



**AWMS METHANE RECOVERY
AMPUERO DAIRY
Torreon, Coah, Mexico**

UNFCCC CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED DESIGN DOCUMENT



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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 | <ul style="list-style-type: none">• 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, Ampuero Dairy Farm

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

The Ampuro dairy needs a modern waste management system to reduce the time and expense involved in manure handling, and to protect the environment. As a result of anaerobic decomposition processes, dairy farms' storage and disposal of animal waste is a source of water/land contamination and odor. These systems emit both methane (CH₄) and nitrous oxide (N₂O).

The “AWMS Methane Recovery, Ampuero Dairy Farm Project” (hereafter, the “Project”) is an anaerobic digestion (AD) treatment facility to recover methane gas and produce electrical power from that gas.

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 odor. 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 of resulting biogas. The biogas produced in the anaerobic digester will be captured and run through a biogas driven generator to generate electricity for on-site usage.

In the absence of the Project Activity, the operations at this dairy would rely on electricity from the Mexican grid. With the implementation of the project activity, electricity will be supplied by renewable biogas. Surplus biogas, beyond that needed for the engine generators, will be stored in a gas-tight membrane cover or flared rather than released to the atmosphere.

Contribution to Sustainable Development

According to official statistics, livestock production occupies more than half of Mexico's land area¹ (mostly for cattle) and involves more than 3 million producers. However, large livestock production facilities have generated a new level of environmental impacts and public concerns. This is the reason why it is important to establish a positive model for livestock operations.

The appropriate handling of large-scale animal waste production is critical to protecting human health and the environment. Manure volumes commonly exceed the local capacity for re-use. Since manure is an important primary source of pathogenic bacterial contamination, livestock waste management practices together with farm design and location are of paramount importance for human health and environment.

¹ Comparative Standards for Intensive Livestock Operations in Canada, Mexico, and the United States, 2003, http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=1082



This project, anaerobic digestion waste management system (AWMS) with methane recovery, energy production and reduction of effluent pollutants will have a positive effect on the local environment and support the Mexican national goals. These goals are clearly outlined in the main Mexican planning instrument, the 2001-2006 National Development Plan, which establishes sustainability as one of its twelve basis principles².

Some of the key expected benefits of an anaerobic digester are:

- Odor control
- Renewable energy production
- Pathogen reduction
- Greenhouse gas reduction
- Reduction in total oxygen demand of the treated manure (total oxygen demand is a measure of potential impact on aquatic systems)

These benefits will not only have positive effects on the environment but will set an example for future projects that will have an additional positive effect on the reduction of GHG and ground water contamination problems.

A.3. Project participants:

AMPUERO (AMPUERO S.P.R DE R.L DE C.V.) is a modern 2,100-milk cow dairy in central Mexico near the city of Torreon. AMPUERO wants to improve its animal waste management and potential odor problems as well as produce energy to meet its needs.

TESA (TECNOLOGIA EN SISTEMAS AMBIENTALES, S.A. DE C.V.) a corporate subsidiary of Grupo Domos, is an engineering construction firm that provides water, wastewater, and solid waste services to industry and municipalities throughout Mexico. TESA has agreed to finance and construct the facilities required by AMPUERO to produce energy and solve its energy and waste disposal problems for a share of the income from products produced by the waste management process.

EQI (ENVIRO-QUEST INTERNATIONAL) is a Vancouver, BC Environmental Corporation (Civil, Agricultural, and Chemical Engineering) that has technology required to meet the needs of Ampuero and TESA in solving the waste disposal and energy production needs.

A.4. Technical description of the small-scale project activity:

The Ampuero dairy is a large modern 2,100-milk cow dairy. Dry and young stocks are housed in a separate open corral facility. The dairy has five large buildings. The main building has a large state-of-

² Mexico Case Study Analysis of National Strategies for Sustainable Development, http://www.iisd.org/pdf/2004/measure_sdsip_mexico.pdf#search=%22National%20Development%20Plan%20Mexico%22



the-art carousel milk parlor, animal hospital, conference room, and office. The other four buildings house the 2,100 milk cows in a free stall - open corral arrangement. The milk parlor, holding area, conduction lanes, and hospital are flushed of manure throughout the day. Each of the four open corral buildings has two feed lane's that are flushed daily.

There are six water storage flush tanks adjacent to the milk parlor. The facility also includes manure-handling structures such as a solids removal screen and an anaerobic lagoon with a floating pump. The lagoon has a capacity of 31,500 m³ of which 15,000 m³ is continuous storage. The floating pump only removes the top liquid daily. The liquid retention time is estimated to be 40 days while the solids retention time exceeds 80 days, sufficient for a majority of the solids to be converted to gas. The average annual temperature of the stored solids is > 28°C.

The Ampuero dairy uses a large number of cooling fans to maintain a proper environment for the milk cows and improve milk yield. The dairy also has two large wells, one producing 70 L per second and the other producing at least 80 L per second. The fresh well water is pumped to six large aboveground flush tanks where the water is held for flushing the milk parlor, conduction alley, animal hospital, and the 8 feed lanes in the corral housing buildings. The total capacity of the flush tanks is 78,000 L.

The total water use is 384,004 L per day, which is discharged with the manure to the anaerobic holding pond. Periodically the contents of a holding pond are pumped through an overhead screen and discharge to the irrigation channel. The floating pump removes the top liquid from the anaerobic pond while the solids remain in the pond for anaerobic decomposition.

The Ampuero dairy desires to improve its waste management system, produce renewable power, and reduce the time and expense involved in manure handling. To maintain a clean dairy environment free of manure and flies it uses large quantities water. Unfortunately, the uses of large volumes of water severely restrict the options available for waste management to either aerobic or anaerobic digestion. The dairy also needs power for the cooling fans that were recently installed throughout the dairy.

Only two proven options are available, aerobic or anaerobic biological waste treatment. Aerobic waste treatment uses large quantities of energy to produce a significant quantity of waste sludge. Aerobic digestion does not significantly reduce the mass of solids (fiber) that must be processed. On the other hand, anaerobic biological treatment reduces the volume of solids that must be disposed while at the same time producing methane gas, which can be converted to power.

The Project Activity consists of the construction of a new mesophilic anaerobic biological treatment system. This system will reduce the volume of solids that must be disposed, while at the same time it will produce methane gas, which can be converted to power. The digester is a high SRT, periodically mixed, HDP enclosed, with totally enclosed floating cover, heated, mesophilic, digester commonly utilized throughout North America. The totally sealed flexible cover will provide a large quantity of biogas storage. Heat will be provided through an engine generator heat exchanger.

The biogas produced in the anaerobic digester will be captured and run through a biogas driven generator to produce electricity for on-site usage, which will be approximately 1,800,000 KWh per year. The installed generation capacity will be in the range of 240 to 260 KW in order to meet this energy demand. In the absence of the Project Activity, the operations at this dairy would rely on electricity from the Mexican grid. With the implementation of the project activity, electricity will in the future be supplied by renewable biogas. Surplus biogas that exceeds storage capacity will be flared rather than released to the atmosphere.

A.4.1. Location of the small-scale project activity:

The farm is located in central MEXICO in the State of COAHUILA, Province of TORREON, approximately 6 miles Southeast of the city of Torreon, Mexico at latitude, 25° 27' 29" N, and longitude, 103° 22' 22" W. It is hosted by Mexico and will be developed by TESA

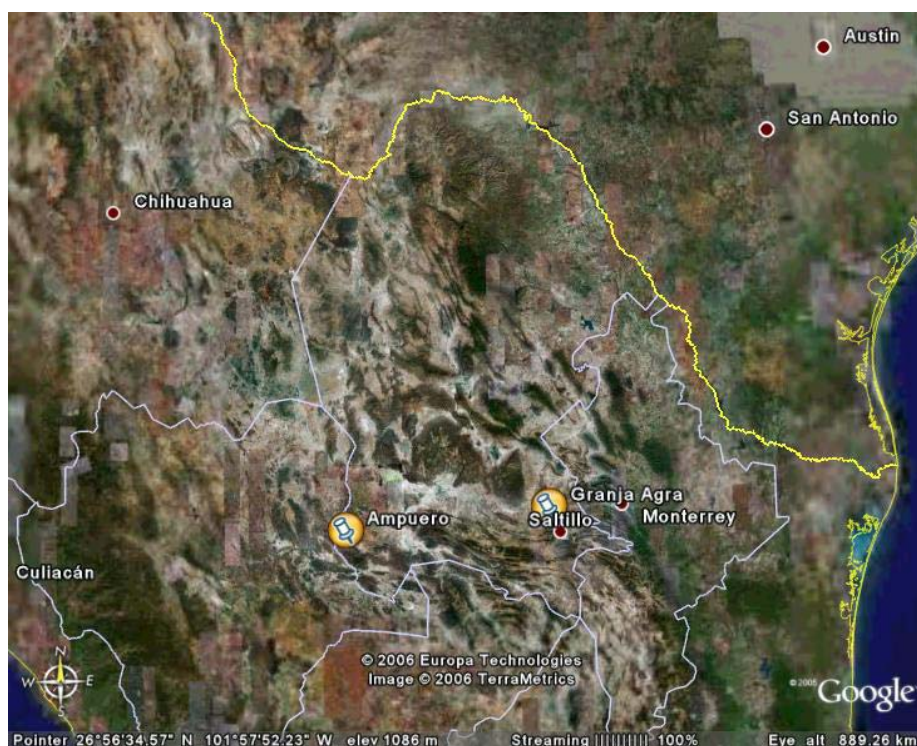
A.4.1.1. Host Party(ies):

The Ampuero dairy is located in central MEXICO in the State of COAHUILA.

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

The Ampuero dairy is located in central MEXICO in the State of COAHUILA; the Province of TORREON. The general location of the facility is shown in Figure 1.

Figure 1 – Ampuero Dairy in Central Mexico

**A.4.1.3. City/Town/Community etc:**

The Ampuero dairy is situated approximately 6 miles Southeast of the city of Torreon.

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 Ampuero dairy is at latitude, 25° 27' 29" N, and longitude, 103° 22' 22" W. Figure 2 presents an aerial view of the Ampuero dairy.

Figure 2 – Aerial view of the Ampuero Dairy



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

The category for the project activity according to the UNFCCC's published "Appendix B – Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activities" is Type III.D (reference AMS-III.D) / Version 10 – "Methane recovery" – for the methane recovery component.

The project conforms to project categories III.D since it comprises methane recovery from manure by changing the management practice of a animal waste in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system. The project activities result in annual emission reductions lower than 25,000 ton CO₂e, and they directly emit less than 15 kilo tonnes of carbon dioxide equivalent annually.



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:

Agriculture accounts for about one-fifth of the projected anthropogenic greenhouse effect, producing about 50 and 70%, respectively, of overall anthropogenic CH₄ and N₂O emissions; agricultural activities account for approximately 5% of anthropogenic emissions of CO₂³. One of the largest agricultural sources of CH₄ is managed ruminant animals. Emissions of CH₄ from domestic ruminant animals can be reduced as producers use animal waste disposal systems to produce methane and provide an on-farm energy supply, while the CH₄ utilized in this manner is not emitted to the atmosphere. Currently, the Ampuero farm produces green house gasses that are 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 10-Year Crediting Period

| Years | Annual Estimation of Emission Reduction (Tonnes of CO₂) |
|---|---|
| Year 1 | 9,391 |
| Year 2 | 9,391 |
| Year 3 | 9,391 |
| Year 4 | 9,391 |
| Year 5 | 9,391 |
| Year 6 | 9,391 |
| Year 7 | 9,391 |
| Year 8 | 9,391 |
| Year 9 | 9,391 |
| Year 10 | 9,391 |
| Total Estimated Reduction (Tones CO₂) | 93,910 |
| Total Number of Crediting Years | 10 |
| Annual Average | 9,391 |

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

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

³ Cole V. et al, SAR II, Chapter 23, *Agricultural Options for Mitigation of Greenhouse Gas Emissions*, <http://www.gcric.org/ipcc/techrepI/endnotes.html#17>

**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, a proposed small-scale project activity 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 or registered within the previous 2 years, whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION B. Application of a baseline methodology:**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, and **Category III.D: Methane recovery in agricultural and agro industrial activities, Version 10**. This category is applicable because project activities comprise of methane recovery from agro-industries and result in annual emission reductions lower than 25,000 ton CO₂e and they directly emit less than 15 kilo tonnes of carbon dioxide equivalent annually.

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

The project activity will capture and combust methane gas produced from the decomposing manure at a dairy cattle farm located in State of COAHUILA, the Province of TORREON, México. The simplified baseline methodology is applicable to this project activity because in the absence of the proposed project activity, methane from the existing AWMS would continue to be emitted to the atmosphere during the crediting period. The GHG emission reductions can be estimated using internationally accepted IPCC guidance.

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:

Currently Ampuero dairy operates an open-air lagoon system, which releases large quantities of GHG into the atmosphere. This practice is currently common in Mexico and dairies are not prohibited from irrigating land throughout the year, provided it does not affect drinking water quality. If Ampuero continues to operate using their existing system they will continue to discharge pollutants throughout the year.

The proposed project activity aims to advance current AWMS practices toward the mitigation of anthropogenic GHG emissions by controlling the lagoon's decomposition processes and methane



recovery. The project will displace a high-GHG AWMS practice (an open-air lagoon) with a lower-GHG AWMS practice (an anaerobic digester with capture of resulting biogas).

In Mexico, regulatory control, although minimal, is primarily a matter of federal law, with oversight and enforcement issues usually managed at local levels. Federal law currently regulates discharges into waterways, but a federal regulatory system for addressing environmental concerns in general has not yet been developed. While Mexico's federal water law could be applied to intensive livestock operations (ILO), its environmental agency, Semarnat, has not developed the technical standards specific to waste discharges from ILOs into waterways⁴.

According to the Attachment A to Appendix B of the simplified modalities and procedures for CDM small scale project activities, the most important evidence that supports the additionality of the project are:

1. Investment Barrier

- Current Practice

The current lagoon-based treatment method is considered standard operating tradition. Also, for the farm owner, the current system (business as a usual scenario) is financially attractive because it satisfies Mexican Standards.

- Institutional Constraints

Presently, Mexico does not allow electricity-generated onsite from biogas to be sold back to the grid. Without the CDM, this would drastically reduce the benefits available to the farms for implementing anaerobic digesters.

- Economic Constraint

Due to increased worldwide production and low operating margins, Mexican dairy producers face the same economic challenges as farmers in other parts of the world. Although a new anaerobic digester would reduce odor and offer an increase in water quality, these reasons alone are not convincing enough to motivate farmers to upgrade current practices to expensive anaerobic digestion systems.

- Perceived Risk

Without some kind of government guarantee or incentive, local banks are unwilling to finance AWMS projects primarily because of the lack of knowledge and experience with the technology.

2. Technological Barrier

Anaerobic digester systems are a new technology not only in Mexico but also in the world. While hundreds of anaerobic-digestion projects have been installed in Europe and the U.S. since the 1970s, it was not until the 1990s that the United States installed better and more successful projects. It is estimated

⁴ Comparative Standards for Intensive Livestock Operations in Canada, Mexico and the United States, Comparative Standards for Intensive Livestock Operations in Canada, Mexico and the United States



that presently the United States has around 40 farm-scale projects in operation across the country⁵. As a new technology, it has often been mismanaged in the past due to inadequate operation and maintenance.

3. Prevailing Practice

An open lagoon treatment system is the most common host country practice for wastewater treatment in farm operations because it is the least expensive manure treatment that meets the requirements of local, state, and federal wastewater legislation. The anaerobic digester systems are a higher risk and cost choice than the business-as-usual scenario.

4. Legal Barriers

The implementation of this project activity significantly surpasses current Mexican regulations for dairy waste treatment. There is no expectation that Mexican legislation will require future use of digesters due to the *significant* investments required.

The proposed project activity will change current AWMS practices. These changes will result in the recovery of anthropogenic GHG emissions by controlling the lagoon's decomposition processes. The project activity will capture methane gas and convert it into energy. In the absence of the proposed small-scale project activity GHG emission reductions would not occur. The inclusion of revenues from carbon credits is an important part of the farmer's implementation and financing strategy. Without selling greenhouse gas credits, there will be no money for AWMS investment and methane releases into the atmosphere will continue.

In the absence of the project activity, Ampuero dairy farm would not change their AWMS practice because they do not have the motivation or resources (especially financial resources) to change their AWMS.

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 lagoon for the disposal of the waste. Proposed AWMS practice changes include the construction of a mesophilic temperature digester comprised of cells that capture the resulting biogas, which is then combusted in an engine generator system. The engine generator system produces on site power as well as heat for the mesophilic digester. The project boundary considers these practice changes as well as future options that the producer may elect to use.

The project boundary does *not* consider the effects of enteric emissions, nor does it include barn-related emissions, whether directly or indirectly associated with the animals, as these emissions are not affected by the proposed practice changes. The manure management system will collect 70% of the manure waste while 30% will degrade and dry in the open corral housing.

⁵ Anaerobic Digestion of Animal Wastes: Factor to Consider, <http://attra.ncat.org/attra-pub/anaerobic.html#intro>

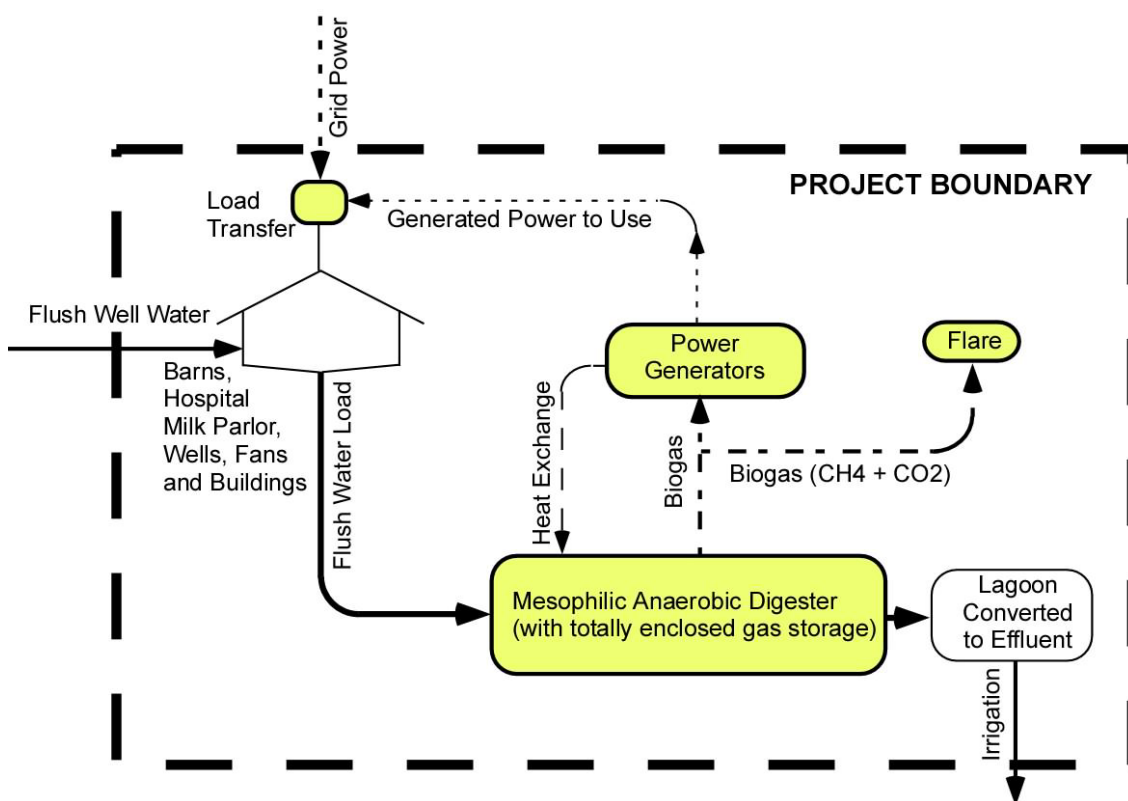


Figure B1. Project Boundary

B.5. Details of the baseline and its development:

The Ampuero dairy is a large modern 2,100-milk cow dairy. Dry and young stock are housed in a separate location. The dairy has five large buildings, the main building, animal hospital, conference room, and office. The other four buildings house the 2,100 milk cows in a free stall - open corral arrangement. The milk cows are large animals similar to typical North American Dairy Cows. Each building has two feed lane's that are flushed throughout the day. There are six water storage flush tanks adjacent to the milk parlor. The facility also includes manure-handling structures such as a solids removal screen and an anaerobic lagoon with a floating pump. Fans are used to cool the barns and increase milk production.

The amount of methane that would be emitted to the atmosphere in the absence of the project activity can be estimated by referring to Chapter 10 of the Revised 2006 IPCC Guidelines for National GHG Inventories and to the Approved Consolidated Baseline Methodology ACM0010/version 01.

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:

Baseline Emissions

The baseline is the AWMSs identified through the baseline selection procedure. Baseline emissions are:



$$BE_y = BE_{CH_4,y} + BE_{N_2O,y} + BE_{eleheat,y}$$

Equation (1)⁶

where,

- BE_y Baseline emissions in year y, in tCO₂e/year.
- $BE_{CH_4,y}$ Baseline methane emissions in year y, in tCO₂e/year.
- $BE_{N_2O,y}$ Baseline N₂O emissions in year y, in tCO₂e/year.
- $BE_{eleheat,y}$ Baseline CO₂ emissions from electricity and/or heat used in the baseline, in tCO₂e/year.

(i) Methane emissions

$$BE_{CH_4,y} = GWP_{CH_4} \cdot D_{CH_4} \cdot \sum_{j,LT} MCF_j \cdot B_{0,LT} \cdot N_{LT} \cdot VS_{LT,y} \cdot MS\%_{0,BI,j}$$

Equation (2)⁷

where,

- $BE_{CH_4,y}$ the annual baseline methane emissions in t CO₂e/y
- GWP_{CH_4} Global Warming Potential (GWP) of CH₄. (Value used = 21)
- D_{CH_4} CH₄ density (0.00067 t/m³ at room temperature (20 °C) and 1 atm pressure).
- MCF_j Annual methane conversion factor (MCF) for the baseline AWMS_j from IPCC 2006 table 10.17, chapter 10, volume 4.
- $B_{0,LT}$ Maximum methane producing potential of the volatile solid generated, in m³CH₄/kg_{dm}, by animal type LT. (=0.70*COD/VS)
- N_{LT} Number of animals of type LT for the year y, expressed in numbers.
- $VS_{LT,y}$ Annual volatile solid for livestock LT entering all AWMS [on a dry matter weight basis (kg-dm/animal/year)], as estimated below.
- $MS\%_{0,BI,j}$ Fraction of manure handled in system j

Estimation of various variables and parameters for above equations:

The Ampuero dairy uses a large state-of-the-art carousel milk parlor and has a constant numbers of animals during the year. Animal populations for the project activity sites are described in the Section E.1.2.1, Table E1. Dairy cows are large North American cows producing substantial quantities of milk. Milk production is directly related to excreted manure volatile solids (VS).

⁶ Adapted from Equation 1, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

⁷ Adapted from Equation 2, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

Scaling default IPCC values $VS_{default}$ to adjust for a site-specific average animal weight as shown in equation below:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) \cdot VS_{default} \cdot nd_y$$

Equation (3)⁸

$VS_{LT,y}$ Adjusted volatile solid excretion per year on a dry-matter basis for a defined livestock population at the project site in kg-dm/animal/yr.

W_{site} Average animal weight of a defined population at the project site in kg.

$W_{default}$ Default average animal weight of a defined population in kg from where the data on $VS_{default}$ is sourced (IPCC 2006).

$VS_{default}$ Default value (IPCC 2006 or US-EPA, which ever is lower) for the volatile solid excretion per day on a dry-matter basis for a defined livestock population in kg-dm/animal/day.

nd_y Number of days in year y where the treatment plant was operational.

(ii) N_2O emissions from manure management

$$BE_{N_2O,y} = GVP_{N_2O} \cdot CF_{N_2O-N,N} \cdot \frac{1}{1000} \cdot (E_{N_2O,D,y} \cdot E_{N_2O,ID,y})$$

Equation (4)⁹

where,

$BE_{N_2O,y}$ Annual baseline N_2O emissions in t CO₂e / yr

GVP_{N_2O} Global Warming Potential (GWP) for N_2O .

$CF_{N_2O-N,N}$ Conversion factor N_2O-N to N_2O (44/28).

$E_{N_2O,D,y}$ Direct N_2O emission in kg N_2O-N /year.

⁸ Adapted from Equation 4, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

⁹ Adapted from Equation 5, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

$E_{N_2O,ID,Y}$ Indirect N₂O emission in kg N₂O-N/year.

$$E_{N_2O,D,Y} = \sum_{j,LT} (EF_{N_2O,D,J} \cdot NEX_{LT,y} \cdot N_{LT} \cdot NMS\%_{BI,j})$$

Equation (5)¹⁰

$E_{N_2O,D,Y}$ Are the direct nitrous oxide emissions in kg of N₂O per year.

$EF_{N_2O,D,J}$ direct N₂O emission factor for the treatment system j of the manure management system in kg N₂O-N/kg N (estimated with site-specific, regional data if such data is available, otherwise use default EF₃ from table 10.21, chapter 10, volume 4, the IPCC 2006 Guidelines for National Greenhouse Gas Inventories).

$NEX_{LT,y}$ annual average nitrogen excretion per head of a defined livestock population in kg N/animal/year.

$MS\%_{BI,j}$ Fraction of manure handled in system j, in %

N_{LT} Number of animals of type LT for the year y, expressed in numbers.

$$E_{N_2O,ID,Y} = \sum_{j,LT} (EF_{N_2O,ID,j} \cdot F_{gasm} \cdot NEX_{IT,y} \cdot N_{IT} \cdot MS\%_{BI,j})$$

Equation (6)¹¹

where:

$E_{N_2O,ID,Y}$ Are the direct nitrous oxide emissions in kg of N₂O per year.

$EF_{N_2O,ID,J}$ Is the indirect N₂O emission factor for N₂O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N₂O-N/kg NH₃-N and NO_x-N emitted, Default values for EF₄ from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines for National Greenhouse Gas Inventories.

$NEX_{LT,y}$ Is the annual average nitrogen excretion per head of a defined livestock population in kg N/animal/year.

$NMS\%_{BI,j}$ Fraction of manure handled in system j, in %

¹⁰ Adapted from Equation 6, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

¹¹ Adapted from Equation 7, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC



F_{gasm} Percent of managed manure nitrogen for livestock category that volatilises as NH₃ NOx in the manure management system.

(iii) CO₂ emission from electricity and heat within the project boundary

$$BE_{elec/heat,y} = EG_{BL,Y} \cdot CEF_{Bl,elec,y} + EG_{d,Y} \cdot CEF_{grid} + HG_{BL,Y} \cdot CEF_{Bl,therm,y}$$

Equation (7)¹²

where,

$BE_{elec/heat,y}$ amount of electricity in the year y that would be consumed at the project site in the absence of the project activity (MWh) for operating AWMS.

$EG_{BL,Y}$ carbon emissions factor for electricity consumed at the project site in the absence of the project activity (tCO₂/MWh)

$CEF_{Bl,elec,y}$ amount of electricity generated utilizing the biogas collected during project activity and exported to the grid during the year y (MWh). The default emission factor for a diesel generator with a capacity of more than 200 kW small-scale project activities (0.8 tCO₂/MWh, Table I.D.1 in the simplified baseline and monitoring methodology AMS.I.D).

$EG_{d,Y}$ carbon emissions factor for the grid in the project scenario (tCO₂/MWh)

CEF_{grid} carbon emissions factor for the grid in the project scenario (tCO₂/MWh).
quantity of thermal energy that would be consumed in year y at the project site in the absence of the project activity (MJ) using fossil fuel for operating AWMS.

$CEF_{Bl,therm,y}$ CO₂ emissions intensity for thermal energy generation (tCO₂ e/MJ)

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

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

10 years +

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

¹² Adapted from Equation 8, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC



October 2007

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

25 y-0 m

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

10 years

C.2.1. Renewable crediting period:

NA

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

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:

10 years

C.2.2.1. Starting date:

Starting date of the first crediting period (01/10/2007):

C.2.2.2. Length:

10y-0m

SECTION D. Application of a monitoring methodology and plan:**D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:**

The methodology applied to this project activity is **AMS-III.D: Methane recovery in agricultural and agro industrial activities, Version 10.**

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

This project category comprises methane recovery from manure and wastes from agricultural or agro-industrial activities by changing the manure management practice in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.

This category is applicable for the proposed project activities because the resulting annual emission reductions are lower than 25,000 ton CO₂e and they directly emit less than 15 kilo tones of carbon dioxide equivalent annually.

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 to ensure that all biogas produced by the digester is destroyed.

D.3 Data to be monitored:

AMS-III.D – (10)

The number of animals, their weight and milk production will be monitored on a daily basis. These values will be used to confirm the excreted manure VS and subsequent gas production.

The amount of methane used as fuel or combusted shall be monitored, using flow meters and analyzing the methane content of the combusted gases either online, or with samples taken at least quarterly, and more frequently if the results show significant deviations from previous values. The power generated (kWh) shall be continuously monitored and recorded.

The amount of methane flared shall be monitored, using flow meters and analyzing the methane content of the combusted gases either online, or with samples taken at least quarterly, and more frequently if the results show significant deviations from previous values. Regular maintenance should ensure optimal operation of flares. The flare efficiency, defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process, shall 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 |
|-----------|------------------|---------------------------------|----------------|---|---------------------|------------------------------------|--------------------------------|---|---|
| DO 1 | Number | Number | Number | Each | Daily | 100% | Data management system | Five Years | All tagged animals on site will be monitored & number recorded |
| DO2 | Weight | Animal Weight | Kg | Kg | Daily | 100% | Data management system | Five years | Weight of all tagged animals |
| DO 3 | Weight | Milk Production | Kg | Kg | Daily | 100% | Data management system | Five years | Milk production per tagged animal |
| BG 1 | Volume | Biogas produced | m ³ | m | Daily | 100% | Electronic | Duration of project activity +2y | This parameter measures cumulative biogas produced. A biogas meter will continuously measure amount of biogas produced. |
| GB 2 | Percent | Methane content | % | m/c | Daily | 100% | Electronic | Duration of project activity +2y | This parameter determines the actual methane content of the biogas. |
| BG 3 | Power | Daily Energy | kWh | kWh | Daily | 100% | Electrical | Duration of project activity +2y | Power produced by engine generators |
| BG 4 | Fraction of time | Combustion equipment efficiency | % | m/c | Quarterly | 100% | Electronic | Duration of project activity +2y | This parameter is used to determine the fraction of time in which gas is combusted. |
| BG 5 | Percent | Flare efficiency | % | m/c | Once | n/a | Electronic | Duration of project activity +2y | Efficiency is factory tested prior to installation and amount of methane consumed is calculated based on the efficiency rating. |

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

A Quality control plan will be prepared with the operation and maintenance plan. The plan will address the integration of the Ampuero Dairy data management system and the anaerobic digester / engine generator system Supervisory Control System. The data acquired by the integrated dairy cow / anaerobic digester / engine generator SCADA system will be used to calculate the performance of the system and the GHG credits earned on a monthly basis. Periodic manual sampling will be performed to confirm the values acquired through the data management system.

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 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 nonadjustable.

Low or varying line pressures do not affect accuracy. Accuracy of the flow meters 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.

Methane concentration is determined with CO₂ content measurement and is obtained with a gas analyzer as described in the Monitoring Plan. An accuracy of $\pm 1\%$ is sufficient to determine uncertainties. The measuring equipment is calibrated in accordance with the manufacturer specifications.

Further, TESA, the operating participant, 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. EQI 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 Enviro-Quest International 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:**

This project applies Type III.D Version 10, from appendix B of the simplified modalities and procedures for small-scale CDM project activities. This project category comprises methane recovery from manure and wastes from agricultural activities by changing the management practice of biogenic waste in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.

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

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 Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

Livestock Population

Since the farm is employing a milking carousel, the constant animal population is maintained every day. Slight variations occur when more or less animals are confined to the hospital. Livestock population for the project activity is described in the tables E1

E.1. Formulae used:**E.1.1 Selected formulae as provided in appendix B:**

This project applies Type III.D Version 10, from appendix B of the simplified modalities and procedures for small-scale CDM project activities. This project category comprises methane recovery from manure and wastes from agricultural activities by changing the management practice of biogenic waste in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.

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

**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 Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

Livestock Population

Since the farm is employing a milking carousel, the constant animal population is maintained every day. Livestock population for the project activity is described in the tables below.

Table E1: Animal Population

| Month/Year | Milking Cow Population |
|----------------|------------------------|
| September-2005 | 2100 |
| October--2005 | 2100 |
| November-2005 | 2100 |
| December-2005 | 2100 |
| January-2006 | 2100 |
| February-2006 | 2100 |
| March-2006 | 2100 |
| April-2006 | 2100 |
| May-2006 | 2100 |
| June-2006 | 2100 |
| July-2006 | 2100 |
| August-2006 | 2100 |

In view of the fact that the procedure for the type III.D. version 10, of the small-scale CDM project activities, does not require leakage calculation and that aerobic emissions from AWMS are negligible the project emissions are estimated as follows:

$$PE_y = PE_{AD,y} + PE_{N2O,y} + PE_{elec/heat}$$

Equation (8)¹³

were,

$PE_{AD,y}$ Leakage from AWMS systems that capture's methane in t CO2e/yr

$PE_{N2O,y}$ Nitrous oxide emission from project manure waste management system in t CO2e/yr

$PE_{elec/heat}$ Project emissions from use of heat and/or electricity in the project case in t CO2e/yr

¹³ Modified from Equation 9, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

$$PE_{AD,y} = GWP_{CH_4} \cdot D_{CH_4} \cdot LF_{AD} \cdot F_{AD} \cdot \sum_{LT} (B_{0,LT} \cdot N_{LT} \cdot VS_{LT,y})$$

Equation (9)¹⁴

were,

GWP_{CH_4} Global Warming Potential (GWP) of CH₄.

D_{CH_4} CH₄ density (0.00067 t/m³ at room temperature (20 °C) and 1 atm pressure)

LF_{AD} Methane leakage from Anaerobic digesters, default of 0.15 multiplied by methane content of biogas.

F_{AD} Fraction of volatile solid directed to anaerobic digester.

LT Index for livestock type

$B_{0,LT}$ CH₄ production capacity from manure for livestock type LT, in m³ CH₄/kg-VS, to be chosen based on procedure provided for in the baseline methodology section.

N_{LT} Population of livestock type LT for the year y, expressed in num

$VS_{LT,y}$ Annual volatile solid excretion of livestock type LT on a dry-matter basis in kg/animal/year

(iii) N₂O emissions from manure management

$$PE_{N_2O,y} = GWP_{N_2O} \cdot CF_{N_2O-N,N} \cdot \frac{1}{1000} \cdot (EF_{N_2O,D,y} + E_{N_2O,ID,y})$$

Equation (10)¹⁵

where,

$PE_{N_2O,y}$ Annual project N₂O emissions in t CO₂e/year

GWP_{N_2O} Global Warming Potential (GWP) for N₂O.

¹⁴ Adapted from Equation 10.a, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

¹⁵ Adapted from Equation 13, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC



$CF_{N_2O-N,N}$ Conversion factor N₂O-N to N₂O (44/28).

$EF_{N_2O,D,y}$ Direct N₂O emission in kg N₂O-N/year.

$EF_{N_2O,ID,y}$ Indirect N₂O emission in kg N₂O-N/year.

$$EF_{N_2O,D,y} = \sum_{j,LT} (EF_{N_2O,D,j} \cdot NEX_{LT,y} \cdot N_{LT} \cdot MS\%_j)$$

Equation (11)¹⁶

where,

$EF_{N_2O,D,y}$ Are the direct nitrous oxide emissions in kg of N₂O per year.

$EF_{N_2O,D,j}$ Direct N₂O emission factor for the treatment system j of the manure management system in kg N₂O-N/kg N (default EF₃ in volume 4, chapter 10, table 10.21 in IPCC 2006 Guidelines)

$NEX_{LT,y}$ Annual average nitrogen excretion per head of a defined livestock population in kg N/animal/year estimated as described in Annex 2.

$MS\%_j$ Fraction of manure handled in system j, in %.

N_{LT} Population of livestock type LT for the year y, expressed in numbers.

$$EF_{N_2O,ID,y} = \sum_{j,LT} (EF_{N_2O,ID,j} \cdot F_{gasm} \cdot NEX_{LT,y} \cdot N_{LT} \cdot MS\%_j)$$

Equation (12)¹⁷

where:

$EF_{N_2O,ID,y}$ Are the indirect nitrous oxide emissions in kg of N₂O per year.

$EF_{N_2O,ID,j}$ Indirect N₂O emission factor for N₂O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N₂O-N/kg NH₃-N and NO_x-N emitted. Default values for EF₄ from table 11.3, chapter 11, volume 4 of IPCC 2006 guidelines.

F_{gasm} Percent managed manure nitrogen for livestock category that volatilises as NH₃ and NO_x in the manure management system

¹⁶ Adapted from Equation 14, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC

¹⁷ Adapted from Equation 15, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC



$MS\%_j$ Fraction of manure handled in system j

$NEX_{LT,y}$ Annual average nitrogen excretion per head of a defined livestock population in kg N/animal/year estimated as described in Annex 2.

N_{LT} Population of livestock type LT for the year y, expressed in numbers.

$MS\%_j$ Fraction of manure handled in system j

(vi) Project emissions from heat use and electricity use ($PE_{elec/heat}$):

$$PE_{elec/heat} = EL_{Pr,y} \cdot CEF_d + HG_{Pr,y} \cdot CEF_{Pr,therm,y}$$

Equation (13)¹⁸

where,

$EL_{Pr,y}$ Amount of electricity in the year y that is consumed at the project site in the project case (MWh).

CEF_d Carbon emissions factor for electricity consumed at the project site during the project activity (tCO₂/MWh), estimated as described below. Factor is zero if biogas is used to produce electricity.

$HG_{Pr,y}$ Quantity of thermal energy consumed in year y at the project site in the project case (MJ).

$CEF_{Pr,therm,y}$ CO₂ emissions intensity for thermal energy generation (tCO₂e/MJ). Factor is zero if biogas is used for generating thermal energy.

¹⁸ Adapted from Equation 17, Approved consolidated baseline methodology ACM0010/version 01, 29 September 2006/ UNFCCC



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 *III.D. Methane recovery in agricultural and agro industrial activities*, no leakage calculations are required.

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

Table E2, Small-Scale Project Activity Emissions:

| Population/year | CH ₄ annual (kg) | PE (CO ₂ eq) |
|-----------------|-----------------------------|--------------------------|
| 2,100 | 48,921 | 1,027 |

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, Small-Scale Baseline Activity Emissions:

| Population/year | CH ₄ annual (kg) | BE (CO ₂ eq) |
|-----------------|-----------------------------|-------------------------|
| 2,100 | 497,133 | 10,418 |

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 Reduction:

| Emission | (CO ₂ eq) |
|---|----------------------|
| Total Baseline Emissions (BE) | 10,418 |
| Total Project Emissions (PE) | 1,027 |
| Total Emission Reductions (ER net=B-PE) | 9,391 |



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

| BASELINE | | | |
|-----------------------|---------|--------------------------------------|--|
| Variable | Values | Units | Description |
| METHANE | | | |
| GWP_{CH_4} | 21 | - | Global Warming potential of CH ₄ |
| D_{CH_4} | 0.00067 | t/m ³ | Density of CH ₄ |
| T | 28 | °C | Mean Annual Temperature at Site |
| AWM | lagoon | | Animal Waste Management System (IPCC 2006, Table 10.17) |
| MCF_j | 0.80 | Fraction | Annual Methane Conversion Factor f (Temp & AWMS), L=80%, D=10% from IPCC 2006, Table 10.17, Chapter 10, Volume 4. |
| nd_y | 365 | days | |
| N_{LT1} | 2100 | Number Livestock Type 1 | Milk Cows Average 660 Kg producing 8,200 KgMilk/year |
| N_{LT2} | 0 | Number Livestock Type 2 | Dry Cows Average 460 Kg |
| $VS_{LT1,y}$ | 2153.74 | kg VS/year/LT ₁ | Adjusted Volatile Solids Excreted per year per Livestock Type 1, |
| $W_{siteLT1}$ | 660 | kg | Average animal weight of a defined population LT1 at the project site in kg. |
| $VS_{LT2,y}$ | 1035.89 | kg VS/d/LT ₂ | Adjusted Volatile Solids Excreted per day per Livestock Type 2, |
| $W_{siteLT2}$ | 450 | kg | Average animal weight of a defined population LT2 at the project site in kg. |
| $W_{default}$ | 604 | kg | Default average animal weight of a defined population |
| $VS_{defaultT1}$ | 5.40 | kg-dm/animal/day | Default value (IPCC 2006, Table 10A4) |
| $VS_{defaultT2}$ | 2.40 | kg-dm/animal/day | Default value (IPCC 2006, Table 10A5) |
| $VS_{LT,y}$ | 2153.74 | kg VS/y/avg animal | Volatile Solids Excreted per Average Animal Per Year |
| $B_{0,LT1}$ | 0.24 | m ³ CH ₄ /kgVS | Maximum methane produced per Kg of VS Excreted LT1 (IPCC 2006, Table 10A-4) |
| $B_{0,LT2}$ | 0.19 | m ³ CH ₄ /kgVS | Maximum methane produced per Kg of VS Excreted LT2 (IPCC 2006, Table 10A-5) |
| $MS\%_{BL,i}$ | 0.70 | Fraction | Fraction Flushed from feed Lane (0.5) plus fraction from parlor & holding area (0.15) plus fraction from hospital 0.05 |
| N₂O | | | |
| GWP_{N_2O} | 320 | - | Global Warming Potential Nitrous Oxide |
| $CF_{N_2O-N,N}$ | 1.57 | - | Conversion Factor N ₂ O-N to N ₂ O (44/28). |
| $E_{N_2O,D,y}$ | 0 | kg N ₂ O-N/year | Direct N ₂ O emissions |
| $E_{N_2O,ID,y}$ | 681.04 | kg N ₂ O-N/year | Indirect N ₂ O emissions |
| $EF_{N_2O,D,j}$ | 0.00 | - | EF3 from IPCC 2006 Guidelines Table 10.21 (Anaerobic Lagoon) |



| | | | |
|-------------------------------|---------|--|--|
| $NEX_{Kg LT1,d}$ | 0.48 | kg N/kgLT1/d | Kg of N excreted per 1000 Kg of lactating cow weight per day as described in Annex 2 of ACM0010 |
| $NEX_{IPCCdefault}$ | 0.44 | kg N/animal/year. | Default value for the nitrogen excretion per head; IPCC 2006, Table 10.19, p.10.59 |
| $NEX_{Kg LT2,d}$ | 0.33 | kg N/kgLT1/d | Kg of N excreted per 1000 Kg of lactating cow weight per day as described in Annex 2 of ACM0010 |
| $NEX_{LT1,y}$ | 0.32 | kg N/LT1/y | Kg of N excreted per 660 Kg milk cow per year |
| $NEX_{LT2,y}$ | 0.15 | kg N/LT2/y | Kg of N excreted per 460 Kg dry cow per year |
| $EF_{N2O,ID,j}$ | 0.01 | kg N ₂ O-N/Kg NH ₃ -N and NO _x -N/ year | Indirect N ₂ O emission factor EF ₄ , Table 11.3, Chap 11, Volume 4, IPCC 2006 |
| F_{qasm} | 0.40 | Fraction | Percentage of managed manure nitrogen for livestock category that volatilizes as NH ₃ |
| ELECTRICITY & HEAT | | | |
| $EG_{BL,Y}$ | 1930.70 | MWh | Electricity consumed annually in absence of project (232kWh) |
| $CEF_{BL,elec y}$ | 0.80 | tCO ₂ /MWh | Carbon emission factor from Table I.D.1 >200 kW = 0.8 |
| $EG_{d,y}$ | 0 | MWh | Electricity generated from biogas collected during project and exported to the grid |
| CEF_{grid} | | tCO ₂ /MWh | Carbon emission factor for the grid in the project scenario |
| $HG_{BL,y}$ | 0 | MJ | Thermal energy consumed in the absence of the project activity per year |
| $CEF_{BL,therm}$ | 0 | tCO ₂ e/MJ | CO ₂ emission intensity for thermal energy generation |



| PROJECT | | | |
|-----------------------|---------|----------------------------|---|
| Variable | Values | Units | Description |
| METHANE | | | |
| GWP_{CH_4} | 21 | - | Global Warming potential of CH_4 |
| D_{CH_4} | 0.00067 | t/m^3 | Density of CH_4 |
| Default LF_{AD} | 0.15 | - | Methane leakage from anaerobic digestion |
| Gas % Meth | 0.60 | - | Methane gas concentration of biogas |
| LF_{AD} | 0.09 | - | Methane leakage from anaerobic digestion, default of 0.15 multiplied by methane content of biogas |
| nd_y | 365 | days | |
| N_{LT1} | 2100 | Number Livestock Type 1 | Milk Cows Average 660 Kg producing 8,200 KgMilk/year |
| N_{LT2} | 0 | Number Livestock Type 2 | Dry Cows Average 460 Kg |
| $VS_{LT1,y}$ | 2153.74 | kg VS/year/LT ₁ | Adjusted Volatile Solids Excreted per year per Livestock Type 1 |
| $W_{siteLT1}$ | 660 | kg | Average animal weight of a defined population LT1 at the project site in kg. |
| $VS_{LT2,y}$ | 1035.89 | kg VS/d/LT ₂ | Adjusted Volatile Solids Excreted per day per Livestock Type 2 |
| $W_{siteLT2}$ | 450 | kg | Average animal weight of a defined population LT2 at the project site in kg. |
| $W_{default}$ | 604 | kg | Default average animal weight of a defined population |
| $VS_{defaultT1}$ | 5.40 | kg-dm/animal/day | Default value (IPCC 2006, Table 10A4) |
| $VS_{defaultT2}$ | 2.40 | kg-dm/animal/day | Default value (IPCC 2006, Table 10A5) |
| $VS_{LT,y}$ | 2153.74 | kg VS/y/avg animal | Volatile Solids Excreted per Average Animal Per Year |
| $B_{0,LT1}$ | 0.24 | $m^3CH_4/kgVS$ | Maximum methane produced per kg of VS Excreted LT1 (IPCC 2006, Table 10A-4) |
| $B_{0,LT2}$ | 0.19 | $m^3CH_4/kgVS$ | Maximum methane produced per Kg of VS Excreted LT2 (IPCC 2006, Table 10A-5) |
| $F_{AD=MS,i}$ | 0.70 | Fraction | Fraction Directed to Anaerobic Digestion = Fraction Flushed from feed Lane (0.5) plus fraction from parlor & holding area (0.15) plus fraction from hospital 0.05 |
| N₂O | | | |
| GWP_{N_2O} | 320 | - | Global Warming Potential Nitrous Oxide |
| $CF_{N_2O-N,N}$ | 1.57 | - | Conversion Factor N_2O-N to N_2O (44/28). |
| $E_{N_2O,D,y}$ | 0 | kg N_2O-N /year | Direct N_2O emissions |
| $E_{N_2O,ID,y}$ | 85 | kg N_2O-N /year | Indirect N_2O emissions |
| $EF_{N_2O,D,j}$ | 0 | - | EF3 from IPCC 2006 Guidelines Table 10.21 (Anaerobic Digester) |
| $NEX_{Kg,LT1,d}$ | 0.48 | kg N/kgLT1/d | Kg of N excreted per 1000 Kg of lactating cow weight per day as described in Annex 2 of ACM0010 |
| $NEX_{IPCCdefault}$ | 0.44 | kg N/animal/year | Default value for the nitrogen excretion per head; IPCC 2006, Table 10.19, p.10.59 |



| | | | |
|-------------------------------|---------|--|--|
| $NEX_{Kg\ LT2,d}$ | 0.33 | kg N/kgLT1/d | Kg of N excreted per 1000 Kg of lactating cow weight per day as described in Annex 2 of ACM0010 |
| $NEX_{LT1,y}$ | 116 | kg N/LT1/y | Kg of N excreted per 660 Kg milk cow per year |
| $NEX_{LT2,y}$ | 55 | kg N/LT2/y | Kg of N excreted per 460 Kg dry cow per year |
| $EF_{N2O,ID,j}$ | 0.01 | kg N ₂ O-N/Kg NH ₃ -N and NO _x -N/ year | Indirect N ₂ O emission factor EF ₄ , Table 11.3, Chap 11, Volume 4, IPCC 2006 |
| F_{qasm} | 0.05 | Fraction | Percentage of managed manure nitrogen for livestock category that volatilizes as NH ₃ in management system. Low value |
| ELECTRICITY & HEAT | | | |
| $EG_{BL,Y}$ | 1930.70 | MWh | Electricity consumed annually in absence of project (232kWh) |
| $CEF_{BL,elec\ y}$ | 0.80 | tCO ₂ /MWh | Carbon emission factor from Table I.D.1 >200 kW = 0.8 |
| $EG_{d,y}$ | 0.00 | MWh | Electricity generated from biogas collected during project and exported to the grid |
| CEF_{grid} | | tCO ₂ /MWh | Carbon emission factor for the grid in the project scenario |
| $HG_{BL,y}$ | 0.00 | MJ | Thermal energy consumed in the absence of the project activity per year |
| $CEF_{BL,therm}$ | 0.00 | tCO ₂ e/MJ | CO ₂ emission intensity for thermal energy generation |

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. There are no negative environmental impacts resulting from the proposed project activity. Actually, the proposed anaerobic digestion waste management system, with methane recovery, energy production and reduction of effluent pollutants will have a positive effect on local environment. Beyond the most important benefit, mitigating GHG emissions (the primary focus of the proposed project), the proposed activity will result in positive environmental co-benefits. They include:

- Odor control
- Reducing atmospheric emissions of Volatile Organics Compounds (VOCs)
- Lowering the population of flies and associated enhancement to on-farm bio-security thus reducing the possible spread of disease
- Protection of ground water
- Pathogen reduction



- Reduction in total oxygen demand of the treated manure (total oxygen demand is a measure of potential impact on aquatic systems)
- Reduction of effluent suspended solids and the subsequent soil plugging, saturation, salt accumulation, and nitrification/denitrification at the soil surface.

These benefits will not only have positive effects on the environment, but will set an example for future projects that will have a further positive consequence on the reduction of GHG and ground water contamination problems.

SECTION G. Stakeholders' comments:

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

In April 1 of 2006 a first meeting between Ampuero and TESA was conducted in the city of Torreon, Coah., Mexico, at the project site. The project participants were invited by telephone. **Alberto R. Torres of TESA** visited the project site and conducted the meeting where he made a general presentation about the Kyoto Protocol, the UNFCCC CDM process, project technology, audit systems, and environmental and economic benefits of the project.

In April 20 a second meeting with the stakeholders was conducted where more detail information was presented about the project. **Dennis A. Burke** of EQI, gave a presentation, 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.

On September 28, 2006 EQI / TESA submitted a PID document to the Mexican Designated National Authority and received a no objection letter from the DNA.

G.2. Summary of the comments received:

After the presentations, attendees were afforded the opportunity to ask questions regarding the proposed project activities.

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****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

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Annex 2**INFORMATION REGARDING PUBLIC FUNDING**

There is no official development assistance being provided for this project
