AWMS METHANE RECOVERY PROJECT MX06-S-35, JALISCO AND MICHOACÁN, MÉXICO

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

AgCert

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CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

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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>.

SECTION A. General description of the small-scale project activity

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

AWMS Methane Recovery Project MX06-S-35, Jalisco and Michoacán, México

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.

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 Jalisco and Michoacán, México. 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 ambient temperature anaerobic digester with capture and combustion of resulting biogas.

Contribution to sustainable development:

In January, 2000, the Food and Agriculture Organization of the United Nations began a two-year project in Central México to study the effects of pork production operations on the environment.[1] The project revealed issues which require immediate attention. In some operations, residuals are discharged into receiving bodies (land or water) without previous treatment. In other farms, management practices and treatment systems are inadequate, resulting in contamination higher than allowable limits. When residuals *are* applied to agricultural land, they are generally applied to the surface and not homogenously distributed in the soil. Further, nutrient content from such application is not normally considered to aid in the reduction of inorganic fertilizers.

[1] http://www.fao.org/WAIRDOCS/LEAD/X6372S/X6372S00.htm, Reporte de la Iniciativa de la Ganadería, en Medio Ambiente y el Desarrollo (LEAD) – integración por Zonas de la Ganadería y de la Agricultura Especializadas (AWI) – Opciones para el manejo de Efluentes de Granja Porcícolas de la Zona Centro de México

Establishing a positive model for livestock operations is essential. In the last ten years, Mexican swine production grew by 28%. In 2003, the swine population in México was 14,625,199.[2] In 2003, the swine population of Jalisco and Michoacán was approximately 2.9 million heads.[3] Considering that a typical hog produces 5.8 kilograms of effluent daily (Table A1), some 6.1 million metric tons of hog waste is produced annually in Jalisco and Michoacán alone. Introducing progressive AWMS practices throughout these states has the potential to reduce approximately 2.6 million tonnes[4] of carbon dioxide equivalent (CO2e) each year.

Table A1. Daily production of effluent by type of porcine[5]

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.[6]

This methane recovery project activity will upgrade livestock operations infrastructure. The infrastructure improvement is in direct alignment with President Vicente Fox's national goals and objectives for agriculture, livestock, rural development, fishing and nutrition as outlined in the Mexican government's *Plan Nacional de Desarrollo, 2001 –2006* (National Development Plan, 2001 -2006).[7]

This project activity will also 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

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[2] http://www.siea.sagarpa.gob.mx/ar_compec_pobgan.html

[3] http://www.siea.sagarpa.gob.mx/ar_compec_pobgan.html

[4] Approximate calculation using IPCC model and emission factors.

[5] 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.

[6] 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.

[7] http://www.sagarpa.gob.mx/Dgg/sectorial.htm

on other CAFO livestock farms throughout México, 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 Mexican government priorities for environmental stewardship and sustainability while positioning rural agricultural operations to develop 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)
México (host)	• AgCert International plc • AgCert México Servicios Ambientales, S. de R.L. de C.V.	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 **México.**

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

The project will be located in **Jalisco** and **Michoacán.**

A.4.1.3. City/Town/Community etc:

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

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

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

Avicampo SPR de RL de CV owns two sites in Michoacán:

- El Coyote is a nurser operation with 10 containment areas, which could house a maximum capacity of 10,000 animals. Manure is removed from these areas via the pull plug method and routed to one of two primary open lagoons.

- Los Charcos I is a finisher operation, which can house a maximum capacity of 6,300 animals in six containment areas. Manure is removed from these areas with a charca of water and routed to one primary and then one secondary open lagoon.

Granja La Guadalupana has one site Jalisco:

- Rancho San Miguel is a farrow to finish operation, and its 26 containment areas have a maximum capacity for approximately 17,400 animals. Manure is cleaned from these areas with a scraper and, in some cases, with hay that is removed daily. Waste from the containment areas is routed to one of four primary open lagoons. One of these lagoons has a secondary lagoon where processed effluent flows to. The secondary lagoon and one of the primary lagoons dispose of effluent through surface spread and irrigation.

Porcicola Angulos has one site in Jalisco:

- Porcicola Angulos is a farrow to finish operation. There are six containment areas on site, which could hold a maximum capacity of approximately 1,960 animals. These areas are cleaned via either the scraper or pull plug method of manure removal. Waste from containment areas 1 and 2 are routed to one primary lagoon; waste from containment areas 3, 4, 5 and 6 are routed to another primary lagoon.

San Carlos ASP SPR de RL has two sites in Jalisco:

- La Soledad is a farrow to finish operation with 24 containment areas to house its animals through the various stages of production. These barns have a maximum capacity of approximately 7,320 animals. Waste is cleaned from these areas with hay, a scraper and/or via the pull plug method. At the time of the AgCert assessment, the manure was routed to two primary open lagoons, one of which had a secondary lagoon. Water from the secondary lagoon was used for irrigation as was the water from the primary lagoon that did not have a secondary lagoon. However, one of the two primary original lagoons was used for the construction of the digester, and its secondary lagoon is now used as a primary. So there are two primary lagoons.

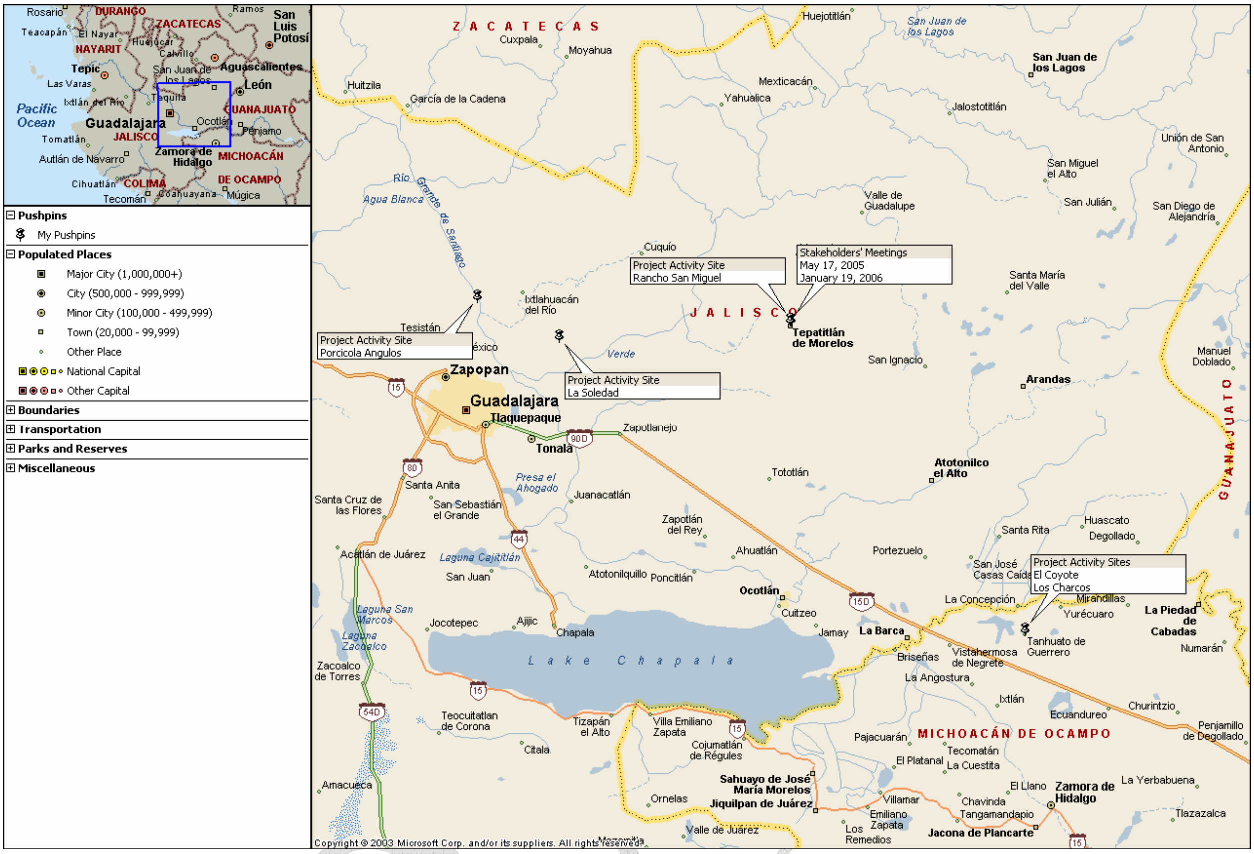

Figure A1. States of Jalisco and Michoacán project activity sites

Table A2. Detailed physical location and identification of project sites

Farm/Site Name	AgCert Site ID	Address	Town/State	Contact	Phone	GPS
Avicampo SPR de RL de CV	Main Office	Km. 2 Carretera La Barca-Guadalajara	La Barca, Jalisco, 47900	José Luis Alvarez Jiménez	393-935-1763	
El Coyote	31752	Predio Ejido Tarimoro	Tanuato, Michoacan, 59320	Roberto García		N 20º14 W 102º25
Los Charcos I	31152	Km 1.5 Los Charcos Tanuato				N 20º16 W 102º23
Granja La Guadalupana	Main Office	Sevilla y Gómez No. 50	Pegueros, Jalisco, 47711	Ezequiel Gutiérrez Martín	378-717-0006	
Rancho San Miguel	31222	Km 10.5 Carretera TepatitlÃ¡n-Lagos de Moreno	Tepatitlán, Jalisco, 47600	Luis Manuel Magallón	378-786-2806	N 20º.54 W 102º42
Porcicola Angulos	Main Office	Hidalgo #20	Palos Altos, Jalisco	José Ramón Angulo Padilla	373-734-6233	
Porcicola Angulos	3280160					
San Carlos ASP SPR de RL	Main Office	Lopez Mateos #433	Trejos Mpio de Ixtlahuacan del Rio, Jalisco, 45280	Juaquin Angelo Sanchez	373-734-6534	
La Soledad	31742	Domicilio Conocido La Colmena / 3km SE of the Rumbo al Ccerro de La Higuera		Raúl Macías	871-747-1044	N 20º45 W 103º13

A.4.2. Type and category(ies) and technology 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. Methane recovery.

The project activity will capture and combust methane gas produced from the decomposing manure of swine CAFOs located in Jalisco and Michoacán, México.

The technology to be employed by the project activity includes the installation of new covered lagoons creating a negative pressure 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 and extrusion welds 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 lagoon cells will be routed to the clarification lagoon(s) and captured gas will be removed and combusted. The system will include an efficient enclosed flare to combust the methane gas produced.

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.

Technology and know-how transfer:

The project developer is implementing a multi-faceted approach to ensure the project, including technology transfer, proceeds smoothly. This approach includes careful specification and design of a complete technology solution, identification and qualification of appropriate technology/services providers, supervision of the complete project installation, farm staff training, ongoing monitoring (by the project developer) and developing/implementing a complete Operations & Maintenance plan using project developer staff. As part of this process, the project developer has specified a technology solution that will be self-sustaining (i.e., highly reliable, low maintenance, and operate with little or no user intervention). The materials and labour used in the base project activity are sourced 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. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

Anthropogenic GHGs, specifically methane is released into the atmosphere via decomposition of animal manure. Currently, the farm produced GHG is not collected or destroyed.

The proposed project activity intends to change current AWMS practices. These changes will result in the recovery of anthropogenic GHG emissions by controlling the lagoon's decomposition processes and collecting and combusting the methane biogas.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

THE TOTAL ESTIMATE OF EMISSIONS REDUCTION OVER THE FIXED 10 YEAR CREDITING PERIOD

A.4.3.1 - Estimated Emission Reductions over chosen Crediting Period	
Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1	13,794
Year 2	13,794
Year 3	13,794
Year 4	13,794
Year 5	13,794
Year 6	13,794
Year 7	13,794
Year 8	13,794
Year 9	13,794
Year 10	13,794
Total estimated reductions (tonnes CO_2e)	137,946
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	13,794

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 larger 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 small-scale CDM project activities with the same project participants, in the same project category and technology/measure whose project boundary is within 1 km of another proposed small-scale activity.

SECTION B. Application of a baseline methodology:

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

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

The project activity is a Type III, Other Project Activities, Category III.D. Methane Recovery. The project is a small scale project because it comprises methane recovery from agro-industries, and project emissions are less than 15 kt CO2eq.

B.2 Project category applicable to the small-scale project activity:

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 CAFOs located in Jalisco and Michoacán, México. 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.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered 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 Mexican 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 costs involved in the investment compared to other available systems and due to regionalized subsidies for electric generation.

   Mexican pork producers face the same economic challenges as farmers in other nations due to increased worldwide production and low operating margins. Farm owners focus on the bottom line. Odour benefits, potential water quality enhancements, and the incremental savings associated with heating cost avoidance, are rarely enough to compel farmers to upgrade to an (expensive) advanced AWMS system.[9] Unless the AWMS upgrade activity affords the producer the means to (partially) offset the practice change cost (via the sale of Certified Emission Reduction (CER) credits, for instance) the open lagoon will remain the common AWMS practice – *and all AWMS GHG biogas will continue to be emitted*.

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.

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 methane from the manure. These systems become progressively more expensive on a 'per animal' basis as farm animal population (i.e., farm size) is decreased. Moreover, operations and maintenance requirements involved with this technology, including a detailed monitoring program to maintain system performance levels, must also be considered. Worldwide, few anaerobic digesters have achieved long-term operations, due primarily to inappropriate operations and maintenance.

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

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 Mexican legislation will require future use of digesters due to the *significant* investments required. Further, there is no expectation that México will pass any legislation which deals with the GHG emissions. Indeed, the developer is aware of no Latin American or other worldwide location requiring either the use of digesters or the constraints of agricultural GHG emissions. Qualitatively, this is the most likely "risk" area associated with possible changes in the baseline scenario. Overarching environmental regulations have to balance creating a legislative framework that enables agricultural production against social pressures to make industrialized livestock operations "good neighbours." México has successfully grown this sector, building upon low operating costs and technically expert labour. They have recently demonstrated environmental sensitivity by requiring lagoon liners.

b) *Common practice*: While past practices cannot predict future events, it is worth noting that some sites included in this project activity have been in existence for many years, during which time, the prevailing AWMS practice was open lagoons.

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

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

The project boundary is defined 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. The project activity site uses a system of one or more lagoons. Proposed AWMS practice changes include the construction of an ambient temperature digester comprised of cells that capture the resulting bio-gas which is then combusted. The project boundary considers these practice changes as well as future options that the producer may elect to use.

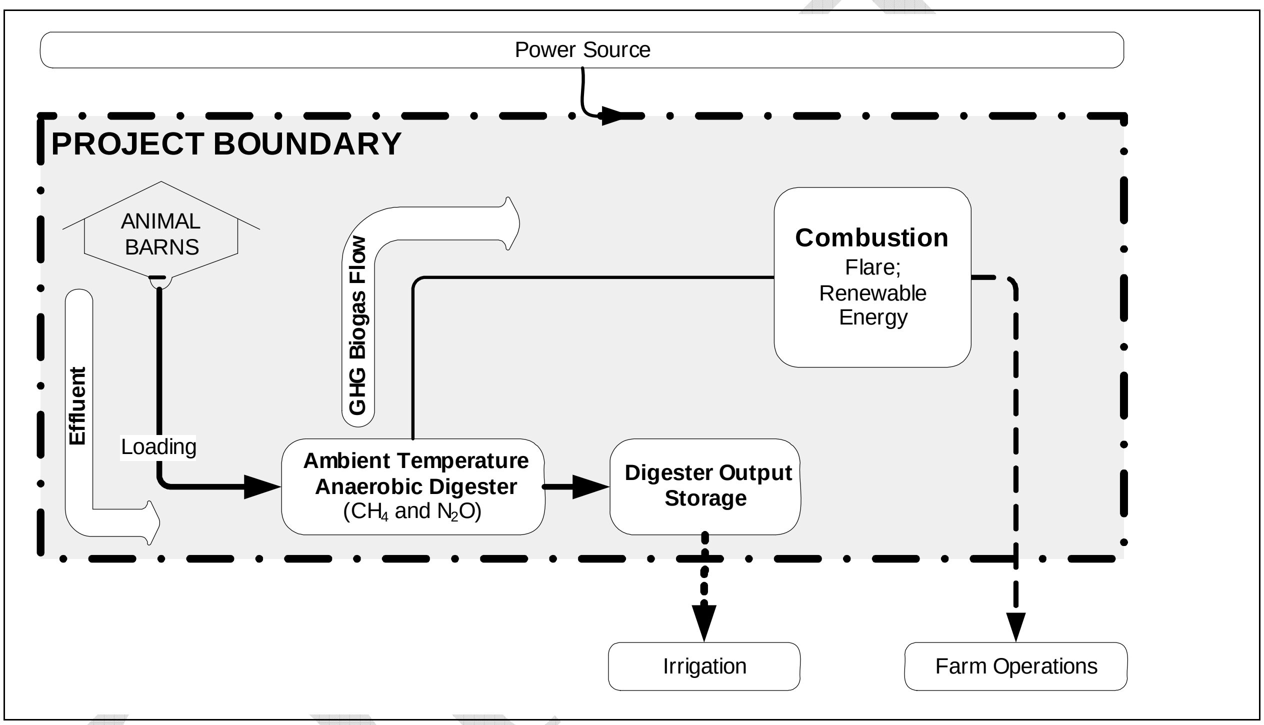

Figure B1. Project Boundary

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

B.5. Details of the 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 4.2.5 of the Revised 1996 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 anaerobic lagoon is considered the baseline and estimated emissions are determined as follows:

Step 1 – Animal Population

Animal populations for the project activity sites are described in the Section E.1.2.1, Table E1. The AWMS used on the farms is an open anaerobic lagoon, unless otherwise noted in Section A.4.1.4.

Step 2 – Emission Factors

The emission factor for the animal group for any given month is:

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

Equation B1[10]

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}[11]/$W_{default}$)*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:

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

[10] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual. Page 4.26, equation 16 and Page 4.46, Table B6.

[11] Standard weight values based on USEPA AgStar.

Equation B2[12]

Where:

CH_{4a} = methane produced in kg/yr for animal type I,

EF_i = emission factor (kg) for animal type i (e.g., swine),

$Poulation_{year}$ = 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[13]

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).

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

The starting date for this activity is 08/02/2005

C.1.2. Expected operational lifetime of the small-scale project activity:

The expected life of this project is 12y – 11m

[12] Adapted from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual. Page 4.26.

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

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

The project activity will use a **fixed** crediting period

C.2.1. Renewable crediting period:

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The starting date of the crediting period is 01/09/2006.

C.2.2.2. Length:

The length of the crediting period is **10y-0m**.

SECTION D. Application of a monitoring methodology and plan:

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

The methodology applied to this project activity is AMS-III.D., Methane recovery

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

The simplified monitoring methodologies are applicable to this project activity because they provide a method to accurately measure and record the GHG emissions that will be captured and combusted by the project activity.

D.3 Data to be monitored:

See Table D1 for specific parameters to be monitored.

Table D1. Data to be monitored

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived?	For how long is archived data to be kept?	Comment
1. BGP	Volume	Biogas produced	m^3	m	Monthly	100%	electronic	Duration of project activity +2y	This parameter measures cumulative biogas produced. A biogas meter will continuously measure amount of biogas produced.
2. MC	Percent	Methane content	%	m	Quarterly	100%	electronic	Duration of project activity +2y	This parameter determines the methane content of the biogas. If results show significant variation, more increase sampling frequency.
3. CEE	Fraction of time	Combustion equipment efficiency	%	m	Quarterly	100%	electronic	Duration of project activity +2y	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 (based on last known documented status). Flare maintenance records will be used to make this determination.[14]
4.EFP	Percent	Efficiency of Flaring	%	m	After each test	100%	Electronic or paper	Duration of project activity +2y	AgCert will test the efficiency of the flaring process periodically. The performance of the test will be outsourced to a laboratory certified to national standards.

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[14] A weekly maintenance check is performed and documented. If flare is observed as non-functional during weekly check, the out of service time is based on the last documented weekly check.

Calculating Methane (CH_4) Emissions

Step 1: Record biogas meter reading (ID1).

Step 2: Record the percentage of methane of the biogas (ID2).

Step 3: Multiply ID 1 and ID 2.

Step 4: Multiply ID3 and ID4[15]

Step 5: Multiply the result of Step 3 and Step 4

[15] 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. If the efficiency for the flare process can't be measured, a conservative destruction efficiency factor should be used – 99% for enclosed flares and 50% for open flares.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

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

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

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

A complete set of procedures and an Operations and Maintenance Plan 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.

Metering devices used for measurement of biogas are positive displacement; rotary impeller-type gas meters designed for continuously measuring and indicating the accurate measurement of gas 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 $\pm$ 1 percent. Bearing oil is changed as required on the unit, as required, to assure optimal operation and achieve specified performance. Differential pressure tests are conducted by maintenance technicians to periodically substantiate that the original accuracy of a meter has remained unchanged. If flow is less than optimal, the unit is replaced. Factory testing of meters are traceable to United States National Institute of Standards and Technology (NIST) and traceable to NMi - Netherlands Measurements Institute for volumetric flow rate.

Methane concentration is determined with CO^2 content testing and is obtained with a gas analyzer using the "Orsat" method of volumetric analysis involving chemical absorption of a sample gas. The equipment and test procedures will provide an accuracy with a $\pm$ ½ percent uncertainty range. The chemical sampling/testing unit is used and calibrated prior to each test according to the manufacturers specifications and procedures. The unit is manufactured by an ISO 9001 TUV company, certificate registration number 950 97 0113.

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 O&M Manual 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.

D.6. Name of person/entity determining the monitoring methodology:

The entity determining this monitoring methodology is AgCert International plc, who is the project developer listed in Annex 1 of this document.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Specific formula to calculate the GHG emission reductions by sources for the AWMS improvement are not provided in appendix B of the simplified M&P for small-scale CDM project activities.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

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 Section 4.2.5 of the Revised 1996 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 – Animal Population

Animal populations for the project activity sites are described in the tables below. The AWMS proposed for use on the farm is an anaerobic digester.

Table E1. Animal Populations

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Los Charcos I (31152)	Oct-04	0	0	0	5,664	0
	Nov-04	0	0	0	6,009	0
	Dec-04	0	0	0	5,648	0
	Jan-05	0	0	0	5,158	0
	Feb-05	0	0	0	5,210	0
	Mar-05	0	0	0	5,338	0
	Apr-05	0	0	0	4,649	0
	May-05	0	0	0	3,977	0
	Jun-05	0	0	0	4,718	0
	Jul-05	0	0	0	3,661	0
	Aug-05	0	0	0	3,083	0
	Sep-05	0	0	0	5,021	0

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Rancho San Miguel (31222)	Oct-04	1,632	495	21	6,481	4,051
	Nov-04	1,671	464	20	5,900	3,631
	Dec-04	1,675	454	21	4,678	4,285
	Jan-05	1,669	418	22	5,668	3,356
	Feb-05	1,681	399	23	5,629	3,768
	Mar-05	1,728	361	23	5,862	4,087
	Apr-05	1,707	469	22	5,009	4,826
	May-05	1,718	451	24	5,432	4,868
	Jun-05	1,730	482	24	6,479	4,424
	Jul-05	1,716	495	24	6,624	4,774
	Aug-05	1,712	464	24	6,633	4,844
	Sep-05	1,702	454	24	6,510	5,222

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
La Soledad (31742)	Sep-04	519	143	7	2,764	1,124
	Oct-04	517	157	7	2,798	1,128
	Nov-04	527	168	7	2,813	1,135
	Dec-04	530	165	7	2,729	1,158
	Jan-05	536	138	7	2,857	1,090
	Feb-05	539	154	7	2,832	1,166
	Mar-05	548	159	7	2,850	1,146
	Apr-05	552	162	7	2,839	1,160
	May-05	553	167	6	3,016	1,198
	Jun-05	560	197	6	2,900	1,209
	Jul-05	560	163	6	2,887	1,133
	Aug-05	556	180	6	3,006	1,193

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
El Coyote (31752)	Oct-04	0	0	0	0	4,958
	Nov-04	0	0	0	0	5,254
	Dec-04	0	0	0	0	5,139
	Jan-05	0	0	0	0	5,434
	Feb-05	0	0	0	0	5,052
	Mar-05	0	0	0	0	5,866
	Apr-05	0	0	0	0	4,779
	May-05	0	0	0	0	5,501
	Jun-05	0	0	0	0	5,923
	Jul-05	0	0	0	0	6,392
	Aug-05	0	0	0	0	7,148
	Sep-05	0	0	0	0	8,010

	Month/Yr	Animal Type				
		Sow	Gilt	Boar	Fin	Nurs
Porcicola Angulos (3280160)	Jun-05	187	0	4	952	442
	Jul-05	186	0	4	942	508
	Aug-05	182	0	4	947	486
	Sep-05	176	0	4	936	434
	Oct-05	179	0	4	984	484
	Nov-05	187	0	4	990	495
	Dec-05	190	0	4	981	523
	Jan-06	194	0	3	983	549
	Feb-06	195	0	3	994	558
	Mar-06	197	0	3	1,005	560
	Apr-06	203	0	3	1,046	587
	May-06	220	0	3	1,184	659

Step 2 – Emission Factors

The emission factor for the animal group for any given month is:

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

Equation E2[16]

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}[17]/$W_{default}$)*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.

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[16] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual. Page 4.26, equation 16 and Page 4.46, Table B6.

[17] Standard weight values based on USEPA AgStar.

The amount of methane emitted can be calculated using:

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

Equation E3[18]

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.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

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

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

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

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

Equation E4[19]

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,
GWP_{CH4}	=	global warming potential of methane (21).

[18] Adapted from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual. Page 4.26.

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

Table E2. Project Activity Emissions

El Coyote (31752)

	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	0	365	0	82	181	5.50	0.00	5.50
Gilts:	0	365	0	82	181	5.50	0.00	5.50
Boars:	0	365	0	82	204	5.50	0.00	5.50
Finishers:	0	365	0	82	56	3.76	0.00	5.50
Nur/Wean:	5,788	365	0	82	13	0.87	5,049.03	5.50

Total Annual CH_4: 5,049.03

PE (CO_2e/year): 106.03

La Soledad (31742)

	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	541	365	0	82	181	5.50	2,976.78	5.50
Gilts:	163	365	0	82	181	5.50	896.89	5.50
Boars:	7	365	0	82	204	5.50	38.52	5.50
Finishers:	2,858	365	0	82	56	3.76	10,739.56	5.50
Nur/Wean:	1,153	365	0	82	13	0.87	1,005.79	5.50

Total Annual CH_4: 15,657.54

PE (CO_2e/year): 328.81

Los Charcos I (31152)

	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	0	365	0	82	181	5.50	0.00	5.50
Gilts:	0	365	0	82	181	5.50	0.00	5.50
Boars:	0	365	0	82	204	5.50	0.00	5.50
Finishers:	4,845	365	0	82	56	3.76	18,206.15	5.50
Nur/Wean:	0	365	0	82	13	0.87	0.00	5.50

Total Annual CH_4: 18,206.15

PE (CO_2e/year): 382.33

Porcicola Angulos (3280160)

	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	191	365	0	82	181	5.50	1,050.95	5.50
Gilts:	0	365	0	82	181	5.50	0.00	5.50
Boars:	4	365	0	82	204	5.50	22.01	5.50
Finishers:	995	365	0	82	56	3.76	3,738.93	5.50
Nur/Wean:	524	365	0	82	13	0.87	457.10	5.50

Total Annual CH_4: 5,268.99

PE (CO_2e/year): 110.65

Rancho San Miguel (31222)								
	Population$_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	1,695	365	0	82	181	5.50	9,326.53	5.50
Gilts:	451	365	0	82	181	5.50	2,481.57	5.50
Boars:	23	365	0	82	204	5.50	126.55	5.50
Finishers:	5,909	365	0	82	56	3.76	22,204.36	5.50
Nur/Wean:	4,345	365	0	82	13	0.87	3,790.26	5.50
Total Annual CH_4:							37,929.28	
PE (CO_2e/year):								796.51

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

Table E3. Baseline Emissions

El Coyote (31752)								
	Population$_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	0	365	0	82	181	49.52	0.00	49.52
Gilts:	0	365	0	82	181	49.52	0.00	49.52
Boars:	0	365	0	82	204	49.52	0.00	49.52
Finishers:	0	365	0	82	56	33.82	0.00	49.52
Nur/Wean:	5,788	365	0	82	13	7.85	45,441.30	49.52
Total Annual CH_4:							45,441.30	
BE (CO_2e/year):								954.27

La Soledad (31742)								
	Population$_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	541	365	0	82	181	49.52	26,791.06	49.52
Gilts:	163	365	0	82	181	49.52	8,071.98	49.52
Boars:	7	365	0	82	204	49.52	346.65	49.52
Finishers:	2,858	365	0	82	56	33.82	96,656.06	49.52
Nur/Wean:	1,153	365	0	82	13	7.85	9,052.14	49.52
Total Annual CH_4:							140,917.90	
BE (CO_2e/year):								2,959.28

Los Charcos I (31152)

	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	0	365	0	82	181	49.52	0.00	49.52
Gilts:	0	365	0	82	181	49.52	0.00	49.52
Boars:	0	365	0	82	204	49.52	0.00	49.52
Finishers:	4,845	365	0	82	56	33.82	163,855.36	49.52
Nur/Wean:	0	365	0	82	13	7.85	0.00	49.52

Total Annual CH_4: 163,855.36

BE (CO_2e/year): 3,440.96

Porcicola Angulos (3280160)

	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	191	365	0	82	181	49.52	9,458.58	49.52
Gilts:	0	365	0	82	181	49.52	0.00	49.52
Boars:	4	365	0	82	204	49.52	198.09	49.52
Finishers:	995	365	0	82	56	33.82	33,650.38	49.52
Nur/Wean:	524	365	0	82	13	7.85	4,113.90	49.52

Total Annual CH_4: 47,420.94

BE (CO_2e/year): 995.84

Rancho San Miguel (31222)

	$Population_{year}$	N_m	Days OB	Default BW	Ave Bw, kg	EF_i	CH_4 annual	Cap EF_1
Sows:	1,695	365	0	82	181	49.52	83,938.73	49.52
Gilts:	451	365	0	82	181	49.52	22,334.14	49.52
Boars:	23	365	0	82	204	49.52	1,138.99	49.52
Finishers:	5,909	365	0	82	56	33.82	199,839.28	49.52
Nur/Wean:	4,345	365	0	82	13	7.85	34,112.38	49.52

Total Annual CH_4: 341,363.52

BE (CO_2e/year): 7,168.63

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Table E4. Total Emission Reductions

	CO_2e/year
Total Baseline Emissions (BE)	15,518.98
Total Project Emissions (PE)	1,724.33
Total Emission Reductions (ER_{net} = BE - PE)	**13,794.65**

E.2 Table providing values obtained when applying formulae above:

Table E5.

Parameter/Factor	Value	Source/Comment
Baseline		
GWP CH_4	21	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
$Population_{year}$	Table E1	Animal population used to estimate baseline and project emission estimates was based on a 12 month period of actual operation production data (See Table E1).
n_m	Table E1	Days resident in system
$MS\%_{ijk}$	100%	Percent of effluent used in system.
VS_i	0.50	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
B_{oi}	0.45	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
MCF_{jk}	0.90	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
Project Activity		
GWP CH_4	21	Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996)
$Population_{year}$	Table E1	Animal population used to estimate baseline and project emission estimates was based on a 12 month period of actual operation production data (See Table E1).
n_m	Table E1	Days resident in system
$MS\%_{ijk}$	100%	Percent of effluent used in system
VS_i	0.50	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
B_{oi}	0.45	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46
MCF_{jk}	0.10	Obtained from 1996 IPCC, Appendix B, Table B-6, p. 4.46

Table E6.

Uncertainty Parameter for GHG Mitigation Project Estimates	
Uncertainty:	**How Addressed:**
o Data collection inaccuracies o Animal type o Animal population, group/type, mortality rates o Genetics o Choice of appropriate emission coefficients o Data security o Animal health	o Accurate data collection is essential. The farms included in this project activity use a Standardized industry database package which captures a wide range of incremental production data to manage operations and enable the farm to maximize both productivity and profitability. AgCert uses some data points collected via this system. o AgCert has a rigorous QA/QC system that ensures data security and data integrity. AgCert performs spot audits data collection activities. o AgCert has a data management system capable of interfacing with producer systems to serve as a secure data repository. Project activity data related uncertainties will be reduced by applying sound data collection quality assurance and quality control procedures. o Any significant mortality rates will be visible from the Monthly Monitoring Form and addressed accordingly.

SECTION F.: Environmental impacts:

F.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

SECTION G. Stakeholders’ comments:

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

AgCert invited stakeholders to meetings to explain the UNFCC CDM process and proposed project activity. These meetings were held in Tepatitlán, Jalisco on May 17, 2005 and January 19, 2006. Another meeting was held January 31, 2006 in La Piedad, Michoacán, and a fourth meeting was held on April 5, 2006 in Tehuacán, Puebla. These meetings were presided over by Juan Carlos González, Alejandro Velarde and Gabriela Dávila, representatives of AgCert México.

AgCert issued invitations to government officials at the federal, state, and local levels. Furthermore, AgCert published announcements of the meetings in the newspapers, which covers the states of Jalisco and Michoacán.

These public announcements appeared in:

1. *El Informador*, Jalisco, May 12, 2005
2. *El Informador,* Jalisco, January 12, 2006
3. *Diario A.M.*, Michoacán, January 25, 2006
4. *El Dictamen de Veracruz,* Veracruz, March 28, 2006
5. *El Mundo de Tehuacan,* Puebla, March 28, 2006

All invitations were in the Spanish language. The meeting was attended by project participants and farm representatives. A full list of attendees and the meeting minutes are available on request.

Messrs. González and Velarde and Ms. Dávila gave presentations, which covered the following topics: purpose of the 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.

AgCert has also participated as a speaker and described in detail this project in the Mexican government sponsored CDM workshops being presented throughout México.

G.2. Summary of the comments received:

Overall, the comments from the attendees at the stakeholders' meeting were positive and supportive of the project.

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

No action required

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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