AWMS GHG Mitigation Project BR05-B-01, Minas Gerais, Brazil

UNFCCC Clean Development Mechanism
Project Design Document

Document ID: BR05-B-01

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

A. General description of project activity

B. Application of a baseline methodology

C. Duration of the project activity / Crediting period

D. Application of a monitoring methodology and plan

E. Estimation of GHG emissions by sources

F. Environmental impacts

G. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

AWMS GHG Mitigation Project BR05-B-01, Minas Gerais, Brazil

A.2 Description of the project activity:

General: Worldwide, agricultural operations are becoming progressively more intensive to realize economies of production and scale. The pressure to become more efficient drives significant operational similarities between farms of a "type," as inputs, outputs, practices, genetics, and technology have become similar around the world.

This is especially true in livestock operations (swine, dairy cows, etc.) which can create profound environmental consequences, such as greenhouse gas emissions, odour, and water/land contamination (including seepage, runoff, and over application), that result from storing (and disposing of) animal waste. Confined Animal Feeding Operations (CAFOs) use similar Animal Waste Management System (AWMS) options to store animal effluent. These systems emit both methane (CH_4) and nitrous oxide (N_2O) resulting from both aerobic and anaerobic decomposition processes.

This project proposes to apply to multiple swine CAFOs (located in Minas Gerais, Brazil) a GHG mitigation methodology which is applicable to intensive livestock operations. The proposed project activities will mitigate AWMS GHG emissions in an economically sustainable manner, and will result in other environmental benefits, such as improved water quality and reduced odour. In simple terms, the project proposes to move the designated farms from a high-GHG AWMS practice; an open air lagoon, to a lower-GHG AWMS practice; an ambient temperature anaerobic digester with capture and combustion of resulting biogas.

Purpose: The purpose of this project is to mitigate animal effluent related GHG by improving AWMS practices.

Contribution to sustainable development:

The Minas Gerais Federation of Livestock and Agriculture (FAEMG) has three conventions for the development of farming:

- To be socially just,
- Economically viable,
- And ecologically sustainable.[1]

According to Brazil's *Inter-Ministerial Commission on Global Climatic Change,*[2] manure management is an important issue that needs to be solved. Failure to do so will allow existing problems (such as increased (insect) pest populations, problems with allergies and livestock disease, including foot-and-mouth disease (FMD) which exists in Brazil), to continue unabated. To this end, Brazil has in recent

---

[1] http://www.gaemg.org.br

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

years required all CAFOs to transition from single to multi-lagoon systems, and even more recently has required them to line the bottom of their primary sedimentation lagoon to prevent effluent seepage.[3]

Establishing a positive model for other livestock operations is essential. In the last ten years, Brazilian swine production grew by 28%, reaching breeding levels of approximately 36 million animals.[4] In 2001, the swine population in Minas Gerais, Brazil was 3,358,696.[5] Considering that a typical hog produces 5.8 kilograms of effluent daily (Table A1), annually some 7.1 million metric tons of hog waste is produced in Minas Gerais alone. Introducing progressive AWMS practices throughout the region could result in an annual reduction of approximately 2.5 million tonnes[6] of carbon dioxide equivalent (CO_2e) in the state of Minas Gerais alone.

Table A1. Daily production of effluent by type of porcine[7]

Stage	Manure kg/day	Manure and Urine kg/day	Volume litres/day	Volume m^3/animal/month
25-100 kg	2.3	4.9	7.0	.25
Gestating sows	3.6	11.0	16.0	.48
Nursing sows	6.4	18.0	27.0	.81
Boar pig	3.0	6.0	9.0	.28
Piglet	0.35	0.95	1.4	.05
Average	2.35	5.8	8.6	.27

Furthermore, the proper handling of this large quantity of CAFO animal waste is critical to protecting human health and the environment. Because of the practices employed by farmers, the design, location, and management of livestock operations are critical components in ensuring an adequate level of protection of human health and the environment.[8]

Energy problems are also a major issue in rural regions of Brazil. Dilma Rousseff, Brazil's Minister of Energy states, "We are facing a great crisis in the country's electricity system." In July, 2003, Roussef warned that the country could face another power crisis by 2007.[9] Anaerobic digesters produce biogas containing a high percentage of methane, which can be used for localized energy (either heat or electricity) production. This previously untapped energy potential can serve to augment or offset local supply.

---

[3] A re-lined lagoon typically delivers a nominal 20-30 years of performance. For additional data refer to: R.J. McMillan, et al, "Studies of Seepage Beneath Earthen Manure Storages and Cattle Pens in Manitoba," Manuscript in Preparation, University of Manitoba & The Water Branch of Manitoba; Ground Water Monitoring & Assessment Program, (2001) "Effects of Liquid Manure Storage Systems on Ground Water Quality," Minnesota Pollution Control Agency; American Society of Agricultural Engineers, (2003) "Seepage Losses From Animal Waste Lagoons: A Summary of a Four Year Investigation in Kansas", Technical Library

[4] Anaulpec, 2001

[5] www.agricultura.gov.br/pls/portal/docs/PAGE/MAPA/ESTATISTICAS/PECUARIA/3_5.XLS, February 2003

[6] Approximate calculation using IPCC model and emission factors

[7] KRUEGGER et al, (1995); Another outstanding reference for manure output is: Lorimor, Powers, et.al "Manure Characteristics", Manure Management Series, MWPS-18, Section 1; pg 12.

[8] Speir, Jerry; Bowden, Marie-Ann; Ervin, David; McElfish, Jim; Espejo, Rosario Perez, "Comparative Standards for Intensive Livestock Operations in Canada, Mexico, and the U.S.," Paper prepared for the Commission for Environmental Cooperation.

[9] http://www.eia.doe.gov/emeu/cabs/brazil.html

The proposed GHG mitigation project satisfies the Brazilian government priorities for environmental stewardship and sustainability while positioning the project activity participants to develop and use renewable ("green") energy. Indeed, it does so with no negative consequences and affords a series of environmental and infrastructure co-benefits (some of which are outlined in Section F).

Because the proposed project establishes an advanced AWMS and includes means for subsequently establishing on-farm electricity generation, the project participants believe the farm managers will adopt – and continue to practice these AWMS practice changes that result in meaningful, and permanent, GHG emission reductions.

This project activity will have positive effects on the local environment improving air quality (by reducing the emission of Volatile Organic Compounds (VOCs) and odour, for instance) and will set the stage for future possible on-farm projects (such as changes in land application practices) that would have an additional positive impact on GHG emissions with an attendant potential for reducing groundwater contamination problems.

This project activity will also increase local employment of skilled labour for the fabrication, installation, operation and maintenance of the specialized equipment. Finally, this voluntary project activity will establish a model for animal waste management practices, which can be duplicated on other CAFO livestock farms, dramatically reducing livestock related GHG and providing the potential for a new source of revenue and green power.

The Minas Gerais Secretary of State for Environment, José Carlos Carvalho, commented on this type of proposed project activity stating:

> *"…with this project Minas [Gerais] sets, once more, the example of how to solve problems that affect environmental quality: joining forces that viably employ the most modern technology available in the market in favour of the health and welfare of the population."*
>
> *Portal Minas*[10]
> *11/02/03*

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)	• AgCert Do Brasil Solucoes Ambientais Ltda.	No

A.4 Technical description of the project activity:

A.4.1 Location of the project activity:

[10] http://www.mg.gov.br/

A.4.1.1 Host Party(ies):

The host party for this project activity is Brazil.

A.4.1.2 Region/State/Province etc.:

The sites included in this project activity are located in the state of Minas Gerais.

A.4.1.3 City/Town/Community etc:

The project sites are shown in Figure A1 with specifics detailed in Table A2

A.4.1.4 Detail on physical location, including information allowing the unique identification of this project activity (maximum one page):

The physical location of each of the sites involved in this project activity is shown in Figure A1 and listed in Table A2.

Fazenda Quilombo is a 2,800 animal Site I gestation/farrowing operation. The flush water and effluent from the barns is routed to two open lagoons. Water from the lagoons is skimmed from the surface and used to irrigate crop fields.

Fazenda Vitória is a farrowing/gestating operation consisting of approximately 1,000 sows. It consists of 3 open lagoons, a primary, secondary, and tertiary. There are barns for nursery and finishers, but are not considered in the baseline.

Fazenda Cinco Estrelas is a 450 sow farrowing operation. The site consists of 5 lagoons, 3 of which are used for AWMS practices. The two unused lagoons were built after the project activity start to hold the output of the biodigester for irrigation and fertilization purposes.

Granja Ressaca is a farrow-to-finish operation of approximately 2,500 sows. The site contains 5 open lagoons, one primary, one secondary, and three tertiary.

Fazenda Esplanada is a farrowing/gestating operation consisting of approximately 2,300 sows. There are 3 open lagoons, a primary, secondary, and tertiary.

Granja CFM is a farrowing/gestating operation consisting of approximately 2,500 sows. There are two open lagoons on site.

Fazenda São Sebastião is a farrow-to-finish operation of just under 1,000 sows. It includes two lagoons.

São Bernardo is a farrow-to-finish operation with approximately 2,000 sows and three open lagoons.

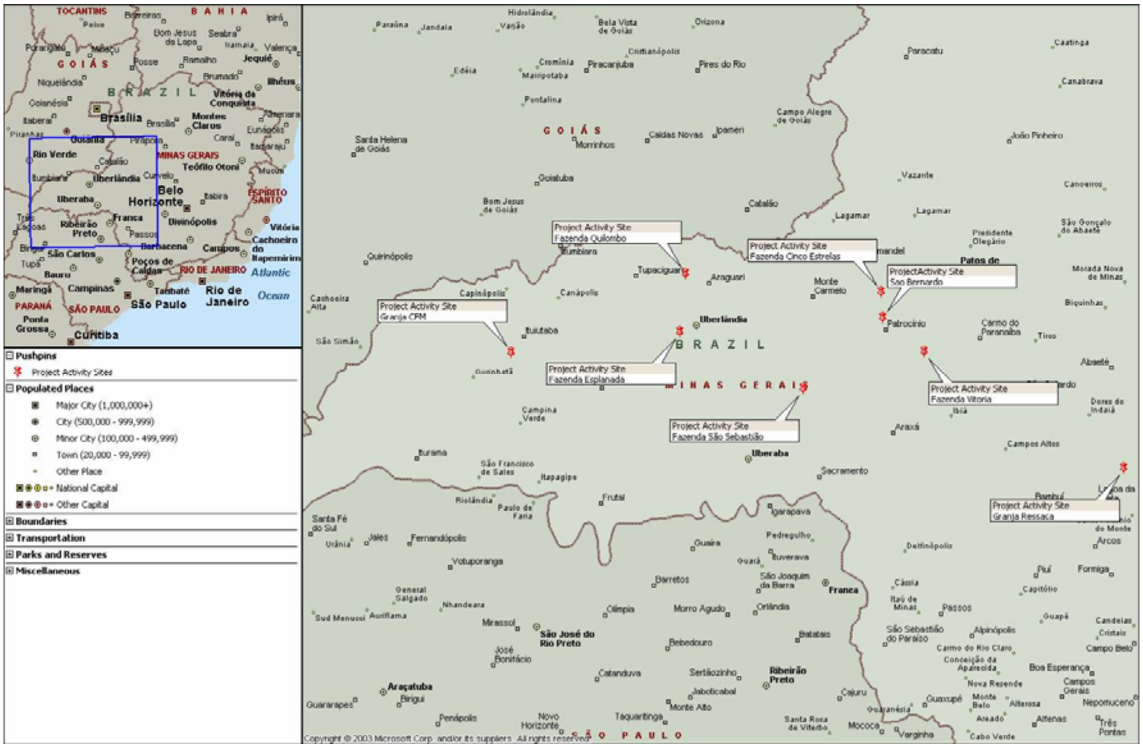


Figure A1. State of Minas Gerais, Brazil and project activity sites

Table A2. Detailed physical location and identification of project sites

Farm Name/Owner	Address	Location/ Postal Code	Animal Type/ Type of Operation
Fazenda Quilombo/ Agrícola Veredinha Ltda.	Rodovia Araguari Inianópolis, Km 18 a esuerda	Araguai, Minas Gerais, Brazil 38400-134	Swine, CAFO, Farrow to Nursery[11]
Fazenda Vitória/Conquista Agropecuária Ltda	Estrada Municipal 12 Km 03	Serra do Salitre, Minas Gerais, Brazil 38760-000	Swine, CAFO, Farrow / Gestation
Fazenda Cinco Estrelas/Ricardo dos Santos Bartholo	Rodovia MG-188 Km 389	Patrocino, Minas Gerais, Brazil 38740-000	Swine, CAFO, Farrowing
Granja Ressaca/Romulo de Melo Gontijo	Rua Deputado Riberio Penna, 261-Bairro São José	Bom Despacho, Minas Gerais, Brazil 35600-000	Swine, CAFO, Farrow to Finish
Fazenda Esplanada/José Antônio da Silveira	Entroncamento da BR 365com a 452	Uberlandia, Minas Gerais Brazil 38400	Swine, CAFO, Farrow / Gestation
Granja CFM/Cristiano Franco de Mendonça	Estrada São Vicente Douradinho km 8	Ituiutaba, Minas Gerais, Brazil 38300-000	Swine, CAFO, Farrow / Gestation
Fazenda São Sebastião/Antonio Narciso Ribeiro Barbosa	Rodovia BR 452 na Estrada do Pião Km 50	Santa Juliana, Minas Gerais, Brazil 38175-000	Swine, CAFO, Farrow to Finish
São Bernardo (Folhados)/ Empresa Agrícola Folhados	BR 365 Km 478	Patrocino, Minas Gerais, Brazil 38740-000	Swine, CAFO, Farrow to Finish

A.4.2 Category(ies) of project activity:

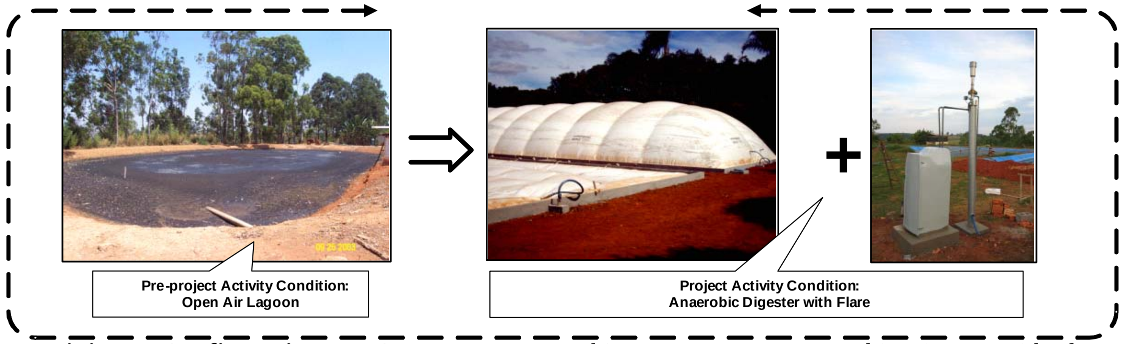
The category of the project activity is in Sectoral Scope 13 - Waste Handling and Disposal, and Sectoral Scope 15 – Agriculture.

A.4.3 Technology to be employed by the project activity:

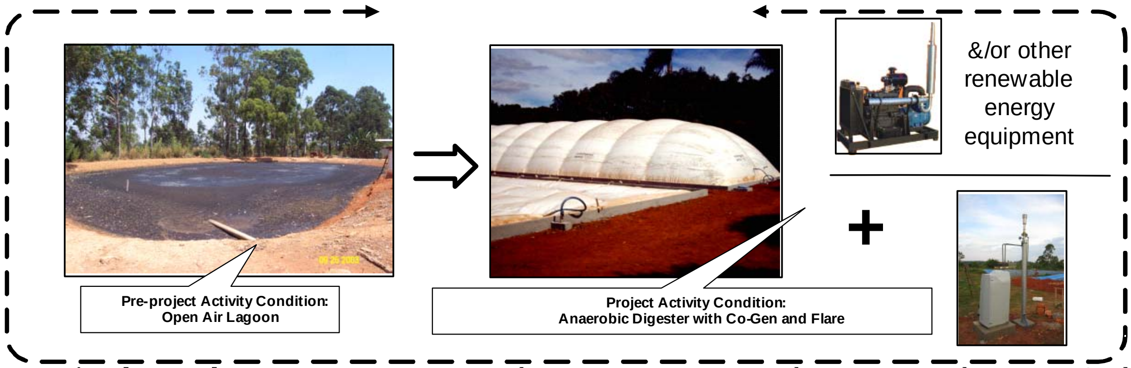
The technology to be employed by the project activity includes the total replacement of the open primary lagoon at the project activity sites with positive pressure covered lagoon "cells," creating ambient temperature anaerobic digesters. The system will be comprised of identical cells with sufficient combined capacity to create an adequate Hydraulic Retention Time (HRT). Each cell will use a liner affixed to a reinforced outer concrete frame. The outer cover consists of a synthetic UV-treated multi-layer membrane, which is also fastened to the frame. The liner and cover will be sealed together. The cells have been designed to enable solids residue removal without breaking seal and the biogas from each cell can be independently sectioned off. Maintenance and repairs can be made to one cell without affecting operation of the other cells. All cell components will be sourced from in-country manufacturers.

[11] A 'Farrow to Nursery Operation' is defined as a production system that contains breeding to gestation to farrowing to nursery production systems.

Processed effluent from the lagoon cells will be routed to the clarification lagoon(s) and captured gas will be routed to flare and/or generator and combusted.



Minimum Configuration - Open Lagoon to Ambient Temperature Anaerobic Digester with Flare



Optional upgrade - Open Lagoon to Ambient Temperature Anaerobic Digester with Co -Gen & Flare

Figure A2. Project Activity Configurations.

Figure A2 depicts two approaches to mitigate AWMS GHG emissions. The minimum configuration constructs cells and a flaring system, as described above. The optional upgrade incorporates the use of a cogeneration system to produce on-farm electricity, using methane produced by the covered cells as fuel. The minimum configuration flare is retained to burn methane not required by the engine/generator set.

Care was given to use compatible components in the design of the AWMS. For example, the geomembrane cover has a tensile and tear strength which far exceeds the flare over-pressure release threshold. Furthermore, the flare combustion capacity exceeds the estimated GHG production forecasts. Depending on the flare assembly selected for this project, it may include a pilot light to ignite the methane. The pilot light would be fueled with a liquid petroleum gas stored in a small 13kg tank located at the base of the flare assembly. Based on the emission coefficient of LPG (1534.23 Kg CO_2/m^3)[12], a tank of LP gas would conservatively emit approximately .042 tCO2e per tank and 4 to 6 tanks of gas would be used each year.

In the case that project participants choose to implement the optional upgrade, the project participants have analyzed the predicted methane production and likely usage patterns to determine an appropriate

[12] US Department of Energy – Fuel and Energy Source Codes and Emission Coefficients – www.eia.doe.gov/oiaf/1605/factors.html

generator size. The project developer shall provide to the validating DOE technical characteristics of the subsystems and material employed in the project.

Technology and know-how transfer:

The project developer is implementing a multi-faceted approach to ensure the project, including technology transfer, proceeds smoothly. This approach includes careful specification and design of a complete technology solution, identification and qualification of appropriate technology/service providers, supervision of the complete project installation, farm staff training, ongoing monitoring (by the project developer) and developing/implementing a complete Operations & Maintenance plan using project developer staff. As part of this process, the project developer has specified a technology solution that will be self-sustaining, i.e., highly reliable, low maintenance, and operate with little or no user intervention. The materials and labour used in the base project activity are sourced primarily from within the host country.

By working closely with the project on a "day to day" basis, the project developer will ensure that all installed equipment is properly operated and maintained, and will carefully monitor the data collection and recording process. Moreover, by working with the farm staff over many years, the project developer will ensure that personnel acquire appropriate expertise and resources to operate the system on an ongoing/continuous basis.

A.4.4 Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

Anthropogenic GHG Reductions

Anthropogenic GHGs, specifically methane and nitrous oxide, are released into the atmosphere via decomposition of animal manure and a nitrification/denitrification process associated with volatilization of nitrogen. Currently, farm produced biogas is not collected or destroyed.

The proposed project activity intends to improve current AWMS 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.

The figure listed in section A.4.4.1 is based upon the current animal head counts. The proposed project activity AWMS will be sized to accommodate each farm's maximum expected animal capacity.

There are no existing, pending, or planned national, state, or local regulatory requirements that govern GHG emissions from agricultural operations, specifically, pork production activities as outlined in this PDD. The project participants have solicited information regarding this issue during numerous conversations with local and state government officials and through legal representation, namely Trench, Rossi E Watanabe Advogados (associates of Baker & McKenzie)(See Section G), and have determined there is no regulatory impetus for producers to upgrade current AWMSs beyond an open air lagoon. The following paragraphs discuss the Brazilian pork industry and how conditions hinder changes in AWMS practices.

Brazilian pork producers face the same economic challenges as farmers in other nations due to increased worldwide pork production and low operating margins. Farm owners focus on the bottom line, and odour benefits, alleged water quality enhancements, and the incremental savings associated with heating cost avoidance, are rarely enough to compel an upgrade to an (expensive) advanced AWMS.[13] Unless the AWMS upgrade activity affords the producer means to (partially) offset the practice change cost (via the sale of Certified Emission Reduction (CER) credits, for instance) the open lagoon will remain the common AWMS practice – *and all AWMS GHG (biogas) will continue to be emitted*. Speaking to this affordability issue, the President of the Santa Catarina Association of Swine Producers (ACCS) recently said:

> *…water pollution from swine manure is a very grave environmental problem…changes are required…the swine producer by himself does not have the capacity to resolve.*
>
> *Porkworld Magazine, 12/10/03*

This sentiment was corroborated by representatives[14] of Brazilian Agricultural Research Corporation (EMBRAPA)[15] as well as officers of national and state agricultural associations (ABCS, ASEMG).

The proposed AWMS practice change will afford these farms the financial means (via CER revenues) to adopt and maintain an advanced AWMS with reductions in GHG emissions and associated environmental co-benefits (including reduced water contamination).

---

[13] DiPietre, Dennis, PhD, Agricultural Economist, (18 June, 2003) Private communication

[14] Conversation between AgCert's Michael Mirda and EMBRAPA's Airton Kunz, Paulo Armando V. de Oliveira, and Paulo Antônio Rabenschlag de Brum on March 2, 2004 at the EMBRAPA National Research Centre of Swine and Poultry in Concórdia, Santa Catarina, Brazil

[15] The Brazilian Agricultural Research Corporation's mission is to provide feasible solutions for the sustainable development of Brazilian agribusiness through knowledge and technology generation and transfer.

A.4.4.1 Estimated amount of emission reductions over the chosen crediting period:

A.4.4.1 - Estimated Emission Reductions over chosen Crediting Period	
Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1	24,677
Year 2	59,226
Year 3	59,226
Year 4	59,226
Year 5	59,226
Year 6	59,226
Year 7	59,226
Year 8	59,226
Year 9	59,226
Year 10	59,226
Total estimated reductions (tonnes CO_2e)	**557,711**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	55,771

A.4.5 Public funding of the project activity:

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

SECTION B. Application of a baseline methodology

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

This project activity utilizes the CDM approved baseline methodology AM0016/Version 02 entitled "*Greenhouse gas mitigation from improved Animal Waste Management Systems in confined animal feeding operations*."

B.1.1 Justification of the choice of the methodology and why it is applicable to the project activity

This baseline methodology was chosen because it offers a GHG emissions model that can be used to characterize baseline emissions for project activity livestock operations. Specifically, the methodology is applicable because:

1. The captured gas is being flared, or
2. The captured gas is being used to produce energy (e.g., electricity/thermal energy), but no emission reductions are claimed for displacing or avoiding energy from other sources.[16]
3. The farms with livestock populations are managed under confined conditions which operate in a competitive market.
4. The livestock populations are comprised of swine animals, an applicable animal type.
5. The AWMS system, including both the baseline scenario and the manure management systems introduced as part of the project activity, is in accordance with the regulatory framework in the host country, excluding the discharge of manure into natural resources (e.g., rivers or estuaries).
6. On-farm systems introduce AWMS practice and technology changes to reduce GHG emissions.
7. The on-farm project systems reduce GHG emissions due to the AWMS improvements.
8. The on- farm project systems establish a sound framework for sustaining these improvements over time to provide economic sustainability and ensure that mitigation measures result in a continuous, verifiable, reduction of GHGs.

B.2 Description of how the methodology is applied in the context of the project activity:

The methodology calls for the classification and categorization of the farm systems to include animal type, population, AWMS in use/projected, climate, region, etc. This data is used to properly select lookup table parameters and can be found in Table B1.

[16] Although in this project no emission reductions are claimed for displacing or avoiding energy from other sources, all possible financial revenues and/or emission leakages will be taken into account in the analysis performed.

Table B1. Data Characterization

Farm System	AWPS		AWMS				Other	
	Animal Category	Genetics	Base-line	No.	Project	No.	Region - Climate	Population Data
Fazenda Quilombo	Swine	North American	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Vitória	Swine	North American	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Cinco Estrelas	Swine	North American	Lagoon	5	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja Ressaca	Swine	North American	Lagoon	5	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Esplanada	Swine	North American	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja CFM	Swine	North American	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda São Sebastião	Swine	North American	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
São Bernardo (Folhados)	Swine	North American	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3

The methodology further calls for the application of the Emission Factor Determination Test, again, in order to select the appropriate IPCC lookup parameters. The project developer applied the "Emission Factor Determination Test" described in AM0016 to ascertain that "developed" country emission factors are appropriate for use with the project activity as host country factors are not available. The methodology also requires that developed nation genetics are used and that the farms employ formulated feed rationing which can be verified. Table B2 lists the farms answers to the four questions posed in the Emission Factor Determination Test which allowed "developed" country emission factors to be used.

Table B2. Emission Factor Determination (EFD) Test Results

Farm System	EFD Test Question				Result
	1	2	3	4	
Fazenda Quilombo	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Vitória.	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Cinco Estrelas	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Ressaca	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Esplanada	No	Yes	Yes	Yes	Use developed nation default EFs
Granja CFM	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda São Sebastião	No	Yes	Yes	Yes	Use developed nation default EFs
São Bernardo (Folhados)	No	Yes	Yes	Yes	Use developed nation default EFs

The data obtained from the above activities are required for use in the equations identified in Section D and the results described in Section E of this document.

The following steps are used to determine the baseline scenario:

Step 1: List of Possible Baseline Scenarios

The following list of scenario alternatives is derived from different AWMSs presented in the approved methodology:

- Daily spread
- Solid storage
- Dry lot
- Liquid/Slurry
- Anaerobic lagoon
- Pit storage below animal confinements
- Anaerobic digester
- Deep litter
- Composting
- Poultry manure
- Aerobic treatment

Step 2: Identify Plausible Scenarios

Listed below are the proposed project activity and other plausible scenarios for the project farms operations and conditions. Justification for including or excluding a scenario from consideration is provided.

- *Liquid Slurry*: Most of the barriers to this technology relate to the cost required to store the volumes of liquid necessary from confined animal operations. It is a viable technology alternative and has been considered.
- *Anaerobic Lagoon*: The relevant technical/regulatory barrier relating to this scenario is that lagoon systems, by Brazilian law, must be lined. The anaerobic stabilization lagoon represents project farms' current practice. It is generally considered to be the most economical, efficient, and reliable AWMS, and is the most common AWMS technology in Brazil, and in the developed and developing world. Pierre Vilela from the Federation of Agriculture and Livestock of Minas Gerais (FAEMG)[17] supports this finding stating: "*Biogas is a technique that is rarely used in Brazilian swine and layer operations; lagoon treatment (open-air) is the most common*."
- *Pit Storage below animal confinements*: Installing pit storage would require excavation underneath each of the existing barns or actual replacement (which is more likely). Further, reliable, uninterrupted electric supply is essential; if power fails, the animal herd will be quickly killed by the accumulation of toxic fumes, including hydrogen sulphide (H_2S). Power in rural Brazil is not reliable.[18] Although less plausible as a solution to an existing operation, an economic evaluation of this scenario is included.
- *Anaerobic digester*: The barriers to this technology are developed in section B.3 as part of an additionality test. This scenario has been included as the "proposed project activity."

Excluded scenarios:

The overall criterion used in evaluating potential scenarios is to assess the 'practicality' and economics of a technology/approach. Said differently, is a given technology/system both practical to implement and economically attractive to be adopted? Applying this criterion resulted in excluding the scenarios listed below:

- *Daily spread*: This technology is less effective than the open lagoon system currently in use. Animal waste generated from project farm production operations would only be applied to land at certain periods throughout the growing season, so a storage system would also be required. Further, the application of animal waste directly to the field (under aerobic conditions) has the potential to result in a higher release of Nitrous Oxide (N_2O) emissions, a gas which has a Global Warming Potential (GWP) 310 times worse than CO_2. Finally, the incorporation of this solution requires additional manpower resources. It has been excluded as a plausible scenario.
- *Solid Storage*: Depending on storage design, this system will not be efficient enough for odour and vector control; so the exclusion of this potential baseline scenario can be justified.
- *Dry lot:* This AWMS has been excluded because it is not applicable to the conditions of barns which incorporate the use of slats and paved pens.
- *Deep litter*: Pig farmers have found tending deep litter bedding systems so laborious and unpleasant, that this approach has been replaced with liquid-manure or solid-manure systems. It becomes difficult to optimize the composting process with large numbers of animals; this is

[17] FAEMG is a private institution created in 1951. It is supported by the rural producers. It is part of the Rural Trade Union Patronage System: led by CNA Brasil (Brazilian Confederation of Agriculture and Livestock), major representative entity of Brazilian producers.

[18] Energy problems are a major issue in rural regions of Brazil. Dilma Rousseff, Brazil's Minister of Energy states, "We are facing a great crisis in the country's electricity system." In July, 2003, Roussef warned that the country could face another power crisis by 2007.

counter to achieving economies of scale associated with large animal counts (typical of the CAFO approach). Farms seek the most cost effective solution meeting local regulatory and farm conditions, and, therefore, use liquid manure systems.[19] Further, the deep litter practice is not often used in Brazil and has been excluded from consideration.

- *Composting*: Composting systems are not adapted to large volumes of water, or moisture contents. This dry aerobic system can only be applied after solid separation stages of activated sludge. For this reason, it is excluded from the list of plausible scenarios.
- *Poultry manure*: This AWMS has been excluded as it is a management technique associated with poultry operations. The project sites are a pork production operation. This scenario has been excluded from the list of plausible scenarios.
- *Aerobic treatment*: Aerobic treatment is typically suited for separated slurry or diluted effluents. Solids in manure increase the amount of oxygen needed and also increase the energy needed for mixing. The biggest drawbacks to aerated lagoons are (a) the cost of energy to run the aerators; (b) biosolids production, which is higher than in anaerobic systems; and (c) the potential for release of ammonia if the aeration level is not correct. This scenario has been excluded from the list of plausible scenarios.

Therefore, the list of plausible scenarios has been reduced to three alternative scenarios and one proposed project activity scenario:

Plausible alternative scenarios:	(i)	Liquid/Slurry
	(ii)	Anaerobic Lagoon
	(iii)	Pit storage
Proposed project activity scenario:	(i)	Anaerobic digester

Step 3: Economic Comparison

Tables B3 through B7 illustrate the economic comparison between plausible baseline scenarios and the proposed project activity scenarios. Data presented has been based on a typical 500 to 600 sow potential project activity in Minas Gerais, Brazil. The scalability of this data when applied to larger or smaller project activities is not strictly linear, but the economic relationship between the scenarios will remain generally the same. This comparison was prepared by AgCert and reviewed by a swine industry economist.[20]

The comparison was made using a 10% discount rate, which might be typically used in a developed nation. As shown in Figure B1, this rate is extremely conservative in Brazil as the calculated rate can exceed 25%.[21]

---

[19] Klemola, Esa and MalKKi, Sirkka, Handling of Manure in Deep-Litter Pig Houses, 1998, http://www.ramiran.net/doc98/FIN-ORAL/MALKKI.pdf

[20] DiPietre, Dennis, PhD, Agricultural Economist, formal communication

[21] http://faculty.fuqua.duke.edu/~charvey/Teaching/BA456_2003/Despegar/Despegar.ppt#591,25, Project's Risks Cost of Capital Implications

	Brazil
Cost of Equity Capital	25.45%
Industry beta adjustment	0.25%
Operational - Sovereign Risks	
Macroeconomics	0.00%
Political/Legal	0.42%
Force Majeure	0.00%
Financial Risks	-0.70%
Adj. Project Discount Rate:	25.42%

Figure B1. Brazilian discount rate.

Table B3. Economic analysis of the liquid/slurry AWMS baseline scenario

AWMS: LIQUID SLURRY				
COSTS AND BENEFITS	**Year 1**	**Year 2**	**Year n**	**Year n+1**
Equipment costs (pump & piping)	$ (280,004)	$ -	$ -	$ -
Installation costs of a slurry system	$ (31,100)	$ -	$ -	$ -
Maintenance costs	$ (1,400)	$ (1,400)	$ (1,400)	$ (2,800)
Other costs (e.g. operation, transportation, consultancy, engineering, etc.)	$ (6,000)	$ (6,000)	$ (6,000)	$ (6,000)
Revenues from the sale of electricity or other project related products, when applicable	$ -	$ -	$ -	$ -
SUBTOTAL	$ (318,504)	$ (7,400)	$ (7,400)	$ (8,800)
TOTAL BASELINE	$ (318,504)	$ (7,400)	$ (7,400)	$ (8,800)
NPV (US$) (10% discount rate)	($341,051)			
IRR (%)	undefined			

Table B4. Economic analysis of the anaerobic lagoon AWMS baseline scenario.

AWMS: ANAEROBIC LAGOON				
COSTS AND BENEFITS	**Year 1**	**Year 2**	**Year n**	**Year n+1**
Equipment costs (lined lagoon, pump & piping)	$ (8,562)	$ -	$ -	$ -
Installation costs of a lined lagoon system	$ (5,246)	$ -	$ -	$ -
Operations and maintenance costs	$ (100)	$ (100)	$ (100)	$ (100)
Other costs (e.g. consultancy, engineering, etc.)	$ (500)	$ -	$ -	$ -
Revenues from the sale of electricity or other project related products, when applicable	$ -	$ -	$ -	$ -
SUBTOTAL	$ (14,408)	$ (100)	$ (100)	$ (100)
TOTAL BASELINE	$ (14,408)	$ (100)	$ (100)	$ (100)
NPV (US$) (10% discount rate)	($13,657)			
IRR (%)	undefined			

Table B5. Economic analysis of the pit storage AWMS baseline scenario.

AWMS: PIT STORAGE				
COSTS AND BENEFITS	**Year 1**	**Year 2**	**Year n**	**Year n+1**
Equipment costs (pump, piping, and generator)	$ (892,575)	$ -	$ -	$ -
Installation costs of a pit storage system	$ (63,110)	$ -	$ -	$ -
Maintenance costs	$ (4,463)	$ (4,463)	$ (4,463)	$ (8,926)
Other costs (e.g. operation, consultancy, engineering, etc.)	$ (10,000)	$ -	$ -	$ -
Revenues from the sale of electricity or other project related products, when applicable	$ -	$ -	$ -	$ -
SUBTOTAL	$ (970,148)	$ (4,463)	$ (4,463)	$ (8,926)
TOTAL BASELINE	$ (970,148)	$ (4,463)	$ (4,463)	$ (8,926)
NPV (US$) (10% discount rate)	($939,289)			
IRR (%)	undefined			

Table B6. Economic analysis of the anaerobic digester with flare AWMS project activity scenario.

AWMS: AMBIENT TEMPERATURE ANAEROBIC DIGESTER WITH FLARE				
COSTS AND BENEFITS	**Year 1**	**Year 2**	**Year n**	**Year n+1**
Equipment costs (lined lagoon, cover, piping, flare)	$ (36,379)			
Installation costs	$ (21,220)	$ -	$ -	$ -
Maintenance costs	$ (1,400)	$ (1,400)	$ (1,400)	$ (1,400)
Other costs (e.g. operation, consultancy, engineering, etc.)	$ -	$ -	$ -	$ -
Revenues from the sale of electricity or other project related products, when applicable	$ -	$ -	$ -	$ -
SUBTOTAL	$ (58,999)	$ (1,400)	$ (1,400)	$ (1,400)
TOTAL BASELINE	$ (58,999)	$ (1,400)	$ (1,400)	$ (1,400)
NPV (US$) (10% discount rate)	($61,456)			
IRR (%)	undefined			

Table B7. Economic analysis of the anaerobic digester with cogeneration/flare AWMS project activity scenario.

AWMS: AMBIENT TEMPERATURE ANAEROBIC DIGESTER W/CO-GEN /FLARE				
COSTS AND BENEFITS	**Year 1**	**Year 2**	**Year n**	**Year n+1**
Equipment Costs (covered lagoon, flare, engine, generator)	$ (63,425)			
Installation costs	$ (21,220)	$ -	$ -	$ -
Maintenance costs	$ (3,000)	$ (5,925)	$ (4,325)	$ (4,325)
Other costs (e.g. operation, consultancy, engineering, etc.)	$ (5,000)	$ -	$ -	$ -
Revenues from the sale or use of electricity or other project related products, when applicable	$ 7,600	$ 7,600	$ 7,600	$ 7,600
SUBTOTAL	$ (85,045)	$ 1,675	$ 3,275	$ 3,275
TOTAL BASELINE	$ (85,045)	$ 1,675	$ 3,275	$ 3,275
NPV (US$) (10% discount rate)	($63,869)			
IRR (%)	undefined			

As shown in the above tables, none of the above scenarios yield potential revenues. Because there are no positive cash flows, the economic analysis compares Net Present Value (NPV) parameters between the different scenarios. An economic comparison suffices to identify the best AWMS scenario - favouring those with lower costs. In this instance it can be seen that the anaerobic lagoon AWMS, the prevailing practice, is the most economically attractive course of action.

Both configurations of the project activity scenario, ambient temperature digester with or without cogeneration, have ranges of NPV that are far more negative than the baseline scenario. The cost of implementing this system (in either configuration) is much higher than the cost of an open lagoon system, so it is determined that the project is "additional" from an economic perspective. The economic value ascribed to project generated electricity is the offset "retail" cost the farm pays for this supply.

A sensitivity analysis was performed to determine whether any variables or inputs could cause significant variations in the results.

Animal Waste Management Systems are sized or scaled to accommodate the number of animals present at a given farm. The volumetric storage requirement scales linearly with the number of animals, so long as population mixes are similar, for instance: farrow-to-finish compared to farrow-to-finish.

The deep pit solution typically accommodates approximately 1,200 animals per building, so as animal population rises there can be a "discontinuity" in the costs as additional buildings have to be brought "online." The other solutions can be scaled without such discontinuities. Indeed, a volume increase can often be accommodated with a modest material/equipment change plus an incremental increase in excavation costs.

In summary: With regards to the two AWMS solutions of greatest interest (open lagoon vs. digester), there are no variables whose minor variation causes significant variations in the result.

Conclusion: The most likely plausible scenario, the anaerobic lagoon, is the "baseline scenario." The proposed project activity scenario is not an "economically attractive" course of action and therefore it is not the baseline scenario.

The application of baseline methodology Steps 4 and 5 follow in the next section, B.3.

B.3 Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

In the absence of the project activity, the project farms would not change their AWMS practice. As noted earlier in Section A.4.4, pork producers do not have the motivation or resources (especially financial resources) to change their AWMS: there are no laws or regulatory directives driving such change and even if a producer were so inclined, it has been demonstrated in Tables B.6 and B7 that they would find the upgrade costs prohibitive. This, in itself, demonstrates additionality between the baseline scenario and project activity scenario. Additionally, Step 4 of the methodology requires a barrier assessment of the proposed project activity:

Step 4: Assessment of barriers.

The proposed project activity has not been adopted on a national or worldwide scale due to the following barriers:

a. *Investment Barriers*: This treatment approach is considered one of the most advanced AWMS systems in the world. Only a few countries have implemented such technology because of the high investment costs compared to other available systems and due to regionalized subsidies for electric generation. The Brazilian energy market does not currently offer incentives to sell biogas into the grid. The investment required to produce energy by utilizing biogas is still too high compared to electricity prices in Brazil. Additionally, much of the power distributed in Brazil is derived from hydroelectric sources.

EMBRAPA noted that in general, producers view the AWMS as a stage that is outside of the production process and have difficulty financing changes that should be undertaken. Even banks have been unwilling to finance such activities absent government guarantees or other incentives. Professor Dr. Carlos Claúdio Perdomo, a swine and poultry researcher from EMBRAPA, states: "*Many producers don't possess the capacity of investment for a new AWMS. Even the big large producing farms that require more sophisticated systems also lack this capacity of investment*."[22]

b. *Technology barriers*: Anaerobic digester systems have to be sized to handle projected animal/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.

The proposed AWMS represents the most advanced AWMS technology in the state. The proposed project activity AWMS mitigates GHG emissions with associated environmental co-benefits. See quote from Minas Gerais State Secretary of Environment and Sustainable Development in Section A2 above.

c. *Legal barriers*: The implementation of this project activity by these farms highly exceeds current Brazilian regulations for swine waste treatment. Apart from existing legislation in Brazil that establishes water quality parameters that require lagoons to be lined, hence protecting water supplies from contamination, there is no legislation in place that requires specific swine manure treatment, especially as it relates to the emission of GHG.

Per local and state officials, as well as the project developer's legal consul, there were no existing laws or regulations, nor were any anticipated, that would require these farms to change their open lagoon AWMS practice in order to mitigate GHG emissions.

Step 5: Consideration of possible changes in the baseline scenario during the crediting period.

Background

Please note that the planning, construction, and operation of the improved AWMS at the sites listed in this PDD began prior to actual registration as a CDM project activity using the early start provision (paragraph 13 of decision 17/CP.7). As shown in Table B8, the availability of the CDM was considered throughout project inception through completion. Further, the infrastructure and data management system at AgCert were developed with the prime goal of managing data related to CDM project activities.

Table B8. Project activity timeline

DATE	ACTIVITY
Jan 2003	AgCert established to perform CDM environmental projects in the agricultural industry
Mar 2003	AgCert begins development of proposed new methodology for CDM activities
May 2003	AgCert opens discussions with representatives of candidate project sites to

[22] http://www.jornalexpress.com.br/noticials/detalhes.php?id_jornal=2&id_noticia=5802

DATE	ACTIVITY
	consider the potential for their inclusion in a CDM Project Activity
Jun 6, 2004	Project start date. AgCert and project farms executed a carbon contract to undertake a Clean Development Mechanism project activity. Initiated construction engineering and planning activities
Jun – Sep 2004	Site Survey, Data Collection, Baseline Analysis, PDD preparation
Jul 12, 2004	Broke ground at first construction site
Jul 21, 2004	Conducted Stakeholders' Meeting in Patos de Minas, Minas Gerais
Jan 21, 2005	AgCert submits to the DOE the first draft of GHG Mitigation PDD
Feb, 2005	Projected construction completed at final site, flare operational

Analysis

An analysis was performed to assess whether the basis in choosing the baseline scenario is expected to change during the crediting period and the results follow:

a) *Economic performance*: Given that (1) the technology required to implement the proposed project activity is both specialized and "advanced," (2) the demonstrated demand for this technology in Brazil is minimal, and (3) inflation rates in developing nations typically range from 5% to 60% (2002 est.), there is no reason to expect that implementation costs will drop so dramatically that the economic models summarized in tables B6 and B7 will become invalid. However, these costs will be periodically assessed and changes presented to the Operational Entity at their request.

b) *Legal constrains*: There is no expectation that Brazilian legislation will require future use of digesters due to the significant investments required. Further, there is no expectation that Brazil will pass any legislation which deals with the GHG emissions (see Step 4c above).

c) *Common practice*: While past practices cannot predict future events, it is worth noting that these farms (see Table A2), have been in existence for many years, during which time they have only used open lagoons as their AWMS practice. Local agricultural officials/inspectors confirmed (at the stakeholders' meeting) that open lagoons have always been used at these farms.

   The project developer conducted a survey to determine the common practice in the industry. Working in conjunction with Brazil's swine producer associations and their global swine genetics suppliers (Danbred, PIC, and Seghers), 171 producers in Minas Gerais, representing over 50% of the CAFO producers in Minas Gerais, were surveyed regarding the AWMS used in their operations. All but two used open anaerobic lagoon AWMS.

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

By incorporating Animal Waste Management Systems (AWMS) such as proposed in this PDD, GHG emissions will be captured and combusted. The resulting emission reduction credits would then be sold to large emitters in developed countries, helping to offset the costs of implementing the AWMS change. This mechanism was the primary factor influencing the decision to install ambient temperature anaerobic digesters at these farms.

B.4 Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project boundary is defined in Figure B2.

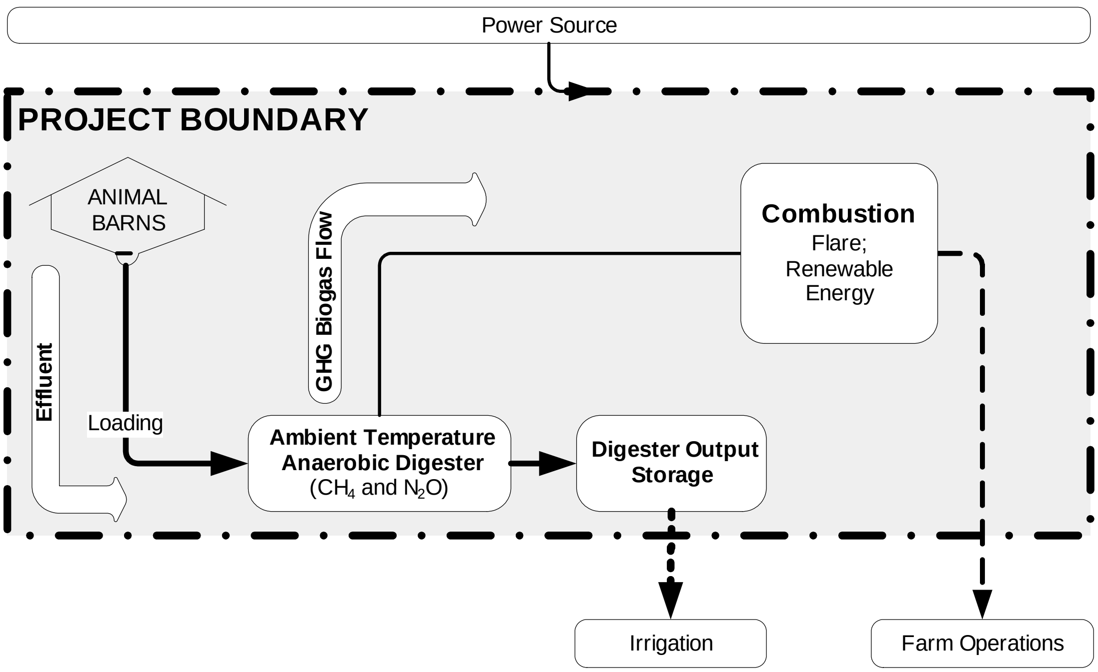


Figure B2. Project Boundary

The proposed project boundary considers the GHG emissions that come from AWMS practices, including the GHG resulting from the capture and combustion of biogas. The project activity sites use systems of two or more lagoons. Proposed AWMS practice changes include covering each primary lagoon into an ambient temperature digester that includes cells that capture the resulting biogas which is then combusted. The project boundary considers these practice changes as well as future options that the producer may elect to use.

The project boundary does *not* consider the effects of enteric emissions, nor does it include barn-related emissions, whether directly or indirectly associated with the animals, as these emissions are not affected by the proposed practice changes.

B.5 Detailed baseline information, including the date of completion of the baseline study and the name of the person(s)/entity(ies) determining the baseline:

The final draft of this baseline section was completed on 20/01/2005. The name of entity determining the baseline is AgCert International Limited. AgCert International is a project participant.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

The starting date of the project activity is 06/06/04.

C.1.2 Expected operational lifetime of the project activity:

The expected operational lifetime of the project activity is 11y 3m.

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

The project activity will use a fixed crediting period.

C.2.1 Renewable crediting period

C.2.1.1 Starting date of the first crediting period: N/A

C.2.1.2 Length of the first crediting period: N/A

C.2.2 Fixed crediting period:

C.2.2.1 Starting date: 01/9/2004

C.2.2.2 Length: 10y 0m

SECTION D. Application of a monitoring methodology and plan:

D.1 Name and reference of approved monitoring methodology applied to the project activity:

The project activity utilizes the CDM approved monitoring methodology AM0016/Version 02 entitled "*Greenhouse gas mitigation from improved Animal Waste Management Systems in confined animal feeding operations*."

D.2 Justification of the choice of the methodology and why it is applicable to the project activity:

This monitoring methodology was chosen because it offers a GHG emissions model that can be used to characterize baseline and project activity emissions. Specifically, the methodology is applicable because:

1. The captured gas is being flared, or

2. The captured gas may be used to produce energy (e.g., electricity/thermal energy), but no emission reductions will be claimed for displacing or avoiding energy from other sources.[23]
3. The farms have livestock populations managed under confined conditions and operate in a competitive market.
4. The livestock populations are comprised of swine animals, an applicable animal type.
5. The AWMS, including both the baseline scenario and the manure management systems introduced as part of the project activity, is in accordance with the regulatory framework in the country, excluding the discharge of manure into natural resources (e.g., rivers or estuaries).
6. The project activity introduces an AWMS practice and technology to reduce GHG emissions at the designated farms.
7. The project activity at the designated farms results in a reduction of GHG emissions due to the AWMS improvements.

[23] Although in this project no emission reductions are claimed for displacing or avoiding energy from other sources, all possible financial revenues and/or emission leakages will be taken into account in the analysis performed.

D.2.1 Option 1: Monitoring of the emissions in the project scenario and the baseline scenario:

AM0016 monitoring methodology is a broad based methodology that can be applied to various animal categories, waste management systems, and data types. As such, the methodology defines a superset of ID numbered parameters available for application at individual project activity scenarios. Individual projects will not require monitoring of the entire superset of parameters. The selection of such parameters is dependent on the result of the data characterization and emission factor determination test (Figure 2 in AM0016). The following subset of parameters has been identified for use at the project activities:

D.2.1.1 Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
1. Population month	Integer, Classification	Herd/breed counts per type	#, Type	m	Entrance – exit records of animals to the barn	100%	electronic	Animal counts by population classification and genetics. Classification data also includes mortality and days resident.
6. BA	Classification	Type of barn and AWMS	Type	m	Entrance – exit records of animals to the barn	100%	electronic	AWMS type used to select appropriate parameters from IPCC lookup tables
9. TR	Integer, volume	Temperature	°C, cm	m	Monthly	100%	electronic	Used to determine climate conditions for selection of appropriate parameters from IPCC lookup tables
12. CF	Volume	Biogas produced	M^3	m	Cumulative monthly production recorded monthly	100%	electronic	QC/QA check. This parameter enables verification of the anaerobic digestion process. Considered over several months, this parameter helps establish "typical" performance for an anaerobic digester.
13. CD	Percent	CO_2 concentration	%	m	Quarterly	100%	electronic	QC/QA check. This parameter monitors digester operation.
14. INT	N/A	Operational status	N/A	m	Weekly	100%	electronic	Operational status of all project equipment is checked. This parameter helps ensure proper digester operation.

D.2.1.2 Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emission units of CO_2 equ.):

Equations 9, 10, 11, 13, 14, 15, and 16 from Approved Methodology AM0016 are used to determine project activity emissions.

Four options are available for the determination of the volatile solids (V_s) excretion rate used with equation 11. Two of the four originate from lookup tables, IPCC and country-specific. If lookup references were not available, then the V_s could have been determined via calculation based on feed nutrition content and animal weight, e.g., equations 1 and 2 in AM0016. IPCC default values for V_s. were selected for use at the project activity farms. Furthermore, country specific factors are not available.

Two options are available for the determination of methane conversion factors (MCF) used with equation 11. One originates from IPCC lookup tables and the other can be calculated using equation 8 in AM0016. IPCC default values were selected for use at the project activity farms.

Four options are available for the determination of the nitrogen excretion (N_{ex}) rate used with equations 15 and 16. Two of the four originate from lookup tables, IPCC and country-specific. If lookup references were not available, then the N_{ex} could have been determined via calculation based on feed nutrition content and animal weight, e.g., equations 3 and 4 in AM0016. IPCC default values were selected for use at the project activity farms. Furthermore, country specific factors are not available.

- Equation 9, Baseline methane (CH_4) emissions in CO_2e:

$$CO_{2eq\ methane} = CH_{4\ annual} * GWP_{CH4}/1000$$

- Equation 10, Baseline methane (CH_4) annual emissions:

$$CH_{4\ annual} = \sum_{mj} EF_{month} * Population_{month} * MS\%j$$

- Equation 11, Animal group emission factor:

$$EF_{month} = V_s * n_m * B_0 * 0.67kg/m^3 * MCF_{month}$$

- Equation 13, Baseline nitrous oxide (N_2O) emissions in CO_2e:

$$CO_{2equiv\ N2O} = GWP_{N2O} * N_2O_{total\ annual}/1000$$

- Equation 14, Baseline nitrous oxide (N_2O) annual emissions:

$$N_2O_{total\ annual} = \sum_{mj} (N_2O_d + N_2O_i) * Population_{month} * MS\%j$$

- Equation 15, Direct nitrous oxide (N_2O) emissions:

$$N_2O_d = N_{ex\ month} * EF_3 * (1- F_{gasm}) * C_m$$

- Equation 16, Indirect nitrous oxide (N_2O) emissions:

$$N_2O_i = N_{ex\ month} * EF_4 * F_{gasm} * C_m$$

D.2.1.3 Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and how such data will be collected and archived.

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
1. Population month	Integer, Classification	Herd/breed counts per type	#, Type	m	Entrance – exit records of animals to the barn	100%	electronic	Animal counts by population classification and genetics. Classification data also includes mortality and days resident.
6. BA	Classification	Type of AWMS	Type	m	Entrance – exit records of animals to the barn	100%	electronic	AWMS type used to select appropriate parameters from IPCC lookup tables
9. TR	Integer, volume	Temperature and rainfall	ºC, cm	m	Monthly	100%	electronic	Used to determine climate conditions for selection of appropriate parameters from IPCC lookup tables

D.2.1.4 Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emission units of CO_2 equ.):

Equations 9, 10, 11, 13, 14, 15, and 16 from Approved Methodology AM0016 are used to determine baseline emissions.

Four options are available for the determination of the volatile solids (V_s) excretion rate used with equation 11. Two of the four originate from lookup tables, IPCC and country-specific. If lookup references were not available, then the V_s could have been determined via calculation based on feed nutrition content and animal weight, e.g., equations 1 and 2 in AM0016. IPCC default values for V_s. were selected for use at the eight sites. Furthermore, country specific factors are not available.

Two options are available for the determination of methane conversion factors (MCF) used with equation 11. One originates from IPCC lookup tables and the other can be calculated using equation 8 in AM0016. IPCC default values were selected for use at the eight sites.

Four options are available for the determination of the nitrogen excretion (N_{ex}) rate used with equations 15 and 16. Two of the four originate from lookup tables, IPCC and country-specific. If lookup references were not available, then the N_{ex} could have been determined via calculation based on feed nutrition content and animal weight, e.g., equations 3 and 4 in AM0016. IPCC default values were selected for use at the eight sites. Furthermore, country specific factors are not available.

- Equation 9, Baseline methane (CH_4) emissions in CO_2e:

$$CO_{2eq\ methane} = CH_{4\ annual} * GWP_{CH4}/1000$$

- Equation 10, Baseline methane (CH_4) annual emissions:

$$CH_{4\ annual} = \sum_{mj} EF_{month} * Population_{month} * MS\%j$$

- Equation 11, Animal group emission factor:

$$EF_{month} = V_s * n_m * B_0 * 0.67kg/m^3 * MCF_{month}$$

- Equation 13, Baseline nitrous oxide (N_2O) emissions in CO_2e:

$$CO_{2equiv\ N2O} = GWP_{N2O} * N_2O_{total\ annual}/1000$$

- Equation 14, Baseline nitrous oxide (N_2O) annual emissions:

$$N_2O_{total\ annual} = \sum_{mj} (N_2O_d + N_2O_i) * Population_{month} * MS\%j$$

- Equation 15, Direct nitrous oxide (N_2O) emissions:

$$N_2O_d = N_{ex\ month} * EF_3 * (1- F_{gasm}) * C_m$$

- Equation 16, Indirect nitrous oxide (N_2O) emissions:

$$N_2O_i = N_{ex\ month} * EF_4 * F_{gasm} * C_m$$

D.2.2 Option2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E):

D.2.2.1 Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2 Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emission units of CO_2 equ.):

D.2.3 Treatment of leakage in the monitoring plan:

D.2.3.1 If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
16. EP_y	Electricity	Power	kWh	m	Monthly	100%	electronic	Electricity used for project equipment
19. EP_p	Electricity	Power	kWh	m	Monthly	100%	electronic	Electricity produced through co generation of the captured methane

D.2.3.2 Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emission units of CO_2 equ.):

Equations 17 to 23 from Approved Methodology AM0016 are used to determine project activity leakage.

Equation 17 will be used to determine electrical leakage on a continual basis.

The project developer used equations 18 through 23 in a one-time analysis to confirm that the change in AWMS (project activity) did not adversely affect GHG emissions due to land application, runoff and ammonia volatilization. The results of the analysis show that there is no change in GHG emissions in these areas by incorporation an anaerobic digester.

- Equation 17, Project activity electricity emissions in CO_2e:

$$EE_y = (EP_{y\text{-}project} - EP_{p\text{-}project} - EP_{y\text{-}baseline}) * EC_y / 1000$$

- Equation 18, Land leakage:

$$\text{Land Leakage} = \text{Project activity land emissions} - \text{Baseline land emissions}$$

- Equation 19, Direct nitrous oxide (N_2O) emissions from land application:

$$N_2O_{land} = N_{ex} * N * (1-F_{gasm}) * EF_1 * C_m$$

- Equation 20, Indirect nitrous oxide (N_2O) emissions from runoff:

$$N_2O_{runoff} = N_{ex} * N * (1-F_{gasm}) * F_{leach} * EF_5 * C_m$$

- Equation 21, Indirect nitrous oxide (N_2O) emissions from ammonia volatilization:

$$N_2O_i = N_{ex} * N * EF_4 * F_{gasm} * C_m$$

- Equation 22, Total nitrous oxide (N_2O) emissions:

$$N_2O_{total} = (N_2O_{land} + N_2O_i + N_2O_{runoff}) / 1000$$

- Equation 23, Total nitrous oxide (N_2O) emissions in CO_2 equivalent:

$$N_2O_{CO2\text{-}equiv} = GWP_{N2O} * N_2O_{total}$$

- And, the following equation was used to sum the land application and electricity leakage:

$$L_o = EE_y + N_2O_{CO2\text{-}equiv}$$

D.2.4 Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Equations 24 and 26 from Approved Methodology AM0016 are used to determine project activity emission reductions:

- Equation 24, Total emissions in metric tonnes CO_2e:

$$Total\ Emissions_{mt} = CO_{2eq\ methane} + CO_{2equiv\ N2O}$$

- Equation 26, Net emission reductions:

$$ER_{net} = BE - PE - L_o$$

D.3 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored.

Data *(Indicate table and ID number, e.g., D.2-1, D.2-2)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.1-1	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.3-1	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-6	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.3-6	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-9	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.3-9	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-12	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-13	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-14	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.3.1-16	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.3.1-19	Low	Work instructions for the collection of this data point are available in O&M Manual

AgCert's monitoring and reporting plan has been developed under the organization's ISO 9001 and ISO 14001 Quality and Environmental Management System. Additionally, AgCert has been privileged to be afforded the opportunity to comment on draft ISO 14064, Guidelines for measuring, reporting, and verifying entity project-level GHG emissions and has applied the main concepts to its QC and QA procedures.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

AgCert has a trained staff located in the host nation to perform O&M activities including, but not limited to monitoring and collection of parameters, quality audits, personnel training, and equipment inspections. The associated O&M Manual has been developed to provide guidance (work instructions) to individuals that collect and/or process data. An AgCert employed "circuit rider" will routinely perform audits of farm operations personnel to ensure proper data collection and handling.

AgCert has designed and implemented a unique set of data management tools to efficiently capture and report data throughout the project lifecycle. On-site assessment (collecting Geo-referenced, time/date stamped data), supplier production data exchange, task tracking, and post-implementation auditing tools have been developed to ensure accurate, consistent, and complete data gathering and project implementation. Sophisticated tools have also been created to estimate/monitor the creation of high quality, permanent, ERs using IPCC formulae.

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

D.5 Name of person/entity determining the monitoring methodology:

AgCert International Limited determined the monitoring methodology for use at these project activities. AgCert International Limited is the project developer.

SECTION E. Estimation of GHG emissions by sources:

E.1 Estimate of GHG emissions by sources:

The **methane (CH_4)** emissions for the project activity were calculated using AM0016 equations 9, 10, and 11. Within these equations several key parameters and emission factors were utilized.

The **nitrous oxide (N_2O)** emissions for the project activity were calculated using Equations 13, 14, 15, and 16. Within these equations several key parameters and emission factors were utilized.

The **carbon dioxide (CO_2)** equivalent emissions (the extra power required for project equipment) for the project activity were calculated using Equation 17. Within this equation a coefficient factor was utilized.

The following is a project activity table of annual GHG emissions by source in CO_2 equivalents:

E1 - Project Activity Emissions				
Site	Source	GHG Emissions (CO_2e)		
		CH_4	N_2O	
1	Fazenda Quilombo	355	84	
2	Fazenda Vitória	125	30	
3	Fazenda Cinco Estrelas	59	14	
4	Granja Ressaca	3,032	715	
5	Fazenda Explanada	272	64	
6	Granja CFM	298	70	
7	Fazenda São Sebastião	1,054	249	
8	São Bernardo (Folhados)	2,207	521	
	Total:	7,402	1,747	**9,149** metric tonnes

E.2 Estimated leakage:

The leakage estimate for the project activity was calculated using Equations 17 to 23 from the *Emission Reductions* section of AM0016 and Section D.2.3.2 of this document.

Increased Power Consumption

Electrical demand as a consequence of the project activity is not expected to increase significantly. Additional electrical power will run low voltage sensors, and meters. The total power increase is expected to be less than 500 kWh/year, unless cogeneration is used. However power consumption will be monitored to determine if any leakage occurs as a result of the project activity.

Total Estimated Leakage Emissions

The following table gives the estimated project leakage:

E2 - Total Leakage Emissons										
Site	Source	GHG Emissions (CO_2e)								
		Baseline			Project			Change		
		CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2
	Land Application									
1	Fazenda Quilombo		478			478			0	
2	Fazenda Vitória		169			169			0	
3	Fazenda Cinco Estrelas		80			80			0	
4	Granja Ressaca		4,088			4,088			0	
5	Fazenda Explanada		367			367			0	
6	Granja CFM		402			402			0	
7	Fazenda São Sebastião		1,421			1,421			0	
8	São Bernardo (Folhados)		2,976			2,976			0	
	AWMS Electrical Power									
1	Fazenda Quilombo			0			0.36			0.36
2	Fazenda Vitória			0			0.36			0.36
3	Fazenda Cinco Estrelas			0			0.36			0.36
4	Granja Ressaca			0			0.36			0.36
5	Fazenda Explanada			0			0.36			0.36
6	Granja CFM			0			0.36			0.36
7	Fazenda São Sebastião			0			0.36			0.36
8	São Bernardo (Folhados)			0			0.36			0.36
							Total:			2.88	**3**

AWMS Electrical Power project leakage is calculated using emission factors from OECD: Road-Testing Baselines for GHG Projects in the Electric Power Sector, Table 3-1(c), p.19. As directed in the methodology, electrical leakage from project activity is offset by the "green" energy produced using the captured methane. The following table describes the calculation and was the basis for the figure used above for the *AWMS Electrical Power – Project - CO_2* parameter

Source per site	Est kwh consumed/produced per yr	kg CO2e emitted per kwh produced - Brazil	metric tonnes CO2e per site
Leakage	500	0.7190	0.3595
Green energy produced	0	0.2750	0
			0.3595

E.3 The sum of E.1 and E.2 representing the project activity emissions:

The total project emissions are given below as the sum of the totals provided in Sections E.1 and E.2:

E3 - Total Project Activity Emissions				
Source	GHG Emissions (CO_2e)			
	CH_4	N_2O	CO_2	
E1 - Project Emissions	7,402	1,747	0	
E2 - Leakage	0	0	3	
Total:	7,402	1,747	3	**9,152**

E.4 Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

The following sections describe the baseline emission calculations and the resulting emissions expressed in terms of CO_2 equivalents.

The baseline was calculated using Equations 9, 10 and 11 for methane emissions and Equations 13, 14, 15 and 16 for nitrous oxide emissions. These equations were customized from the *Emission Reductions* section of AM0016 and Section D.2.1.4 of this document. Within these equations several key parameters and emission factors were utilized.

E4 - Baseline Emissions					
Site	Source	GHG Emissions (CO_2e)			
		CH_4	N_2O		
1	Fazenda Quilombo	3,194	84		
2	Fazenda Vitória	1,129	30		
3	Fazenda Cinco Estrelas	532	14		
4	Granja Ressaca	27,288	715		
5	Fazenda Explanada	2,451	64		
6	Granja CFM	2,685	70		
7	Fazenda São Sebastião	9,486	249		
8	São Bernardo (Folhados)	19,866	521		
	Total:	66,631	1,747	**68,378**	metric tonnes

E.5 Difference between E.4 and E.3 representing the emission reductions of the project activity:

The project activity emission reductions are obtained by differencing the totals listed in Sections E.4 and E.3, as shown in the table that follows:

E5 - Total Project Activity Emission Reductions			
Source	GHG Emissions (CO_2e)		
E4 - Est. Baseline Emissions	68,378		
E3 - Project Activity Emissions	9,152		
Total:	59,226	**59,226**	metric tonnes

E.6 Table providing values obtained when applying formulae above:

Values for the parameters/factors used in the formulae in previous sections are listed with their sources and comments in the table that follows:

Table E1-1. Parameter/Factor Values and References

Parameter/Factor	Value	Source/Comment
	Baseline	
CH_4 GWP	21	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
ID1	Annex 3	Animal population used to estimate baseline and project emission estimates was based on a 12 month period of actual operation production data (See Annex 3).
ID1	Annex 3	Mortality rate
ID1 (n_m)	Annex 3	Days resident in system
ID14	100%	AWMS operation status
MS%j	100%	Percent of effluent used in system.
V_S	0.5	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
B_o	0.45	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
MCF_{month}	0.90	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
N_2O GWP	310	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
C_m	1.5714	Conversion factor from [N_2O – N] to N_2O (Cm=44/23)
F_{gasm}	0.2	Obtained from 1996 IPCC, Table 4-19, p. 4.94
EF_3	0.001	Obtained from IPCC 2000 Table 4.12, Section 4.4.1.2, p. 4.43
EF_4	0.01	Obtained from IPCC 2000 Table 4.18 Section 4.8.1.2, p. 4.73
N_{ex}	20	Obtained from 1996 IPCC, Table 4-20, p. 4.99
	Project Activity	
CH_4 GWP	21	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
ID1	Annex 3	Animal population used to estimate baseline and project emission estimates was based on a 12 month period of actual operation production data (See Annex 3).
ID1	Annex 3	Mortality rate
ID1 (n_m)	Annex 3	Days resident in system
ID14	100%	AWMS operation status
MS%j	100%	Percent of effluent used in system
V_S	0.5	Obtained from 1996 IPCC Appendix B, Table B-6, p. 4.46

Parameter/Factor	Value	Source/Comment
ID1		Days resident in farm
B_o	0.45	Obtained from 1996 IPCC, Appendix B, Table B6, p. 4.46
MCF_{month}	0.10	Obtained from 1996 IPCC Appendix B, Table B-6, p. 4.46
N_2O GWP	310	Intergovernmental Panel on Climate Change, *Climate Change* *Change* (Cambridge*1995: The Science of Climate*, UK: Cambridge University Press, 1996)
C_m	1.5714	Conversion factor from [N_2O – N] to N_2O (Cm=44/23)
F_{gasm}	0.2	Obtained from 1996 IPCC, Table 4-19, p. 4.94
EF_3	0.001	Obtained from IPCC 2000 Table 4.12, Section 4.4.1.2, p. 4.43
EF_4	0.01	Obtained from IPCC 2000 Table 4.18 Section 4.8.1.2, p. 4.73
N_{ex}	20	Obtained from 1996 IPCC, Table 4-20, p. 4.99
Leakage		
N_{ex}	20	Obtained from 1996 IPCC, Table 4-20, p. 4.99
ID1	Annex 3	Animal population used to estimate baseline and project emission estimates was based on a 12 month period of actual operation production data (See Annex 3).
ID1	Annex 3	Mortality rate
ID1 (n_m)	Annex 3	Days resident in system
F_{gasm}	0.2	Obtained from IPCC 1996, Table 4-19, p. 4.94
EF_1	0.0125	Obtained from IPCC 1996, Table 4-18, p. 4.39
C_m	1.5714	Conversion factor from [N_2O – N] to N_2O (Cm=44/23)
F_{leach}	0.3	Obtained from IPCC 1996, Table 4-24, p. 4.106
EF_5	0.025	Obtained from IPCC 1996, Table 4-23, p. 4.105
EF_4	0.01	Obtained from IPCC 2000 Table 4.18 Section 4.8.1.2, p. 4.73
ID16	500 kwh/yr	Electricity consumed by project activity equipment
ID19	90,000kwh/yr	Electricity generated by project activity equipment using captured methane
ECy	0.719kg CO2 / kwh	OECD: Road-Testing Baseline for GHG Projects in the Energy Power Sector. Emission coefficient for electricity (Consumed by Project Activity Equipment)
ECy	0.275kg CO2 / kwh	OECD: Road-Testing Baseline for GHG Projects in the Energy Power Sector. Emission coefficient for electricity (Produced by Project Activity Generator)

Table E1-2. Uncertainty Parameters

Uncertainty Parameter for the eight sites GHG Mitigation Project Estimates	
Uncertainty:	**How Addressed:**
o Data collection inaccuracies o Animal type o Animal population, group/type, mortality rates o Genetics o Choice of appropriate emission coefficients. o Data security o Animal health	o Accurate data collection is essential. The eight sites use a standardized industry database package which captures a wide range of incremental production data to manage operations and enable the farm to maximize both productivity and profitability. AgCert uses some data points collected via this system. o AgCert employed the emission factor determination test to assist in the selecting of appropriate IPCC "developed" or "developing" country values. o AgCert has a rigorous QA/QC system that ensures data security and data integrity. AgCert performs spot audits of data collection activities. o Lastly, AgCert has a data management system capable of interfacing with producer systems to serve as a secure data repository. Project activity data related uncertainties will be reduced by applying sound data collection quality assurance and quality control procedures. o Strict bio-security procedures are observed and adhered to.

SECTION F. Environmental impacts:

F.1 Documentation on the analysis of the environmental impacts, including transboundary impacts:

There are no negative environmental impacts resulting from the proposed project activity.

Beyond the principal benefit of mitigating GHG emissions (the primary focus of the proposed project), the proposed activities will also result in positive environmental co-benefits. They include:

- Reducing atmospheric emissions of Volatile Organics Compounds (VOCs) that cause odour,
- Reducing the risk of releasing disease-transmitting vectors and airborne pathogens.

The combination of these factors will make the proposed project sites more "neighbour friendly."

F.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:

All of the impacts on the environment are considered to be significantly positive.

SECTION G. Stakeholders comments

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

AgCert invited stakeholders to a meeting to explain the UNFCCC CDM process and proposed project activity. Representatives from the local community as well as the State of Minas Gerais were also invited. Invitations were sent to selected individuals via post and electronic mail on July 6, 2004. A listing of those individual is available upon request. Further, a public notification regarding the meeting was published in four local and state newspapers in Minas Gerais:

1) *Estado de Minas*, Minas Gerais (state), July 17, 2004

2) *CORREIO*, Uberlândia – MG, July 10, 2004

3) *Patrocínio Hoje*, Patrocínio – MG, July 15, 2004

4) *Folha Patense*, Patos de Minas – MG, July 17, 2004

The meeting took place on July 21, 2004, at the Hotel Antares in Patos de Minas, Minas Gerais, Brazil. A slide presentation was given in Portuguese by Michael Mirda, AgCert and attendees were afforded the opportunity to ask questions and provide comments. Included in the attendee list was the Uberlândia Secretary of Environment and Sustainable Development.

On other occasions, representatives from AgCert also met with and explained project details to local and state government officials including:

- On 12/02/04, George Bolton spoke to members of the Swine Producers Association of Minas Gerais (ASSEMG). The Secretary Environment and Sustainable Development of Minas Gerais, José Carlos Carvalho, who was already aware of the initiative and in attendance, commented on the project and sent AgCert a letter of support suggesting that the project is a "pioneering environmental management model."

- On 02/03/04, John McMorris and George Bolton met with the Mayor of Patos de Minas, José Humberto Soares who expressed his strongest support.

- Michael Mirda performed an interview for NPV, the local television network to discuss the CDM project activity.

G.2 Summary of the comments received:

No negative issues were raised by local stakeholders. Comments voiced by individuals were positive and supporting of the project activity.

One attendee, José Mauricio de O. Pádua, who is knowledgeable about the carbon market and has performed seven presentations on Kyoto and CDM throughout Brazil, commented that AgCert's methodology for grouping various farms into one project is wonderful and that signing contracts with individual producers is in line with Brazilian needs. Another, Bertholdino Apolonio Teixeira Jr., stated that the project provides not just the benefits of reducing GHG, but also the opportunity to take advantage of the biogas and produce some sort of energy, as well as obtaining other environmental co-benefits. A complete listing of the comments and the individuals who made them is on file. The above comments were translated into English by AgCert.

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

Overall, positive feedback on the project activity was received from all participants. The group pledged their support and offered to assist if needed in the facilitation and completion of the project.

ANNEX 1.

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Participant:	
Organization:	Agcert do Brasil Soluções Ambientais Ltda.
Street/P.O. Box:	R. Alexandre Dumas, 2100 - 11th andar – cj 112
Building:	
City:	Chácara Santo Antônio
State/Region:	São Paulo
Postfix/ZIP:	04717-004
Country:	Brasil
Telephone:	+55 11 5185-5542
FAX:	
E-Mail:	
URL:	www.Agcert.com
Represented by:	David Lawrence
Title:	Project Coordinator
Salutation:	
Last Name:	Lawrence
Middle Name:	
First Name:	David
Department:	
Mobile:	+55 11 9283-3347
Direct FAX:	
Direct tel:	+55 11 5185-5542
Personal E-Mail:	dlawrence@agcert.com

ANNEX 2.

INFORMATION REGARDING PUBLIC FUNDING

The implementation of this project is not dependent on any Official Development Assistance resource or any other resources from any international development-funding agency.

ANNEX 3.

BASELINE INFORMATION

Site 1 (Fazenda Quilombo) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	2,825	2,850	2,893	2,857	2,892	2,838	2,864	2,812	2,840	2,870	2,858	2,842
Mortalities	21	19	17	30	25	25	22	23	28	25	23	26
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	167	168	160	165	140	158	139	163	176	154	168	214
Mortalities	10	10	7	8	6	7	7	7	7	7	7	7
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	38	38	38	38	38	36	37	36	39	40	39	40
Mortalities	0	0	1	0	0	0	1	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Site 2 (Fazenda Vitória) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,053	1,071	1,078	987	994	1,009	1,035	1,029	1,025	1,046	1,048	1,063
Mortalities	12	16	12	11	10	6	3	6	7	3	5	3
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	60	37	32	37	42	55	15	13	4	32	44	55
Mortalities	0	0	0	0	0	0	0	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	11	11	11	10	10	9	10	9	7	9	9	8
Mortalities	0	0	0	0	0	0	0	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Site 3 (Fazenda Cinco Estrelas) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	454	465	459	446	455	457	453	451	450	451	450	446
Mortalities	12	11	7	10	10	0	5	3	3	19	7	21
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	66	47	51	50	32	42	54	44	62	54	65	81
Mortalities	0	0	0	0	0	0	0	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Site 4 (Granja Ressaca) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	2,477	2,484	2,515	2,309	2,357	2,385	2,444	2,422	2,463	2,462	2,458	2,479
Mortalities	45	23	37	19	32	41	26	42	38	30	47	36
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	554	528	464	416	367	326	328	309	309	350	458	557
Mortalities	2	3	2	4	2	3	1	1	2	4	3	3
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	28	27	29	23	25	25	25	25	26	27	28	28
Mortalities	1	0	0	0	0	1	0	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	16,955	17,634	17,315	18,070	18,343	17,545	17,036	17,271	16,294	16,612	16,511	16,721
Mortalities	86	57	64	39	50	61	58	77	74	65	92	71
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	6,480	6,027	6,324	5,597	5,068	5,323	5,563	5,923	7,156	6,520	6,645	6,423
Mortalities	59	47	74	66	97	76	63	77	60	53	76	62
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Site 5 (Fazenda Esplanada) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	2,203	2,218	2,170	2,163	2,208	2,240	2,231	2,256	2,256	2,254	2,244	2,273
Mortalities	24	13	16	11	17	9	14	15	15	12	10	6
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	78	78	84	122	100	100	100	100	100	100	100	100
Mortalities	1	0	0	1	0	0	1	0	0	1	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	17	17	17	18	33	33	32	32	29	30	30	33
Mortalities	1	0	0	0	1	0	0	0	0	1	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Site 6 (Granja CFM) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	2,438	2,434	2,462	2,490	2,476	2,480	2,427	2,441	2,453	2,487	2,499	2,476
Mortalities	14	14	24	13	10	14	15	14	14	18	19	19
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	82	124	136	92	106	92	82	82	82	82	80	82
Mortalities	1	1	1	1	1	1	1	1	1	1	1	1
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	13	13	13	14	13	13	12	12	12	24	28	30
Mortalities	1	0	0	0	1	0	0	1	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Site 7 (Fazenda São Sebastião) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	996	989	996	989	1,092	1,070	1,063	1,038	1,026	1,004	983	1,021
Mortalities	2	18	4	8	5	9	8	16	4	3	4	3
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	70	40	50	60	105	107	106	104	103	100	90	82
Mortalities	0	0	0	0	0	0	0	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3	2	1	6	6	6	6	5	5	5	4	3
Mortalities	0	0	0	0	0	0	0	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	5,850	5,600	5,568	5,602	4,959	4,900	4,940	4,865	5,240	5,196	4,930	6,080
Mortalities	44	49	39	34	52	36	29	48	58	56	27	39
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	2,960	2,802	2,800	2,832	2,474	2,456	2,470	2,431	2,619	2,600	2,465	3,044
Mortalities	27	24	22	17	26	31	27	27	20	28	17	22
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Site 8 (São Bernardo (Folhados)) Baseline Information

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,922	2,019	2,012	1,668	1,717	1,713	1,711	1,701	1,706	1,738	1,790	1,861
Mortalities	2	5	3	3	2	3	9	1	8	6	1	6
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	130	130	130	130	130	130	130	130	130	130	130	130
Mortalities	0	0	0	0	0	0	0	0	0	0	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	23	23	20	23	26	29	24	22	22	24	20	23
Mortalities	0	0	0	1	0	0	0	0	0	1	0	0
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	12,602	12,709	12,415	10,775	11,090	10,934	10,582	10,556	10,736	11,588	11,998	12,518
Mortalities	42	47	56	67	72	78	34	64	58	41	42	68
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	5,438	4,940	5,818	5,190	4,439	5,011	5,476	5,252	6,189	6,168	5,774	6,040
Mortalities	147	164	201	175	185	222	267	243	266	241	205	204
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

ANNEX 4.

MONITORING PLAN

The project developer, in conjunction with its in-country suppliers/partners, have developed an operation and maintenance (O&M) plan and have reviewed the plan with the producer (Attachment 1). The plan lists operation and maintenance requirements including but not limited to:

a. A description of the planned start-up procedures, normal operation, safety issues, and normal maintenance items.

b. Alternative operation procedures in the event of equipment failure.

c. Instructions for safe use and/or flaring of biogas.

d. Inspection criteria

e. Work instructions for the measurement and recording of key GHG parameters, e.g., animal counts, mortalities, days in system, etc., as well as instructions for quality control measurements and other information collection, as appropriate.