Project design document form
(Version 11.0)

BASIC INFORMATION	
Title of the project activity	BRASCARBON Methane Recovery Project BCA-BRA-09
Scale of the project activity	☐ Large-scale ☒ Small-scale
Version number of the PDD	13
Completion date of the PDD	29/09/2020
Project participants	SP Carbono Créditos de Carbono S/A Norwegian Ministry of Climate and Environment
Host Party	Brazil
Applied methodologies and standardized baselines	AMS-III.D.: Methane recovery in animal manure management systems (version 21.0)
Sectoral scopes	Sectoral Scope 13: Waste handling and disposal
Estimated amount of annual average GHG emission reductions	51,191 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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 procedures are very wide and grow progressively and intensive to attend the worldwide food demand. There are three types of Confined Animal Operation for this project: finishing, breeding and nursery.

The scenario existing prior to the implementation of the project activity is the same as the baseline scenario, as follows: the confined animal wastewater, which consists of fresh water mixed with manure and urine that accumulates in pits under or beside the barns, is transported to one open lagoon for evaporation, fed by gravity pipeline systems. The organic material degraded in the primary treatment lagoon is digested, thereby producing significant amounts of methane. These systems emit methane (CH_4) resulting from anaerobic decomposition process. The swine livestock operations create profound environmental consequences, such as greenhouse gas emissions, odor and water/land contamination that result of storing animal waste, where this operation is not sustainable due to its sever environmental pollution.

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

The project activity is a Type III since it comprises activities not included in Type I or Type II and results in GHG emission reductions not exceeding 60kt CO_2e per year in any year of the crediting period.

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. The project proponent estimates 51,191 tCO_2e/year and 358,337 tCO_2e over the second 7 years crediting period will be reduced from the baseline scenario as a result of the installation of the project activity.

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 consists of open tanks, open digesting and ponds (anaerobic lagoons) once they are the most economic and viable system approved to manage the manure in confined animals feed operations. Economic barriers are very common because can invest only in the confined feed operations and with no need to invest in waste management systems. Financial resources are always used to maintain the confined feed operation working. Also, waste treatment involves low technology, as open lagoons need 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.

Just few producers invest in bio-digesters to have a modern waste management system. The material cumulated in the open lagoons is normally distributed by pumps or gravity and applied to

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

crops and pastures. EMBRAPA[2] stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina by giving instructions and providing publications to help the producers and agro-industries to implement projects or systems to control the animal waste management protecting the eco-system[3].

Failure to do so will spread existing disease continually (i.e. increased (insect) pest populations, problems with allergies and livestock disease). With the purpose of avoiding this problem, 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.

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 are 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 tons[6] of carbon dioxide equivalent (CO_2e/year).

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

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

Source: PNMA-II – Projeto de Controlo da Degradação Ambiental Decorrente da Suinocultura em Santa Catarina, coordenado pelo Sr. Paulo Armando Vitoria de Oliveira, Concordia – SC, EMBRAPA Suínos e Aves, 2004 (Environmental Degradation Control Project ,in Suine Farms Santa Catarina, coordinated by . Paulo Armando Vitoria de Oliveira, Concordia – SC, EMBRAPA Suines and Birds 2004);

http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_n3r85f3h.pdf

Socio-Economic Sustainability

- Improvement in air quality (e.g. – reduction of Volatile Organic Compounds [VOCs]) and worker safety;
- Elimination of odors in surrounding areas, improving the 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.

[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/sgc/sgc_publicacoes/publicacao_n3r85f3h.pdf

[3] Boas Práticas de Produção de Suínos: http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_k5u59t7m.pdf

[4] IBGE – Pesquisa Pecuária Municipal (www.ibge.gov.br).

[5] www.agricultura.gov.br

[6] Approximate calculation using IPCC model and emission factors

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 GHGs produced by Confined Animal Operation and promote a transfer of technology for methane production and capture through anaerobic digestion and combustion.

A.2. Location of project activity

The project activity is located in the Central region/State of Mato Grosso do Sul, cities of Bandeirantes, Rio Verde do Mato Grosso, Dourados, Costa Rica and São Gabriel do Oeste. The geographical location of the project sites is shown in Figure A1 with specifics detailed in Table A2.

Table A2 – Detailed physical location and identification of project site

Farm / Site	Brascarbon ID	Address	Town / State	Contact	Phone	GPS Coord
Fazenda Corrego Azul - Paredão 1	BCA-155MS8-09	Fazenda Corrego Azul	Brasilandia – MS	João Antonio Pozzobon	+55 67 3546-1467	21.4472 S 52.1952 W
Fazenda Corrego Azul - Paredão 2	BCA-155MS7-09	Fazenda Corrego Azul	Brasilandia – MS	João Antonio Pozzobon	+55 67 3546-1467	21.4737 S 52.1669 W
Sitio Paraíso	BCA-156MS1-09	Reta X - Km 24-Rodovia 267	Bataguassu – MS	Adão Costa Mariano	+55 67 9116-5561	21.7224 S 52.3651 W
Sitio Lote São José	BCA-157MS1-09	Reta X - S/N	Bataguassu – MS	Jose Admilson Dantas	+55 67 3466-3194	21.6819 S 52.6819 W
Sitio Santa Izabel	BCA-158MS1-09	Reta A1 Estrada Boiadeira	Bataguassu – MS	Hideiko Okidoi	+55 67 3546-1467	21.6734 S 52.2782 W
Sitio São João – Córrego da Anta	BCA-167MS1-09	Estrada municipal ER- 210-05	Bataguassu – MS	Viviane Araújo Costa Collete	+55 67 3546-1064	21.7656 S 52.2925 W
Lote 24 e 26	BCA-174MS1-09	Linha 3ª Nascente Km 13	Glória de Dourados – MS	Geraldo Ferro da Silva	+55 67 9649-2665	22.4842 S 54.1237 W
Lote Rural 37,35 e 39	BCA-176MS1-09	Linha Guaçu, Quadra 39	Glória de Dourados – MS	Luiz Sergio Golfeto	+55 67 9971-5881	22.4403 S 54.2989 W
Lote Rural 56	BCA-177MS1-09	Linha Guaçu – Poente Quadra 34 4Km	Glória de Dourados – MS	Maria de Lourdes Merlotte	+55 67 9965-9131	22.4498 S 54.2798 W
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	22.3732 S 54.2606 W
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	22.5037 S 54.1629 W
Sitio Boa Esperança	BCA-184MS1-09	Estrada 6° Linha Poente Km 02	Glória de Dourados – MS	Samy Arfux de Figueredo	+55 67 3453-3594	22.3715 S 54.2256 W
Sitio Lote 43	BCA-185MS1-09	7° Linha nascente 5,5Km	Glória de Dourados – MS	Valdecir Pedro Gomes	+55 67 3456-3594	22.3755 S 54.1547 W
Sitio Lote 65	BCA-186MS1-09	Estrada 6° Nascente Km 08	Glória de Dourados – MS	Walter Fukoda	+55 67 3466-1450	22.4052 S 54.1394 W
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	22.3294 S 54.1841 W
Sitio Lote 45	BCA-199MS1-09	7° Linha nascente 6Km	Glória de Dourados – MS	Maria Amelia	+55 67 9997-8985	22.3762 S 54.1527 W

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.

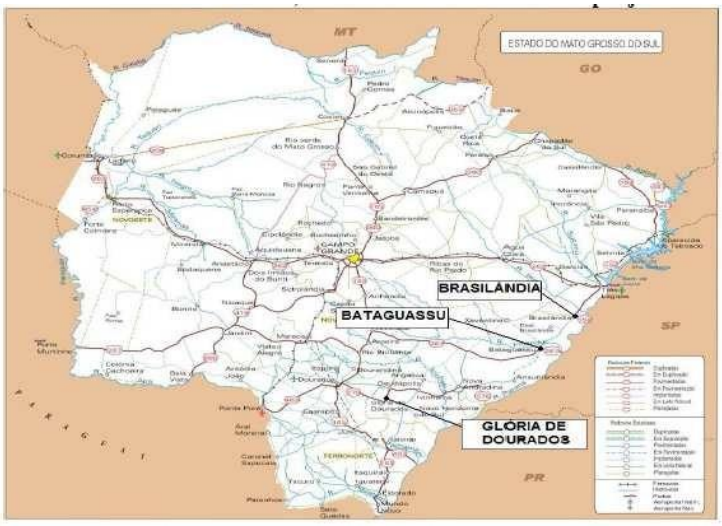
Viviane Araújo Costa Collete has one site in Bataguassu city:

- 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.3. Technologies/measures

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 the reduction of both volume and mass 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 at an 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 piping biogas collector, from the digester to the flare system.

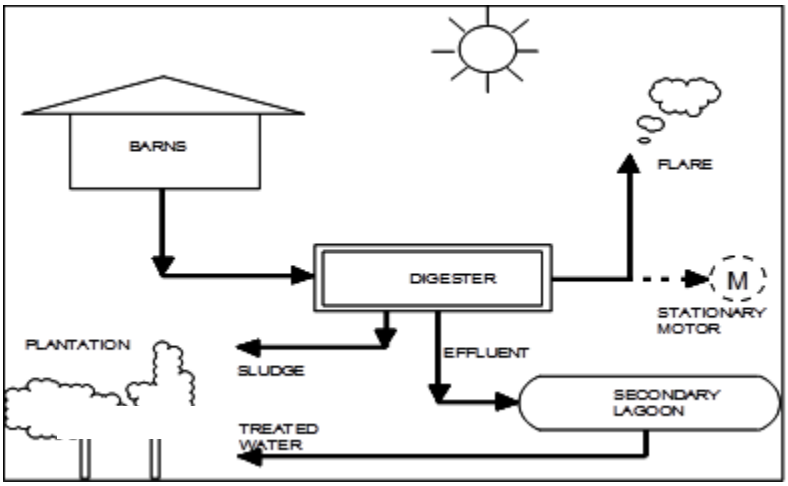
The flare is enclosed and controlled by a data logger PLC – Programmable Logic Controller – in which the combustion temperature is stored every one minute in the system. This system will record every each minute the combustion temperature to determinate the flare efficiency according to the specification 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 PLC in which every each minute the system records the flow rate. The sparkling system, the PLC and the control panel are powered by a 12 volts battery charged by solar cells.

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

Figure A4 – Flowchart of the treatment system



Prior to the implementation of the project activity, the confined animal wastewater, which consists of fresh water mixed with manure and urine that accumulates in pits under or beside the barns, is transported 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 scenario existing prior to the implementation of the project activity is the same as the baseline scenario.

Each farm will have one biodigestor which will send the biogas through a pipe where it will be located the flow meter. The biogas will then be burned in an enclosed flare and all data stored in a Control Logic Program (CLP).

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

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil	SP Carbono, Créditos de Carbono S.A. (private entity)	No
Norway	Norwegian Ministry of Climate and Environment	No

A.5. Public funding of project activity

The project activity did not receive any public funding from Party(ies) included in Annex 1.

A.6. History of project activity

The start of the first construction was 24/06/2011. All sites included in the PDD and the relevant dates of the project implementation for each site are described in the following table A3. The project is composed by 16 sites (farms). The project was registered in 01/11/2012 and has already requested the renewal of the crediting period.

Table A3. Relevant dates of project implementation.

Farm/Site Name	Brascarbon ID	Start Construction	Finish Construction	Start-up and Tests	Monitoring Start Date
Fazenda Corrego Azul - Paredão 1	BCA-155MS8-09	24/06/2011	04/12/2011	01/02/12	10/05/12
Fazenda Corrego Azul - Paredão 2	BCA-155MS7-09	24/06/2011	20/12/2011	01/02/12	10/05/12
Sitio Paraíso	BCA-156MS1-09	21/07/2011	04/12/2011	01/02/12	10/05/12
Sitio Lote São José	BCA-157MS1-09	21/07/2011	04/12/2011	01/02/12	10/05/12
Sitio Santa Izabel	BCA-158MS1-09	21/07/2011	04/12/2011	02/02/12	11/05/12
Sitio São João – Córrego da Anta	BCA-167MS1-09	21/07/2011	04/12/2011	02/02/12	11/05/12
Lote 24 e 26	BCA-174MS1-09	24/06/2011	23/01/2012	02/02/12	11/05/12
Lote Rural 37,35 e 39	BCA-176MS1-09	24/06/2011	18/11/2011	02/02/12	11/05/12
Lote Rural 56	BCA-177MS1-09	24/06/2011	18/11/2011	02/02/12	11/05/12
Sitio Água Limpa	BCA-180MS1-09	24/06/2011	18/12/2011	02/02/12	11/05/12
Sitio Lote 1 Quadra 32	BCA-183MS1-09	24/06/2011	18/12/2011	02/02/12	11/05/12
Sitio Boa Esperança	BCA-184MS1-09	24/06/2011	18/12/2011	02/02/12	11/05/12
Sitio Lote 43	BCA-185MS1-09	31/06/2011	12/03/2012	02/02/12	11/05/12
Sitio Lote 65	BCA-186MS1-09	24/06/2011	18/12/2011	02/02/12	11/05/12
Sítio Lote 04 e 06	BCA-196MS1-09	24/06/2011	12/03/2012	01/02/12	10/05/12
Sitio Lote 45	BCA-199MS1-09	21/07/2011	23/01/2012	01/02/12	10/05/12

Currently, the farms Fazenda Corrego Azul - Paredão 1 and Fazenda Corrego Azul - Paredão 2 has had their operations suspended and therefore was not accounted for the CER calculation. It is expected that the farms may resume its full operation at some point in time, being that the reason why they are still considered in the current version of the PDD.

A.7. Debundling

Based on paragraph 2 of Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities[7] [8], this project is not a debundled component of a large project activity. 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 the project boundary of the proposed small- scale activity.

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

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

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

AMS-III.D – "**Methane recovery in animal manure management systems**" (Version 21.0)

For more information on this methodology, please refer to the link:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

The following tools were also used:
Methodological Tool: "Project and leakage emissions from anaerobic digesters" (version 02)
Methodological Tool: "Project emissions from flaring" (version 03)
Methodological Tool: "Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period" (version 03.0.1)

B.2. Applicability of methodologies and standardized baselines

The choice of the selected simplified methodology is considered to be appropriate because the project activity meets each applicability conditions of the selected methodology AMS III-D (Version 21.0).

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

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

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

d) **In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and if anaerobic lagoons are used in the baseline, their depths are at least 1 m:**
The retention time of waste in open anaerobic open lagoons has proven to be more than 1 month as recommended by EMBRAPA (from 30 to 40 days)[9]. 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.

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

e) **No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario;**
The baseline scenario for all farms in this PDD is a Confined Animal Feed Operation with open anaerobic lagoons for the manure treatment system. No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario, which can be verified in each farm during validation. The project is new and does not involve capacity additions to the baseline scenario. This complies with para 7 and 8 of AMS-III.D version 21.0.

The project will also satisfy the following conditions:

a) **The residual waste from the animal manure management system shall be handled aerobically, otherwise the related emissions shall be taken into account as per relevant procedures of AMS-III.AO "Methane recovery through controlled anaerobic digestion". In case of soil application, proper conditions and procedures (not resulting in methane emissions) must be ensured;**
The final sludge will be handled aerobically. It will be applied in the soil, according with the proper conditions and procedures, being assured that no methane emissions are resulting from this application. The project involves the use of treated effluent for irrigation in farms and application of stabilized sludge on crops irrigation in farms, without any anaerobic conditions. The practice is to distribute the sludge over the field according the usual practice to improve the field fertilization. This complies with para 4(a) of AMS-III.D version 21.0.

b) **Technical measures will be used ensuring that all biogas produced by the digester is used or flared:**
The project involves facilities to burn (flaring) the biogas generated by the digester. This complies with para 4(b) of AMS-III.D version 21.0. An enclosed flare will be used in the project and also sized to support high temperatures. A continuous sparkling system is installed in the combustion chamber of the flare. In adequate conditions, the project activity will install electricity generator for in site electricity supply of farm needs according to conditions established on para 4 of AMS-III.H version 19.0, although no claims for emissions reductions by the electricity generation will be requested during the entire project activity, only by the emissions reductions of the biogas destroyed in the generators. This comply with para 6 of AMS-III.D version 21.0.

c) **The storage time of the manure after removal from the animal barns, including transportation, will not exceed 45 days before being fed into the anaerobic digester:**
This situation is assured due to the fact that the barns are directly connected to the biodigesters and considering the common farms practices where each day the barn is washed and all waste is removed by the water flushing system sent to the digester. This complies with para 4(c) of AMS-III.D version 21.0. The Confined Animal Feed Operation Practices follows recommendations from EMBRAPA (Empresa Brasileira de Agricultura e Agropecuária) to get high standards of sanitary conditions in the confined operations. These recommendations can be found at EMBRAPA web site where all producers use as a guideline.

Finally, the project doesn't involve any landfill activity. The project activity recovers methane generated in the treatment of swine manure by installing methane recovery and combustion systems (biodigester). This complies with paragraph 5 of AMS-III.D version 21.0.

Utilization of the recovered biogas in one of the options detailed in AMS-III.H is also eligible under this methodology. The respective procedures in AMS-III.H shall be followed in this regard. If the recovered biogas is used to power auxiliary equipment of the project activity, it should be taken

into account accordingly, using zero as its emission factor; however, energy used for such purposes is not eligible as an SSC CDM Type I project component.

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

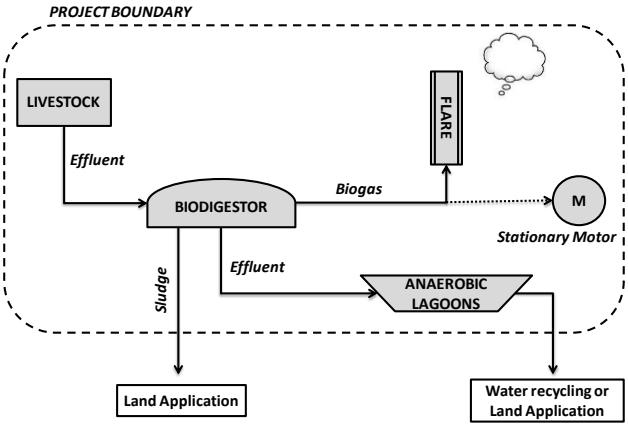
The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General guidelines for SSC CDM methodologies".

The project activity is a Type III: other project activities not included in Type I or Type II that result in GHG emission reductions not exceeding 60kt CO_2e per year in any year of the crediting period. this is clearly demonstrated in Tables B.7 and B.8 of Section B.6.

B.3. Project boundary, sources and greenhouse gases (GHGs)

According to version 21.0 of the AMS-III.D methodology, the project boundary is defined as the physical, geographical site of the livestock, of the manure generation and management systems and of the equipment installed which recover and flare the methane. This is described in Figure B1 in a schematic format. As there is the future possibility to install electricity generator for in site electricity supply, this component is also included (dotted) within the project boundary.

Figure B1 – Project Boundary



As it was stated in section A.1, the baseline scenario, prior to the implementation of the project activity consists in gathering and collection of the wastewater that results from the confined animal production (fresh water mixed with manure and urine that accumulates in pits under or beside the barns) into an open lagoon for evaporation.

The project boundary consists, as the figure B1 illustrates, of the barns were the livestock is held, the biodigestor which was built within the barns and the open lagoons (which already existed as baseline scenario prior to the project implementation), the monitoring system and flare and finally the open lagoons.

The organic material degraded in the primary treatment lagoon is digested, thereby producing significant amounts of methane. These systems emit methane (CH_4) resulting from anaerobic decomposition process. Since the baseline treatment process is, as stated, open lagoons, all the methane production, resulting from the organic matter decomposition is, in the baseline scenario, emitted to the atmosphere.

Hence, the source of the project emissions, in the baseline scenario, is the wastewater resultant from the cleaning of the barns where the animals are held. This effluent, heavily charged with organic matter, would be conducted, prior to the project activity, to the open lagoons, where the organic matter would be decomposed, originating methane emissions directly to the atmosphere. With the project activity, this methane emission is avoided through the flaring of the biogas.

Source		GHG	Included?	Justification/Explanation
Baseline Scenario	Emissions from the open lagoons	CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted
		CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions from the decomposition of organic waste are not accounted
Project activity	Emissions from the open lagoons	CO_2	No	Excluded for simplification. This emission source is considered to be very small
		CH_4	No	Excluded for simplification. This emission source is considered to be very small
		N_2O	No	Excluded for simplification. This emission source is considered to be very small
	Emissions from on-site electricity use	CO_2	No	No electricity is consumed in the project activity
		CH_4	No	No electricity is consumed in the project activity
		N_2O	No	No electricity is consumed in the project activity

B.4. Establishment and description of baseline scenario

In accordance with "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (version 03.0.1), the validity of the current baseline is assessed using the following sub-steps:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

Prior to the registration of the project as a CDM, there was no legal obligation for swine farms to to capture and destroy the methane in their effluent being the open lagoons the common practice and the effluent treatment required by the law. This situation prevails until today, hence, currently, there is still no legal requirement for the capture and destroy of the methane content in swine farm effluents,

.

Although there was no regional or national legal requirement in Brazil establishing the implementation of biodigestors in swine farms to collect and destroy the methane produced, at the time the project activity was validated, a very small share of swine farms had biodigestors, being the open lagoons, the majority of the effluent treatment adopted.

Step 1.2: Assess the impact of circumstances

The previously identified baseline scenario for the project activity has not changed at the time of requesting renewal of the crediting period. Although the previously identified baseline scenario for the project activity remains the same, it is important to note that baseline emissions and ex-ante estimations of emission reductions to be achieved by the project activity during the 2nd 7-year renewable crediting period have changed when compared assumptions as presented in the latest version of the PDD (and related emission reduction spreadsheet) valid for the 1st 7-year crediting period. There was made an update in the number of animals for each farm which led to different emissions reductions per site. Also, there were also some farms which have terminated their activity and therefore were withdrawn from the project activity.

Furthermore, it is also noteworthy that the ex-ante selected value for Global Warming Potential (GWP) for methane (CH4) which is valid for the 2nd 7-year crediting period (the value valid for the 2nd commitment period of the Kyoto Protocol) is higher than the one previously applied (value of 25 instead of 21 values previously applied).

While the baseline scenario identified at the validation stage of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is thus required for the renewal of the crediting period. This is required by the methodological tool —Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period" (version 03.0.1). Hence the current baseline does not need to be updated.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

The baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, there's no current baseline equipment or an investment, hence the current baseline does not need to be updated. Go to step 1.4.

Step 1.4: Assessment of the validity of the data and parameters

Some methodological requirements, ex-ante selected data and parameters which were previously determined during the project validation period and thus prior to the start of the 1st 7-year crediting period as per the applicable requirements of the earlier applied CDM baseline and monitoring methodology (AMS-III.D (version 17)) will not any longer be valid/applicable during the 2nd 7-year crediting period. As per the applied latest version of the valid CDM baseline and monitoring methodology (AMS-III.D (version 21.0)) and related methodological tools, there are differentiated methodological approaches which are applicable and thus should be considered (incl. some of the ex-ante determined parameters, other default values and even other assumptions). Due to that, other data and ex-ante determined parameters are thus applied in the context of the demonstration of the validity of the earlier derived baseline scenario and also applied in the determination of baseline emissions during the 2nd 7-year crediting period. Thus, some of data and parameters as presented in the latest version of the PDD valid for the 1st crediting period not any longer valid.

As a conclusion, since the demonstration of validity of the earlier derived baseline scenario, determination of baseline emissions during the 2nd 7-year crediting period and ex-ante determined parameters and default values are all determined/calculated as per applicable guidance of AMS-III.D (version 21.0) and related methodological tools, the validity of earlier defined ex-ante determined parameters is thus limited. The methodological approaches for the demonstration of validity of the earlier derived baseline scenario, baseline emissions during the 2nd 7-year crediting period, ex-ante determined parameters and monitored parameters are presented and justified in this Section, in Section B.6.1, Section B.6.2 and Section B.7.1 respectively.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

The determination of the baseline scenario (as per applicable guidance of AMS-III.D (version 21.0)) is included below under "Determination of the baseline scenario". It is important to note that while the baseline scenario for the project activity was not changed for the 2nd 7-year renewable crediting period, the applied methodological approaches for the determination of baseline scenario and baseline emissions (as per AMS-III.D (version 21.0)) is indeed different than the one required by the previously applied methodology AMS-III.D (version 17). Thus, for completeness reasons, this PDD includes the whole determination of the baseline scenario and baseline emissions as per the applicable guidance and requirements and stepwise approaches of AMS-III.D (version 21.0) regardless the fact baseline scenario remains being the same.

The determination of baseline emissions (by following all applicable guidance and requirements of AMS-III.D (version 21.0) and applicable related methodological tools) is presented in Section B.6.1. Related ex-ante estimations of baseline emissions for the 2nd 7-year crediting period are summarized in Section B.6.3.

Step 2.2: Update the data and parameters

All applicable and required ex-ante determined parameters valid for the 2nd 7-year renewable crediting period are presented in Sections B.6.1 and B.6.2.

While some of the ex-ante determined parameters (which are summarized in Sections B.6.1.and B.6.2) are applied only in the context of ex-ante estimations of emission reductions along the 2nd crediting period, other ex-ante determined parameters will however be used for the calculation/determination of emission reductions in an ex-post basis (in conjunction with parameters determined ex-post) along the 2nd 7-year crediting period.

It is also important to consider that AMS-III.D (version 21.0) and applicable methodological tools include parameters (ex-ante or ex-post determined) which were not previously applied/considered in the PDD valid for the 1st 7-year crediting period (as this PDD was completed in accordance requirements and guidance of the baseline and monitoring methodology AMS-III.D (version 17)). Furthermore, as also outlined previously, the value for the Global Warming Potential (GWP) for the GHG methane is also changed for the 2nd crediting period when compared to the value previously applied during the largest fraction of the 1st crediting period. The applied revised value for the ex-ante determined parameter GWPCH4 is in accordance with the "Standard for application of the global warming potential to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol".

Determination of the baseline scenario

This section is based on the equations used on the approved methodology AMS.III.D version 21.0 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 21.0.

The final draft of this baseline section was completed on 01/04/2009. The name of entity determining the baseline is Brascarbon which was a project participant at this time, as well as the project developer.

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

Step 1: Animal Population.

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

Step 2: Baseline Emissions.

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

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

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

Option a) was chosen.

Equation B1

$$BE_y = GWP_{CH4} \times D_{CH4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j}$$

Where:

BEy	Baseline emissions in year "y" (tCO_2e)
GWPCH4	Global Warming Potential (GWP) of CH_4 (25)
DCH4	CH_4density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
j	Index for animal waste management system
MCFj	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
B0,LT	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m_3 CH_4/kg dm)
NLT,y	Annual average number of animals of type "LT" in year "y" (numbers)
VSLT,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

As per definition of the methodology, "*The maximum methane-producing capacity of the manure (B0) varies by species and diet. The preferred method to obtain B0 measurement values is to use data from country-specific published sources, measured with a standardised method (B0 shall be based on total as-excreted VS). These values shall be compared to IPCC default values and any significant differences shall be explained. If country specific B0 values are not available, default*

values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site".

Also, the methodology refers that the "*Volatile solids (VS) are the organic material in livestock manure and consist of both biodegradable and non-biodegradable fractions. For the calculations the total VS excreted by each animal species is required. The preferred method to obtain VS is to use data from nationally published sources. These values shall be compared with IPCC default values and any significant differences shall be explained. If data from nationally published sources are not available, country-specific VS excretion rates can be estimated from feed intake levels, via the enhanced characterisation method (tier 2) described in section 10.2 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10. If country specific VS values are not available IPCC default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, chapter 10 table 10 A-4 to 10 A-9 can be used provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to feed intake levels*"

Brazil does not have any national published values nor sources to obtain the default values need. Hence, the VS values chosen for the current project were the *2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, chapter 10 table 10 A-7 and 10 A-8* for the Region Western Europe since they have proven to be the more suitable for the specific situation of the treatment site particularly with reference to feed intake levels.

The genetics used in the project are originally from that region and the values presented are the more similar when compared with the specific project site values. The same situation occurs with the feed intake level, which is than reflected in the specific animal weight, being the IPCC values for Western Europe swine the more adjusted and suited to the project sites.

Therefore, the parameter $VS_{LI,y}$ will be calculated according with the following methodology consideration "*In case default IPCC values for VS are adjusted for a site-specific average animal weight, it shall be well explained and documented."*.

Where:

$VS_{LT,y}$ 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.

According to paragraph 17 (d) from AMS-III.D version 21.0, B0 or VS values applicable to developed countries can be used provided the following four conditions are satisfied:

- *The genetic source of the livestock originates from an Annex I Party;*
Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/ and also at ASSUGLÓRIA (Cooperativa de Gloria de Dourados).

The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement.

- *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;*

The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement.

- *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);*
The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14.

- *The project specific animal weights are more similar to developed country IPCC default values.*
The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation.

Finishers is the animal category that represents the totality of all animals from the farms included in this PDD. Finishers are considered to be “market swine” and presented an average weight of 90kg among all farms included in the PDD by the time of the project’s registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe’s.

This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project’s registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe’s. Only in the category nursery (also Market Swine), which roughly represents 30% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values.

Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

And,

(A) $N_{LT,y}$, 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
$VS_{default}$	0.46 for breeding swine (sows, gilts) 0.3 for market swine (nursery, boars and finishers)	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8. Values for Western Europe
GWP_{CH4}	25	IPCC Fourth Assessment Report: Climate Change 2007
$B_{0,LT}$	0.45	Obtained from 2006 IPCC, Table 10A-7, p.10.80 and Table 10A-8, p.10.81. Values for Western Europe
D_{CH4}	0.00067	CH_4 density at room temperature 20ºC 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	-	3,500	-	-	-	**3,500**
2	Faz. Corrego Azul – Paredão 2	-	3,500	-	-	-	**3,500**
3	Sítio Santa Izabel	-	3,900	-	-	-	**3,900**
4	Sítio Paraíso	-	3,500	-	-	-	**3,500**
5	Sítio Lote 43	-	4,900	-	-	-	**4,900**
6	Sítio Lote 04 e 06	-	5,000	-	-	-	**5,000**
7	Lote Rural 56	-	5,000	-	-	-	**5,000**
8	Lote Rural 37, 39 e 35	-	4,660	-	-	-	**4,660**
9	Sítio Lote 65	-	5,500	-	-	-	**5,500**
10	Sitio Boa Esperança	-	4,660	-	-	-	**4,660**
11	Lote 24 e 26	-	5,500	-	-	-	**5,500**
12	Sitio Água Limpa	-	4,660	-	-	-	**4,660**
13	Sitio Lote 1 Quadra 32	-	4,660	-	-	-	**4,660**
14	Sitio Lote São José	-	2,400	-	-	-	**2,400**
15	Sitio São João – Córrego da Anta	-	2,400	-	-	-	**2,400**
16	Sitio Lote 45	-	6,000	-	-	-	**6,000**
TOTAL		**-**	**69,740**	**-**	**-**	**-**	**69,740**

B.5. Demonstration of additionality

The table below is only applicable if the proposed project activity is a type of project activity which is deemed automatically additional, as defined by the applied approved methodology, tool, standardized baseline or specific renewable technologies/measures conferring automatic additional microscale CDM project activities proposed by a DNA and approved by the Board.

Specify the methodology, tool, standardized baseline or specific renewable technologies/measures conferring automatic additional microscale CDM project activities proposed by DNAs and approved by the Board, that establish automatic additionality for the proposed project activity (including the version number and the specific paragraph, if applicable).	N/A
Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology, tool, standardized baselines or specific renewable technologies/measures conferring automatic additional microscale CDM project activities proposed by a DNA and approved by the Board.	N/A

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

- In September 2008 the PDD has been published for global stakeholder consultation;
- In March 2009 the Emission Reduction Purchase Agreement (ERPA) was signed between the Project Developer (Brascarbon) and the carbon credit Buyer (Luso Carbon Fund);
- The contracts between the project developer and the owner of the pig farms especially mention the project implementation under the context of CDM.

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

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

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

In accordance with paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in Appendix B may be used if project participants can demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in attachment A of Appendix B. 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 and water quality enhancements are rarely a strong motive to upgrade to an expensive advanced animal waste management system. Also, in the producer´s point of view the animal waste is outside of the production process and has difficult financing challenges that should be undertaken. Even banks have been unwilling to finance such activities without government guarantees or other incentives. The anaerobic digester requires a much higher investment than an anaerobic lagoon. Therefore, this last one is the most likely alternative and can be considered as the baseline scenario.

To demonstrate the existence of an investment barrier, that prevents the implementation of the project without the revenue of the carbon credits, the project proponent has undertaken an investment analysis of the project activity (without the revenue of the carbon credits), considering three scenarios:

- **I: Baseline Scenario**: the installation of an anaerobic lagoon;
- **II: Project Scenario**: the installation of the anaerobic digester with flare.
- **III: Project Scenario + Generator**: the installation of the anaerobic digester with flare and a generator, which assumes that all the farms will install standard generators with a capacity of 40kW, to produce energy during 12 hours/day and will consume 100% of the energy produced for farm activities proposals. It is considered that the revenues associated with this scenario are the avoided costs with electricity purchase

Although in the initial version of the PDD the investment analysis has been referenced to March 2009, the data has been further updated to take into account the effective date on which the investment decision was made, which was 12th of April 2011. The following assumptions were considered (Table B3.0):

Table B3.0 – Assumptions for the Investment Analysis

Parameter	Assumption / Value	Comments / Source
Date for the Investiment Analysis	12th of April 2011	Investment Decision date Approval of the investment by the board of Luso Carbon Fund, the carbon credit buyer which is going to fully finance the project
Period	21 years	Maximum period of the Small Scale project life cycle
Discount rate	11.67	Brazilian Selic Tax for the 12th of April 2011 http://www.bcb.gov.br/?SELICDIA SELIC Tax is the main index rate used by the Market in Brazil
Exchange rate R$/USD	1.5870	Exchange rate for 12th of April 2011 http://www4.bcb.gov.br/pec/taxas/port/ptaxnpesq.asp?id=txcotacao
Electricity tariff R$/MWh	209.33	Data for Central Region (Mato Grosso do Sul region) Rural consumption http://www.aneel.gov.br/
Total electricity produced per farm (MWh)	175.2	Assuming farmers will produce energy during 12 hours/day during 365days a year
Investment cost Project Scenario	Variable according to size of farm	According to budget provided by supplier
Maintenance cost Project Scenario	R$ 8,784	According to budget provided by supplier Does not vary per farm size (equipment replacement + transport costs)
Investment cost Baseline Scenario	Variable according to size of farm	According to budget provided by supplier
Maintenance cost Baseline Scenario	R$ 1,587	According to budget provided by supplier Does not vary per farm size (equipment replacement + transport costs)
Investment cost Generator 40kW	R$ 128,560	According to budget provided by supplier
Maintenance cost Generator 40kW	R$ 10,285	According to budget provided by supplier

The results of the financial analysis for the three scenarios are presented in tables B 3.1, B.3.2. and B.3.3.

In the Baseline scenario (Table B3.1) and in the Project scenario (Table B3.2) there are only negatives cash flows, as no revenue will be expected from the implementation of the project activity.

In the Project + Generator scenario, Table B3.3, although the project activity generates positive returns from the avoided costs of the electricity purchase and this is enough to offset the maintenance costs of the anaerobic digester and the generator, the yearly cash-flows are not enough to recover the initial amount which is necessary to investment in the digester plus flare and generator. The NPV of this scenario is still negative, lower than in the baseline scenario.

Table B3.1. – Financial Analysis for Baseline Scenario (open lagoon) (US$)

ID	FARM/SITE	Equipment costs	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable			NPV (US$) (11,67% discount rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Faz. Corrego Azul – Paredão 1	-8,484	-16,469	0	-1,000	-1,000	-1,000	0	0	0	-32,579	UNDEFINED
2	Faz. Corrego Azul – Paredão 2	-8,484	-16,469	0	-1,000	-1,000	-1,000	0	0	0	-32,579	UNDEFINED
3	Sítio Santa Izabel	-5,656	-10,979	0	-1,000	-1,000	-1,000	0	0	0	-24,262	UNDEFINED
4	Sítio Paraíso	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
5	Sítio Lote 43	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
6	Sítio Lote 04 e 06	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
7	Lote Rural 56	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
8	Lote Rural 37, 39 e 35	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
9	Sítio Lote 65	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
10	Sitio Boa Esperança	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
11	Lote 24 e 26	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
12	Sitio Água Limpa	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
13	Sitio Lote 1 Quadra 32	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED
14	Sitio Lote São José	-5,656	-10,979	0	-1,000	-1,000	-1,000	0	0	0	-24,262	UNDEFINED
15	Sitio São João – Córrego da Anta	-5,656	-10,979	0	-1,000	-1,000	-1,000	0	0	0	-24,262	UNDEFINED
16	Sitio Lote 45	-7,070	-13,724	0	-1,000	-1,000	-1,000	0	0	0	-28,421	UNDEFINED

Table B3.2. – Financial Analysis for Project Scenario (digester + flare) (US$)

ID	FARM/SITE	Equipment costs	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from electricity savings due the onsite energy production (during 12 hours/day in year)			NPV (US$) (11,67% discount rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Faz. Corrego Azul – Paredão 1	-54,896	-28,280	0	-5,535	-5,535	-5,535	0	0	0	-125,389	UNDEFINED
2	Faz. Corrego Azul – Paredão 2	-54,896	-28,280	0	-5,535	-5,535	-5,535	0	0	0	-125,389	UNDEFINED
3	Sítio Santa Izabel	-36,597	-18,853	0	-5,535	-5,535	-5,535	0	0	0	-97,664	UNDEFINED
4	Sítio Paraíso	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
5	Sítio Lote 43	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
6	Sítio Lote 04 e 06	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
7	Lote Rural 56	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
8	Lote Rural 37, 39 e 35	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
9	Sítio Lote 65	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
10	Sitio Boa Esperança	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
11	Lote 24 e 26	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
12	Sitio Água Limpa	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
13	Sitio Lote 1 Quadra 32	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED
14	Sitio Lote São José	-36,597	-18,853	0	-5,535	-5,535	-5,535	0	0	0	-97,664	UNDEFINED
15	Sitio São João – Córrego da Anta	-36,597	-18,853	0	-5,535	-5,535	-5,535	0	0	0	-97,664	UNDEFINED
16	Sitio Lote 45	-45,747	-23,566	0	-5,535	-5,535	-5,535	0	0	0	-111,527	UNDEFINED

Table B3.3. – Financial Analysis for Project Scenario + Generator (digester + flare + generator) (US$)

ID	FARM/SITE	Equipment costs	Installation costs	Other costs (operation, consultancy, engineering, etc.)	Maintenance costs			Revenues from the sale of electricity or other project related products, when applicable (*)			NPV (US$) (10,77% discount rate)	IRR (%)
					2012	year n	year n+1	2012	year n	year n+1		
1	Faz. Corrego Azul – Paredão 1	-128,154	-36,030	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-79,577	UNDEFINED
2	Faz. Corrego Azul – Paredão 2	-128,154	-36,030	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-79,577	UNDEFINED
3	Sítio Santa Izabel	-109,855	-26,604	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-51,851	UNDEFINED
4	Sítio Paraíso	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
5	Sítio Lote 43	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
6	Sítio Lote 04 e 06	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
7	Lote Rural 56	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
8	Lote Rural 37, 39 e 35	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
9	Sítio Lote 65	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
10	Sitio Boa Esperança	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
11	Lote 24 e 26	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
12	Sitio Água Limpa	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
13	Sitio Lote 1 Quadra 32	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED
14	Sitio Lote São José	-109,855	-26,604	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-51,851	UNDEFINED
15	Sitio São João – Córrego da Anta	-109,855	-26,604	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-51,851	UNDEFINED
16	Sitio Lote 45	-119,004	-31,317	0	-12,016	-12,016	-12,016	23,109	23,109	23,109	-65,714	UNDEFINED

In the Table B3.4 the summary of the investment analysis for each farm is presented and it can be seen that the Baseline scenario (anaerobic lagoon) appears as the most attractive option.

Table B3.4. – NPV Comparison for the three scenarios (US$)

ID	FARM/SITE	NPV (1st SCENARIO) Open Lagoon	NPV (2nd SCENARIO) DIGESTER + FLARE	NPV (3rd SCENARIO) DIGESTER + FLARE+GENERATOR
1	Faz. Corrego Azul – Paredão 1	-32,579	-125,389	-79,577
2	Faz. Corrego Azul – Paredão 2	-32,579	-125,389	-79,577
3	Sítio Santa Izabel	-24,262	-97,664	-51,851
4	Sítio Paraíso	-28,421	-111,527	-65,714
5	Sítio Lote 43	-28,421	-111,527	-65,714
6	Sítio Lote 04 e 06	-28,421	-111,527	-65,714
7	Lote Rural 56	-28,421	-111,527	-65,714
8	Lote Rural 37, 39 e 35	-28,421	-111,527	-65,714
9	Sítio Lote 65	-28,421	-111,527	-65,714
10	Sitio Boa Esperança	-28,421	-111,527	-65,714
11	Lote 24 e 26	-28,421	-111,527	-65,714
12	Sitio Água Limpa	-28,421	-111,527	-65,714
13	Sitio Lote 1 Quadra 32	-28,421	-111,527	-65,714
14	Sitio Lote São José	-24,262	-97,664	-51,851
15	Sitio São João – Córrego da Anta	-24,262	-97,664	-51,851
16	Sitio Lote 45	-28,421	-111,527	-65,714

A sensitivity analysis of the Scenario Project + Generator (only scenario with revenues) was undertaken, considering the variations of 10% as recommended by the Guidelines on the Assessment of Investment Analysis (Annex 58 of the EB 51):

- Alternative A: Investment Cost: decrease in 10%
- Alternative B: Electricity Tariff: increase in 10%

The results are presented in the Table B2.5 and it can be seen that in both alternatives considered, the project is still not viable and the NPV is negative.

Table B3.5. – Sensitivity analysis summary (US$)

ID	FARM/SITE	A - CONSIDERING 10% INVESTMENT COST REDUCTION	B - CONSIDERING 10% INCREASE OF THE ENERGY PRICE
		NPV (3rd SCENARIO) DIGESTER + FLARE + GENERATOR	NPV (3rd SCENARIO) DIGESTER + FLARE + GENERATOR
1	Faz. Corrego Azul – Paredão 1	-63,158	-61,952
2	Faz. Corrego Azul – Paredão 2	-63,158	-61,952
3	Sítio Santa Izabel	-38,205	-34,227
4	Sítio Paraíso	-50,682	-48,089
5	Sítio Lote 43	-50,682	-48,089
6	Sítio Lote 04 e 06	-50,682	-48,089
7	Lote Rural 56	-50,682	-48,089
8	Lote Rural 37, 39 e 35	-50,682	-48,089
9	Sítio Lote 65	-50,682	-48,089
10	Sitio Boa Esperança	-50,682	-48,089
11	Lote 24 e 26	-50,682	-48,089
12	Sitio Água Limpa	-50,682	-48,089
13	Sitio Lote 1 Quadra 32	-50,682	-48,089
14	Sitio Lote São José	-38,205	-34,227
15	Sitio São João – Córrego da Anta	-38,205	-34,227
16	Sitio Lote 45	-50,682	-48,089

From the 3 Scenarios considered, the installation of the open anaerobic lagoon (baseline scenario) is the most economic option to the swine producers. Both the investment and maintenance cost are inferior to the other scenarios considered and this is an option approved by the environment

department. The negative cash flows and present value indicate that the farm producers would not engage and invest in any implementation of anaerobic digester plus flare with or without generator. Continuation of the actual practices, anaerobic lagoon, would be the most attractive course of action because it requires less investment (especially since all the producers already have an anaerobic lagoon under place) and this practice is compliant with the environmental legislation. The installation of an anaerobic lagoon is the option with higher GHG emissions.

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 destruction.

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 CH_4 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 the temperature information) have 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 do 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)
According to researchers of Embrapa Swine and Poultry (CNPSA), the common practice regarding swine waste storage and treatment systems in the 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.

In order to clarify the actual circumstances regarding to confined animal operations in Brazil and the serious environmental problems that can occur due the bad animal waste management system, EMBRAPA stimulated by the Expansion and Waste Treatment Program of the State of Santa Catarina published a Good Practices Manual 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[10]. This idea was supported by officers of national swine producers association (ABCS).

Although the installation of an animal waste management system will, by itself, provide the producers with some external benefits as it was stated before, the project itself could not be developed without the revenues from the CERs. CDM funding will help to alleviate the identified barrier by providing the financial means which are necessary to implement the project activity.

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

[10] Boas Práticas de Produção de Suínos: http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_k5u59t7m.pdf

B.6. Estimation of 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 21.0 – *"**Methane recovery in animal manure management systems**"* and data from 2006 IPCC Guidelines for National GHG Inventories, volume 4, chapter 10.

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

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

Step 1: Emission Reductions.

Equation B4

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

Where:

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

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

Equation B4.1

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

Where:

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

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

Equation B4.2

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

Where:

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

Step 2: Baseline Emissions.

According to the Equation B1 section B.4

$$BE_y = GWP_{CH4} \times D_{CH4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j}$$

Where:

BEy	Baseline emissions in year "y" (tCO2e)
$GWPCH_4$	Global Warming Potential (GWP) of CH4 (25)
DCH_4	CH4 density (0.00067 t/m3at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
J	Index for animal waste management system
MCFj	Annual methane conversion factor (MCF) for the baseline animal waste management system "j"
B0,LT	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m3 CH4/kg dm)
NLT,y	Annual average number of animals of type "LT" in year "y" (numbers)
VSLT,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"
UFb	Model correction factor to account for model uncertainties (0.94)

Step 3: Project Emissions.

According to the simplified baseline and monitoring methodology for a small-scale CDM project Type-III (AMS.III.D – version 21.0), 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) CO_2emissions from use of fossil fuels or electricity for the operation of all the installed facilities (*PEpower,y*).

(d) CO_2 emissions from incremental transportation distances ($PE_{transp,y}$)

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

Equation B5

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

Where:

PEy	Project emissions in year “y” (tCO2e)
PEPL,y	Emissions due to physical leakage of biogas in year “y” (tCO2e)
PEflare,y	Emissions from flaring or combustion of the biogas stream in the year “y” (tCO2e)
PEpower,y	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year “y” (tCO2e)
PEtransp,y	Emissions from incremental transportation in the year y (tCO_2e), as per relevant paragraph in AMS-III.F
PEstorage,y	Emissions from the storage of the manure in the year “y” (tCO2e)

Where:

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

Equation B6

$$PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{CH4} \times \sum_{i,LT} B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y}$$

Where:

$GWPCH_4$	Global Warming Potential (GWP) of CH4 (25)
$PEPL,y$	Emissions due to physical leakage of biogas in year "y" (tCO2e)
$GWPCH_4$	Global Warming Potential (GWP) of CH4 (25)
DCH_4	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LT	Index for all types of livestock
J	Index for animal waste management system
$B0,LT$	Maximum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)
NLT,y	Annual average number of animals of type "LT" in year "y" (numbers)
$VSLT,y$	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:

According with the tool Project emissions from flaring version 3, the calculation procedure in this tool determines the project emissions from flaring the residual gas ($PE_{flare,y}$) based on the flare efficiency ($\eta_{flare,m}$) and the mass flow of methane to the flare ($F_{CH4,RG,m}$). The flare efficiency is determined for each minute *m* of year *y* based either on monitored data or default values.

The project emissions calculation procedure is given in the following steps:

(a) STEP 1: Determination of the methane mass flow of the residual gas;

(b) STEP 2: Determination of the flare efficiency;

(c) STEP 3: Calculation of project emissions from flaring.

Step 1: Determination of the methane mass flow in the residual gas

The "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" shall be used to determine the following parameter:

Parameter	SI Unit	Description
$F_{CH4,m}$	kg	Mass flow of methane in the residual gaseous stream in the minute *m*

The following requirements apply:

(a) The gaseous stream tool will be applied to the residual gas;

(b) The flow of the gaseous stream will be measured continuously;

(c) CH4 is the greenhouse gas *i* for which the mass flow will be determined;

(d) The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 and 17 in the tool); and

(e) The time interval *t* for which mass flow should be averaged is every minute *m*.

According with the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03, The mass flow of a greenhouse gas i in a gaseous stream ($F_{i,t}$) is determined through measurement of the flow and volumetric fraction of the gaseous stream.

Option D was chosen

The flow measurement on a dry basis is not doable for a wet gaseous stream. Therefore, it is necessary to demonstrate that the gaseous stream is dry to use this option. According with the tool, there are two ways to do this:

(a) Measure the moisture content of the gaseous stream (CH2O,t,db,n) and demonstrate that this is less or equal to 0.05 kg H2O/m3 dry gas; or
(b) Demonstrate that the temperature of the gaseous stream (Tt) is less than 60ºC (333.15 K) at the flow measurement point.

The temperature of the biogas is less than 60ºC, and that will be demonstrated during the monitoring of the parameter, according with the MP.

Step 2: Determination of flare efficiency

The flare efficiency depends on the combustion efficiency of in the flare and the time that the flare is operating. For determining the efficiency of enclosed flares project participants shall choose to determine the efficiency based on monitored data or the option to apply a default value. For open flares a default value must be applied. The time the flare is operating is determined by using a flame detector and, for the case of enclosed flares, in addition the monitoring requirements provided by the manufacturer's specifications for operating conditions shall be met.

In the case of enclosed flares, project participants may choose between the following two options to determine the flare efficiency for minute *m* ($\eta_{flare,m}$) and shall document in the CDM-PDD which option is selected:

(a) Option A: Apply a default value for flare efficiency;

(b) Option B: Measure the flare efficiency.

Option A was chosen

Option A: Default value

The flare efficiency for the minute *m* ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

(a) The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare (*FRG,m*) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute *m*; and

(b) The flame is detected in minute m ($Flame_m$).

Otherwise $\eta_{flare,m}$ is 0%.

It is important to highlight that the flares are considered a low height so, in line with the tool, a conservative approach should be applied, and 10 percentile points should be subtracted to the flare efficiency. Hence the flare efficiency adopted in the current PDD will be the default value of 80%.

In line with the monitoring plan, if any minute of any hour presents a temperature value below 500ºC the entire hour will be discount form the CER calculation. This discount will be applied to the volume of that specific hour since it is a more conservative approach than to discount in the average of the flare efficiency percentage.

Step 3: Calculation of project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions for each minute *m* in year *y,* based on the methane mass flow in the residual gas ($F_{CH4,RG,m}$) and the flare efficiency ($\eta_{flare,m}$), as follows:

Equation B7

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

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y, tCO_2e
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period, tCO_2e/tCH_4
$F_{CH4,RG,m}$	Mass flow rate of methane in the residual gas in the minute m, kg/m
$\eta_{flare,\,m}$	Flare efficiency in the minute m

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

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

(D) Emissions from incremental transportation

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

(E) Emissions from storage of the manure:

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

Step 4: Leakage.

According with the methodology AMS.III.D version 21.0, the leakage should be determined by following the relevant procedure in the methodological tool "*Project and leakage emissions from anaerobic digesters*".

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

B.6.2. Data and parameters fixed ex ante

Data / Parameter	MCF_j
Data unit	%
Description	Annual methane conversion factor for the baseline animal waste management system "j".
Source of data	Obtained from IPCC2006, vol 4, chapter 10, Tables 10.17.
Value(s) applied	79%
Choice of data or Measurement methods and procedures	Average temperature of southwest region, mainly where the project sites are located is 23 to 25 Celsius during the year, according to CPTEC/INPE/EMBRAPA http://satelite.cptec.inpe.br/PCD/
Purpose of data	Calculation of Baseline Emissions
Additional comment	

Data / Parameter	$MS\%_{BL,j}$
Data unit	Fraction
Description	Fraction of manure handled in baseline animal manure management system "j".
Source of data	Project proponents
Value(s) applied	1
Choice of data or Measurement methods and procedures	100% of the manure will be handled per category T, system S and climate region k.
Purpose of data	Calculation of Baseline Emissions
Additional 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	Obtained from IPCC2006, vol 4, chapter 10, Tables 10A-7 and 10A-8.
Value(s) applied	0.3 for Market Swine (finishers, nursery/weaners, boars) 0.46 for Breeding Swine (guilts, sows)
Choice of data or Measurement methods and procedures	Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association). http://www.abcs.org.br/ The genetic source of production operation is originated from Annex I; The farm uses formulated feed rations optimized for the various stage of growth and animals category; The formulated feed rations can be validated through on farm record keeping; The project specific animal weights are more similar to developed country IPCC default values. Used of factors as defined in IPCC2006, chapter 10, volume 4, since that there is no national data for the default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population.
Purpose of data	Calculation of Baseline Emissions

Additional comment	The four conditions to apply VS value of developed countries are fully applicable to developed countries can be used provided the following four conditions are satisfied: - *The genetic source of the livestock originates from an Annex I Party;* Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/ and also at ASSUGLÓRIA (Cooperativa de Gloria de Dourados). The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. - *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;* The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement. - *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);* The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. - *The project specific animal weights are more similar to developed country IPCC default values.* The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. *Finishers* is the animal category that represents the totality of all animals from the farms included in this PDD. Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's. This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 30% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values. Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

Data / Parameter	$GWPCH_4$
Data unit	tCO_2e/tCH_4
Description	Global warming potential of CH_4
Source of data	IPCC Fourth Assessment Report: Climate Change 2007
Value(s) applied	25
Choice of data or Measurement methods and procedures	Conversion factor for metric tons of CH_4 to metric tons of CO_2 equivalent.
Purpose of data	Calculation of Baseline Emissions and Project Emissions
Additional comment	

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

Additional comment	The four conditions to apply B0 value of developed countries are fully applicable to developed countries can be used provided the following four conditions are satisfied: - *The genetic source of the livestock originates from an Annex I Party;* Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/ and also at ASSUGLÓRIA (Cooperativa de Gloria de Dourados). The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. - *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;* The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement. - *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);* The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. - *The project specific animal weights are more similar to developed country IPCC default values.* The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. *Finishers* is the animal category that represents the totality of all animals from the farms included in this PDD. Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's. This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 30% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values. Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

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

Additional comment	The four conditions to apply $W_{default}$ value of developed countries are fully applicable to developed countries can be used provided the following four conditions are satisfied: - *The genetic source of the livestock originates from an Annex I Party;* Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/ and also at ASSUGLÓRIA (Cooperativa de Gloria de Dourados). The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. - *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;* The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement. - *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);* The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. - *The project specific animal weights are more similar to developed country IPCC default values.* The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. *Finishers* is the animal category that represents the totality of all animals from the farms included in this PDD. Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's. This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 30% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values. Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

Data / Parameter	UF_b
Data unit	Fraction
Description	Model correction factor to account for model uncertainties
Source of data	FCCC/SBSTA/2003/10/Add.2, page 25.
Value(s) applied	0.94
Choice of data or Measurement methods and procedures	Default value according to methodology AMS-III.D
Purpose of data	Calculation of Baseline Emissions
Additional comment	

Data / Parameter	$SPEC_{flare}$
Data unit	Temperature - °C Flow rate or heat flux - kg/h or m^3/h Maintenance schedule - number of days
Description	Manufacturer's flare specifications for temperature, flow rate and maintenance schedule
Source of data	Flare manufacturer
Value(s) applied	The flare optimal conditions are, according the manufacturers specifications: Flow: between $\pm$ 40% of the estimated flow (in m^3/h) for any giving farm; Temperature: between 500ºC and 800ºC Maintenance: Annually, recommended by the manufacturer. The PP preforms monthly maintenance, both preventive and corrective, if needed.
Choice of data or Measurement methods and procedures	N/A
Purpose of data	N/A
Additional comment	The maintenance schedule is not required if Option A is selected to determine flare efficiency of an enclosed flare

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 B4:

Table B4 – Baseline emissions for the second CP renewal year – 2019

ID	Farm/Site	Baseline Emissions per Annual Average Number of Animals Type "LT", in t CO_2e/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Faz. Corrego Azul – Paredão 1	-	3,861	-	-	-	**3,861**
2	Faz. Corrego Azul – Paredão 2	-	3,861	-	-	-	**3,861**
3	Sítio Santa Izabel	-	4,303	-	-	-	**4,303**
4	Sítio Paraíso	-	3,861	-	-	-	**3,861**
5	Sítio Lote 43	-	5,406	-	-	-	**5,406**
6	Sítio Lote 04 e 06	-	5,516	-	-	-	**5,516**
7	Lote Rural 56	-	5,516	-	-	-	**5,516**
8	Lote Rural 37, 39 e 35	-	5,141	-	-	-	**5,141**
9	Sítio Lote 65	-	6,068	-	-	-	**6,068**
10	Sitio Boa Esperança	-	5,141	-	-	-	**5,141**
11	Lote 24 e 26	-	6,068	-	-	-	**6,068**
12	Sitio Água Limpa	-	5,141	-	-	-	**5,141**
13	Sitio Lote 1 Quadra 32	-	5,141	-	-	-	**5,141**
14	Sitio Lote São José	-	2,648	-	-	-	**2,648**
15	Sitio São João – Córrego da Anta	-	2,648	-	-	-	**2,648**
16	Sitio Lote 45	-	6,619	-	-	-	**6,619**
TOTAL		**-**	**76,939**	**-**	**-**	**-**	**76,939**

Table B5 – Total baseline emission per year

ID	Farm/Site	Baseline Emissions per year, in t CO_2e / year								Total
		2019	2020	2021	2022	2023	2024	2025	2026	
1	Faz. Corrego Azul – Paredão 1	645	3,861	3,861	3,861	3,861	3,861	3,861	3,216	**27,027**
2	Faz. Corrego Azul – Paredão 2	645	3,861	3,861	3,861	3,861	3,861	3,861	3,216	**27,027**
3	Sítio Santa Izabel	719	4,303	4,303	4,303	4,303	4,303	4,303	3,584	**30,121**
4	Sítio Paraíso	645	3,861	3,861	3,861	3,861	3,861	3,861	3,216	**27,027**
5	Sítio Lote 43	903	5,406	5,406	5,406	5,406	5,406	5,406	4,503	**37,842**
6	Sítio Lote 04 e 06	922	5,516	5,516	5,516	5,516	5,516	5,516	4,594	**38,612**
7	Lote Rural 56	922	5,516	5,516	5,516	5,516	5,516	5,516	4,594	**38,612**
8	Lote Rural 37, 39 e 35	859	5,141	5,141	5,141	5,141	5,141	5,141	4,282	**35,987**
9	Sítio Lote 65	1,014	6,068	6,068	6,068	6,068	6,068	6,068	5,054	**42,476**
10	Sitio Boa Esperança	859	5,141	5,141	5,141	5,141	5,141	5,141	4,282	**35,987**
11	Lote 24 e 26	1,014	6,068	6,068	6,068	6,068	6,068	6,068	5,054	**42,476**
12	Sitio Água Limpa	859	5,141	5,141	5,141	5,141	5,141	5,141	4,282	**35,987**
13	Sitio Lote 1 Quadra 32	859	5,141	5,141	5,141	5,141	5,141	5,141	4,282	**35,987**
14	Sitio Lote São José	443	2,648	2,648	2,648	2,648	2,648	2,648	2,205	**18,536**
15	Sitio São João – Córrego da Anta	443	2,648	2,648	2,648	2,648	2,648	2,648	2,205	**18,536**
16	Sitio Lote 45	1,106	6,619	6,619	6,619	6,619	6,619	6,619	5,513	**46,333**
Total baseline emission per year		**12,857**	**76,939**	**76,939**	**76,939**	**76,939**	**76,939**	**76,939**	**64,082**	**538,573**
Total baseline emissions in 7 years, in tonnes CO_2e										

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

Table B6 – Total project activity emissions for the second CP renewal year – 2019

ID	Farm/Site	Project Emissions per Annual Average Number of Animals Type "LT", in t CO_2e/year					Total
		Sows	Finishers	Nursery/Weaners	Boars	Gilts	
1	Faz. Corrego Azul – Paredão 1	-	1,292	-	-	-	**1,292**
2	Faz. Corrego Azul – Paredão 2	-	1,292	-	-	-	**1,292**
3	Sítio Santa Izabel	-	1,440	-	-	-	**1,440**
4	Sítio Paraíso	-	1,292	-	-	-	**1,292**
5	Sítio Lote 43	-	1,809	-	-	-	**1,809**
6	Sítio Lote 04 e 06	-	1,846	-	-	-	**1,846**
7	Lote Rural 56	-	1,846	-	-	-	**1,846**
8	Lote Rural 37, 39 e 35	-	1,720	-	-	-	**1,720**
9	Sítio Lote 65	-	2,031	-	-	-	**2,031**
10	Sitio Boa Esperança	-	1,720	-	-	-	**1,720**
11	Lote 24 e 26	-	2,031	-	-	-	**2,031**
12	Sitio Água Limpa	-	1,720	-	-	-	**1,720**
13	Sitio Lote 1 Quadra 32	-	1,720	-	-	-	**1,720**
14	Sitio Lote São José	-	887	-	-	-	**887**
15	Sitio São João – Córrego da Anta	-	887	-	-	-	**887**
16	Sitio Lote 45	-	2,215	-	-	-	**2,215**
TOTAL		**-**	**25,748**	**-**	**-**	**-**	**25,748**

Table B7 – Total project activity emissions per year

ID	Farm Name/Site	Project Activity Emissions in t CO_2e / year								
		2019	2020	2021	2022	2023	2024	2025	2026	Total
1	Faz. Corrego Azul – Paredão 1	216	1,292	1,292	1,292	1,292	1,292	1,292	1076	9,044
2	Faz. Corrego Azul – Paredão 2	216	1,292	1,292	1,292	1,292	1,292	1,292	1076	9,044
3	Sítio Santa Izabel	241	1,440	1,440	1,440	1,440	1,440	1,440	1199	10,080
4	Sítio Paraíso	216	1,292	1,292	1,292	1,292	1,292	1,292	1076	9,044
5	Sítio Lote 43	302	1,809	1,809	1,809	1,809	1,809	1,809	1507	12,663
6	Sítio Lote 04 e 06	309	1,846	1,846	1,846	1,846	1,846	1,846	1537	12,922
7	Lote Rural 56	309	1,846	1,846	1,846	1,846	1,846	1,846	1537	12,922
8	Lote Rural 37, 39 e 35	287	1,720	1,720	1,720	1,720	1,720	1,720	1433	12,040
9	Sítio Lote 65	339	2,031	2,031	2,031	2,031	2,031	2,031	1692	14,217
10	Sitio Boa Esperança	287	1,720	1,720	1,720	1,720	1,720	1,720	1433	12,040
11	Lote 24 e 26	339	2,031	2,031	2,031	2,031	2,031	2,031	1692	14,217
12	Sitio Água Limpa	287	1,720	1,720	1,720	1,720	1,720	1,720	1433	12,040
13	Sitio Lote 1 Quadra 32	287	1,720	1,720	1,720	1,720	1,720	1,720	1433	12,040
14	Sitio Lote São José	148	887	887	887	887	887	887	739	6,209
15	Sitio São João – Córrego da Anta	148	887	887	887	887	887	887	739	6,209
16	Sitio Lote 45	370	2,215	2,215	2,215	2,215	2,215	2,215	1845	15,505
Total project activity emissions per year		**4,301**	**25,748**	**25,748**	**25,748**	**25,748**	**25,748**	**25,748**	**21,447**	**180,236**
Total project activity emissions in 7 years, in t CO_2e/year =										

(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 B8 – Total Emission Reductions

Description	Year							
	2019	2020	2021	2022	2023	2024	2025	2026
Total Baseline Emissions - $BE_{y,}$,in t CO_2e/year	**12,857**	**76,939**	**76,939**	**76,939**	**76,939**	**76,939**	**76,939**	**64,082**
Total Project Emissions - $PE_{y,}$ in t CO_2e/year	**4,301**	**25,748**	**25,748**	**25,748**	**25,748**	**25,748**	**25,748**	**21,447**
Total Emission Reductions - ER_y = BE_y – PE_y (in t CO_2e/year)	**8,556**	**51,191**	**51,191**	**51,191**	**51,191**	**51,191**	**51,191**	**42,635**

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2019	12,857	4,301	0	8,556
2020	76,939	25,748	0	51,191
2021	76,939	25,748	0	51,191
2022	76,939	25,748	0	51,191
2023	76,939	25,748	0	51,191
2024	76,939	25,748	0	51,191
2025	76,939	25,748	0	51,191
2026	64,082	21,447	0	42,635
Total	**538,573**	**180,236**	**0**	**358,337**
Total number of crediting years	7 years			
Annual average over the crediting period	76,939	25,748	0	51,191

B.7. Monitoring plan

The methodology applied to this project activity is AMS-III.D./version 21.0, ***Methane recovery in animal manure management systems***. If in the future an electricity generator for in site electricity supply is installed, methodology AMS-III.H /version 19.0, ***Methane recovery in wastewater treatment***, will also be applied. 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.7.3.

All data monitored and required for verification and issuance is kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. All parameters are deeply controlled by operational procedures developed by Brascarbon. A list and the procedures contained in the Brascarbon Operational Procedures Manual are mentioned in the PDD in the Appendix 5.

Brascarbon trained several regional technicians who will be responsible for the maintenance and the monitoring system based in ISO 9001 (Brascarbon Operational Procedure Manual).

B.7.1. Data and parameters to be monitored

Data / Parameter	T_f
Data unit	^oC
Description	Combustion temperature of the flare
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	Every 1 minute measurement and registration by a Control Logic Program (CLP) According to the Monitoring Operational Procedure POP-01
Monitoring frequency	Every 1 minute measurement and registration by the PLC. Data is collected monthly from the field by the use of the pen drive.
QA/QC procedures	Check the data for more accurate information.
Purpose of data	Calculation of Baseline Emissions and Project Emissions
Additional comment	Monitoring operational procedure POP-01 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	W_{site}
Data unit	kg
Description	Average animal weight of a defined livestock population at the project site in year
Source of data	The data collection is realized quarterly by each farm owner, together with ASSUGLÓRIA (Cooperativa de Gloria de Dourados) and provided to the PP. ASSUGLORIA is the Pig Producers Association to whom the farms contained in the PDD are associated; its main role is to act as a third party responsible for the assurance of all the logistics associated with the swine producers, providing the animal nutrition, genetics and all the overall animal weight.
Value(s) applied	Sows: 220 kg Finishers: 90 kg Nursery: 20 kg Boars: 240 kg Gilts: 220 kg
Measurement methods and procedures	The quarterly weight of the animals for each producer of the PDD is made following ASSUGLORIA's internal procedure, that is **not under the PP's control** – the association selects the animals based on a random sampling approach applied in each category, since it is infeasible to weight each animal individually in the farms belonging to the project (these farms can more than 5,000 animals each). In addition, each project site presents the actual animal weight by using Brascarbon form 16.001 after a cross-check by the PP, using the real information after each batch of animals exits each farm; the template was designed to quarterly report animal weight per category. It is important to highlight that this approach is made only to attend the quarterly report frequency. Since the 100% of the animals are weighted around 5 to 6 months and the PP has access to all those records, the information reported quarterly is than crosschecked with the actual data and corrected if needed.
Monitoring frequency	Quarterly (based on sampling following ASSUGLORIA's internal procedure) and at full weight of the batch of pigs every time it leaves the farms (each batch stays around 5 to 6 months per farm).
QA/QC procedures	Check of the site records and documents. The values of the quarterly weights presented by ASSUGLORIA's (following the association's internal procedures) to the PP are cross-checked against two different credible sources: - reference figures from EMBRAPA (an undisputed Brazilian Agricultural Research Corporation nationally recognized for these scope) for each category; and - the figures provided by ASSUGLORIA when each of the swine batches exits each farm (each batch stays around 5 to 6 months per farm), as explained below. Here ASSUGLORIA provides invoices with 100% of the animals weight (and number), allowing a full cross-check with the weight values provided and assuring that all the information is accurate. If the PP verifies during the cross-check any discrepancy between the values provided quarterly and the full weighting and counting of the animals in the invoices provided by ASSUGLORIA's each time any batch exits a giving farm, those values will be updated accordingly with these real figures.
Purpose of data	Calculation of Baseline Emissions and Project Emissions

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

Data / Parameter	SITE INSPECTION
Data unit	N/A
Description	Inspection on the site considering relevant regulation and the infra-structure of the site
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	Annual follow-up of the documentation to check the expiration date, changes in the production lay-out and surroundings of the digester. Actions within the property and around the biodigesters should be taken both by the contractor and the client Brascarbon. Photos should be attached to the annual inspection report to prove that the system of wastewater management has not changed namely regarding the following items: pipes, gutters, roofs, fences, trees, control panel, flare, terminal boxes and general cleaning. Use of the annex attached at the operational procedure POP-02
Monitoring frequency	Annually
QA/QC procedures	A copy of the documents is submitted to the central office to the Quality Coordinator, who will verify the data, controlling it through an electronic system and ensuring its integrity.
Purpose of data	N/A
Additional 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(s) applied	See table B.2
Measurement methods and procedures	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	Information is cross-checked with the documents available at the confined feed operation including, when available, animal purchase and sale records or information on food purchase records.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	$BG_{burnt,y}$
Data unit	m^3
Description	Biogas flared or used as a fuel in the year y.
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	Minute by minute measurement and cumulative registration by a Control Logic Program (CLP). Monthly the registered data will be recovered in the data logger (CLP) of the volume in the local control panel according to the operational procedure POP-04
Monitoring frequency	Continuously recording. Every 1 minute measurement and registration by the PLC. Data is collected monthly from the field.
QA/QC procedures	Check the monthly registers sent from the field to proceed with the emissions reductions calculation. The registers are read and stored every minute continuously in the CLP. The data is recovered from the CLP every month. The QA/QC also controls and assures the calibration program of the flow meter.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Monitoring operational procedure POP-04 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	WCH_4
Data unit	%
Description	Methane content in biogas in the year “y”
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	Use of methane concentration analysis instrument on dry basis in the sampling point at piping to the flare.
Monitoring frequency	Periodical. To assure. that the monitoring frequency provides a 90% confidence level and 10% precision. 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. According with the data/parameter table 6 of the methodology AMS III.D version 21.0, The fraction of methane in the biogas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) or, with periodical measurements at a 90/10 confidence/precision level by following General guidelines for sampling and surveys for SSC project activities, or, alternatively a default value of 60% methane content can be used The option chosen was periodical measurements at a 90/10 confidence/precision level. For details, please see Section B.7.2 – Sampling Plan.
QA/QC procedures	Check the registers in the generated documents. Control and assure the calibration program of the instrument.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Monitoring frequency to be determined to attend 90% confidence level and 10% precision. To assure that the monitoring frequency provides a 90% confidence level and 10% precision, 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. The results will be analyzed to guarantee that the required confidence/precision level has been met and the monitoring frequency will be, at least, monthly. For details, please see Section B.7.2 – Sampling Plan. The equipment used can directly measure methane content in the biogas. The methane content measurement will be carried out close to a location in the system where a biogas flow measurement takes place, and on the same basis (wet or dry) as required by the methodology. Monitoring operational procedure POP-05 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	T_{biogas}
Data unit	^{o}C
Description	Temperature of the biogas at operation conditions
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	Measurement with a local thermometer, with the same equipment as the methane content and at the same time, in the sampling point at piping to the flare. Measurement according with Operational Procedure POP-06.
Monitoring frequency	Periodical. To assure. that the monitoring frequency provides a 90% confidence level and 10% precision. The adequate frequency will be determined through a statistical analysis of the temperature variation, based on temperature data gathered on a group of farms per region during a certain period time. According to the data/parameter table 6 of the methodology AMS III.D version 21.0 when the temperature of the biogas at the flow measurement site is not measured by a continuous analyser, the frequency of periodical measurements at a 90/10 statistical confidence/precision level shall be determined following the “Standard for sampling and surveys for CDM project activities and programme of activities”. The minimum sample size required would be dependent on the variability in the values of temperature, which will be determined in the sampling plan. For details, please see Section B.7.2 – Sampling Plan.
QA/QC procedures	Check the registers in the generated documents and thermometer calibration
Purpose of data	Calculation of Baseline Emissions
Additional comment	Monitoring frequency to be determined to attend 90% confidence level and 10% precision. To assure that the monitoring frequency provides a 90% confidence level and 10% precision, the adequate frequency will be determined through a statistical analysis of the temperature variation, based on temperature data gathered on a group of farms per region during a certain period time. The results will be analyzed to guarantee that the required confidence/precision level has been met and the monitoring frequency will be, at least, monthly. For details, please see Section B.7.2 – Sampling Plan. Monitoring operational procedure POP-06 can be found at the Brascarbon Operational Procedure Manual

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

Data / Parameter	Q_{DM}
Data unit	N/A
Description	Sludge soil application
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	Supervision in the field
Monitoring frequency	Defined according to the digester performance
QA/QC procedures	Check the registers in the generated documents.
Purpose of data	N/A
Additional comment	Monitoring operational procedure POP-09 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	FE or $\eta_{flare,h}$
Data unit	%
Description	Enclosed Flare Efficiency
Source of data	Brascarbon Monitoring Report System
Value(s) applied	.N/A.
Measurement methods and procedures	Enclosed flare (low height) is used in the entire project. Brascarbon registers the gas flow sent to the flares and the combustion temperature of the flares every minute. A 80% efficiency for a specific hour is considered if the following conditions are met for all minutes in that specific hours: (i) all temperature records are above or equal to 500º Celsius and (ii) the temperature of the flare (TEG.m) and the flow rate of the residual gas to the flare (FRG,m) are within the manufacturer's specification for the flare (SPECflare). (iii) The flame is detected in minute m (Flamem). Otherwise, a 0% efficiency for the specific hour is applied if at any minute the records of temperature measurement are below 500º Celsius or the flare is operating outside of the manufacturer's specification (SPECflare). This discount will be applied to the volume of that specific hour since it is a more conservative approach than to discount in the average of the flare efficiency percentage for any giving hour.
Monitoring frequency	Every 1 minute measurement and registration by a CLP of flare temperature and biogas flow rate. Data is recovered monthly for Flare Efficiency hourly calculation
QA/QC procedures	Check the registers in the generated documents. The enclosed flare will regularly undergo a maintenance process subject to the appropriate industrial standards and/or manufacturer´s specifications in order to ensure measurement accuracy. The Monitoring Operational Procedure POP-08 was developed to calculate the flare efficiency and it can be found at the Brascarbon Operational Procedure Manual.
Purpose of data	Calculation of Baseline Emissions and Project Emissions
Additional comment	The Monitoring Operational Procedure POP-08 was developed to calculate the monthly efficiency and it can be found at the Brascarbon Operational Procedure Manual.

Data / Parameter	$ER_{y,ex\text{-}post}$
Data unit	t CO2e
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(s) applied	59,238
Measurement methods and procedures	Comparison of the baseline with the actual measured data according to the operational procedure POP-17. The minimum value between the $BE_{ex\text{-}post}$ and MD_y will be chosen for the calculation of the $ER_{y\ ex\text{-}post}$.
Monitoring frequency	Yearly
QA/QC procedures	Check the ER calculation and the registers in the generated documents.
Purpose of data	N/A
Additional 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	N/A
Description	Formulated Feed Rations
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	According to the Operational Procedure POP-14
Monitoring frequency	Monthly
QA/QC procedures	Check the registers and/or food purchases records on the farm.
Purpose of data	Calculation of Baseline Emissions (to validate B0 and VS values used)
Additional 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(s) applied	N/A
Measurement methods and procedures	Measurement with portable local pressure gauge, with the same equipment as the methane content and at the same time, in the sampling point at piping to the flare. Measurement according with Operational Procedure POP-13.
Monitoring frequency	Periodical. To assure. that the monitoring frequency provides a 90% confidence level and 10% precision. The adequate frequency will be determined through a statistical analysis of the pressure variation, based on pressure data gathered on a group of farms per region during a certain period time. According to the data/parameter table 6 of the methodology AMS III.D version 21.0, the pressure of the biogas at the flow measurement site is not measured by a continuous analyser, the frequency of periodical measurements at a 90/10 statistical confidence/precision level shall be determined following the "Standard for sampling and surveys for CDM project activities and programme of activities". The minimum sample size required would be dependent on the variability in the values of pressure, which will be determined in the sampling plan. For details, please see Section B.7.2 – Sampling Plan.
QA/QC procedures	Check the registers in the generated documents and equipment for measurement calibration
Purpose of data	Calculation of Baseline Emissions
Additional comment	Monitoring frequency to be determined to attend 90% confidence level and 10% precision. To assure that the monitoring frequency provides a 90% confidence level and 10% precision, the adequate frequency will be determined through a statistical analysis of the pressure variation, based on pressure data gathered on a group of farms per region during a certain period time. The results will be analyzed to guarantee that the required confidence/precision level has been met and the monitoring frequency will be, at least, monthly. For details, please see Section B.7.2 – Sampling Plan. Monitoring operational procedure POP-13 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	GENETIC SOURCE
Data unit	N/A
Description	Genetic source from annex I party
Source of data	Brascarbon Monitoring Report System
Value(s) applied	Western Europe
Measurement methods and procedures	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
Purpose of data	Calculation of Baseline Emissions (to validate Bo and VS values used)
Additional 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(s) applied	1
Measurement methods and procedures	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, based on daily measurement and monthly aggregation
QA/QC procedures	A copy of the documents is submitted to the central office to the Quality Coordinator, who will verify the data, controlling it through an electronic system and ensuring its integrity.
Purpose of data	Calculation of Project Emissions
Additional comment	Monitoring operational procedure POP-02 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	$FV_{RG,h}$
Data unit	m^3/h
Description	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	This parameter and the parameter $BG_{burnt,y}$ are the same. Please refer to the measurement methods and procedures from the parameter “$BG_{burnt,y}$”
Monitoring frequency	This parameter and the parameter $BG_{burnt,y}$ are the same. Please refer to the monitoring frequency from the parameter “$BG_{burnt,y}$”
QA/QC procedures	This parameter and the parameter $BG_{burnt,y}$ are the same. Please refer to the QA/QC procedures from the parameter “$BG_{burnt,y}$”
Purpose of data	Calculation of Project Emissions
Additional comment	This parameter and the parameter BGburnt,y are the same. Please refer to the additional comments from the parameter “$BG_{burnt,y}$”

Data / Parameter	$F_{CH4, m}$
Data unit	kg
Description	Mass flow rate of methane in the residual gaseous stream in the minute m,
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	To be calculated according to the "Tool to determine project emissions from flaring gases containing methane". An operational procedure POP 17 includes the instruction to the calculation. According with the step 1 – Determination of the methane mass flow in the residual gas of this tool, this parameter should be determined using another tool, namely *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*. In second tool, there are several options to determine the Mass flow rate of methane in the residual gaseous stream. Option 2 - Simplified calculation without measurement of the moisture content was chosen by the PP. Within this option, option A will be applicable by the demonstration that the gaseous stream is dry. The PP will demonstrate that the temperature of the gaseous stream (Tt) is less than 60ºC (333.15 K) at the flow measurement point. Hence this parameter will be calculated according with Equations 5 and 6 of the tool. This means: $F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,t}$ Equation (5) With: $\rho_{i,t} = \frac{P_t \times MM_i}{R_u \times T_t}$ Equation (6) Where: $F_{i,t}$ = Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h) $V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m³ dry gas/h) $v_{i,t,db}$ = Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m³ gas *i*/m³ dry gas) $\rho_{i,t}$ = Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas *i*/m³ gas *i*) P_t = Absolute pressure of the gaseous stream in time interval *t* (Pa) MM_i = Molecular mass of greenhouse gas *i* (kg/kmol) R_u = Universal ideal gases constant (Pa.m^3/kmol.K) T_t = Temperature of the gaseous stream in time interval *t* (K)
Monitoring frequency	Every minute and aggregated monthly
QA/QC procedures	Check the registers sent from the field. Calculation of the parameter according to the procedures mentioned above.
Purpose of data	Calculation of Project Emissions
Additional comment	Monitoring operational procedure POP-17 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	$fv_{CH4,RG}$
Data unit	Fraction
Description	Volumetric fraction of methane content in the residual gas on hour h
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	This parameter and the parameter W_{CH4} are the same. Please refer to the Measurement methods and procedures from the parameter "W_{CH4}"
Monitoring frequency	This parameter and the parameter W_{CH4} are the same. Please refer to the monitoring frequency from the parameter "W_{CH4}
QA/QC procedures	This parameter and the parameter W_{CH4} are the same. Please refer to the QA/QC procedures from the parameter "W_{CH4}"
Purpose of data	Calculation of Project Emissions
Additional comment	This parameter and the parameter W_{CH4} are the same. Please refer to the additional comments from the parameter "W_{CH4}"

Data / Parameter	$N_{da,y}$
Data unit	Number
Description	Number of days animal is alive in the farm, in year "y"
Source of data	Brascarbon Monitoring Report System
Value(s) applied	N/A
Measurement methods and procedures	Checking of the documentation located at the confined animal production and use of the operational procedure POP-03
Monitoring frequency	Annually, based on monthly records
QA/QC procedures	Information is cross-checked with the documents available at the confined feed operation including, when available, animal purchase and sale records or information on food purchase records.
Purpose of data	Calculation of Baseline Emissions
Additional 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(s) applied	N/A
Measurement methods and procedures	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, based on monthly records
QA/QC procedures	Information is cross-checked with the documents available at the confined feed operation including, when available, animal purchase and sale records or information on food purchase records.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Monitoring operational procedure POP-03 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	nd_y
Data unit	Number
Description	Number of days in year “y” where the treatment plant was operational
Source of data	Brascarbon Monitoring Report System
Value(s) applied	365
Measurement methods and procedures	The number of days the animal manure management system is operational can be determined by the POP 24 – days of functioning, where it is monitored the number of days in a year “y” that the treatment plant has operated. According to the operational procedure POP-24
Monitoring frequency	Annually, based on daily records and monthly aggregation
QA/QC procedures	The documentation should be sent to the central office to the Quality Coordinator, who will verify the data, controlling and ensuring its integrity.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Monitoring operational procedure POP-24 can be found at the Brascarbon Operational Procedure Manual

Data / Parameter	$VS_{LT,y}$
Data unit	kg dry matter/animal/year
Description	Volatile solids for livestock *LT* entering the animal manure management system in year *y*
Source of data	Brascarbon Monitoring Report System
Measurement methods and procedures	N/A
Monitoring frequency	Annually
QA/QC procedures	Check the registers in the generated documents. Control and assure the correct calculation of the parameter.
Purpose of data	Calculation of Baseline Emissions

Additional comment	The four conditions to apply B0 value of developed countries are fully applicable to developed countries can be used provided the following four conditions are satisfied: - *The genetic source of the livestock originates from an Annex I Party;* Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/. The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement. - *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;* The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement. - *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);* The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14. - *The project specific animal weights are more similar to developed country IPCC default values.* The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation. *Finishers* is the animal category that represents the totality of all animals from the farms included in this PDD. Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's. This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 30% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values. Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

Data / Parameter:	$Q_{manure,LT,y}$
Data unit:	Tonnes DM/year
Description:	Quantity of manure treated from livestock type *LT* at animal manure management system *j*
Source of data:	Brascarbon Monitoring Report System
Measurement procedures (if any):	Supervision in the field
Monitoring frequency:	Annually, based on daily measurement and monthly aggregation
QA/QC procedures:	Check the registers in the generated documents.
Any comment:	N/A

Data / Parameter:	$SVS_{j,LT,y}$
Data unit:	tonnes VS/tonnes DM
Description:	Specific volatile solids content of animal manure from livestock type *LT* and animal manure management system *j* in year *y*
Source of data:	Brascarbon Monitoring Report System
Measurement procedures (if any):	This parameter and the parameter $VS_{LT,y}$ are the same. Please refer to the monitoring frequency from the parameter $VS_{LT,y}$
Monitoring frequency:	This parameter and the parameter $VS_{LT,y}$ are the same. Please refer to the QA/QC procedures from the parameter $VS_{LT,y}$
QA/QC procedures:	Calculation of Project Emissions
Any comment:	This parameter and the parameter $VS_{LT,y}$ are the same. Please refer to the additional comments from the parameter $VS_{LT,y}$

Data / Parameter:	AI_l
Data unit:	Days
Description:	Annual average interval between manure collection and delivery for treatment at a given storage device *l*
Source of data:	N/A
Measurement procedures (if any):	Supervision in the field
Monitoring frequency:	Annually, based on monthly records
QA/QC procedures:	Check the registers in the generated documents.
Any comment:	N/A

Data / Parameter:	GE_{LT}
Data unit:	MJ/day
Description:	Daily average gross energy intake in MJ/day
Source of data:	N/A
Measurement procedures (if any):	There is no energy consumption nor energy production in the project activity.
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	No comments

Data / Parameter:	DE_{LT}
Data unit:	%
Description:	Digestible energy of the feed in per cent
Source of data:	N/A
Measurement procedures (if any):	There is no energy consumption nor energy production in the project activity.
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	No comments

Data / Parameter:	***UE***
Data unit:	Fraction of GE
Description:	Urinary energy expressed as fraction of *GE*
Source of data:	N/A
Measurement procedures (if any):	There is no energy consumption nor energy production in the project activity.
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	No comments

Data / Parameter:	***ASH***
Data unit:	Fraction of the dry matter feed intake
Description:	Ash content of the manure calculated as a fraction of the dry matter feed intake
Source of data:	Brascarbon Monitoring Report System
Measurement procedures (if any):	N/A
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	No comments.

Data / Parameter:	ED_{LT}
Data unit:	MJ/kg DM
Description:	Energy density of the feed in MJ/kg fed to livestock type LT
Source of data:	N/A
Measurement procedures (if any):	There is no energy consumption nor energy production in the project activity.
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	No comments

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Total electricity generated from the recovered biogas in year *y*
Source of data:	N/A
Measurement procedures (if any):	The project activity does not have any farm with electricity generated from the recovered biogas
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	No comments

Data / Parameter:	EE_y
Data unit:	%
Description:	Energy Conversion Efficiency of the project equipment
Source of data:	N/A
Measurement procedures (if any):	The project activity does not Energy Conversion Efficiency of the project equipment.
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	No comments

Data / Parameter:	$Flame_m$
Data unit:	Flame on or Flame off
Description:	Flame detection of flare in the minute m
Source of data:	Brascarbon Monitoring Report System
Measurement procedures (if any):	Measure will be made using a fixed installation optical flame detector
Monitoring frequency:	Once per minute.
QA/QC procedures:	Check the registers in the generated documents. The enclosed flare will regularly undergo a maintenance process subject to the appropriate industrial standards and/or manufacturer´s specifications in order to ensure measurement accuracy. The Monitoring Operational Procedure POP-08 was developed to calculate the flame and it can be found at the Brascarbon Operational Procedure Manual.
Any comment:	No comments.

B.7.2. Sampling plan

a) Sampling design

According to methodology AMS-III.D version 21.0 requirements, the parameter methane content in biogas will be measured with periodical measurements to attend 90% confidence level and 10% precision level.

Since the biogas is flowing continuously, the study population can be thought of as all the possible methane content measurements in a certain period– so large as to be almost infinite. The sampling method to be applied will be systematic sampling with a random start date which is appropriate for this type of population.

The sample size/adequate frequency of measurements will be determined using data from ex-ante methane content measurements gathered on a group of farms located in the same region during a certain period time and will be done in accordance with the Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities. The collected data will be analyzed in order to assess compliance with the 90/10 confidence/precision level.

B.7.3. Other elements of 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 Appendix 5.

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	^oC	Flare Temperature	Every 1 minute	M	100%	electronic	Until end of CP + 2 years	Use for flare efficiency
2	Site Inspection	Document	----	----	Annually	D	100%	electronic	Until end of CP + 2 years	General Site Inspection
3	$N_{LT,y}$	Number	-	Nr, Of heads	Monthly	C	100%	electronic	Until end of CP + 2 years	Used to quantify the methane generation potential
4	$BG_{burnt,y}$	Volume	m^3	Biogas produced	Every 1 minute	M	100%	electronic	Until end of CP + 2 years	Cumulative biogas production
5	W_{CH4}	Fraction	%	Methane content	TBD(*)	M	100%	electronic	Until end of CP + 2 years	Concentration in wet basis
6	T_{biogas}	Temp	^oC	Biogas Temperature	TBD(*)	M	100%	electronic	Until end of CP + 2 years	Use to biogas density calculation
7	D_{CH4}	Mass	tonne/m^3	Density	Monthly	C	100%	electronic	Until end of CP + 2 years	Density
8	FE	Efficiency	%	Temperature and flare operation parameters	every 1 minute data	C	100%	electronic	Until end of CP + 2 years	Efficiency determined by the burning temp and flare operation parameters
9	QDM	Supervision	--	---	Every Batch Disposed	E	100%	electronic	Until end of CP + 2 years	Sludge disposed outside project boundary
10	W_{site}	Mass	kg	Average Animal weight	Quarterly	D	100%	electronic	Until end of CP + 2 years	Average Animal weight
11	$ER_{y,ex\text{-}post}$	Mass	tonne	CO_2e	Annually	C	100%	electronic	Until end of CP + 2 years	Yearly methane potential generation
12	FFR	------	---	Feed Formulation	Monthly	D	100%	electronic	Until end of CP + 2 years	Feed Formulation Rations
13	P_{biogas}	Pressure	mbar	Biogas Pressure	TBD(*)	M	100%	electronic	Until end of CP + 2 years	Biogas pressure
14	Genetic Source	Document	-------	genetic	Annually	D	100%	electronic	Until end of CP + 2 years	Genetic Source
15	$MS_{\%i,y}$	fraction	%	Manure handled	Annually, based on daily measurement and monthly aggregation	E	100%	electronic	Until end of CP + 2 years	General Site Inspection
16	$FV_{RG,h}$	volume	m^3/h	Volume	Every 1 minute	M	100%	electronic	Until end of CP + 2 years	Volume of residual gas
17	$fv_{CH4,RG}$	fraction	%	Methane content	TBD(*)	M	100%	electronic	Until end of CP + 2 years	Volumetric methane fraction of the residual gas
18	$F_{CH4,m}$	mass	kg	Mass flow rate	Every 1 minute and aggregated monthly	C	100%	electronic	Until end of CP + 2 years	Total mass flow rate of the residual gas
19	$N_{da,y}$	number	days	days	Annually, based on monthly records	M	100%	electronic	Until end of CP + 2 years	Nr. Of days animal is alive
20	$N_{p,y}$	number	heads	Nr of heads	Annually, based on monthly	M	100%	electronic	Until end of CP + 2 years	Nr. Of heads per category annually

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
					records					
21	ndy	number	Days	days	Annually, based on daily records and monthly aggregation	M	100%	electronic	Until end of CP + 2 years	Number of days the treatment plant was operational
22	$VS_{LT,y}$	Mass	kg	Volatile solids for livestock	Annually	C	100%	electronic	Until end of CP + 2 years	Volatile solids for livestock LT entering the animal manure management system in year y
23	$Q_{manure\ LT,y}$	Mass	ton	Manure handled	Annually, based on daily records and monthly aggregation	E	100%	electronic	Until end of CP + 2 years	Quantity of manure treated from livestock type LT at animal manure management system j
24	$SVSj_{LT,y}$	Mass	ton	Specific volatile solids content of animal manure	Annually	C	100%	electronic	Until end of CP + 2 years	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y
25	*ASH*	Fraction	_%	Ash content	Annually	C	100%	electronic	Until end of CP + 2 years	Ash content of the manure calculated as a fraction of the dry matter feed intake
26	$Flame_m$	On/Off	N/A	Flame detection of flare in the minute m	Every minute	M	100%	electronic	Until end of CP + 2 years	$Flame_m$ is measured every minute and assesses if the flame is on or off.

(*)TBD: to be determined to attend 90% confidence level and 10% precision. The monitoring frequency will be, at least, monthly.

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

Brascarbon introduced operational procedures, from the Brascarbon Operational Procedures Manual, to facilitate the monitoring system of the parameters described in the Table B8 – Monitoring Plan.

A list of the operational procedures can be found in the Appendix 5, 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

The temperature of the flare will be controlled by a logic system, 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 PLC where the information of the temperature is recorded every each minute.
The file information from the logic system will be recovered monthly, by using a pen drive and the file will be sent to the QA/QC officer to manage the information for further verification. Then, a spreadsheet in excel will be available from the system to show the temperature per minute per day.
The system PLC 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.

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

PEN DRIVE

PLC

Site Inspection.

A check list included in the procedure POP 2 – Site Inspection - number 02.001 is the basic orientation to guide the technicians during inspection in the field to follow all items related to the project activity installation.
Attached on it, the MS% i,y - Fraction of manure handled in the system during the year, is included to be inspected during the each farm visit.
No changes in the manure managing system will be permitted during the project activity.
Variables to be monitored: SITE INSPECTION and MS%i,y.

Average number of animals.
To calculate the average number of animals per category LT in the year y ($N_{LT,y}$) the operational procedure has the forms 03.003 and 03.001 in the operational procedure POP 3 (average number of animals) where it takes into account of the number of days the animal is alive in the year y ($N_{da,y}$) and the number of animals produced per category LT in the year y ($N_{p,y}$).
The days of animals alive and the total animal produced is also monitored with the same procedure and the formulary 03.003.
The formula used to the calculation is indicated in the PDD section B.4, step 2 item B, equation B3.
Variables to be monitored: $N_{LT,y}$, $N_{day,y}$ and $N_{p,y.}$

Measurement of the volumetric flow rate of the biogas and residual gas.
The operational procedure POP 4- Measurement of the biogas flow rate, is a guide that explains to the technicians how to obtain the biogas flow rate.
The control of the flow rate is by a PLC (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 that 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 reliable 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 PLC is recovered by the use of a pen drive and the file containing the information will be send to the QA/QC officer to manage information for further verification. A spreadsheet in excel is available from the system to show the flow rate per minute per day.
The variables measured with this procedure are: $BG_{burnt,y}$ and $FV_{RG,h.}$.
The data monitored is controlled in the form 04.001 attached in the operational procedure POP-04.

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 BIOGAS or TESTO electronic equipment.
The concentration of methane is measured in few seconds before starting the measurement button.
The equipment operation and the devices to be used are described in the operational procedure, as well as in the equipment manual.

Both equipment are able to measure the methane concentration in the biogas or in the flare residual gas.
The variables measured with this equipment are: W_{CH4} and $fv_{CH4,RG,y}$.
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 form 04.001.

Biogas temperature measurement.
The biogas temperature is obtained by an electronic equipment BIOGAS.
The methane temperature is measured in few seconds after inserting the thermocouple in the biogas line device.
The equipment operation and the devices to be used are described in the operational procedure, as well 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 form 04.001 described in the operational procedure POP 6 – Biogas temperature measurement.

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

Flare efficiency.
According with the of version 03 of the tool Project emissions from flaring, in its step 2 – Determination of flare efficiency, for determining the efficiency of combustion of enclosed flares there is the option to apply a default value or determine the efficiency based on monitored data. The operational procedure POP 8 – Flare efficiency was developed to monitor and calculate the flare efficiency.

In the case of enclosed flares, project participants may choose between two options to determine the flare efficiency for minute m ($\eta_{flare,m}$). The PP has chosen Option A – Apply a default value for flare efficiency.

The flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

(1) The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m; and
(2) The flame is detected in minute m ($Flame_m$).

Otherwise $\eta_{flare,m}$ is 0%.

All the flares in the project are considered, as per definition of the tool as low height, hence a default value of 80% flare efficiency is applied to the entire project. All data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to manufacturer´s specifications will be continuously monitored. The temperature and biogas flow rate will be monitored minute by minute by a sensor installed in the enclosed flare and are registered by a CLP. The data stored in the CLP is recovered monthly by the use of a pen drive and the file containing the information will be sent to the QA/QC officer to manage the information. Brascarbon developed the formulary 08.001 in the operational procedure to monitor the hourly flare efficiency according to the criteria above mentioned.

The variable monitored with this procedure: FE.

Biogas pressure.
The biogas pressure is obtained by an electronic equipment BIOGAS and procedures described in the operational procedure POP 13- Biogas pressure.
The operating pressure of the biodigestor is atmospherically.

The equipment operation and the devices to be used are described in the operational procedure, as well 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 form 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 form 16.001 where each animal category is monitored during the year, according to the operational procedure POP 16 – Animal Weight Monitoring.

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

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

The values of the quarterly weights presented by ASSUGLORIA (following the association's internal procedures) to the PP are cross-checked against two different credible sources:

- Reference figures from EMBRAPA (an undisputed Brazilian Agricultural Research Corporation nationally recognized for these scope) for each category; and
- Figures provided by ASSUGLORIA when each of the swine batches exits each farm (each batch stays around 5 to 6 months per farm), as explained below. Here ASSUGLORIA provides invoices with 100% of the animals weight (and number), allowing a full cross-check with the weight values provided and assuring that all the information is accurate.

If the PP verifies during the cross-check any discrepancy between the values provided quarterly and the full weighting and counting of the animals in the invoices provided by ASSUGLORIA each time any batch exits a giving farm, those values will be updated accordingly with these real figures.

The current practice of swine farms in Brazil is that each farm receives new batches of animals every 5 to 6 months (which is also the average time that a batch stays in a farm) and the producer, together with ASSUGLORIA, performs regular and periodical visits to each farm in order to assess and evaluate the correct development of each batch in terms of growing/weighting of the animals (according with what is expected at each growing stage of a given batch). It is important to highlight that both the farm owners ASSUGLORIA rely on the quality of the values measured since

their sole professional occupation is the pig production and, therefore, it is within their best interests to have a correct and reliable way to assess the weighting of the animals (which is their business) based on their experience and internal procedures.

Every 5 to 6 months (depending on each batch and farm), the animal batches leave the farms and they are, in this specific situation, 100% weighted by the producers, together with ASSUGLORIA – this weighting is undertaken to the totality of animal presented in the batch since the profits associated with the animal production are weight based. The results are cross-checked against reference figures from EMBRAPA (the Brazilian Agricultural and Livestock Research Corporation, a recognized federal institution responsible for studies and research in these scopes). According with ASSUGLORIA a possible range of +/- 5kg within the animal growing is considered a normal fluctuation and therefore admissible.

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

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

Methane mass flow rate in the residual gas.
The residual mass flow rate can be determinate by the POP 17 – Emissions reductions ex-post, where it calculates all parameters to determine the emissions reductions ex-post.

To be calculated according to the “Tool to determine project emissions from flaring gases containing methane”. An operational procedure POP 17 includes the instruction to the calculation.

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

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

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

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

With:

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

Where:

$F_{i,t}$	=	Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)
$v_{i,t,db}$	=	Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m^3 gas *i*/m^3 dry gas)
$\rho_{i,t}$	=	Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas *i*/m^3 gas *i*)
P_t	=	Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i	=	Molecular mass of greenhouse gas *i* (kg/kmol)
R_u	=	Universal ideal gases constant (Pa.m^3/kmol.K)
T_t	=	Temperature of the gaseous stream in time interval *t* (K)

The formulary 17.001 (CER spreadsheet) is used to determine the variables above mentioned.

Number of days the treatment plant was operational

The number of days the treatment plant was operational can be determinate by the POP 24 – days of functioning, where it is monitored the number of days in a year “y” that the treatment plant has operated.

The variables monitored with this procedure: nd_y

Volatile solids

The four conditions to apply B0 value of developed countries are fully applicable to developed countries can be used provided the following four conditions are satisfied:

- The genetic source of the livestock originates from an Annex I Party;

Genetics and nutrition adopted for these farms as so as in western Europe. More details or information of the genetics can be obtained at the producers or at the Associação Brasileira dos Criadores de Suinos (Brazilian Swine Association) – http://www.abcs.org.br/.

The genetic source of the livestock is therefore in compliance with this methodology requirement, which can be confirmed and verified by the genetic documents of the animals of each farm. These evidences were provided and assessed to assure their applicability to this requirement.

- The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;

The formulated feed rations are created according with the characteristics of the animals, their stage of growth, category, weight gain and genetics. Each farm possesses their FFR composition according with the type of animal(s) accommodated, which was confirmed and verified. These evidences were provided and assessed to assure their applicability this requirement.

- The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);

The formulated feed rations are part of the management system of the farms and therefore, each site possesses on-farm records which attest the FFR used. These evidences are also monitored on a monthly basis, according monitoring plan for the parameter FFR, as described in section B.7.1, and the PP internal procedure POP 14.

- The project specific animal weights are more similar to developed country IPCC default values.

The W_{site} value considered for each category of swine is the result of an average weight of the animals of all farms included in the project, and this value was applied in the baseline calculation.
Finishers is the animal category that represents the totality of all animals from the farms included in this PDD. Finishers are considered to be "market swine" and presented an average weight of 90kg among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (50 kg) – the values form Latin America (28 kg), where the project is located, is even lower than Western Europe's.

This situation is also observed for the remaining four categories of swine (nursery and boars for market swine, guilts and sows for breeding swine): the values are more similar to those adopted in Western Europe than in Latin America, especially regarding the Breeding Swine (guilts and sows) and in the Market Swine (boars) which presented an average weight of 210kg and 230 kg respectively, among all farms included in the PDD by the time of the project's registration (and this was the value adopted for the parameter W_{site}). Taking into account the figures presented in Tables 10 A-7 and 10 A-8 from the 2006 IPCC Guidelines for *National Greenhouse Gas Inventories, Volume 4, chapter 10*, the weights that are more similar to the project situation are those from the Western Europe region (198kg for Breeding Swine and 50 kg for Market Swine) – the values form Latin America (28kg for both classes of Breeding and Market Swine), where the project is located, is much lower than Western Europe's. Only in the category nursery (also Market Swine), which roughly represents 30% of all animals from the farms included in this PDD, have an average weight of 20 kg, closer to the Latin America values than the Western Europe values.

Therefore, is fair to consider that "*the project specific animal weights are more similar to developed country IPCC default values"* condition is fulfilled and that the VS adopted values for developed counties is in full compliance with the methodology requirements.

Monitoring System
The monitoring system will be followed according to the Brascarbon Operations Procedures Manual, detailed to attend all necessary controls in the site.

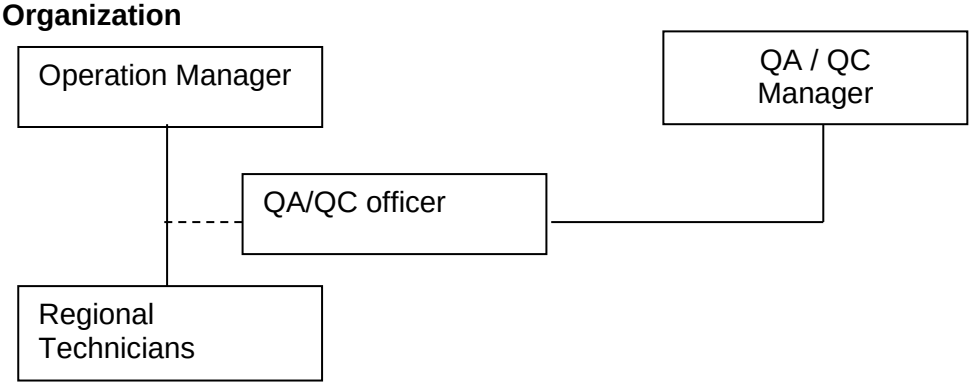
Operational / Monitoring Procedures
Operational / Monitoring procedures listed in the Appendix 5.

Quality Assurance/Control: QA/QC
The measuring instruments will be calibrated by the manufacturers' representatives on a manufacturer recommendation basis. The certification of calibration will be controlled by QA/QC officer. Also, the QA/QC officer will be responsible to assure that all Brascarbon Operations Procedures will be executed based in the ISO 9001.

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

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

Organization



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

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

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

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

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

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

The starting date for this activity was **24/06/2011**, which represented the date where the first sites started their construction.

C.2. Expected operational lifetime of project activity

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

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable crediting period (the second crediting period).

C.3.2. Start date of crediting period

The starting date of the second crediting period is: **01/11/2019.**

C.3.3. Duration of crediting period

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

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

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

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

D.2. Environmental impact assessment

No environmental Impact Assessment for the project activity was conducted.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The invitation for the stakeholders' consultation for the project activity was done by personal mail sent on the 4th of May 2009 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 comments received

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

E.3. Consideration of comments received

No comments were received from stakeholders.

SECTION F. Approval and authorization

The letters of approval both from Annex I party and Host country party were issued and are available an UNFCCC website for the projects (https://cdm.unfccc.int/Projects/DB/DNV-CUK1323422275.71/view).

Date of issuance	Party involved in the project activity
30/05/2012	Brazil (Host country)
08/08/2016	Norway (Annex I country)

Appendix 1. Contact information of project participants

Organization name	SP Carbono, Créditos de Carbono S.A.
Country	Brazil
Address	Rua Amália de Noronha, 151, CJ 502, 05410-010 São Paulo, SP, Brazil
Telephone	+55 11 98901 7810
Fax	N/A
E-mail	mario.pacifico@spcarbono.com
Website	N/A
Contact person	Mário Pacifico da Silva

Organization name	Norwegian Ministry of Climate and Environment
Country	Norway
Address	Kongensgate, 20, 0153, Olso, Norway
Telephone	+47 48045797
Fax	N/A
E-mail	malin.meyer@kld.dep.no
Website	N/A
Contact person	Malin Meyer

Appendix 2. Affirmation regarding public funding

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

Appendix 3. Applicability of methodologies and standardized baselines

Complete information regarding applicability of selected methodology has been given in Section B.2 of PDD.

Appendix 4. Further background information on ex ante calculation of emission reductions

BASELINE INFORMATION

BCA-BRA-09

		MS% i,y	$PE_{flare,y}$			
		1	0.2			
		76,939	**10,360**	**15,388**	**25,748**	**51,191**

																					REDUCTIONS
ID	Farm/Site	Animal Category	$N_{LT,y}$	$N_{Avg,y}$	$N_{p,y}$	$W_{default}$	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	-		122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	3,500	10,471	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	3,861	520	772	1,292	2,569
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	3,500	10,471															3,861	520	772	1,292	2,569
2	Faz. Corrego Azul - Paredão 2	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	3,500	10,471	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	3,861	520	772	1,292	2,569
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	3,500	10,471															3,861	520	772	1,292	2,569
3	Sitio Santa Izabel	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	3,900	11,668	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	4,303	579	861	1,440	2,863
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	3,900	11,668															4,303	579	861	1,440	2,863
4	Sitio Paraíso	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	3,500	10,471	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	3,861	520	772	1,292	2,569
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	3,500	10,471															3,861	520	772	1,292	2,569

BASELINE INFORMATION (Cont.)

5	Sitio Lote 43	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	4,900	14,660	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	5,406	728	1,081	1,809	3,597
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	4,900	14,660															5,406	728	1,081	1,809	3,597
6	Sitio Lote 04 e 06	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	5,000	14,959	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	5,516	743	1,103	1,846	3,670
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	5,000	14,959															5,516	743	1,103	1,846	3,670
7	Lote Rural 56	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	5,000	14,959	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	5,516	743	1,103	1,846	3,670
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	5,000	14,959															5,516	743	1,103	1,846	3,670
8	Lote Rural 37, 39 e 35	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	4,660	13,943	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	5,141	692	1,028	1,720	3,421
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	4,660	13,943															5,141	692	1,028	1,720	3,421
9	Sitio Lote 65	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	5,500	16,455	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	6,068	817	1,214	2,031	4,037
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	5,500	16,455															6,068	817	1,214	2,031	4,037

ASELINE INFORMATION (Cont.)

10	Sitio Boa Esperança	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	4,660	13,943	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	5,141	692	1,028	1,720	3,421
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	4,660	13,943															5,141	692	1,028	1,720	3,421
11	Lote 24 e 26	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	5,500	16,455	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	6,068	817	1,214	2,031	4,037
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	5,500	16,455															6,068	817	1,214	2,031	4,037
12	Sitio Água Limpa	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	4,660	13,943	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	5,141	692	1,028	1,720	3,421
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	4,660	13,943															5,141	692	1,028	1,720	3,421
13	Sitio Lote 1 Quadra 32	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	4,660	13,943	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	5,141	692	1,028	1,720	3,421
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	4,660	13,943															5,141	692	1,028	1,720	3,421
14	Sitio Lote São José	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	2,400	7,180	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	2,648	357	530	887	1,761
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	2,400	7,180															2,648	357	530	887	1,761

BASELINE INFORMATION (Cont.)

15	Sitio São João - Córrego da Anta	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	2,400	7,180	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	2,648	357	530	887	1,761
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	2,400	7,180															2,648	357	530	887	1,761
16	Sitio Lote 45	Sows	-	-	122	198	220	0.46	0.51	365	187	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Finishers	6,000	17,951	122	50	90	0.3	0.54	365	197	0.94	0.45	25	0.00067	79	1	1	6,619	891	1,324	2,215	4,404
		Nursery/Weaner	-	-	122	50	27	0.3	0.16	365	59	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Boars	-	-	122	50	240	0.3	1.44	365	526	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		Gilts	-	-	122	198	210	0.46	0.49	365	178	0.94	0.45	25	0.00067	79	1	1	-	-	-	-	-
		total	6,000	17,951															6,619	891	1,324	2,215	4,404

Totals	**76,939**	**10,360**	**15,388**	**25,748**	**51,191**

Appendix 5. Further background information on monitoring plan

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	^oC	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	^oC	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	$ER_{y,ex\text{-}post}$	Low	t 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	$FV_{RG,h}$	Low	m^3/h	Register information managed by Brascarbon.
17	$fv_{CH4,RG}$	Low	%	Register information managed by Brascarbon.
18	$F_{CH4,\ m}$	Low	kg	Register information managed by Brascarbon.
19	$N_{da,y}$	Low	days	Register information managed by Brascarbon.
20	$N_{p,y}$	Low	Nr, Of heads by category	Register information managed by Brascarbon.
21	ndy	Low	days	Register information managed by Brascarbon.
22	$VS_{LT,y}$	Low	kg	Register information managed by Brascarbon.
23	$Q_{manure\ LT,y}$	Low	ton	Register information managed by Brascarbon.
24	$SVSj_{LT,y}$	Low	ton	Register information managed by Brascarbon.
25	*ASH*	Low	%	Register information managed by Brascarbon.
26	$Flame_m$	Low	ON/OFF	Register information managed by Brascarbon.

BRASCARBON has implemented the Operation Procedures Manual and forms to capture and report monitored 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	RESPONSIBLE	PROCEDURE	COMENTS
1	T_f	TR	POP 1	Flare Temperature
2	SITE INSPECTION MS% i,y $VS_{LT,y}$ $SVS_{jLT,y}$	TR	POP 2	General site Inspection
3	$N_{LT,y}$ $N_{aa,y}$ $N_{p,y}$	TR	POP 3	Number of heads
4	$BG_{burnt,y}$ $FV_{RG,h}$	TR	POP 4	Biogas produced and burnt
5	W_{CH4} $fv_{CH4,RG}$	TR	POP 5	Methane content
6	T_{biogas}	TR	POP 6	Biogas Temperature
7	D_{CH4}	QC	POP 7	Methane Density
8	FE $Flame_m$	TR	POP 8	Flare Efficiency Flame on or Flame off
9	QDM Q_{manure} ASH	TR	POP 9	Sludge Mass
10	TRAINING	QC	POP 11	General training of procedures and safety issues
11	MAINTENANCE	OM	POP 12	Up-date of the maintenance activities
12	P_{biogas}	TR	POP 13	Biogas pressure
13	FFR	TR	POP 14	Formulated Feed Rations
14	GENETIC SOURCE	TR	POP 15	Genetic source
15	W_{site}	TR	POP 16	Average animal weight
16	$ER_{ex-post}$ $F_{CH4,m}$	QC	POP 17	Yearly emissions reductions ex-post
17	Ndy	QC	POP 24	Number of days the treatment plant was operational

Legend:
A: Annually
Q: Quarterly
M: Monthly
S: Semesterly
TR: Regional Technician
QC: Quality Control
TBD: to be determined to attend 90% confidence level and 10% precision. The monitoring frequency will be, at least, monthly.
OM: Operation Manger

Appendix 6. Summary report of comments received from local stakeholders

No comments were received from local stakeholders.

Appendix 7. Summary of post-registration changes

No post registration changes were requested.

- - - - -

Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.

Version	*Date*	*Description*
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document