AWMS GHG Mitigation Project BR05-B-03, Brazil

UNFCCC Clean Development Mechanism
Project Design Document

Document ID: BR05-B-03

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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

AWMS GHG Mitigation Project BR05-B-03, 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 Mato Grasso do Sol, 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:

According to Brazil's *Inter-Ministerial Commission on Global Climatic Change,*[1] manure management is an important issue that needs to be solved. Failure to do so will allow existing problems (e.g., 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 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.[2]

---

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

[2] 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

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.[3] In 2003, the swine population in Mato Grosso do Sul, Mato Grosso, Goias, and Minas Gerais was approximately 6,799,000.[4] Considering that a typical hog produces 5.8 kilograms of effluent daily (Table A1), annually some 14 million metric tons of hog waste is produced in these states alone. Introducing progressive AWMS practices throughout the region could result in an annual reduction of over 6.5 million tonnes[5] of carbon dioxide equivalent (CO_2e) annually.

Table A1. Daily production of effluent by type of porcine[6]

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.[7]

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.[8] 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.

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 –

[3] Anaulpec, 2001

[4] http://www.agricultura.gov.br/pls/portal/docs/PAGE/MAPA/ESTATISTICAS/PECUARIA/3.4.XLS, March 2003

[5] Approximate calculation using IPCC model and emission factors

[6] Kruger I, Taylor G, Ferrier M (eds) (1995) 'Australian pig housing series: effluent at work' (NSW Agriculture: Tamworth). Another outstanding reference for manure output is: Lorimor, Powers, et.al "Manure Characteristics", Manure Management Series, MWPS-18, Section 1; pg 12.

[7] 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.

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

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 by 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.

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:

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 states of Mato Grosso do Sul, Mato Grosso, Goias, and 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):

COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense has three sites associated with this project activity located in Mato Grosso.

- COOAGRIL - UPD 1, UPD 2 and Multiplicadora is a sow/guilt only site with approximately 3,800 animals dispersed in 23 containment areas that has a capacity of over 6,000 animals. The site uses three open lagoons, one primary, one secondary, and one tertiary.
- COOAGRIL UPL - 3 e UT 3 is a farrow-to-finish operation with approximately 8,700 total animals spread throughout 23 containment areas. The farm has a total 1-time capacity of over 11,000 animals and uses 5 open lagoons as the manure management system, one primary, one secondary, and three tertiary.
- Fazenda Nadin is a finisher operation that houses just over 5,500 animals in 5 containment areas and has a total 1-time capacity of about 6,000 animals. It has one primary open lagoon and one secondary open lagoon.

COOASGO has ten farms associated with this project activity in and around the Mato Grosso do Sul area.

- Fazenda Alvorada is a farrow-to-finish operation with a total of approximately 3,900 total animals. There are nine containment areas that use two primary open lagoons, three lagoons were constructed, but never used. Two additional lagoons are full and no longer used.
- Fazenda Brejao is an approximately 750 sow farrowing operation. There are 16 total containment areas that can house up to 12,600 animals and uses four primary open lagoons as its manure management system.
- Fazenda Belvedere is a farrow-to-finish operation with an average inventory of about 1,285 total animals. Five containment areas can house up to 3,290 animals throughout the various stages of production. The site has four open lagoons; one primary, one secondary, and two tertiary.
- Fazenda Monte Azul is a farrow-to-finish operation with an average of approximately 1,750 sow. The farm has 46 containment areas to house the large population of animals throughout the various stages of production. The farm has one large primary open lagoon, one secondary open lagoon and four tertiary lagoons to handle the manure.
- Fazenda Ponto Alto is a farrow-to-finish operation of about 900 sows. There are 13 containment areas that can house up to 12,300 animals. Four open lagoons are used to handle the effluent produced, one primary, one secondary, and two tertiary.
- Fazenda Rancho Alegre is a farrow-to-finish operation with an average of approximately 1,500 sows. The site consists of 18 containment areas that have a capcity of over 14,500 total animals. The effluent from these areas is fed into three open lagoons.
- Fazenda Santa Cruz is a farrow-to-finish site with over 6,500 total animals. The site's 12 containment areas can house up to 8,600 animals and feed into five open lagoons.
- Suinocultura Jeroa Ltda is a large farrow-to-finish operation with 20 containment areas that can house close to 25,000 animals. Effluent from these containment areas are fed into 3 large open lagoons.

- Suinoeste I is an average 1,250 sow, farrowing operation that also houses a large number of nurser swine. The 12 containment facilities can house approximately 6,600 total animals. The farm uses four open lagoons to process the effluent produced by the operation.
- Suinoeste II is the farm that houses a majority of the finishers produced by Suinoeste I. Suinoeste II's containment areas, which can house over 10,500 animals, use four open lagoons as their waste management system.

Fazenda Sao Luiz II is an average 500 sow, farrow-to-finish operation with 13 total containment areas with a capacity of just under 5,500 total animals. The effluent from these facilities run into 4 open lagoons.

Granja Coopermutum is a large farrowing operation that also houses close to 10,000 nursers. The farms 25 containment areas can accommodate over 17,000 animals whose effluent feeds into five open lagoons.

Fazenda Monte Alegre is a farrowing operation with approximately 1,100 sows. Five containment areas can house over 4,800 animals. One of the containment areas houses up to 3,570 nursers. Three open lagoons are used to process effluent from this CAFO.

Fazenda Paraíso, whose legal entity is José Ricardo Brandão Martins, is located in Minas Gerais. This average 650 sow, farrow-to-finish operation has 17 containment facilities and is capable of housing over 8,000 animals. The site uses three open lagoons to manage its animal waste.

Fazenda Paraíso, whose legal entity is Luis Claudio Magalhães de Carvalho, consists of two sites (Sitio 1 & 2) and is a finisher operation of approximately 7,500 animals located outside of Jatai, Goiás. The farm has 8 containment areas with a total capacity of about 8,000 animals. The two sites combined currently use six open lagoons for its AWMS.

Fazenda Paraíso, whose legal entity is Vanessa Magalhães de Carvalho, consists of two sites (Sitio 1 & 2) is a finisher operation of approximately 7,300 animals also located outside of Jatai, Goiás. The farm has 8 containment areas with a total capacity of about 7,600 animals. The two sites combined currently use six open lagoons for its AWMS.

Fazenda Rio Doce - Talhado e Talhado is a finisher operation owned by Diniz Vanz. There are approximately 3,500 animals in 4 containment areas with a total capacity of 3,640 animals. There are two open lagoons.

Fazenda Rio Doce Talhado is a finisher operation owned by Orestes Vanz. There are approximately 3,500 animals in 4 containment areas with a total capacity of 3,640 animals. This site shares four open lagoons with Fazenda Rio Doce Talhado e Talhado which is owned by Dirceu Vanz.

Fazenda Rio Doce Talhado e Talhado is a finisher operation owned by Dirceu Vanz. There are approximately 3,500 animals in 4 containment areas with a total capacity of 3,640 animals. This site shares four open lagoons with Fazenda Rio Doce Talhado which is owned by Orestes Vanz.

Fazenda São Tomaz Cachoeirinha, whose legal entity is Adecir Cardozo da Silva, is located near Rio Verde, Goiás. It is a finisher operation of approximately 4,000 animals divided amongst 4 containment areas with a total capacity of 4,080 head. There are 3 primary open lagoons associated with this farm.

Fazenda São Tomaz Cachoeirinha, whose legal entity is Luiz Cardozo da Silva, is located near Rio Verde, Goiás. It is a finisher operation of approximately 4,000 animals divided amongst 4 containment areas with a total capacity of 4,080 head. There are 4 open lagoons associated with this farm.

Fazenda São Tomaz Cachoeirinha, whose legal entity is Cledson Niomar Cardozo da Silva, is located near Rio Verde, Goiás. It is a finisher operation of approximately 4,000 animals divided amongst 4 containment areas with a total capacity of 4,080 head. There are 4 open lagoons associated with this farm.

Fazenda São Tomaz Paraíso do Rio Preto is owned by Vilson Luis Miola and is located near Rio Verde, Goiás. It is a finisher operation with approximately 4,000 animals. Eight containment areas have a capacity 8,000 animals. This farm currently uses 4 open lagoons to manage its manure.

Fazenda São Tomaz Paraíso do Rio Preto is owned by Elcy Miola Pavim and is located near Rio Verde, Goiás. It is a finisher operation with approximately 4,000 animals. Four containment areas have a capacity of the same. This farm currently shares the 4 open lagoons with the Vilson Luis Miola Fazenda São Tomaz Paraíso do Rio Preto farm described above.

Granja CAS, whose owner is Carlos Alberto Segalin, is a finishing operation with approximately 3,500 animals. Its 4 containment areas can house up to 3,600 animals, whose effluent is fed into 3 open lagoons.

Granja Cas, whose legal entitiy is Claiton Antonio Segalin, is a finishing operations with about 3,500 animals. Its 3 open lagoons currently accommodate 4 containment areas with a capacity of 3,600 animals.

Fazenda Ana Bela is a farrow-to-finish operation with approximately 4,000 total animals throughout the various stages of production. The farm's 9 containment areas have a total capacity of over 6,800 animals and use 3 open lagoons to process its waste.

Fazenda Texas is a finishing operation with approximately 4,000 finishers. The two containment areas have a total capacity of 4,400 animals and uses 2 open lagoons.

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

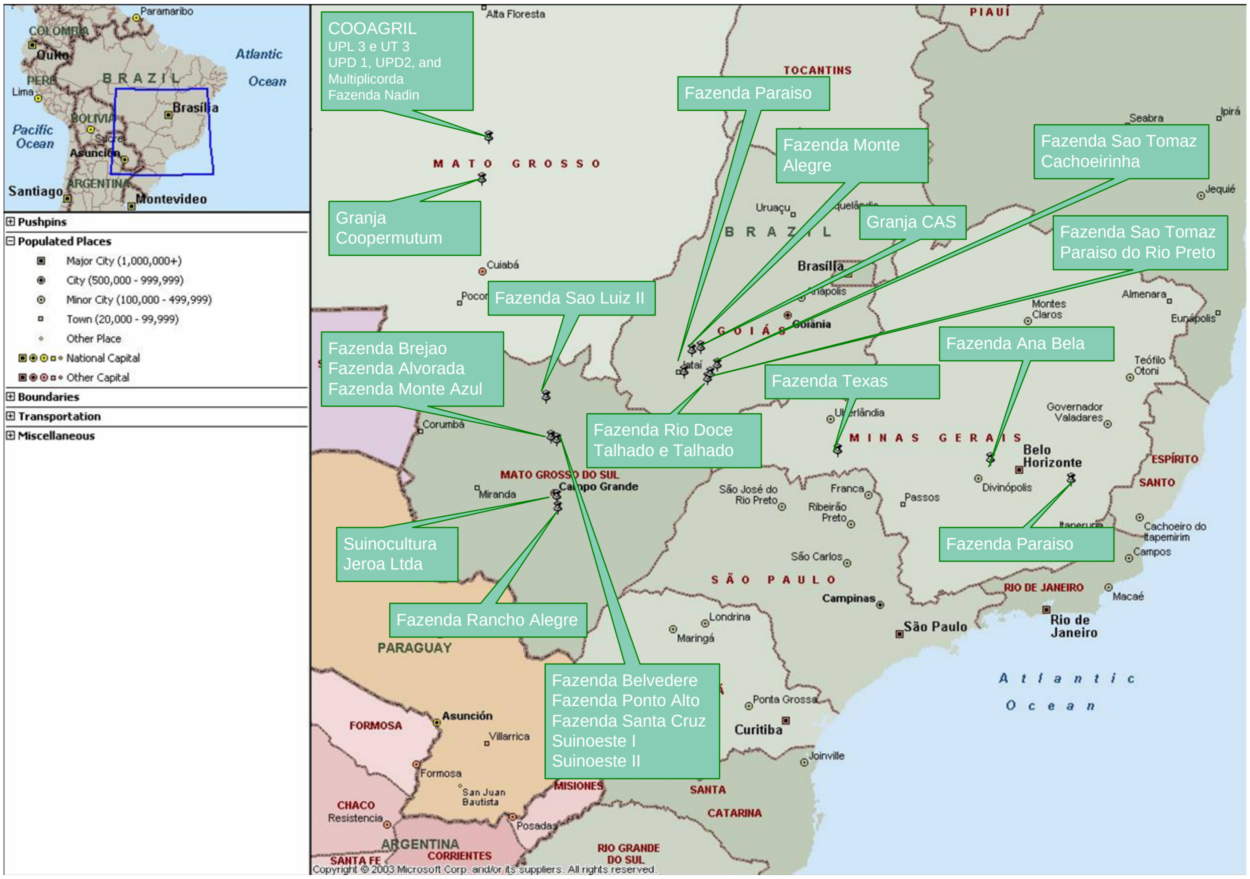


Figure A1. States Goias, Minas Gerais, Mato Grosso, and Mato Grosso do Sul, Brazil project activity sites

Table A2. Detailed physical location and identification of project sites

Farm/Site Name	Address	Town/State	Contact	Phone	GPS	Animal Category
COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense	Lote 1 Quadra 6 - Setor Industrial	Lucas do Rio Verde, Mato Grosso, 78455	Paulo Franz	+55.65.5491389		Main Office
COOAGRIL UPL - 3 e UT 3	Estrada Municipal Dona Frida, s/n, Zona Rural	Sorriso, Mato Grosso, 78455	Paulo Franz	+55.65.5491389	12.85 S 55.87 W	Swine, F-F
COOAGRIL - UPD 1, UPD 2 and Multiplicadora	Lote 1 Quadra 6 - Setor Industrial	Lucas do Rio Verde, Mato Grosso, 78455	Paulo Franz	+55.65.5491389	12.97 S 55.93 W	Swine, Sow
Fazenda Nadin	Linha 1, Setor 4, Lote 51, s/n Zona Rural	Lucas do Rio Verde, Mato Grosso, 78455	Clair Nadin	+55.65.5494748	12.82 S 56.04 W	Swine, Finishers
COOASGO	Rodovia BR 163 Km 609	Sao Gabriel do Oeste, Mato Grosso do Sul, 79490	João Almeida	+55.67.2951201		Main Office
Fazenda Alvorada	Estrada Reta Velha Sentido Rio Negro - Km14	Sao Gabriel do Oeste, Mato Grosso do Sul, 79490	Balduino Maffissoni	+55.67.2951261	19.34 S 54.67 W	Swine, F-F
Fazenda Brejao	Reta Velha, Km 12			+55.67.6822005	19.36 S 54.66 W	Swine, F-F
Fazenda Belvedere	Estrada para Areado sentido Santa Cecília	Sao Gabriel do Oeste, Mato Grosso do Sul, 79490	Valmor P. Brum	+55.67.2951416	19.30 S 54.52 W	Swine, F-F
Fazenda Monte Azul	BR 163, km 641.	Sao Gabriel do Oeste, Mato Grosso do Sul, 79490	José Pinesso	+55.67.2955018	19.25 S 54.72 W	Swine, F-F
Fazenda Ponto Alto	Reta Velha	Sao Gabriel do Oeste, Mato Grosso do Sul, 79490	Angelo Brizot	+55.67.2951117	19.48 S 54.58 W	Swine, F-F

Farm/Site Name	Address	Town/State	Contact	Phone	GPS	Animal Category
Fazenda Rancho Alegre	Rodovia BR 163 Km 342, 7 km a direita	Campo Grande, Mato Grosso do Sul, 79004-190	Arão Antônio Morais	+55.67.3823172	20.88 S 54.55 W	Swine, F-F
Fazenda Santa Cruz	Estrada para Areado/Ponte Vermelha	Sao Gabriel do Oeste, Mato Grosso do Sul, 79490	Zélio Pessato	+55.67.2951647	19.54 S 54.43 W	Swine, F-F
Suinocultura Jeroa Ltda	BR 163, Km 45	Campo Grande, Mato Grosso do Sul, 75064	Levy Dias	+55.67.3251107	20.64 S 54.57 W	Swine, F-F
Suinoeste I	BR 163 km 609	Sao Gabriel do Oest Mato Grosso do Sul, 79490	Sérgio Luiz Marcon	+55.67.2953198	19.42 S 54.54 W	Swine, Farrowing
Suinoeste II	BR 163 estrada Reta Velha/Ponto Alto				19.53 S 54.56 W	Swine, Finishers
Fazenda Sao Luiz II	Estrada para Alcinópolis km 50 à direita + 12km	Coxim, Mato Grosso do Sul, 79490	Luiz João Faccin	+55.67.6832019	18.45 S 54.31 W	Swine, F-F
Granja Coopermutum	BR 163 km 596	Nova Mutum, Mato Grosso, 78450	Valdomir Natal Ottonelli	+55.65.3081512	13.74 S 56.06 W	Swine, Farrowing
Fazenda Monte Alegre	Rodovia GO 174, Km 20, Zona Rural	Rio Verde, Goiás, 75900	José Antonio Nogueira Junior	+55.64.6202500	17.54 S 51.42 W	Swine, Farrowing
Fazenda Paraíso	Estrada Piedade de Ponte Nova, 03 km da cidade sentido Viçosa	Piedade de Ponte Nova, Minas Gerais, 35382	José Ricardo Brandão Martins	+55.31.3871 5112	20.23 S 42.74 W	Swine, F-F
Fazenda Paraíso Sitio 1 & 2 (Carvalho)	Rodovia BR 364, Km 173, Zona Rural	Jatai, Goiás, 75800	Luis Claudio Magalhães de Carvalho	+55.64.6319171	18.02 S 51.60 W	Swine, Finishing
Fazenda Paraíso Sitio 1 & 2			José Parassu de Carvalho Neto		18.01 S 51.60 W	Swine, Finishing
Fazenda Rio Doce - Talhado e Talhado	Rodovia GO 174, Km 35, Zona Rural	Rio Verde, Goiás, 75900	Diniz Vanz	+55.64.6139033	18.16 S 51.08 W	Swine, Finishing

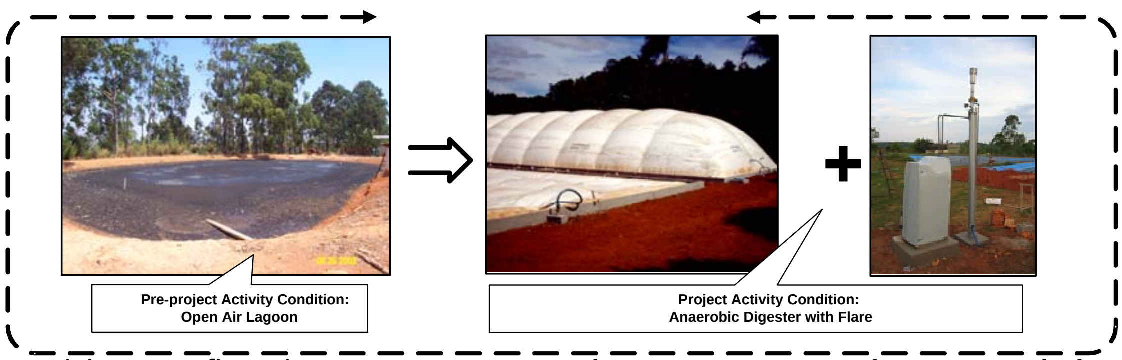
Farm/Site Name	Address	Town/State	Contact	Phone	GPS	Animal Category
Fazenda Rio Doce Talhado			Orestes Vanz	+55.64.6139356	18.16 S 51.08 W	Swine, Finishing
Fazenda Rio Doce Talhado e Talhado			Dirceu Vanz	+55.64.6139369	18.16 S 51.08 W	Swine, Finishing
Fazenda São Tomaz Cachoeirinha	Rodovia BR 452, Km 09, Zona Rural	Rio Verde, Goiás, 75900	Cledson Niomar Cardozo da Silva	+55.64.6220924	17.88 S 50.85 W	Swine, Finishing
Fazenda São Tomaz Cachoeirinha			Luiz Cardozo da Silva		17.88 S 50.84 W	Swine, Finishing
Fazenda São Tomaz Cachoeirinha			Adecir Cardozo da Silva		17.87 S 50.84 W	Swine, Finishing
Fazenda São Tomaz Paraíso do Rio Preto	Rodovia GO 174, Km 36, Zona Rural	Rio Verde, Goiás, 75900	Vilson Luis Miola	+55.64.6220645	18.05 S 51.02 W	Swine, Finishing
Fazenda São Tomaz Paraíso do Rio Preto			Elcy Miola		18.05 S 51.01 W	Swine, Finishing
Granja CAS	Estrada Municipal Paraúna, Km 11.8, Zona Rural	Montividiu, Goiás, 75915	Carlos Alberto Segalin	+55.64.6214299	17.49 S 51.23 W	Swine, Finishing
GRANJA CAS	Estrada Municipal Parauna, Rod GO 174, Km 50, Zona Rural		Claiton Antonio Segalin		17.49 S 51.23 W	Swine, Finishing
Fazenda Ana Bela	Rodovia MG 352, km 11 - Povoado dos Gorduras	Pará de Minas, Minas Gerais, 35660	Marcelo Gomes de Araújo	+55.37.32370193	19.82 S 44.65 W	Swine, F-F
Fazenda Texas	Rodovia Uberaba/Campo Florido	Uberaba, Minas Gerais, 38010	Luzineth Podboy	+55.34.33333340	19.72 S 48.13 W	Swine, Finishing

A.4.2 Category(ies) of project activity:

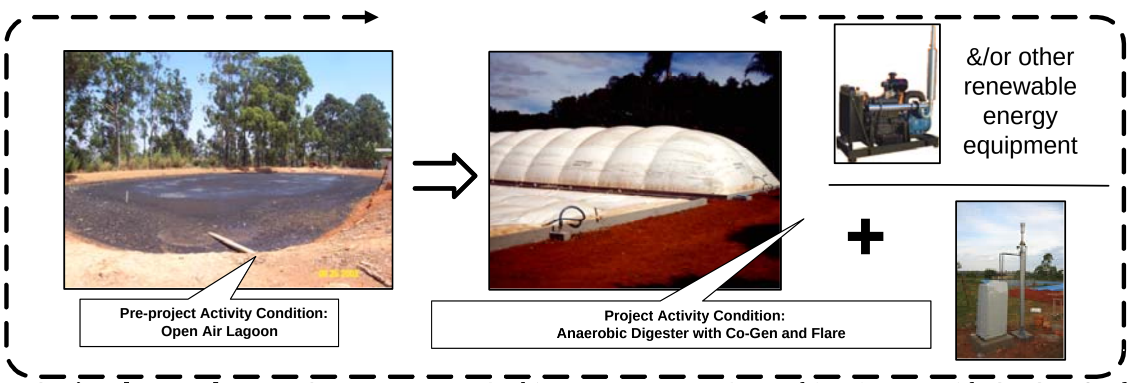
The category of the project activity is in Sectoral Scope 13 - Waste Handling and Disposal, and Sectoral Scope 15 – Agriculture.

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 one or more cells with sufficient capacity to create an adequate Hydraulic Retention Time (HRT). The digester's size will be based on each farm's potential animal capacity. 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. Processed effluent from the lagoon cells will be routed to the clarification lagoon(s) and captured gas will be routed to a flare and/or other renewable energy equipment (e.g., heaters) to be 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 other renewable energy systems to produce on-farm electricity and/or heat, using methane produced by the covered cells as fuel. The minimum configuration flare is retained to burn methane not required by the other renewable energy equipment.

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)[9], 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 generator size. Analysis indicated an average unit sizing of 62 KVA of energy.

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/services 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 host country.

By working so 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

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

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.[10] 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[11] of Brazilian Agricultural Research Corporation (EMBRAPA)[12] 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).

---

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

[11] 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

[12] 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:

THE TOTAL ESTIMATE OF EMISSIONS REDUCTION OVER THE 10 YEAR PROJECT PERIOD IS 1,820,790 TONNES OF CO_2 EQUIVALENT (182,079 ANNUALLY)

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; and
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.[13]
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 country, excluding the discharge of manure into natural resources (e.g., rivers or estuaries).

[13] 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.

6. On-farm project systems introduce AWMS practice and technology changes to reduce GHG emissions.
7. The project farm systems reduce GHG emissions due to the AWMS improvements.
8. The project farm 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.

Table B1. Data Characterization

Site	AWPS		AWMS				Other	
	Animal Category	Genetics Source	Base-line	#	Project	#	Region - Climate	Population Data
COOAGRIL UPL - 3 e UT 3	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
COOAGRIL - UPD 1, UPD 2 and Multiplicadora	Swine	Annex I Country	Lagoon	5	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Nadin	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Alvorada	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America – Temperate	See Annex 3
Fazenda Brejao	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Belvedere	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America – Temperate	See Annex 3
Fazenda Monte Azul	Swine	Annex I Country	Lagoon	6	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Ponto Alto	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Rancho Alegre	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3

Site	AWPS		AWMS				Other	
	Animal Category	Genetics Source	Base-line	#	Project	#	Region - Climate	Population Data
Fazenda Santa Cruz	Swine	Annex I Country	Lagoon	5	Anaerobic Digester	1	Latin America – Temperate	See Annex 3
Suinocultura Jeroa Ltda	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Suinoeste I	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America – Temperate	See Annex 3
Suinoeste II	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Sao Luiz II	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America – Temperate	See Annex 3
Granja Coopermutum	Swine	Annex I Country	Lagoon	5	Anaerobic Digester	1	Latin America – Temperate	See Annex 3
Fazenda Monte Alegre	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Paraíso (José Martins)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Paraíso Sitio 1 (Luiz Carvalho)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Paraíso Sitio 2 (Luiz Carvalho)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Paraíso Sitio 1 (Vanessa Carvalho)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Paraíso Sitio 2 (Vanessa Carvalho)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3

<table>
<tr><th rowspan="2">Site</th><th colspan="2">AWPS</th><th colspan="4">AWMS</th><th colspan="2">Other</th></tr>
<tr><th>Animal Category</th><th>Genetics Source</th><th>Base-line</th><th>#</th><th>Project</th><th>#</th><th>Region - Climate</th><th>Population Data</th></tr>
<tr><td>Fazenda Rio Doce - Talhado e Talhado (Diniz Vanz)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>2</td><td rowspan="3">Anaerobic Digester</td><td>1</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda Rio Doce Talhado (Orestes Vanz)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td rowspan="2">4</td><td rowspan="2">1</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda Rio Doce Talhado e Talhado (Dirceu Vanz)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda São Tomaz Cachoeirinha (Adecir Silva)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>3</td><td rowspan="3">Anaerobic Digester</td><td rowspan="3">2</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda São Tomaz Cachoeirinha (Luiz Silva)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>4</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda São Tomaz Cachoeirinha (Cledson Silva)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>4</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda São Tomaz Paraíso do Rio Preto (Vilson Miola)</td><td>Swine</td><td>Annex I Country</td><td rowspan="2">Lagoon</td><td rowspan="2">4</td><td rowspan="2">Anaerobic Digester</td><td rowspan="2">1</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda São Tomaz Paraíso do Rio Preto (Elcy Miola)</td><td>Swine</td><td>Annex I Country</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Granja CAS (Carlos Segalin)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>3</td><td rowspan="2">Anaerobic Digester</td><td rowspan="2">1</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>GRANJA CAS (Claiton Segalin)</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>3</td><td>Latin America - Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda Ana Bela</td><td>Swine</td><td>Annex I Country</td><td>Lagoon</td><td>3</td><td>Anaerobic Digester</td><td>1</td><td>Latin America – Temperate</td><td>See Annex 3</td></tr>
<tr><td>Fazenda Texas</td><td>Swine</td><td>Annex I</td><td>Lagoon</td><td>2</td><td>Anaerobic</td><td>1</td><td>Latin</td><td>See Annex 3</td></tr>
</table>

Site	AWPS		AWMS				Other	
	Animal Category	Genetics Source	Base-line	#	Project	#	Region - Climate	Population Data
		Country			Digester		America – Temperate	

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	
COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense	No	Yes	Yes	Yes	Use developed nation default EFs
COOASGO	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Sao Luiz II	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Coopermutum	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Monte Alegre	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Paraíso	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Paraíso (Carvalho)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Rio Doce - Talhado e Talhado	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda São Tomaz Cachoeirinha	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda São Tomaz Paraíso do Rio Preto	No	Yes	Yes	Yes	Use developed nation default EFs
Granja CAS	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Ana Bela	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Texas	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)[14] 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

[14] 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.

Brazil is not reliable.[15] 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.4 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 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 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.[16] 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

---

[15] 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.

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

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.[17]

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%.[18]

	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

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

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

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 <u>the anaerobic lagoon AWMS, the prevailing practice, is the most economically attractive course of action.</u>

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 up to 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 Table B.6 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.

Absent CDM project activities, 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*."[19]

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

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.

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 prompt 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 consider the potential for their inclusion in a CDM Project Activity
Apr 20, 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 2004 – Mar 2005	Site Survey, Data Collection, Baseline Analysis, PDD preparation
Sep 2004	Broke ground at first construction site
Jan 24, 2005	Conducted Stakeholders' Meeting in Belo Horizonte, Minas Gerais

DATE	ACTIVITY
Jan 26, 2005	Conducted Stakeholders' Meeting in Lucas do Rio Verde – Mato Grosso, Rio Verde – Goias, and Sao Gabriel do Oeste – Mato Grosso do Sul
Apr 2005	AgCert submits to the DOE the first draft of this GHG Mitigation PDD
Jul 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 constraints*: 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.

   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. 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.

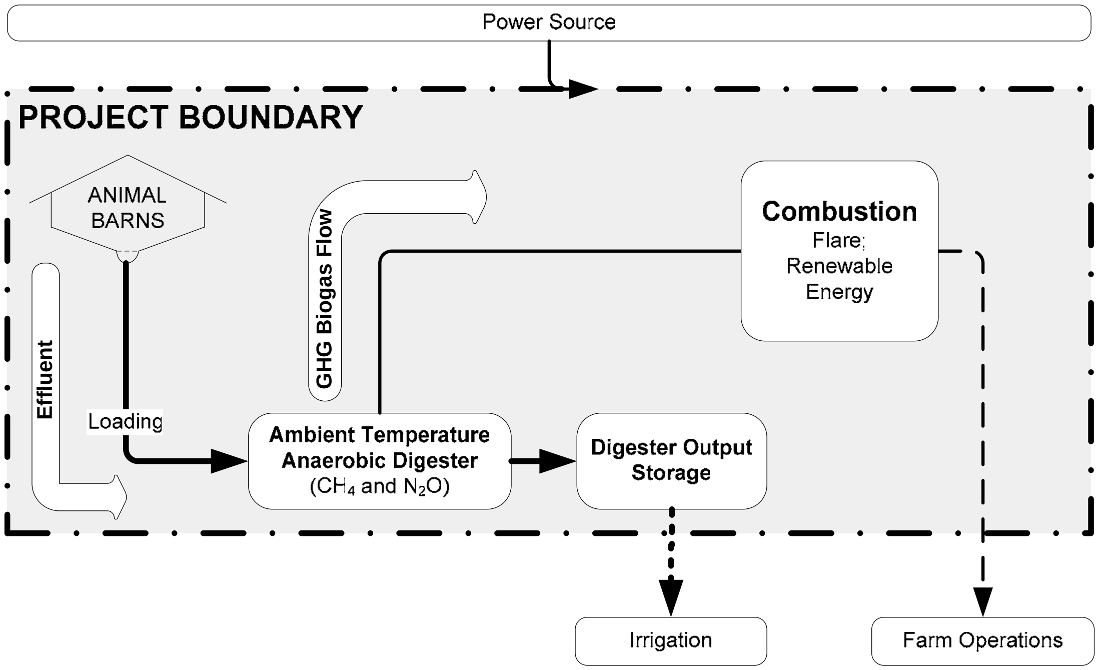


Figure B2. Project Boundary

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, a project participant, as well as the project developer.

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 20/04/2004.

C.1.2 Expected operational lifetime of the project activity:

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

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: 01/03/2005

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.
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.[20]
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.

[20] 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.

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.

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 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	^{o}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	^{o}C, 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 project 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 project 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 project 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:

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

- 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:

$$Land\ Leakage = Project\ activity\ land\ emissions – Baseline\ land\ emissions$$

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

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

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

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

- 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. AgCert is currently working towards ISO certification and 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 perform audits of farm operations personnel on a periodic basis 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 determined the monitoring methodology for use at these project activities. AgCert 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				
Sys	Site	Source	GHG Emissions (CO_2e)	
			CH_4	N_2O
1		COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense		
	1	COOAGRIL UPL - 3 e UT 3	926	219
	2	COOAGRIL - UPD 1, UPD 2 and Multiplicadora	393	93
	3	Fazenda Nadin	670	158
2		COOASGO		
	1	Fazenda Alvorada	352	83
	2	Fazenda Brejao	1,067	252
	3	Fazenda Belvedere	167	39
	4	Fazenda Monte Azul	2,200	519
	5	Fazenda Ponto Alto	1,174	277
	6	Fazenda Rancho Alegre	1,499	354
	7	Fazenda Santa Cruz	806	190
	8	Suinocultura Jeroa Ltda	2,141	505
	9	Suinoeste I	625	147
	10	Suinoeste II	1,238	292
3		Fazenda Sao Luiz II	894	211
4		Granja Coopermutum	831	196
5		Fazenda Monte Alegre	553	130
6		Fazenda Paraíso (José Martins)	760	179
7		Fazenda Paraíso (Carvalho Family)		
	1	Fazenda Paraíso Sitio 1 (Luis Carvalho)	437	103
	2	Fazenda Paraíso Sitio 2 (Luis Carvalho)	383	90
	3	Fazenda Paraíso Sitio 1 (Vanessa Carvalho)	440	104
	4	Fazenda Paraíso Sitio 2 (Vanessa Carvalho)	374	88
8		Fazenda Rio Doce - Talhado e Talhado (Vanz Family)		
	1	Fazenda Rio Doce - Talhado e Talhado (Diniz Vanz)	393	93
	2	Fazenda Rio Doce Talhado (Orestes Vanz)	373	88
	3	Fazenda Rio Doce Talhado e Talhado (Dirceu Vanz)	393	93
9		Fazenda São Tomaz Cachoeirinha (Silva Family)		
	1	Fazenda São Tomaz Cachoeirinha (Adecir Silva)	441	104
	2	Fazenda São Tomaz Cachoeirinha (Luiz Silva)	435	103
	3	Fazenda São Tomaz Cachoeirinha (Cledson Silva)	431	102
10		Fazenda São Tomaz Paraíso do Rio Preto (Miola Family)		
	1	Fazenda São Tomaz Paraíso do Rio Preto (Vilson Miola)	424	100
	2	Fazenda São Tomaz Paraíso do Rio Preto (Elcy Miola)	428	101
11		Granja CAS (Segalin Family)		
	1	Granja CAS (Carlos Segalin)	393	93
	2	GRANJA CAS (Claiton Segalin)	369	87
12		Fazenda Ana Bela	322	76
13		Fazenda Texas	429	101
			22,761	5,370

28,131 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 Emissisons											
Sys	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	COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense		2,684			2,684			0		
2	COOASGO		15,194			15,194			0		
3	Fazenda São Luiz II		1,205			1,205			0		
4	Granja Coopermutum		1,120			1,120			0		
5	Fazenda Monte Alegre		745			745			0		
6	Fazenda Paraíso (José Martins)		1,025			1,025			0		
7	Fazenda Paraíso (Carvalho's)		2,203			2,203			0		
8	Fazenda Rio Doce - Talhado e Talhado (Vanz's)		1,562			1,562			0		
9	Fazenda São Tomaz Cachoeirinha (Silva's)		1,762			1,762			0		
10	Fazenda São Tomaz Paraíso do Rio Preto (Miola's)		1,148			1,148			0		
11	Granja CAS (Segalin's)		1,027			1,027			0		
12	Fazenda Ana Bela		435			435			0		
13	Fazenda Texas		578			578			0		
	AWMS Electrical Power										
1	COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense			0			1.08			1.08	
2	COOASGO			0			3.60			3.60	
3	Fazenda São Luiz II			0			0.36			0.36	
4	Granja Coopermutum			0			0.3595			0.3595	
5	Fazenda Monte Alegre			0			0.3595			0.3595	
6	Fazenda Paraíso			0			0.3595			0.3595	
7	Fazenda Paraíso (Carvalho's)			0			1.44			1.44	
8	Fazenda Rio Doce - Talhado e Talhado (Vanz's)			0			1.08			1.08	
9	Fazenda São Tomaz Cachoeirinha (Silva's)			0			1.08			1.08	
10	Fazenda São Tomaz Paraíso do Rio Preto (Miola's)			0			0.72			0.72	
11	Granja CAS (Segalin's)			0			0.72			0.72	
12	Fazenda Ana Bela			0			0.3595			0.3595	
13	Fazenda Texas			0			0.36			0.36	
							Total:			12	**12** metric tonnes

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	22,761	5,370	0		
E2 - Leakage	0	0	12		
Total:	22,761	5,370	12	**28,143**	metric tonnes

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				
Sys	Site	Source	GHG Emissions (CO_2e)	
			CH_4	N_2O
1		COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense		
	1	COOAGRIL UPL - 3 e UT 3	8,338	219
	2	COOAGRIL - UPD 1, UPD 2 and Multiplicadora	3,540	93
	3	Fazenda Nadin	6,038	158
2		COOASGO		
	1	Fazenda Alvorada	3,165	83
	2	Fazenda Brejao	9,599	252
	3	Fazenda Belvedere	1,503	39
	4	Fazenda Monte Azul	19,804	519
	5	Fazenda Ponto Alto	10,569	277
	6	Fazenda Rancho Alegre	13,495	354
	7	Fazenda Santa Cruz	7,252	190
	8	Suinocultura Jeroa Ltda	19,267	505
	9	Suinoeste I	5,621	147
	10	Suinoeste II	11,145	292
3		Fazenda Sao Luiz II	8,043	211
4		Granja Coopermutum	7,480	196
5		Fazenda Monte Alegre	4,975	130
6		Fazenda Paraíso (José Martins)	6,842	179
7		Luis & Vanessa Carvalho		
	1	Fazenda Paraíso Sitio 1 (Luis Carvalho)	3,930	103
	2	Fazenda Paraíso Sitio 2 (Luis Carvalho)	3,451	90
	3	Fazenda Paraíso Sitio 1 (Vanessa Carvalho)	3,956	104
	4	Fazenda Paraíso Sitio 2 (Vanessa Carvalho)	3,364	88
8		Fazenda Rio Doce - Talhado e Talhado (Vanz's)		
	1	Fazenda Rio Doce - Talhado e Talhado (Diniz Vanz)	3,541	93
	2	Fazenda Rio Doce Talhado (Orestes Vanz)	3,353	88
	3	Fazenda Rio Doce Talhado e Talhado (Dirceu Vanz)	3,538	93
9		Fazenda São Tomaz Cachoeirinha (Silva Family)		
	1	Fazenda São Tomaz Cachoeirinha (Adecir Silva)	3,970	104
	2	Fazenda São Tomaz Cachoeirinha (Luiz Silva)	3,912	103
	3	Fazenda São Tomaz Cachoeirinha (Cledson Silva)	3,881	102
10		Fazenda São Tomaz Paraíso do Rio Preto (Miola Family)		
	1	Fazenda São Tomaz Paraíso do Rio Preto (Vilson Miola)	3,816	100
	2	Fazenda São Tomaz Paraíso do Rio Preto (Elcy Miola)	3,848	101
11		Granja CAS (Segalin Family)		
	1	Granja CAS (Carlos Segalin)	3,538	93
	2	GRANJA CAS (Claiton Segalin)	3,318	87
12		Fazenda Ana Bela	2,901	76
13		Fazenda Texas	3,859	101
			204,852	5,370

210,222 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:

Total Project Activity Emission Reductions			
Source	GHG Emissions (CO_2e)		
E4 - Est. Baseline Emissions	210,222		
E3 - Project Activity Emissions	28,143		
Total:	182,079	**182,079**	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

Parameter/Factor	Value	Source/Comment
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
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

Parameter/Factor	Value	Source/Comment
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 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 Lastly, 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 release) of 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:

Stakeholders meetings for this project activity were held in Lucas do Rio Verde-Mato Grosso, São Gabriel do Oeste-Mato Grosso dul Sol, Rio Verde-Goiás, Belo Horizonte-Minas Gerais and Uberlandia-Minas Gerais on 24 and 26 January 2005.

AgCert invited stakeholders to the meetings to explain the UNFCCC CDM process and proposed project activity, presided over by Josefa Maria Fellegger Garzillo in Mato Grosso, Michael Mirda and Paulo Furtado in Mato Grosso dul Sul, Miguel Henrique Gastão de Oliveira in Minas Gerais, and Hellen Souza de Macedo in Goiás. Invitations were sent via electronic mail and postal directly to project participants, federal, state and local officials 2 – 3 weeks prior to the meetings.

The CDM Project Stakeholders Meeting information was published in the municipal newspaper in the region of the CDM project activity:

a) *O Mercador* - Jornal de Rio Verde January 18, 2005

b) *Estado de Minas* -Belo Horizonte, January 17, 2005.

c) *Folha de São Gabriel* - São Gabriel do Oestel, 1st half of January, 2005.

d) *Correio Uberlandense*, Uberlândia, January 17, 2005

A slide presentation was given, in Portuguese, and attendees were afforded the opportunity to ask questions and provide comments. Additionally, Michael Mirda performed an interview for NPV, the local television network. On other occasions, representatives from AgCert also met with and explained project details to local and state government officials.

Minutes for these meetings have been compliled and include questions and answers for each of the meetings.

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.

Mr. Adão Rolim, Mayor of São Gabriel do Oeste – MS thanked everyone for attending the meeting, especially the Mato Grosso do Sul government and AgCert. He stated that the city of São Gabriel do Oeste, together with the producers and AgCert, will improve the environment and help the producers better their farms. He also personally welcomed AgCert to São Gabriel do Oest. 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, there was good feedback from all participants about the project activity. The group pledged their support and offered to assist if needed in the facilitation and completion of the project. Several stakeholders voiced their appreciation for having the opportunity to participate in these project activies.

ANNEX 1.

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Developer and 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

COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense Farm Data, Mar 2004 – Feb 2005:
COOAGRIL - UPD 1, UPD 2 and Multiplicadora

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,636	3,636	3,131	3,161	3,193	3,205	3,208	3,257	3,317	3,338	3,435	3,503
Mortalities	4	6	9	8	5	2	10	1	11	17	4	8
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	118	133	62	54	42	21	29	86	75	72	72	51
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

COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense Farm Data, Apr 2004 – Mar 2005:
COOGARIL - UPL - 3 e UT 3

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,320	1,330	1,310	1,253	1,264	1,283	1,296	1,300	1,330	1,334	1,336	1,338
Mortalities	0	7	13	15	0	6	3	1	15	12	8	5
Days Unpopulated	0	5	0	5	0	5	0	5	0	5	0	5
Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	4,804	4,591	4,969	5,055	3,815	3,800	3,723	3,380	3,410	3,623	3,881	4,000
Mortalities	44	30	50	60	60	66	50	57	32	50	33	46
Days Unpopulated	5	0	0	0	5	0	0	0	0	5	0	0
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390
Mortalities	100	100	100	100	100	100	100	100	100	100	100	100
Days Unpopulated	5	5	5	5	5	5	5	5	5	5	5	5

COOAGRIL - Cooperativa Agropecuária e Industrial Luverdense Farm Data, Mar 2004 – Feb 2005:
Fazenda Nadin

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	5,637	5,637	5,667	5,655	5,655	6,535	6,535	5,637	5,637	5,637	5,637	5,637
Mortalities	41	40	30	25	51	15	14	23	23	23	23	23
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Mar 2004 – Feb 2005: Fazenda Alverado

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	391	395	208	229	228	247	261	258	392	382	388	386
Mortalities	0	0	0	0	0	0	3	2	2	2	0	1
Days Unpopulated	0	0	5	0	0	5	0	0	5	0	0	5
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	16	11	70	30	53	18	14	16	16	13	28	15
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	16	11	5	5	5	6	6	5	11	10	10	10
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	2,996	2,358	1,429	1,413	1,447	1,582	1,551	1,646	1,830	1,983	2,433	2,488
Mortalities	0	14	12	10	20	17	9	13	11	15	11	15
Days Unpopulated	0	0	5	0	5	0	0	0	0	5	0	0
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,090	1,203	313	555	624	437	536	645	1,065	1,350	1,186	1,160
Mortalities	16	4	6	7	1	2	2	4	4	5	9	4
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Jan 04 – Jan 05: Fazenda Belvedere

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	262	265	288	234	243	252	250	256	258	262	260	248
Mortalities	3	3	1	2	2	4	6	3	6	4	3	4
Days Unpopulated	0	5	0	0	5	0	0	5	0	0	5	0
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	31	31	45	51	40	29	24	25	26	27	22	33
Mortalities	0	0	3	0	0	1	0	2	0	0	1	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	6	4	6	6	6	5	4	5	4	5	5	5
Mortalities	0	0	0	0	0	1	1	0	1	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	855	745	812	969	781	522	453	259	475	505	573	329
Mortalities	6	11	9	9	14	13	10	10	9	11	9	9
Days Unpopulated	0	0	0	5	0	0	0	5	0	0	0	5
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	508	617	871	503	445	624	699	576	588	609	630	600
Mortalities	9	11	8	11	33	9	8	11	9	14	16	13
Days Unpopulated	0	0	5	0	0	5	0	0	5	0	0	5

COOASGO Farm Data, Jan 2004 – Dec 2004: Fazenda Brejao

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	770	772	770	761	761	764	767	767	747	781	789	800
Mortalities	5	4	9	11	4	7	11	13	10	9	6	7
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	95	57	61	87	87	57	63	60	42	60	77	106
Mortalities	2	0	0	1	0	0	2	0	0	0	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	12	15	15	15	15	15	13	13	13	13	13	14
Mortalities	1	0	0	0	2	0	0	1	0	0	2	1
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean/Finish	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	8,137	8,239	7,795	8,226	8,226	7,885	8,288	8,571	8,512	8,520	8,760	8,688
Mortalities	101	97	94	95	104	105	94	92	92	100	95	97
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Jan 2004 – Dec 2004: Fazenda Monte Azul

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,364	1,395	1,370	1,357	1,473	1,674	1,873	2,062	2,100	2,194	2,142	2,122
Mortalities	4	8	11	11	25	22	16	35	36	47	46	29
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	113	91	56	215	265	481	257	163	250	65	35	87
Mortalities	2	3	1	3	3	4	0	1	14	29	37	2
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	24	14	15	21	20	24	21	25	25	25	28	24
Mortalities	0	0	0	0	0	0	0	0	0	0	1	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	8,704	8,874	9,220	8,567	8,096	9,735	9,940	10,063	9,196	11,615	13,869	13,758
Mortalities	34	36	33	31	30	34	36	38	36	39	42	41
Days Unpopulated	0	0	0	5	0	0	5	0	0	0	0	0
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	6,868	6,607	5,821	5,136	6,301	6,131	5,950	7,113	8,606	8,606	8,861	9,563
Mortalities	54	53	55	49	43	53	51	54	53	51	63	53
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Apr 2004 – Mar 2005: Fazenda Ponto Alto

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	990	993	1,020	862	876	890	882	888	909	945	960	1,001
Mortalities	18	19	24	8	23	13	25	15	7	2	13	2
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	67	68	88	69	55	73	97	94	103	98	94
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	18	18	18	12	12	16	17	15	15	16	16	21
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	7,007	7,329	7,845	5,378	5,651	5,557	5,584	6,004	5,709	5,679	6,296	9,488
Mortalities	59	61	39	55	52	67	51	65	64	18	0	30
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	2,598	2,286	2,889	2,602	2,506	2,268	2,866	2,508	2,954	3,032	2,415	2,546
Mortalities	25	26	21	20	43	29	30	31	28	29	11	5
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Feb 2004 – Jan 2005: Fazenda Rancho Alegre

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,102	1,470	1,506	1,510	1,539	1,548	1,548	1,566	1,571	1,581	1,586	1,590
Mortalities	6	9	11	13	13	11	10	8	10	11	12	14
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	331	293	316	294	330	293	289	274	268	274	295	338
Mortalities	1	0	0	0	1	0	0	1	0	0	1	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	12	16	18	18	22	21	12	11	13	12	12	12
Mortalities	1	0	0	1	0	0	0	0	1	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	6,924	6,757	6,785	7,322	6,018	6,285	6,315	6,281	7,557	7,881	7,594	6,704
Mortalities	65	67	67	73	60	62	63	62	75	78	75	67
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	4,544	4,341	4,291	4,125	4,195	3,659	4,230	4,322	4,146	4,261	4,290	4,349
Mortalities	37	34	33	31	30	36	38	31	33	31	33	34
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Jan 2004 – Dec 2004: Fazenda Santa Cruz

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	751	746	733	718	688	693	680	708	732	731	728	731
Mortalities	0	0	1	1	2	2	4	4	2	2	3	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	121	91	73	131	157	138	96	105	139	153	118	102
Mortalities	0	0	0	1	0	0	2	0	0	3	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	13	13	11	11	12	12	10	10	10	10	10	10
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	4,001	4,284	4,519	4,765	3,962	4,127	4,263	3,635	3,415	3,486	3,386	4,119
Mortalities	37	21	38	70	36	28	27	26	17	18	15	32
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	2,079	2,051	2,213	2,203	2,261	2,176	2,068	2,008	1,781	2,013	2,166	2,132
Mortalities	22	24	36	23	38	50	44	32	31	29	15	22
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Jan 2004 – Dec 2004: Suinocultura Jeroa Ltda

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,725	1,731	1,761	1,762	1,792	1,828	1,823	1,881	1,891	1,926	1,956	1,977
Mortalities	26	32	36	31	3	28	29	31	29	36	49	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	340	310	298	295	382	241	318	304	237	219	137	274
Mortalities	3	2	3	2	1	2	1	1	2	2	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	18	18	18	17	18	18	21	23	19	19	19	21
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	10,683	10,733	10,726	10,234	10,232	10,644	9,626	10,836	12,105	11,709	10,718	11,753
Mortalities	11	11	9	10	11	9	8	9	10	9	9	9
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	5,031	5,010	5,078	5,634	5,434	5,078	5,922	5,720	5,578	5,886	5,892	5,871
Mortalities	41	40	40	43	41	41	47	40	44	47	47	46
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Jan 2004 – Dec 2004: Suinoeste I

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,290	1,302	1,268	1,255	1,244	1,251	1,262	1,242	1,278	1,292	1,313	1,309
Mortalities	2	2	2	2	2	2	2	2	2	2	2	2
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	184	200	224	206	315	263	322	254	212	214	142	170
Mortalities	3	2	2	1	0	0	2	1	4	0	1	2
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	15	15	20	20	22	20	21	21	21	20	20	18
Mortalities	4	3	2	2	2	2	3	2	2	2	1	1
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	4,471	3,781	3,097	4,487	3,709	2,928	3,741	3,270	3,879	4,742	4,166	4,102
Mortalities	37	32	15	27	48	16	29	32	51	45	36	45
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

COOASGO Farm Data, Jan 2004 – Dec 2004: Suinoeste II

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	11,086	11,578	11,872	10,763	11,789	11,993	10,853	11,563	11,545	10,578	10,730	11,731
Mortalities	51	60	70	29	37	33	37	71	69	107	97	123
Days Unpopulated	0	0	0	7	0	0	0	7	0	0	0	7

Fazenda Sao Luiz II Farm Data, Jan 2004 – Dec 2004:

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	496	496	502	506	504	500	500	500	500	500	500	500
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
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	105	103	100	102	106	110	101	103	101	100	101	100
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	5,610	5,592	5,586	5,454	6,024	5,640	5,340	5,628	5,934	5,814	5,826	5,820
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
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,475	1,413	1,410	1,377	1,522	1,425	1,348	1,422	1,498	1,470	1,470	1,470
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

Granja Coopermutum Farm Data, Apr 2004 – Mar 2005:

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,521	1,502	1,512	1,542	1,552	1,543	1,555	1,569	1,559	1,555	1,529	1,529
Mortalities	15	20	16	17	16	10	12	13	20	18	29	22
Days Unpopulated	0	0	7	0	0	7	0	0	7	0	0	7
Gilt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	490	456	503	542	558	612	636	566	550	556	578	625
Mortalities	31	14	25	20	54	24	28	15	32	46	47	7
Days Unpopulated	0	0	5	0	0	5	0	0	5	0	0	5
Boar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	9	9	9	8	8	8	8	8	8	9	9	9
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
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	4,416	4,191	8,607	5,278	5,545	4,824	6,015	6,114	5,257	5,460	5,209	5,335
Mortalities	0	0	0	0	0	0	0	0	0	0	0	0
Days Unpopulated	0	0	0	7	0	0	0	7	0	0	0	7

Fazenda Monte Alegre Farm Data, May 2004 – Apr 2005:

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	1,107	1,102	1,123	1,108	1,125	1,141	1,162	1,128	1,130	1,127	1,129	1,124
Mortalities	2	0	3	1	1	0	4	4	0	2	2	2
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	115	122	124	120	149	145	114	128	122	119	109	123
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	6	6	5	5	5	5	5	4	4	8	6	6
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
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,637	3,293	3,490	3,393	3,769	3,152	3,707	2,965	3,293	3,977	3,474	3,929
Mortalities	73	36	23	20	29	23	58	56	19	34	20	26
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Paraiso (José Martins) Farm Data, Jan 2004 – Dec 2004:

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	648	654	662	667	654	673	663	657	664	664	661	665
Mortalities	4	11	7	5	6	4	0	4	2	2	4	4
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	218	183	183	176	180	141	139	106	75	82	83	75
Mortalities	1	0	0	2	1	0	1	0	4	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	8	7	8	7	7	7	8	7	7	9	8	8
Mortalities	0	0	0	1	0	0	0	0	0	0	1	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	3,633	3,752	4,082	3,871	3,709	3,829	4,206	4,222	4,604	4,931	4,712	4,493
Mortalities	6	7	9	3	6	3	1	25	32	37	29	23
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	1,603	1,623	1,464	1,488	1,586	1,569	1,603	1,855	1,646	1,436	1,608	1,491
Mortalities	10	13	19	11	16	49	29	13	13	30	32	15
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Paraiso (Luiz Carvalho) Fazenda Paraiso Sitio 1 Farm Data, Jul 2004 – Jun 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,904	3,975	4,033	4,008	3,982	3,963	4,023	3,997	3,976	4,029	3,988	3,946
Mortalities	6	25	26	26	21	37	41	42	42	19	26	25
Days Unpopulated	0	0	0	0	5	4	0	0	0	11	0	0

Fazenda Paraiso (Luiz Carvalho) Fazenda Paraiso Sitio 2 Farm Data, Jul 2004 – Jun 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,452	3,442	3,607	3,585	3,562	3,544	3,522	3,502	3,483	3,491	3,486	3,469
Mortalities	8	20	20	19	11	16	17	17	10	23	22	23
Days Unpopulated	0	0	0	0	11	0	0	0	10	0	0	0

Fazenda Paraiso (Vanessa Carvalho) Fazenda Paraiso Sitio 1 Farm Data, Mar 2004 – Feb 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,948	3,919	4,065	4,046	4,027	4,097	4,080	4,063	4,046	4,044	4,014	3,981
Mortalities	7	18	20	19	19	13	17	17	17	18	32	33
Days Unpopulated	0	0	0	0	2	7	0	0	0	12	0	0

Fazenda Paraiso (Vanessa Carvalho) Fazenda Paraiso Sitio 2 Farm Data, Jun 2004 – May 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,465	3,444	3,421	3,398	3,393	3,569	3,551	3,538	3,546	3,512	3,479	3,446
Mortalities	26	25	28	20	15	17	18	13	26	34	33	33
Days Unpopulated	0	0	0	8	5	0	0	7	6	0	0	1

Fazenda Rio Doce – Talhado e Talhado (Diniz Vanz) Farm Data, Apr 2004 – Mar 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,583	3,569	3,566	3,630	3,612	3,596	3,621	3,639	3,630	3,621	3,617	3,598
Mortalities	18	16	13	16	17	16	5	9	9	9	8	15
Days Unpopulated	0	0	0	7	0	0	0	7	0	0	0	7

Fazenda Rio Doce – Talhado e Talhado (Orestes Vanz) Farm Data, Mar 2004 – Feb 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,576	3,574	3,566	3,557	3,548	3,634	3,625	3,616	3,607	3,629	3,612	3,594
Mortalities	13	7	10	9	9	5	9	9	9	11	17	18
Days Unpopulated	0	9	0	0	3	14	0	0	1	11	0	0

Fazenda Rio Doce – Talhado e Talhado (Dirceu Vanz) Farm Data, May 2004 – Apr 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,650	3,636	3,621	3,614	3,630	3,622	3,614	3,595	3,567	3,557	3,547	3,604
Mortalities	13	13	15	10	8	8	8	5	10	10	10	9
Days Unpopulated	0	0	0	7	0	0	0	7	0	0	0	7

Fazenda Sao Tomaz Cachoeirinha (Adecir Silva) Farm Data, Apr 2004 – Mar 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	4,080	4,062	4,039	4,023	4,060	4,044	4,028	4,006	4,060	4,042	4,020	3,997
Mortalities	16	18	23	26	16	16	22	24	18	22	24	23
Days Unpopulated	0	0	0	7	0	0	0	7	0	0	0	7

Fazenda Sao Tomaz Cachoeirinha (Luiz Silva) Farm Data, Apr 2004 – Mar 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	4,057	4,040	4,038	3,945	3,916	3,973	4,004	3,966	3,929	3,910	4,093	4,075
Mortalities	39	34	27	28	29	22	38	38	37	19	17	18
Days Unpopulated	0	1	0	0	0	6	0	0	0	16	0	0

Fazenda Sao Tomaz Cachoeirinha (Cledson Silva) Farm Data, May 2004 – Apr 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,977	4,015	3,991	3,968	4,016	4,039	4,024	4,009	4,045	4,041	3,993	3,943
Mortalities	29	21	24	23	16	15	15	15	16	50	48	50
Days Unpopulated	9	0	0	0	0	0	0	7	10	0	0	0

Fazenda Sao Tomaz Paraiso do Rio Preto (Vilson Miola) Farm Data, Apr 2004 – Mar 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,952	3,897	3,824	3,966	3,903	3,860	3,820	3,922	3,986	3,948	4,010	4,027
Mortalities	33	44	43	40	36	37	38	28	73	75	68	61
Days Unpopulated	0	0	7	7	0	0	3	2	0	0	7	0

Fazenda Sao Tomaz Paraiso do Rio Preto (Elcy Miola) Farm Data, Jan 2004 – Dec 2004:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	4,056	4,049	4,039	4,056	4,038	4,033	4,020	4,054	4,037	4,016	4,007	4,068
Mortalities	7	10	11	18	5	13	16	17	21	9	14	12
Days Unpopulated	0	0	0	8	0	0	0	12	0	0	0	11

Granja CAS (Carlos Segalin) Farm Data, Jan 2004 – Dec 2004:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,682	3,667	3,651	3,633	3,635	3,494	3,458	3,528	3,590	3,532	3,482	3,449
Mortalities	7	15	16	13	4	34	36	70	26	58	50	33
Days Unpopulated	6	0	0	0	6	0	0	0	0	6	0	0

Granja CAS (Claiton Segalin) Farm Data, Feb 2004 – Jan 2005:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	3,600	3,587	3,564	3,541	3,520	3,487	3,454	3,420	3,720	3,701	3,683	3,664
Mortalities	17	17	17	17	25	25	25	25	14	14	14	14
Days Unpopulated	0	0	0	12	0	0	0	18	0	0	0	11

Fazenda Ana Bela Farm Data, Apr 2004 – Mar 2005:

Sow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	400	407	402	300	300	300	300	300	306	302	300	342
Mortalities	1	1	2	0	0	1	0	3	1	1	2	0
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	12	10	12	10	9	7	7	8	9	10	7	7
Mortalities	0	0	1	0	2	0	0	1	1	2	0	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	2	2	2	2	2	2	2	2	2	2	2	2
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	2,400	2,225	2,390	1,321	1,295	1,403	1,296	1,504	1,582	1,547	1,587	1,451
Mortalities	0	19	39	19	5	14	29	7	6	6	4	18
Days Unpopulated	0	0	0	3	0	0	0	3	0	0	0	3
Nurse/Wean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	800	820	812	741	774	795	884	690	828	851	695	977
Mortalities	5	6	4	18	18	25	13	14	8	2	10	24
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Texas Farm Data, Dec 2003 – Nov 2004:

Finisher	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Population	4,024	4,082	4,128	4,100	4,071	4,043	4,066	4,066	4,039	4,012	3,994	4,053
Mortalities	29	29	18	29	28	29	28	20	27	27	27	18
Days Unpopulated	0	0	10	0	0	0	0	11	0	0	0	11

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.