AWMS METHANE RECOVERY PROJECT BR07-S-31, MATO GROSSO DO SUL, PARANA, RIO GRANDE DO SUL, AND SANTA CATARINA, BRAZIL

UNFCCC Clean Development Mechanism
Simplified Project Design Document
for
Small Scale Project Activity

DOCUMENT ID: BR07-S-31
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CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

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Annexes

CDM – Executive Board

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

AWMS Methane Recovery Project BR07-S-31, Mato Grosso do Sul, Parana, Rio Grande do Sul, and Santa Catarina, Brazil, Ver 03, 23 May 2007.

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

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

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.

Explanation of GHG emission reductions: This project proposes to apply the Methane Recovery methodology identified in Section III.D, of the Indicative Simplified Baseline and Monitoring Methodologies for Small-Scale CDM Project Activity Categories, to swine CAFOs located in Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul, and Santa Catarina,, Brazil. The proposed project activities will mitigate and recover 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 from a high-GHG AWMS practice, an open air lagoon, to a lower-GHG AWMS practice, an anaerobic digester with capture and combustion of resulting biogas.

Contribution to sustainable development: According to Brazil's *Inter-Ministerial Commission on Global Climatic Change*,[1] manure management is an important issue that needs to be solved. Failure to do so will allow existing problems (e.g., increased (insect) pest populations, problems with allergies and livestock disease, including foot-and-mouth disease (FMD) which exists in Brazil), to continue unabated. To this end, Brazil has in recent years required all CAFOs to transition from single to multi-lagoon systems, and even more recently has required them to line the bottom of their primary sedimentation lagoon to prevent effluent seepage.[2]

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

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

Establishing a positive model for livestock operations is essential. In 2005, the swine population in Brazil was 34,063,934.[3] In 2005, the swine population of Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul, and Santa Catarina, was approximately 15.95 million heads.[4] Considering that a typical hog produces 5.8 kilograms of effluent daily (Table A1), some 33.75 metric tons of hog waste is produced annually in Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul, and Santa Catarina, alone. Introducing progressive AWMS practices throughout Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul, and Santa Catarina, has the potential to reduce approximately 15.86. tonnes[5] of carbon dioxide equivalent (CO2e) each year.

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

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]

This project activity will have positive effects on the local environment by improving air quality (i.e., reducing the emission of Volatile Organic Compounds (VOCs) and odour) and will set the stage for future on-farm projects (i.e., changes in land application practices) that will 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 world-class, scalable animal waste management practices, which can be duplicated on other CAFO livestock farms throughout Brazil, dramatically reducing livestock related GHG and providing the potential for a new source of revenue and green power.

The proposed methane recovery project uniquely satisfies the Brazilian government priorities for environmental stewardship and sustainability while positioning rural agricultural operations to develop

[3] ftp://ftp.ibge.gov.br/Producao_Pecuaria/Producao_da_Pecuaria_Municipal_%5Banual%5D/2004/grandes_regioes_Ufs.zip

[4] ftp://ftp.ibge.gov.br/Producao_Pecuaria/Producao_da_Pecuaria_Municipal_%5Banual%5D/2004/grandes_regioes_Ufs.zip

[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.

and use renewable ("green") power. Indeed, it does so with no negative consequences and with a series of environmental and infrastructure co-benefits.

Because the proposed project establishes an advanced AWMS the project participants believe the farm managers will adopt – and continue to practice – AWMS practice changes that result in meaningful, and permanent, GHG emission reductions beyond the project's expected lifespan.

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 small-scale project activity:

A.4.1. Location of the small-scale 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 project will be located in **Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul,** and **Santa Catarina.**

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

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

Sigefrido Davi Milanesi owns one site in Poxoréu, Mato Grosso:

- Fazenda Buritis (2008022) is a farrow to finisher operation. This site had approximately 7,968 animals on site between January and December, 2005. The producer intends to increase his production having 150 sows per year (2007 and 2008) and 200 sows per year for the subsequent 8 years. This site has a total of eight containment areas; four of which use the flush method of manure removal and the final four use the scraper method. It is then routed to the site's AWMS,

which consists of a consecutive series of six open lagoons. The lagoons are approximately 10m x 10m x 2.8m, 37m x 15.5m x m2, 55m x 32m x 2m, 59m x 32m x 2.5m, 96m x 25m x 2.5m and 100m x 25m x 3.5m. Effluent is disposed of from the lagoons through surface spread. Construction of the anaerobic digester was completed on 15 May, 2007. The digester consists of 1 cell, approximately 70m x 20m x 5m.

Milton Bigatão owns one site in Itaporã, Mato Grosso do Sul:

- Sítio Alto do Céu (26172) is a finishing operation. This site had approximately 3,672 animals on site between September, 2005 and August, 2006. This site has a total of two containment areas which use the flush method of manure removal. It is then routed to the site's AWMS, which consists of a consecutive series of three open lagoons. Two lagoons are approximately 30m x 12m x 4m and the final one is 14m x 30m x 4m. Effluent is disposed of from the lagoons through irrigation. Construction of the proposed anaerobic digester is expected to be complete on 27 January, 2007. The digester will consist of 1 cell, approximately 41m x 13m x 5m.

Lauri Emelio Rauber owns two sites in São Miguel do Iguacu & Serranopolis, Parana:

- Granja Jucelia 1 (10802) is a nurser/finishing operation. This site had approximately 6,594 animals on site between May, 2004 and April, 2005. The producer intends to increase production: 10% each year for 2006 and 2007; 3% each year from 2008 to 2016. This site has a total of five containment areas which use the flush method of manure removal. It is then routed to the site's AWMS, which consists of a consecutive series of five open lagoons. Four lagoons are approximately 20m x 15m x 3.5m and the final one is 15m x 10m x 3.5m. Effluent is disposed of from the lagoons through surface spread. Construction of the anaerobic digester was completed on 18 December, 2005. The digester consists of 1 cell, approximately 28m x 10m x 5m.
- Granja Jucelia 2 (10801) is a farrowing operation. This site had approximately 1,069 animals on site between May, 2004 and April, 2005. This site has a total of six containment areas; three of which use the flush method of manure removal, two use the scraper method, and the final uses the pull plug method. Waste flows from the containment areas through one of three primary open lagoons. From these primary lagoons, waste is routed through two additional secondary lagoons, for a total of five lagoons on site making up this site's AWMS. Each lagoon is approximately 17m x 10.4m x 2m. Effluent is disposed of from the lagoons through surface spread. The anaerobic digester was completed on 17 Aug, 2006. The digester consists of 2 cells, each approximately 38m x 12m x 5m.

Erno Roberto Binsfeld owns one site in São Martinho, Rio Grande do Sul:

- Fazenda Erno Roberto Binsfeld (29252) is a farrow to finisher operation. This site had approximately 4,304 animals on site between October, 2005 and September, 2006. This site has a total of eleven containment areas which use the flush method of manure removal. It is then routed to the site's AWMS, which consists of a consecutive series of seven open lagoons. Three lagoons are approximately 25m x 15m x 2.5m. The remaining four lagoons are approximately 10m x 08m x 1.5m. Effluent is disposed of from the lagoons through irrigation. Construction of the proposed anaerobic digester is expected to be complete on 10 June, 2007. The digester will consist of 1 cell, approximately 56m x 17m x 3.5m.

Enori Pelizza owns one site in Xaxim, Santa Catarina:

- Granja Enori Pelizza (21452) is a finishing operation. This site had approximately 2,961 animals on site between September, 2004 and August, 2005. This site has a total of four containment areas; three of which use the flush method and the remaining one uses the pull plug method of manure removal. It is then routed to the site's AWMS, which consists of one primary and one secondary open lagoon. One lagoon is approximately 30m x 30m x 2m. The remaining lagoon is

approximately 40m x 20m x 2m. Effluent is disposed of from the lagoons through irrigation. Construction of the anaerobic digester was completed on 29 January, 2006. The digester consists of 1 cell, approximately 30m x 12m x 5m.

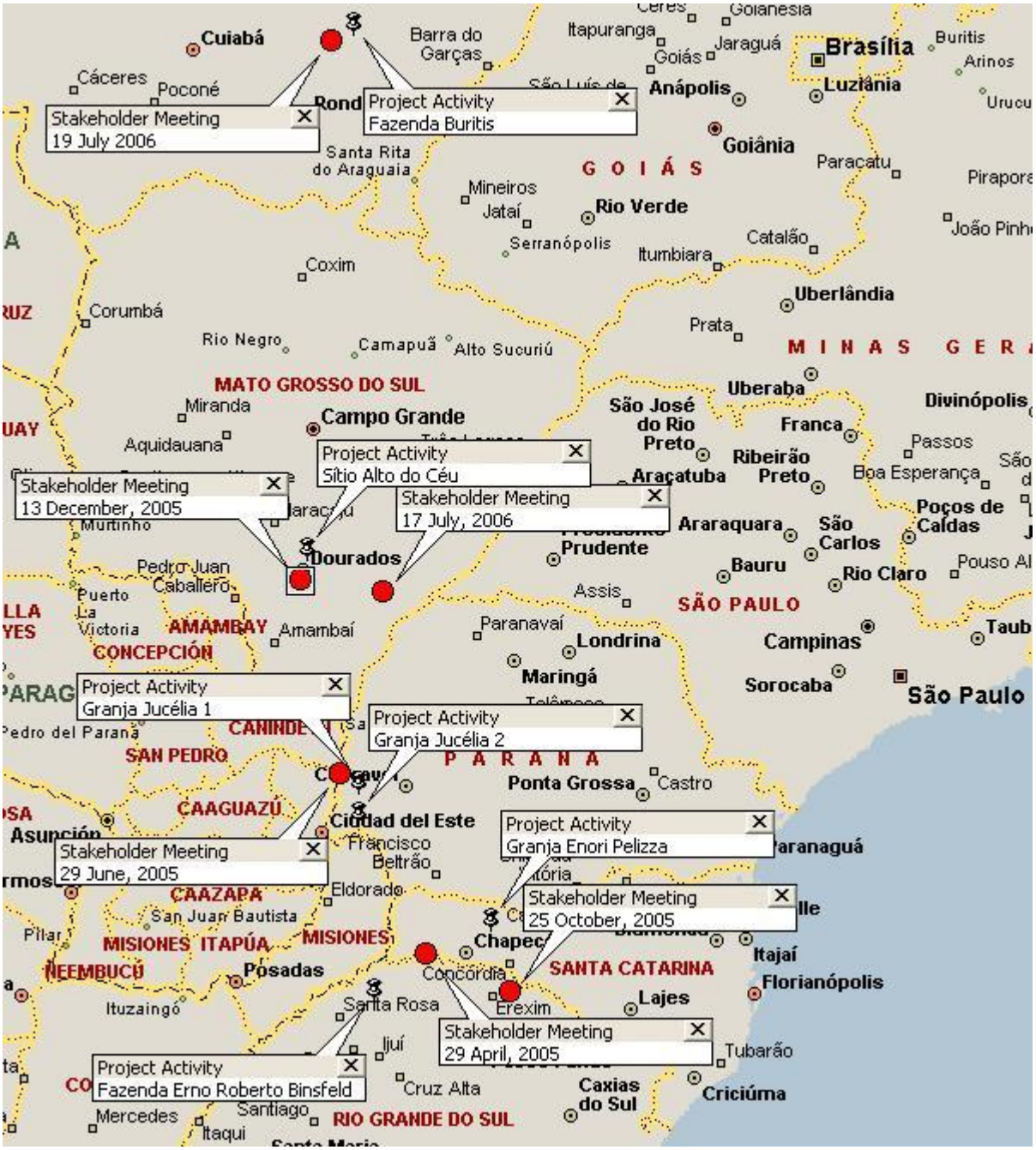

Figure A1. Project Activity Sites in Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul, and Santa Catarina, Brazil.

Table A2. Detailed physical location and identification of project sites

Farm/Site Name	AgCert ID	Address	Town / State	Contact	Phone	GPS Coord
Fazenda Buritis	2008022	Rodovia BR 70 - km. 267 + 24 km. à esquerda	Poxoréu, Mato Grosso	Rogério Auri Milanesi	55 66 3498-1617	15.46S 53.99W
Fazenda Erno Roberto Binsfeld	29252	Linha Folmann	São Martinho, Rio Grande do Sul	Erno Roberto Binsfeld	55 55 3533-1125	27.68S 53.96W
Granja Enori Pelizza	21452	Linha Diadema	Xaxim, Santa Catarina	Enori Pelizza	55 49 3433-1251	26.95S 52.49W
Granja Jucélia 1	10802	Linha Navegantes	São Miguel do Iguaçu, Parana	Lauri Emilio Rauber	55 45 3540-1196	25.23S 54.0759W
Granja Jucélia 2	10801	Linha São Carlos	Serranópolis do Iguaçu, Parana	Lauri Emilio Rauber	55 45 3540-1196	25.2206S 54.06W
Sítio Alto do Céu	26172	Rod. Itaporã/Douradina, km01, à direita + 4km	Itaporã, Mato Grosso do Sul	Milton Bigatão	55 67 3451-1892	22.09S 54.74W

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

The project activity described in this document is classified as a Type III, Other Project Activities, Category III.D./Ver. 11, Methane recovery in agricultural and agro industrial activities.

The project activity will capture and combust methane gas produced from the decomposing manure of swine farms located in Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul, and Santa Catarina, Brazil.

The technology to be employed by the project activity includes the installation of new covered lagoons creating an anaerobic digester. The system will be comprised of a lined and covered lagoon creating a digester with sufficient capacity and Hydraulic Retention Time (HRT) to greatly reduce the volatile solids loading in the effluent. The cover consists of a synthetic high density polyethylene (HDPE) geomembrane, which is secured to the liner by means of an anchor trench around the perimeter. HDPE is the most commonly used geomembrane in the world and is well suited for use in this project. HDPE is an excellent product for large applications that require UV, ozone, and chemical resistance. The digester has been designed to permit solids residue removal without breaking the gas retention seal. Processed effluent from the digester(s) will be routed to a secondary and tertiary lagoon system, as needed, and captured biogas will be routed to a highly efficient combustion system to destroy methane gas produced. Special maintenance procedures have been developed to ensure proper handling and disposition of the digester sludge.

The flaring combustion system is automated to ensure that all biogas that exits the digester and passes through the flare (and flow meter) is combusted. Pressure control devices within the gas handling system maintain proper biogas flow to the combustion system. A continuous ignition system ensures methane combustion whenever biogas is present at the flare. Two (2) sparking electrodes provide operational redundancy. If biogas is present in the flare, it is immediately ignited by the sparking system. If biogas is not present, the igniter sparks harmlessly approximately every 3 seconds. This continuous ignition system is powered by a robust solar module (solar-charged battery system) that operates independently from the power grid. With a fully charged battery, the module will provide power to the igniter for up to two weeks without sunlight. The component parts are verified functional on a periodic basis in accordance with manufacturer and other technical specifications.

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 Monitoring 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 from the host country whenever economically possible.

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 the staff acquires appropriate expertise and resources to operate the system on an ongoing/continuous basis.

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

ESTIMATED AMOUNT OF EMISSION REDUCTIONS OVER THE 7 YEAR CREDITING PERIOD

A.4.3 - Estimated Emission Reductions over chosen Crediting Period	
Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1	14,968
Year 2	15,530
Year 3	16,124
Year 4	16,487
Year 5	16,854
Year 6	17,223
Year 7	17,601
Total estimated reductions (tonnes CO_2e)	114,788
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	16,398

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

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

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

Based on paragraph 2 of Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities,[8] this project is not debundled. There are no other registered large-scale CDM project activities with the same project participants, in the same project category and technology/measure whose project boundary is within 1 km of another proposed small-scale activity.

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

SECTION B. Application of a baseline and monitoring methodology

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

The project activity is a Type III, Other Project Activities, Category III.D./Ver. 11, Methane recovery in agricultural and agro industrial activities. The project is a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 60 kt CO_2eq.

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

The simplified methodologies are appropriate because the project activity site is considered an agro-industry and GHG emissions calculations can be estimated using internationally accepted IPCC guidance.

The project activity will capture and combust methane gas produced from the decomposing manure at swine farms located in Mato Grosso do Sul, Mato Grosso, Parana, Rio Grande do Sul, and Santa Catarina, Brazil. This simplified baseline methodology is applicable to this project activity because without the proposed project activity, methane from the existing AWMS would continue to be emitted into the atmosphere. The proposed project activity will change the current animal waste management practice to that which uses an anaerobic digestion system equipped with a methane recovery and combustion system. Based on historical animal inventories and baseline estimates, the estimated emission reductions of the project activity will not exceed 60 kt CO_2e in any year of the crediting period as shown in Section A.4.3.

B.3. Description of the project boundary:

The project boundary is illustrated in Figure B1. It describes the basic layout of the project farm in a schematic format. The proposed project boundary considers the GHG emissions that come from AWMS practices, including the GHG resulting from the capture and combustion of biogas using the technology described in Section A.4.2.

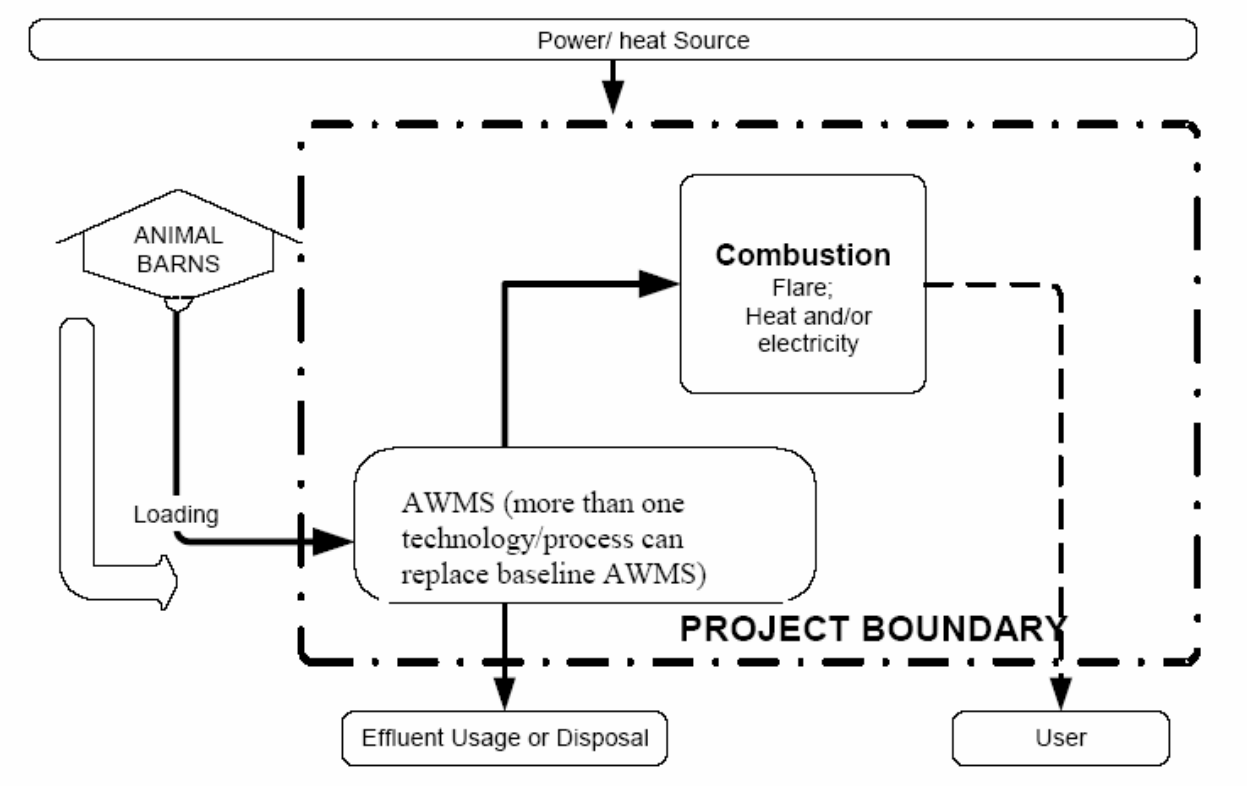

Figure B1. Project Boundary

The project activity site uses a system of one or more lagoons. Proposed AWMS practice changes include the construction of a digester comprised of cells that capture the resulting biogas which is then combusted. Based on the methodology, the anaerobic digester is the physical boundary of the methane recovery facility.

B.4. Description of baseline and its development:

The amount of methane that would be emitted to the atmosphere in the absence of the project activity can be estimated by referring to Section 10.44 through 10.47 of the 2006 IPCC Guidelines for National GHG Inventories.

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

Step 1 – Livestock Population

Animal populations for the project activity sites are described in Annex 3. The AWMS used on the farms is an open lagoon, unless otherwise noted in Section A.4.1.4.

Step 2 – Emission Factors

The emission factor for the animal group is:

$$EF_i = VS_i * n_m * B_{0i} * 0.67kg/m3 * MCF_{jk} * MS\%_{ijk}$$

Equation B1[9]

Where:

EFi	=	emission factor (kg) for animal type i (e.g., swine, weight adjusted),
VSi	=	Volatile solids excreted in kg/day for animal type i, max Vs is 0.5 kg/head/day (adjusted as Vs = ($W_{site}/W_{default}$[10])*VS_{IPCC})
n_m	=	Number of days animals present,
B_o	=	Maximum methane producing capacity (m^3/kg of *VS*) for manure produced by animal type i,
MCF_{jk}	=	Methane conversion factor for each manure management system j by climate region k; and
$MS\%_{ijk}$.	=	fraction of animal type i's manure handled using manure system j in climate region k.

The amount of methane emitted can be calculated using:

$$CH_{4a} = EF_i * Population_{year}$$

Equation B2[11]

Where:

CH_{4a}	=	methane produced in kg/yr for animal type i,
EF_i	=	emission factor (kg) for animal type i (e.g., swine),
$Population_{year}$	=	yearly average population of animal type i.

Step 3 – Total Baseline Emissions

To estimate total yearly methane emissions the selected emission factors are multiplied by the associated animal population and summed.

$$BE = [CH_{4a} * GWP_{CH4}]/1000$$

Equation B3[12]

[9] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Equation 10.23, p.10.41 and Annex 10A.2, Tables 10A-7 and 10A-8, p. 10.80 and 10.81

[10] Obtained from 2006 IPCC, Annex 10A.2, Tables 10A-7 and 10A-8, p. 10.81 and 10.82

[11] Adapted from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Equation 10.23, p. 10.41.

Where:

BE	=	Baseline carbon dioxide equivalent emission in metric tons per year,
CH_{4a}	=	annual methane produced in kg/yr for animal type i,
GWP_{CH4}	=	global warming potential of methane (21),

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

Anthropogenic GHGs, specifically methane, are released into the atmosphere via decomposition of animal manure. Currently, this 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, specifically the recovery of methane, by controlling the lagoon's decomposition processes and collecting and combusting the biogas.

There are no existing, pending, or planned national, state, or local regulatory requirements that govern GHG emissions from agro-industry 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 and have determined there is no regulatory impetus for producers to upgrade current AWMS beyond existing open air lagoon. The following paragraphs discuss the Brazilian pork industry and how conditions hinder changes in AWMS practices.

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.*"[13]

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

[12] Adapted from Equation 9, page 12, AM0016/version 02, 22 October 2004 / UNFCCC / CDM Meth Panel

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

to maintain system performance levels, must also be considered. Worldwide, few anaerobic digesters have achieved long-term operations, due primarily to inappropriate operations and maintenance.

The proposed AWMS represents the most advanced AWMS technology in the state. The proposed project activity AWMS mitigates GHG emissions with associated environmental co-benefits.

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

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

b) *Common practice*: While past practices cannot predict future events, it is worth noting most farms (see Table A2) have been in existence for many years, during which time most 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.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline Emissions

Baseline emissions are calculated as described in section B.4.

Project Emissions

The amount of methane that would be emitted to the atmosphere due to the project activity and within the project boundaries can be estimated by referring to Table 10.17 of the 2006 IPCC Guidelines for National GHG Inventories.

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

Step 1 – Livestock Population

Livestock populations for the project activity sites are described in Annex 3. The AWMS proposed for use on the farm is an anaerobic digester.

Step 2 – Emission Factors

The emission factor for the animal group is:

$$EF_i = VS_i * n_m * B_{0i} * 0.67kg/m3 * MCF_{jk} * MS\%_{ijk}$$

Equation B4[14]

Where:

EF_i	=	emission factor (kg) for animal type i (e.g., swine, weight adjusted),
VS_i	=	Volatile solids excreted in kg/day for animal type i, max Vs is 0.5 kg/head/day (adjusted as Vs = ($W_{site}/W_{default}$[15])*VS_{IPCC})
n_m	=	Number of days animals present,
B_o	=	Maximum methane producing capacity (m^3/kg of *VS*) for manure produced by animal type i,
MCF_{jk}	=	Methane conversion factor for each manure management system j by climate region k; and
$MS\%_{ijk}$.	=	fraction of animal type i's manure handled using manure system j in climate region k.

The amount of methane emitted can be calculated using:

$$CH_{4a} = EF_i * Population_{year}$$

Equation B5[16]

Where:

CH_{4a}	=	methane produced in kg/yr for animal type i,
EF_i	=	emission factor (kg) for animal type i (e.g., swine),
$Population_{year}$	=	yearly average population of animal type i.

To estimate total yearly methane emissions the selected emission factors are multiplied by the associated animal population and summed.

$$PE = [CH_{4a} + FE] * GWP_{CH4} / 1000$$

Equation B6[17]

[14] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Page 10.41, Equation 10.23 and Page 10.77, Table 10A-4.

[15] Obtained from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Annex 10A.2, Table 10A-7 and Table 10A-8, p. 10.80 and 10.81

[16] Adapted from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, p. 10.41.

[17] Adapted from Equation 9, page 12, AM0016/version 02, 22 October 2004/UNFCCC/CDM Methodology Panel

Where:

PE	=	Project activity carbon dioxide equivalent emission in metric tons per year,
CH_{4a}	=	annual methane produced in kg/yr for animal type i,
FE	=	annual methane emitted from flare due to inefficiency
GWP_{CH4}	=	global warming potential of methane (21)

Leakage

In accordance with the baseline methodology, leakage calculations are not required.

Emission Reductions

The ex-ante baseline emissions calculated as described in section B.4 of this PDD will be compared to the actual monitored amount of methane captured and combusted by the project activity. The lesser of these values will be used as the project emission reductions of the crediting period.

$$ER_{net} = BE - (PE + DE)$$

Equation B7

Where:

BE	=	Baseline carbon dioxide equivalent emission in metric tons per year,
PE	=	Project activity carbon dioxide equivalent emission in metric tons per year,
DE	=	Direct emissions from use of fossil fuels or electricity for operation of facility

According to the methodology, direct emissions from the use of fossil fuels and/or electricity for the operation of the facility must be considered as part of the project emissions. For swine farms in Brazil, the standard equipment configuration consists of one 2 horsepower (HP) biogas blower that operates 24 hours per day per anaerobic digester.

HP to kWh conversion = HP (2) x hours per day (24) x days a year (365) x 0.7457[18]

As such, the electrical consumption per year per anaerobic digester for a swine farm in Brazil is approximately 13,065 kWh/yr. To convert this number into metric tonnes of CO2e per year, the following formula is applied:

kWh to CO_2e conversion = (kWh (13,065) x country specific emission factor (02677)[19]*) / 1000*

[18] .7457 is the standard scientific conversion factor from horsepower (HP) to Kilowatt Hours (kWh) based on Ohm's Law

[19] .2677kg CO2 / kWh, Obtained from ACM0002 and registered CDM project 0190 titled: Moema Bagasse Cogeneration Project (MBCP).

Therefore, for each anaerobic digester, approximately 3.5 metric tonnes of CO_2e are produced per year as a result of the project activity.

Because the digester is a sealed system, all methane is captured and flared, leaving none to be released to the atmosphere via physical leakage. In addition, the methane conversion factor of the emission reduction calculations includes a conservative 10% discount to compensate for intrinsic digester emissions.

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

Accurate data collection is essential. The farms included in this project activity use a standardized industry database package which captures a wide range of incremental production data to manage operation and enable the farm to maximize both productivity and profitability. AgCert uses some data collected from this system (referred to as "Data collected on the AgCert Form B" in Table B.1.). AgCert has a rigorous QA/QC system that ensures data security and data integrity. Spot audits of data collection activities are conducted on a regular basis.

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. Table B.1. details data and parameters available at the time of validation.

Table B.1. Data / Parameter Values and References

Data / Parameter:	**GWP CH_4**
Data unit:	
Description:	Global Warming Potential of Methane
Source of data used:	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	**$Population_{year}$**
Data unit:	Number of animals
Description:	Annual average population of animal type
Source of data used:	Data collected on the AgCert Form B (Baseline data collection).
Value applied:	See Annex 3 Animal Inventory
Justification of the choice of data or description of measurement methods and procedures actually applied:	Animal population used to estimate baseline and project emission estimates was based on a 12 month period of actual or projected operation production data.
Comments:	

Data / Parameter:	**n_m**
Data unit:	Number of days

Description:	Days animals resident in system per year
Source of data used:	Data collected on the AgCert Form B (Baseline data collection).
Value applied:	See Table B2 for Baseline Activity See Table B3 for Project Activity
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	$\mathbf{MS\%_{ijk}}$
Data unit:	Fraction or percentage
Description:	Percent of animal effluent used in system.
Source of data used:	Data collected on the AgCert Form B (Baseline data collection).
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	$\mathbf{VS_{i\ market}}$
Data unit:	Kg/day
Description:	Volatile solids excreted for animal type (market swine)
Source of data used:	Obtained from 2006 IPCC, Annex 10A.2, Table 10A-7, p. 10.80
Value applied:	0.27
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	$\mathbf{VS_{i\ breeding}}$
Data unit:	Kg/day
Description:	Volatile solids excreted for animal type (breeding swine)
Source of data used:	Obtained from 2006 IPCC, Annex 10A.2, Table 10A-8, p. 10.81
Value applied:	0.50
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	$\mathbf{B_{oi}}$
Data unit:	m^3/kg of *VS*
Description:	Maximum methane producing capacity for manure produced by animal type
Source of data used:	Obtained from 2006 IPCC, Annex 10A.2, Tables 10A-7 and 10A-8, p. 10.80 and 10.81

Value applied:	0.48
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	**MCF_{jk}**
Data unit:	
Description:	Methane conversion factor for each manure management system
Source of data used:	Obtained from 2006 IPCC, Table 10.17, p. 10.45 for Baseline Activity Obtained from 2006 IPCC, Table 10.17, p. 10.46 for Project Activity
Value applied:	Refer to 2006 IPCC, Table 10.17, p. 10.45 for Baseline Activity Refer to 2006 IPCC, Table 10.17, p. 10.46 for Project Activity
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	**Days OB**
Data unit:	
Description:	Days out of barn
Source of data used:	Data collected on the AgCert Form B (Baseline data collection).
Value applied:	See Table B2 for Baseline Activity See Table B3 for Project Activity
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

Data / Parameter:	**BW kg**
Data unit:	Kg
Description:	Body weight of animals in kilograms.
Source of data used:	Obtained from 2006 IPCC, Annex 10A.2, Table 10A.7 and Table 10A-8, p. 10.80 and 10.81
Value applied:	See Table B2 for Baseline Activity See Table B3 for Project Activity
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Comments:	

B.6.3 Ex-ante calculation of emission reductions:

Emission factors for the baseline are calculated as described in Section B.3. To estimate total yearly baseline methane emissions, the selected emission factors are multiplied by the associated animal population and summed.

Table B.2. Baseline Emissions (Methane shown in metric tonnes of CO_2e)

Fazenda Erno Roberto Binsfeld (29252)							*Year 1*
	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual
Sows:	434	365	0	198	215	49.71	21,574.29
Gilts:	54	365	0	198	112	25.90	1,398.36
Boars:	6	365	0	198	234	54.10	324.62
Finishers:	2,756	365	0	46	68	36.54	100,715.79
Nur/Wean:	1,055	365	0	46	15	8.06	8,504.59
					Total Annual CH_4:		132,517.65
					BE (CO_2e/year):		2,782.87

Fazenda Erno Roberto Binsfeld (29252)								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Baseline Emissions (CO2e/year)	2,782.9	2,782.9	2,782.9	2,782.9	2,782.9	2,782.9	2,782.9	**19,480.1**

Fazenda Buritis (2008022)							*Year 1*
	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual
Sows:	928	365	0	198	210	49.80	46,213.73
Gilts:	33	365	0	198	124	29.41	970.37
Boars:	5	365	0	198	243	57.62	288.12
Finishers:	3,996	365	0	46	67	36.93	147,572.39
Nur/Wean:	3,006	365	0	46	17	9.37	28,167.14
					Total Annual CH_4:		223,211.75
					BE (CO_2e/year):		4,687.45

Fazenda Buritis (2008022)								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*6%*	*6%*	*6%*	*5%*	*5%*	*5%*	
Baseline Emissions (CO2e/year)	4,687.4	4,978.6	5,270.0	5,560.5	5,851.7	6,142.3	6,438.6	**38,929.2**

Granja Enori Pelizza 21452							*Year 1*
	$Population_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	0	365	0	198	215	49.71	0.00
Gilts:	0	365	0	198	112	25.90	0.00
Boars:	0	365	0	198	234	54.10	0.00
Finishers:	2,961	365	0	46	68	36.54	108,207.35
Nur/Wean:	0	365	0	46	15	8.06	0.00
	Total Annual CH_4:						108,207.35
	BE (CO_2e/year):						2,272.35

Granja Enori Pelizza 21452								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Baseline Emissions (CO2e/year)	2,272.4	2,272.4	2,272.4	2,272.4	2,272.4	2,272.4	2,272.4	**15,906.5**

Granja Jucélia I 10802							*Year 1*
	$Population_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	0	365	0	198	215	49.71	0.00
Gilts:	0	365	0	198	112	25.90	0.00
Boars:	0	365	0	198	234	54.10	0.00
Finishers:	4,770	365	0	46	68	36.54	174,315.79
Nur/Wean:	1,824	365	0	46	15	8.06	14,703.66
	Total Annual CH_4:						189,019.45
	BE (CO_2e/year):						3,969.41

Granja Jucélia I 10802								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*10%*	*10%*	*3%*	*3%*	*3%*	*3%*	
Baseline Emissions (CO2e/year)	3,969.4	4,335.5	4,738.1	4,871.0	5,007.9	5,148.9	5,294.1	**33,364.9**

Granja Jucélia II 10801							*Year 1*
	Population$_{year}$	**N$_m$**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF$_i$**	**CH$_4$ annual**
Sows:	830	365	0	198	215	49.71	41,259.59
Gilts:	230	365	0	198	112	25.90	5,955.99
Boars:	9	365	0	198	234	54.10	486.93
Finishers:	0	365	0	46	68	36.54	0.00
Nur/Wean:	0	365	0	46	15	8.06	0.00
Total Annual CH_4:							47,702.51
BE (CO_2e/year):							1,001.75

Granja Jucélia II 10801								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Baseline Emissions (CO2e/year)	1,001.8	1,001.8	1,001.8	1,001.8	1,001.8	1,001.8	1,001.8	**7,012.3**

Output Data:							
Sítio Alto do Céu (26172)							*Year 1*
	Population$_{year}$	**N$_m$**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF$_i$**	**CH$_4$ annual**
Sows:	0	365	0	198	215	49.71	0.00
Gilts:	0	365	0	198	112	25.90	0.00
Boars:	0	365	0	198	234	54.10	0.00
Finishers:	3,666	365	0	46	68	36.54	133,971.00
Nur/Wean:	0	365	0	46	15	8.06	0.00
Total Annual CH_4:							133,971.00
BE (CO_2e/year):							2,813.39

Sítio Alto do Céu (26172)								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Baseline Emissions (CO2e/year)	2,813.4	2,813.4	2,813.4	2,813.4	2,813.4	2,813.4	2,813.4	**19,693.7**

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

Table B.3 Project Activity Emissions (Methane shown in metric tonnes of CO_2e)

Fazenda Buritis (2008022)							*Year 1*
	Population$_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	928	365	0	198	210	6.22	5,776.72
Gilts:	33	365	0	198	124	3.68	121.30
Boars:	5	365	0	198	243	7.20	36.02
Finishers:	3,996	365	0	46	67	4.62	18,446.55
Nur/Wean:	3,006	365	0	46	17	1.17	3,520.89
					Digester CH_4:		27,901.47
					Direct Emissions (Flare) CH_4:		3,906.21
					Total Annual CH_4:		31,807.67
					PE (CO_2e/year):		667.96

Fazenda Buritis (2008022)								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*6%*	*6%*	*6%*	*5%*	*5%*	*5%*	
Project Emissions (CO2e/year)	668.0	709.4	751.0	792.4	833.9	875.3	917.5	**5,547.4**

Fazenda Erno Roberto Binsfeld (29252)							*Year 1*
	Population$_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	434	365	0	198	215	6.37	2,765.93
Gilts:	54	365	0	198	112	3.32	179.28
Boars:	6	365	0	198	234	6.94	41.62
Finishers:	2,756	365	0	46	68	4.69	12,912.28
Nur/Wean:	1,055	365	0	46	15	1.03	1,090.33
					Digester CH_4:		16,989.44
					Direct Emissions (Flare) CH_4:		2,310.56
					Total Annual CH_4:		19,300.01
					PE (CO_2e/year):		405.30

Fazenda Erno Roberto Binsfeld (29252)								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Project Emissions (CO2e/year)	405.3	405.3	405.3	405.3	405.3	405.3	405.3	**2,837.1**

Granja Enori Pelizza 21452							*Year 1*
	$Population_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	0	365	0	198	215	6.37	0.00
Gilts:	0	365	0	198	112	3.32	0.00
Boars:	0	365	0	198	234	6.94	0.00
Finishers:	2,961	365	0	46	68	4.69	13,872.74
Nur/Wean:	0	365	0	46	15	1.03	0.00
						Digester CH_4:	13,872.74
						Direct Emissions (Flare) CH_4:	1,886.69
						Total Annual CH_4:	15,759.43
						PE (CO_2e/year):	330.95

Granja Enori Pelizza 21452								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Project Emissions (CO2e/year)	330.9	330.9	330.9	330.9	330.9	330.9	330.9	**2,316.6**

Granja Jucélia I 10802							*Year 1*
	$Population_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	0	365	0	198	215	6.37	0.00
Gilts:	0	365	0	198	112	3.32	0.00
Boars:	0	365	0	198	234	6.94	0.00
Finishers:	4,770	365	0	46	68	4.69	22,348.18
Nur/Wean:	1,824	365	0	46	15	1.03	1,885.08
						Digester CH_4:	24,233.26
						Direct Emissions (Flare) CH_4:	3,295.72
						Total Annual CH_4:	27,528.99
						PE (CO_2e/year):	578.11

Granja Jucélia I 10802								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*10%*	*10%*	*3%*	*3%*	*3%*	*3%*	
Project Emissions (CO2e/year)	578.1	631.4	690.1	709.4	729.4	749.9	771.0	**4,859.3**

Granja Jucélia II 10801							*Year 1*
	$Population_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	830	365	0	198	215	6.37	5,289.69
Gilts:	230	365	0	198	112	3.32	763.59
Boars:	9	365	0	198	234	6.94	62.43
Finishers:	0	365	0	46	68	4.69	0.00
Nur/Wean:	0	365	0	46	15	1.03	0.00
						Digester CH_4:	6,115.71
						Direct Emissions (Flare) CH_4:	831.74
						Total Annual CH_4:	6,947.44
						PE (CO_2e/year):	145.90

Granja Jucélia II 10801								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Project Emissions (CO2e/year)	145.9	145.9	145.9	145.9	145.9	145.9	145.9	**1,021.3**

Sítio Alto do Céu (26172)							*Year 1*
	$Population_{year}$	**N_m**	**Days OB**	**Default BW**	**Ave Bw, kg**	**EF_i**	**CH_4 annual**
Sows:	0	365	0	198	215	6.37	0.00
Gilts:	0	365	0	198	112	3.32	0.00
Boars:	0	365	0	198	234	6.94	0.00
Finishers:	3,666	365	0	46	68	4.69	17,175.77
Nur/Wean:	0	365	0	46	15	1.03	0.00
						Digester CH_4:	17,175.77
						Direct Emissions (Flare) CH_4:	2,335.90
						Total Annual CH_4:	19,511.67
						PE (CO_2e/year):	409.75

Sítio Alto do Céu (26172)								
Year	1	2	3	4	5	6	7	**Total**
Expected Growth %	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	
Project Emissions (CO2e/year)	409.7	409.7	409.7	409.7	409.7	409.7	409.7	**2,868.2**

Using Equation B7 from Section B.6.1, the ex-ante baseline emissions calculated as shown in Table B.2 of this PDD will be compared to the actual monitored amount of methane captured and combusted by the project activity shown in Table B.3. The lesser of these values will be used as the project emission reductions of the crediting period.

Using the standard equipment configuration of one 2 horsepower (HP) biogas blower that operates 24 hours per day per anaerobic digester, direct emissions from the use of fossil fuels and/or electricity for the operation of the facility are considered as part of the project emissions.

For this particular project with seven project activity sites and a corresponding seven anaerobic digesters, the direct emission totals are as follows:

Table B.4. Direct Emissions

Source	Est kWh consumed / produced per year	Kg CO2e emitted per kWh produced	Metric Tonnes CO2e per year
Direct emissions from use of electricity or fossil fuel	79,172	0.2677	21.19

Because the digester is a sealed system, all methane is captured and flared, leaving none to be released to the atmosphere via physical leakage. In addition, the methane conversion factor of the emission reduction calculations includes a conservative 10% discount to compensate for intrinsic digester emissions.

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

Table B.5. Total Emission Reductions

Table B.5. Total Emission Reductions (tonnes CO2e)				
Year	Estimation of project activity emissions (PE)	Estimation of baseline emissions (BE)	Direct emissions from electricity / fossil fuel (DE)	Estimation of overall emission reductions (ER_{net} = BE - (PE + DE))
1	2,538	17,527	21	**14,968**
2	2,633	18,184	21	**15,530**
3	2,733	18,879	21	**16,124**
4	2,794	19,302	21	**16,487**
5	2,855	19,730	21	**16,854**
6	2,917	20,162	21	**17,223**
7	2,980	20,603	21	**17,601**
Total (tonnes CO_2e)	19,450	134,387	148	**114,788**

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

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-based quality and environmental management system, AgCert enables transparent data collection and verification.

Metering devices used are designed to continuously and accurately measure biogas flow and are specially designed for corrosive environments. Meters are received from the factory fully-calibrated and retain calibration for the service life of the unit. Volumetric accuracy of the meter is permanent and non-adjustable. Accuracy is not affected by low or varying line pressures. Accuracy of the flowmeters utilized exceeds 99 percent across the entire measured rate curve with an uncertainty range of less than ± 1 percent. Periodic maintenance will be performed based on manufacturer specifications. Other equipment calibrations are accomplished using procedures developed by the project developer (Annex 4).

Methane concentration is determined using a Bacharach Model Fyrite (or equivalent) gas analyzer. The process is described in the Monitoring Plan. The measuring equipment is calibrated in accordance with the manufacturer specifications. The equipment is accurate to within 0.5%.

An industry standard gas analyser (Landtec GEM-500 or equivalent) will be used when measuring methane content of the biogas to determine the efficiency of the flaring process. The unit will be calibrated to an accuracy of ±1 percent.

See Table B.6 for specific parameters to be monitored.

Table B.6. Data to be monitored

Parameter:	**SIR**
Unit:	Numeric frequency
Description:	Sludge removal count
Source of data:	Data collected on the AgCert Monthly Monitoring Form, if required.
Value of data:	
Brief description of measurement methods and procedures to be applied:	Measured as required. Sludge removal will be accomplished to ensure proper disposition so there is no resulting methane emissions.
QA/QC procedures to be applied (if any):	AgCert employs an internal QA audit process that ensures monitoring activities are conducted in accordance with the monitoring plan and verifies the accuracy of data reported.
Any comment:	Data will be archived electronically and kept for the duration of the project + 2 years.

Parameter:	**BGP**
Unit:	Volume of m^3
Description:	Biogas produced (cumulative)
Source of data:	Data collected on the AgCert Monthly Monitoring Form.
Value of data:	
Brief description of measurement methods and procedures to be applied:	Measured and recorded monthly. A biogas meter will continuously measure the amount of biogas produced.
QA/QC procedures to be applied (if any):	AgCert employs an internal QA audit process that ensures monitoring activities are conducted in accordance with the monitoring plan and verifies the accuracy of data reported.
Any comment:	Data will be archived electronically and kept for the duration of the project + 2 years.

Parameter:	MC
Unit:	Percentage
Description:	Methane content of biogas
Source of data:	Data collected on the AgCert Monthly Monitoring Form.
Value of data:	
Brief description of measurement methods and procedures to be applied:	Measured and recorded quarterly.
QA/QC procedures to be applied (if any):	AgCert employs an internal QA audit process that ensures monitoring activities are conducted in accordance with the monitoring plan and verifies the accuracy of data reported.
Any comment:	Data will be archived electronically and kept for the duration of the project + 2 years.

Parameter:	CEE
Unit:	Percentage (fraction of time)
Description:	Combustion equipment efficiency (fraction of time in which gas is combusted)
Source of data:	Data collected on the AgCert Equipment Maintenance Log.
Value of data:	
Brief description of measurement methods and procedures to be applied:	Measured and recorded quarterly. The fraction of time will be determined as 100% less any time the flare is out of service and gas is flowing. Flare maintenance records will be used to make this determination.
QA/QC procedures to be applied (if any):	AgCert employs an internal QA audit process that ensures monitoring activities are conducted in accordance with the monitoring plan and verifies the accuracy of data reported.
Any comment:	Data will be archived electronically and kept for the duration of the project + 2 years.

Parameter:	EFP
Unit:	Percentage
Description:	Efficiency of flaring process
Source of data:	Data collected on the AgCert Equipment Maintenance Log.
Value of data:	
Brief description of measurement methods and procedures to be applied:	Measured and recorded upon initial installation. Maintenance will be performed annually after installation to ensure optimal operation.
QA/QC procedures to be applied (if any):	AgCert employs an internal QA audit process that ensures monitoring activities are conducted in accordance with the monitoring plan and verifies the accuracy of data reported.
Any comment:	Data will be archived electronically or on paper and kept for the duration of the project + 2 years.

B.7.2 Description of the monitoring plan:

A complete set of procedures and a Monitoring Plan (see Annex 4) has been developed to ensure accurate measurement of biogas produced and proper operation of the digester equipment. This plan exceeds the requirements outlined in the approved methodology outlined in Appendix B of the simplified modalities and procedures for small-scale CDM project activities as it applies to proposed project activity.

Further, 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 Monitoring Plan has been developed to provide guidance (work instructions) to individuals that collect and/or process data. AgCert staff will perform audits of farm operations personnel on a regular basis to ensure proper data collection and handling.

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

The final draft of the application of the methodology was completed on 18/04/2007.

The entity determining the baseline and monitoring methodology is AgCert International plc who is the project developer as well as a project participant. Contact information is listed in Annex 1.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date for this activity is 13/06/2005.

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

The expected life of this project is 24y – 2m.

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

The project activity will use a **renewable** crediting period.

C.2.1. Renewable crediting period

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

The starting date of the crediting period is 01/11/2007.

C.2.1.2. Length of the first crediting period:

The length of the crediting period is **7y-0m**.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Environmental impacts

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

An environmental impact analysis is not required for this type of GHG project activity.

Environment:

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,
- Lowering the population of flies and associated enhancement to on-farm bio-security thus reducing the possible spread of disease.

The combination of these factors will make the proposed project site more "neighbour friendly" and environmentally responsible.

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

No action required.

SECTION E. Stakeholders' comments

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

Stakeholders meetings for this project activity were held in Dourados, Mato Grosso do Sul on 13 December, 2005; Chapecó, Santa Catarina on 29 April, 2005; Passo Fundo, Rio Grande do Sul on 25 October, 2005; Primavera do Leste, Mato Grosso on 19 July, 2006; and São Miguel do Iguaçu, Parana on 27 June, 2005.

AgCert invited stakeholders to the meetings to explain the UNFCCC CDM process and proposed project activity, presided over by Carlos Bortolato and Cesar Machado in Santa Catarina; Cesar Machado in Rio Grande do Sul; Oldemar Eichelt in Mato Grosso and Mato Grosso do Sul; and Carlos Bortolato in Parana. Invitations were sent via electronic mail and postal directly to project participants, federal, state and local officials prior to the meetings.

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

1. Jornal Integração do Oeste, 18 - 24 of June, 2005
2. Zero Hora, 23 April, 2005.
3. Diário da Manhã,
    a. 23 April, 2005
    b. 24 April, 2005
4. Diário Catarinense, 23 April, 2005
5. Diário do Campo,
    a. 8 December, 2005
    b. 13 July, 2006
6. O Nacional – Geral
    a. 22 October, 2005
    b. 23 October, 2005
7. O Diário, Primavera do Leste – 13 July, 2006
8. Folha do Estado, Cuiabá – 13 July, 2006

A slide presentation was given, in Portuguese, and attendees were afforded the opportunity to ask questions and provide comments. The presentation which covered the following topics: purpose of meeting, background on global warming and the Kyoto Protocol, UNFCCC CDM process, process and responsibilities of the project, participants, equipment to be used for evaluation and audits, information management system, an example of project, benefits from the project (environmental and economic), and where to get further information. 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.

E.2. Summary of the comments received:

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

Mr. Wilson Luiz da Silva, Municpal Secretary of Agriculturalists commented that he was happy with the project .

Edison Maggi: “This type of project is extremely important for the region.”

A complete listing of the comments and the individuals who made them is on file. The above comments were translated into English by AgCert.

E.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:	
Organization:	Agcert do Brasil Soluções Ambientais Ltda.
Street/P.O. Box:	Rua James Joule, 92, 14th andar
Building:	
City:	Cidade Moncões
State/Region:	São Paulo
Postfix/ZIP:	04576-080
Country:	Brasil
Telephone:	+55 11 2127.0450
FAX:	+55 11 2127.0550
E-Mail:	
URL:	www.Agcert.com
Represented by:	David Lawrence
Title:	Project Coordinator
Salutation:	
Last Name:	Lawrence
Middle Name:	
First Name:	David
Department:	
Mobile:	+55 11 8412 3206
Direct FAX:	
Direct tel:	
Personal E-Mail:	dlawrence@agcert.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

BASELINE INFORMATION

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Fazenda Buritis (2008022)	May-05	889	32	5	3,939	2,870
	Jun-05	890	26	5	4,061	2,767
	Jul-05	899	40	5	4,083	2,934
	Aug-05	913	44	5	3,766	2,828
	Sep-05	921	33	5	3,726	2,833
	Oct-05	945	38	5	3,825	3,179
	Nov-05	965	46	5	3,862	3,181
	Dec-05	959	27	5	3,856	2,991
	Jan-06	958	27	5	4,001	2,909
	Feb-06	939	25	5	4,149	3,216
	Mar-06	928	29	5	4,348	3,055
	Apr-06	925	29	5	4,338	3,314

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Fazenda Erno Roberto Binsfeld (29252)	Oct-05	445	63	5	3,339	1,188
	Nov-05	439	48	5	3,193	1,137
	Dec-05	434	55	5	3,201	1,103
	Jan-06	434	56	6	3,084	975
	Feb-06	426	46	6	2,892	1,007
	Mar-06	425	46	6	2,413	1,010
	Apr-06	424	59	6	2,575	927
	May-06	423	62	6	2,412	976
	Jun-06	438	39	6	2,634	927
	Jul-06	436	60	5	2,176	1,067
	Aug-06	437	58	5	2,452	1,099
	Sep-06	446	57	5	2,704	1,238

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Granja Enori Pelizza (21452)	Sep-04	0	0	0	2,953	0
	Oct-04	0	0	0	2,988	0
	Nov-04	0	0	0	2,995	0
	Dec-04	0	0	0	2,980	0
	Jan-05	0	0	0	2,940	0
	Feb-05	0	0	0	2,938	0
	Mar-05	0	0	0	2,944	0
	Apr-05	0	0	0	2,980	0
	May-05	0	0	0	2,933	0
	Jun-05	0	0	0	2,942	0
	Jul-05	0	0	0	2,970	0
	Aug-05	0	0	0	2,973	0

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Granja Jucélia 1 (10802)	May-04	0	0	0	4,770	1,839
	Jun-04	0	0	0	4,770	1,667
	Jul-04	0	0	0	4,770	1,641
	Aug-04	0	0	0	4,770	1,772
	Sep-04	0	0	0	4,770	1,966
	Oct-04	0	0	0	4,770	1,812
	Nov-04	0	0	0	4,770	1,808
	Dec-04	0	0	0	4,770	1,933
	Jan-05	0	0	0	4,770	1,916
	Feb-05	0	0	0	4,770	1,850
	Mar-05	0	0	0	4,770	2,044
	Apr-05	0	0	0	4,770	1,645

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Granja Jucélia 2 (10801)	May-04	820	220	9	0	0
	Jun-04	820	220	9	0	0
	Jul-04	820	220	9	0	0
	Aug-04	820	220	9	0	0
	Sep-04	820	220	9	0	0
	Oct-04	820	220	9	0	0
	Nov-04	820	220	9	0	0
	Dec-04	820	220	9	0	0
	Jan-05	850	250	9	0	0
	Feb-05	850	250	9	0	0
	Mar-05	850	250	9	0	0
	Apr-05	850	250	9	0	0

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Sítio Alto do Céu (26172)	Apr-07	0	0	0	3,841	0
	May-06	0	0	0	3,810	0
	Jun-06	0	0	0	3,780	0
	Jul-06	0	0	0	3,749	0
	Aug-06	0	0	0	3,718	0
	Sep-06	0	0	0	3,688	0
	Oct-06	0	0	0	3,657	0
	Nov-06	0	0	0	3,606	0
	Dec-06	0	0	0	3,575	0
	Jan-07	0	0	0	3,544	0
	Feb-07	0	0	0	3,516	0
	Mar-07	0	0	0	3,509	0

Annex 4

MONITORING INFORMATION

Monitoring Plan

PURPOSE

The purpose of this method specification is to describe the criteria for maintaining equipment, reporting equipment outages, and to provide detailed guidance for collection and processing of data that is used in the determination of Green House Gas (GHG) emissions.

SCOPE

This document applies to GHG Mitigation Project related activities. It applies to all personnel that operate and/or maintain project activity equipment and/or have an active role in data collection and processing.

ASSOCIATED DOCUMENTS

- UNFCCC approved monitoring methodology: AMS-III.D., Methane Recovery. http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_LM875Z64MVHWOE3JVL4BGGIC4SRUBE

- Jody Zall Kusek, and Ray C. Rist, June 2004. Ten Steps to a Results-based Monitoring and Evaluation System: A Handbook for Development Practitioners, World Bank. http://www.worldbankinfoshop.org/ecommerce/catalog/product?item_id=3688663

- Component guides / manuals for:
    - Manure transfer system
    - Anaerobic digester
    - Biogas transfer system including a biogas flow-meter
    - Combustion system (Flare)
    - Optional combustion system
- MS004-F1, O & M Weekly Monitoring Checklist
- MS004-F2, O & M Monthly Monitoring Form
- MS004-F3, O & M Maintenance Log (en-br)
- MS004-F4, O & M Maintenance Log (sp-mx)
- MS008, Farm Data Collection Procedure
- MS008-F1, Animal Inventory Control
- MS008-F2, Monthly Inventory Reporting
- P004, Control of Nonconforming Product/Service
- P020, Monitoring & Measurement of Product/Processes

- P025, Control of Monitoring & Measurement Devices
- I025-1, Equipment Calibration & Verification
- P039, Competence, Training, and Awareness
- I031-2F11, Form B – Swine – IPCC (en)
- I031-2F13, Form B – IPCC – MX (sp)
- I031-2F16, Form B – Dairy – IPCC (en), (sp), (pt)
- I036-9, Bio-security and Safety
- Operations Manual CO_2 Analyzer
- EnviroCert Operations Management System (OMS)

OPERATION AND MAINTENANCE ACTIVITIES

System Overview

The Animal Waste Management System (AWMS) used in this project is shown in Figure 1. The system is made up of four (4) major system components:

- Manure transfer system which includes one lift station if needed
- Anaerobic digester cell(s)
- Biogas transfer system including a biogas flow-meter
- Combustion system (Flare)
- Optional combustion system

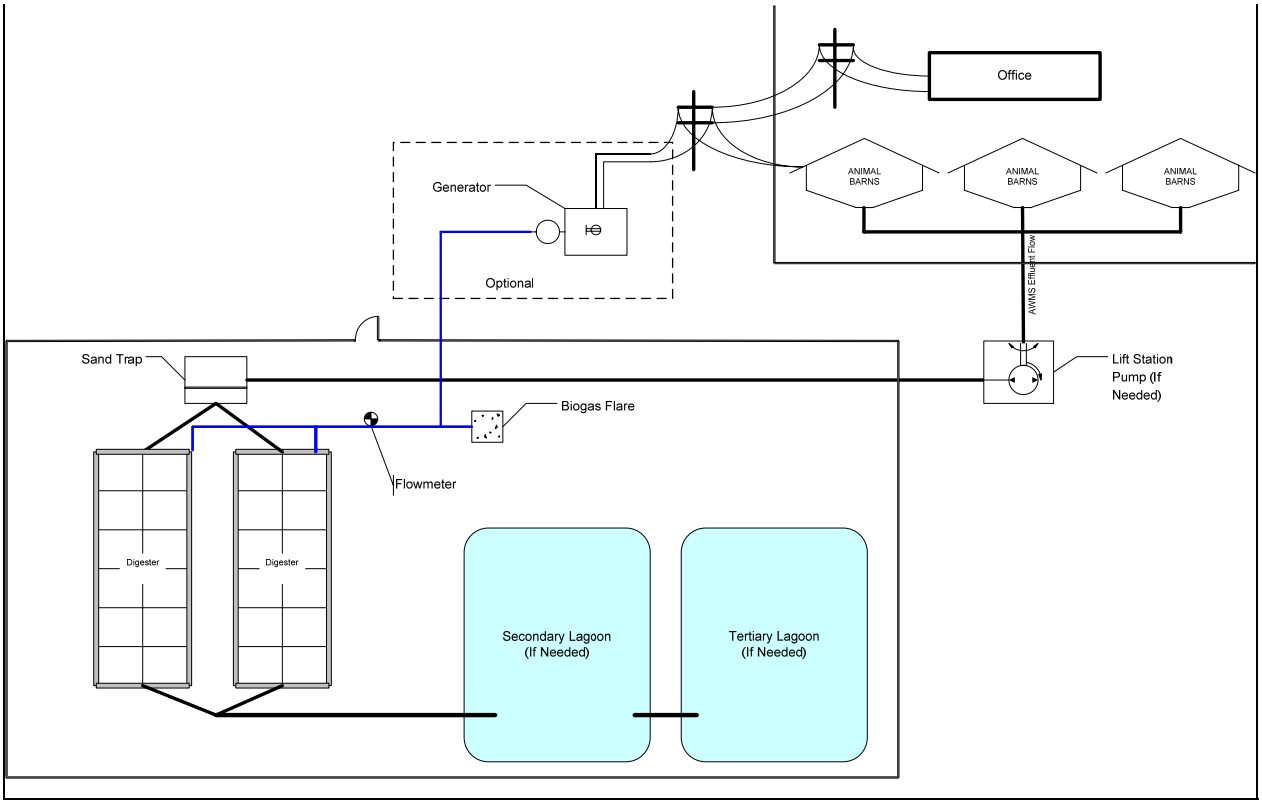

Figure 1. Typical GHG Mitigation Project System Overview

System Components Operation Requirements

Manure Transfer System

Training

Training on the Manure Transfer System shall be provided to the operations personnel by the system manufacturer and installer. Training shall include: system components, normal operation, emergency operations, maintenance, and request for warranty service. Training on reporting procedures shall be provided to the productions operations manager by AgCert.

Normal Operation

The system described in Figure 1 is a typical flush system with one optional lift station. Under normal conditions, farm hands clean the manure from the barns using water hoses and squeegees. This effluent is captured and then flushed from the barns periodically. Effluent from the barns is deposited in a lift station. Upon reaching predetermined threshold, the pump engages and routes the effluent to the digester cell. Upon being treated in the digester, the effluent is then routed from the digester to the storage lagoon. Liquid from the lagoon can then be used for irrigation.

Safety Issues and Emergency Preparedness

Care should be exercised when working around the lift station and distribution box (if installed) to avoid falling into the pit.

Weekly Inspection

A periodic inspection shall include the following:

- Check for pipeline obstructions
- Check for leaks in exposed pipelines
- Check for corrosion at exposed joints

Alternative Operating Procedures

In the event the manure transport system becomes unusable, the farm manager shall notify AgCert in accordance with the Emergency Maintenance section of this annex. Both parties shall work together to reach an acceptable alternate method to route the effluent so that farm operations are not affected, and GHG continues to be captured. If maintenance or warranty service is required, AgCert shall contact the appropriate service provider. Upon restoration of the system the farm manager shall notify the Regional Maintenance Technician (RMT) (phone, e-mail, etc.).

Anaerobic Digester

WARNING

The gas contained in the digester cell is EXTREMELY flammable.

Sources of ignition and smoking are not permitted within 10 meters of the cell and gas handling system.

Death or serious injury may result.

Training

Training on the Anaerobic Digester shall be provided to production operations personnel by the system manufacturer and installer. Training shall include: system components, start-up procedures, normal operation, emergency operations, maintenance, and request for service. Training on reporting procedures shall be provided to the productions operations personnel by AgCert.

Startup Procedures

Refer to the guide / manual for the anaerobic digester.

Loading Rate and Total Solids Content

Refer to the guide / manual for the anaerobic digester.

Normal Operation

Refer to the guide / manual for the anaerobic digester.

Safety Issues and Emergency Preparedness

- No open flame permitted within 10 meters of the digester
- Do not allow personnel to stand, sit, or lean against the digester cover
- Do not use sharp objects/tools in the vicinity of the cover

Weekly Inspection

A weekly inspection shall include the following:

- Cover material – check for cracks, tears, or points of distress around perimeter of digester cell.
- Check for excessive ballooning of cover or presence of odor
- Check seams for signs of gas leakage

Alternative Operating Procedures

In the event the digester cell becomes unusable, the farm manager shall notify AgCert in accordance with Emergency Maintenance section of this annex. Both parties shall work together to reach an acceptable alternate method to treat the effluent so that farm operations are not affected, and GHG gas continues to be captured. If maintenance or warranty service is required, AgCert shall contact the appropriate service provider. Upon restoration of the system the Regional Maintenance Technician shall be notified (phone, e-mail, etc.).

Biogas Transfer System and Biogas Sensor/Flow-Meter

Training

Training on the Biogas Transfer System shall be provided to the operations personnel by the system manufacturer and installer. Training shall include: system components, normal operation, emergency operations, maintenance, and request for warranty service. Training on reporting procedures shall be provided to the production operations personnel by AgCert.

Figure 2. Roots biogas flowmeter

Normal Operation

Biogas produced in the anaerobic digester is trapped under a positive or negative pressure geomembrane cover installed over the digester cell. The biogas is routed from the digester to the flare via PVC tubing. A flow meter, which measures gas flow, is fitted in the biogas transfer system piping.

Safety Issues and Emergency Preparedness

Gas to the metering system should be disconnected prior to performing maintenance on the flow-meter. Care should be taken when digging in the area where the pipeline is buried.

Preventive Maintenance

Preventive maintenance shall be conducted in accordance with manufacturer's recommendations. NOTE: A record of the cumulative biogas reading must be recorded prior to zeroing the meter.

Weekly Inspection

The weekly inspection shall include the following:

- Check for leaks in exposed pipelines
- Check for proper operation of the flow-meter

Alternative Operating Procedures

In the event that the biogas transfer system becomes unusable; the farm manager shall **immediately** notify AgCert in accordance with the Emergency Maintenance section of this annex. Both parties shall work together to reach an acceptable alternate method to route the biogas so that farm operations are not affected and GHG gas emissions are mitigated. If maintenance or warranty service is required, AgCert shall contact the appropriate service provider. Upon restoration of the system the RMT shall be notified (phone, e-mail, etc.).

Combustion System (Flare)

Training

Training on the Flare Combustion System shall be provided by the system manufacturer and installer. Training shall include: system components, normal operation, emergency operations, maintenance, and request for warranty service. Training on reporting procedures shall be provided to the production operations personnel by AgCert.

Normal Operation

The flare system is designed to combust the biogas whenever it is present. AgCert's flaring combustion system is automated to ensure that all biogas that exits the digester and passes through the flare (and flow meter) is combusted. Pressure control devices within the gas handling system maintain proper biogas flow to the combustion system. A continuous ignition system ensures methane combustion whenever biogas is present at the flare. The continuous ignition system is powered by a robust solar module (solar-charged battery system) that operates independently from the power grid. These solar modules are designed for rigorous outdoor application in remote locations and are proven through many years of operational experience in ranch and farm settings similar to AgCert project sites. Two (2) sparking electrodes provide operational redundancy to ensure that a minimum of one (1) spark is produced at the flare burner every 3 seconds. If biogas is present in the flare, it is immediately ignited by the sparking system. If biogas is not present, the igniter sparks harmlessly.

Safety Issues and Emergency Preparedness

Prior to performing any maintenance on the flare system, the gas flow **must** be turned off. Care should be exercised when working around the flare system as components can be extremely hot.

Preventive Maintenance

Preventive maintenance shall be conducted at least yearly.

Weekly Inspection

The weekly inspection shall include a visual inspection to determine the flare is combusting gas.

- If no flame is visible, check to see if there is a heat signature or if the flare assembly itself is hot. Night time inspection should reveal a visible light from the unit.

Alternative Operating Procedures

In the event that the flare system becomes unusable, the farm manager shall **immediately** notify AgCert in accordance with the Emergency Maintenance section of this annex. Both parties shall work together to reach an acceptable alternate method to combust the biogas so that farm operations are not affected and GHG emissions are mitigated. If maintenance or warranty service is required, AgCert shall contact the appropriate service provider. Upon restoration of the system the RMT shall be notified (phone, e-mail, etc.).

Optional Combustion System

If optional combustion equipment is installed during the project crediting period, the project developer will submit a change to the registered monitoring plan as required by the UNFCCC Secretariat.

Training

Training on any optional combustion system, e.g., generator, space heater, etc., shall be provided by the system manufacturer and installer. Training shall include: system components, normal operation, emergency operations, maintenance, and request for warranty service. Training on reporting procedures shall be provided to the production operations personnel by AgCert.

Normal Operation

An optional combustion system is designed to take advantage of the biogas and convert it into renewable energy. The systems can be used to generate electricity, heat a barn, or any other process approved (in writing) by AgCert and the verifying designated operational entity (DOE).

Safety Issues and Emergency Preparedness

Prior to performing any maintenance on an optional combustion system, the gas flow **must** be turned off. Care should be exercised when working around the optional combustion system as components can be extremely hot and high voltage may be present (when operating).

Preventive Maintenance

Preventive maintenance shall be conducted in accordance with manufacturer's recommendations. NOTE: In any case where it is required to zero and/or remove a meter, ensure that the meter reading is noted prior to zeroing and/or removing the meter.

Alternative Operating Procedures

In the event that the generator system becomes unusable, the user shall notify AgCert in accordance with the Emergency Maintenance section of this annex. The flare shall be used as the only method to combust GHG biogas. The user shall take appropriate action to notify his service provider should maintenance or warranty service be required. Upon restoration of the system the RMT shall be notified (phone, e-mail, etc.).

Maintenance, Trouble Reporting and Documentation

Emergency Maintenance:

Situations requiring immediate attention due to failure of components of the digester or combustion system that could cause significant damage to the physical structure, or could result in the release of GHG or failure to capture GHG should be immediately reported to the Regional Maintenance Technician. If unavailable, contact the National Monitoring or Maintenance Manager of the country where the equipment is located or the International Operations and Maintenance Manager.

Title	Phone	e-mail
Regional Maintenance Technician (RMT)	Supplied during training	Supplied during training
Argentina National Monitoring Manager	(54) 348-844-6127	operationsar@agcert.com
Brazil National Monitoring Manager	(55) 212-704-50 ext 0490	operationsbr@agcert.com
Chile National Monitoring Manager	(56) 222-911-52	operationscl@agcert.com
International Monitoring Manager	(001) 321-409-7846	operations@agcert.com
Mexico National Monitoring Manager	(52) 552-122-0310	operationsmx@agcert.com
Canada National Monitoring Manager	(001) 780-409-9286	n/a

Unscheduled Maintenance:

Situations requiring maintenance (not resulting in the release or failure to capture GHG) should be reported to the Regional Maintenance Technician, normally within 1 to 24 hours of discovery.

Records Keeping

Maintenance and servicing of equipment shall be recorded.

MONITORING ACTIVITES

The following table summarizes key parameters monitored:

Table 1. Key parameters monitored

ID	Item	Applies to Project	Monitored		ER Calculation Data		Performed by	Comments
			Ex-ante	Ex-post	Primary	Secondary		
1	Sludge Removal (SlR)	✓		✓			RMT	Ensures proper disposition of sludge
2	Biogas Produced (BGP)	✓		✓		✓	FH, RMT	QA/QC
3	Methane Content (MC)	✓		✓		✓	RMT	QA/QC
4	Combustion System Operational Time (CEE)	✓		✓	✓		FH, RMT	Whenever the flare is observed to be out of service, any biogas metered from the last known operational point in time, shall be deducted from the total Biogas reading
5	Efficiency of Flare process (EFP)	✓		✓			EN	Ensures correct performance of combustion
Farm: FH – Farm Hand; DP – Data Processor; FM – Farm Manager; AgCert: RMT – Regional Maintenance Technician, QA – Quality Assurance; OP – Operations, EN - Engineer								

MONITORING WORK INSTRUCTIONS

Work instructions for the monitoring of key parameters can be found on the following pages:

Work Instruction for monitoring ID 1, Sludge Removal

Summary

Due to the physical characteristics of the manure, it becomes necessary at times to remove the sludge that has accumulated inside a biodigester. This helps ensure the digester system is operating nominally. It is important to ensure the removed sludge is disposed of properly.

This ID monitors the number of times sludge is removed from the digester and ensures the sludge is disposed of properly.

References

- AgCert Preventive Maintenance Instruction GM001, Biodigester Sludge, Removal and Disposal Instruction
- UNFCCC approved monitoring methodology: AMS-III.D, Ver 10., Methane Recovery.

Prerequisite(s)

Processes

- I036-9, Bio-security and Safety

Training of Monitoring Personnel

- Regional Monitoring Technicians shall be trained on data collection transfer processes.
- Operations personnel shall be trained on proper disposition practices.

Equipment, Materials and Tools

- GM001, Biodigester Sludge Removal and Disposal Instruction
- GM001-F1, Sludge removal record

Calibration

- None

Process

Step	Operator	Activity	Documentation	Comments
1	RMT	Determine need to remove sludge		Sludge is disposed of by applying to soil or some other aerobic process
2	RMT	Coordinate with Maintenance to schedule sludge removal	Electronic	
3	M	Performs sludge removal in accordance with the PMI		
4	M	Properly dispose of sludge		
5	M	Document disposal method on maintenance form	Paper/electronic	
Farm: FH – Farm Hand; DP – Data Processor; FM – Farm Manager; AgCert: RMT – Regional Maintenance Technician, QA – Quality Assurance; OP – Operations, EN – Engineer, M - Maintenance				

Record Control

RECORD ID	RECORD LOCATION	RETENTION TIME	DISPOSITION
GM001-F1	EnviroCert	Duration of project +2 years	Destroy

Work Instruction for monitoring ID 2, Biogas Produced

Summary

This ID monitors the volume and flow of biogas sent to the combustion system on a monthly basis. It is a quality control check to ensure proper operation of the anaerobic digester.

References

- UNFCC approved monitoring methodology: AMS-III.D., Methane Recovery.
- Data collection forms (provided by farm manager)
- P025, Control of Monitoring and Measuring Device (MMD)
- MS004-F2, O & M Monthly Monitoring Form

Prerequisite(s)

Processes

- I036-9, Bio-security and Safety

Training of Monitoring Personnel

- Regional Maintenance Technicians and operations personnel shall be trained on data collection transfer processes.

Equipment, Materials and Tools

- Biogas Flow Meter

Calibration

- Prior to using a measuring device, ensure it is calibrated.

Process

Step	Operator	Activity	Documentation	Comments
1	RMT	Record reading in appropriate area of MS004-F2, Monthly Monitoring Form	MS004-F2, Monthly Monitoring Form	
2	RMT	Transmit data to MLB operations	Fax, Electronic, etc	Enter data into EnviroCert
3	QA	Perform Quality Control Check for format, integrity, etc.		
4	OP	Confirm reading within expected limits IAW manufacturer guidelines.		
5	OP	Store Data		
Farm: FH – Farm Hand; DP – Data Processor; FM – Farm Manager; AgCert: RMT – Regional Monitoring Technician, QA – Quality Assurance; OP – Operations, EN – Engineer				

Record Control

RECORD ID	RECORD LOCATION	RETENTION TIME	DISPOSITION
MS004-F2, Monthly Monitoring Form	Document Control Center	Duration of project + 2 years	Destroy

Work Instruction for monitoring ID 3, Methane Content

Summary

This ID determines the methane content of the biogas. It is a snapshot of the AMWS methane production efficiency. Methane concentration is determined with CO_2 content measurement and is obtained with a gas analyzer. A range of ± 10% points is sufficient to determine uncertainties. For example, the nominal percentage of CH4 in biogas is approximately 65%. Readings between 55% and 75% indicate proper operation of the digester. The measuring equipment is calibrated in accordance with the manufacturer specifications.

References

- UNFCC approved monitoring methodology: AMS-III.D., Methane Recovery
- P025, Control of Monitoring and Measuring Device (MMD)
- Operations Manual CO_2 Analyzer
- MS004-F2, Monthly Monitoring Form
- MS004-F3 or F4, O & M Maintenance Log

Prerequisite(s)

Processes

- I036-9, Bio-security and Safety

Training of Monitoring Personnel

- Operating the CO_2 Analyzer
- Regional Maintenance Technicians shall be trained on data collection transfer processes.
- Operations personnel shall be trained on data processing and storage

Equipment, Materials and Tools

- CO_2 Analyzer

Calibration

- As required by the manufacturer.

Process

Step	Operator	Activity	Documentation	Comments
1	RMT	Prepare the gas analyzer as directed in the operator manual.	CO_2 Analyzer Operations Manual	
2	RMT	Connect the CO_2 analyzer to the system test port.		
3	RMT	Open valve on test port		
4	RMT	Take gas reading in accordance with Operations Manual		Take 5 readings and average the results.
5	RMT	Record CO_2 readings in appropriate spaces of MS004-F2, Monthly Monitoring Form	MS004-F2, Monthly Monitoring Form	If there is greater than 10% points difference from previous reading, initiate appropriate maintenance actions.
6	RMT	Close valve on test port		
7	RMT	Disconnect hose in reverse order of connection		
8	RMT	Double check that biogas test port valve is closed prior to leaving area		
9	RMT	Transmit data to MLB operations	Fax, Electronic, etc	Enter into EnviroCert
10	QA	Perform Quality Control Check for format, integrity, etc.		
11	OP	Confirm reading within expected limits IAW manufacturer guidelines.		
12	OP	Store Data		
Farm: FH – Farm Hand; DP – Data Processor; FM – Farm Manager; AgCert: RMT – Regional Monitoring Technician, QA – Quality Assurance; OP – Operations, EN – Engineer				

Record Control

RECORD ID	RECORD LOCATION	RETENTION TIME	DISPOSITION
MS004-F2, Monthly Monitoring Form	Document Control Center	Duration of project + 2 years	Destroy

Work Instruction for monitoring ID 4, Fraction of Time Combustion Equipment Operates

Summary

This parameter is used to determine the fraction of time in which gas is combusted. The fraction of time will be determined as 100% less any time the flare is out of service and gas is flowing. Flare maintenance records will be used to make this determination.

References

- UNFCC approved monitoring methodology: AMS-III.D., Methane Recovery
- MS004-F2, O & M Monthly Monitoring Form
- P025, Control of Monitoring and Measuring Device (MMD)

Prerequisite(s)

Processes

- I036-9, Bio-security and Safety

Training of Monitoring Personnel

- Regional Maintenance Technicians and operations personnel shall be trained on data collection transfer processes.

Equipment, Materials and Tools

- None

Calibration

- Prior to using a measuring device, ensure it is calibrated.

Process

Step	Operator	Activity	Documentation	Comments
1	RMT	Record reading in appropriate area of MS004-F2, Monthly Monitoring Form	MS004-F2, Monthly Monitoring Form	
2	RMT	Transmit data to MLB operations	Fax, Electronic, etc	Enter data into EnviroCert
3	QA	Perform Quality Control Check for format, integrity, etc.		
4	OP	Confirm reading within expected limits IAW manufacturer guidelines.		
5	OP	Store Data		
Farm: FH – Farm Hand; DP – Data Processor; FM – Farm Manager; AgCert: RMT – Regional Maintenance Technician; QA – Quality Assurance; OP – Operations, EN - Engineer				

Record Control

RECORD ID	RECORD LOCATION	RETENTION TIME	DISPOSITION
MS004-F2, Monthly Monitoring Form	Document Control Center	Duration of project + 2 years	Destroy

CDM – Executive Board

Work Instruction for monitoring ID 5, Flare Efficiency

Summary

This parameter guarantees the correct performance of digester and gas recovery.

References

- Approved monitoring methodology: AMS-III.D., Methane Recovery.
- P025, Control of Monitoring and Measuring Devices
- MS004-F2, O & M Monthly Monitoring Form
- OM002, Flare Efficiency Test Instruction
- OM002-F1, Flare Efficiency Test Table

Prerequisite(s)

Processes

Efficiency is tested prior to installation and amount of methane combusted is calculated based on the efficiency rating. According to the methodology, the flare efficiency shall be calculated as fraction of time the gas is combusted in the flare multiplied by the efficiency of the flaring process.

The enclosed-flaring combustion system is automated to ensure that all biogas that exits the digester and passes through the flare (and flow meter) is combusted. Pressure control devices within the gas handling system maintain proper biogas flow to the combustion system. A continuous ignition system ensures methane combustion whenever biogas is present at the flare. Two (2) sparking electrodes provide operational redundancy. If biogas is present in the flare, it is immediately ignited by the sparking system. If biogas is not present, the igniter sparks harmlessly. This continuous ignition system is powered by a robust solar module (solar-charged battery system) that operates independently from the power grid. The component parts are tested and verified functional on a periodic basis in accordance with manufacturer and other technical specifications.

A flare efficiency test will be performed for each new flare that is installed at an AgCert digester project site. Initial flare efficiency testing will be performed by trained personnel using calibrated equipment and a third-party verified test protocol. Both methane destruction determinations described in the flare efficiency testing protocol will be performed during the initial flare testing to ensure that the flare performs according to specifications. Results of the initial flare efficiency test will be kept on project file and will be made available to the verifying Designated Operational Entity (DOE). Subsequent operational testing shall be accomplished at least yearly using the verified test protocol.

Equipment, Materials and Tools

- Gas analyzer (a Landtec GA-90, GEM-500 or equivalent).

Calibration

- Prior to using a measuring device, ensure it is calibrated.

CDM – Executive Board

Process

Step	Operator	Activity	Documentation	Comments
1	EN	Perform procedures outlined in OM002.	OM002-F1, Flare Efficiency Test Table	
Farm: FH – Farm Hand; DP – Data Processor; FM – Farm Manager; AgCert: RMT – Regional Monitoring Technician, QA – Quality Assurance; OP – Operations, EN - Engineer				

Record Control

RECORD ID	RECORD LOCATION	RETENTION TIME	DISPOSITION
OM002-F1, Flare Efficiency Test Table	EnviroCert	Duration of Project +2 years	Destroy