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

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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-09.
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 the cities located at the Mato Grosso do Sul state, central 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 Mato Grosso do Sul state was 855,000.[4,5]

Considering that a typical hog produces 4.9 kilograms of effluent daily (Table A1), annually some 4.2 million metric tons of hog waste produced in this 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).

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

[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

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 stores the flow rate.

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

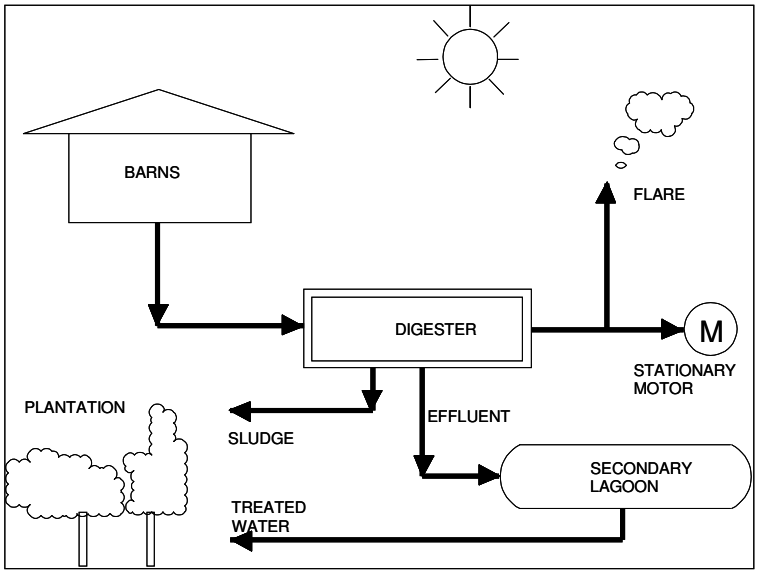
A derivation pipe will be installed before the flare and after the flow meter, for future proposals, to supply biogas to the power generators, for in site electricity supply only, where **no claims for emissions reductions by the electricity generation will be requested** during the entire project activity 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 Brazil, at the province of Mato Grosso do Sul state.

A.4.1.1. Host Party(ies):

The host party for this project activity is Brazil.

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

Central region / State Mato Grosso do Sul.

A.4.1.3. City/Town/Community etc:

Cities of Brasilândia, Bataguassu and Glória de Dourados.

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

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

Table A2. Detailed physical location and identification of project site

Farm/Site Name	Brascarbon ID	Address	Town/State	Contact	Phone	GPS Coord
Fazenda Corrego Azul - Paredão 1	BCA-155MS8-09	Fazenda Corrego Azul	Brasilandia – MS	João Antonio Pozzobon	+55 67 3546-1467	S 21° 26'50,0" W52° 11'42,7"
Fazenda Corrego Azul - Paredão 2	BCA-155MS7-09	Fazenda Corrego Azul	Brasilandia – MS	João Antonio Pozzobon	+55 67 3546-1467	S 21° 28' 25,3" W52° 10'00,9"
Sitio Santa Izabel	BCA-158MS1-09	Reta A1 Estrada Boiadeira	Bataguassu – MS	Hideiko Okidoi	+55 67 3546-1467	S 21° 40' 24,1" W52°16'41,6"
Sitio Paraíso	BCA-156MS1-09	Reta X - Km 24 - Rodovia 267	Bataguassu – MS	Adão Costa Mariano	+55 67 9116-5561	S 21° 43' 20,6" W 52° 21' 54,3"
Sitio Lote 43	BCA-185MS1-09	7° Linha nascente 5,5Km	Glória de Dourados – MS	Valdecir Pedro Gomes	+55 67 3456-3594	S 22° 22' 31,70" W 54° 9' 16,98"
Sítio Lote 04 e 06	BCA-196MS1-09	8° Linha Nascente, 0,5Km - Quadra 61	Glória de Dourados – MS	Graça Rodrigues Nantes	+55 67 3453-3594	S 54° 11' 02,6" W 22° 19' 45,9"
Lote Rural 56	BCA-177MS1-09	Linha Guaçu – Poente Quadra 34 4Km	Glória de Dourados – MS	Maria de Lourdes Merlotte	+55 67 9965-9131	S 22° 26' 59,23" W54° 16'47,11"
Lote Rural 37,35 e 39	BCA-176MS1-09	Linha Guaçu, Quadra 39	Glória de Dourados – MS	Luiz Sergio Golfeto	+55 67 9971-5881	S 22° 26' 24,92" W 54° 17' 55,94"
Sitio Lote 65	BCA-186MS1-09	Estrada 6° Nascente Km 08	Glória de Dourados – MS	Walter Fukoda	+55 67 3466-1450	S 22° 24' 18,57" W 54° 8' 21,70"
Sitio Boa Esperança	BCA-184MS1-09	Estrada 6° Linha Poente Km 02	Glória de Dourados – MS	Samy Arfux de Figueredo	+55 67 3453-3594	S 22° 22' 17,37" W54° 13'32,06"
Lote 24 e26	BCA-174MS1-09	Linha 3ª Nascente Km 13	Glória de Dourados – MS	Geraldo Ferro da Silva	+55 67 9649-2665	S 22° 29' 2,97" W 54° 7' 25,42"
Sitio Água Limpa	BCA-180MS1-09	Estr. 5° Linha Poente Km 4,5 Lote 43, Qda. 55	Glória de Dourados – MS	Jesuíno Arlindo dos Santos	+55 67 9624-7310	S 22° 22' 23,49" W54° 15'38,24"
Sitio Lote 1 Quadra 32	BCA-183MS1-09	Estr. Barreirão Lote rural 1 Qda. 32	Glória de Dourados – MS	Marcelo Schils Slongo	+55 67 3466-3194	S 22° 30' 13,48" W 54° 9' 46,57"
Sitio Lote São José	BCA-157MS1-09	Reta X - S/N	Bataguassu – MS	Jose Admilson Dantas	+55 67 9967-8224	S 21° 40' 54,7" W 52° 40' 54,7"
Sitio São João – Córrego da Anta	BCA-167MS1-09	Estrada municipal ER-210-05	Bataguassu – MS	Viviane Araújo Costa Collete	+55 67 3546-1064	S 21° 45' 56" W 52° 17' 33"
Sitio Lote 45	BCA-199MS1-09	7° Linha nascente 6Km	Glória de Dourados – MS	Maria Amelia	+55 67 9997-8985	S 22° 22' 34,22" W 54° 9' 9,83"

João Antonio Pozzobon has two sites in Brasilândia city:

- Fazenda Córrego Azul – Paredão 1 is a finishing 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 Córrego Azul – Paredão 2 is a finishing swine operation. The site uses one 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.

Hideiko Okidoi has one site in Bataguassu city:

- Sítio Santa Izabel 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. Water from this lagoon will be used for irrigation.

Adão Costa Mariano has one site in Bataguassu city:

- Sítio Paraíso is a finishing 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.

Valdecir Pedro Gomes has one site in Glória de Dourados city:

- Sítio Lote 43 is a finishing 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.

Graça Rodrigues Nantes has one site in Glória de Dourados city:

- Sítio Lote 04 e 06 is a finishing 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.

Maria de Lourdes Merlotte has one site in Glória de Dourados city:

- Lote Rural 56 is a finishing 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.

Luiz Sérgio Golfeto has one site in Glória de Dourados city:

- Lote Rural 37, 39, 35 is a finishing 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.

Walter Fukoda has one site in Glória de Dourados city:

- Sítio Lote 65 is a finishing 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.

Samy Arfux de Figueredo has one site in Glória de Dourados city:

- Sítio Boa Esperança is a finishing 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.

Geraldo Ferro da Silva has one site in Glória de Dourados city:

- Lote 24 e 26 is a finishing 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.

Jesuino Arlindo dos Santos has one site in Glória de Dourados city:

- Sítio Água Limpa is a finishing 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.

Marcelo Schils Slongo has one site in Glória de Dourados city:

- Sítio Lote 1 Quadra 32 is a finishing 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.

José Admilson Dantas has one site in Bataguassu city:

- Sítio São José is a finishing 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.

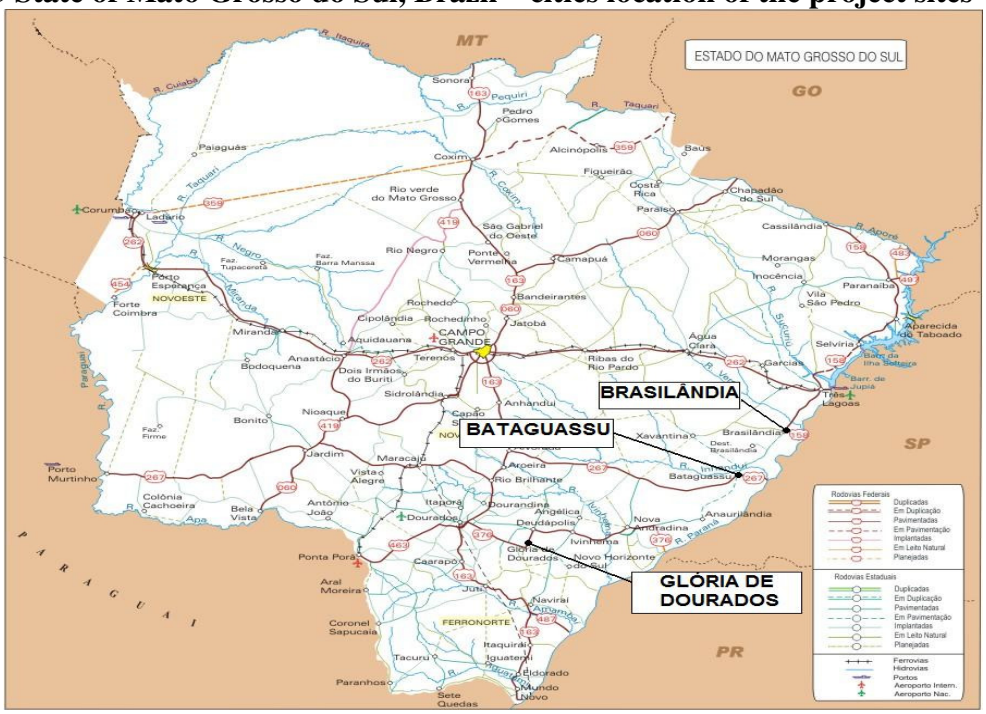
Viviane Araújo Costa Collete has one site in Bataguassu city:

- Sítio São João – Córrego da Anta is a finishing 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.

Maria Amélia has one site in Glória de Dourados city:

- Sítio Lote 45 is a finishing 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.

Figure A3 State of Mato Grosso do Sul, Brazil – cities location of the project sites



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

The project activity is a Type III.
The project is a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 60 kt 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 Mato Grosso do Sul state, Brazil. This simplified baseline methodology is applicable to this project activity because without the proposed project activity, methane from the existing animal waste management system would continue to be emitted into the atmosphere.

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	**57,014**
2012	**57,014**
2013	**57,014**
2014	**57,014**
2015	**57,014**
2016	**57,014**
2017	**57,014**
Total estimated reductions (tonnes of CO2e)	**399,098**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions **(tonnes of CO2e)**	**57,014**

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 de-bundled component of a large scale project activity:

Based on paragraph 2 of Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities[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.

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".**

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

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 Mato Grosso do Sul, 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 Mato Grosso do Sul 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.

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.

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.

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

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.

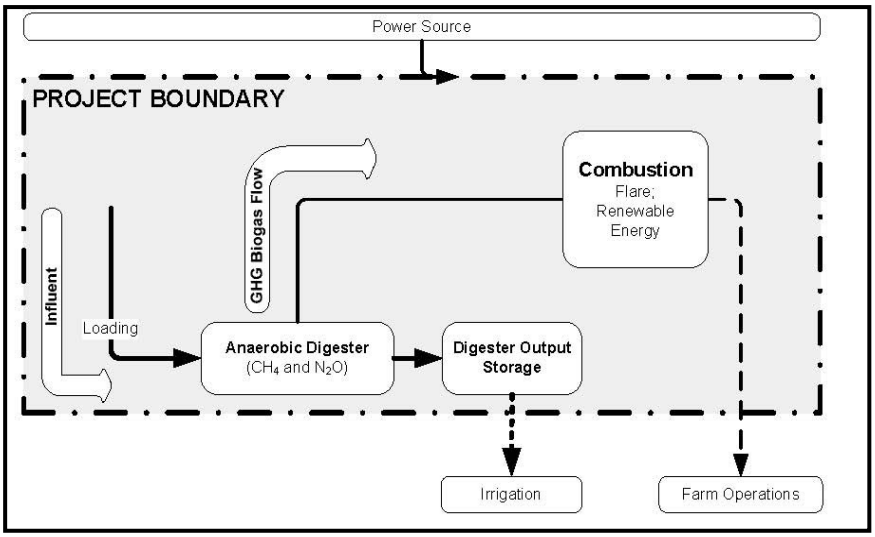
c) The storage time of the manure after removal from the animal barns, including transportation, will not exceed 24 hours before being fed into the anaerobic digester: This situation is assured due to the common farms practices where each day all the manure is washed and sent to the digester. The Confined 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 ºC) and 1 atm pressure).
LT	Index for all types of livestock
j	Index for animal waste management system
MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,y}$	Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system "j"
UF_b	Model correction factor to account for model uncertainties (0.94)[1]

Where:

(A) $VS_{LT,y}$ can be 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	Animal Category - N_{LT}					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Faz. Corrego Azul - Paredão 1	-	14,425	-	-	-	**14,425**
2	Faz. Corrego Azul - Paredão 2	-	11,096	-	-	-	**11,096**
3	Sitio Santa Izabel	-	2,275	-	-	-	**2,275**
4	Sitio Paraíso	-	3,107	-	-	-	**3,107**
5	Sítio Lote 43	-	4,660	-	-	-	**4,660**
6	Sitio Lote 04 e 06	-	4,660	-	-	-	**4,660**
7	Lote Rural 56	-	4,660	-	-	-	**4,660**
8	Lote Rural 37, 39 e 35	-	4,660	-	-	-	**4,660**
9	Sitio Lote 65	-	4,660	-	-	-	**4,660**
10	Sitio Boa Esperança	-	4,660	-	-	-	**4,660**
11	Lote 24 e 26	-	4,660	-	-	-	**4,660**
12	Sitio Água Limpa	-	4,660	-	-	-	**4,660**
13	Sitio Lote 1 Quadra 32	-	4,660	-	-	-	**4,660**
14	Sitio Lote São José	-	1,553	-	-	-	**1,553**
15	Sitio São João - Córrego da Anta	-	1,332	-	-	-	**1,332**
16	Sitio Lote 45	-	4,660	-	-	-	**4,660**
TOTAL		**-**	**80,390**	**-**	**-**	**-**	**80,390**

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 scenarios 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% taxa de juros)	IRR (%)
					2011	year n	year n+1	2011	year n	year n+1			
1	Faz. Corrego Azul - Paredão 1	-69,600	-13,920	0	-15,600	-15,600	-15,600	0	0	0	-99,120	-187,276	UNDEFINED
2	Faz. Corrego Azul - Paredão 2	-64,600	-12,920	0	-15,600	-15,600	-15,600	0	0	0	-93,120	-181,950	UNDEFINED
3	Sitio Santa Izabel	-42,600	-8,520	0	-15,600	-15,600	-15,600	0	0	0	-66,720	-158,517	UNDEFINED
4	Sitio Paraíso	-43,900	-8,780	0	-15,600	-15,600	-15,600	0	0	0	-68,280	-159,901	UNDEFINED
5	Sítio Lote 43	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
6	Sitio Lote 04 e 06	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
7	Lote Rural 56	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
8	Lote Rural 37, 39 e 35	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
9	Sitio Lote 65	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
10	Sitio Boa Esperança	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
11	Lote 24 e 26	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
12	Sitio Água Limpa	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
13	Sitio Lote 1 Quadra 32	-54,000	-10,800	0	-15,600	-15,600	-15,600	0	0	0	-80,400	-170,659	UNDEFINED
14	Sitio Lote São José	-39,300	-7,860	0	-15,600	-15,600	-15,600	0	0	0	-62,760	-155,002	UNDEFINED
15	Sitio S. João - Córrego da Anta	-39,300	-7,860	0	-15,600	-15,600	-15,600	0	0	0	-62,760	-155,002	UNDEFINED
16	Sitio Lote 45	-39,300	-7,860	0	-15,600	-15,600	-15,600	0	0	0	-62,760	-155,002	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.

Table B 2.2. NPV and IRR calculation (Digester plus Flare and the Generator of Electricity , 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% taxa de juros)	IRR (%)
					2011	year n	year n+1	2011	year n	year n+1			
1	Faz. Corrego Azul - Paredão 1	-99,100	-43,920	0	-25,510	-25,510	-25,510	14,767	14,767	14,767	-153,763	-204,860	UNDEFINED
2	Faz. Corrego Azul - Paredão 2	-94,100	-42,920	0	-25,010	-25,010	-25,010	14,767	14,767	14,767	-147,263	-195,908	UNDEFINED
3	Sitio Santa Izabel	-72,100	-38,520	0	-22,810	-22,810	-22,810	14,767	14,767	14,767	-118,663	-156,519	UNDEFINED
4	Sitio Paraíso	-73,400	-38,780	0	-22,940	-22,940	-22,940	14,767	14,767	14,767	-120,353	-158,846	UNDEFINED
5	Sítio Lote 43	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
6	Sitio Lote 04 e 06	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
7	Lote Rural 56	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
8	Lote Rural 37, 39 e 35	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
9	Sitio Lote 65	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
10	Sitio Boa Esperança	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
11	Lote 24 e 26	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
12	Sitio Água Limpa	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
13	Sitio Lote 1 Quadra 32	-83,500	-40,800	0	-23,950	-23,950	-23,950	14,767	14,767	14,767	-133,483	-176,929	UNDEFINED
14	Sitio Lote São José	-68,800	-37,860	0	-22,480	-22,480	-22,480	14,767	14,767	14,767	-114,373	-150,610	UNDEFINED
15	Sitio S. João - Córrego da Anta	-68,800	-37,860	0	-22,480	-22,480	-22,480	14,767	14,767	14,767	-114,373	-150,610	UNDEFINED
16	Sitio Lote 45	-68,800	-37,860	0	-22,480	-22,480	-22,480	14,767	14,767	14,767	-114,373	-150,610	UNDEFINED

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

The NPV of the project activity is also 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.

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.

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.

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% taxa de juros)	IRR (%)
					2011	year n	year n+1	2011	year n	year n+1			
1	Faz. Corrego Azul - Paredão 1	-34,697	-2,785	0	-1,000	-1,000	-1,000	0	0	0	-38,482	-40,523	UNDEFINED
2	Faz. Corrego Azul - Paredão 2	-42,050	-3,168	0	-1,000	-1,000	-1,000	0	0	0	-46,219	-47,390	UNDEFINED
3	Sitio Santa Izabel	-11,127	-1,166	0	-1,000	-1,000	-1,000	0	0	0	-13,293	-18,164	UNDEFINED
4	Sitio Paraíso	-13,754	-1,378	0	-1,000	-1,000	-1,000	0	0	0	-16,133	-20,685	UNDEFINED
5	Sítio Lote 43	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
6	Sitio Lote 04 e 06	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
7	Lote Rural 56	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
8	Lote Rural 37, 39 e 35	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
9	Sitio Lote 65	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
10	Sitio Boa Esperança	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
11	Lote 24 e 26	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
12	Sitio Água Limpa	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
13	Sitio Lote 1 Quadra 32	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED
14	Sitio Lote São José	-8,819	-977	0	-1,000	-1,000	-1,000	0	0	0	-10,796	-15,947	UNDEFINED
15	Sitio S. João - Córrego da Anta	-7,715	-860	0	-1,000	-1,000	-1,000	0	0	0	-9,576	-14,865	UNDEFINED
16	Sitio Lote 45	-17,711	-1,635	0	-1,000	-1,000	-1,000	0	0	0	-20,346	-24,424	UNDEFINED

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 + ELECT GENERATOR	NPV (3rd SCENARIO) ANAEROBIC OPEN LAGOON	IRR(%)
1	Faz. Corrego Azul - Paredão 1	-187,276	-204,860	-40,523	UNDEFINED
2	Faz. Corrego Azul - Paredão 2	-181,950	-195,908	-47,390	UNDEFINED
3	Sitio Santa Izabel	-158,517	-156,519	-18,164	UNDEFINED
4	Sitio Paraíso	-159,901	-158,846	-20,685	UNDEFINED
5	Sítio Lote 43	-170,659	-176,929	-24,424	UNDEFINED
6	Sitio Lote 04 e 06	-170,659	-176,929	-24,424	UNDEFINED
7	Lote Rural 56	-170,659	-176,929	-24,424	UNDEFINED
8	Lote Rural 37, 39 e 35	-170,659	-176,929	-24,424	UNDEFINED
9	Sitio Lote 65	-170,659	-176,929	-24,424	UNDEFINED
10	Sitio Boa Esperança	-170,659	-176,929	-24,424	UNDEFINED
11	Lote 24 e 26	-170,659	-176,929	-24,424	UNDEFINED
12	Sitio Água Limpa	-170,659	-176,929	-24,424	UNDEFINED
13	Sitio Lote 1 Quadra 32	-170,659	-176,929	-24,424	UNDEFINED
14	Sitio Lote São José	-155,002	-150,610	-15,947	UNDEFINED
15	Sitio S. João - Córrego da Anta	-155,002	-150,610	-14,865	UNDEFINED
16	Sitio Lote 45	-155,002	-150,610	-24,424	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	Faz. Corrego Azul - Paredão 1	-192,165	-194,150	UNDEFINED
2	Faz. Corrego Azul - Paredão 2	-183,746	-185,198	UNDEFINED
3	Sitio Santa Izabel	-146,700	-145,808	UNDEFINED
4	Sitio Paraíso	-148,889	-148,136	UNDEFINED
5	Sítio Lote 43	-165,896	-166,219	UNDEFINED
6	Sitio Lote 04 e 06	-165,896	-166,219	UNDEFINED
7	Lote Rural 56	-165,896	-166,219	UNDEFINED
8	Lote Rural 37, 39 e 35	-165,896	-166,219	UNDEFINED
9	Sitio Lote 65	-165,896	-166,219	UNDEFINED
10	Sitio Boa Esperança	-165,896	-166,219	UNDEFINED
11	Lote 24 e 26	-165,896	-166,219	UNDEFINED
12	Sitio Água Limpa	-165,896	-166,219	UNDEFINED
13	Sitio Lote 1 Quadra 32	-165,896	-166,219	UNDEFINED
14	Sitio Lote São José	-141,143	-139,900	UNDEFINED
15	Sitio S. João - Córrego da Anta	-141,143	-139,900	UNDEFINED
16	Sitio Lote 45	-141,143	-139,900	UNDEFINED

Premises adopted for the investment analysis calculation

UNIT PRICE OF ELECTRICITY (*)	(in USD / MWh)	84.29	USD/MWh
	(in BR / MWh)	199.85	BR/MWh
EXCHANGE RATE (**)	BR/USD	2.371	BR/USD
Total energy produced / farm/year	(in MWh / year)	175.20	MWh/y
Brazilian bonds (taxa SELIC) (***)		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]

According to researchers of Embrapa Swine and Poultry (CNPSA), swine waste storage and

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

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 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 $5^{o}C$.

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

[11] http://www.cnpsa.embrapa.br/index.php?ids=Sn6l70p11&idl=&pg=1&area=21

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.

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^3at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
J	Index for animal waste management system
MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"

$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m_3 CH_4/kg dm)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,y}$	Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system "j"
UF_b	Model correction factor to account for model uncertainties $(0.94)_1$

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^3at 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

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

Where:

$PE_{flare,y}$	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 central region, mainly where the project sites are located is 23 to 25 Celsius during the year, according to CPTEC/INPE/EMBRAPA and INMET http://bancodedados.cptec.inpe.br http://www.inmet.gov.br/html/clima.php
Any comment:	

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

Data / Parameter:	$VS_{default}$
Data unit:	kg dry matter/animal/day
Description:	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population
Source of data used:	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
Value applied:	0.3 for Market Swine 0,46 for Breeding Swine 0,46 for Guilts
Justification of the choice of data or description of measurement methods and procedures actually applied :	Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/portal/index2.jsp The genetic source of production operation is originated from Annex I; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed rations can be validated through on farm record keeping. Used of factors as defined in IPCC2006, chapter 10, volume 4, since that there is no national data for gross energy calculation.
Any comment:	

Data / Parameter:	**GWP**CH4
Data unit:	tCO2e/tCH4
Description:	Global warming potential of CH4
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:	**$B_{0,LT}$**
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 :	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; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed ratings can be validated through on farm record keeping.
Any comment:	

Data / Parameter:	$W_{default}$
Data unit:	Kg
Description:	Default average animal weight of a defined population at the project site.
Source of data:	IPCC 2006, Tables 10-A7 and 10-A8.
Value applied:	Sows(breeding swine): 198 kg Finishers(market swine): 50 kg Nursery (market swine): 50 kg Boars (market swine): 50 kg Gilts (breeding swine): 198 kg
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value according to IPCC 2006 in western Europe region. Genetics and nutrition adopted for these farms as so as in Western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/portal/index2.jsp
Any comment:	

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

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

Table B3 – Baseline emissions for the first year – 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	Faz. Corrego Azul - Paredão 1	-	13,368	-	-	-	**13,368**
2	Faz. Corrego Azul - Paredão 2	-	10,283	-	-	-	**10,283**
3	Sitio Santa Izabel	-	2,108	-	-	-	**2,108**
4	Sitio Paraíso	-	2,879	-	-	-	**2,879**
5	Sítio Lote 43	-	4,319	-	-	-	**4,319**
6	Sitio Lote 04 e 06	-	4,319	-	-	-	**4,319**
7	Lote Rural 56	-	4,319	-	-	-	**4,319**
8	Lote Rural 37, 39 e 35	-	4,319	-	-	-	**4,319**
9	Sitio Lote 65	-	4,319	-	-	-	**4,319**
10	Sitio Boa Esperança	-	4,319	-	-	-	**4,319**
11	Lote 24 e 26	-	4,319	-	-	-	**4,319**
12	Sitio Água Limpa	-	4,319	-	-	-	**4,319**
13	Sitio Lote 1 Quadra 32	-	4,319	-	-	-	**4,319**
14	Sitio Lote São José	-	1,440	-	-	-	**1,440**
15	Sitio São João - Córrego da Anta	-	1,234	-	-	-	**1,234**
16	Sitio Lote 45	-	4,319	-	-	-	**4,319**
TOTAL		**-**	**74,502**	**-**	**-**	**-**	**74,502**

Table B4 – Total baseline emission per year

ID	Farm/Site	Baseline Emissions per year, in t CO2e/year							Total
		2011	2012	2013	2014	2015	2016	2017	
1	Faz. Corrego Azul - Paredão 1	13,368	13,368	13,368	13,368	13,368	13,368	13,368	**93,576**
2	Faz. Corrego Azul - Paredão 2	10,283	10,283	10,283	10,283	10,283	10,283	10,283	**71,981**
3	Sitio Santa Izabel	2,108	2,108	2,108	2,108	2,108	2,108	2,108	**14,756**
4	Sitio Paraíso	2,879	2,879	2,879	2,879	2,879	2,879	2,879	**20,153**
5	Sítio Lote 43	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
6	Sitio Lote 04 e 06	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
7	Lote Rural 56	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
8	Lote Rural 37, 39 e 35	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
9	Sitio Lote 65	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
10	Sitio Boa Esperança	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
11	Lote 24 e 26	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
12	Sitio Água Limpa	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
13	Sitio Lote 1 Quadra 32	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
14	Sitio Lote São José	1,440	1,440	1,440	1,440	1,440	1,440	1,440	**10,080**
15	Sitio São João - Córrego da Anta	1,234	1,234	1,234	1,234	1,234	1,234	1,234	**8,638**
16	Sitio Lote 45	4,319	4,319	4,319	4,319	4,319	4,319	4,319	**30,233**
TOTAL		**74,502**	**74,502**	**74,502**	**74,502**	**74,502**	**74,502**	**74,502**	**521,514**

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

Table B5 – Total project activity emissions for the first year – 2011

ID	Farm/Site	Project Emissions per Annual Average Number of Animals Type "LT", in t CO2/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Faz. Corrego Azul - Paredão 1	-	3,137	-	-	-	**3,137**
2	Faz. Corrego Azul - Paredão 2	-	2,413	-	-	-	**2,413**
3	Sitio Santa Izabel	-	495	-	-	-	**495**
4	Sitio Paraíso	-	676	-	-	-	**676**
5	Sítio Lote 43	-	1,014	-	-	-	**1,014**
6	Sitio Lote 04 e 06	-	1,014	-	-	-	**1,014**
7	Lote Rural 56	-	1,014	-	-	-	**1,014**
8	Lote Rural 37, 39 e 35	-	1,014	-	-	-	**1,014**
9	Sitio Lote 65	-	1,014	-	-	-	**1,014**
10	Sitio Boa Esperança	-	1,014	-	-	-	**1,014**
11	Lote 24 e 26	-	1,014	-	-	-	**1,014**
12	Sitio Água Limpa	-	1,014	-	-	-	**1,014**
13	Sitio Lote 1 Quadra 32	-	1,014	-	-	-	**1,014**
14	Sitio Lote São José	-	338	-	-	-	**338**
15	Sitio São João - Córrego da Anta	-	289	-	-	-	**289**
16	Sitio Lote 45	-	1,014	-	-	-	**1,014**
TOTAL		**-**	**17.488**	**-**	**-**	**-**	**17,488**

Table B6 – Total project activity emissions per year

ID	Farm/Site	Project Emissions per year, in t CO2e/year							Total
		2011	2012	2013	2014	2015	2016	2017	
1	Faz. Corrego Azul - Paredão 1	3,137	3,137	3,137	3,137	3,137	3,137	3,137	**21,959**
2	Faz. Corrego Azul - Paredão 2	2,413	2,413	2,413	2,413	2,413	2,413	2,413	**16,891**
3	Sitio Santa Izabel	495	495	495	495	495	495	495	**3,465**
4	Sitio Paraíso	676	676	676	676	676	676	676	**4,732**
5	Sítio Lote 43	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
6	Sitio Lote 04 e 06	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
7	Lote Rural 56	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
8	Lote Rural 37, 39 e 35	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
9	Sitio Lote 65	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
10	Sitio Boa Esperança	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
11	Lote 24 e 26	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
12	Sitio Água Limpa	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
13	Sitio Lote 1 Quadra 32	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
14	Sitio Lote São José	338	338	338	338	338	338	338	**2,366**
15	Sitio São João - Córrego da Anta	289	289	289	289	289	289	289	**2,023**
16	Sitio Lote 45	1,014	1,014	1,014	1,014	1,014	1,014	1,014	**7,098**
TOTAL		**17.488**	**17,488**	**17,488**	**17,488**	**17,488**	**17,488**	**17,488**	**122,416**

(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	**74,502**	**74,502**	**74,502**	**74,502**	**74,502**	**74,502**	**74,502**
Total Project Emissions – $PE_{y,}$ in ton CO2e/year	**17,488**	**17,488**	**17,488**	**17,488**	**17,488**	**17,488**	**17,488**
Total Emission Reductions – $ER_y = BE_y – PE_y$ (in ton CO2e/year)	**57,014**	**57,014**	**57,014**	**57,014**	**57,014**	**57,014**	**57,014**

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	**17,488**	**74,502**	0	**57,014**
2012	**17,488**	**74,502**	0	**57,014**
2013	**17,488**	**74,502**	0	**57,014**
2014	**17,488**	**74,502**	0	**57,014**
2015	**17,488**	**74,502**	0	**57,014**
2016	**17,488**	**74,502**	0	**57,014**
2017	**17,488**	**74,502**	0	**57,014**
Total (ton de CO2 e)	**122,416**	**521,514**	**0**	**399,098**

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:	Above 500^oC
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	Check the data for more accurate information.
Any comment:	Monitoring operational procedure POP-01 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter:	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:	$BG_{burnt,y}$
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 biogas 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:	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:	$D_{CH4,y}$
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 operation 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:	FE or $\eta_{flare,\,h}$
Data unit:	%
Description:	Flare Efficiency
Source of data:	Brascarbon Monitoring Report System
Value of data:	If exhaust gas hourly temperature >=500°C than 90% efficiency If exhaust gas hourly temperature < 500°C than 0% 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.

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:	$N_{day,y}$
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

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

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 can be found in the Annex 4.

Table B9 – Monitoring Plan

ID	DATA	Data Type	Data Unit	Data Variable	Frequency	Measured(m) Calculated(c) Estimated(e) Documented(d)	Proportion of the data to be monitored	How will the data be archived?	For how long is archived data to be kept?	Comment
1	T f	Temp	°C	Flare Temperature	Every 1 minute	M	100%	electronic	Project Duration +5years	Use for flare efficiency
2	Site Inspection	Document	----	----	Annually	D	100%	electronic	Project Duration +5years	General Site Inspection
3	$N_{LT,y}$	Number	-	Nr, Of heads	Monthly	M	100%	electronic	Project Duration +5years	Used to quantify the methane generation potential
4	$BG_{burnt,y}$	Volume	m^3	Biogas produced	Monthly	M	100%	electronic	Project Duration +5years	Cumulative biogas production
5	$w_{CH4,y}$	Fraction	%	Methane content	TBD(*)	M	100%	electronic	Project Duration +5years	Concentration in wet basis
6	T_{biogas}	Temp	°C	Biogas Temperature	Monthly	M	100%	electronic	Project Duration +5years	Use to biogas density calculation
7	D_{CH4}	Mass	Ton/m^3	Density	Monthly	C	100%	electronic	Project Duration +5years	Density
8	FE	Efficiency	%	Temperature	Monthly	C	100%	electronic	Project Duration +5years	Efficiency determinate by the burning temp.
9	QDM	Supervision	--	---	Every Batch Disposed	E	100%	electronic	Project Duration +5years	Sludge disposed outside project boundary
10	W site	Mass	kg	Average Animal weight	Quarterly	D	100%	electronic	Project Duration +5years	Yearly methane potential generation
11	$ER_{y,estimated}$	Mass	Ton	CO_2e	Annually	C	100%	electronic	Project Duration +5years	Yearly methane potential generation
12	FFR	------	---	Feed Formulation	Monthly	D	100%	electronic	Project Duration +5years	Feed Formulation Rations
13	P biogas	Pressure	mbar	Biogas Pressure	Monthly	M	100%	electronic	Project Duration +5years	Density
14	Genetic Source	Document	-------	genetic	Annually	D	100%	electronic	Project Duration +5years	Genetic Source
15	MS% i,y	fraction	%	Manure handled	Annually	E	100%	electronic	Project Duration +5years	General Site Inspection
16	N day,y	number	days	days	Monthly	M	100%	electronic	Project Duration +5years	Nr. Of days animal is alive
17	N p,y	number	heads	Nr of heads	Monthly	M	100%	electronic	Project Duration +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 pen drive 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 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 a electronic equipment BIOGAS and procedures described in the operational procedure POP 13- Biogas pressure.
The operating pressure of the digester is atmospherically.
The operation of the equipment and the devices to be used is clearly described in the operational procedure as so as in the equipment manual.
All QA/QC procedures are described in the operational procedure related to the maintenance and/or calibration of the equipment.
The variable measured with this equipment is: P biogas.
The data monitored is controlled in the formulary 04.001.

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

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

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

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.

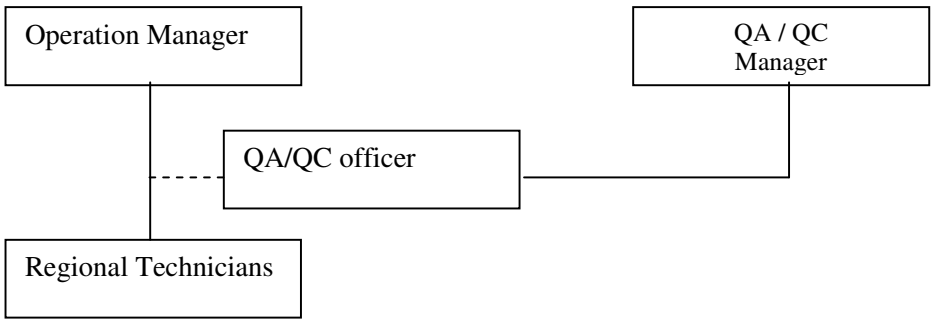
Operational / Monitoring Procedures
Operational / Monitoring procedures listed in the Annex 4.

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



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

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

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

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

Maintenance
For maintenance of the equipment and to attend the monitoring system, BRASCARBON will use the practices recommended by the equipment supplier for repairs, calibration, etc…
The regular maintenance in the site project boundary will be according to the Brascarbon Operation Procedures Manual for all items considered in the project such as the digester, flare, measuring systems, piping's, 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 length of the crediting period is **7 years and 0 months**,

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The project activity will not use a fixed period.

C.2.2.2. Length:

The project activity will not use a fixed period.

SECTION D. Environmental impacts

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

An environmental impact analysis is not required for this type of GHG project activity,
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

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 personal mail asking for comments of the PDD attached to the Brascarbon site and also in the UNFCCC site, according to the Resolution 7 of the Brazilian DNA.
The 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.
- Departments and Secretaries: municipal, state and federal.
- ONG´s
- Unions.
- Ministry Public – State
- Ministry Public – Federal
- State
- Legislative Assembly

E.2. Summary of the comments received:

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

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

No comments were received from stakeholders.

Annex 1
CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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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

																						REDUCTIONS
ID	Farm/Site	Animal Category	$N_{da,y}$	$N_{p,y}$	$N_{LT,y}$	$W_{default}$	W_{site}	$VS_{default}$	VS_{LT}	nd_y	$VS_{(LT,y)}$	UF b	$B_{0(T)}$	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	Faz. Corrego Azul - Paredão 1	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	58.500	14.425	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	13.368	1.800,00	1.337,00	3.137	10.231
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			14.425														13.368	1.800	1.337	3.137	10.231
2	Faz. Corrego Azul - Paredão 2	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	45.000	11.096	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	10.283	1.385,00	1.028,00	2.413	7.870
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			11.096														10.283	1.385	1.028	2.413	7.870
3	Sitio Santa Izabel	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	9.225	2.275	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	2.108	284,00	211,00	495	1.613
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			2.275														2.108	284	211	495	1.613
4	Sitio Paraíso	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	12.600	3.107	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	2.879	388,00	288,00	676	2.203
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			3.107														2.879	388	288	676	2.203
5	Sítio Lote 43	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305
6	Sitio Lote 04 e 06	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305

Annex 3 - BASELINE INFORMATION (Continuation)

																						REDUCTIONS
ID	Farm/Site	Animal Category	$N_{da,y}$	$N_{p,y}$	$N_{LT,y}$	$W_{default}$	W_{site}	$VS_{default}$	VS_{LT}	nd_y	$VS_{(LT,y)}$	UF b	$B_{0(T)}$	GWP_{CH4}	D_{CH4}	MCF	$MS_{(T,S,k)}$	MS% i,y	BE_y	$PE_{PL,y}$	$PE_{flare,y}$	PE y	ER y
7	Lote Rural 56	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305
8	Lote Rural 37, 39 e 35	Sows	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305
9	Sitio Lote 65	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305
10	Sitio Boa Esperança	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305
11	Lote 24 e 26	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305
12	Sitio Água Limpa	Sows	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		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	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total			4.660														4.319	582	432	1.014	3.305

Annex 3 - BASELINE INFORMATION (Continuation)

																							REDUCTIONS
ID	Farm/Site	Animal Category	N_{LT}	$N_{da,y}$	$N_{p,y}$	$N_{LT,y}$	$W_{default}$	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
13	Sitio Lote 1 Quadra 32	Sows	0	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	4200	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		Nursery/Weaners	0	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	0	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	0	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total	4200			4.660														4.319	582	432	1.014	3.305
14	Sitio Lote São José	Sows	0	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	1400	90	6.300	1.553	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.440	194,00	144,00	338	1.102
		Nursery/Weaners	0	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	0	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	0	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total	1400			1.553														1.440	194	144	338	1.102
15	Sitio São João - Córrego da Anta	Sows	0	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	1200	90	5.400	1.332	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	1.234	166,00	123,00	289	945
		Nursery/Weaners	0	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	0	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	0	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total	1200			1.332														1.234	166	123	289	945
16	Sitio Lote 45	Sows	0	365	-	-	198	230	0,46	0,53	365	195	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Finishers	4200	90	18.900	4.660	50	90	0,3	0,54	365	197	0,94	0,45	21	0,00067	79	1	1	4.319	582,00	432,00	1.014	3.305
		Nursery/Weaners	0	70	-	-	50	20	0,3	0,12	365	44	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Boars	0	365	-	-	50	240	0,3	1,44	365	526	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		Gilts	0	365	-	-	198	220	0,46	0,51	365	187	0,94	0,45	21	0,00067	79	1	1	-	-	-	-	-
		total	4200			4.660														4.319	582	432	1.014	3.305

Annex 4

MONITORING INFORMATION

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

ID	DATA VARIABLE	UNCERTAINTY LEVEL	DATA UNIT	DATA ORIGIN
1	T f	Low	°C	Register from the measurement system, information managed by Brascarbon,
2	Site Inspection	Low	-----	Register information managed by Brascarbon
3	$N_{LT,y}$	Low	Nr, Of heads by category	Register from the measurement system, information managed by Brascarbon,
4	$BG_{burned,y}$	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	°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 a 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	$T_{biogás}$	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 biogás	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