AWMS GHG Mitigation Project BR05-B-13, Goiás and Minas Gerais, Brazil

UNFCCC Clean Development Mechanism
Project Design Document

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CLEAN DEVELOPMENT MECHANISM
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CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

AWMS GHG Mitigation Project BR05-B-13, Goiás and Minas Gerais, Brazil

A.2 Description of the project activity:

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

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

This project proposes to apply to multiple swine CAFOs (located in Minas Gerais and Goiás, 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]

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[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 Goiás, and Minas Gerais was approximately 4,871,000.[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 4.5 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 –

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[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 activityof 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 Goiás 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):

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

Fazenda Agua Amarela is a finishing operation, which has a capacity for almost 4,000 animals. In February 2005, this site had 3,538 finishers. There are three containment areas to house the animals. These barns were built in 2002 and 2004. The AWMS is comprised of a primary (50m x 20m x 3m) and secondary open lagoon (30m x 15m x 3m), both of which were built in 2002. These lagoons dispose of effluent through surface spread. This site is located in Minas Gerais.

Fazenda Boa Vista is a finishing operation in Minas Gerais. The site has a capacity for 2,700 animals and had a population of 2,689 in April 2005. Three open lagoons, built in 1998, are used for the site's AWMS. One of the primary open lagoons measures 12m in diameter and is 2.5m deep. The second primary lagoon measures 40m x 20m x 2.5, and the secondary lagoon measures 40m x 15m x 2.5m. All of the lagoons dispose of effluent through surface spread. There are three containment areas to house the animals.

Daniel Liberato Schwening has two sites in Goiás:

- <u>Fazenda Rioverdinho da Barra Grande</u> is a finishing operation, which had 3,470 animals in May 2005. The site's four containment areas, built in 2002, have a total capacity for 3,600 animals. The site uses three primary open lagoons (each built in 2002 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through surface spread.

- <u>Fazenda Rioverdinho da Barra Grande Sítio 2</u> is also a finishing operation. The site had 3,466 animals in April 2005. The site's four containment areas, built in 2002, have a total capacity for 3,600 animals. The site uses three primary open lagoons (each built in 2002 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Décio Bruxel has four sites in Minas Gerais:

- <u>Fazenda Bom Retiro</u> is a farrow to finish operation.[9] The site's nine containment areas, which were built between 1994 and 2001, have a capacity for almost 3,000 animals. While the site has an average sow population of 250, some of these animals are not confined and will, therefore, not be calculated in the baseline. In the alternative, AgCert will use the conservative estimate of 85 percent of the capacity for sows. The site uses four lagoons for its AWMS: the oldest lagoon was built in 1994 and measures 11m x 5m x 2m; the second lagoon was built in 1995 and measures 17m in diameter and is 2m deep; the third lagoon was built in 2001 and measures 19m x 12.5m x 2.5m; and the fourth lagoon was built in 2002 and measures 3.5m x 3m x 4m.

- <u>Fazenda Chuá</u> is a farrowing operation, which has a capacity for approximately 3,300 animals. In June 2005, the site had 2,989 sows, gilts and boars. The site uses four open lagoons for its AWMS: one primary lagoon was built in 1988 and measures 54m x 29m x 2.5m; one secondary lagoon was built in 1988 and measures 30m x 27m x 2.5m; a second primary lagoon was built in 1996 and measures 48m x 22m x 2.5m; and the second secondary lagoon was also built in 1996 and measures 37m x 25m x 2.5m. All four lagoons dispose of effluent through irrigation. The site has 14 containment areas, built between 1988 and 2001, to house its animals.

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[9] A 'farrow to finish operation' is defined as a production system that contains all production phases, from breeding to gestation to farrowing to nursery to grow-finishing to market.

- Fazenda Chuá – Sitio 2 is a farrow to finish operation with the capacity for over 4,000 animals. This site utilizes 3 open lagoons for its AWMS: two primary lagoons, measuring 28 x 17 x 2.5 and 30 x 17 x 2.5, and one secondary lagoon measuring 20 x 13 x 2.5. Irrigation is used as the method of effluent disposal. The animals are housed in four containment areas at this site.

- Fazenda Mata Burros is a finishing operation, which had 1,442 animals in June 2005. The site's two containment areas, which were built in 1996, have a capacity for up to 2,100 animals. The site uses three open lagoons for its AWMS. Two other lagoons are on site but are no longer in use. The three lagoons in use were built between 1997 and 2005. They measure: 37m x 28m x 2m; 21m in diameter, 2m deep; and 33m x 25m x 2m. All dispose of effluent through irrigation.

- Fazenda São João is a finishing operation. Eleven containment areas, built between 1985 and 2004, house approximately 11,200 animals. The site uses four open lagoons for its AWMS. There is an additional lagoon on site but it is not in use. One lagoon was built in 1990 and measures 31m x 18m x 2m; another lagoon was built in 1993 and measures 64m x 40m x 4m; a third lagoon was built in 1988 and measures 18m x 28m x 2m; and the fourth lagoon was built in 2000 and measures 15m x 15m x 3m. All the lagoons dispose of effluent through surface spread.

Fazenda Campo Belo is a finishing operation in Goiás. The site has a capacity for 4,080 animals and had 3,602 finishers in July 2005. The site uses three primary open lagoons (each built in 2000 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through surface spread. Four containment areas, built in 2000, house the animals.

Fazenda Confusão – Dois Irmãos (Osvaldo Soerger) is a finishing operation in Goiás. The site has a capacity for 3,600 finishers and had 3,567 animals in July 2005. Four containment areas, built in 2001, house the animals. Two open lagoons comprise the AWMS. These lagoons measure 44.5m x 32.5m x 3.5m, were built in 2001 and dispose of effluent through irrigation.

Fazenda Confusão – Dois Irmãos (Fredi Soerger) is another finishing operation in Goiás. In April 2005, the site had 3,484 animals, but has a capacity for up to 3,600. Four containment areas, built in 2001, house the animals. Two open lagoons comprise the AWMS. These lagoons measure 44.5m x 32.5m x 3.5m, were built in 2001 and dispose of effluent through surface spread.

Fazenda Coqueiros do Rio Doce e Rio Verdinho is a farrowing operation in Goiás, which has a capacity for about 5,075 animals. In June 2005, the site was near capacity with 5,025 sows, gilts, boars and nursers. The site uses three primary open lagoons (each built in 2001 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation. Four containment areas, built in 2001, house the animals.

Fazenda Dona Oscila is another farrowing operation in Goiás. The site's four containment areas, which were built in 2001, have a capacity for approximately 5,260 animals. In June 2005, the site had 4,839 sows, gilts, boars and nursers. The site uses four open lagoons, built in 2001, for its AWMS. Two of the lagoons measure 35m x 28m x 3.5m; the other two lagoons measure 22m x 18m x 3.5m. All dispose of effluent through irrigation.

Fazenda Estreito e Ponte de Pedras (Pedro Paulo de Souza Ferraz) is a finishing operation in Goiás, which had 3,545 animals in May 2005. The site's four containment areas, which were built in 2002, have a capacity for up to 3,600 animals. The site uses three primary open lagoons (each built in 2002 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Fazenda Estreito e Ponte de Pedras (Ana Marta de Souza Ferraz) is another finishing operation in Goiás. The site's four containment areas, built in 2000, have a capacity for 4,080 animals; in March 2005, the site had 3,999 finishers. The site uses three primary open lagoons (each built in 2000 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Fazenda Fortaleza Castelo is a finishing operation, which had 3,565 animals in June 2005. Located in Goiás, this site's four containment areas, which were built in 2002, have the capacity for 3,680 finishers. The site uses three primary open lagoons (each built in 2002 and measuring 42m x 32m x 3.8m) for its AWMS. These lagoons dispose of effluent through irrigation.

Fazenda Paraíso do Rio Preto is a finishing operation in Goiás, which had 3,569 animals in March 2005. Four containment areas house the animals; these barns were built in 2002 and have a capacity for 4,080 animals. The site uses three primary open lagoons (each built in 2002 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Fazenda Rio Doce –Beira do Sabiá is another finishing operation in Goiás. This site had 3,553 animals in June 2005. Its four containment areas, built in 2001, have a capacity for 3,600 finishers. The site uses three primary open lagoons (each built in 2001 and measuring 35m x 28m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation. The producer plans to double the size of his operation in the next year.

Fazenda Santa Lucia is a farrow to finish operation in Minas Gerais. In July 2005, the site had 4,205 animals. Five containment areas, built between 1993 and 1995, have the capacity to house 4,879 sows, gilts, boars, nursers and finishers. The site uses two open lagoons, built in 1995, for its AWMS. These lagoons measure 27m x 10m x 1.5m and 45m x 16m x 1.2m and dispose of effluent through irrigation.

Fazenda São Tomaz Lugar Matinha is a finishing operation in Goiás, with a capacity for 3,600 animals in four containment areas, built in 2002. In April 2005, the site had 3,451 finishers. The site uses three primary open lagoons (each built in 2002 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Fazenda Talhado Lugar Irara is a finishing operation in Goiás. Four containment areas, built in 2004, house approximately 3,900 animals. The site uses three primary open lagoons (each built in 2004 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Fazenda Talhado Rio Doce is a finishing operation in Goiás. Four containment areas, built in 2004, house approximately 4,000 animals. The site uses three primary open lagoons (each built in 2004 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Geraldo Xavier de Faria e outro has two sites in Minas Gerais:

- Fazenda Mourão is a farrow to finish operation. The site had approximately 8,671 animals in July 2005. Nineteen containment areas, built between 1990 and 2005, house the animals through the various stages of production. The site uses four lagoons, built in 1999, for its AWMS. These lagoons measure: 41m x 24.6m x 2m; 48m x 28.2m x 2m; 36m x 19.6m x 2m; and 60m x 50m x 1.5m. All dispose of effluent through surface spread.

- Granja São Jorge is a farrow to finish operation with a capacity for 1,861 animals. In July 2005, the site had 1,628 animals. Five containment areas, built in 1996, house the animals through the various stages of production. The site uses four lagoons, built in 2002, for its AWMS. These lagoons dispose of effluent through surface spread and measure: 5.33m x 4.3m x 2m; 20m x 20m x 2.5m; 26.8m x 25m x 3m; and 21m x 20m x 4m.

Granja Araújo is a farrow to finish operation in Minas Gerais. The site's 11 containment areas, built between 1984 and 1990, house approximately 2,100 animals. The AWMS is one primary open lagoon, which was built in 1986 and measures 40m x 13m x 3m. This lagoon disposes of effluent through irrigation.

Granja Cometa is also a farrow to finish operation in Minas Gerais. There are 13 containment areas on site. These barns can house up to 4,925 animals; in July 2005, the site had a population of 4,403. One primary open lagoon comprises the AWMS. This lagoon measures 40m in diameter and is 2m deep. It was built in 2000 and dispose of effluent through irrigation.

Granja Lagoa is a farrow to finish operation in Minas Gerais. The site's six containment areas, built in 1992 and 2004, house approximately 2,700 animals. Manure from these barns is routed to five open lagoons, built in 1990, 1992 and 2000. Three of the lagoons are 12m in diameter and 3m deep. The two other lagoons measure 8m x 3m x 3m and 20m x 7m x 3m.

Granja Ludmila is another farrow to finish operation in Minas Gerais. The site's seven containment areas were built in 1980 and 1990. In June 2005, the site had approximately 2,300 animals. Two open lagoons, built in 1980 and 1990, comprise the AWMS. The primary lagoon measures 40m x 15m x 3m, the secondary lagoon measures 23m x 6m x 3m, and both dispose of effluent through irrigation.

Granja Santo Cristo is a farrowing operation in Goiás. The site's eight containment areas housed approximately 2,400 animals in June 2005. The site uses three primary open lagoons, built in 1998 and 2005, for its AWMS. Two of the lagoons measure 38.5m x 26.5m x 3.5m; the third measures 44.5m x 32.5m x 3.5m. These lagoons dispose of effluent through surface spread.

Letícia Liberato Schwening has two sites in Goiás:

- <u>Fazenda Rioverdinho da Barra Grande</u> is a finishing operation, which had 3,973 animals in June 2005. The site's four containment areas were built in 2002. The site uses three primary open lagoons (each built in 2002 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through surface spread.

- <u>Fazenda Rioverdinho da Barra Grande Sítio 2</u> is another finishing operation. It had 3,521 animals in March 2005. The site's four containment areas, built in 2002, have a total capacity for 4,080 animals. The site uses three primary open lagoons (each built in 2002 and measuring 44.5m x 32.5m x 3.5m) for its AWMS. These lagoons dispose of effluent through irrigation.

Muriol da Silveira Coelho e Outros have five sites in Minas Gerais:

- <u>Fazenda Panorama</u> is a farrowing operation, which has a capacity for 1,238 animals. In June 2005, there 915 sows, gilts and boars at Fazenda Panorama. There are ten containment areas, built in 1980 and 1990, on site to house the animals. However, four of these containment areas, which were designated for finishers, are no longer in use as this site sends its finishers to Fazenda Panorama Granja 2. The site uses five open lagoons, each built in 1980 and measuring 20m x 10m x 2m, for its AWMS. The lagoons dispose of effluent through irrigation.

- Fazenda Panorama Granja 2 is a finishing/nursing operation. In June 2005, the site had 1,881 nursers and 4,810 finishers. Three open lagoons comprise the AWMS. These lagoons were built in 1995 and dispose of effluent through irrigation. The first lagoon measures 30m x 20m x 2m; the other two lagoons measure 20m x 15m x 2m. There are five containment areas, built in 1984 and 1990, to house the animals.

- Fazenda União is a farrowing operation, which has four containment areas, built in 1990, with the capacity to house 1,788 animals. In June 2005, the site had approximately 1,300 animals. The site uses a primary, secondary and tertiary lagoon for its AWMS. These lagoons were built in 1990, dispose of effluent through irrigation and measure 25m x 15m x 3m, 50m x 15m x 3m and 90m x 20m x 3m.

- Fazenda União Granja 2 is a nurser/finisher operation, which has approximately 8,100 animals housed in four containment areas. Two additional containment areas are not currently in operation. The producer does plan on utilizing the two additional containment areas in the future, however, this was not factored into the baseline emission calculations. The site uses three open lagoons for its AWMS. These lagoons were built in 2000, dispose of effluent through irrigation and measure 20m x 20m x 2m, 20m x 18m x 2m and 20m x 12m x 2m.

- Granja Fumal is a farrow to finish operation, which began activities in February 2005. The site uses two open lagoons, built in 1980, for its AWMS. The primary lagoon measures 20m x 4m x 2m; the secondary lagoon measures 30m x 4m x 3m. Both dispose of effluent through irrigation. There are six containment areas to house the animals. These barns were built in 1980. The producer intends to increase his sow population to 300 in the near future.

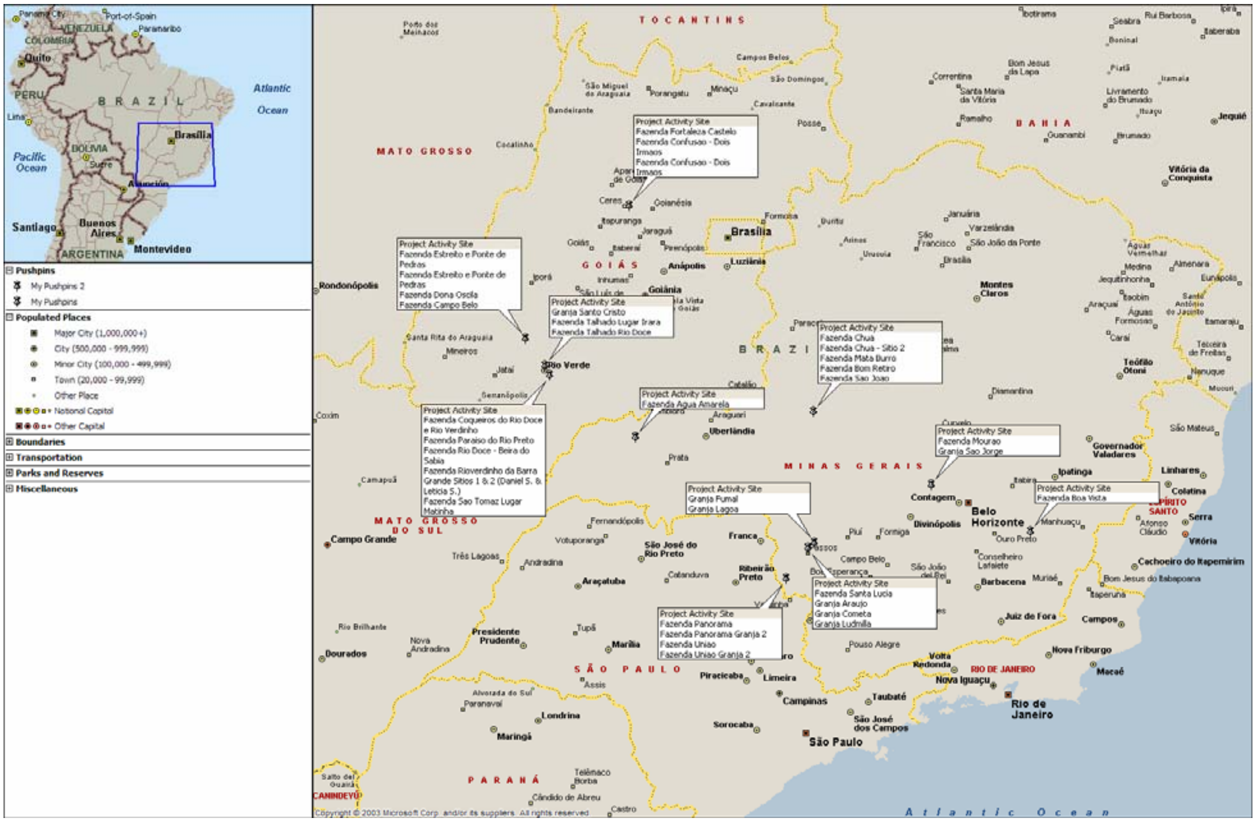

Figure A1. States Goiás and Minas Gerais, Brazil project activity sites

Table A2. Detailed physical location and identification of project sites

<table>
<tr><th>Farm/Site Name (AgCert ID Number)</th><th>Address</th><th>Town/State</th><th>Contact</th><th>Phone</th><th>GPS</th><th>Animal Category</th></tr>
<tr><td>Fazenda Agua Amarela BRMGIT2509AGUA2509-01</td><td>Rodovia MGT 154</td><td>Ituiutaba, Minas Gerais, 38000</td><td>Marcos de Carvalho Franco</td><td>55.34.32622509</td><td>18.92 S 49.50 W</td><td>Swine, Finishing</td></tr>
<tr><td>Fazenda Boa Vista BRMGNO0048BOAV0048-01</td><td>Rodovia Uberlândia / Araxá - após trevo Uberaba / Nova Ponte - 1 km à esq.</td><td>Nova Ponte, Minas Gerais, 38000</td><td>José Paulo Pinto</td><td>55.34.33560048</td><td>19.26 S 47.68 W</td><td>Swine, Finishing</td></tr>
<tr><td>Décio Bruxel</td><td>Avenida JK , 2094 Bairro Ipanema</td><td>Patos de Minas, Minas Gerais 38706</td><td>Décio Bruxel</td><td>55.34.3818 2500</td><td></td><td>Main Office</td></tr>
<tr><td>Fazenda Bom Retiro BRMGPA2500BOMR2500-01</td><td>Rod. Patos de Minas a Paracatu - MG 410 km. 57</td><td>Presidente Olegário, Minas Gerais, 38750</td><td rowspan="5">Marcos Bruxel</td><td rowspan="5">55.34.3818 2500</td><td>18.13 S 46.49 W</td><td>Swine, Farrow to Finish</td></tr>
<tr><td>Fazenda Chuá BRMGPA2500CHUÁ2500-01</td><td>Rod. Patos de Minas a Leal , Km 03</td><td rowspan="3">Patos de Minas, Minas Gerais 38000</td><td>18.59 S 46.43 W</td><td>Swine, Farrowing</td></tr>
<tr><td>Fazenda Chuá-Sitio 2 BRMGPA2500CHUA2500-02</td><td>Rod. Patos de Minas a Leal , Km 03</td><td></td><td>Swine, Farrow to Finish</td></tr>
<tr><td>Fazenda Mata Burro BRMGPA2500MATA2500-0</td><td>Rod. 354 Km 1</td><td></td><td>Swine, Finishing</td></tr>
<tr><td>Fazenda São João BRMGPA2500SÃOJ2500-01</td><td>Rod. BR 365 Km 351</td><td>Varjão de Minas, Minas Gerais 38700</td><td>18.44 S 46.05 W</td><td>Swine, Finishing</td></tr>
<tr><td>Fazenda Campo Belo BRGOJA7523CAMP7523-01</td><td>Rodovia BR 364, Km 146, Zona Rural</td><td>Jataí, Goiás, 75800</td><td>Rildo de Oliveira Naves</td><td>55.64.99587523</td><td>18.13 S 51.40 W</td><td>Swine, Finishing</td></tr>
<tr><td>Fazenda Confusão - Dois Irmãos BRGOSA5919COFU5919-</td><td>Rodovia BR 060, Km 318, Zona Rural</td><td>Santo Antonio da Barra, Goiás 75935</td><td>Osvaldo Soerger</td><td>55.64.96415919</td><td>17.42 S 50.62 W</td><td>Swine, Finishing</td></tr>
</table>

Farm/Site Name (AgCert ID Number)	Address	Town/State	Contact	Phone	GPS	Animal Category
01						
Fazenda Confusão - Dois Irmãos BRGOSA5919CONF5919-01	Rodovia BR 060, Km 318, Zona Rural	Santo Antonio da Barra, Goiás 75935	Fredi Soerger	55.64.96415919	17.41 S 50.61 W	Swine, Finishing
Fazenda Coqueiros do Rio Doce e Rio Verdinho BRGORI4968COQU4968-01	Rodovia BR 060, Km 406, Zona Rural	Rio Verde, Goiás, 75900	Ricardo Antonio Pazini	55.64.6214968	17.86 S 51.13 W	Swine, Farrowing
Fazenda Dona Oscila BRGOSA6587DONA6587-01	Rodovia GO 164, km 15 à esquerda, Zona Rural	Santa Helena de Goiás, Goiás 75920	Fabio Leão Velasco	55.64.6126587	N/A	Swine, Farrowing
Fazenda Estreito e Ponte de Pedras BRGORI1661ESTR1661-02	Rodovia GO 174 a Iporá, Km 80	Montividiu, Goiás, 75915	Paulo Pedro de Souza Ferraz	55.64.6221661	17.17 S 51.06 W	Swine, Finishing
Fazenda Estreito e Ponte de Pedras BRGORI1661ESTR1661-01	Rodovia GO 174 a Iporá, Km 80	Montividiu, Goiás, 75915	Ana Marta de Souza Ferraz	55.64.6221661	17.18 S 51.07 W	Swine, Finishing
Fazenda Fortaleza Castelo BRGOCA1279FORT1279-01	Rodovia BR 452, km 78, Zona Rural	Castelândia, Goiás, 75925	Renata Fabricio Rechia	55.64.6491279	N/A	Swine, Finishing
Geraldo Xavier de Faria e outro	Rua Melo Guimarães, 237 apto 201, Nossa Senhora de Fátima	Pará de Minas, Minas Gerais, 35660	Geraldo Xavier de Faria	55.37.32360077		Main Office
Fazenda Mourão BRMGPA0077MOUR0077-01	Rodovia MG 431 - Pará de Minas a São José da Varginha km 01	São José da Varginha, Minas Gerais, 35694	Geraldo Xavier de Faria	55.37.32360077	N/A	Swine, Farrow to Finish
Granja São Jorge BRMGPA0077SÃOJ0077-	Rodovia BR 262, km 462	Pará de Minas, Minas Gerais, 35660			19.90 S 44.84 W	Swine, Farrow to

Farm/Site Name (AgCert ID Number)	Address	Town/State	Contact	Phone	GPS	Animal Category
01						Finish
Murilo da Silveira Coelho e Outros	Rua Zulmira Lemos Macedo , 22 - Centro	Passos, Minas Gerais, 37900	Murilo da Silveira Coelho	55.35.3521 9399		Main Office
Fazenda Panorama BRMGPA9399PANO9399-01	Rodovia do Caf'é - BR 491 , Km 45	Monte Santo de Minas, Minas Gerais, 37958	Murilo da Silveira Coelho	55.35.3521 9399	21.26 S 46.92 W	Swine, Farrowing
Fazenda Panorama - Granja 2 BRMGPA9399PANO9399-03	Rodovia do Caf'é - BR 491 , Km 45	Monte Santo de Minas, Minas Gerais, 37958	Murilo da Silveira Coelho	55.35.3521 9399	21.27 S 46.95 W	Swine, Finishing, Nursing
Fazenda União BRMGPA9399UNIÃ9399-02	Linha Leitura da Mata, km. 25	Distrito de Bom Jesus dos Campos, Municipio Sao Jose de Barra, Minas Gerais, 37945	Murilo da Silveira Coelho	55.35.3521 9399	20.77 S 46.21 W	Swine, Farrowing
Fazenda União - Granja 2 BRMGPA9399UNIÃ1045-01	Linha Leitura da Mata, km. 25	Distrito de Bom Jesus dos Campos, Municipio Sao Jose de Barra, Minas Gerais, 37945	Roberta Silveira Coelho	55.35.3527 1045	20.74 S 46.19 W	Swine, Finishing, Nursing
Granja Fumal BRMGPA9399FUMA9399-01	Linha Glória a Furnas , Km 12	São João Batista do Glória, Minas Gerais, 37920	Murilo da Silveira Coelho	55.35.3521 9399	20.64 S 46.40 W	Swine, Farrow to Finish
Fazenda Paraíso do Rio Preto BRGORI1224PARA1224-01	Rodovia GO 174, Km 28, Zona Rural	Rio Verde, Goiás, 75900	Fabiola Ferreira Ferrari	55.64.6211224	N/A	Swine, Finishing
Fazenda Rio Doce - Beira do Sabiá BRGORI2399RIOD2399-01	Rodovia BR 060, Km 428, Zona Rural	Rio Verde, Goiás, 75901	Rafael Antonio Alves Ferracciu	55.64.9462399	N/A	Swine, Finishing
Daniel Liberato Schwening	Rodovia BR 060, Km 455, Zona Rural	Rio Verde, Goiás, 75900	Nilto Schwening	55.64.612620		Main Office
Fazenda Rioverdinho da Barra Grande BRGORI6200RIOV6200-01	Rodovia BR 060, Km 455, Zona Rural	Rio Verde, Goiás, 75900	Nilto Schwening	55.64.612620	17.71 S 51.38 W	Swine, Finishing

Farm/Site Name (AgCert ID Number)	Address	Town/State	Contact	Phone	GPS	Animal Category
Fazenda Rioverdinho da Barra Grande - Sítio 2 BRGORI6200VERD6200-01					17.70 S 51.38 W	Swine, Finishing
Letícia Liberato Schwening Suet	Rodovia BR 060, Km 455, Zona Rural	Rio Verde, Goiás, 75900	Nilto Schwening	55.64.612620		Main Office
Fazenda Rioverdinho da Barra Grande BRGORI6200RIOV6200-02	Rodovia BR 060, Km 455, Zona Rural	Rio Verde, Goiás, 75900	Nilto Schwening	55.64.612620	17.72 S 51.37 W	Swine, Finishing
Fazenda Rioverdinho da Barra Grande - Sítio 2 BRGORI6200VERD6200-02					17.70 S 51.38 W	Swine, Finishing
Fazenda Santa Lucia BRMGPA1997TALU1997-01	MG 050 , KM 346	Passos, Minas Gerais, 37900	Rubens Carlos Lemos	55.35.3521 1997	20.73 S 46.53 W	Swine, Farrow to Finish
Fazenda São Tomaz Lugar Matinha BRGORI1166SÃOT1166-01	Rodovia GO 174, Km 14, Sentido Cachoeira Alta	Rio Verde, Goiás, 75900	Justino João Canale	55.64.6231166	17.95 S 51.11 W	Swine, Finishing
Fazenda Talhado Lugar Irara BRGORI9179TALH9179-01	Rodovia GO 174, Km 35, Zona Rural	Rio Verde, Goiás, 75900	Moacir Luiz Bresiani	55.64.6139179	N/A	Swine, Finishing
Fazenda Talhado Rio Doce BRGORI1035TALH1035-01	Rodovia GO 174, Km 35, Zona Rural	Rio Verde, Goiás, 75900	Erzelino Chiarello	55.64.96111035	N/A	Swine, Finishing
Granja Araújo BRMGPAARAÚ9399-01	Rodovia MG 050 , KM 344 , Zona Rural	Passos, Minas Gerais, 37920	José Hélio Araújo	55.35.3521 9399	20.73 S 46.51 W	Swine, Farrow to Finish
Granja Cometa BRMGPA9168COME9168-	Rodovia MG 050, Estrada Rural	Passos, Minas Gerais, 37900	Julio Lopes Cançado	55.35.3522 9168	20.73 S 46.50 W	Swine, Farrow to

Farm/Site Name (AgCert ID Number)	Address	Town/State	Contact	Phone	GPS	Animal Category
01	Taquarucu, KM 6					Finish
Granja Lagoa BRMGSÃ1223GOA*1223-01	Rodovia Gloria a Furnas, KM 05	Sao Joao Batista do Gloria, Minas Gerais, 37920	Jose Waldner Gomes de Brito	55.35.3524 1223	20.66 S 46.47 W	Swine, Farrow to Finish
Granja Ludmila BRMGPALUDI9399-01	Rodovia MG 050 , KM 319 , Zona Rural	Passos, Minas Gerais, 37902	Cério Tiso Monteiro	55.35.3521 9399	20.73 S 46.57 W	Swine, Farrow to Finish
Granja Santo Cristo BRGORI4423SANT4423-01	Rodovia Br 060, Km 251, Zona Rural	Rio Verde, Goiás, 75900	Raymundo Ferronato	55.64.6214423	17.89 S 51.06 W	Swine, Farrowing

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.

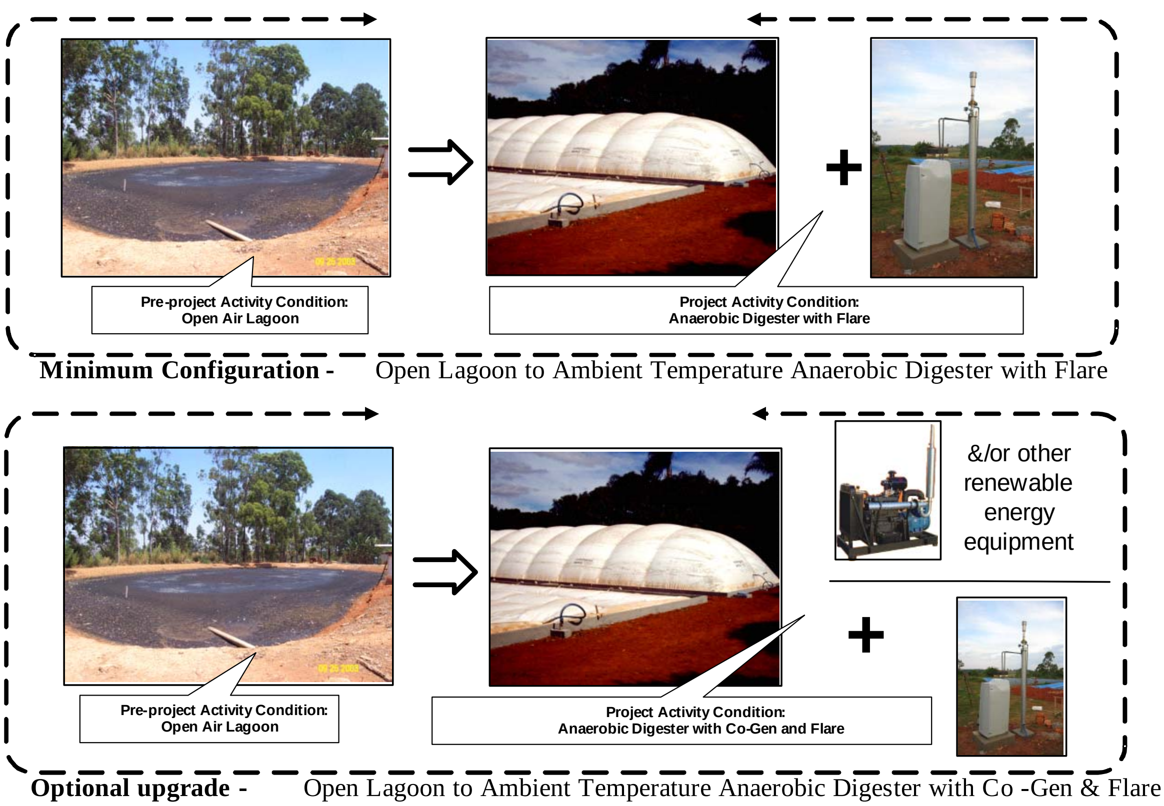

Figure A2. Project Activity Configurations.

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)[10], 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

[10] 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.[11] 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[12] of Brazilian Agricultural Research Corporation (EMBRAPA)[13] 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).

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

[12] 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

[13] 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

A.4.4.1 - Estimated Emission Reductions over chosen Crediting Period	
Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1	124,218
Year 2	124,218
Year 3	124,218
Year 4	124,218
Year 5	124,218
Year 6	124,218
Year 7	124,218
Year 8	124,218
Year 9	124,218
Year 10	124,218
Total estimated reductions (tonnes CO_2e)	1,242,181
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	124,218

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.[14]
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).
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

Farm System	AWPS		AWMS				Other	
	Animal Category	Genetics Source	Base-line	#	Project	#	Region - Climate	Population Data
Fazenda Agua Amarela	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Boa Vista	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3

[14] 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.

Farm System	AWPS		AWMS				Other	
	Animal Category	Genetics Source	Base-line	#	Project	#	Region - Climate	Population Data
Fazenda Bom Retiro	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Chuá	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Chuá – Sitio 2	Swine	Annex I Country	Lagoon	3			Latin America - Temperate	See Annex 3
Fazenda Mata Burro	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda São João	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	2	Latin America - Temperate	See Annex 3
Fazenda Campo Belo	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Confusão - Dois Irmãos (F. Soerger)	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Confusão - Dois Irmãos (O. Soerger)	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Coqueiros do Rio Doce e Rio Verdinho	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Dona Oscila	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Estreito e Ponte de Pedras (Ana)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Estreito e Ponte de Pedras (Pedro)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Fortaleza Castelo	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3

Farm System	AWPS		AWMS				Other	
	Animal Category	Genetics Source	Base-line	#	Project	#	Region - Climate	Population Data
Fazenda Mourão	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja São Jorge	Swine	Annex I Country	Lagoon	4	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Panorama	Swine	Annex I Country	Lagoon	5	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Panorama – Granja 2	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda União	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda União – Granja 2	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja Fumal	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Paraíso do Rio Preto	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Rio Doce - Beira do Sabiá	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Rioverdinho da Barra Grande (Daniel)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Rioverdinho da Barra Grande - Sítio 2 (Daniel)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Rioverdinho da Barra Grande (Leticia)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Rioverdinho da Barra Grande - Sítio 2 (Leticia)	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3

Farm System	AWPS		AWMS				Other	
	Animal Category	Genetics Source	Base-line	#	Project	#	Region - Climate	Population Data
Fazenda Santa Lucia	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda São Tomaz Lugar Matinha	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Talhado Lugar Irara	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Fazenda Talhado Rio Doce	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja Araújo	Swine	Annex I Country	Lagoon	1	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja Cometa	Swine	Annex I Country	Lagoon	1	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja Lagoa	Swine	Annex I Country	Lagoon	5	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja Ludmila	Swine	Annex I Country	Lagoon	2	Anaerobic Digester	1	Latin America - Temperate	See Annex 3
Granja Santo Cristo	Swine	Annex I Country	Lagoon	3	Anaerobic Digester	1	Latin America - Temperate	See Annex 3

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

Table B2. Emission Factor Determination (EFD) Test Results

Farm System	EFD Test Question				Result
	1	2	3	4	
Fazenda Agua Amarela	No	Yes	Yes	Yes	Use developed nation default EFs

Farm System	EFD Test Question				Result
	1	2	3	4	
Fazenda Boa Vista	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Bom Retiro	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Chuá	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Chuá-Sitio 2	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Mata Burro	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda São João	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Campo Belo	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Confusão - Dois Irmãos (F. Soerger)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Confusão - Dois Irmãos (O. Soerger)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Coqueiros do Rio Doce e Rio Verdinho	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Dona Oscila	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Estreito e Ponte de Pedras (Ana)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Estreito e Ponte de Pedras (Pedro)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Fortaleza Castelo	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Mourão	No	Yes	Yes	Yes	Use developed nation default EFs
Granja São Jorge	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Panorama	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Panorama - Granja 2	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda União	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda União - Granja 2	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Fumal	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Paraíso do Rio Preto	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Rio Doce - Beira do Sabiá	No	Yes	Yes	Yes	Use developed nation default EFs

Farm System	EFD Test Question				Result
	1	2	3	4	
Fazenda Rioverdinho da Barra Grande (Daniel)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Rioverdinho da Barra Grande - Sítio 2 (Daniel)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Rioverdinho da Barra Grande (Leticia)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Rioverdinho da Barra Grande - Sítio 2 (Leticia)	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Santa Lucia	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda São Tomaz Lugar Matinha	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Talhado Lugar Irara	No	Yes	Yes	Yes	Use developed nation default EFs
Fazenda Talhado Rio Doce	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Araújo	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Cometa	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Lagoa	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Ludmila	No	Yes	Yes	Yes	Use developed nation default EFs
Granja Santo Cristo	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)[15] supports this finding stating: "*Biogas is a technique that is rarely used in Brazilian swine and layer operations; lagoon treatment (open-air) is the most common*."
- *Pit Storage below animal confinements*: Installing pit storage would require excavation underneath each of the existing barns or actual replacement (which is more likely). Further, reliable, uninterrupted electric supply is essential; if power fails the animal herd will be quickly killed by the accumulation of toxic fumes, including hydrogen sulphide (H_2S). Power in rural Brazil is not reliable.[16] 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

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[15] 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.

[16] 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.

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

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

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

Step 3: Economic Comparison

Tables B3 through B7 illustrate the economic comparison between plausible baseline scenarios and the proposed project activity scenarios. Data presented has been based on a typical 500 to 600 sow potential project activity in Minas Gerais, Brazil. The scalability of this data when applied to larger or smaller project activities is not strictly linear, but the economic relationship between the scenarios will remain generally the same. This comparison was prepared by AgCert and reviewed by a swine industry economist.[18]

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

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

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%.[19]

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

Figure B1. Brazilian discount rate.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The deep pit solution typically accommodates 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*."[20]

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.

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

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
Jan 2004	Project start date. AgCert and Mario Cesar Mendes (owner of Granja Santo Cristo) agree to undertake a Clean Development Mechanism project activity. Initiated construction engineering and planning activities
Jan 2004 - Sept 2005	Site Survey, Data Collection, Baseline Analysis, PDD preparation
Apr 2005	Broke ground at first construction site (Fazenda Paraiso do Rio Preto-Fabiola)
Jan 24 and 26, 2005	Held stakeholders' meetings in Belo Horizonte – Minas Gerais; Uberlandia – Minas Gerais; and Rio Verde – Goiás.
Jul 7, 2005	Held stakeholders' meetings in Belo Horizonte – Minas Gerais.
Aug 25, 2005	Held stakeholders' meetings in Belo Horizonte – Minas Gerais.
Sept 2005	AgCert submits to the DOE the first draft of this GHG Mitigation PDD
Jan 2006	Projected construction completed at final site, (Fazenda Sao Tomaz Lugar Matinha) 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.

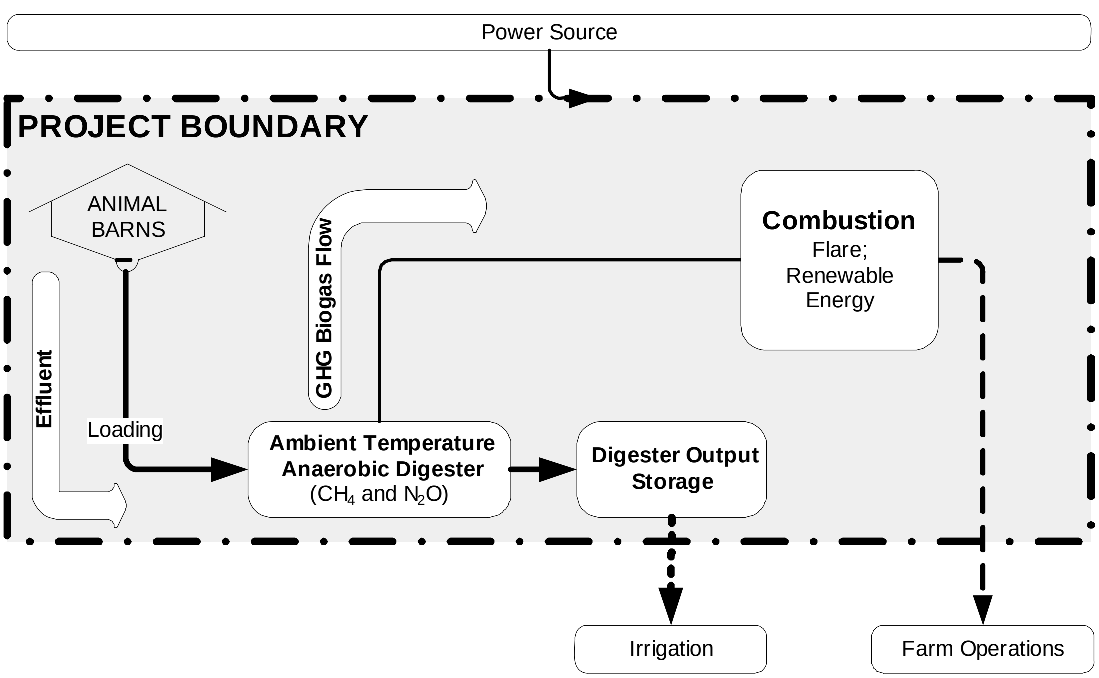

Figure B2. Project Boundary

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 14/09/2005. The name of entity determining the baseline is AgCert. AgCert is a project participant, as well as the project developer.

Some population numbers used to calculate baseline emissions have been estimated in a conservative manner. For example, mortality rates are based on the average Brazilian mortality rate of 1%, finisher inventory is calculated by dividing the number of animals by 3, etc. These are all standard livestock inventory management techniques used within the industry.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

The starting date of the project activity is 06/01/2004.

C.1.2 Expected operational lifetime of the project activity:

The expected operational lifetime of the project activity is 12y 10m.

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: 01/04/2006

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.[21]
3. The farms have livestock populations managed under confined conditions and operate in a competitive market.
4. The livestock populations are comprised of swine animals, an applicable animal type.
5. The AWMS, including both the baseline scenario and the manure management systems introduced as part of the project activity, is in accordance with the regulatory framework in the country, excluding the discharge of manure into natural resources (e.g., rivers or estuaries).
6. The project activity introduces an AWMS practice and technology to reduce GHG emissions at the designated farms.
7. The project activity at the designated farms results in a reduction of GHG emissions due to the AWMS improvements.

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

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

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

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

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
1. $Population_{month}$	Integer, Classification	Herd/breed counts per type	#, Type	m	Entrance – exit records of animals to the barn	100%	electronic	Animal counts by population classification and genetics. Classification data also includes mortality and days resident.
6. BA	Classification	Type of 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	^oC, 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	°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:

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

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

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

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

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

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

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

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

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

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

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

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

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

D.2.3 Treatment of leakage in the monitoring plan:

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

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

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

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

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

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

- Equation 17, Project activity electricity emissions in CO_2e:

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

- Equation 18, Land leakage:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- Equation 24, Total emissions in metric tonnes CO_2e:

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

- Equation 26, Net emission reductions:

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

D.3 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored.		
Data *(Indicate table and ID number, e.g., D.2-1, D.2-2)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.1-1	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.3-1	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-6	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.3-6	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-9	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.3-9	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-12	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-13	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.1.1-14	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.3.1-16	Low	Work instructions for the collection of this data point are available in O&M Manual
D.2.3.1-19	Low	Work instructions for the collection of this data point are available in O&M Manual

AgCert’s monitoring and reporting plan has been developed under the organization’s ISO 9001 and ISO 14001 Quality and Environmental Management System. 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 and a project participant.

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		Fazenda Agua Amarela	319	75	
2		Fazenda Boa Vista	274	65	
3		Decio Bruxel			
	1	Fazenda Bom Retiro	343	81	
	2	Fazenda Chuá	314	74	
	3	Fazenda Chuá - sítio 2	354	83	
	4	Fazenda Mata Burros	199	47	
	5	Fazenda São João	1,269	299	
4		Fazenda Campo Belo	411	97	
5		Fazenda Confusão - Dois Irmãos (Fredi Soerger)	383	90	
6		Fazenda Confusão - Dois Irmãos (Osvaldo Soerger)	380	90	
7		Fazenda Coqueiros do Rio Doce e Rio Verdinho	546	129	
8		Fazenda Dona Oscila	578	136	
9		Fazenda Estreito e Ponte de Pedras (Ana Marta de Souza Ferez)	442	104	
10		Fazenda Estreito e Ponte de Pedras (Pedro Paulo de Souza Ferraz)	389	92	
11		Fazenda Fortaleza Castelo	352	83	
12		Geraldo Xavier de Faria e outro			
	1	Fazenda Mourão	913	215	
	2	Granja São Jorge	212	50	
13		Murilo da Silveira Coelho e Outros			
	1	Fazenda Panorama	105	25	
	2	Fazenda Panorama - Granja 2	794	187	
	3	Fazenda União	161	38	
	4	Fazenda União - Granja 2	892	210	
	5	Granja Fumal	173	41	
14		Fazenda Paraíso do Rio Preto	411	97	
15		Fazenda Rio Doce - Beira do Sabiá	394	93	
16		Daniel Liberato Schwening			
	1	Fazenda Rioverdinho da Barra Grande (Daniel L. Schwening)	397	94	
	2	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Daniel L. Schwening)	384	91	
17		Leticia Liberato Schwening Suet			
	1	Fazenda Rioverdinho da Barra Grande (Leticia L. Schwening)	448	106	
	2	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Leticia L. Schwening)	378	89	
18		Fazenda Santa Lucia	503	119	
19		Fazenda São Tomaz Lugar Matinha	387	91	
20		Fazenda Talhado Lugar Irara	432	102	
21		Fazenda Talhado Rio Doce	448	106	
22		Granja Araújo	241	57	
23		Granja Cometa	498	118	
24		Granja Lagoa	297	70	
25		Granja Ludmila	255	60	
26		Granja Santo Cristo	254	60	
		Total:	15,529	3,664	**19,193**

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										
Site	Source	GHG Emissions (CO_2e)								
		Baseline			Project			Change		
		CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2
	Land Application									
1	Fazenda Agua Amarela		429			429			0	
2	Fazenda Boa Vista		369			369			0	
3	Fazenda Bom Retiro		463			463			0	
4	Fazenda Campo Belo		554			554			0	
5	Fazenda Chuá		424			424			0	
6	Fazenda Chuá - sítio 2		477			477			0	
7	Fazenda Confusão - Dois Irmãos (Fredi Soerger)		517			517			0	
8	Fazenda Confusão - Dois Irmãos (Osvaldo Soerger)		512			512			0	
9	Fazenda Coqueiros do Rio Doce e Rio Verdinho		736			736			0	
10	Fazenda Dona Oscila		779			779			0	
11	Fazenda Estreito e Ponte de Pedras (Ana Marta de Souza Ferez)		596			596			0	
12	Fazenda Estreito e Ponte de Pedras (Pedro Paulo de Souza Ferraz)		524			524			0	
13	Fazenda Fortaleza Castelo		475			475			0	
14	Fazenda Mata Burros		268			268			0	
15	Fazenda Mourão		1,231			1,231			0	
16	Fazenda Panorama		141			141			0	
17	Fazenda Panorama - Granja 2		1,070			1,070			0	
18	Fazenda Paraíso do Rio Preto		554			554			0	
19	Fazenda Rio Doce - Beira do Sabiá		532			532			0	
20	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Daniel L. Schwening)		518			518			0	
21	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Leticia L. Schwening)		510			510			0	
22	Fazenda Rioverdinho da Barra Grande (Daniel L. Schwening)		535			535			0	
23	Fazenda Rioverdinho da Barra Grande (Leticia L. Schwening)		604			604			0	
24	Fazenda Santa Lucia		678			678			0	
25	Fazenda São João		1,711			1,711			0	
26	Fazenda São Tomaz Lugar Matinha		522			522			0	
27	Fazenda Talhado Lugar Irara		583			583			0	
28	Fazenda Talhado Rio Doce		605			605			0	
29	Fazenda União		217			217			0	
30	Fazenda União - Granja 2		1,202			1,202			0	
31	Granja Araújo		324			324			0	
32	Granja Cometa		672			672			0	
33	Granja Fumal		233			233			0	
34	Granja Lagoa		400			400			0	
35	Granja Ludmila		344			344			0	
36	Granja Santo Cristo		342			342			0	
37	Granja São Jorge		286			286			0	

E2 - Total Leakage Emissisons (continued)											
Site	Source	GHG Emissions (CO_2e)									
		Baseline			Project			Change			
		CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	
	AWMS Electrical Power										
1	Fazenda Agua Amarela			0			0.36			0.36	
2	Fazenda Boa Vista			0			0.36			0.36	
3	Fazenda Bom Retiro			0			0.36			0.36	
4	Fazenda Campo Belo			0			0.36			0.36	
5	Fazenda Chuá			0			0.36			0.36	
6	Fazenda Chuá - sítio 2			0			0.36			0.36	
7	Fazenda Confusão - Dois Irmãos (Fredi Soerger)			0			0.36			0.36	
8	Fazenda Confusão - Dois Irmãos (Osvaldo Soerger)			0			0.36			0.36	
9	Fazenda Coqueiros do Rio Doce e Rio Verdinho			0			0.36			0.36	
10	Fazenda Dona Oscila			0			0.36			0.36	
11	Fazenda Estreito e Ponte de Pedras (Ana Marta de Souza Ferez)			0			0.36			0.36	
12	Fazenda Estreito e Ponte de Pedras (Pedro Paulo de Souza Ferraz)			0			0.36			0.36	
13	Fazenda Fortaleza Castelo			0			0.36			0.36	
14	Fazenda Mata Burros			0			0.36			0.36	
15	Fazenda Mourão			0			0.36			0.36	
16	Fazenda Panorama			0			0.36			0.36	
17	Fazenda Panorama - Granja 2			0			0.36			0.36	
18	Fazenda Paraíso do Rio Preto			0			0.36			0.36	
19	Fazenda Rio Doce - Beira do Sabiá			0			0.36			0.36	
20	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Daniel L. Schwening)			0			0.36			0.36	
21	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Leticia L. Schwening)			0			0.36			0.36	
22	Fazenda Rioverdinho da Barra Grande (Daniel L. Schwening)			0			0.36			0.36	
23	Fazenda Rioverdinho da Barra Grande (Leticia L. Schwening)			0			0.36			0.36	
24	Fazenda Santa Lucia			0			0.36			0.36	
25	Fazenda São João			0			0.36			0.36	
26	Fazenda São Tomaz Lugar Matinha			0			0.36			0.36	
27	Fazenda Talhado Lugar Irara			0			0.36			0.36	
28	Fazenda Talhado Rio Doce			0			0.36			0.36	
29	Fazenda União			0			0.36			0.36	
30	Fazenda União - Granja 2			0			0.36			0.36	
31	Granja Araújo			0			0.36			0.36	
32	Granja Cometa			0			0.36			0.36	
33	Granja Fumal			0			0.36			0.36	
34	Granja Lagoa			0			0.36			0.36	
35	Granja Ludmila			0			0.36			0.36	
36	Granja Santo Cristo			0			0.36			0.36	
37	Granja São Jorge			0			0.36			0.36	
							Total:			13	**13**

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	15,529	3,664		
E2 - Leakage			13	
Total:	15,529	3,664	13	**19,206**

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		Fazenda Agua Amarela	2,867	75	
2		Fazenda Boa Vista	2,463	65	
3		Decio Bruxel			
	1	Fazenda Bom Retiro	3,089	81	
	2	Fazenda Chuá	2,828	74	
	3	Fazenda Chuá - sítio 2	3,184	83	
	4	Fazenda Mata Burros	1,789	47	
	5	Fazenda São João	11,422	299	
4		Fazenda Campo Belo	3,700	97	
5		Fazenda Confusão - Dois Irmãos (Fredi Soerger)	3,448	90	
6		Fazenda Confusão - Dois Irmãos (Osvaldo Soerger)	3,420	90	
7		Fazenda Coqueiros do Rio Doce e Rio Verdinho	4,912	129	
8		Fazenda Dona Oscila	5,198	136	
9		Fazenda Estreito e Ponte de Pedras (Ana Marta de Souza Ferez)	3,981	104	
10		Fazenda Estreito e Ponte de Pedras (Pedro Paulo de Souza Ferraz)	3,501	92	
11		Fazenda Fortaleza Castelo	3,171	83	
12		Geraldo Xavier de Faria e outro			
	1	Fazenda Mourão	8,217	215	
	2	Granja São Jorge	1,908	50	
13		Murilo da Silveira Coelho e Outros			
	1	Fazenda Panorama	943	25	
	2	Fazenda Panorama - Granja 2	7,143	187	
	3	Fazenda União	1,447	38	
	4	Fazenda União - Granja 2	8,026	210	
	5	Granja Fumal	1,558	41	
14		Fazenda Paraíso do Rio Preto	3,697	97	
15		Fazenda Rio Doce - Beira do Sabiá	3,548	93	
16		Daniel Liberato Schwening			
	1	Fazenda Rioverdinho da Barra Grande (Daniel L. Schwening)	3,572	94	
	2	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Daniel L. Schwening)	3,457	91	
17		Leticia Liberato Schwening Suet			
	1	Fazenda Rioverdinho da Barra Grande (Leticia L. Schwening)	4,033	106	
	2	Fazenda Rioverdinho da Barra Grande - Sítio 2 (Leticia L. Schwening)	3,404	89	
18		Fazenda Santa Lucia	4,525	119	
19		Fazenda São Tomaz Lugar Matinha	3,484	91	
20		Fazenda Talhado Lugar Irara	3,889	102	
21		Fazenda Talhado Rio Doce	4,036	106	
22		Granja Araújo	2,165	57	
23		Granja Cometa	4,486	118	
24		Granja Lagoa	2,670	70	
25		Granja Ludmila	2,297	60	
26		Granja Santo Cristo	2,284	60	
		Total:	139,760	3,664	**143,424**

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

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

E5 - Total Project Activity Emission Reductions		
Source	GHG Emissions (CO_2e)	
E4 - Est. Baseline Emissions	143,424	
E3 - Project Activity Emissions	19,206	
Total:	124,218	**124,218**

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

E6 - Project Activity Emissions				
Year	**Estimation of Project Activity Emissions (tonnes CO_2e)**	**Estimate of Baseline Emissions (tonnes CO_2e)**	**Estimate of Leakage (tonnes CO_2e)**	**Estimation of Emission Reductions (tonnes CO_2e)**
Year 1	19,193	143,424	13	124,218
Year 2	19,193	143,424	13	124,218
Year 3	19,193	143,424	13	124,218
Year 4	19,193	143,424	13	124,218
Year 5	19,193	143,424	13	124,218
Year 6	19,193	143,424	13	124,218
Year 7	19,193	143,424	13	124,218
Year 8	19,193	143,424	13	124,218
Year 9	19,193	143,424	13	124,218
Year 10	19,193	143,424	13	124,218
Total (tonnes CO_2e)**:**	191,927	1,434,241	133	1,242,181

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).

Parameter/Factor	Value	Source/Comment
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=44/28)
F_{gasm}	0.2	Obtained from 1996 IPCC, Table 4-19, p. 4.94
EF_3	0.001	Obtained from IPCC 2000 Table 4.12, Section 4.4.1.2, p. 4.43
EF_4	0.01	Obtained from IPCC 2000 Table 4.18 Section 4.8.1.2, p. 4.73
N_{ex}	20	Obtained from 1996 IPCC, Table 4-20, p. 4.99
Project Activity		
CH_4 GWP	21	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
ID1	Annex 3	Animal population used to estimate baseline and project emission estimates was based on a 12 month period of actual operation production data (See Annex 3).
ID1	Annex 3	Mortality rate
ID1 (n_m)	Annex 3	Days resident in system
ID14	100%	AWMS operation status
MS%j	100%	Percent of effluent used in system
V_S	0.5	Obtained from 1996 IPCC Appendix B, Table B-6, p. 4.46
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=44/28)
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

Parameter/Factor	Value	Source/Comment
	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=44/28)
F_{leach}	0.3	Obtained from IPCC 1996, Table 4-24, p. 4.106
EF_5	0.025	Obtained from IPCC 1996, Table 4-23, p. 4.105
EF_4	0.01	Obtained from IPCC 2000 Table 4.18 Section 4.8.1.2, p. 4.73
ID16	500 kwh/yr	Electricity consumed by project activity equipment
ID19	90,000kwh/yr	Electricity generated by project activity equipment using captured methane
ECy	0.719kg CO2 / kwh	OECD: Road-Testing Baseline for GHG Projects in the Energy Power Sector. Emission coefficient for electricity (Consumed by Project Activity Equipment)
ECy	0.275kg CO2 / kwh	OECD: Road-Testing Baseline for GHG Projects in the Energy Power Sector. Emission coefficient for electricity (Produced by Project Activity Generator)

Table E1-2. Uncertainty Parameters

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

SECTION F. Environmental impacts:

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

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

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

- Reducing atmospheric emissions of Volatile Organics Compounds (VOCs) that cause odour,
- Reducing the risk (of 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 Rio Verde-Goiás, Belo Horizonte-Minas Gerais and Uberlandia-Minas Gerais on 24 and 26 January 2005. Additional meetings were held in Belo Horizonte-Minas Gerais on 7 July 2005 and in Belo Horizonte -Minas Gerais on 25 August 2005.

AgCert invited stakeholders to the meetings to explain the UNFCCC CDM process and proposed project activity. The January meetings were presided over by Miguel Henrique Gastão de Oliveira in Minas Gerais, and Hellen Souza de Macedo in Goiás. For the July and August meetings in Belo Horizonte, Paulo Guilherme Furtado presided. 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) *Correio Uberlandense*, Uberlândia, January 17, 2005

d) *Estado de Minas*, Agropecuário, July 4, 2005

e) *Estado de Minas* – Agropecuário – August 22 2005

f) *Folha de Ponte Nova* - August, 19, 2005

A slide presentation was given, in Portuguese, and attendees were afforded the opportunity to ask questions and provide comments. 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 compiled 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.

A complete listing of the comments and the individuals who made them is on file. 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 activities.

ANNEX 1.

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Participant and Developer:	
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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

Fazenda Agua Amarela Farm Data (March 2004 – February 2005)

Finisher												
Population	2,630	2,614	2,602	2,690	2,670	2,650	2,630	3,112	3,594	3,575	3,556	3,538
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Boa Vista Farm Data (May 2004 – April 2005)

Finisher												
Population	2,625	2,603	2,597	2,581	2,567	2,552	2,537	2,751	2,733	2,716	2,698	2,689
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Daniel Liberato Schwening Farm Data: Fazenda Rioverdinho da Barra Grande (June 2004 – May 2005)

Finisher												
Population	3,636	3,619	3,602	3,661	3,712	3,697	3,682	3,633	3,562	3,528	3,494	3,470
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Daniel Liberato Schwening Farm Data: Fazenda Rioverdinho da Barra Grande Sítio 2 (May 2004 – April 2005)

Finisher												
Population	3,650	3,631	3,611	3,620	3,610	3,587	3,564	3,572	3,555	3,522	3,486	3,466
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Décio Bruxel Farm Data: Fazenda Bom Retiro (July 2004 – June 2005)

Sow												
Population	85	85	85	85	85	85	85	85	85	85	85	85
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	37	19	20	19	20	28	22	19	29	29	19	18
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	6	7	7	6	5	5	7	8	10	10	10	10
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	2,199	2,148	2,483	2,307	2,306	2,407	2,405	1,882	1,965	2,137	2,271	2,363
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	751	605	743	552	568	710	493	469	592	571	525	771
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Décio Bruxel Farm Data: Fazenda Chuá (July 2004 – June 2005)

Sow												
Population	2,310	2,214	2,198	2,225	2,228	2,219	2,252	2,260	2,267	2,283	2,282	2,302
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	407	376	367	359	379	380	353	373	417	463	531	639
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	42	45	42	40	42	47	45	45	49	51	49	48
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Décio Bruxel Farm Data: Fazenda Chuá-Sitio 2 (July 2004 – June 2005)

Finisher												
Population	779	719	845	825	822	744	1,106	888	1,022	993	1,094	1,042
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												
Population	2,928	1,883	2,550	1,605	2,435	2,285	1,624	2,471	2,592	1,755	2,375	1,371
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

Décio Bruxel Farm Data: Fazenda Mata Burros (July 2004 – June 2005)

Finisher												
Population	2,499	2,405	1,097	2,094	2,344	1,946	734	1,243	2,023	1,962	810	1,442
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Décio Bruxel Farm Data: Fazenda São João (August 2004 – July 2005)

Finisher												
Population	9,737	10,797	10,898	10,993	11,648	11,582	10,892	10,938	11,353	10,756	10,858	11,336
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Campo Belo Farm Data (August 2004 – July 2005)

Finisher												
Population	3,940	3,932	3,950	3,929	3,885	3,842	3,809	3,647	3,633	3,618	3,603	3,602
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Confusão – Dois Irmãos (Osvaldo Soerger) Farm Data (August 2004 – July 2005)

Finisher												
Population	3,683	3,665	3,647	3,629	3,577	3,539	3,505	3,562	3,615	3,595	3,576	3,567
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Confusão – Dois Irmãos (Fredi Soerger) Farm Data (May 2004 – April 2005)

Finisher												
Population	3,533	3,500	3,472	3,584	3,555	3,524	3,495	3,528	3,540	3,517	3,492	3,484
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Coqueiros do Rio Doce e Rio Verdinho Farm Data (August 2004 – July 2005)

Sow												
Population	1,156	1,129	1,117	1,120	1,121	1,120	1,118	1,128	1,118	1,116	1,116	1,108
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	104	110	117	110	110	112	117	117	133	143	154	162
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	5	5	5	5	5	5	5	5	5	5	5	5
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	3,676	3,913	3,394	3,705	3,844	3,658	3,681	3,619	4,065	3,562	3,750	871
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Dona Oscila Farm Data (July 2004 – June 2005)

Sow												
Population	1,199	1,222	1,230	1,242	1,244	1,249	1,218	1,211	1,209	1,199	1,187	1,176
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	104	118	133	136	124	128	95	98	96	97	96	94
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	11	11	11	11	11	11	11	11	11	11	11	11
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	3,834	3,261	3,394	4,225	3,403	3,615	4,072	3,402	3,778	4,026	3,342	3,558
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Estreito e Ponte de Pedras (Pedro Paulo de Souza Ferraz) Farm Data (June 2004 – May 2005)

Finisher												
Population	3,610	3,589	3,569	3,577	3,569	3,553	3,536	3,577	3,601	3,578	3,556	3,545
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Estreito e Ponte de Pedras (Ana Marta de Souza Ferraz) Farm Data (April 2004 – March 2005)

Finisher												
Population	4,068	4,054	4,043	4,085	4,067	4,049	4,031	4,030	3,996	4,030	4,011	3,999
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Fortaleza Castelo Farm Data (July 2004 – June 2005)

Finisher												
Population	3,568	3,551	3,595	3,573	3,552	3,530	3,525	3,676	3,643	3,612	3,579	3,565
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Paraíso do Rio Preto Farm Data (April 2004 – March 2005)

Finisher												
Population	4,002	3,979	4,021	4,004	3,988	3,971	3,955	3,897	3,814	3,733	3,652	3,569
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Rio Doce –Beira do Sabía Farm Data (July 2004 – June 2005)

Finisher												
Population	3,639	3,635	3,630	3,596	3,563	3,530	3,498	3,669	3,633	3,596	3,558	3,553
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Santa Lucia Farm Data (August 2004 – July 2005)

Sow												
Population	433	448	445	444	455	449	454	448	448	440	439	443
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	66	48	48	48	46	38	46	56	60	60	59	58
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	3	3	3	3	3	3	4	4	4	3	3	3
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	2,651	2,620	2,418	2,463	2,715	2,714	2,498	2,737	2,552	2,453	2,477	2,577
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	1,169	1,222	1,450	1,426	1,199	1,223	1,415	1,290	1,367	1,331	1,108	1,124
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda São Tomaz Lugar Matinha Farm Data (May 2004 – April 2005)

Finisher												
Population	3,608	3,581	3,552	3,580	3,604	3,582	3,561	3,563	3,545	3,515	3,482	3,451
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Talhado Lugar Irara Farm Data (February 2004 – January 2005)

Finisher												
Population	4,045	4,016	3,988	4,003	3,996	3,970	3,944	3,979	3,992	3,964	3,935	3,921
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Fazenda Talhado Rio Doce Farm Data (July 2004 – June 2005)

Finisher												
Population	4,097	4,073	4,050	4,074	4,076	4,039	4,002	4,034	4,045	4,010	3,974	3,955
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Geraldo Xavier de Faria e outro Farm Data: Fazenda Mourao (August 2004 – July 2005)

Sow												
Population	794	825	841	865	859	867	854	834	811	804	805	841
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	154	114	203	49	31	14	42	72	92	122	186	203
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	16	16	21	16	16	16	16	20	21	19	19	21
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	4,235	4,216	5,378	4,445	4,603	4,607	4,850	5,686	5,679	4,372	4,381	5,378
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	1,799	2,108	2,228	2,122	1,880	2,144	2,350	2,354	2,285	1,854	2,143	2,228
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Geraldo Xavier de Faria e outro Farm Data: Granja São Jorge (August 2004 – July 2005)

Sow												
Population	205	212	211	211	213	190	186	183	185	186	189	181
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	10	7	6	5	2	4	13	23	19	14	10	9
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	22	22	22	22	22	2	2	2	2	3	3	3
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	1,159	1,252	1,275	1,344	1,489	1,367	1,133	1,160	1,162	1,252	1,118	1,038
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	332	351	408	390	233	339	530	417	450	407	420	397
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Granja Araújo Farm Data (August 2004 – July 2005)

Sow												
Population	260	270	270	280	290	300	310	310	320	320	330	330
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	10	10	10	10	10	10	20	30	20	27	20	30
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	5	5	5	5	5	5	5	5	5	5	5	5
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	1,230	1,210	1,250	1,150	1,180	1,100	1,120	1,100	1,130	1,070	1,080	1,100
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	640	650	660	650	630	590	600	610	600	590	580	600
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Granja Cometa Farm Data (August 2004 – July 2005)

Sow												
Population	361	361	369	365	371	371	374	375	376	389	398	407
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	20	28	20	27	21	31	28	35	43	28	25	19
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	13	13	12	10	9	9	9	9	8	6	4	4
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	2,757	2,748	2,815	2,808	2,818	2,837	3,123	3,595	3,534	3,497	2,712	2,784
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	723	749	703	672	702	723	967	1,073	1,244	972	1,085	1,189
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Granja Lagoa Farm Data (August 2004 – July 2005)

Sow												
Population	310	310	310	315	315	320	320	325	325	330	330	330
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	30	25	25	30	30	35	35	35	37	40	45	50
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	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												
Population	1,200	1,280	1,380	1,400	1,440	1,450	1,440	1,440	1,700	1,700	1,500	1,600
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	900	800	700	700	730	730	750	755	760	730	730	740
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Granja Ludmila Farm Data (July 2004 – June 2005)

Sow												
Population	244	251	259	260	265	265	260	260	270	284	284	298
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	24	24	29	32	25	27	31	24	17	31	58	48
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	2	3	4	4	3	3	3	3	2	2	2	2
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	1,038	1,079	1,054	1,062	1,126	979	1,114	1,167	1,135	1,169	1,182	1,175
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	720	685	730	781	688	851	842	818	934	903	845	830
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Granja Santo Cristo Farm Data (August 2004 – July 2005)

Sow												
Population	578	570	576	582	573	571	584	586	588	590	587	587
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	63	69	70	64	66	68	62	64	66	63	64	59
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	3	3	3	3	2	2	2	2	2	2	5	5
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	1,611	1,803	1,704	1,669	1,500	1,423	1,438	1,606	1,620	1,618	1,768	817
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Leticia Liberato Schwening Farm Data: Fazenda Rioverdinho da Barra Grande (July 2004 – June 2005)

Finisher												
Population	4,091	4,075	4,061	4,038	3,976	3,935	3,895	3,976	4,037	4,100	3,983	3,973
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Leticia Liberato Schwening Farm Data: Fazenda Rioverdinho da Barra Grande Sítio 2 (April 2004 – March 2005)

Finisher												
Population	3,505	3,441	3,379	3,449	3,542	3,537	3,531	3,543	3,548	3,537	3,528	3,521
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Muriol da Silveira Coelho e Outros Farm Data: Fazenda Panorama (July 2004 – June 2005)

Sow												
Population	811	797	813	800	806	799	804	826	827	825	822	822
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	9	48	62	102	86	85	77	74	50	57	71	64
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	39	38	23	26	24	26	26	26	28	29	29	29
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Muriol da Silveira Coelho e Outros Farm Data: Fazenda Panorama Granja 2 (July 2004 – June 2005)

Finisher												
Population	5,349	5,729	5,446	4,791	4,862	4,664	4,729	4,800	4,498	4,644	4,510	4,810
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	2,246	1,980	1,554	2,102	1,975	1,887	1,718	1,904	1,934	2,184	2,205	1,881
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Muriol da Silveira Coelho e Outros Farm Data: Fazenda União (July 2004 – June 2005)

Sow												
Population	990	1,018	1,027	1,017	1,003	1,021	981	978	980	985	1,006	999
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Gilt												
Population	332	375	422	426	402	419	444	413	358	323	325	276
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Boar												
Population	15	12	13	15	15	14	12	13	16	16	15	16
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Muriol da Silveira Coelho e Outros Farm Data: Fazenda União Granja 2 (July 2004 – June 2005)

Finisher												
Population	2,639	3,401	4,950	5,776	5,890	5,894	5,486	5,856	6,026	5,795	5,402	5,583
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	2,000	2,316	2,100	2,345	2,393	2,422	2,798	2,762	2,769	2,574	3,026	2,531
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

Muriol da Silveira Coelho e Outros Farm Data: Granja Fumal (Nursers: January – June 2005; Sows: February – June 2005; remaining months for nursers and sows based on average inventory; Finishers estimated at 85% of capacity)

Sow												
Population	153	127	127	141	183	189	153	153	153	153	153	153
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Finisher												
Population	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105	1,105
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0
Nurse/Wean												
Population	251	163	373	109	135	405	239	239	239	239	239	239
Days Unpopulated	0	0	0	0	0	0	0	0	0	0	0	0

ANNEX 4.

MONITORING PLAN

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

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

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

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

d. Inspection criteria.

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