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

CONTENTS

Annexes

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

Manure treatment system for swine production – KSS
Version 6 – Completion date: 02/28/20008

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

On a global scale, livestock operations are becoming more intensive and technologically advanced to be competitive on the market abroad. The Brazilian farms are by no means exception to this rule, and in order to become more efficient, this sector has invested in several technologies, such as genetics, reproductive techniques and feeding, which led to a 30% increase in the Brazilian swine population over the last ten years.

On the other hand, the effluent treatment of the advanced livestock operations in Brazil has not followed the technological pace set by the production sector. This is especially true for swine farms, which can create enormous environmental and social impacts. As a rule of thumb, swine production in Brazil is not a sustainable activity.

A typical hog generates about 5.8 kg of manure. The proper management of these residues is a crucial factor for environmental conservation and human health. With a swine population of nearly 6 million animals, the Santa Catarina State faces a serious problem to manage this enormous amount of residues, which, when handled improperly, leads to consequences such as GHG emissions, odour, local river basins and land contamination, among others.

Hog production is an important economic activity in Brazil and family farming is fundamental for this sector. They also are responsible for a large part of the greenhouse gas emissions. Smaller farms very often struggle with little available family labor, low profitability, lack of investment possibilities and difficult access to information.

In Brazil, the common practice of manure management consists in discharging the animal waste in open-air anaerobic lagoons (Figure 1), with subsequent land application of the sludge generated. This practice produces biogas at the decomposition of the organic material in an anaerobic environment. The main components of the biogas are methane (50% – 80%) and carbon dioxide (20% - 50%). Despite the fact that this practice fully meets the environmental exigencies established by Brazilian laws and regulations, this “business-as-usual” manure management system results in methane emissions to the atmosphere, thereby contributing to global warming.

The project is based on the replacement of the business-as-usual open anaerobic lagoons at the project activity sites by anaerobic digesters. The equipments to be installed at the project farms works as a reactor that receives the daily load barn effluents and maintains a steady population of methanogenic bacteria for degradation. Within this digester, bacteria are allowed to thrive and decompose available organic matter from the swine manure. Because of this process, biogas is produced. The digester’s cover does not permit methane emissions to the atmosphere. The biogas produced is flared and the methane is destroyed, thereby reducing GHG emissions to the atmosphere.

The project activities will result in the following benefits:

- Increase local employment of skilled labor for the installation, operation and maintenance of the specialized equipment;
- Improvements in air quality, by reducing the emission of Volatile Organic Compounds (VOCs) and odor, for instance;
- Reduction in wastewater emissions to local water resources;

- Lowering the population of flies and associated enhancement to on-farm bio-security thus reducing the possible spread of disease;
- Establishment of a new model for animal waste management practices for local farmers, which can be duplicated on other regions.

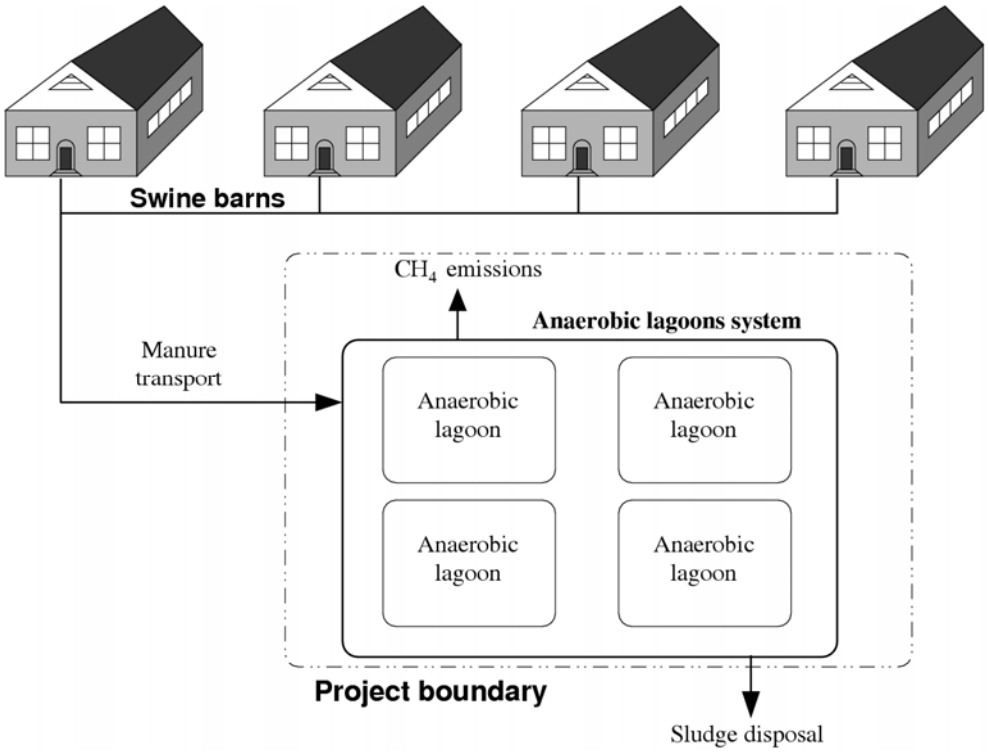


Figure 1 Diagrammatic representation of project boundary in the baseline scenario. Up to five anaerobic lagoons exists in the baseline scenario

Figure 2 Anaerobic lagoons currently used in the baseline scenario

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	**Key Associados**	**No**

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

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

The swine farms are located in South Brazil.

A.4.1.1. Host Party(ies):

Brazil

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

South Region, Santa Catarina and Rio Grande do Sul States

A.4.1.3. City/Town/Community etc:

Campos Novos Municipality, Erval Velho Municipality and São Pedro do Butiá Municipality

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

The project currently supports 9 swine farms; with livestock's sizes ranging from 1200 to 19,541 animals, located at Campos Novos, Erval Velho and São Pedro do Butiá municipalities. Figure 3,obtained using GoogleEarth and georeferenced through on-site GPS measurements, shows the swine farms position. All farms are separated by at least 3 km from each other. Granja dos Pinheiros, the farm which currently supports the largest livestock population, is 17 km far from Campos Novos municipality.

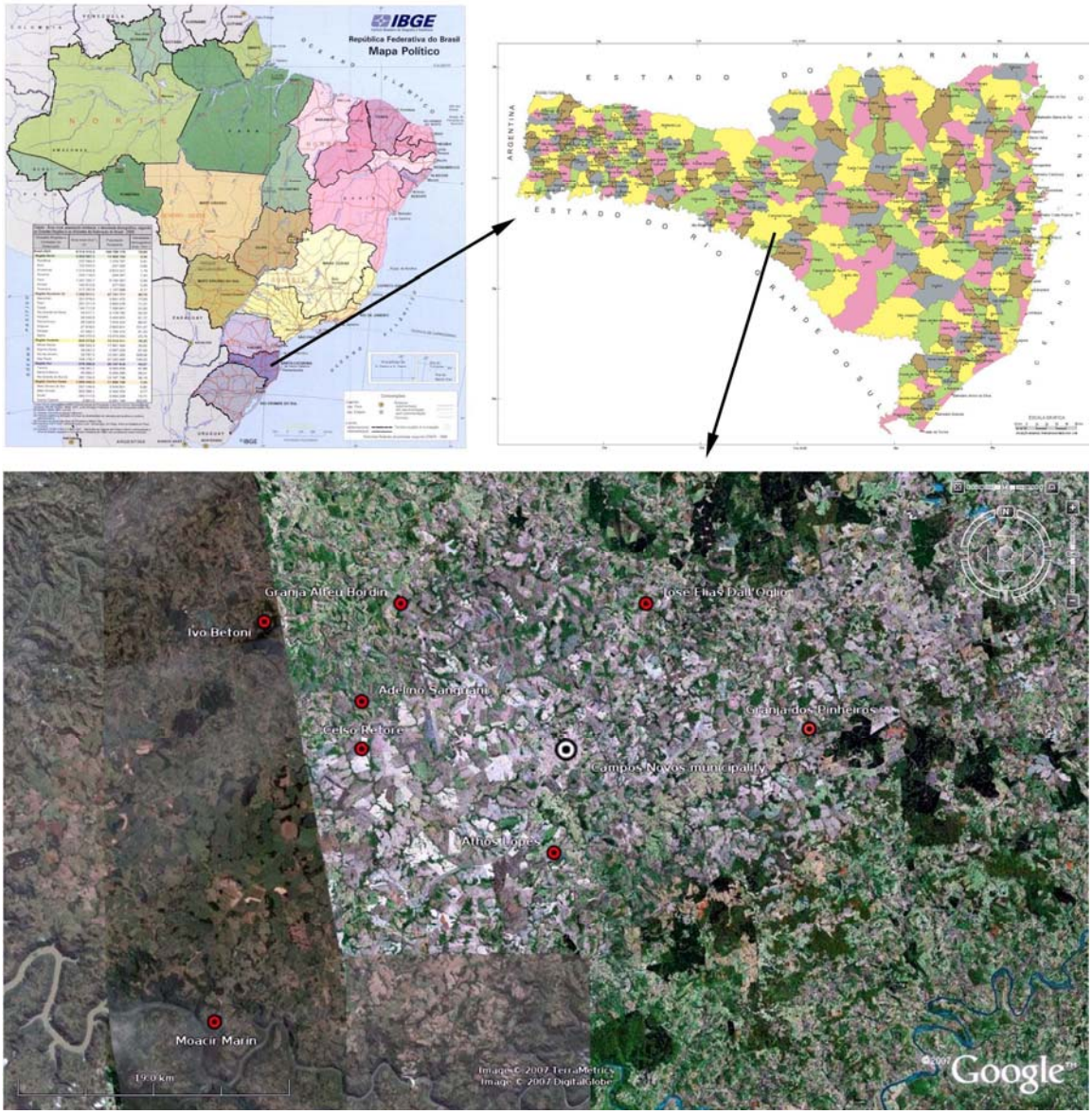


Figure 3 Overview of Brazil and Santa Catarina's political maps, with Campos Novos municipality and a satellite image showing the swine farms position (red symbols) obtained with on-site GPS measurements. The Goldschmitt farm (not shown in the satellite image)

Table 1 below contains the swine farms position and livestock number.

Table 1 Swine farms geographic position and livestock numbers

Farm	Livestock number	Farm Owner	Geographic position
Granja dos Pinheiros	19541	Cooperativa Regional Agropecuária de Campos Novos - COPERCAMPOS	27º22'55.8" S,51º02'43,9"W
Adelino Sanguanini	1200	Adelino Sanguanini	27º21'55"S, 51º24'02"W
Alfeu Bordin	1200	Alfeu Bordin	27º18'15''S, 51º20'00"W
Athos Lopes (Pocilga 2)	1990	Athos de Almeida Lopes	27º23'49''S, 51º21'39"W
Celso Retore	2450	Celso Retore	27º23'49"S, 51º21'39"W
Ivo Betoni	1990	Ivo Betoni	27º18'55"S, 51º25'48"W
José Elias Dall'óglio	2450	José Elias Dall'óglio	27º18'16''S, 51º09'39"W
Moacir Marin	1990	Moacir Marin	27º33'57.8"S, 51º27'55.7"W
Hugo Goldschmitt	7680	Hugo Goldschmitt	28º07'19"S, 54º54'10"W

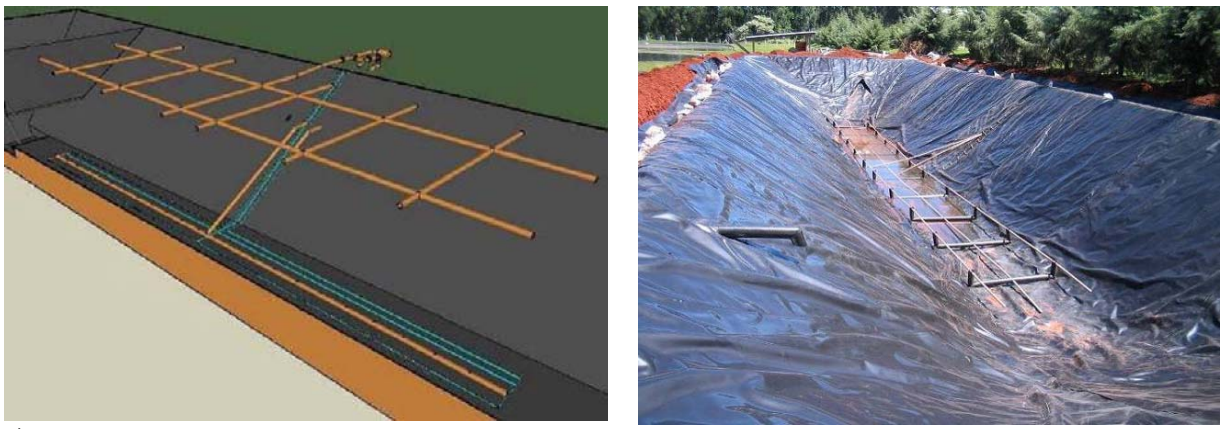
A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The project is categorized into the following sectoral scopes:

13 Waste handling and Disposal
15 Agriculture

The project is based on the replacement of the business-as-usual open anaerobic lagoons at the project activity sites by an anaerobic digester. The equipments to be installed at the project farms works as a reactor that receives the daily load barn effluents and maintains a steady population of methanogenic bacteria for degradation. The methanogenic bacteria is very important for a satisfactory performance of the digester since they grow without oxygen to convert organic acids into biogas, composed mainly by carbon dioxide and methane, which in the baseline scenario are released to the atmosphere, contributing to global warming. The resultant sludge is applied to soils to act as a fertilizer.

The anaerobic digester technology includes a cover of a polyvinylchlorid (PVC) membrane (1,0 mm), which is laid over the primary lagoon (Figure 4b). The system provides an anaerobic environment that enables the manure decomposition resulting in biogas production. Also, to maximize biogas production and avoid sludge generation in the digester, a homogenizer system is built in the digester, so one does not have to clean it, ensuring that the biodigester will be fully operational during its lifetime (Figure 4a).



a) b)

Figure 4 a) Graphic view of the homogenizer system. It works on the bottom and on the surface of the biodigester, b) Installing the homogenizer system. This does not allow the manure to deposit a layer of solid waste on the bottom of the biodigester. So one does need to clean it.

Biogas is produced through the bacterial decomposition of organic waste matter in the absence of oxygen. Swine waste contains bacteria, which thrive in anaerobic conditions, and produces methane as part of its biological process in the decomposition of organic nutrients. Within this digester (Figure 5), bacteria are allowed to thrive and decompose available organic matter from the swine manure. Because of this process, biogas is produced. The manure treatment system (anaerobic digester and aerobic lagoons) have been designed according to corresponding facility waste flow rates and will be adjusted to a hydraulic retention time longer than 30 days. The long retention times coupled with the appropriate, flow and mixing rates allow for the optimum treatment of water and the optimum production of biogas.

The biogas can be combusted through different systems. It can be used for energy generation (e.g.: electricity, barn heating, drying grains) or simply flared. In this project scenario, the biogas generated will be used for barn heating. The emission reduction achievement is based on the transformation of methane (CH_4) into carbon dioxide (CO_2) through combustion, therefore avoiding methane emissions.

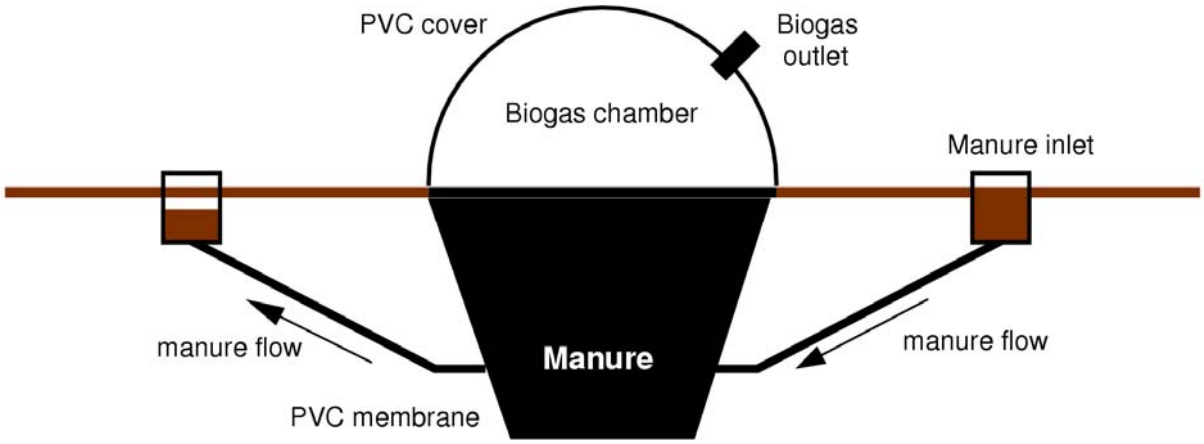


Figure 5 Diagrammatic representation of the anaerobic digester to be implemented in the project activities

Several operating conditions affect the amount of the methane produced in this system:

1) the ambient temperature,

2) the lagoon temperature, and

3) residency time of manure solids in its system. All theses factors affect the amount of methane emitted because they influence the growth of the bacteria responsible of the methane formation. Methane production generally increases with rising temperature and residency time.

On the other hand, the methane production is proportional to the volume of manure produced that is influenced by:

- The manure collecting and stored path;
- Frequency and volume of used water;
- Number and category of livestock animals.

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

Year	Annual estimation of emission reductions in tonnes of CO2e
2008	28.354,44
2009	28.354,44
2010	28.354,44
2011	28.354,44
2012	28.354,44
2013	28.354,44
2014	28.354,44
2015	28.354,44
2016	28.354,44
2017	28.354,44
Total estimated reductions (tonnes of CO2e)	**283.544,39**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions	**28.354,44**

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

Not applicable. There is no public funding involved in this project activity.

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

According to paragraph 2 of Appendix C of the *Simplified Modalities and Procedures for Small-Scale CDM project activities*, this project is not a debundled component of a large-scale project activity. There are no other registered large-scale CDM project activities with the same project participants, in the same project category and technology/measure whose project boundary is within 1 km of another proposed small-scale activity.

SECTION B. Application of a baseline and monitoring methodology

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

The project activity is a Type III, Other Project Activities, Version 13 of AMS-III.D, *Methane recovery in agricultural and agro industrial activities*.

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

The project type and category selected are compatible with the project activities because the following conditions are satisfied:

- The project activity comprises methane recovery and destruction from manure and wastes from agricultural or agro-industrial activities that would be decaying anaerobically in the absence of the project activity by installing methane recovery and combustion system to an existing source of methane emissions;
- Because of the digester's unique design, which allows the manure to be constantly mixed, there is no need to remove the sludge from the digester. The sludge generated will flow to the subsequent lagoons and then applied to the soils as a fertilizer.
- Based on historical animal inventories and the baseline scenario, the estimated emission reductions of the project activity are far below the 60 ktCO_2e threshold determined for small-scale project activities.

B.3. Description of the project boundary:

The project boundary for each farm is defined as the physical, geographical site of the methane recovery facility.

Figure 6 below describes the project boundary in a simplified schematic format.

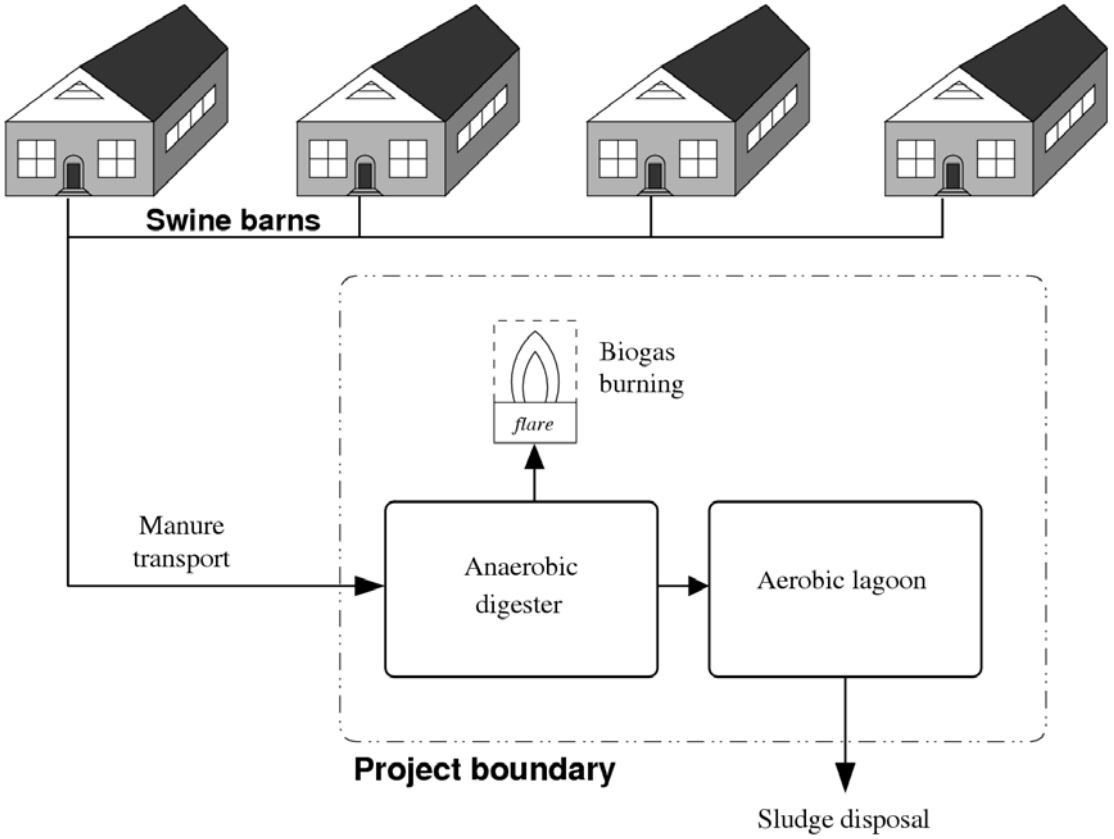


Figure 6 Project boundary

B.4. Description of baseline and its development:

The amount of methane that would be emitted to the atmosphere in the absence of the project activity (baseline scenario) was estimated by referring to Volume 4, Chapter 10 of the *2006 IPCC Guidelines for National GHG Inventories*, Tier 2 method.

In this case, the baseline scenario consists in the deposition of the raw manure in open-air anaerobic lagoons, resulting in emissions of large amounts of methane in the atmosphere. These emissions are calculated ex-ante using the most resent IPCC approach. VS values are calculated by scaling IPCC default values for Latin America swine to adjust for the farms' specific average animal weight.

The baseline emissions are estimated as in **section B.6.1** with the parameters described in **Annex 3.** The associated farms contain 39,501 heads of swine. Table 2 contains the livestock type and numbers for each farm in this CDM project.

Table 2 Farms livestock type, numbers and weight

Animal type and weight (kg) Farm	Sow (250)	Boars (350)	Piglet/A (4.5)	Piglet/C (21.75)	Finishers (75)	Livestock population
Granja dos Pinheiros	3400	17	5560	10200	364	19541
Adelino Sanguani					1200	1200
Alfeu Bordin					1200	1200
Athos Lopes (Pocilga 2)					1990	1990
Celso Retore					2450	2450
Ivo Betoni					1990	1990
José Elias Dall'óglio					2450	2450
Moacir Marin					1000	1000
Hugo Goldschmitt	3240	40	4400			7680
Total by livestock type	6640	57	9960	10200	12644	39501

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

The most common practice in Brazil, anaerobic lagoons, where all biogas generated by the organic decomposition is emitted to the atmosphere. As the business-as-usual anaerobic lagoon is in accordance with the legislation, the farmers do not have motivation, incentive or resources to change their waste treatment system to a more advanced technology.

All farmers in this project use ate least one anaerobic lagoon on their land. As the system is in compliant with the local legislation and it represents one of the most economically attractive scenarios, all farms use the referred waste treatment at their livestock operations.

Thus, to verify if changes in the baseline scenario during the crediting period could be expected, the following issues were assessed:

- Financial factors: Assuming that the technology required to undertake the proposed project activity is both specialized and "advanced," the demonstrated demand for this technology in Brazil is minimal, there is no reason to expect that implementation costs will drop so dramatically that the technology employed by the project activity would become a viable alternative.

- Legal constraints: There is no expectation that Brazilian legislation will require future use of digesters due to the significant investments required. Further, the developer is aware of no Latin American or other worldwide location requiring either the use of digesters or the constraints of agricultural GHG emissions.

- Common practice: While past practices cannot predict future events, it is worth noting that these farms has been in existence for many years, during which time it has only used open lagoons as its AWMS practice. Stakeholders confirmed that open lagoons have always been used at all farms.

Such anaerobic lagoon systems are economically feasible, reliable, effective, and satisfy regulatory requirements, and there is no reason to expect that these conditions will change in the near future.

The proposed project activity intends to improve current AWMS practices by installing at least one anaerobic digester in each farm, which will receive the effluent loading from the swine barns, mitigating anthropogenic GHG emissions by controlling the lagoon's decomposition processes and collecting and combusting the methane emitted.

The following paragraphs discuss the barriers in the adoption of the technology to be implemented in the proposed project activity.

Assessment of barriers

Without the financial income resulting from the sale of CERs, the proposed project activity has not been adopted on a national or worldwide scale due to the following barriers:

Investment barrier:

- Debt funding is not available for this type of innovative activities. There is no revenue associated with this kind of activity.

*Technology barriers***:**

- Anaerobic digester systems have to be designed to handle specific effluent volumes with a Hydraulic Retention Time (HRT) consistent with extracting most/all CH_4 from the manure. These systems become progressively more expensive on a 'per animal' basis as farm animal population (i.e., farm size) is decreased. 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.

- Swine farmers in Brazil are still hesitant to have enclosed biodigesters installed because there is a lack of awareness regarding its effectiveness. Even if it is found to be effective, there is no compelling reason for the business owners to invest in a newer, more effective technology. It is perceived to be a risk by the producers, because they are uncertain about the long-term effects of such technology. Because of that, the periodic maintenance of the equipments is so important. The anaerobic digesters to be installed in this CDM project will receive monthly maintenance.

Barriers due to prevailing practice:

- The alternative is the first-of-its-kind: No alternative of this type is currently operational in the region, providing advanced manure treatment systems to small producers of a local organization of agricultural cooperatives, through the implementation of an anaerobic digester. Only CDM related projects were able to successfully implement this type of AWMS in the last 5 years.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions:

Step 1: Emission factors

The emission factor for the livestock type *i* is[1]:

$$EF_{(i)} = (VS_i \bullet ND) \bullet \left[B_{0(i)} \bullet 0.00067 tonnes/m^3 \bullet MCF_{jk} \bullet MS\%_{ijk}\right] \quad \textbf{(1)}$$

where,

EF_i emission factor (kg) for animal type *i* (e.g., market swine, weight adjusted),
VS_i Volatile solids excreted in kg/day for animal type *i*, adjusted from IPCC default values[2],

$$VS_{i,site} = \frac{W_{i,site}}{W_{i,default}} \times VS_{i,default} \quad \textbf{(2)}$$

ND Number of days animals present,
B_{oi} Maximum methane producing capacity (m^3CH_4/kg VS) for manure produced by animal type i,
MCF_{jk} Methane conversion factor for each manure management system *j* by climate region *k*, and
$MS\%_{ijk}$. fraction of animal type *i*'s manure handled using manure system *j* in climate region *k*.
$W_{i,site}$ weight for animal type *i*
$W_{i,default}$ Default weight for animal type *i*
$VS_{i,default}$ Default VS value for animal type *i*

The amount of methane emitted can be calculated using:

$$CH4_y = EF_i \bullet N_y \quad \textbf{(3)}$$

where,

$CH4_y$ methane produced for animal type *i*, in kg/year,

[1] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, equation 10.23, page 10.41

[2] Obtained from 2006 IPCC, Annex 10A.2, Tables 10A-7 and 10A-8, p. 10.80 and 10.81

EF_i Emission factor for animal type *i* (kg),
N_y yearly average livestock size of animal type *i*.

Step 2: Total baseline emissions

$$BE_y = \frac{\left(CH4_y \bullet GWP_{CH4}\right)}{1000} \quad \textbf{(4)}$$

Where,

BE Baseline carbon dioxide equivalent emission in metric tons per year, (tonCO_2e),
$CH4_y$ methane produced for animal type *i*, in kg/year, and
GWP_{CH4} global warming potential of methane (21).

Project emissions

According to the approved methodology AMS-IIID version 13, the emissions from the project activity consist of CO_2 emissions from use of fossil fuels or electricity for the operation of the facility:

Emissions from the use of fossil fuels and/or electricity for the operation of the facility:

A common standard equipment configuration for the operation of each AWMS is shown below. No fossil fuel will be used to generate the electricity used in the operation of the facility. All electricity will be purchased from the grid.

Table 3 Typical consumption values for equipment configuration necessary to manage manure from 10.000 hogs

Equipment	KW consumption	Operation time (hrs/day)	Consumption (kWh/day)	Days in operation per year	KWh consumption (per year)
Digester mixer	3.73	24	89.52	365	32,674
Manure heating recirculation pump	3.73	24	89.52	365	32,674
Blower	0.75	24	17.9	365	6,532
				Total	**71,880**

As noted above, the electrical consumption per year for the operation of the AWMS facility for the project activity is approximately 71,880 kWh/yr. To convert this number into metric tonnes of CO_2e per year, the following formulae is applied:

$$PE_y = \frac{Elec_{,y} \bullet NEF}{1000} \quad \textbf{(5)}$$

where:

PE_y Project activity emissions from electricity use in the operation of the AWMS facility,
$Elec_y$ yearly electricity consumption of the AWMS facility,
NEF National emission factor, Brazil, South region, tonCO_2e/mWh

Based on the Project Developers assumptions and observations of a similar AWMS running time and power consumption, the total annual amount of electricity from the grid purchased to power the AWMS is estimated at 284 MWh[3], thereby generating 162 tonCO_2e/year.

Leakage

According to the approved methodology AMS-IIID version 13, leakage calculations are not required.

Ex ante estimation of emissions reductions

The emission reduction achieved by the project activity can be estimated by:

$$ER_{y,estimated} = BE_y - PE_y - Leakage \quad \textbf{(6)}$$

Ex post monitoring

The actual emission reduction achieved by the project during the crediting period will be calculated using the amount of methane recovered and destroyed by the project activity, calculated as:

$$ER_{y,calculated} = MD_y - PE_y - Leakage \quad \textbf{(7)}$$

where,

PE_y actual project emissions in the year y,

MD_y methane captured and destroyed by the project activity in year y (tCO_2e), which will be measured using the conditions of the flaring process:

[3] The estimate of energy required used to power all AWMS to be installed at the farms was obtained by scaling the values from Table 3 to the total swine population.

$$MD_y = BG_{burnt,y} \bullet w_{CH4,y} \bullet D_{CH4,y} \bullet FE \bullet GWP_{CH4,y} \quad \textbf{(8)}$$

Where:

$BG_{burnt,y}$ biogas flared or used as fuel in the year *y* (m^3).

$w_{CH4,y}$ methane content in biogas in the year *y* (mass fraction).

$D_{CH4,y}$ density of methane at the temperature and pressure of the biogas in the year *y* (tonnes/m^3).

FE flare efficiency in the year *y* (fraction)

GWP_{CH4} Methane global warming potential (21)

The ex-ante baseline emissions calculated as described in this section will be compared to the actual monitored amount of methane captured and combusted by the project activity. The lesser of these values will be used as the project emission reductions of the crediting period

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

Data / Parameter:	**MCFj**
Data unit:	Number
Description:	Methane conversion factor for each manure management system
Source of data used:	Obtained from 2006 IPCC, Table 10.17, p. 10.45 for Baseline scenario Obtained from 2006 IPCC, Table 10.17, p. 10.46 for Project scenario
Value applied:	0.79 for anerobic lagoons and 1.00 for anaerobic digester
Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years.
Any comment:	---

Data / Parameter:	**ND**
Data unit:	Number
Description:	Days animals resident in system per year
Source of data used:	Project proponents
Value applied:	365
Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years.
Any comment:	---

Data / Parameter:	**$MS\%_{BL,j}$**
Data unit:	Fraction
Description:	Fraction of manure handled in system *j* in the baseline
Source of data used:	Project proponents
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	All manure generated will be handled in the AWMS. Archive electronically during project plus 5 years.
Any comment:	---

Data / Parameter:	**D_{CH4}**
Data unit:	tonnes/m^3
Description:	Density of methane
Source of data used:	Technical literature
Value applied:	0.00067 at 1 atm pressure and 20 °C
Justification of the choice of data or description of measurement methods and procedures actually applied:	Recommended by the methodology. Archive electronically during project plus 5 years.
Any comment:	0.00067 tonnes/m_3 at room temperature 20℃ and 1 atm pressure.

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential for CH_4
Source of data used:	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied:	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Any comment:	0.67 kg/m_3 at room temperature 20℃ and 1 atm pressure.

Data / Parameter:	**$VS_{i,default}$**
Data unit:	kg-dm/animal/day

Description:	Values for the volatile solid excretion per day per animal type *I* on a dry matter basis for Latin America Swine swine
Source of data used:	Table 10A-7 and 10A-8, chapter 10, volume 4, IPCC 2006 Guidelines for Latin American Swine
Value applied:	0.30
Justification of the choice of data or description of measurement methods and procedures actually applied:	Recommended by the methodology as the default value for the volatile solid excretion per day per animal type *I* on a dry matter basis for Latin America Swine swine. Archive electronically during project plus 5 years.
Any comment:	---

Data / Parameter:	**VS_i**
Data unit:	kg-dm/animal/day
Description:	Adjusted value for the volatile solid excretion per day per animal type *I* on a dry matter basis for a defined swine population
Source of data used:	Adjusted from Table 10A-7 and 10A-8, chapter 10, volume 4, IPCC 2006 Guidelines for Latin American Swine
Value applied:	Sow (1.63), Boars (2.28), Piglet/A (0.07), Piglet/C (0.24), Finishers (0.80)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Recommended by the methodology. Archive electronically during project plus 5 years.
Any comment:	---

Data / Parameter:	**NEF**
Data unit:	tonCO_2e/mWh
Description:	Average emission factor from the grid in the South region of Brazil, year 2006
Source of data used:	Brazilian Ministry of Science and Technology.
Value applied:	0.57
Justification of the choice of data or description of measurement methods and procedures actually applied:	Average value of year 2006 used for the ex-ante estimations of project emissions
Any comment:	---

Data / Parameter:	**$W_{i,default}$**
Data unit:	kg

Description:	Default average weight for a defined swine population
Source of data used:	Obtained from Table 10A-7 and 10A-8, chapter 10, volume 4, IPCC 2006 Guidelines for Latin American Swine
Value applied:	28
Justification of the choice of data or description of measurement methods and procedures actually applied:	Recommended by the methodology as the default average swine weight for Latin America. Archive electronically during project plus 5 years.
Any comment:	---

Data / Parameter:	B_{0_i}
Data unit:	M^3 CH_4/kg-VS
Description:	Maximum methane production
Source of data used:	Table 10A-7 and 10A-8, chapter 10, volume 4, IPCC 2006 Guidelines
Value applied:	0.29
Justification of the choice of data or description of measurement methods and procedures actually applied:	Recommended by the methodology as the maximum methane production for Latin America. Archive electronically during project plus 5 years.
Any comment:	The parameter value should be updated on future revisions to the IPCC Guidelines for National Greenhouse Gas Inventories.

B.6.3 Ex-ante calculation of emission reductions:

Emission factors for the baseline are calculated as described in **Section B.6.1** and project emissions are also calculated in **section B.6.1**. To estimate total yearly baseline methane emissions, the selected emission factors are multiplied by the associated animal population and summed.

According to the small-scale methodology AMS-III.D, Version 13, the emissions reductions achieved by the project activity can be estimated *ex-ante* by:

$$ER_{y,estimated} = BE_y - PE_y - Leakage \quad \textbf{(9)}$$

where,

BEy 28.516 tonCO_2e,
PEy 162 tonCO_2e,
Leakage not applicable.

Therefore, the total expected emissions reductions to be achieved to the proposed project activity consists of approximately **28.354 tonCO2e/year**, with a total of **283.544 tonCO$_2$e** in the 10 year crediting period.

Data and parameters used in the calculations are described in **section B.6.2**.

The **actual emission reduction** achieved by the project during the crediting period will be calculated using the amount of methane recovered and destroyed by the project activity, calculated as:

$$ER_{y,calculated} = MD_y - PE_y - Leakage \quad \textbf{(10)}$$

where,

PE_y actual project emissions in year y,

MD_y methane captured and destroyed by the project activity in the year *y* (tCO_2e), that will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} \bullet W_{CH4,y} \bullet D_{CH4,y} \bullet FE \bullet GWP_{CH4} \quad \textbf{(11)}$$

where,

$W_{CH4,y}$ methane content in biogas in the year *y* (mass fraction),
$D_{CH4,y}$ density of methane at the temperature and pressure of the biogas in the year *y* (tonnes/m^3),
FE flare efficiency in the year *y* (fraction),
GWP_{CH4} Methane global warming potential (21).

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

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
2008	161,84	28.516,28	0,00	28.354,44
2009	161,84	28.516,28	0,00	28.354,44
2010	161,84	28.516,28	0,00	28.354,44
2011	161,84	28.516,28	0,00	28.354,44
2012	161,84	28.516,28	0,00	28.354,44
2013	161,84	28.516,28	0,00	28.354,44
2014	161,84	28.516,28	0,00	28.354,44

2015	161,84	28.516,28	0,00	28.354,44
2016	161,84	28.516,28	0,00	28.354,44
2017	161,84	28.516,28	0,00	28.354,44
Total (tonnes of CO2e)	**1.618,42**	**285.162,81**	**0,00**	**283.544,39**

B.7.1 Data and parameters monitored:

Data / Parameter:	**W_{CH4}**
Data unit:	Fraction
Description:	Methane fraction of biogas.
Source of data to be used:	Project proponents, monitoring program.
Value of data	
Description of measurement methods and procedures to be applied:	The project proponents will measure methane content monthly with a gas analyzer. If significant deviations are observed, more frequent measurements will be taken until the values stabilize. Reported monthly. Archive electronically during project plus 5 years. Shall be measured on wet basis.
QA/QC procedures to be applied:	The gas analyzer should be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	---

Data / Parameter:	**N**
Data unit:	Number
Description:	Average swine population used in both baseline and project case emissions estimation.
Source of data to be used:	Project proponents, monitoring program.
Value of data	39,501 (used in the ex-ante estimations)
Description of measurement methods and procedures to be applied:	To be collected for each swine population in all of the pig barns. Animal stock and inlet program of pigs (Net inlet considering mortality) are recorded. Monitored monthly. Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	---
Any comment:	The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed.

Data / Parameter:	**$W_{i,site}$**

Data unit:	kg
Description:	Weight of swine type *i*.
Source of data to be used:	Project proponents, monitoring program.
Value of data	
Description of measurement methods and procedures to be applied:	Average weight of each livestock type and age class. Monitored monthly. Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	---
Any comment:	

Data / Parameter:	**N_y**
Data unit:	Number
Description:	Average swine population of livestock type *i* used in both baseline and project case emissions estimation.
Source of data to be used:	Project proponents (average values of *on-site* measurements)
Value of data:	Sow (6640), Boars (57), Piglet/A (9960), Piglet/C (10200), Finishers (12644)
Description of measurement methods and procedures to be applied:and procedures actually applied :	Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	
Any comment:	---

Data / Parameter:	**FE**
Data unit:	Fraction
Description:	Efficiency of flaring process
Source of data to be used:	Project proponents, monitoring program
Value of data	0.90
Description of measurement methods and procedures to be applied:	The project proponents will measure methane content monthly with a gas analyzer. A default value of 0.90 in the flaring efficiency process will be used. Reported monthly. Archive electronically during project plus 5 years. Shall be measured on wet basis.
QA/QC procedures to be applied:	The gas analyzer should be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	**FE**

Data / Parameter:	**BG_{burnt}**

Data unit:	m^3
Description:	Biogas flow
Source of data to be used:	Project proponents, monitoring program
Value of data	
Description of measurement methods and procedures to be applied:	Measured continuously by two flow meters, one is installed at the outlet of the anaerobic digester and the other one is installed at the inlet of the gas chamber. Pressure and temperature of the biogas will be measured to determine the density of methane combusted. Reported cumulatively on weekly basis. Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	Flow meters will undergo maintenance/calibration subject to appropriate industry standards.
Any comment:	The biogas generated in the project activity is supplied to the system that will combust the biogas in order to ensure barn heating through gas chamber and the pipeline from the gas chamber to the combustion system is too short, so only two flow meters are installed.

Data / Parameter:	**NEF**
Data unit:	tonCO_2e/MWH
Description:	Emission factor from the grid in the South region of Brazil.
Source of data to be used:	Brazilian Ministry of Science and Technology.
Value of data	0.96 used in the ex-ante calculations (2006 average value)
Description of measurement methods and procedures to be applied:	Monitored monthly. Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	
Any comment:	---

Data / Parameter:	**SRC**
Data unit:	Number
Description:	Sludge removal count.
Source of data	Project proponents, monitoring program.
Value of data	
Brief description of measurement methods and procedures to be applied:	To be collected as required. Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	---
Any comment:	Sludge removal will be accomplished to ensure proper disposition so there is no resulting methane emissions.

Data / Parameter:	Elec,y
Data unit:	MWh
Description:	Electricity purchased from the grid to operate AWMS
Source of data	Project proponents, monitoring program.
Value of data	
Brief description of measurement methods and procedures to be applied:	To be collected monthly. Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	---
Any comment:	

B.7.2 Description of the monitoring plan:

To assure a proper monitoring of the project activities, at least five people will be trained in each farm: A local project manager, two plant operators and two assistants. This team will guarantee that the adequate collecting procedures of the manure generated and the proper flaring of the biogas will be done in a consistent way. All data records will be archived electronically and on paper, in a small office located in the farm, with data backups stored in the World Wide Web. Each individual farm will be inspected on a regular basis. In addition, the project manager, the plant operators and the assistants will be capacitated in the complete management of the system. In this CDM project activity, these properly trained teams will ensure that all steps necessary to undertaken the CDM project will be done.

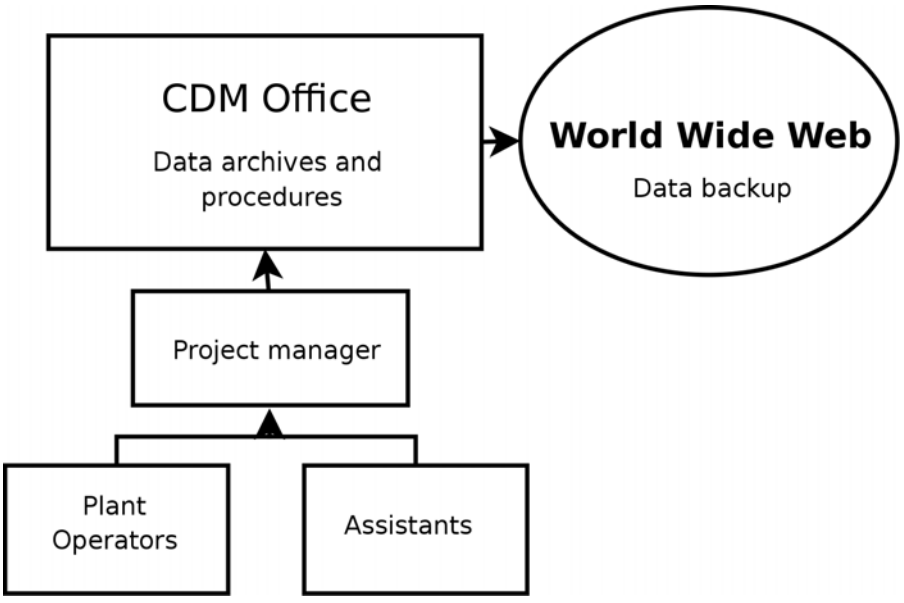


Figure 7 Management flow chart of the project activities

- Livestock population and weight: The responsibility of monitoring and registering this parameter is currently done by the farm manager, since swine population and weight data recording is already common practice at these farms.

- Biogas flow: The biogas generated in the project activity is supplied to the combustion system through a gas chamber and the pipeline from the gas chamber to the generator is short, so only two flow meters have to be installed. One will be installed at the outlet of the anaerobic digester and the other one is installed at the inlet of the gas chamber. Flow meters will undergo maintenance and calibration according to the appropriate industry standards. The biogas generated from the anaerobic digester will be monitored and registered by the operator in charge of the manure treatment system's operation, and the biogas input to the gas chamber shall be monitored and registered by the operator in charge of the flare. The data will be registered daily and reported cumulatively to the CDM project office on weekly basis.

- Methane fraction of biogas: Methane content will be measured monthly with a gas analyzer installed at the outlet of the anaerobic digester by the project proponents. Pressure and temperature of the biogas will be measured to determine the density of methane combusted. It is monitored and registered by the operator in charge of the manure treatment system's operation and reported to the CDM project office on weekly basis.

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

>> The draft of the baseline and monitoring methodology was completed on 02/28/2008.

The entity determining the baseline and monitoring methodology is Key Associados, who is the project developer as well as a project participant. Contact information is listed in Annex 1.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

July 2008

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

15 years

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

C.2.1. Renewable crediting period

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/02/2008 or on the date of registration of the CDM project activity, whichever is later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

There are no negative environmental impacts associated with the project activities. Besides the mitigation of GHG emissions, the proposed activities will also result in positive environmental benefits, including:

- Reducing atmospheric emissions of Volatile Organics Compounds (VOCs) that cause odour,
- Lowering the population of flies and associated enhancement to on-farm bio-security thus reducing the possible spread of disease.

All these factors will make the proposed project site more sustainable and environmentally safe. Besides, the project activity does not require a new analyses of the environmental impacts associated with the anaerobic digester.

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

Each of these swine farms already possesses an environmental license for the anaerobic lagoons. The project activity proposes an anaerobic digester, which exceeds by far the Brazilian laws and regulations regarding manure disposal. The legal procedures necessary to undertake the installation of the project activities (only a correction in the current license) will be performed as soon as the project is approved.

SECTION E. Stakeholders' comments

To be addressed

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

To be addressed

E.2. Summary of the comments received:

To be addressed

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

To be addressed

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**Key Associados**
Street/P.O.Box:	Avenida Paulista 37 – 10 andar
Building:	
City:	São Paulo
State/Region:	São Paulo
Postfix/ZIP:	
Country:	Brazil
Telephone:	55 11 3372 9595
FAX:	
E-Mail:	
URL:	www.keyassociados.com.br
Represented by:	Carlos Henrique Delpupo
Title:	Director
Salutation:	Sr
Last Name:	Delpupo
Middle Name:	Henrique
First Name:	Carlos
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	cdelpupo@keyassociados.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NOT APPLICABLE. THERE IS NO PUBLIC FUNDING INVOLVED IN THIS PROJECT ACITIVITY

Annex 3

BASELINE INFORMATION

The following data sources were consulted in order to determine the baseline scenario:

- *2006 IPCC Guidelines for National Greenhouse Gas Inventories*
- Approved small-scale methodology AMS-III.D. - *Methane recovery in agricultural and agro industrial activities (Version 13)*
- *First Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions- background reports – Agriculture and Livestock*

- **Total livestock number: 39,501**
  Data obtained from farm records supplied by the farms' managers.

- **Average weight for each livestock type (Data obtained from farm records supplied by the farms' managers)**
  Boars: 350 kg Sows: 250 kg Piglet/C: 21.75 kg
  Finishers: 75 kg Piglet/A: 4.5 kg

- **Methane conversion factor for the anaerobic lagoons (MCF): 79%**
  2006 IPCC Guidelines for national GHG inventories

  CH4 density: 0,00067 ton/m^3
  Technical literature

  Bo: 0,29 m^3 CH_4/kg-dm
  2006 IPCC Guidelines for national GHG inventories

- **GWP CH4: 21**
  2006 IPCC Guidelines for national GHG inventories

- **Average annual temperature: 25 degrees Celsius**
  National data sources - IBGE

- **VS: kg/head/day (obtained by adjusting IPCC default values for Latin America Swine)**
  Boars: 2.28
  Sows: 1.63
  Finishers: 0.80
  Piglet/A: 0.07
  Piglet/C: 0.24

Annex 4

MONITORING INFORMATION

Refer to section B.7.