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-06A.
Version 4, 1st March, 2010, 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 São Paulo, Paraná and Minas Gerais states, Brazil, developed by BRASCARBON.
In Brazil the agricultural operations related to the confined animals operations are very wide and grows 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 (CH4) 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, where this operation is not sustainable due to its sever environmental pollution.

The Project Activity consists of the construction of a new covered in-ground anaerobic reactor (digester) that will utilize the organic material currently treated in the wastewater opened lagoon, from the confined animal operations to produce biogas. All manure will be sent daily directly to biodigester not exceeding 24 hours in the barns.

This project proposes to apply the Methane Recovery methodology identified in Section III.D, of the Indicative Simplified Baseline and Monitoring Methodologies for Small-Scale CDM Project Activity Categories, to swine confined feed operations located in the states mentioned above 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 treatment systems in Brazil consist of open tanks, open digesting and ponds (anaerobic, variable and aerobic) due the most economic and viable system approved to manage the manure in confined animals feed operations. Economic barriers are very common because producers invests in the confined feed operations only and not in the waste management systems. Financial resources are always used to maintain the confined feed operation in operation.
Also less technology for waste treatment is involved, as open lagoons, where it needs less employees and technicians for operation and maintenance.
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 with instructions and publications to help the producers and agro-industries to implement projects or systems to control the animal waste management protecting the eco-system.

Failure to do so will allow existing problems (such as increased (insect) pest populations, problems with allergies and livestock disease. To this end, Brazil has in recent years, required all confined animals feed operations to change from single to multi-lagoon systems, introducing a 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.[3]

In 2005, the swine population in Minas Gerais state was 3.793.000[4,5], in São Paulo state was1.707.000.[4,5], and Paraná state was 4.707.000.[4,5].
Considering the follow example, that a typical hog produces 4.9 kilograms of effluent daily (Table A1), annually some 8.4 million metric tons of hog waste was produced in São Paulo state alone.
Introducing a progressive animal waste management practices throughout this region of Brazil could result in an annual reduction of approximately 655 thousand tonnes[6] of carbon dioxide equivalent (CO2e/year).

[1] http://www.ambientebrasil.com.br
[2] PNMA-II – Programa Nacional do Meio Ambiente, 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.agricultura.gov.br/pls/portal/url/ITEM/C90C773459FBB52AE0300801FD0AF827
[4] IBGE – Pesquisa Pecuária Municipal (www.ibge.gov.br).
[5] www.agricultura.gov.br
[6] Approximate calculation using IPCC model and emission factors

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 – Programa Nacional do Meio Ambiente, 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

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

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

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 a methane and carbon dioxide, rich biogas, suitable for energy production helping replace fossil fuels. The nutrient-rich solids left after digestion can be used as fertilizer also.
The digestion process begins with bacterial hydrolysis of the input materials in order to break down insoluble organic polymers such as carbohydrates and make them available for other bacteria. Acidogenic bacteria then convert the sugars and amino acids into carbon dioxide, hydrogen, ammonia, and organic acids. Acetogenic bacteria then convert these resulting organic acids into acetic acid, along with additional ammonia, hydrogen, and carbon dioxide. Methanogenic bacteria finally are able to convert these products to methane and carbon dioxide.

The equipment is based on in one ambient temperature storage covered cells (lagoon) with sufficient capacity to create an adequate Hydraulic Retention Time (HRT). The cell will use a single-piece liner affixed to a reinforced outer concrete frame. The outer cover consists of a synthetic vinyl membrane or High Density Polyethylene (HDPE)-, which is also fastened to the frame. The liner and cover will be sealed together with bolts and iron plate frame.
The system also includes a biogas collector piping, from the digester to the flare system.

The flare is enclosed and controlled by a data logger CLP –Controller Logic Programmable – where the combustion temperature is stored every one minute in the system. This system will record every each minute the combustion temperature to determinate the flare efficiency according to the specification of the flare. A thermocouple installed in the flare is connected to the PLC to control the combustion temperature.

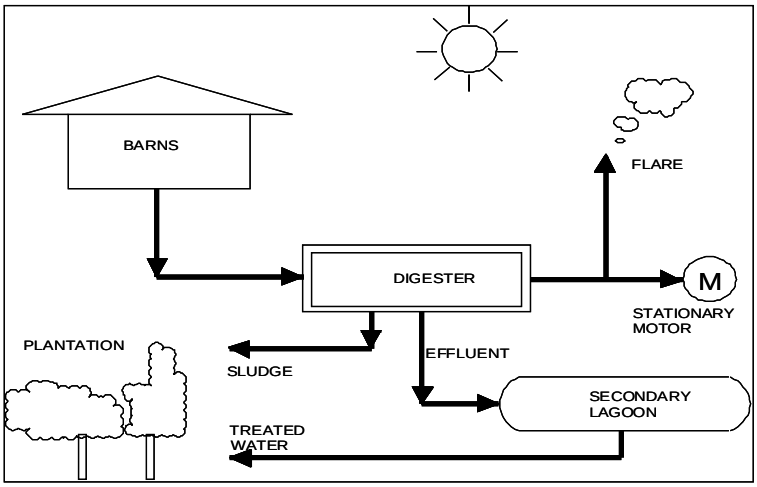
The sparkling system in the flare is automatic. Every one second the system sparks.
The biogas flow rate will be also controlled by a CLP where every each minute the system records the flow rate.
The sparkling system, the PLC and the control panel are powered by a 12 volts battery charged by solar cells.

A derivation pipe will be installed before the flare and after the flow meter, for future proposals, to supply biogas to the power generators, for in site electricity supply where **no claims for emissions reductions by the electricity generation will be requested** during the entire project activity but by the emissions reductions of the biogas destroyed in the generators.

The treated effluent is discharged to the open lagoons where it is aerated as per the design of the original lagoon system.
The treated water can be then recycled and sent back to the farm proposals, or used for irrigation by the use of biogas pumps or electrical stationary pumps supplied by the biogas electricity generator.
No electricity will be consumed from the grid. The technical parts that will be powered by energy will be supplied by solar cells. The energy will be stored in 12 volts batteries.

The sludge from the digesters will be spread aerobically in the surface of the pasture or plantation as 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



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

The project is located in central/southeast/ South Brazil, at the provinces of São Paulo, Minas Gerais and Paraná states.

A.4.1.1. Host Party(ies):

The host party for this project activity is Brazil.

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

Southeast and South Brazil region. States of São Paulo, Minas Gerais and Paraná.

A.4.1.3. City/Town/Community etc:

Cities of Araguari, Carmo do Rio Claro, Guimarânea, Pará de Minas, Santa Juliana and Oliveira at Minas Gerais state.
Cities of Bauru, Fartura, Porto Feliz and Rafard at São Paulo state.
Cities of Ponta Grossa and Pinhalão at Paraná state.

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 the Figures A3 and A4, with specifics detailed in Table A2.

Table A2. Detailed physical location and identification of project site

Farm/Site	Brascarbon ID	Address	Town/State	Contact	Phone	GPS Coord
Fazenda São Francisco	BCA-094MG1-06	Rod. MG 050, Km 5	Carmo do Rio Claro- MG	Moacyr Mendes Galvão	+ 55 35 3561-1298	S 20º57'09'' W 46º 12' 17''
Fazenda Rancho da Paz	BCA-095MG1-06	Estrada do Morro Vermelho	Oliveira - MG	Marcio Eugenio Leite de Castro	+55 31 3335-0713	S 20° 41' 3" W 47° 47' 46"
Fazenda Caixetas (Elite Swine)	BCA-106MG1-06	BR 354, Km 443	Guimarânea - MG	Willian Gomes Eugenio	+55 34 3814-1337	S18° 44' 47" W 46° 47' 04"
Fazenda Boa Vista	BCA-131MG1-06	Estrada Borá, Km 0,5 – Zona Rural	Santa Juliana - MG	Jandira Roman Robel	+55 34 3354-0880	S 19° 17' 51" W 47° 31' 52"
Fazenda Boa Vista (Terminação)	BCA-131MG2-06	Estrada Borá, Km 4 – Zona Rural	Santa Juliana - MG	Jandira Roman Robel	+55 34 3354-0880	S19°16' 15" W 47° 33' 28"
Sitio Bela Vista	BCA-160MG1-06	Rod. Pará de Minas à Pitangui Km 498	Pará de Minas - MG	Hélio José Martins	+55 37 3259-0404	S19° 47' 27" W 44° 44' 48"
Fazenda Cachoeirinha	BCA-169MG1-06	Linha Barreirão – Jateí	Araguari - MG	Livio Rinziler	+55 34 3242 6611	S 18° 38' 30" W 48° 14' 39"
Sitio Ana Paula	BCA-009SP1-06	Estrada Velha Capivari/Porto Feliz - KM 08	Porto Feliz - SP	Vagner Carlini	+55 19 3492-9393	S 23° 09' 35" W 47° 27'10,9"
Fazenda Taquara Branca	BCA-099SP1-06	Bairro Lageado	Fartura - SP	José Carlos Ribeiro	+55 14 3386-1106	S 23° 28` 10" W 49° 29` 03"
Fazenda Santana do Matão	BCA-100SP1-06	Fartura	Fartura – SP	Pedro Alcantara Ribeiro Neto	+55 14 3382-1093	S 23° 23` 05" W 49° 34` 03"
Fazenda Suinolândia	BCA-101SP1-06	Rod. Marechal Rondon KM 360	Bauru - SP	Paulo Pereira Rangel Filho	+55 14 3279-1112	S22° 12'42,12" W49°11' 45,45"
Sitio Santo Antônio	BCA-010SP1-06	Rodovia SP 113 KM 14	Rafard – SP	Nadia Cristina Bressiani	+55 19 3492-3901	S 23° 03' 59,7" W 47° 35' 10,9"
Granja Lago Azul	BCA-081PR1-06	BR 372 - KM 472 - Uvaia	Ponta Grossa – PR	Daniel Dantas Ribeiro	+55 42 3228-9434	S 24º 54´ 54.39" W 50º19´51.50"
Granja Herval	BCA-080PR1-06	Estrada da Serrinha S/N - Bairro Herval	Pinhalão – PR	Pedro Alcantara Ribeiro Neto	+55 14 3382-1093	S 23° 46` 03" W 50° 03` 05"
Granja São João	BCA-210MG1-06	Rodovia Jaguara Km 5 - Zona Rural	Pará de Minas - MG	João Gabriel Sobrinho	+55 37 3235 3144	S 19º 48` 07" W 44º 38` 13"

Moacyr Mendes Galvão has one site in Carmo do Rio Claro city:

- Fazenda São Francisco is a farrow-to-finish swine operation. The site uses three primaries open lagoons 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.

Marcio Eugenio Leite de Castro has one site in Oliveira city:

- Fazenda Rancho da Paz is a farrow-to-finish swine operation. The 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.

Willian Gomes Eugenio has one site in Guimarânea city:

- Fazenda Caixetas (Elite Swine) is a finishing swine operation. The site uses two primaries open lagoons 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.

Jandira Roman Robel has two sites in Santa Juliana city:

- Fazenda Boa Vista is a breeding swine operation. The 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.

- Fazenda Boa Vista (terminação) is a nursery and finishing swine operation. The site uses two primaries open lagoons 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.

Helio José Martins has one site in Para de Minas city:

- Sitio Bela Vista is a finishing swine operation. The site uses two primaries open lagoons 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.

Livio Rinziler has one site in Araguari city:

- Fazenda Cachoeirinha is a farrow-to-finish swine operation. The site uses two primaries open lagoons 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.

Vagner Carlini has one site in Porto Feliz city:

- Sítio Ana Paula is a farrow-to-finish swine operation. The site uses two primaries open lagoons 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.

Jose Carlos Ribeiro has one site in Fartura city:

- Fazenda Taquara Branca is a farrow-to-finish swine operation. The site uses two primaries open lagoons 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.

Pedro Alcantara Ribeiro Neto has one site in Fartura city:

- Fazenda Santana do Matão is a finishing swine operation. The site uses two primary open lagoons 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.

Paulo Pereira Rangel Filho has one site in Bauru city:

- Fazenda Suinolândia is a farrow-to-finish swine operation. The site uses two primary open lagoons 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.

Nadia Cristina Bressiani has one site in Rafard city:

- Sitio Santo Antonio is a finishing swine operation. The site uses two primary open lagoons 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.

Daniel Dantas Ribeiro has one site in Ponta Grossa city:

- Granja Lago Azul is a farrow-to-finish swine operation. The site uses two primary open lagoons 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.

Pedro Alcântara Ribeiro Neto has one site in Pinhalão city:

- Granja Herval is a breeding and nursery swine operation. The site uses two primary open lagoons 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.

João Gabriel Sobrinho has one site in Para de Minas city:

- Granja São João is a farrow-to-finish swine operation. The site uses two primaries open lagoons 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.

Figure A3 State of São Paulo, Brazil - Location of project sites

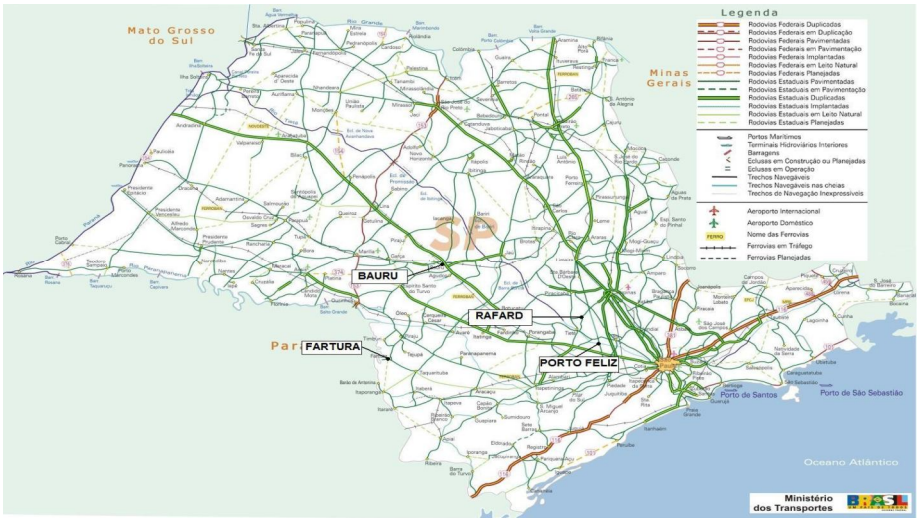


Figure A4 State of Minas Gerais, Brazil - Location of project sites

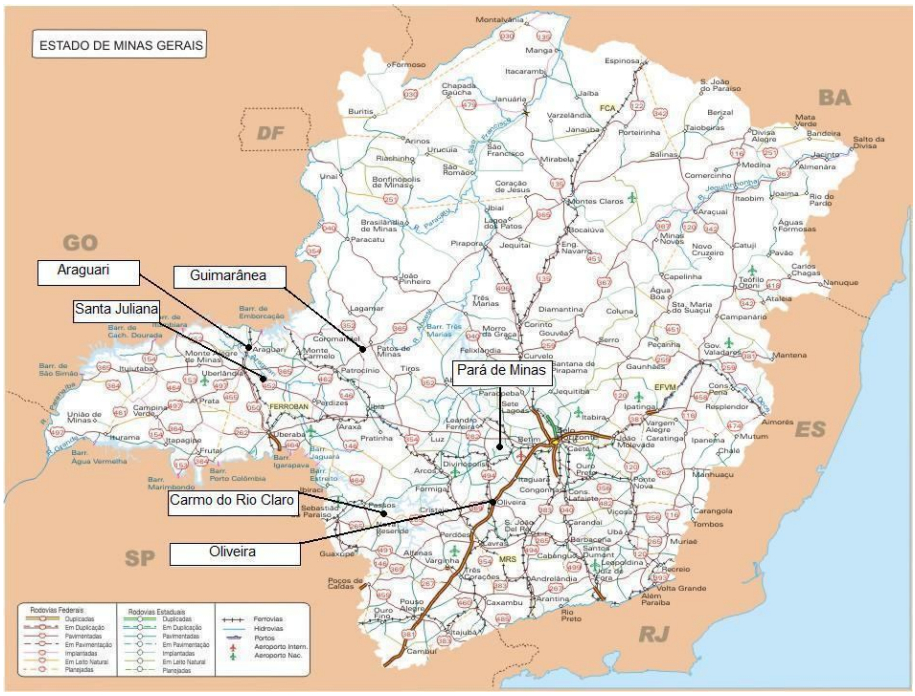
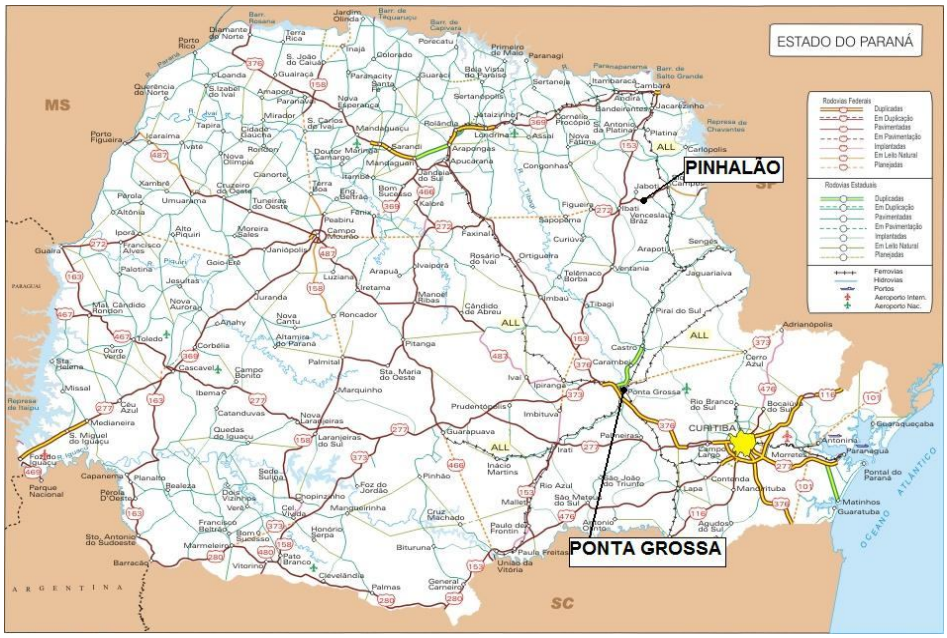


Figure A5 State of Paraná, Brazil - Location of project sites



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 CO2eq.

• Type III.D (reference AMS-III.D) / Version 15 – *"**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 Minas Gerais, São Paulo and Paraná states, 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.

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
2011	**49,850**
2012	**49,850**
2013	**49,850**
2014	**49,850**
2015	**49,850**
2016	**49,850**
2017	**49,850**
Total estimated reductions (tonnes of CO2e)	**348,950**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions **(tonnes of CO2e)**	**49,850**

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

There is no official development assistance being provided for this project.

A.4.5. Confirmation that the small-scale project activity is not a debundled 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[7], 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 whose project boundary is within 1 km of another proposed small-scale activity.

[7] 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 15 – *"**Methane recovery in animal manure management systems**"*.

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

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 confirmed by the obligatory environmental licenses whose document releases the Confined Animals Feed Operation business. The environmental licenses can be found at Brascarbon and it´s available for validation and verification.

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

c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C:
The annual average temperature verified in city of reference to the São Paulo state is 23-25 ° C, Paraná state is 23-25 ° C, and Minas Gerais state is 23-25 ° C, so higher than the methodology provides: 5 ° C. This information can be verified through on INPE (National Institute of space research) web site.
This information is available for validation and verification.

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 recommended by EMBRAPA (from 30 to 40 days)[8]. 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.

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

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 making of a Confined Animal Feed Operation with open anaerobic lagoons for the manure treatment system. Any methane recovery and destruction by flaring, combustion or gainful use wich can be verified in each farm during validation.

The project will also satisfy the following conditions:

a) 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. There is only one deviation proposed in the biogas pipeline from the digester to the flare, blocked with a weld cap, for biogas use in generators (further definition). Only one pipe from digester to flare will be installed. Any other additional biogas pipe will be installed in the digester.
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 24 hours 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.

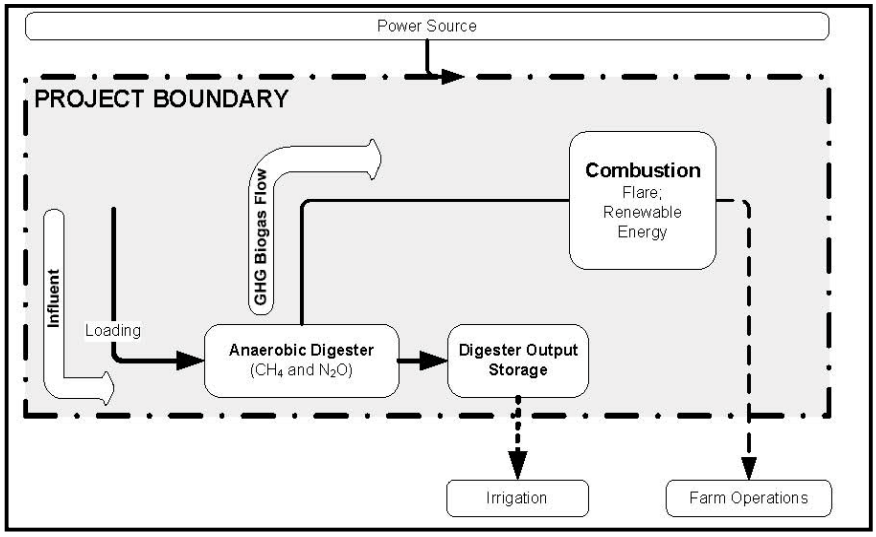
Also, the project is a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 60 kt CO2eq.
The starting date for this activity is expected on 18/01/2010 where Brascarbon will commit expenditures after signing the first site construction contract which will be available for validation and verification. 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:

The project boundary is illustrated in Figure B1. It describes the basic layout of the project farm in a schematic format. The proposed project boundary considers the GHG emissions that come from the animal waste practices, including the GHG resulting from the capture and combustion of biogas. The project activity site uses a system of one or more lagoons.
The proposed animal waste management system practice changes include the construction of

a digester comprised of cells that capture the resulting biogas which is then combusted. Based on the methodology, the anaerobic digester is the physical boundary of the methane recovery facility.

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 15 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 15.

The final draft of this baseline section was completed on 31/03/2009. 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 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

Equation B1

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

Where:

BE_y	Baseline emissions in year "y" (tCO_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 °C) and 1 atm pressure).
LT	Index for all types of livestock
j	Index for animal waste management system
MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^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 determinate 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 IPCC2006, 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	Anual Average Number of Animals of Type LT in year y - $N_{LT,y}$					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Fazenda São Francisco	300	1,881	1,277	7	90	**3,555**
2	Fazenda Rancho da Paz	250	1,596	1,182	3	75	**3,106**
3	Fazenda Caixetas (Elite)	-	4,438	-	-	-	**4,438**
4	Fazenda Boa Vista	1,000	-	-	10	300	**1,310**
5	Fazenda Boa Vista (term)	-	6,840	4,729	-	-	**11,569**
6	Sitio Bela Vista	-	3,356	-	-	-	**3,356**
7	Fazenda Cachoeirinha	550	4,237	2,601	6	165	**7,558**
8	Sitio Ana Paula	562	3,523	2,658	8	63	**6,814**
9	Fazenda Taquara Branca	200	1,254	946	2	60	**2,462**
10	Faz. Santana do Matão	-	5,085	-	-	-	**5,085**
11	Fazenda Suinolandia	500	3,440	2,416	8	200	**6,564**
12	Sitio Santo Antonio	-	3,051	-	-	-	**3,051**
13	Granja Lago Azul	750	4,702	3,546	23	456	**9,477**
14	Granja Herval	1,000	-	4,729	14	-	**5,743**
15	Granja São João	2,600	9,320	11,830	25	450	**24,225**
TOTAL		**7,712**	**52,722**	**35,915**	**106**	**1,859**	**98,313**

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:

Proof of an early consideration of CDM is available, as the contract between the project developer (Brascarbon) and the carbon credit buyer (Luso Carbon Fund) was signed before than the starting date, on June 2007 (document is also available for review). Furthermore, the contract between the project developer and the owner of the pig farms specifically mentions the project implementation under the context of CDM. After the starting date of the project activity and until the PDD started validation (September 2009), the project developer finalized and signed the contracts with the other owners of pig farms/project sites, elaborated the PDD and contracted the DOE for validation.

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, variable and aerobic), 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 confine 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. Similarly, for the identified CDM project, 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, alleged water quality enhancements, and the potential incremental savings associated with electricity cost avoidance, are rarely enough to compel an 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 difficulty financing changes that should be undertaken. Even banks have been unwilling to finance such activities absent government guarantees or other incentives.
The anaerobic digester requires a much higher investment, it can be assumed that the anaerobic lagoon, usually requires less investment, is the most likely alternative and therefore can be considered 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 economic sensitive analysis of the project activity (without the revenue of the carbon credits), considering three different scenarios: first scenario, where only the installation of the anaerobic digester plus flare is being considered and, the second scenario, where the installation of both an anaerobic digester plus flare and a generator are being considered and which assumes that all the farms will start to produce electricity in 2011 (using a standard generator with installed capacity of 40KW, to produce energy during 12 hours/day, consuming 100% of the biogas produced, only for farm activities proposals, without connection to the grid for further energy commercialization); and third, the installation of the anaerobic lagoon, as usual in the baseline scenario.

In all scennarios the Internal Return Rate (IRR) cannot be calculated hence the analysis is based on the NPV, using the discount rate of 10,77% - Brazilian bonds (taxa SELIC - http://www.bcb.gov.br/), in 21 years.

In the first scenario, table B 2.1, there is only negatives cash flows, as no revenue will be expected from the implementation of the project activity.

In the following table it can be seen that there is no positive cash flow scenario involved in the project activity therefore there is an investment barrier that prevents the implementation of the project activity.

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.

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).

Table B 2.1 – NPV and IRR calculation (digester + flare, operation lifetime of the project: 21 years)

ID	FARM/SITE	Equipment costs (digester and flare)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable			TOTAL	NPV (US$) (10,77% discount rate)	IRR (%)
					2011	year n	year n+1	2011	year n	year n+1			
1	Fazenda São Francisco	-55,500,00	-11,100,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-82,200,00	-172,257	UNDEFINED
2	Fazenda Rancho da Paz	-36,300,00	-7,260,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-59,160,00	-151,806	UNDEFINED
3	Fazenda Caixetas (Elite)	-42,200,00	-8,440,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-66,240,00	-158,091	UNDEFINED
4	Fazenda Boa Vista	-37,600,00	-7,520,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-60,720,00	-153,191	UNDEFINED
5	Fazenda Boa Vista (term)	-52,800,00	-10,560,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-78,960,00	-169,381	UNDEFINED
6	Sitio Bela Vista	-37,200,00	-7,440,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-60,240,00	-152,765	UNDEFINED
7	Fazenda Cachoeirinha	-51,500,00	-10,300,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-77,400,00	-167,997	UNDEFINED
8	Sitio Ana Paula	-51,500,00	-10,300,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-77,400,00	-167,997	UNDEFINED
9	Fazenda Taquara Branca	-32,900,00	-6,580,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-55,080,00	-148,185	UNDEFINED
10	Faz. Santana do Matão	-36,700,00	-7,340,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-59,640,00	-152,232	UNDEFINED
11	Fazenda Suinolandia	-54,900,00	-10,980,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-81,480,00	-171,618	UNDEFINED
12	Sitio Santo Antonio	-41,000,00	-8,200,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-64,800,00	-156,812	UNDEFINED
13	Granja Lago Azul	-54,900,00	-10,980,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-81,480,00	-171,618	UNDEFINED
14	Granja Herval	-41,000,00	-8,200,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-64,800,00	-156,812	UNDEFINED
15	Granja São João	-63,200,00	-12,640,00	0,00	-15,600,00	-15,600,00	-15,600,00	0,00	0,00	0,00	-91,440,00	-180,459	UNDEFINED

In the second scenario, table B 2.2, considered electricity cogeneration and anaerobic digester plus flare installation, although the project activity generates positive returns from the avoided costs of the electricity purchase, the yearly cash-flows are always negative, as the electricity avoided cost is not enough to offset the maintenance costs of the anaerobic digester and the generator.

The NPV of the project activity is negative. It is assumed that the farms would implement a 40KW standard generator, which would produce electricity 12 hours per day (to guarantee farm needs) consuming 100% of the biogas produced during the operation.

The revenue adopted in this model was considered the energy cost savings by the use of the biogas generator. The energy generation is directly to the user. Selling energy was not considered due the internal difficulties for grid connection for such amount of energy produced.
Once again, there is an investment barrier that prevents the implementation of the project activity.

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.

Table B 2.2. NPV and IRR calculation (Digester+ Flare+ Electricity Generator, operation lifetime of the project: 21 years)

ID	FARM/SITE	Equipment costs (digester, flare, generator)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from electricity savings due the on site energy production (during 12 hours/day in year) (*)			TOTAL	NPV (US$) (10,77% discount rate)	IRR (%)
					2011	year n	year n+1	2011	year n	year n+1			
1	Fazenda São Francisco	-85,000	-41,100	0	-24,100	-24,100	-24,100	16,791	16,791	16,791	-133,409	-164,936	UNDEFINED
2	Fazenda Rancho da Paz	-65,800	-37,260	0	-22,180	-22,180	-22,180	16,791	16,791	16,791	-108,449	-130,560	UNDEFINED
3	Fazenda Caixetas (Elite)	-71,700	-38,440	0	-22,180	-22,180	-22,180	16,791	16,791	16,791	-115,529	-136,845	UNDEFINED
4	Fazenda Boa Vista	-67,100	-37,520	0	-21,720	-21,720	-21,720	16,791	16,791	16,791	-109,549	-128,609	UNDEFINED
5	Fazenda Boa Vista (term)	-82,300	-40,560	0	-22,770	-22,770	-22,770	16,791	16,791	16,791	-128,839	-152,414	UNDEFINED
6	Sitio Bela Vista	-66,700	-37,440	0	-22,310	-22,310	-22,310	16,791	16,791	16,791	-109,659	-132,462	UNDEFINED
7	Fazenda Cachoeirinha	-81,000	-40,300	0	-23,830	-23,830	-23,830	16,791	16,791	16,791	-128,339	-158,717	UNDEFINED
8	Sitio Ana Paula	-81,000	-40,300	0	-22,270	-22,270	-22,270	16,791	16,791	16,791	-126,779	-147,403	UNDEFINED
9	Fazenda Taquara Branca	-62,400	-36,580	0	-23,700	-23,700	-23,700	16,791	16,791	16,791	-105,889	-137,963	UNDEFINED
10	Faz. Santana do Matão	-66,200	-37,340	0	-23,700	-23,700	-23,700	16,791	16,791	16,791	-110,449	-142,010	UNDEFINED
11	Fazenda Suinolandia	-84,400	-40,980	0	-21,840	-21,840	-21,840	16,791	16,791	16,791	-130,429	-147,906	UNDEFINED
12	Sitio Santo Antonio	-70,500	-38,200	0	-22,900	-22,900	-22,900	16,791	16,791	16,791	-114,809	-140,788	UNDEFINED
13	Granja Lago Azul	-84,400	-40,980	0	-23,150	-23,150	-23,150	16,791	16,791	16,791	-131,739	-955,453	UNDEFINED
14	Granja Herval	-70,500	-38,200	0	-22,220	-22,220	-22,220	16,791	16,791	16,791	-114,129	-135,857	UNDEFINED
15	Granja São João	-92,700	-42,640	0	-24,040	-24,040	-24,040	14,767	14,767	14,767	-144,613	-187,382	UNDEFINED

(*) consumed 100 % of the biogas produced during the operation

In the third scenario considered the installation of the open anaerobic lagoons (baseline scenario) as usually installed due the most economic option to the swine producers. The table B 2.3, considered the installation of the open anaerobic lagoon and a less cost for maintenance, comparing with the 1st and 2nd options, due the less technology involved.
Although the third option is the favorable economic option, the yearly cash-flows are always negative. The NPV of this scenario is also negative.

Table B 2.3. NPV and IRR calculation (Open Lagoon, operation lifetime of the project: 21 years)

ID	FARM/SITE	Equipment costs (anaerobic open lagoon)	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable			TOTAL	NPV (US$) (10,77% discount rate)	IRR (%)
					2011	year n	year n+1	2011	year n	year n+1			
1	Fazenda São Francisco	-15,958	-1,571	0	-1,000	-1,000	-1,000	0	0	0	-18,528	-22,811	UNDEFINED
2	Fazenda Rancho da Paz	-17,275	-1,847	0	-1,000	-1,000	-1,000	0	0	0	-20,122	-24,226	UNDEFINED
3	Fazenda Caixetas (Elite)	-16,960	-1,571	0	-1,000	-1,000	-1,000	0	0	0	-19,531	-23,701	UNDEFINED
4	Fazenda Boa Vista	-16,756	-1,571	0	-1,000	-1,000	-1,000	0	0	0	-19,326	-23,520	UNDEFINED
5	Fazenda Boa Vista (term)	-28,017	-2,423	0	-1,000	-1,000	-1,000	0	0	0	-31,440	-34,272	UNDEFINED
6	Sitio Bela Vista	-15,847	-1,571	0	-1,000	-1,000	-1,000	0	0	0	-18,418	-22,713	UNDEFINED
7	Fazenda Cachoeirinha	-27,387	-2,423	0	-1,000	-1,000	-1,000	0	0	0	-30,809	-33,712	UNDEFINED
8	Sitio Ana Paula	-24,720	-2,213	0	-1,000	-1,000	-1,000	0	0	0	-27,933	-31,159	UNDEFINED
9	Fazenda Taquara Branca	-13,149	-1,378	0	-1,000	-1,000	-1,000	0	0	0	-15,528	-20,148	UNDEFINED
10	Faz. Santana do Matão	-27,884	-2,785	0	-1,000	-1,000	-1,000	0	0	0	-31,669	-34,476	UNDEFINED
11	Fazenda Suinolandia	-27,880	-2,785	0	-1,000	-1,000	-1,000	0	0	0	-31,665	-34,472	UNDEFINED
12	Sitio Santo Antonio	-15,336	-1,566	0	-1,000	-1,000	-1,000	0	0	0	-17,902	-22,255	UNDEFINED
13	Granja Lago Azul	-32,724	-2,785	0	-1,000	-1,000	-1,000	0	0	0	-36,510	-38,772	UNDEFINED
14	Granja Herval	-22,961	-2,313	0	-1,000	-1,000	-1,000	0	0	0	-26,274	-29,686	UNDEFINED
15	Granja São João	-67,964	-4,960	0	-1,000	-1,000	-1,000	0	0	0	-73,924	-71,982	UNDEFINED

Once again, there is also an investment barrier that prevents the implementation of the installation of the anaerobic open lagoon, but it is the option approved by the environment department to the waste management system to the confined feed animal operation.
The negative cash flow and the present value demonstrate in the 3 scenarios indicates that the farm producers would not engage in any implementation due the negative cash-flow and no investment returns.
Continuation of the actual practices, anaerobic lagoon, would be the most attractive course of action because requires less investment (since all the producers already have an anaerobic lagoon under place) and this practice is approved by the environmental department to the confined feed animals operation, but with high emissions.

In the table B2.4 it can be seen the summary of the sensitive investment analysis for each farm where the 3rd scenario (continuation with the baseline scenario) is the most attractive option due the less investment involved comparing with the 1st and end 2nd scenarios but with high emissions practice.

The 1st and end 2nd scenarios without emissions and 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.

Table B 2.4. NPV and IRR results for the lifetime of the project: 21 years

ID	FARM/SITE	NPV (1st SCENARIO) DIGESTER + FLARE	NPV (2nd SCENARIO) DIGESTER + FLARE + GENERATOR	NPV (3rd SCENARIO) ANAEROBIC OPEN LAGOON	IRR(%)
1	Fazenda São Francisco	-172,257	-164,936	-22,811	UNDEFINED
2	Fazenda Rancho da Paz	-151,806	-130,560	-24,226	UNDEFINED
3	Fazenda Caixetas (Elite)	-158,091	-136,845	-23,701	UNDEFINED
4	Fazenda Boa Vista	-153,191	-128,609	-23,520	UNDEFINED
5	Fazenda Boa Vista (term)	-169,381	-152,414	-34,272	UNDEFINED
6	Sitio Bela Vista	-152,765	-132,462	-22,713	UNDEFINED
7	Fazenda Cachoeirinha	-167,997	-158,717	-33,712	UNDEFINED
8	Sitio Ana Paula	-167,997	-147,403	-31,159	UNDEFINED
9	Fazenda Taquara Branca	-148,185	-137,963	-20,148	UNDEFINED
10	Faz. Santana do Matão	-152,232	-142,010	-34,476	UNDEFINED
11	Fazenda Suinolandia	-171,618	-147,906	-34,472	UNDEFINED
12	Sitio Santo Antonio	-156,812	-140,788	-22,255	UNDEFINED
13	Granja Lago Azul	-171,618	-955,453	-38,772	UNDEFINED
14	Granja Herval	-156,812	-135,857	-29,686	UNDEFINED
15	Granja São João	-180,459	-187,382	-71,982	UNDEFINED

Taking into account of the investment sensitive analysis, the project activity still presents negatives NPV where the IRR can´t be calculated. The table B2.5 indicates the sensitive analysis for the option where it is considered the installation of the digester, flare and electricity generator system because this option is the unique alternative where revenues can be obtained in the project activity by the avoided costs from the electricity purchase from the grid. The table shows 2 alternatives, A and B, where the alternative A considers the equipment cost reduction and the alternative B considers the increase of the energy price.

In the alternative A considered the equipment cost reduction of 10 % since the costs of this project activity was estimated based in the registered project design document in 16 March 2009 – BRASCARBON Methane Recovery Project BCA-BRA-01, ref number 2318.
In the alternative B considered the increase of the energy price in 10% since Brazilians electricity price is adjusted according to the IGPM – Indice Geral de Preços do Mercado (Brazil´s Market Price Index). It was around 5,38% in the last 12 months (from April 2008 to April 2009)(http://www.portalbrasil.net/igpm.htm) but Brascarbon considered 10% as a sever tariff adjustment simulation. The energy tariffs can be obtained by the following web site: http://www.aneel.gov.br/area.cfm?idArea=550; Rural consumption class (where the project activity is installed), southwest region.
Conclusion: the project activity is "additional" from an economic perspective, as it is only viable with the revenues of the carbon credits.

Table B 2.5. Sensitive analysis calculation summary, operation lifetime of the project: 21 years

ID	FARM/SITE	A - CONSIDERING 10% EQUIPMENT COST REDUCTION	B - CONSIDERING 10% INCREASE OF THE ENERGY PRICE	IRR(%)
		NPV (2nd SCENARIO) DIGESTER + FLARE + GENERATOR	NPV (2nd SCENARIO) DIGESTER + FLARE + GENERATOR	
1	Fazenda São Francisco	-153,743	-152,758	UNDEFINED
2	Fazenda Rancho da Paz	-121,412	-118,382	UNDEFINED
3	Fazenda Caixetas (Elite)	-127,068	-124,666	UNDEFINED
4	Fazenda Boa Vista	-119,322	-116,431	UNDEFINED
5	Fazenda Boa Vista (term)	-141,509	-140,236	UNDEFINED
6	Sitio Bela Vista	-123,218	-120,284	UNDEFINED
7	Fazenda Cachoeirinha	-147,951	-146,539	UNDEFINED
8	Sitio Ana Paula	-136,636	-135,225	UNDEFINED
9	Fazenda Taquara Branca	-129,177	-125,785	UNDEFINED
10	Faz. Santana do Matão	-132,820	-129,832	UNDEFINED
11	Fazenda Suinolandia	-136,777	-135,728	UNDEFINED
12	Sitio Santo Antonio	-131,140	-128,610	UNDEFINED
13	Granja Lago Azul	-146,278	-145,229	UNDEFINED
14	Granja Herval	-126,208	-123,678	UNDEFINED
15	Granja São João	-175,368	-176,671	UNDEFINED

Premises adopted for the investment analysis calculation

		South	Southeast	Central	
UNIT PRICE OF ELECTRICITY (*)	(in USD /MWh)	87.07	95.84	84,29	USD/MWh
	(in BR / MWh)	206.44	227.24	199,85	BR/MWh
EXCHANGE RATE (**)	BR/USD	2.371	2.371	2,371	BR/USD
Total energy produced / farm/year	(in MWh / year)	175.20	175.20	175,20	MWh/y
Brazilian bonds (taxa SELIC) (***)		10,77	10.77	10.77	%

(*)http://rad.aneel.gov.br/reportserverSAD?%2fSAD_REPORTS%2fSAMP_TarifaMedCConsumoRegiao&rs:Command=Render
(*) http://aneel.gov.br/area.cfm?isArea=550 (Classe Industrial; fev/2009 - per region)
(**) 2.371 in 04/march/2009
(***) http://www.bcb.gov.br/ (Brascarbon cosidered average selic tax from Jan/09 to Aug/09)

Technological Barrier:
There is no technology requested for the waste management system, by the environment department, to be implemented in the confined animals feed operations. The actual and approved waste treatment system is open anaerobic lagoons considered also the most economic system to be installed.
The Brascarbon proposal is the installation of the anaerobic digester technology with biogas recovery and destroys.
Anaerobic digester systems must have sized properly to handle the projected animal/effluent volumes with a Hydraulic Retention Time (HRT) consistent with extracting most/all CH4 from the manure. Variables such as temperature, pressure, methane concentration and density of the biogas have to be determinate or calculated to maintain the lifecycle of the project.
Special equipment such a biogas analyzer, to determine the concentration of the methane in the biogas, has to be acquired to verify the performance of the digester. An enclosed flare has also to be installed to capture and destroy the biogas produced in the digester. Many other instruments such thermo coupling, solar cells, batteries, flow meters, programmable logic controller (to save de temperature information) has also to be installed to perform and control the biogas production.
Also to the adequate operation of the digesters operational procedures have to be followed and managed by an expertise technician. Brascarbon will be responsible for implementing an external support without interfering in the confined animal feed operation because the local animal producers does not have staff available to perform these tasks.
Moreover, operations and maintenance requirements involved with this technology, including a detailed monitoring program to maintain system performance levels, must also be considered.
Worldwide, few anaerobic digesters have achieved long-term operations, due primarily to inappropriate operations and maintenance.
The proposed animal waste management system represents the most advanced technology in the farm. The proposed project activity mitigates GHG emissions with associated environmental co-benefits.

Barrier Due to Prevailing Practice (National Policies and Circumstances)
In order to clarify the actual circumstances regarding to confined animal operations in Brazil and the serious environmental problems can be occurred due the bad animal waste management system, the state of Santa Catarina, in conjunction of EMBRAPA (Brazilian Agricultural Research Corporation), developed a official term[9] dedicated to the producers and agro-industries to reduce the environmental impact, adopting safety measures to control the waste where the major concentration of it is drained directly into the soil, rivers etc…

According to Mr. Everton Vargas, General Subsecretary of the Ministerio das Relações Exteriores do Brasil, during the Major Economies Meeting on Energy Security and Climate Change, in Washington Sptember 27th of 2007, "*…Brasil is ready to contribute and making global efforts to reduce the emissions, under the Kyotho Protocol, …*"[10]

[9] http://www.cnpsa.embrapa.br/pnma/pdf_doc/tac.pdf
[10] http://www.mct.gov.br/index.php/content/view/62460.html

According to researchers of EMBRAPA Swine and Poultry (CNPSA), swine waste storage and treatment systems in the South of Brazil consist of open tanks (esterqueiras), open digesting (bioesterqueiras), ponds (anaerobic, variable and aerobic), cesspit, storage or treatment of compost (in solid form). Very few bio-digesters exist. The material is normally distributed by pumps or gravity and applied to crops and pastures.

EMBRAPA stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina with instructions and publications[11] to help the producers and agro-industries to implement projects or systems to control the animal waste management protecting the eco-system.
This sentiment was collaborated by representatives of Brazilian Agricultural Research Corporation (EMBRAPA) as well as officers of national swine producers association (ABCS) and Santa Catarina swine producer association (ACCS). The proposed practice change will afford these farms the financial means (via CER revenues) to adopt and maintain an advanced animal waste management system with reductions in GHG emissions and associated environmental co-benefits (including reduced water contamination).

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 15 – *"**Methane recovery in animal manure management systems**"* and IPCC 2006.

This baseline methodology was chosen because:

1. This project category comprises methane recovery and destruction from manure and wastes from agricultural or agro-industrial activities that would be decaying anaerobically in the absence of the project activity by:
(a) Installing methane recovery and combustion system to an existing source of methane emissions, or
(b) Changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.

2. The project activity satisfies the following conditions:
(a) The sludge will be handled aerobically.
(b) Technical measures will be used (e.g. flared, combusted) to ensure that all biogas produced by the digester is used or flared.

3. The annual average temperature of baseline site is higher than $5^{o}C$.

[11] http://www.cnpsa.embrapa.br/index.php?ids=Sn6l70p1l&idl=&pg=1&area=21

4. The depth of the baseline anaerobic lagoon is at least 1 meter.

5. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.

6. The storage time of the manure after removal from the animal barns, including transportation, should not exceed 24 hours before being fed into the anaerobic digester. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not apply.

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

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

Step 1: Emission Reductions

Equation B4

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

Where:

ER_y = emission reductions in t CO_2e/year
BE_Y = the annual baseline methane emissions in t CO2e/year
PE_Y = project emissions in t CO2e/year

Step 2: Baseline Emissions

According to the Equation B1 section B.4

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

Where:

BE_y	Baseline emissions in year "y" (tCO_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 °C) and 1 atm pressure).
LT	Index for all types of livestock
J	Index for animal waste management system

MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^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]

Step 3: Project Emissions

According to the simplified baseline and monitoring methodology for a small-scale CDM project Type-III (AMS.III.D – version 15), 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 (*PEPL,y*);
(b) Emissions from flaring or combustion of the gas stream (*PEflare,y*);
(c) CO2emissions from use of fossil fuels or electricity for the operation of all the installed facilities (*PEpower,y*).

Equation B5

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

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)

Where:

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

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

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y, tCO2e
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h , kg/h
$\eta_{flare,h}$	Flare efficiency in hour h
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period , tCO2e/tCH4
$\eta_{flare,h}$	Flare efficiency in the hour h

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

No fossil fuel or electricity will be used in the project, therefore, *PEpower,y* = zero.

Step 4: Leakage.

According to the simplified baseline and monitoring methodology AMS.III.D / version 15, no leakage calculation is required.

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

Data / Parameter:	MCF_j
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 the 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:	$VS_{default}$
Data unit: Description:	kg dry matter/animal/day 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/portal/index2.jsp The genetic source of production operation is originated from Annex I party; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed ratios 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:	$MS\%_{Bl,j}$
Data unit:	Fraction
Description:	Fraction of manure handled in baseline animal manure management system "j".
Source of data used:	Project proponents
Value applied: Justification of the choice of data or description of measurement methods and procedures actually applied :	1 100% of the manure will be handled per category T, system S and climate region k.
Any comment:	

Data / Parameter: Data unit:	**GWP_{CH4}** 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 tones of CH4 to metric tones of CO2 equivalent.
Any comment:	

Data / Parameter:	$W_{default}$
Data unit:	Kg
Description:	Deafult 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/portal/index2.jsp
Any comment:	

Data / Parameter:	**$B_{0,LT}$**
Data unit:	m^3 CH_4/kg dm
Description:	Maximum methane producing potencial 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 : Any comment:	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/portal/index2.jsp The genetic source of production operation is originated from Annex I party; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed ratins can be validated through on farm record keeping.

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 in the first year -2011

ID	Farm/Site	Baseline Emissions per Annual Average Number of Animals Type "LT" in t CO2e/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Fazenda São Francisco	275	1,744	263	17	75	**2,374**
2	Fazenda Rancho da Paz	229	1,479	243	7	63	**2,021**
3	Fazenda Caixetas (Elite)	-	4,113	-	-	-	**4,113**
4	Fazenda Boa Vista	917	-	-	25	251	**1,193**
5	Fazenda Boa Vista (term)	-	6,338	974	-	-	**7,312**
6	Sitio Bela Vista	-	3,110	-	-	-	**3,110**
7	Fazenda Cachoeirinha	504	3,926	536	15	138	**5,119**
8	Sitio Ana Paula	515	3,265	547	20	53	**4,400**
9	Fazenda Taquara Branca	183	1,162	195	5	50	**1,595**
10	Faz. Santana do Matão	-	4,712	-	-	-	**4,712**
11	Fazenda Suinolandia	459	3,188	498	20	167	**4,332**
12	Sitio Santo Antonio	-	2,827	-	-	-	**2,827**
13	Granja Lago Azul	688	4,357	730	57	382	**6,214**
14	Granja Herval	917	-	974	35	-	**1,926**
15	Granja São João	2,384	8,637	2,436	62	377	**13,896**
TOTAL		**7,071**	**48,858**	**7,396**	**263**	**1,556**	**65,144**

Table B4 – Total baseline emission per year

ID	Farm/Site	Baseline Emissions in t CO2e/year							Total
		2011	2012	2013	2014	2015	2016	2017	
1	Fazenda São Francisco	2,374	2,374	2,374	2,374	2,374	2,374	2,374	**16,618**
2	Fazenda Rancho da Paz	2,021	2,021	2,021	2,021	2,021	2,021	2,021	**14,147**
3	Fazenda Caixetas (Elite)	4,113	4,113	4,113	4,113	4,113	4,113	4,113	**28,791**
4	Fazenda Boa Vista	1,193	1,193	1,193	1,193	1,193	1,193	1,193	**8,351**
5	Fazenda Boa Vista (term)	7,312	7,312	7,312	7,312	7,312	7,312	7,312	**51,184**
6	Sitio Bela Vista	3,110	3,110	3,110	3,110	3,110	3,110	3,110	**21,770**
7	Fazenda Cachoeirinha	5,119	5,119	5,119	5,119	5,119	5,119	5,119	**35,833**
8	Sitio Ana Paula	4,400	4,400	4,400	4,400	4,400	4,400	4,400	**30,800**
9	Fazenda Taquara Branca	1,595	1,595	1,595	1,595	1,595	1,595	1,595	**11,165**
10	Faz. Santana do Matão	4,712	4,712	4,712	4,712	4,712	4,712	4,712	**32,984**
11	Fazenda Suinolandia	4,332	4,332	4,332	4,332	4,332	4,332	4,332	**30,324**
12	Sitio Santo Antonio	2,827	2,827	2,827	2,827	2,827	2,827	2,827	**19,789**
13	Granja Lago Azul	6,214	6,214	6,214	6,214	6,214	6,214	6,214	**43,498**
14	Granja Herval	1,926	1,926	1,926	1,926	1,926	1,926	1,926	**13,482**
15	Granja São João	13,896	13,896	13,896	13,896	13,896	13,896	13,896	**97,272**
TOTAL		**65,144**	**65,144**	**65,144**	**65,144**	**65,144**	**65,144**	**65,144**	**456,008**

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

Table B5 – Total project activity emissions in the first year - 2011

ID	Farm/Site	Project Emissions per Annual Average Number of Animals Type "LT", in t CO2e / year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Fazenda São Francisco	65	409	61	4	18	**557**
2	Fazenda Rancho da Paz	54	347	57	2	14	**474**
3	Fazenda Caixetas (Elite)	-	965	-	-	-	**965**
4	Fazenda Boa Vista	215	-	-	6	59	**280**
5	Fazenda Boa Vista (term)	-	1,488	228	-	-	**1,716**
6	Sitio Bela Vista	-	730	-	-	-	**730**
7	Fazenda Cachoeirinha	118	922	126	4	33	**1,203**
8	Sitio Ana Paula	121	767	129	5	12	**1,034**
9	Fazenda Taquara Branca	43	272	46	2	12	**375**
10	Faz. Santana do Matão	-	1,106	-	-	-	**1,106**
11	Fazenda Suinolandia	108	748	117	5	40	**1,018**
12	Sitio Santo Antonio	-	664	-	-	-	**664**
13	Granja Lago Azul	162	1,023	171	14	89	**1,459**
14	Granja Herval	215	-	228	9	-	**452**
15	Granja São João	559	2,027	572	14	89	**3,261**
TOTAL		**1,660**	**11,468**	**1,735**	**65**	**366**	**15,294**

Table B6 – Total project activity emissions per year

ID	Farm/Site	Project Emissions in t CO2e/year							Total
		2011	2012	2013	2014	2015	2016	2017	
1	Fazenda São Francisco	557	557	557	557	557	557	557	**3,899**
2	Fazenda Rancho da Paz	474	474	474	474	474	474	474	**3,318**
3	Fazenda Caixetas (Elite)	965	965	965	965	965	965	965	**6,755**
4	Fazenda Boa Vista	280	280	280	280	280	280	280	**1,960**
5	Fazenda Boa Vista (term)	1,716	1,716	1,716	1,716	1,716	1,716	1,716	**12,012**
6	Sitio Bela Vista	730	730	730	730	730	730	730	**5,110**
7	Fazenda Cachoeirinha	1,203	1,203	1,203	1,203	1,203	1,203	1,203	**8,421**
8	Sitio Ana Paula	1,034	1,034	1,034	1,034	1,034	1,034	1,034	**7,238**
9	Fazenda Taquara Branca	375	375	375	375	375	375	375	**2,625**
10	Faz. Santana do Matão	1,106	1,106	1,106	1,106	1,106	1,106	1,106	**7,742**
11	Fazenda Suinolandia	1,018	1,018	1,018	1,018	1,018	1,018	1,018	**7,126**
12	Sitio Santo Antonio	664	664	664	664	664	664	664	**4,648**
13	Granja Lago Azul	1,459	1,459	1,459	1,459	1,459	1,459	1,459	**10,213**
14	Granja Herval	452	452	452	452	452	452	452	**3,164**
15	Granja São João	3,261	3,261	3,261	3,261	3,261	3,261	3,261	**22,827**
TOTAL		**15,294**	**15,294**	**15,294**	**15,294**	**15,294**	**15,294**	**15,294**	**107,058**

(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						
	2011	2012	2013	2014	2015	2016	2017
Total Baseline Emissions - BE_y,in ton CO2e/year	65,144	65,144	65,144	65,144	65,144	65,144	65,144
Total Project Emissions - PE_y,in ton CO2e/year	15,294	15,294	15,294	15,294	15,294	15,294	15,294
Total Emission Reductions - $ER_y = BE_y – PE_y$ (in ton CO2e/year)	49,850	49,850	49,850	49,850	49,850	49,850	49,850

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 (tCO2 e)	Estimation of baseline emissions (tCO2 e)	Estimation of leakage (tCO2 e)	Estimation of overall emission reductions (tCO2 e)
2011	**15,294**	**65,144**	0	**49,850**
2012	**15,294**	**65,144**	0	**49,850**
2013	**15,294**	**65,144**	0	**49,850**
2014	**15,294**	**65,144**	0	**49,850**
2015	**15,294**	**65,144**	0	**49,850**
2016	**15,294**	**65,144**	0	**49,850**
2017	**15,294**	**65,144**	0	**49,850**
Total (t CO2 e /year)	**107,058**	**456,008**	**0**	**348,950**

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 15, ***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 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 PDD in the Annex 4.

Brascarbon trained several regional technicians who will be responsible to 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:	To be monitored
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)
QA/QC procedures Any comment:	Check the data for more accurate information. Monitoring operational procedure POP-01 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	SITE INSPECTION
Data unit: 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:	Documents
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:	Number of heads
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:	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:	
Measurement procedures (if any):	Checking data and records in the confined feed animal operation
Monitoring frequency	Quarterlly
QA/QC procedures	Check of the site records and documents,
Any comment:	Monitoring operational procedure POP-016

Data / Parameter:	$BG_{bumt,y}$
Data unit:	m^3
Description:	Biogas flared or used as a fuel in the year y.
Source of data:	Brascarbon Monitoring Report System
Value of data:	to be measured during the monitoring period
Measurement procedures (if any):	Reading of the volume in the local flow gear and register in the table annexed in 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:	---
Measurement procedures (if any):	Use of methane concentration analysis instrument or ORSAT.
Monitoring frequency	Periodical. To assure that the monitoring frequency provides a 95% 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-05 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:	According to the operation conditions
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:	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^{o}C than 90% efficiency If exhaust gas hourly temperature < 500^{o}C than 50% efficiency
Measurement procedures (if any):	Enclosed flare. Continuously temperature measurement and registration in the programmable logic controller system (PLC).
Monitoring frequency	Continuously
QA/QC procedures	Check the registers in the generated documents.
Any comment:	Continuous monitoring of the flare efficiency according to Monitoring Operational Procedure POP-08 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 operation conditions
Source of data:	Brascarbon Monitoring Report System
Value of data:	Determinated according the biogas operations conditions (temperature and pressure)
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	Montlhy
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:	-----
Description:	Sludge soil application
Source of data:	Brascarbon Monitoring Report System
Value of data:	------
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:	$ER_{y,ex\text{-}post}$
Data unit:	Ton CO2 e
Description:	Ex-post emission reductions achieved by the project activity based on monitored values for the year "y".
Source of data:	Brascarbon Monitoring Report System
Value of data:	to be determinate according to the measured data
Measurement procedures (if any):	Comparison of the baseline with the actual measured data according to the operational procedure POP-17
Monitoring frequency	Yearly
QA/QC procedures	Check the ER calculation and the registers in the generated documents.
Any comment:	Used to cap the maximal emission reduction in any year. Monitoring Operational Procedure POP-17 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	FFR
Data unit:	-----
Description:	Formulated Feed Rations
Source of data:	Brascarbon Monitoring Report System
Value of data:	------
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:	To be determinate according to the measured data
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:	-----
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:	
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:	$N_{p,y}$
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:	Number of heads
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	annually
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:	$N_{day,y}$
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:	Number of days
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

B.7.2. Description of the monitoring plan:

The following table, Table B9, presents the monitoring plan followed by Brascarbon in order to achieve certified emissions reductions, after each validation and verification process. Other information of monitoring plan and system will 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 Temp.	Every 1 minute	M	100%	electronic	Duration of the project +5years	Use for flare efficiency
2	Site Inspection	Document	----	----	Annually	D	100%	electronic	Duration of the project +5years	General Site Inspection
3	$N_{LT,y}$	Number	-	Nr, Of heads	Monthly	M	100%	electronic	Duration of the project +5years	Used to quantify the methane generation potential
4	$BG_{burnt,y}$	Volume	m^3	Biogas produced	Monthly	M	100%	electronic	Duration of the project +5years	Cumulative biogas production
5	$w_{CH4,y}$	Fraction	%	Methane content	TBD(*)	M	100%	electronic	Duration of the project +5years	Concentration in wet basis
6	T_{biogas}	Temp	°C	Biogas Temperature	Monthly	M	100%	electronic	Duration of the project +5years	Use to biogas density calculation
7	D_{CH4}	Mass	Ton/m^3	Density	Monthly	C	100%	electronic	Duration of the project +5years	Density
8	FE	Efficiency	%	Temperature	Monthly	C	100%	electronic	Duration of the project +5years	Efficiency determinate by the burning temp.
9	QDM	Supervision	--	---	Every Batch Disposed	E	100%	electronic	Duration of the project +5years	Sludge disposed outside project boundary
10	W site	Mass	kg	Average Animal weight	Quarterly	D	100%	electronic	Duration of the project +5years	Yearly methane potential generation
11	$ER_{y,estimated}$	Mass	Ton	CO_2e	Annually	C	100%	electronic	Duration of the project +5years	Yearly methane potential generation
12	FFR	------	---	Feed Formulation	Monthly	D	100%	electronic	Duration of the project +5years	Feed Formulation Rations
13	P biogas	Pressure	mbar	Biogas Pressure	Monthly	M	100%	electronic	Duration of the project +5years	Feed Formulation Rations
14	Genetic Source	Document	-------	genetic	Annually	D	100%	electronic	Duration of the project +5years	Genetic Source
15	MS% i,y	fraction	%	Manure handled	Annually	E	100%	electronic	Duration of the project +5years	General Site Inspection
16	N day,y	number	days	days	Monthly	M	100%	electronic	Duration of the project +5years	Nr. Of days animal is alive
17	N p,y	number	heads	Nr of heads	Monthly	M	100%	electronic	Duration of the project +5years	Nr. Of heads per category annually

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

The monitoring plan will concentrate on ensuring the emission reductions are accurately accounted within the project boundary.
Brascarbon introduce de 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 be able to store the flare temperature continuously. 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 for 240 hours.
The flare system will operate according to the flare manufacturer's specification where the flare is operational from temperatures above 100 ^{o}C.

According to the Tool to determine project emissions from flaring gases containing methane and the specification of the flare, the temperature of the flare will be separated in 3 groups, to determine the flare efficiency, as follows:

a) Total hours when the exhaust gas temperature is ≥ 500 ^{o}C for more than 40 minutes.
b) Total hours when the exhaust gas temperature is ≤ 500 ^{o}C and ≥ 100 ^{o}C for more than 40 minutes.
c) Total hours when the exhaust gas temperature is < 100 ^{o}C or without registers in any hour.

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.
Variable 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 03.002 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 03.002.
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 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: $BG_{burnt,y}$.
The data monitored is controlled in the formulary 04.001 attached in the operational procedure POP 4.

Methane content determination.
The POP 5- Methane content was prepared to guide the technicians how to obtain the methane content using electronic equipment.
The methane content is obtained by a 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.
Both equipment is able to measure the methane concentration in the biogas.
The variables measured with this equipment are: $W_{CH4,y}$.
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.

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 8 – Flare efficiency was developed to monitoring and calculation of the flare efficiency.
The flare efficiency is monitored in compliance with manufactures specification.
According to the Tool to determine project emissions from flaring gases containing methane and the specification of the flare, the flare efficiency is calculated according to the following criteria:

a) If the exhaust gas temperature is $\geq 500\ ^{o}C$ for more than 40 minutes, the flare efficiency is 90% in the respective hour.
b) If the exhaust gas temperature is $\leq 500\ ^{o}C$ and $\geq 100\ ^{o}C$, the flare efficiency is 50% in the respective hour (*).
c) If the exhaust gas temperature is $< 100\ ^{o}C$, or in absence of temperature, the flare efficiency is 0% (zero) in any respective hour (*).

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.
(*) according to the manufacturers specification

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 biodigestor 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.

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 the approved methodology AMS.III.D – Version 15 – *"Methane recovery in animal manure management systems"* and IPCC 2006.

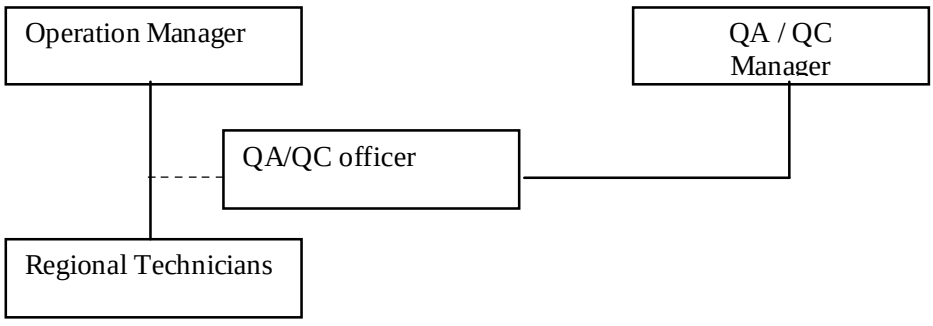
Operational / Monitoring Procedures
Operational / Monitoring procedures listed in the Annex 4.

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. Some topics of the training are below indicated:
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



Operations 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 for the Quality Assurance Management 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 15, ***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 is **18/01/2010**.

This date represents the prevision of the first contracted company to develop the first site construction.

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: **01/01/2011 or the registration date of the project activity.**

C.2.1.2. Length of the first crediting period:

The lenght 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, Beyond the principal environmental benefits of the project includes:

- 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:

Digesters, to reduce GHG emissions in the confined animals operations, are not pre-requisite to get the environmental licenses. The environmental impacts concerning the project activity is 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

The stakeholder consultation for this project activity was done also by the invitation of comments to the PDD published on the UNFCCC and at Brascarbon web sites, according to the Resolution 7 of the Brazilian DNA regarding stakeholder consultation.

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 by 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 following list of the stakeholders was invited to comment on the project activity according to the Resolution 7 of the Brazilian DNA:

- City Hall and Chamber of Councilors.
- Departaments 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 were received from 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

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no official development assistance being provided for this project.

ANNEX 3 - BASELINE INFORMATION

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	$B_{0(T)}$	GWP_{CH4}	D_{CH4}	MCF	$MS_{(T,S,k)}$	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	PE y	ER y
1	Fazenda São Francisco	Sows	365	300	300	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	275	37	28	65	210
		Finishers	116	5.920	1.881	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.744	235	174	409	1.335
		Nursery/Weaners	70	6.658	1.277	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	263	35	26	61	202
		Boars	365	7	7	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	17	2	2	4	13
		Gilts	365	90	90	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	75	10	8	18	57
		total			3.555														2.374	319	238	557	1.817
2	Fazenda Rancho da Paz	Sows	365	250	250	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	229	31	23	54	175
		Finishers	90	6.472	1.596	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.479	199	148	347	1.132
		Nursery/Weaners	70	6.162	1.182	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	243	33	24	57	186
		Boars	365	3	3	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	7	1	1	2	5
		Gilts	365	75	75	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	63	8	6	14	49
		total			3.106														2.021	272	202	474	1.547
3	Fazenda Caixetas (Elite)	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.000	4.438	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.113	554	411	965	3.148
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.438														4.113	554	411	965	3.148
4	Fazenda Boa Vista	Sows	365	1.000	1.000	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	917	123	92	215	702
		Finishers	90	-	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	365	10	10	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	25	3	3	6	19
		Gilts	365	300	300	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	251	34	25	59	192
		total			1.310														1.193	160	120	280	913
5	Fazenda Boa Vista (Term)	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	27.738	6.840	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	6.338	854	634	1.488	4.850
		Nursery/Weaners	70	24.660	4.729	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	974	131	97	228	746
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			11.569														7.312	985	731	1.716	5.596

ANNEX 3 - BASELINE INFORMATION (CONTINUATION)

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	$B_{0(T)}$	GWP_{CH4}	D_{CH4}	MCF	$MS_{(T,S,k)}$	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	PE y	ER y
6	Sitio Bela Vista	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	116	10.560	3.356	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.110	419	311	730	2.380
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			3.356														3.110	419	311	730	2.380
7	Fazenda Cachoeirinha	Sows	365	550	550	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	504	68	50	118	386
		Finishers	116	13.331	4.237	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.926	529	393	922	3.004
		Nursery/Weaners	70	13.560	2.601	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	536	72	54	126	410
		Boars	365	6	6	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	15	2	2	4	11
		Gilts	365	165	165	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	138	19	14	33	105
		total			7.558														5.119	690	513	1.203	3.916
8	Sitio Ana Paula	Sows	365	562	562	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	515	69	52	121	394
		Finishers	116	11.085	3.523	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.265	440	327	767	2.498
		Nursery/Weaners	70	13.860	2.658	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	547	74	55	129	418
		Boars	365	8	8	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	20	3	2	5	15
		Gilts	365	63	63	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	53	7	5	12	41
		total			6.814														4.400	593	441	1.034	3.366
9	Fazenda Taquara Branca	Sows	365	200	200	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	183	25	18	43	140
		Finishers	116	3.946	1.254	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.162	156	116	272	890
		Nursery/Weaners	70	4.932	946	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	195	26	20	46	149
		Boars	365	2	2	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	5	1	1	2	3
		Gilts	365	60	60	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	50	7	5	12	38
		total			2.462														1.595	215	160	375	1.220
10	Faz. Santana do Matão	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	116	16.000	5.085	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.712	635	471	1.106	3.606
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			5.085														4.712	635	471	1.106	3.606

ANNEX 3 - BASELINE INFORMATION (CONTINUATION)

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	$B_{0(T)}$	GWP_{CH4}	D_{CH4}	MCF	$MS_{(T,S,k)}$	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	PE y	ER y
11	Fazenda Suinolandia	Sows	365	500	500	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	459	62	46	108	351
		Finishers	90	13.950	3.440	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	3.188	429	319	748	2.440
		Nursery/Weaners	70	12.600	2.416	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	498	67	50	117	381
		Boars	365	8	8	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	20	3	2	5	15
		Gilts	365	200	200	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	167	23	17	40	127
		total			6.564														4.332	584	434	1.018	3.314
12	Sitio Santo Antonio	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	116	9.600	3.051	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	2.827	381	283	664	2.163
		Nursery/Weaners	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			3.051														2.827	381	283	664	2.163
13	Granja Lago Azul	Sows	365	750	750	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	688	93	69	162	526
		Finishers	116	14.794	4.702	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.357	587	436	1.023	3.334
		Nursery/Weaners	70	18.492	3.546	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	730	98	73	171	559
		Boars	365	23	23	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	57	8	6	14	43
		Gilts	365	456	456	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	382	51	38	89	293
		total			9.477														6.214	837	622	1.459	4.755
14	Granja Herval	Sows	365	1.000	1.000	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	917	123	92	215	702
		Finishers	116	-	-	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Nursery/Weaners	70	24.660	4.729	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	974	131	97	228	746
		Boars	365	14	14	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	35	5	4	9	26
		Gilts	365	-	-	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			5.743														1.926	259	193	452	1.474
15	Granja São João	Sows	365	2.600	2.600	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	2.384	321	238	559	1.825
		Finishers	116	29.325	9.320	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	8.637	1.163	864	2.027	6.610
		Nursery/Weaners	70	61.686	11.830	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	2.436	328	244	572	1.864
		Boars	365	25	25	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	62	8	6	14	48
		Gilts	365	450	450	198	210	0,46	0,49	365	178	0,94	0,45	21	0,00067	79	1	1	377	51	38	89	288
		total			24.225														13.896	1.871	1.390	3.261	10.635

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	^{o}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	$BG_{burned,y}$	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	^{o}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	ER y,ex-post	Low	Tons CO_2e	Register from the measurement system, information managed by Brascarbon,
12	FFR	Low	-----	Register from the measurement system, information managed by Brascarbon,
13	P biogas	Low	mbar	Register information managed by Brascarbon.
14	Genetic Source	Low	-----	Register information managed by Brascarbon.
15	MS% i,y	Low	%	Register information managed by Brascarbon.
16	N day,y	Low	days	Register information managed by Brascarbon.
17	N p,y	Low	Nr, Of heads by category	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	M	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	TR	POP 3	Number of heads
4	$BG_{burnt,y}$	M	TR	POP 4	Biogas produced and burnt
5	$W_{CH4,y}$	TBD	TR	POP 5	Methane content
6	T_{biogas}	M	TR	POP 6	Biogas Temperature
7	D_{CH4}	M	TR	POP 7	Methane Density
8	FE	M	TR	POP 8	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	ER ex-post	A	QC	POP 17	Yearly emissions reductions ex-post

Legend:
A: Annually
Q: Quarterly
M: Monthly
S: Semesterlly
TR: Regional Technician
QC: Quality Control
TBD: to be determinate to attend 95% confidence level
OM: Operation Manger