gathered on a group of farms per region during a certain period time.
QA/QC procedures	Check the registers in the generated documents. Control and assure the calibration program of the instrument.
Any comment:	Monitoring operational procedure POP-05a can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	T_{biogas}
Data unit:	ºC
Description:	Temperature of the biogas at operation conditions
Source of data:	Brascarbon Monitoring Report System
Value of data:	20º
Measurement procedures (if any):	Measurement with a local thermometer. Measurement according Operational Procedure POP-06
Monitoring frequency	Monthly
QA/QC procedures	Check the registers in the generated documents and thermometer calibration
Any comment:	Monitoring operational procedure POP-06 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$D_{CH4,y}$
Data unit:	tones / m^3
Description:	Density of the methane combusted at operational condictions.
Source of data:	Brascarbon Monitoring Report System
Value of data:	0.00067 tones / m^3
Measurement procedures (if any):	Calculation According to the Operational Procedure POP-07. Use of the formula considering pressure, temperature and molecular mass of methane
Monitoring frequency	Monthly
QA/QC procedures	Check and approve the density value calculation.
Any comment:	Monitoring operational procedure POP-07 can be found at the Brascarbon Operational Procedure Manual. Reference: Annex 13-Tool to determine project emissions from flaring gases containing methane.

Data / Parameter:	Q_{DM}
Data unit:	n.a.
Description:	Sludge soil application
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	Supervision in the field
Monitoring frequency	Defined according to the digester performance
QA/QC procedures	Check the registers in the generated documents.
Any comment:	Monitoring operational procedure POP-09 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	FE or $\eta_{flare,\,h}$
Data unit:	%
Description:	Flare Efficiency
Source of data:	Brascarbon Monitoring Report System
Value of data:	If exhaust gas hourly temperature >=500°C than 90% efficiency If exhaust gas hourly temperature >=500°C but out of the manufacturer´s specifications than 50% efficiency If exhaust gas hourly temperature < 500°C than 0% efficiency
Measurement procedures (if any):	Enclosed flare. The temperature measurement and it´s registration in the programmable logic controller system (PLC) is every minute. Brascarbon considers efficiency 90% for the hour with all temperature measurements above or equal to 500º Celsius or 50% if the temperature in the exhaust gas of the flare (Tflare) is above 500 °C but the manufacturer´s specifications on proper operation of the flare are not met at any point in time during the hour h. It will consider 0% efficiency for the hour h if any temperature measurements is below 500º Celsius
Monitoring frequency	Monthly
QA/QC procedures	Check the registers in the generated documents.
Any comment:	Every minute monitoring of the flare temperature. The efficiency calculation is monthly and according to Monitoring Operational Procedure POP-08a can be found at the Brascarbon Operational Procedure Manual.

Data / Parameter:	FFR
Data unit:	n.a.
Description:	Formulated Feed Rations
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	According to the Operational Procedure POP-14
Monitoring frequency	Monthly
QA/QC procedures	Check the registers and/or food purchases records on the farm.
Any comment:	Monitoring operational procedure POP-14 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	P biogas
Data unit:	mbar
Description:	Pressure of the biogas at operation conditions
Source of data:	Brascarbon Monitoring Report System
Value of data:	1013 mbar (or 1 atm)
Measurement procedures (if any):	Measurement with portable local pressure gauge. Measurement according Operational Procedure POP-13
Monitoring frequency	Monthly
QA/QC procedures	Check the registers in the generated documents and equipment for measurement calibration
Any comment:	Monitoring operational procedure POP-13 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	GENETIC SOURCE
Data unit:	n.a.
Description:	Genetic source from annex I party
Source of data:	Brascarbon Monitoring Report System
Value of data:	Western Europe
Measurement procedures (if any):	Data and records from the confined feed animal operation. According Operational Procedure POP-15
Monitoring frequency	Annually
QA/QC procedures	Check data and records from the farm operation
Any comment:	Monitoring operational procedure POP-15 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	MS% i,y
Data unit:	Fraction
Description:	Fraction of manure handled in project emissions in system “i”, year “y”.
Source of data:	Brascarbon Monitoring Report System
Value of data:	100%
Measurement procedures (if any):	During the site inspection, checking if changes in the adopted waste management system and surroundings of the digester was modified from the original proposal project activity. Use of the annex attached at the operational procedure POP-02
Monitoring frequency	Annually
QA/QC procedures	Check of the confined animal production official documents
Any comment:	Monitoring operational procedure POP-02 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$FV_{RG,h}$
Data unit:	m^3/h
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	Recover the data registered in the data logger (CLP) of the volume in the local control panel and calculate flow rate according to the operational procedure POP-04
Monitoring frequency	Monthly
QA/QC procedures	Check the registers sent from the field. Control and assure the calibration program of the flow meter.
Any comment:	Monitoring operational procedure POP-04 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$TM_{RG,h}$
Data unit:	Kg/h
Description:	Mass flow rate of methane in the residual gas in the hour h
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	To be 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.
Monitoring frequency	Monthly
QA/QC procedures	Check the registers sent from the field. Calculation of the parameter according to the procedures mentioned above.
Any comment:	Monitoring operational procedure POP-17 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$fv_{CH4,RG}$
Data unit:	Fraction
Description:	Volumetric fraction of methane content in the residual gas on dry basis measured as 90% confidence level
Source of data:	Brascarbon Monitoring Report System
Value of data:	n.a.
Measurement procedures (if any):	Use of methane concentration analysis instrument on dry basis in the sampling point at piping to the flare.
Monitoring frequency	Periodical. To assure that the monitoring frequency provides a 90% confidence level, the adequate frequency will be determined through a statistical analysis of the methane fraction variation, based on methane fraction data gathered on a group of farms per region during a certain period time.
QA/QC procedures	Check the registers in the generated documents. Control and assure the calibration program of the instrument.
Any comment:	Monitoring operational procedure POP-05a can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$N_{day,y}$
Data unit:	Number
Description:	Number of days animal is alive in the farm, in year "y"
Source of data:	Brascarbon Monitoring Report System
Value of data:	Sows 365 Finishers 90 Nursery/Weaners 70 Boars 365 Gilts 365
Measurement procedures (if any):	Checking of the documentation located at the confined animal production and use of the operational procedure POP-03
Monitoring frequency	Monthly
QA/QC procedures	Check of the site records and documents.
Any comment:	Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	$N_{p,y}$
Data unit:	Number
Description:	Number of animals produced annually of type "LT" in year "y"
Source of data:	Brascarbon Monitoring Report System
Value of data:	Animal production data (see Annex 3)
Measurement procedures (if any):	Checking of the documentation located at the confined animal production and use of the table annexed at the operational procedure POP-03
Monitoring frequency	Monthly
QA/QC procedures	Check of the site records and documents.
Any comment:	Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	nd_y
Data unit:	Number
Description:	Number of days in year "y" where the treatment plant was operational
Source of data:	Brascarbon Monitoring Report System
Value of data:	365
Measurement procedures (if any):	According to the operational procedure POP-24
Monitoring frequency	Annually
QA/QC procedures	Check the data for more accurate information.
Any comment:	Monitoring operational procedure POP-24 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	Other flare operation parameters
Data unit:	-
Description:	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer´s specifications including a flame detector in case of open flars
Source of data:	Measurement by project participants
Measurement procedures (if any):	
Monitoring frequency	Continuously
QA/QC procedures	
Any comment:	Only applicable in case of use of a default value

B.7.2. Description of the monitoring plan:

The following table, Table B9, presents the monitoring plan to be applicable for each farm described in the PDD and followed by Brascarbon in order to achieve certified emissions reductions, after each

validation and verification process. Other information of monitoring plan and system can be found in the Annex 4.

Table B9 – Monitoring Plan

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 f	Temp	°C	Flare Temperature	Every 1 minute	M	100%	electronic	Until end of CP or Last issuance + 2 years	Use for flare efficiency
2	Site Inspection	Document	----	----	Annually	D	100%	electronic	Until end of CP or Last issuance + 2 years	General Site Inspection
3	$N_{LT,y}$	Number	-	Nr, Of heads	Monthly	C	100%	electronic	Until end of CP or Last issuance + 2 years	Used to quantify the methane generation potential
4	$BG_{burnt,y}$	Volume	m^3	Biogas produced	Monthly	M	100%	electronic	Until end of CP or Last issuance + 2 years	Cumulative biogas production
5	$w_{CH4,y}$	Fraction	%	Methane content	TBD(*)	M	100%	electronic	Until end of CP or Last issuance + 2 years	Concentration in wet basis
6	T_{biogas}	Temp	°C	Biogas Temperature	Monthly	M	100%	electronic	Until end of CP or Last issuance + 2 years	Use to biogas density calculation
7	D_{CH4}	Mass	Ton/m^3	Density	Monthly	C	100%	electronic	Until end of CP or Last issuance + 2 years	Density
8	FE	Efficiency	%	Temperature	Monthly	C	100%	electronic	Until end of CP or Last issuance + 2 years	Efficiency determinate by the burning temp.
9	QDM	Supervisio n	--	---	Every Batch Disposed	E	100%	electronic	Until end of CP or Last issuance + 2 years	Sludge disposed outside project boundary
10	W site	Mass	kg	Average Animal weight	Quarterly	D	100%	electronic	Until end of CP or Last issuance + 2 years	Average Animal weight
11	FFR	------	---	Feed Formulation	Monthly	D	100%	electronic	Until end of CP or Last issuance + 2 years	Feed Formulation Rations
12	P biogas	Pressure	mbar	Biogas Pressure	Monthly	M	100%	electronic	Until end of CP or Last issuance + 2 years	Biogas pressure
13	Genetic Source	Document	-------	genetic	Annually	D	100%	electronic	Until end of CP or Last issuance + 2 years	Genetic Source
14	MS% i,y	Fraction	%	Manure handled	Annually	E	100%	electronic	Until end of CP or Last issuance + 2 years	General Site Inspection
15	$FV_{RG,h}$	Volume	m^3/h	Volume	Monthly	M	100%	electronic	Until end of CP or Last issuance + 2 years	Volume of residual gas
16	$fv_{CH4,RG}$	Fraction	%	Methane content	TBD(*)	M	100%	electronic	Until end of CP or Last issuance + 2 years	Volumetric methane fraction of the residual gas
17	$TM_{RG,h}$	mass	Kg/h	Mass flow rate	Monthly	C	100%	electronic	Until end of CP or Last issuance + 2 years	Total mass flow rate of the residual gas
18	$N_{day,y}$	Number	days	days	Monthly	M	100%	electronic	Until end of CP or Last issuance + 2 years	Nr. Of days animal is alive
19	$N_{p,y}$	Number	heads	Nr of heads	Monthly	M	100%	electronic	Until end of CP or Last issuance + 2 years	Nr. Of heads per category annually
20	nd_y	Number	days	days	Annually	M	100%	electronic	Until end of CP or Last issuance + 2 years	Number of days the treatment plant was operational

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
21	Other flare operation parameters	------	---	---	Continuously	M	100%	electronic	Until end of CP or Last issuance + 2 years	

(*) TBD: to be determinate to attend 90% confidence level

The monitoring plan will guarantee that emission reductions are accurately accounted within the project boundary.

Brascarbon introduced operational procedures, from the Brascarbon Operational Procedures Manual, to facilitate the monitoring system of the parameters described in the Table B9 – Monitoring Plan. A list of the operational procedures can be found in the annex 4, at the end of this project document design. The summary of the operational procedures with the main activities is described below:

Monitoring of the Flare Temperature

Temperature of the flare will be controlled by a logic system which will store the flare temperature data every minute. The sensor - thermo coupling - is installed in the flare body. The signal from the thermocouple is sent to the CLP where the information of the temperature is recorded every each minute. The file information from the logic system will be recovered monthly using a pendrive and the file will be sent to the QA/QC officer to manage the information for further verification. A spreadsheet in excel is available from the system to show the temperature per minute per day.

The system CLP and the thermocouple will be powered by solar cell – no use of energy from the grid. A 12 volts battery is also included in the system to save energy to be used during the night or days lack of sun. The battery capacity is 240 hours.

In the operational procedure POP 1 can be found the formulary 01.001 where the temperature information is managed according to the specification above mentioned. All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.

PEN DRIVE

CLP

Site Inspection.

A check list included in the procedure POP 2 – Site Inspection - number 02.001 is the basic orientation to guide the technicians during inspection in the field to follow all items related to the project activity installation.

Attached on it, the MS% i,y - Fraction of manure handled in the system during the year, is included to be inspected during the each farm visit.

No changes in the manure managing system will be permitted during the project activity.

Variables to be monitored: SITE INSPECTION and MS%i,y.

Average number of animals.
To calculate the average number of animals per category LT in the year y ($N_{LT,y}$) the operational procedure has the formulary 03.003 from 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 formulary 03.003.
The formula used to the calculation is indicated in the PDD section B.4, step 2 item B, equation B3.
Variables to be monitored: $N_{LT,y}$, $N_{day,y}$ and $N_{p,y.}$

Measurement of the volumetric flow rate of the biogas.
The operational procedure POP 4- Measurement of the biogas flow rate, is a guide to explain to the technicians how to obtain the biogas flow rate. The control of the flow rate is by a CLP (see picture in the POP 1 description above) installed in the control panel in the project activity site. The panel is equipped with solar cells to supply energy to the system, a battery (capacity for 10 days lack of sun) and the flow rate transmitter device to receive information from the thermal mass meter. The flow meter used in the project activity is a thermal mass flow meter.
The system is very confident and supplied by Endress+hauser, leader of measurement system of liquids and gases. Example of the meter used in the project activity:

The information recorded in the CLP is recovered by the use of a pendrive and the file containing the information will be sent to the QA/QC officer to manage the information for further verification. A spreadsheet in excel is available from the system to show the flow rate per minute per day.
The variable measured with this procedure are: $BG_{burnt,y}$ and $FV_{RG,h}$.
The data monitored is controlled in the formulary 04.001 attached in the operational procedure POP 4.

Methane content determination.
The POP 05a - Methane content was prepared to guide the technicians how to obtain the methane content using electronic equipment.
The methane content is obtained by electronic equipment BIOGAS or TESTO.
The concentration of methane is measured in a few seconds before starting the measurement button.
The operation of the equipment and the devices to be used is clearly described in the operational procedure as so as in the equipment manual.

The equipment is able to measure both the methane concentration in the biogas or in the flare residual gas.
The variables measured with this equipment are: $W_{CH4,y}$ and $fv_{CH4,RG,h}$.
All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.
The data monitored is controlled in the formulary 04.001 and 05.001.

Biogas temperature measurement.
The biogas temperature is obtained by electronic equipment BIOGAS.
The methane temperature is measured in a few seconds after inserting the thermocouple in the biogas line device.
The operation of the equipment and the devices to be used is clearly described in the operational procedure as so as in the equipment manual.
All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.
The variable measured with this equipment is: T biogas.
The data monitored is controlled in the formulary 04.001 described in the operational procedure POP 4 – Biogas temperature measurement.

Density of the methane determination.
The POP 7- Density of the Methane - is a guide to calculate the methane density. The formulary 07.001 attached in the operational procedure shows the data to be filled to make the calculation.
The methane density calculation is according to the Tool to determine project emissions from flaring gases containing methane.
The variable monitored with this procedure: D_{CH4}.

Flare efficiency.
The operational procedure POP 8a – Flare efficiency was developed for the monitoring and calculation of the flare efficiency.
The flare efficiency will be monitored according with the guidelines in the *Tool to determine project emissions from flaring gases containing methane* as followed:

a) If exhaust gas hourly temperature >=500^{o}C than 90% efficiency
b) If exhaust gas hourly temperature >=500^{o}C but out of the manufacturer´s specifications than 50% efficiency
c) If exhaust gas hourly temperature < 500^{o}C than 0% efficiency

Brascarbon developed the formulary 08.001 in the operational procedure to monitor the hourly flare efficiency according to the criteria above mentioned.
The variable monitored with this procedure: FE

Biogas pressure.
The biogas pressure is obtained by electronic equipment BIOGAS and procedures described in the operational procedure POP 13- Biogas pressure.
The operating pressure of the digester is atmospherically.
The operation of the equipment and the devices to be used is clearly described in the operational procedure as so as in the equipment manual.

All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.
The variable measured with this equipment is: P biogas.
The data monitored is controlled in the formulary 04.001.

Formulated feed rations.
Monitoring and controlling of the formulated feed rations used per animal category per confined feed animal operation.
The variable monitored: FFR.
Reference of the operational procedure: POP 14 – formulated feed rations monitoring.

Genetic Source.
Monitoring and controlling of the genetic source in the project activity per farm.
The variable monitored: GENETIC SOURCE.
Reference of the operational procedure: POP 15 – Genetic Source Monitoring.

Animal weight.
The animal weight is monitored and controlled by a formulary 16.001 where each animal category is monitored during the year, according to the operational procedure POP 16 – Animal Weight Monitoring.
Quarterly the data from the feed operations are checked and transferred to the formulary.
Records available in the feed operations will be copied and filed at Brascarbon office and attached with the formulary 16.001.
The variable monitored: W site.

Methane mass flow rate in the residual gas.
The residual mass flow rate can be determinate by the POP 17 – Emissions reductions ex-post, where it calculates all parameters to determine the emissions reductions ex-post. The operational procedure is based according to the Annex 13 – *"Tool to determine project emissions from flaring gases containing methane"*, equation 15 on Step 7 and equation 13 Step 5.
The variables monitored with this procedure are:
$TM_{RG,h}$; mass flow rate of the methane in the residual gas in the hour h.
MD_y; Methane captured and destroyed ex-post.

The formularies 17.001 and 17.002 as so as 10.001 are used to determine the variables above mentioned.

Number of days the treatment plant was operational
The number of days the treatment plant was operational can be determinate by the POP 24 – days of functioning, where it is monitored the number of days in a year "y" that the treatment plant has operated.
The variables monitored with this procedure: nd_y

Monitoring System
The monitoring system will be followed according to the Brascarbon Operations Procedures Manual, detailed to attend all necessary controls in the site to attend all monitoring parameters in the approved methodology AMS.III.D – Version 17 – *"**Methane recovery in animal manure management systems**"* and IPCC 2006.

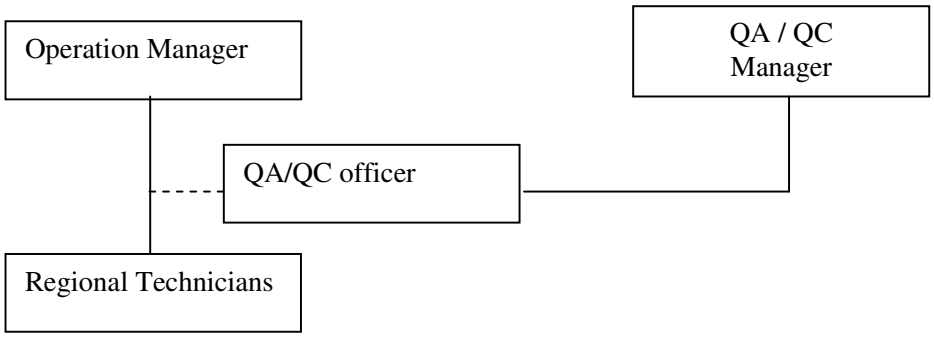
Operational / Monitoring Procedures
Operational / Monitoring procedures listed in the Annex 4.

Quality Assurance/Control: QA/QC
The measuring instruments will be calibrated by the manufacturers' representatives on a manufacturer's recommendation basis. The certification of calibration will be controlled by QA/QC officer. The QA/QC officer will be also responsible to assure that all Brascarbon Operations Procedures will be executed based in the Iso9000.

Training
The training of the technicians and all employees is provided by the Operations Manager. The topics of the training are as below:
1. General explanation of the project.
2. Explanation of the procedures of the Operations Procedure Manual.
3. Procedures and preparations for the star-up.
4. Maintenance procedures.
5. Biogas safety instructions.
6. Biogas measurement.
7. Safety Issues.

The training document and the equipment manuals are stored for easy reference in the Brascarbon office.

Organization



Operation Manager
Engineer, responsible for the project maintenance and monitoring data collection.

QA/QC Manager
Engineer, responsible for the monitoring operation and emissions for the project activity.

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

QA/QC officer
Responsible to assure the quality control of the information and the CDM project documents.

Maintenance
For maintenance of the equipment and to attend the monitoring system, BRASCARBON will use the practices recommended by the equipment supplier for repairs, calibration, etc…
The regular maintenance in the site project boundary will be according to the Brascarbon Operation Procedures Manual for all items considered in the project such as the digester, flare, measuring systems, pipings, electrical parts and others.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

The methodology applied to this project activity is AMS-III.D./Version 17 '***Methane recovery in animal manure management systems'.*** The simplified monitoring methodologies are applicable to this project activity because they provide a method to accurately measure and record the GHG emissions that will be captured and combusted by the project activity. The completion date of the application of the baseline is 31/03/2009.

The entity determining this monitoring methodology is BrasCarbon Consultoria, Projetos e Representação S/A, who is the project developer listed in Annex 1 of this document

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date for this activity was **15/06/2011**, which was the signature date of the construction contract.

C.1.2. Expected operational lifetime of the project activity:

The expected life for this project is **21 years and 0 months**.

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

The starting date of the crediting period is: **01/01/2012 or the registration date of the project activity**, what happens by last.

C.2.1.2. Length of the first crediting period:

The length of the crediting period is **7 years and 0 months**,

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The project activity will not use a fixed period.

C.2.2.2. Length:

The project activity will not use a fixed period.

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

An environmental impact analysis is not required for this type of GHG project activity. The principal environmental benefits of the project include:

- reducing atmospheric emissions of volatile solids causing odour;
- reducing the population of flies;
- best control on the bio-security system;
- reducing the possible spread of disease.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The use of digesters (to reduce GHG emissions in the confined animals operations) is not pre-requisite to get the environmental licenses even in the Brazilian states with that obligation, which is not the case in this project since São Paulo state does not have the requirement for environmental licences for these type of operation. The environmental impacts concerning the project activity are very significant because this project activity can contribute for the local and global sustainable development.
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_l4l77t4r.PDF
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_q9m29k2j.pdf
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_b889i6r.pdf
www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_f6c34f6j.pdf

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The invitation for the stakeholders' consultation for the project activity was done through personal mail asking for comments of the PDD attached to the Brascarbon site and also in the UNFCCC site, according to the Resolution 7 of the Brazilian DNA. The mail was sent to the stakeholders on 5th April 2010.

The following stakeholders were invited to comment on the project activity according to the Resolution 7 of the Brazilian DNA:

- City Hall and Chamber of Councilors
- Departments and Secretaries: municipal, state and federal
- ONG´s
- Unions
- Ministry Public – State
- Ministry Public – Federal
- State
- Legislative Assembly

E.2. Summary of the comments received:

No comments and negative issues were received from the local stakeholders.

E.3. Report on how due account was taken of any comments received:

No comments were received from stakeholders.

Annex 1
CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Brascarbon Consultoria, Projetos e Representação S/A.
Street/P,O,Box:	Rua Doutor Gentil Leite Martins 395
Building:	
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	04648-001
Country:	Brazil
Telephone:	+55 11 5523 7059
FAX:	+55 11 2533-6346
E-Mail:	info@brascarbon.com.br
URL:	www.brascarbon.com.br
Represented by:	
Title:	Director
Salutation:	Mr,
Last Name:	Pacífico
Middle Name:	
First Name:	Mário
Department:	Operations
Mobile:	+55 11 8901 7810
Direct FAX:	
Direct tel:	
Personal E-Mail:	mario.silva@brascarbon.com.br

Organization:	Luso Carbon Fund – Fundo Especial de Investimento Fechado
Street/P.O.Box:	Rua Tierno Galvan
Building:	Torre 3, 10º piso
City:	Lisbon
State/Region:	Lisbon
Postfix/ZIP:	1070-274
Country:	Portugal
Telephone:	+351 21 3806510
FAX:	+351 21 3806519
E-Mail:	geral@mco2.pt
URL:	www.mco2.pt
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Costa
Middle Name:	
First Name:	Luis
Department:	Director
Personal E-Mail:	lcosta@mco2.pt

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding in this project. All funding was provided by the PPs which are private entities.

ANNEX 3 - BASELINE INFORMATION

AMS.III.D - VERSÃO 17

SP - PDD 15

INSERIR	INSERIR
MS% i,y	$\eta_{flare,h}$
1	0,9

																							REDUCTIONS
ID	Farm/Site	Animal Category	$N_{da,y}$	$N_{p,y}$	$N_{LT,y}$	$W_{default}$	W_{site}	$VS_{default}$	VS_{LT}	nd_y	$VS_{(LT,y)}$	UF b	$B_{0,LT}$	GWP_{CH4}	D_{CH4}	MCF	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	$PE_{power,y}$	$PE_{transp,y}$	$PE_{discharge,y}$	PE y	ER y
1	Sitio Barreiro	Sows	365	3.300	3.300	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	2.895	390,00	290,00	-	-	-	680	2.215
		Finishers	90	-	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Boars	365	15	15	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	37	5,00	4,00	-	-	-	9	28
		Gilts	365	660	660	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	579	78,00	58,00	-	-	-	136	443
		total			3.975													3.511	473	352				825	2.686
2	Sitio Santa Rosa dos	Sows	365	3.000	3.000	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	2.631	354,00	263,00	-	-	-	617	2.014
		Finishers	90	-	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Boars	365	15	15	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	37	5,00	4,00	-	-	-	9	28
		Gilts	365	600	600	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	526	71,00	53,00	-	-	-	124	402
		total			3.615													3.194	430	320				750	2.444
3	Sitio Mirante do Macuco	Sows	365	3.200	3.200	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	2.807	378,00	281,00	-	-	-	659	2.148
		Finishers	90	-	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Boars	365	15	15	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	37	5,00	4,00	-	-	-	9	28
		Gilts	365	1.000	1.000	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	877	118,00	88,00	-	-	-	206	671
		total			4.215													3.721	501	373				874	2.847
4	Faz São	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Finishers	90	50.289	12.400	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	11.491	1.547,00	1.149,00	-	-	-	2.696	8.795
		Nursery/Weaners	70	57.357	11.000	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	2.265	305,00	227,00	-	-	-	532	1.733
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		total			23.400													13.756	1.852	1.376				3.228	10.528
5	Fazenda Bom	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Finishers	90	66.511	16.400	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	15.198	2.047,00	1.520,00	-	-	-	3.567	11.631
		Nursery/Weaners	70	52.143	10.000	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	2.059	277,00	206,00	-	-	-	483	1.576
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		total			26.400													17.257	2.324	1.726				4.050	13.207
6	Sitio Agua do Rosario	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Finishers	90	81.111	20.000	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	18.534	2.496,00	1.853,00	-	-	-	4.349	14.185
		Nursery/Weaners	70	41.714	8.000	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1.648	222,00	165,00	-	-	-	387	1.261
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		total			28.000													20.182	2.718	2.018				4.736	15.446
7	Granja	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Finishers	90	29.606	7.300	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	6.765	911,00	677,00	-	-	-	1.588	5.177
		Nursery/Weaners	70	27.636	5.300	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1.091	147,00	109,00	-	-	-	256	835
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		Gilts	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	-	-	-	-	-	-	-	-
		total			12.600													7.856	1.058	786				1.844	6.012

Annex 4

MONITORING INFORMATION

The following table presents the explanation of the QA/QC procedures of the monitoring plan followed by BRASCARBON in order to achieve certified emission reductions, after each validation and verification process:

ID	DATA VARIABLE	UNCERTAINTY LEVEL	DATA UNIT	DATA ORIGIN
1	T f	Low	°C	Register from the measurement system, information managed by Brascarbon,
2	Site Inspection	Low	-----	Register information managed by Brascarbon
3	$N_{LT,y}$	Low	Nr, Of heads by category	Register from the measurement system, information managed by Brascarbon,
4	$BG_{burnt,y}$	Low	m^3	Register from the measurement system, information managed by Brascarbon,
5	W_{CH4}	Low	%	Register from the measurement system, information managed by Brascarbon,
6	T_{biogas}	Low	°C	Register from the measurement system, information managed by Brascarbon,
7	D_{CH4}	Low	t/m^3	Register from the measurement system, information managed by Brascarbon,
8	FE	Low	%	Register information managed by Brascarbon,
9	QDM	Low	---	Register from the measurement system, information managed by Brascarbon,
10	W_{site}	Low	Kg	Register from the measurement system, information managed by Brascarbon,
11	FFR	Low	-----	Register from the measurement system, information managed by Brascarbon,
12	P_{biogas}	Low	mbar	Register information managed by Brascarbon.
13	Genetic Source	Low	-----	Register information managed by Brascarbon.
14	$MS\%_{i,y}$	Low	%	Register information managed by Brascarbon.
15	$FV_{RG,h}$	Low	m^3/h	Register information managed by Brascarbon.
16	$fv_{CH4,RG}$	Low	%	Register information managed by Brascarbon.
17	$TM_{RG,h}$	Low	Kg/h	Register information managed by Brascarbon.
18	$N_{day,y}$	Low	days	Register information managed by Brascarbon.
19	$N_{p,y}$	Low	Nr, Of heads by category	Register information managed by Brascarbon.
20	nd_y	Low	days	Register information managed by Brascarbon.
21	Other flare operation parameters	Low	-----	Register information managed by Brascarbon.

BRASCARBON has implemented an Operation Procedures Manual and formularies to capture and report monitoring data and maintenance activities throughout the project lifecycle. On-site assessment, supplier production data, task tracking, and post-implementation auditing tools have been developed to ensure accurate, consistent, and complete data gathering and project

implementation.

By coupling these capabilities with an ISO-based quality and environmental management system, BRASCARBON enables transparent data collection and verification.

Procedures from Brascarbon Operation Procedures Manual to ensure accurate and consistent data for monitoring system have been developed as indicated in the following table:

ID	DATA /PARAMETERS/TITLE	FREQUENCY	RESPONSIBLE	PROCEDURE	COMENTS
1	T_f	Every minute	TR	POP 1	Flare Temperature
2	SITE INSPECTION $MS\%_{i,y}$	A	TR	POP 2	General site Inspection
3	$N_{LT,y}$ $N_{Day,y}$ $N_{p,y}$	M	QC	POP 3	Number of heads
4	$BG_{burnt,y}$ $FV_{RG,h}$	M	QC	POP 4	Biogas produced and burnt
5	$W_{CH4,y}$ $fv_{CH4,RG}$	TBD	TR	POP 5a	Methane content
6	$T_{biogás}$	M	TR	POP 6	Biogas Temperature
7	D_{CH4}	M	QC	POP 7	Methane Density
8	FE	M	QC	POP 8a	Flare Efficiency
9	QDM	Every Batch	TR	POP 9	Sludge Mass
10	ER	A	QC	POP 10	Emission reduction calculation
11	TRAINING	A	OM	POP 11	General training of procedures and safety issues
12	MAINTENANCE	S	OM	POP 12	Up-date of the maintenance activities
13	P_{biogas}	M	TR	POP 13	Biogas pressure
14	FFR	M	TR	POP 14	Formulated Feed Rations
15	GENETIC SOURCE	A	TR	POP 15	Genetic source
16	W_{site}	Q	TR	POP 16	Average animal weight
17	nd_y	A	QC	POP 24	Number of days the treatment plant was operational

Legend:

A: Annually
Q: Quarterly
M: Monthly
S: Semesterlly
TR: Regional Technician
QC: Quality Control
TBD: to be determinate to attend 90% confidence level
OM: Operation Manger