المجلس العالمي للبصمة الكربونية
GLOBAL CARBON COUNCIL

Methodology for Energy Generation from Animal Manure and Waste Management Projects

GCCM003

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CONTENTS

1. Baseline and Monitoring Methodologies of GCC

1. Global Carbon Council (GCC) is MENA region's first and only voluntary carbon offsetting program that aims to contribute to a vision of sustainable and low carbon economy of the region and help to catalyse climate actions on the ground. Refer www.globalcarboncouncil.com for details.

2. GCC methodologies facilitate the project owners of eligible greenhouse gas (GHG) reduction projects to calculate emission reduction of their projects, monitor the emission reductions, and develop the project submission in accordance with the methodologies.

3. This methodology for renewable energy generation projects (here onwards referred as "the project activity") applies to the projects that displace the electricity and heat energy which wouldbe provided to the grid by more emission-intensive mix of power sources, than that established under project activity.

2. Source/s of this Baseline and Monitoring Methodology

4. For the development of GCC methodologies, the requirements of the 'GCC Program Manual' (paragraphs 43-46) and 'Standard for Development of Methodologies' are applied. The determination of baseline scenario and baseline emissions are consistent with UNFCCC's Clean Development Mechanism (CDM) guideline "Guideline for determining baseline for measure/s" (Baseline Guideline) referred in the above standard.

5. This methodology is based on following baseline and monitoring methodologies of CDM.

- ACM0022: Alternative waste treatment processes
- ACM0010: GHG emission reductions from manure management systems
- AM0080: Mitigation of greenhouse gases emissions with treatment of wastewater in aerobicwastewater treatment plants

6. This methodology also refers to the latest approved versions of the following tools andguidelines of CDM:

(a) "Tool to calculate baseline, project and/or leakage emissions from electricityconsumption";
(b) "Tool to calculate the emission factor for an electricity system";
(c) "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion";
(d) "Assessment of the validity of the original/current baseline and update of the baselineat the renewal of the crediting period";
(e) "Combined tool to identify the baseline scenario and demonstrate additionality";
(f) "Project and leakage emissions from anaerobic digesters";
(g) "Tool to determine the baseline efficiency of thermal or electric energy generationsystems";
(h) "Tool to determine the mass flow of a greenhouse gas in a gaseous stream".

(i) “Tool to determine project emissions from flaring gases containing methane”;
(j) “Emissions from solid waste disposal sites”;

3. Description of key terms

7. Following description of key terms apply to the projects using this methodology:

a) **Anaerobic digester** - Equipment that is used to generate biogas from liquid or solid waste through anaerobic digestion. The digester is covered or encapsulated to enable biogas capture for heat and/or electricity generation or feeding biogas into a natural gas network.

b) **Anaerobic digestion** - Degradation and stabilization of organic materials by the action of anaerobic bacteria in the absence of supply of air/oxygen that result in production of methane and carbon dioxide. Typical organic materials that undergo anaerobic digestion are municipal solid waste (MSW), animal manure, wastewater, organic industrial effluent and biosolids from aerobic wastewater treatment plants.

c) **Anaerobic lagoon** - A treatment system consisting of a deep earthen basin with sufficient volume to permit sedimentation of settable solids, to digest retained sludge, and to anaerobically reduce some of the soluble organic substrate. Anaerobic lagoons are not aerated, heated, or mixed and anaerobic conditions prevail except possibly for a shallow surface layer in which excess undigested grease and scum are concentrated.

d) **Biogas** - Gas generated from an anaerobic digester / anaerobic lagoon. Typically, the composition of the gas is 50 to 70% CH4 and 30 to 50 % CO2, with traces of H2S and NH3 (1 to 5 %)

e) **Organic waste** - solid waste that contains degradable organic matter. This may include, manure, agro-industrial and food industry waste, sludge from wastewater treatment plants, and MSW.

f) **Municipal solid waste (MSW)** - a heterogeneous mix of different solid waste types, usually collected by municipalities or other local authorities. MSW includes household waste, garden/park waste, and commercial/institutional waste.

g) **Solid waste disposal site (SWDS)** - designated areas intended as the final storage place for solid waste. Stockpiles are considered an SWDS if: (a) their volume to surface area ratio is 1.5 or larger; and if (b) a visual inspection by the GCC verifiers confirms that the material is subjected to anaerobic conditions (i.e., it has low porosity and is moist).

h) **Domestic or industrial wastewater sludge** - Sludge/sediment generated from: industrial aerobic / anerobic wastewater treatment systems; and, household wastewater treatment system.

4. Applicable Project Activities and their Eligibility Conditions

8. The project activities eligible under this methodology aim to build and operate a new power plant that generates renewable energy in form of electricity and/or heat, by implementing combined heat and/or power systems that use input energy from existing sources of animal manure, agro-industrial wastes, domestic waste, food industry wastes, municipal solid wastes (MSW), wastes and wastewater treatment sludge under anaerobic conditions. The project may use one type or combination of waste types mentioned above.

The following applies for energy generation from project activities:

a) The biogas will be generated from the waste types mentioned above using digestor, anaerobic lagoon or other waste treatment technologies that do not allow for aerobic decomposition of waste.

b) The project activities involve power, heat or combined power and heat generation using the energy of biogas generated.

c) Generated electricity may be used for internal consumption and/or supplied to national or a regional grid. Project activities that supply electricity also for internal consumption or domestic purposes instead of (or in addition to) supply to grid, shall demonstrate that grid connection was available on the site before the installation of project activity.

d) Generated heat is used for internal consumption to replace heat generated by emission intensive fuels. The project activities may sell/deliver excess energy to nearby facilities after meeting the internal demand of heat energy, if any.

e) The project activities shall not involve co-firing of fossil fuel of any kind, except the use of diesel generators for breakdown power supply.

f) The project activities may consume electricity (from grid or on-site generation) for site offices and operation of power plant units as internal usage.

If the animal manure waste is used in the Project Activity, the following applies:

g) Manure management of livestock farms shall either replace an existing animal waste management system with new one or introduce a new animal waste management system or a combination of multiple animal waste management systems that result in less GHG emissions.

h) In case of anaerobic lagoons treatments systems, the depth of the lagoons used for manure management under the baseline scenario shall be at least 1 m;

i) The annual average ambient temperature at the site where the anaerobic manure treatment facility exists, shall be higher than 5°C;

j) The minimum retention time of manure waste in the anaerobic treatment system shall be one month;

k) Farms shall not discharge manure into natural water resources (e.g. rivers or estuaries), in absence of project activity;

l) Farms shall manage livestock populations, comprising of cattle, buffalo, swine, sheep, goats, and/or poultry, under confined conditions.

If the agricultural and food industry wastes and Municipal Solid Waste (MSW) is used in the project activity, the following applies:

m) These is no law/regulation in the country requiring mandatory flaring of landfill gas where agricultural and food industry wastes and Municipal Solid Waste (MSW) wasor would have been disposed in absence of the project activity.

n) The waste was (or would have been) disposed in a solid waste disposal site or an anaerobic lagoon that led (or would lead) to methane emissions as landfill gas/ biogas without being captured or flared.

If the sludge from industrial wastewater treatment system is used in the project activity, thefollowing applies:

o) Sludge is produced in the baseline aerobic wastewater treatment plant which operates for treatment of domestic and/or industrial wastewater. Sludge is treated in a new anaerobic digester, with the biogas extracted from the anaerobic digesterbeing flared and/or used to generate electricity and/or heat.

5. Sectoral Scope applicable to GCC verifier

10. The sectoral scopes eligible under GCC have been defined in section 3.2 of ‘Standardfor Development of Methodologies’.

11. Only a third-party verifier approved under GCC for the:

- Sectoral scope 1: Energy Industries (renewable/non-renewable sources);
- Sectoral scope 13: Waste handling and disposal; and
- Sectoral scope 15: Agriculture can conduct Project Verification or Emission Reduction Verification of GCC project that applies this methodology. One, combination of two or three scopes could be selected by Project Owners depending on waste types which will be handled within the project activity.

6. Project Boundary

12. The spatial extent of the GCC project boundary encompasses the site of the AnaerobicSolid Waste Management Site(s), Anaerobic lagoon for wastewater, anaerobic waste

management systems (AWMS(s)), energy and/or heat generation equipment and the power/heat source of baseline. Figure 1 represents the various components of the projectactivity.

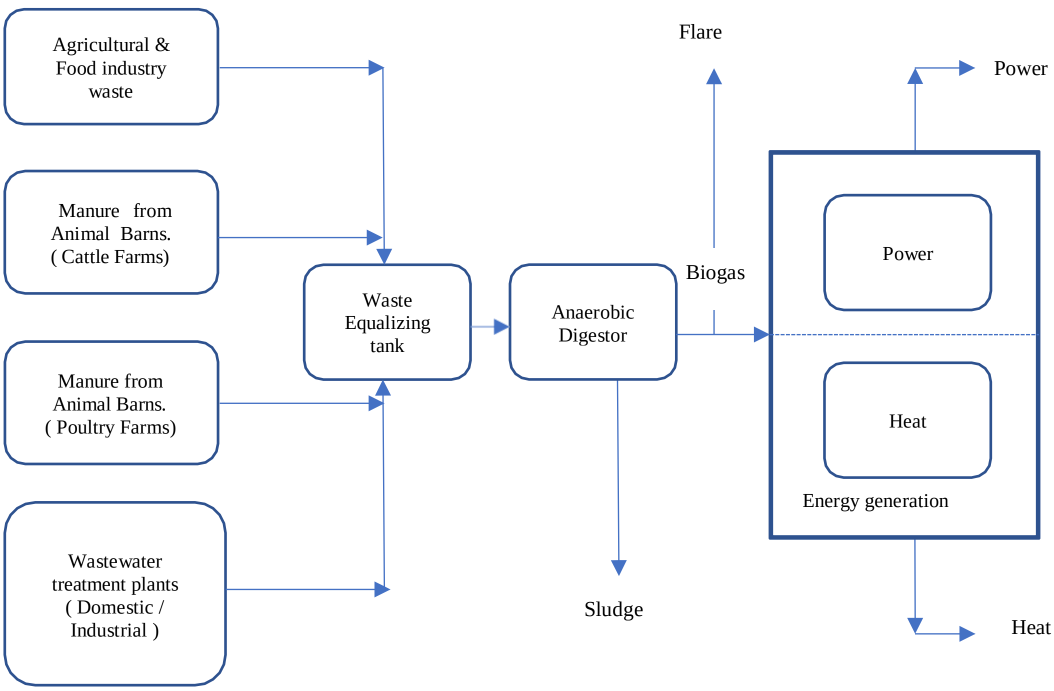

Figure 1: Project Boundary

The GHGs included in or excluded from the project boundary are listed in Table 1.

Source		GHG	Included	Justification/Explanation
Baseline Activity	Methane Emissions from the waste treatment and disposal from SWDS or Lagoon	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	Excluded for simplification. This is conservative.
		CO_2	No	CO_2 emissions from the decomposition of organic waste is not accounted
	Emissions from electricity consumption/ generation	CO_2	Yes	Electricity may be consumed from the grid or generated onsite in the baseline scenario, major source
		CH_4	No	Excluded for simplification. This is conservative

		N_2O	No	Excluded for simplification. This is conservative
	Emissions from thermal energy generation	CO_2	Yes	If thermal energy generation is included in the project activity, major source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from domestic and/or industrial sludge treatment	CH_4	Yes	The emission from sludge, if it is left to decay
		CO_2	No	No emissions
		N_2O	No	No emissions
Project Activity	Emissions from thermal energy use	CO_2	No	Excluded since: (i) the CO2 generated from biogas is of renewable nature; (ii) the project activity shall not consist of incineration, orgasification of waste; (iii) the co-firing is not allowed in thermal energy generation equipment.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from on-site electricity use	CO_2	Yes	May be an important emission source. If electricity consumed on site is generated from collected biogas, these emissions are not accounted for
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from the waste treatment processes	CH_4	Yes	The emission from anaerobic digesters
		CO_2	No	CO_2 emissions from the decomposition of organic waste is not accounted

		N_2O	No	Excluded for simplification since these emissions are also excluded in baseline emissions
	Emissions from the transportation of waste from point of origin to the treatment plant.	CH_4	No	Excluded for simplicity
		CO_2	Yes	Main emission source
		N_2O	No	Excluded for simplicity

7. Baseline scenario

13. The rationale as per Baseline Guideline for determination of baseline for measure(s) isdetermined based on the project activity, as follows.

Project activities involving the generation of electricity and export to the grid

14. In absence of project activity, the electricity would be generated by the operation of grid- connected power plants either existing or by the addition of new generation sources into the grid or by the fossil fuel source of electricity generation that is directly replaced by theproject activity.

15. Hypothetically it means that a power plant with emission factor equivalent to grid mix wouldhave supplied electricity in absence of new project plant or added capacity. A grid emissionfactor is a reasonable benchmark that provides the proxy performance of the baseline power plant.

Project activities involving the generation of heat and/or electricity for captive consumption

16. In absence of project activity, the electricity and/or heat would be supplied by the operationof most attractive course of action, considering the economic attractiveness and/or barriersfor implementation.

17. Considering the above guidance for different project activity types, the identification of the baseline scenario shall be done following the latest version of CDM tool "Combined tool toidentify the baseline scenario and demonstrate additionality".

Baseline scenario for waste from agro-industry, food industry, MSW andwastewater treatment sludge

a) Disposal of the wastes in a SWDS and/or lagoon without an Landfill gas (LFG)/biogascapture system
b) Disposal of the wastes in a SWDS and/or lagoon with a partial capture of theLFG/biogas and flaring of the captured LFG/biogas.

Baseline scenario for manure management

a) For the baseline alternatives on manure management the complete set of existing/possible manure management systems listed in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 4, Chapter 10, Table 10.17*). In Identifyingplausible scenarios, the exclusion criteria are determined by:
   - Legal constrains (the scenario must be in accordance with the regulatory frameworkof the country);
   - Historical practice of manure management (e.g. in the company and region);
   - Availability of waste treatment technology;

- Considerations of developments for manure management systems appropriate for thenational conditions, including technological innovations.

18. The following two steps will define the baseline uncovered anaerobic lagoon:

a) In the baseline case, the minimum retention time of manure waste in the anaerobictreatment system is greater than one month.

b) In case of anaerobic lagoons treatments systems, the depth of the lagoons usedfor manure management under the baseline scenario should be at least 1 m.

19. Baseline alternatives shall take into consideration with economic or financial attractiveness comparison to compare the economic attractiveness without revenuesfrom ACCs for all applying the investment analysis the IRR shall be used as an indicator. The latest version of “CDM Methodological Tool 27: Investment Analysis” shall be used to show economic attractiveness.

8. Additionality

8.1 Project specific additionality

20. Under project-specific additionality approach, the additionality of GCC projects shall be determined by Project Owner using the latest version of CDM Tool: “Combined tool to identify the baseline scenario and demonstrate additionality”.
21. The Project Owner/s can demonstrate that the project activity qualifies as “automatically additional” following the latest applicable CDM Methodological tool: Positive list of technologies. For project activities which fall under the micro-scale category of CDM, the GCC Project Standard requires Project Owners to demonstrate the additionality using “CDM Methodological tool: Demonstration of additionality of microscale project activities”.

9. Baseline emissions

22. Baseline emissions include CO_2 emissions from electricity generation, heat generation and CH_4 emissions from waste management via anaerobic waste management system (AWMS) system that are displaced due to the project activity.

23. Baseline emissions are determined according to equation (1) and comprise the following sources:
(a) Methane emissions from agro-industrial wastes, domestic waste, food industry wastesand MSW, in the absence of the project activity;

(b) Methane emissions from manure management in the absence of project activity;
(c) Methane emissions from the management of wastewater treatment sludge in the absence of project activity
(d) Energy generated by the grid in the absence of the project activity;
(e) Fossil fuel used for heat generation in the absence of the project activity.

24. Baseline emissions are:

$$BE_y = BE_{CH4,\, total,\, y} + BE_{elec/heat,\, y} \quad \text{Equation 01}$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2e/yr)
$BE_{CH4,\, total,\, y}$	=	Baseline CH_4 emissions in year y (tCO_2e/yr)
$BE_{elec/heat,\, y}$	=	Baseline CO_2 emissions from electricity and/or heat used in the baseline in year y (tCO_2e/yr)

Baseline CH_4 emissions

$$BE_{CH4,\, total,\, y} = BE_{AWMS,\, y} + BE_{agro-industrial\ wastes, CH4, y} + BE_{sl, CH4, y} \quad \text{Equation 02}$$

Where:

$BE_{CH4,\, total,\, y}$	=	Baseline CH_4 emissions in year y (tCO_2e/yr)
$BE_{AWMS,y}$	=	Baseline CH_4 emissions from animal waste management site in year y (tCO_2e/yr)
$BE_{agro-industrial\ wastes,\, CH4,\, y}$	=	Baseline methane emissions occurring in year *y* generated from waste disposal at a SWDS during a time period ending in year y (tCO_2e/yr)
$BE_{sl,\, CH4,\, y}$	=	Baseline CH_4 emissions from sludge management in year y (tCO_2e/yr)

Baseline CH_4 emissions from manure treatment ($BE_{AWMS,y}$):

The manure management system in the baseline could be based on different livestock, treatment systems and on one or more stages. Therefore:

$$BE_{AWMS,\, y} = GWP_{CH4} \times D_{CH4} \times \sum_{j,LT} (MCF_j \times B_{o,LT} \times VS_{LT,y} \times N_{LT} \times MS\%_{BL,j}) \quad \text{Equation 03}$$

Where:

$BE_{AWMS,y}$	=	Baseline CH_4 emissions from animal waste management site in year y (tCO_2e/yr)

GWP_{CH4}	=	Global Warming Potential (GWP) of CH_4 (t CO_2e/t CH_4)
D_{CH4}	=	Density of CH_4 (tCH_4/m^3 CH_4)
MCF_j	=	Annual methane conversion factor (MCF) for the baseline *AWMS*
$B_{0,LT}$	=	Maximum methane producing potential of the volatile solid generated by animal type *LT* (m^3 CH_4/kg -dm)
N_{LT}	=	Annual average number of animals of type *LT* for the year *y* (number)
$VS_{LT,y}$	=	Annual volatile solid excretions for livestock LT entering all AWMS on a dry matter weight basis (kg -dm/animal/yr)
$MS\%_{Bl,j}$	=	Fraction of manure handled in system *j* in the baseline
LT	=	Type of livestock
j	=	Type of treatment system

$VS_{LT,y}$ shall be determined in one of the following ways, presented in the order of preference:

(a) Option 1: Using published country specific data. If the data is expressed in kilogram volatile solid excretion per day on a dry-matter basis (kg -dm per day), multiply the value with nd_y (number of days treatment plant was operational in year y)

(b) Option 2: Scaling default IPCC values $VS_{default}$ to adjust for a site-specific average animal weight as shown in equation below:

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

$$VS_{LT,y} = (w_{site}/w_{default}) \times VS_{default} \times nd_y \qquad \text{Equation 04}$$

Where:

$VS_{LT,y}$	=	Annual volatile solid excretions for livestock *LT* entering all AWMS on a dry matter weight basis (kg -dm/animal/yr)
W_{site}	=	Average animal weight of a defined livestock population at the project site (kg)
$W_{default}$	=	Default average animal weight of a defined population (kg)
$VS_{default}$	=	Default value for the volatile solid excretion per day on a dry-matter basis for a defined livestock population (kg-dm/animal/day)
nd_y	=	Number of days treatment plant was operational in year *y* (days/yr)

(c) Option 3: Utilizing published IPCC defaults for $VS_{LT,y}$ (*IPCC 2006 guidelines,volume 4, chapter 10*), multiply the value by nd_y (number of days in year y).

Developed countries $VS_{LT,y}$ values may be used provided the following conditionsare satisfied:

(i) The genetic source of the production operations livestock originates from anAnnex I Party.

(ii) The farm use formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/orgenetics;

(iii) The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.); and

(iv) The project specific animal weights are more similar to developed country IPCC default values.

For subsequent treatment stages, the reduction of the volatile solids during a treatment stage is estimated based on referenced data for different treatment types. Emissions fromthe next treatment stage are then calculated following the approach outlined above, but with volatile solids adjusted for the reduction from the previous treatment stages by multiplying by (1 - R_{VS}), where R_{VS} is the relative reduction of volatile solids from the previous stage. The relative reduction (R_{VS}) of volatile solids depends on the treatment technology and should be estimated in a **conservative manner**. Default values for different treatment technologies can be found in **Appendix 1** ($VS_{default}$).

Annual average number of animals of type *LT* (N_{LT}) shall be determined in one ofthe following ways, presented in order of preference:

Option 1

$$\mathbf{N_{LT}} = \mathbf{N_{da,LT}} \times (\mathbf{N_{p,LT}}/\mathbf{365}) \qquad \text{Equation 4a}$$

Where:

N_{LT}	=	Annual average number of animals of type *LT* for the year *y* (number)
$N_{da,LT}$	=	Number of days animal of type *LT* is alive in the farm in the year *y* (number)
$N_{p,LT}$	=	Number of animals of type *LT* produced annually for the year *y* (number)

Option 2

2. If the project developer can monitor in a reliable and traceable way the daily stock of animals in the farm, discounting dead animals and animals discarded from the productive

process from the daily stock, then the annual average number of animals (N_{LT}) may be calculated as follows:

$$N_{LT} = \sum_{1}^{365} N_{AA,LT} / 365 \quad \text{Equation 4b}$$

Where:

N_{LT}	=	Annual average number of animals of type LT for the year y (number)
$N_{AA,LT}$	=	Daily stock of animals of type LT in the farm, discounting dead and discarded animals (number)

Baseline CH_4 emissions from organic fraction of agro-industrial wastes, food industry wastes and MSW management ($BE_{agro-industrial\ wastes,CH4,y}$):

Baseline, project and leakage emissions of methane from the management of agro-industrial waste, waste from food industry and organic wastes are determined using the CDM methodological tool "Emissions from solid waste disposal sites (Tool 04 version 08.0)".

At that point baseline emissions of methane from the SWDS are determined using the CDM methodological tool "Emissions from solid waste disposal sites (Tool 04 version 08.0)". Tool 04 version 08.0 states two options to calculate baseline emissions as "Application A" and "Application B".

As per tool, Application A is only used where Project involves an existing SWDS for all other avoidance projects Application B is to be used. In this Project activity applying this methodology Application B will be used.

In the baseline scenario, emission calculations shall be calculated as follows , based on Application B of the Tool 04 "Emissions from solid waste disposal sites". (plz refer to point 16 of the tool for selection of yearly or monthly mode), in case of monthly mode of baseline emission determination from agro industrial waste equation 5b of this methodology must be used in place of equation 2 of the Tool 04 "Emissions from solid waste disposal sites"

The amount of methane generated from disposal of waste at the SWDS is calculated for year y using equation (5a) or for month m using equation (5b). Either of these two approaches may be used to calculate the amount of methane from disposal of waste at the SWDS.. All data used to apply the equations should be documented transparently in PSF or the monitoring reports.

$$BE_{agro-industrial\ wastes,CH4,y} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \times \sum_{x=1}^{y} \sum_j (W_{j,x} \times DOC_j \times e^{-k_j*(y-x)} \times (1 - e^{-k_j})). \quad \text{Equation 5a}$$

Or

$$BE_{agro-industrial,CH4,m} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,m} \times MCF_y \times \sum_{i=1}^{m} \sum_j (W_{j,i} \times DOC_j \times e^{-kj/12*(m-i)} \times (1 - e^{-kj/12}))$$

Equation 5b

Where, for the yearly model:

$BE_{agro-industrial\ wastes,CH4,y}$	=	Baseline methane emissions occurring in year *y* generated from waste disposal at a SWDS during a time period ending in year *y* (tCO_2e/yr)
x	=	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (*x* = 1) to year *y* (*x* = *y)*
y	=	Year of the crediting period for which methane emissions are calculated (*y* is a consecutive period of 12 months)
$DOC_{f,y}$	=	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year *y* (weight fraction)
$W_{j,x}$	=	Amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the year *x* (tonnes)

Where, for the monthly model:

$BE_{agro-industrial,CH4,m}$	=	Baseline methane emissions occurring in month *m* generated from waste disposal at a SWDS during a time period ending in month *m* (tCO_2e/m)
m	=	Month of the crediting period for which methane emissions are calculated
i	=	Months in the time period in which waste is disposed at the SWDS, extending from the first month in the time period (*i* = 1) to month *m* (*i* = m)
$DOC_{f,m}$	=	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for month *m* (weight fraction)
$W_{j,i}$	=	Amount of organic waste type *j* disposed/prevented from disposal in the SWDS in the month *i* (tonnes)

Where, for both the yearly and monthly model:

φ_y		Model correction factor to account for model uncertainties for year *y*

f_y	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y*
GWP_{CH4}	=	Global Warming Potential of methane (t CO_2e/t CH_4)
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction)
MCF_y	=	Methane correction factor for year *y*
DOC_j	=	Fraction of degradable organic carbon in the waste type *j* (weight fraction)
k_j	=	Decay rate for the waste type *j* (1 / yr)
j	=	Type of residual waste or types of waste in the MSW

To determine the value of the parameters, the latest version of CDM methodological tool 04 "Emissions from solid waste disposal sites" and related guidance in the same document shall befollowed.

Baseline CH_4 emissions from sludge management ($BE_{sl,CH4,y}$):

CH_4 emissions from sludge management shall be calculated by using the baseline emissions calculation pathway explained in CDM Methodology "*AM0080: Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants*"

According to related methodology, if the sludge produced in the baseline scenario from the treatment of wastewater in the open lagoons system would have been treated by means of controlled drying under aerobic conditions and then disposed to a landfill with methane recoveryor with use in soil application, methane emissions ($BE_{sl,CH4,y}$) are considered to be negligible.

$$BE_{sl,CH4,y} = 0$$

If the sludge that is produced in the baseline scenario from the treatment of wastewater in the open lagoons system would have been dumped or left to decay (S1), corresponding methane emissions are calculated as:

$$BE_{sl,CH4,y} = \frac{16}{12} \times GWP_{CH4} \times F \times DOC_F \times MCF_{BL,Sl} \times DOC_{BL,SL} \times Q_{BL,SL,y} \quad \text{Equation 6}$$

Where

$BE_{sl,CH4,y}$	=	Methane emissions from treatment of sludge in the baseline scenario in year y (tCO_2e/year)
16/12	=	Ratio between molar mass of methane and molar mass of carbon (tCH_4/tC)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period

		(tCO_2e/tCH_4)
F	=	Fraction of methane in the gas. IPCC default value of 0.5 should be used (fraction)
DOC_F	=	Fraction of degradable organic content dissimilated to biogas. The IPCC default value of 0.5 should be used (fraction)
$MCF_{BL,SL}$	=	Methane conversion factor for the site where sludge would have been dumped or left to decay in the baseline (fraction)
$DOC_{BL,SL}$	=	Degradable organic content of the sludge that would have been produced in the baseline scenario in year *y*. IPCC default values should be used: 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10%) and 0.09 for industrial sludge (wet basis, assuming dry matter content of 35%) (fraction)
$Q_{BL,SL,y}$	=	Quantity of sludge that would have been produced and treated in the baseline scenario in year *y* (t/yr)

Baseline emissions associated with heat and electricity generation ($BE_{elec/heat,y}$)

$$BE_{elec/heat,y} = BE_{EG,y} + BE_{HG,y} \quad \text{Equation 7}$$

Where:

$BE_{EG,y}$ = Baseline emissions associated with electricity generation in year y (tCO_2e/yr)

$BE_{HG,y}$ = Baseline emissions associated with heat generation in year y (tCO_2e/yr)

Baseline emissions associated with electricity generation ($BE_{EG,y}$)

The baseline emissions associated with electricity generation in year *y* ($BE_{EG,y}$) shall be calculated using the CDM's "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". When applying the tool:

$$BE_{EG,y} = EG_{BL,y} \times EF_{Co2,grid,y} \quad \text{Equation 8}$$

Where:

$BE_{EG,y}$	=	Baseline emissions associated with electricity generation in year y (tCO_2e/yr)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid from project activity in year y (MWh/yr)
$EF_{Co2,grid,y}$	=	Emission factor of the grid (tCO_2e /MWh)

Baseline emissions associated with heat generation ($BE_{HG,y}$)

The baseline emissions associated with heat generation in year *y* ($BE_{HG,y}$) are determined based on the amount of biogas which is sent to the heat generation equipment in the project activity (boiler or air heater), as follows:

$$BE_{HG,y} = \sum_{k=1} HG_{pj,k,y} \times EF_{co2,BL,HG,k} / \eta_{HG,BL,k} \quad \text{Equation 9}$$

Where:

$BE_{HG,y}$ = Baseline emissions associated with heat generation in year *y* (tCO_2e/yr)

$HG_{pj,k,y}$ = Net quantity of heat generated with biogas by equipment type *k* in the project in year *y* (TJ/yr)

$EF_{co2,BL,HG,k}$ = CO_2 emission factor of the fossil fuel type used for heat generation by equipment type *k* in the baseline (tCO_2/TJ)

$\eta_{HG,BL,k}$ = Efficiency of the heat generation equipment type *k* used in the baseline (%)

k = Heat generation equipment (boiler or air heater or kiln)

Efficiency of baseline heat generation equipment to be ascertained in line with the latest version CDM Tool 09 “Tool to determine the baseline efficiency of thermal or electric energy generationsystems”.

10. Project emissions

25. Project emissions in year y are calculated for alternative waste treatment options implemented in the project activity as follows:

$$PE_Y = PE_{AD,Y} + PE_{EC,y} + PE_{FC,Y} + PE_{Tran,y} \quad \text{Equation 10}$$

Where:

PE_Y = Project emission in year y (tCO_2e/yr)

$PE_{AD,Y}$ = Project emissions associated with the anaerobic digester in year y (tCO_2e/yr)

$PE_{EC,y}$ = Project emissions from electricity consumption (other than anaerobic digestor) in year y (tCO_2e/yr)

$PE_{FC,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2e/yr)

$PE_{Tran,y}$ = Project emissions from waste transportation in the year y (tCO_2e/yr)

Project emissions associated with the anaerobic digester in year y ($PE_{AD,y}$)

$PE_{AD,y}$ is determined by referring to latest version of CDM methodological tool CDM Tool 14: 'Project and leakage emissions from anaerobic digesters'.

Project emissions from use of electricity ($PE_{EC,y}$) and fossil fuel ($PE_{FC,y}$)

Project emissions from electricity and fuel consumption (other than anaerobic digestor) will be calculated following the latest versions of CDM Tool 05: 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption' and CDM Tool 03: 'Tool to calculate project or leakage CO2 emissions from fossil fuel combustion'.

Project emissions from manure, agro-industrial wastes, food industry wastes and sludge transportation ($PE_{Tran,y}$)

Project emissions from manure / agro- industrial waste transportation from collection points to the project plant shall be calculated as below.

$$PE_{Tran,y} = \sum_{i,j,k} N_{i,j,k,y} \times D_j \times F_{i,k} \times NCV_k \times EF_k \qquad \text{Equation 11}$$

Same equation for $LE_{Tran,y}$ (in case transport related emission is treated as leakage due to selection of project boundary)

Where:

$PE_{Tran,y}$	=	project emissions due to transport of waste from sources to the project plant in year y (tCO_2/ yr)
$N_{i,j,k,y}$	=	Number of trips (vehicle of type i with similar loading capacity) for transportation of waste from source j using transportation fuel k to project plant in year y (trips /yr)
D_j	=	Average round trip distance from source j to project plant (Kms/ trip)
$F_{i,k}$	=	specific fuel consumption of vehicle type i using transportation fuel type k (volume / mass Units of fuel / km)
NCV_k	=	Net calorific value of transportation fuel type k (TJ / mass or volume units)
EF_k	=	emission factor of transportation fuel type k (tCO_2/ TJ)
i	=	vehicle type
j	=	source of waste
k	=	type of transporation fuel.

11. Leakage emissions

26. Leakage emissions associated with anaerobic digestion of waste ($LE_{AD,y}$) shall be calculated according to the latest versions of CDM Methodological Tool 14 “Project and leakage emissions from anaerobic digesters”. Project owner or developer shall follow the leakage emissions procedure of the Tool.

12. Emission reductions

27. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation 12}$$

Where:

ER_y = Emission reduction in the year y (tCO2e/yr)

BE_y = Baseline emissions in the year y (tCO2e/yr)

PE_y = Project emissions in the year y (tCO2e/yr)

LE_y = Leakage emissions in the year y (tCO2e/yr)

Further, in estimating emissions reduction for claiming certified emissions reductions, if the calculated CH_4 baseline emissions from anaerobic lagoons and SWDS are higher than the measured CH_4 generated in the anaerobic digester in the project situation ($Q_{CH4,y}$in the tool “Project and leakage emissions from anaerobic digesters”), then the latter shall be used to calculate the emissions reduction for claiming certified emissions reductions. Therefore, the actual methane captured from an anaerobic digester shall be compared to the ($BE_{CH4,total,y}$ - $PE_{AD,Y}$ in the tool “Project and leakage emissions from anaerobic digesters”) and if found lower, then ($BE_{CH4,total,y}$- $PE_{AD,Y}$) (which is a component of BE_y -PE_y) is replaced by $Q_{CH4,y}$.

$Q_{CH4,y}$ shall be measured using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”.

When applying the tool, the following applies:

(a) The gaseous stream to which the tool is applied is the biogas collected from the digester and used for energy generation;
(b) CH_4 is the greenhouse gas i for which the mass flow should be determined; and
(c) The flow of the gaseous stream should be measured on an hourly basis or a smaller time interval; and then accumulated for the year y.

Please note that volumetric units need to be converted to mass units (tons), when applying the results in this tool.

13. Monitoring methodology

28. All the assumptions made related to monitoring parameters should be explained and documented transparently in the project submission to GCC. In addition to the parameters below, all the applicable monitoring parameters indicated in the CDM Tools used for baseline, project and leakage emission calculations shall be monitored.

13.1 Parameters not monitoring during the crediting period

Data / Parameter Table 1

Data / Parameter:	$MS\%_{Bl,j}$
Data unit:	Fraction
Description:	Fraction of manure handled in system *j* in the baseline
Source of data:	Project proponents
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter Table 2

Data / Parameter:	GWP_{CH4}
Data unit:	t CO_2e/t CH_4
Description:	Global warming potential of CH_4
Source of data:	IPCC
Measurement procedures (if any):	Shall be based on IPCC AR5 report
Any comment:	-

Data / Parameter Table 3

Data / Parameter:	D_{CH4}
Data unit:	t /m^3
Description:	Density of CH_4
Source of data:	Technical literature
Measurement procedures (if any):	-
Any comment:	0.00067 t/m^3 at room temperature 20ºC and 1 atm pressure

Data / Parameter Table 4

Data / Parameter:	MCF_j
Data unit:	-
Description:	Methane conversion factor for the baseline $AWMS_j$

Source of data:	IPCC 2006 table 10.17, chapter 10, volume 4 (see appendix 3)
Measurement procedures (if any):	-
Any comment:	(a) MCF values depend on the annual average temperature where the anaerobic manure treatment facility in the baseline existed. For average annual temperatures below 10 ºC and above 5 ºC, a linear interpolation should be used to estimate the MCF value at the specific temperature assuming an MCF value of 0 at an annual average of 5 ºC. Future revisions to the IPCC Guidelines for National Greenhouse Gas Inventories should be taken into account; (b) A conservativeness factor should be applied by multiplying MCF values (estimated as per above bullet) with a value of 0.94, to account for the 20 per cent uncertainty in the MCF values as reported by IPCC 2006

Data / Parameter Table 5

Data / Parameter:	$EF_{co2,BL,HG,k}$
Data unit:	t CO_2/TJ
Description:	CO_2 emission factor of the fossil fuel type used for heat generation by equipment type *k* in the absence of the project activity
Source of data:	Actual measured or local data is to be used. If local data is not available, regional data should be used and, in its absence, IPCC default values can be used from the latest version of IPCC Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Any comment:	If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Double-checked against IPCC defaults (for consistency) if data is local or regional

Data / Parameter Table 6

Data / Parameter:	$W_{default}$
Data unit:	kg
Description:	Default average animal weight of a defined population
Source of data:	IPCC 2006 or US-EPA, whichever is lower
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter Table 7

Data / Parameter:	$VS_{default}$
Data unit:	kg -dm/animal/day
Description:	Default value for the volatile solid excretion per day on a dry-matter basis for a defined livestock population
Source of data:	IPCC 2006 or US-EPA, whichever is lower
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter Table 8

Data / Parameter:	EF_k
Data unit:	t CO2/TJ
Description:	Emission factor of transportation fuel k
Source of data:	Default depending on the type of fuel.
Measurement procedures (if any):	NA
Monitoring frequency:	Once during start of crediting period for each type of vehicle.
QA/QC procedures:	NA
Any comment:	

Data / Parameter Table 9

Data / Parameter:	NCV_k
Data unit:	TJ / Mass or volume units
Description:	Net calorific value of transportation fuel type k
Source of data:	Default depending on the type of fuel.
Measurement procedures (if any):	NA
Monitoring frequency:	Once during start of crediting period for each type of vehicle.
QA/QC procedures:	NA
Any comment:	

Data / Parameter Table 10

<table>
<tr><td>Parameter:</td><td colspan="2">$MCF_{BL,sl}$</td></tr>
<tr><td>Data unit:</td><td colspan="2">Fraction</td></tr>
<tr><td>Description:</td><td colspan="2">The average baseline methane conversion factor for sludge</td></tr>
<tr><td rowspan="4">Source of data:</td><td colspan="2">The average baseline methane conversion factor for sludge (MCFBL,sl) should be determined in accordance with the guidance provided in IPCC 2006 Guidelines for National Greenhouse Gas Inventories.</td></tr>
<tr><td>Type of disposal site</td><td>MCFBL,sl,y</td></tr>
<tr><td>Anaerobic managed solid waste disposal sites - These must have controlled placement of waste (i.e. waste directed to specific deposition area, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) Cover material; (ii) Mechanical compacting; (iii) Levelling of the waste.</td><td>1.0</td></tr>
<tr><td>Semi-anaerobic managed solid waste disposal sites - These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) Permeable cover material; (ii) Leachate drainage system; (iii) Regulating pondage; (iv) Gas ventilation system.</td><td>0.5</td></tr>
</table>

	Unmanaged solid waste disposal site (deep and/or with high water table) - This comprises of all solid waste disposal sites not meeting the criteria of managed solid waste disposal sites and which have depths of greater than or equal to 5 metres and/or high water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste.	0.8
	Unmanaged shallow solid waste disposal sites- This comprises all solid waste disposal sites not meeting the criteria of managed solid waste disposal sites and which have depths of less than 5 metres.	0.4
	Uncategorized solid waste disposal sites- Only if the project proponents cannot categorize their SWDS into above four categories of managed and unmanaged SWDS, the MCF for this category can be used.[1]	0.4
Measurement procedures (if any):	-	
Any comment:	-	

13.2 Parameters for monitoring during the crediting period

Data / Parameter Table 1

Data / Parameter:	$B_{0,LT}$
Data unit:	m^3CH_4/kg dm
Description:	Maximum methane producing potential of the volatile solid generated by animal type *LT*

[1] For uncategorized solid waste disposal sites, the IPCC prescribes an MCF equal to 0.6. For conservativenessreasons, the value 0.4 should be used instead in this methodology.

Source of data:	This value varies by species and diet. Where default values are used, they should be taken from tables 10A-4 through 10A-9 (IPCC 2006 Guidelines for National Greenhouse Gas Inventories volume 4, chapter 10) specific to the country where the project is implemented. Developed countries $B_{0,LT}$ values can be used provided the following conditions are satisfied: (a) The genetic source of the production operations livestock originate from an Annex I Party; (b) The farm use formulated feed ratios (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics; (c) The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.); (d) The project specific animal weights are more similar to developed country IPCC default values. Directly measure $B_{0,LT}$ as per: (a) ISO 11734:1995; (b) ASTM E2170-01 (2008);and (c) ASTM D 5210-92
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	The value is taken from published sources. The parameter value should be updated on latest available public data source

Data / Parameter Table 2

Data / Parameter:	$\mathbf{W_{site}}$
Data unit:	kg
Description:	Average animal weight of a defined livestock population at the project site
Source of data:	Project proponents
Measurement procedures (if any):	-
Monitoring frequency:	Monthly

QA/QC procedures:	-
Any comment:	This parameter is used in equation 4 for estimating $VS_{LT,y}$ using option 3, and in equation 2 (appendix 2) for estimating $NEX_{LT,y}$ when using IPCC 2006 default values. Sampling procedures can be used to estimate this variable, taking into account the following guidance: (a) To ensure representativeness, each defined livestock population should be classified into a minimum of three age categories; (b) For each defined livestock population, a minimum of one monthly sample per age category should be taken; (c) When estimating baseline emissions and emissions released during baseline scenario from land application of the treated manure in the leakage section, the lower bound of the 95% confidence interval obtained from the sampling measurements should be used; (d) When estimating project emissions and emissions released during project activity from land application of the treated manure in the leakage section, the upper bound of the 95% confidence interval obtained from the sampling measurements should be used. The PSF should describe the system of random sampling taking into account stratification of each livestock population into a minimum of three weight categories as described above

Data / Parameter Table 3

Data / Parameter:	$N_{da,LT}$
Data unit:	Number
Description:	Number of days animal of type LT is alive in the farm in the year *y*
Source of data:	Project proponents
Measurement procedures (if any):	-
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	The PSF should describe the system on monitoring the number of days the animal is alive in the farm. The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed. This parameter is used in option 1 to calculate N_{LT}

Data / Parameter Table 4

Data / Parameter:	$N_{p,LT}$
Data unit:	Number
Description:	Number of animals of type *LT* produced annually for the year *y*
Source of data:	Project proponents
Measurement procedures (if any):	-
Monitoring frequency:	Monthly

QA/QC procedures:	-
Any comment:	The PSF should describe the system on monitoring the number of livestock produced. The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed. This parameter is used in Option 1 to calculate N_{LT}

Data / Parameter Table 5

Data / Parameter:	$\mathbf{N_{AA,LT}}$
Data unit:	-
Description:	Daily stock of animals in the farm, discounting dead and discarded animals
Source of data:	Daily counting of alive animals in the farm, discounting dead animals and animals discarded from the productive process from the daily stock
Measurement procedures (if any):	-
Monitoring frequency:	Daily
QA/QC procedures:	-
Any comment:	The PSF should describe the system for monitoring stock of animals

Data / Parameter Table 6

Parameter:	$Q_{BL,sl,y}$
Data unit:	tonnes
Description:	Quantity of sludge that would have been produced and treated in the baseline scenario in the year *y*
Source of data:	If the baseline scenario is an existing open lagoon (W3), historical records of monthly quantity of sludge generated per unit volume of wastewater being treated in the open lagoon should be collected for one year before the implementation of the project activity. In order to ensure a conservative computation of baseline emissions, the lowest amongst the monthly values should be considered and multiplied by the quantity of wastewater treated in year *y* to estimate the sludge that would have been produced If the baseline scenario is a new to be built open lagoon (W6), the sludge quantity generated from unit volume of waste water being treated in the open lagoon should be determined for the baseline lagoon configuration as identified following the guidance provided in step 1 of the section "Procedure for the identification of the most plausible baseline scenario and assessment of additionality". The value should be then multiplied by the quantity of wastewater treated in year *y* to estimate the sludge that would have been produced
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter Table 7

Data / Parameter:	$\mathbf{HG_{PJ,k,y}}$
Data unit:	TJ/yr

Description:	Quantity of heat supplied by the project activity displacing baseline heat generation by a fossil fuel boiler or air heater in year y (TJ)
Source of data:	Steam meter
Measurement procedures (if any):	In case of steam meter: the enthalpy of steam and feed water will be determined at measured temperature and pressure and the enthalpy difference will be multiplied with quantity measured by steam meter. In case of hot air: the temperature, pressure and mass flow rate will be measured
Monitoring frequency:	Monitored daily
QA/QC procedures:	In case of monitoring of steam, it will be calibrated for pressure and temperature of steam at regular intervals. The meter shall be subject to regular maintenance and testing to ensure accuracy
Any comment:	-

Data / Parameter Table 8

Data / Parameter:	$EG_{BL,y}$
Data unit:	MWh/yr
Description:	Net quantity of power generated by the project in year *y*
Source of data:	Energy meter readings at project site/ Bill of sale of power to the grid counter signed by the grid authorities.
Measurement procedures (if any):	In case of export-import meter, the net of power exported to the grid (Export – import) will be used for calculation of the net power exported. The meters would be of accuracy class as per government / regional regulations.
Monitoring frequency:	Monitored continuously, recorded on a monthly basis
QA/QC procedures:	Meters would be calibrated for accuracy as per the gove regulations or manufacturers spec.
Any comment:	

Data / Parameter Table 9

Data / Parameter:	$EF_{co2,grid,y}$
Data unit:	tCO2/MWh
Description:	Emission factor of the grid in the year y
Source of data:	Calculated as per the ACM0002 or as per nationally available data on the grid characteristics or as firmed up in the standardized baseline tools. If no valid Standardized Baseline value for the host country available on CDM website Follow the requirements of latest version of CDM Tool 07: *"Tool to calculate the emission factor for an electricity system"*
Measurement procedures (if any):	Calculated as per the approved methodology / nationally available grid emission factor / standardized baseline
Monitoring frequency:	yearly
QA/QC procedures:	NA
Any comment:	

Data / Parameter Table 10

Data / Parameter:	D_j
Data unit:	Kms.
Description:	Round trip distance between the origin of waste in plant j to the project plant
Source of data:	Maps, records , log books
Measurement procedures (if any):	The physical distance between the source of the waste and the project plant is measured from maps, transport logs, or reference literatures
Monitoring frequency:	Each transfer loads and consolidated on monthly basis, for conservative estimates the longest distance can be taken for estimates.
QA/QC procedures:	NA
Any comment:	

Data / Parameter Table 11

Data / Parameter:	$N_{i,j,k,y}$
Data unit:	Trips

Description:	Number of trips (vehicle of type i with similar loading capacity) for transportation of waste from source j using transportation fuel k to project plant in year y (trips /yr)
Source of data:	plant log records, financial records
Measurement procedures (if any):	The number of trips made between the source and the project plant will be logged by type of vehicle and type of transportation fuel consumed.
Monitoring frequency:	Each transfer loads and consolidated on monthly basis.
QA/QC procedures:	NA
Any comment:	

Data / Parameter Table 12

Data / Parameter:	$F_{i,k}$
Data unit:	Volume or mass units of fuel / km
Description:	specific fuel consumption of vehicle type i using transportation fuel type k (volume / mass Units of fuel / km)
Source of data:	Default depending on the type of transport and fuel
Measurement procedures (if any):	NA
Monitoring frequency:	Once during start of crediting period for each type of vehicle.
QA/QC procedures:	NA
Any comment:	

Appendix 1 : Anaerobic unit process performance.

Anaerobic treatment	HRT	COD	TS	VS	TN	P	K
	Days	% Reduction					
Pull plug pits	4 - 30	-	0 - 30	0 - 30	0 - 20	0 - 20	0 - 15
Underfloor pit storage	30 – 180	-	30 – 40	20 – 30	5 - 20	5 - 15	5 - 15
Open top tank	30 - 180	-	-	-	25 - 30	10 - 20	10 - 20
Open pond	30 - 180	-	-	-	70 - 80	50 -65	40 - 50
Heated digestor effluent prior to storage	12 - 20	35 – 70	25 - 50	40 - 70	0	0	0
Covered first cell of 2 cell lagoon	30 - 90	70 – 90	75 - 95	80 - 90	25 - 35	50 - 80	30 -50
One cell lagoon	>365	70 – 90	75 - 95	75 - 85	60 - 80	50 -70	30 -50
2 cell lagoon	210+	90 - 95	80 – 95	90 - 98	50 - 80	85 - 90	30 - 50
HRT = Hydraulic retention time**, COD =** Chemical oxygen demand**, TS =** Total solids**, VS =** Volatile solids**, TN=** Total Nitrogen**, P=** Phosphorous**, K =** Potassium **, - = data not available**							

Source: US-EPA 2001: Development Document for the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations.

DOCUMENT HISTORY

Version	Date	Comment
V 2.0	02 November 2022	Revision to: • Provide consistency with latest applicable version of CDM Tool 32: Positive list of technologies
V 1.0	8 July 2021	• Initial adoption by GCC Steering Committee based on the following: • Consideration by individual steering committee member, followed by evaluation of entire Steering Committee • 15-day global stakeholder consultation taken place between 22/06/2021 to 07/07/2021

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