

CDM-MP98-A02

Draft Small-scale Methodology

AMS-III.D.: Methane recovery in animal manure management systems

Version 22.0

Sectoral scope(s): 13

DRAFT



United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board, at its 116th meeting (EB116 meeting report, para 33), requested the MP to conduct further analysis and consider possible revisions of the methodologies “AMS-III.R.:Methane recovery from livestock and manure management at households and small farms, version 5.0), “AMS-III.D.:Methane recovery in animal manure management systems, (version 21.0), “AMS-I.I.: Biogas/biomass thermal applications for households/small users, (version 7.0)”, and TOOL14: Project and leakage emissions from anaerobic digesters, (version 2.0) addressing fugitive methane emissions from biogas digesters and use of updated Intergovernmental Panel on Climate Change (IPCC) methods.

2. Purpose

2. The purpose is to update the small scale methodology “AMS-III.D.: Methane recovery in animal manure management systems” to include a comprehensive approach to addressing fugitive methane emissions from biogas digesters and updated IPCC methods.

3. Key issues and proposed solutions

3. The proposed revision aims to:
 - (a) Address fugitive methane emissions from biogas digesters; and
 - (b) Use of updated IPCC methods.
4. This revision also makes the methodology consistent with the approach and elements from the latest version of “ACM0010: GHG emission reductions from manure management systems” including removing the option of allowing the use of the amount of manure treated instead of the monitored number of animals and to amend parameters from per head of animal to per 1000kg of animal.

4. Impacts

5. The revision of the methodological tool, if approved, will provide clarity and updated default values to stakeholders on calculation of project and leakage emissions from projects involving the use of anaerobic digesters.

5. Subsequent work and timelines

6. The MP, at its 98th meeting, agreed to seek public inputs on the revised version of the small scale methodology. If inputs are received, they will be discussed with the MP and forwarded to the Board for its consideration. The MP will considered any comment received during the period open for public inputs to this revised methodology. If no inputs are received, the MP recommends that the Board approve the proposed draft version of the small scale methodology. No further work is envisaged.

6. Recommendations to the Board

7. The MP will consider any comment received during the period open for public inputs to this revised methodology. If no inputs are received during the call for public input, the MP recommends that the Board adopt this proposed revision, to be made effective at the time of the Board's approval. If inputs are received, they will be discussed with the MP and forwarded to the Board for its consideration.

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1. Introduction

1. The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical projects	Replacement or modification of existing anaerobic manure management systems in livestock farms, or installation of a centralized plant that treats manure collected from several farms to achieve methane destruction by energy production or by flaring
Type of GHG emissions mitigation action	GHG destruction: GHG destruction and displacement of more- GHG -intensive service

2. Scope, applicability, and entry into force

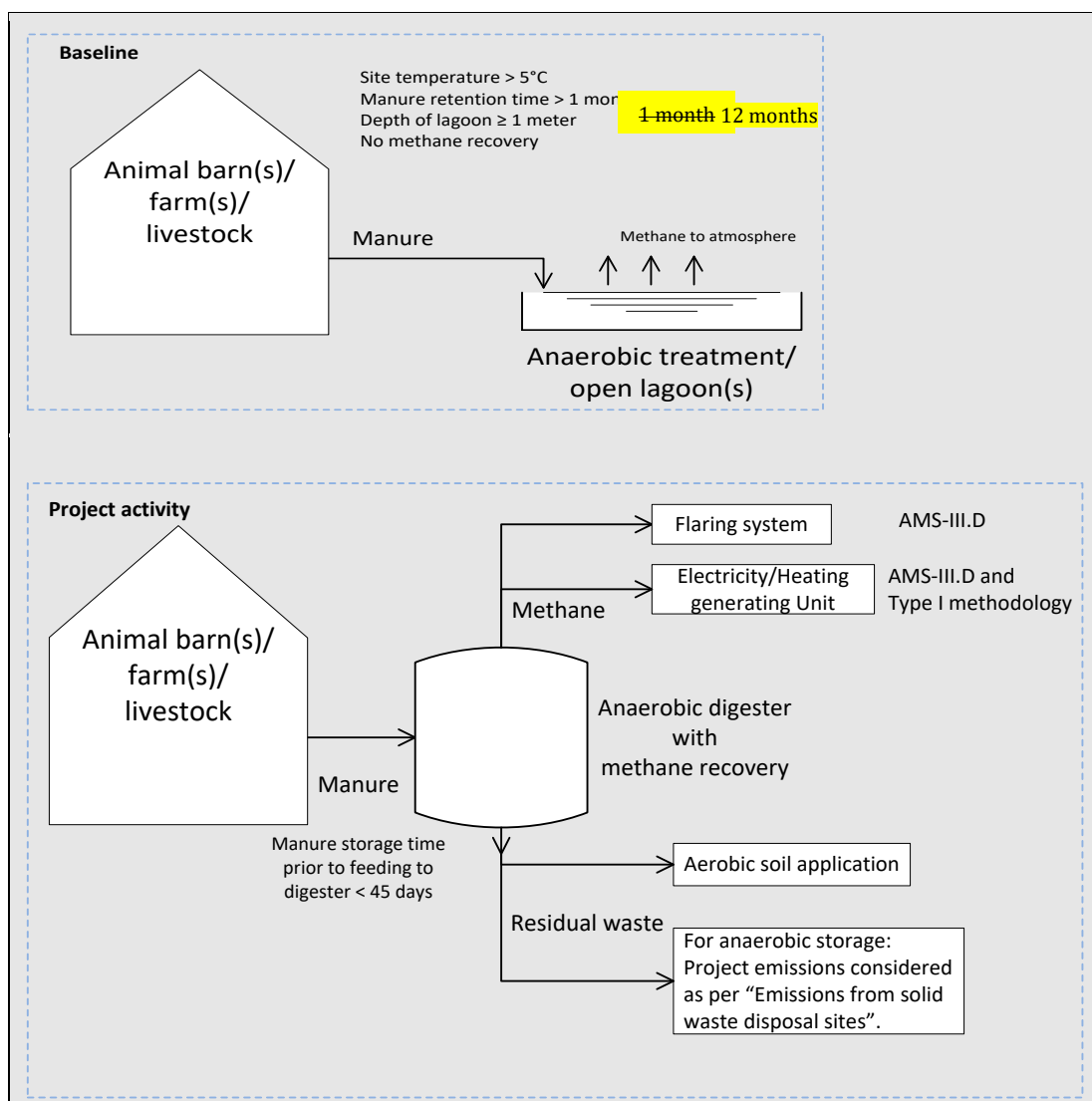
2.1. Scope

2. This methodology covers project activities involving replacement or modification of anaerobic animal manure management systems in livestock farms to achieve methane recovery and destruction by flaring **or energy use (heat or electricity)** of the recovered methane. It also covers centralized plants that collect manure from different farms.

2.2. Applicability

3. This methodology is only applicable under the following conditions:
 - (a) The livestock population in the farm is managed under confined conditions;
 - (b) Manure is not discharged into natural water resources (e.g., rivers, estuaries, lakes);
 - (c) The annual average temperature of the site where the baseline anaerobic manure management system is located is higher than 5°C;
 - (d) In the baseline scenario, the retention time of manure in the anaerobic management system is greater than **one 12 months, in accordance with 2019 Refinement to the 2006 IPCC Guidelines, table 17, footnote 7**, and if anaerobic lagoons are used, the depth of each lagoon must be at least 1 m;
 - (e) No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario.
4. The project activity shall satisfy the following conditions:
 - (a) The residual waste from the anaerobic manure management system(s) is handled aerobically, **taking into account the of emissions from residual waste**;
 - (b) Technical measures, including an emergency flare, are in place to ensure that all biogas produced by the anaerobic manure management system is destroyed (used or flared);

- (c) In order to mitigate the risk for physical leakage and venting, the following are ensured and documented in the PDD:
- (i) Anaerobic manure management system(s) are appropriately designed in terms of their sizing, considering the rates of manure inputs and the biogas consumption. Justifications shall be provided in the PDD and monitoring reports to demonstrate that gasholders are sufficiently large to capture and store all the biogas that would be generated until consumption;
 - (ii) Construction and installation of the anaerobic manure management system complies with relevant national and/or international standards and that an appropriate quality assurance/quality control (QA/QC) system is put in place for the construction or installation;
 - (iii) Necessary trainings are conducted for all users of the anaerobic manure management system prior to their commissioning or installation and that the trainings shall be documented in a verifiable manner (e.g. protocol of trainings, documentation of on-site visits);
 - (iv) A plan for periodic inspection and maintenance is in place and rehabilitation services are made available throughout the crediting period. Descriptions of such technical support system shall be provided in the PDD and verified by the designated operational entity (DOE) during verification. If the rehabilitation is undertaken, the details (e.g. parts replaced, specifications followed, personnel conducting the repairs and date of retrofitting) on each anaerobic manure management system, and methane recovery and combustion system shall be documented.
- (d) The storage time of the manure after removal from the animal barns, including transportation, does not exceed 45 days before being fed into the anaerobic manure management system unless the project proponent can demonstrate that the dry matter content of the manure entering the storage is greater than 20%.

Figure 1. Non-binding best practise example 1: Application of paragraphs 3 and 4

5. Project activities that recover methane from landfills shall use "AMS-III.G. Landfill methane recovery" and project activities that recover methane from wastewater treatment shall use AMS-III.H. Project activities that composts animal manure shall use "AMS-III.F. Avoidance of methane emissions through composting". Project activities that involve co-digestion of animal manure and other organic matters shall use "AMS-III.AO. Methane recovery through controlled anaerobic digestion". Project activities that discharge the waste water from treatment system obtained after the treatment into natural water resources (e.g., rivers, or estuaries, lakes), shall follow relevant procedures in in AMS-III.H. to calculate the project emissions associated with methane emissions from degradable organic carbon in treated wastewater.
6. The recovered biogas may be used in one of the options detailed in AMS-III.H., in which case, the respective procedures in AMS-III.H shall be followed. If the recovered biogas is used to power auxiliary equipment of the project activity, it should be accounted

accordingly under project emissions, using zero as its emission factor; however, no emission reduction can be claimed for displacing energy used for such purposes.

7. New manure management facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario, must satisfy relevant requirements in the "General guidelines for SSC CDM methodologies".
8. The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General guidelines for SSC CDM methodologies".
9. Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO₂ equivalent annually from all Type III components of the project activity.

2.3. Entry into force

10. The Month of entry into force is the date of the publication of the **EB 126** meeting report on **7 November 2025**.

2.4. Applicability of sectoral scopes

11. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 13 is mandatory.

3. Normative references

12. Project participants shall take into account the "General guidelines for SSC CDM methodologies" and the **"TOOL21: Guidelines on the demonstration of additionality of small-scale project activities"** (Attachment A to Appendix B) provided at: <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.
13. This methodology also refers to the latest approved versions of the following methodologies and tools:
 - (a) "ACM0010: Consolidated baseline methodology for GHG emission reductions from manure management systems";
 - (b) "AM0073: GHG emission reductions through multi-site manure collection and treatment in a central plant";
 - (c) "AMS-III.F.: Avoidance of methane emissions through composting";
 - (d) "AMS-III.G.: Landfill methane recovery";
 - (e) "AMS-III.H.: Methane recovery in wastewater treatment";
 - (f) "AMS-III.AO.: Methane recovery through controlled anaerobic digestion";
 - (g) ~~Methodological Tool: "TOOL14: Project and leakage emissions from anaerobic digesters"~~ **"TOOL14: Project and leakage emissions from anaerobic digesters" (hereinafter referred to as TOOL14);**

- (h) ~~Methodological Tool:~~ "TOOL06: Project emissions from flaring" (hereinafter referred to as TOOL06);
- (i) "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (hereinafter referred to as TOOL05); ~~Tool to calculate baseline, project and/or leakage emissions from electricity consumption";~~
- (j) "TOOL03: Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion" (hereinafter referred to as TOOL03).

4. Baseline methodology

4.1. Project boundary

14. The project boundary includes:

- (a) Manure management systems (including centralised manure treatment plant where applicable);
- (b) Facilities which recover and flare/combust or use methane; and
- (c) The livestock ~~in case the number of heads or the mass of the animals is used to calculate baseline emissions.~~

4.2. Additionality

15. The additionality of the project activity may be demonstrated by showing that there is no regulation in the host country applicable to the project site that requires the collection and destruction of methane from livestock manure. If so, the project activity is deemed additional and it is not required to further apply the "Guidelines on the demonstration of additionality of small-scale project activities". This applies to both existing and greenfield project activities.
16. Project activities applying this methodology in combination with a Type I methodology, i.e., those that have energy components whose installed capacity is less than 5 MW, the approach in paragraph 15 for additionality demonstration **can be** applied. If, however, the installed capacity exceeds 5 MW, the "Guidelines on the demonstration of additionality of small-scale project activities" must be applied.

4.3. Baseline emissions

17. The baseline scenario is the situation where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. Baseline emissions (BE_y) are calculated by using the amount of manure that would decay anaerobically in the absence of the project activity, with the **most recent 2019 IPCC Tier 2** approach (please refer to chapter 10 'Emissions from Livestock and Manure Management', volume 4 '*Agriculture, Forestry and other Land use*' of **the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories**). This option requires information about the livestock, characteristics of the manure and of the anaerobic manure management systems in the baseline. Manure characteristics

include the rate at which livestock produces volatile solids (VS_{rate}) and the maximum amount of methane that can be produced from that manure (B₀);

18. Baseline emissions are determined as follows:

$$BE_y = GWP_{CH_4} \times UF_b \times D_{CH_4} \times nd_y \quad \text{Equation (1)}$$

$$\times \sum_{MS} \left(\frac{MCF_{MS}}{100} \right) \sum_{LT} \left(N_{LT,y} \times \frac{AM_{LT,y}}{1000} \times VS_{rate_{LT,y}} \times B_{0,LT} \right. \\ \left. \times AWMS_{LT,MS,y} \times \frac{MCF_{MS}}{100} \right)$$

$$BE_y = GWP_{CH_4} \times D_{CH_4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times \quad \text{Equation (2)}$$

$$MS\%_{B_{0,j}}$$

Where:

BE_y	=	Baseline emissions during in year y (t CO ₂ e)
GWP_{CH_4}	=	Global Warming Potential (GWP) of CH ₄ applicable to the crediting relevant period (t CO ₂ e/t CH ₄)
D_{CH_4}	=	CH ₄ density (0.000717 t/m ³ at reference conditions ¹)
LT	=	Index for all types of livestock
j	=	Index for animal manure management system
MCF_j	=	Annual methane conversion factor (MCF) for the baseline animal manure management system j
MCF_{MS}	=	Methane conversion factor for each baseline anaerobic manure management system MS (per cent)
$B_{0,LT}$	=	Maximum methane producing capacity for manure produced by livestock type LT (m ³ CH ₄ per kg of VS, dry basis), determined as per paragraph 18(a) (a) potential of the volatile solid generated for animal type LT (m ³ CH ₄ /kg-dm)
$N_{LT,y}$	=	Annual average number of animals of type LT in year y (numbers)
$N_{LT,y}$	=	Annual average number of animals of livestock type LT in year y (heads)
$VS_{LT,y}$	=	Volatile solids production/excretion per animal of livestock LT in year y (on a dry matter weight basis, kg-dm/animal/year)
$VS_{rate_{LT,y}}$	=	Daily volatile solid excretion rate per 1,000 kg animal mass per day for livestock type LT in year y (kg VS per 1,000 kg animal mass per day, dry basis)

¹ Reference conditions are defined as 0 °C (273.15 K, 32°F) and 1 atm (101.325 kN/m², 101.325 kPa, 14.69 psia, 29.92 in Hg, 760 torr).

$MS\%_{BL,j}$	=	Fraction of manure handled in baseline animal manure management system j
$AWMS_{LT,MS,y}$	=	Fraction of the total annual VS from livestock type LT that would have been treated in the baseline anaerobic manure management system MS in year y
UF_b	=	Model correction factor to account for model uncertainties (0.94) ² Net-to-gross adjustment factor to account for uncertainties. The value applied is 0.89 ³
$AM_{LT,y}$	=	Average animal mass for livestock type LT (kg per head) in year y
nd_y	=	Number of days the project anaerobic animal manure management system is operational in year y (days)

- (a) The maximum methane producing capacity of the manure (B_0) varies by livestock types and their diet. The preferred method to obtain B_0 values is to use data from country-specific published sources, measured with a standardised method (B_0 shall be based on total as-excreted VS). These values shall be compared to IPCC default values and any significant differences shall be explained. If country specific B_0 values are not available, default values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 provided in Table 10.16 of chapter 10 volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories can be used, provided that the project participants' assess the suitability of those data to the specific situation of the farm operation, such as the geographical region and productivity system⁴;
- (b) Volatile solid excretion rate (VS rate) is the rate at which VS is excreted per 1,000 kg of animal mass per day by livestock type LT :
- The preferred method to obtain VS rate is to use data from nationally published sources. These values shall be compared with IPCC default values and any significant differences shall be explained;
 - If data from nationally published sources are not available, country-specific VS excretion rates can be estimated from feed intake levels, via the enhanced characterisation method (tier 2) described in section 10.2 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10, using equation (2) below;

$$VS_rate_{LT} = \left[GE_{LT} \times \left(1 - \frac{DE_{LT}}{100} \right) + (UE \times GE_{LT}) \right] \times \left[\left(\frac{1 - ASH}{18.45 \times ED_{LT}} \right) \right] \times nd_y \quad \text{Equation (3)}$$

² Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

³ This is to account for uncertainties of the method (See Annex III (Table of conservativeness factors), FCCC/SBSTA/2003/10/Add.2).

⁴ For the definition of high and low productivity systems, refer to chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Where:

$VS_{rate_{LT,y}}$	=	Annual volatile solid excretions for livestock LT entering all animal waste management systems on a dry matter weight basis (kg-dm/animal/yr) Daily volatile solid excretion rate of livestock type LT per day in year y (kg VS per 1,000 kg animal mass per day, dry basis)
GE_{LT}	=	Daily average gross energy intake of livestock type LT (MJ/1,000 kg animal mass animal/day)
DE_{LT}	=	Digestible energy of the feed (per cent)
UE	=	Urinary energy (fraction of GE_{LT})
ASH	=	Ash content of manure (fraction of the dry matter feed intake)
$18.45 ED_{LT}$	=	Energy density of the feed fed to livestock type LT (MJ/kg-dm)
nd_y	=	Number of days treatment plant was operational in year y

- (iii) If country specific values for VS rate are not available, the default values from provided in **Table 10.13A** of chapter 10 volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories **Volume 4 chapter 10 table 10-A-4 to 10-A-9** can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to the productivity system and geographical region.
- (c) B_0 or VS rate values applicable to developed countries can be used provided that the following four conditions are satisfied:
- The genetic source of the livestock originates from an Annex I Party;
 - The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;
 - The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);
 - The project specific animal weights are more similar to developed country IPCC default values.
- (d) In case there are sequential treatment stages, the reduction of the volatile solids in each treatment stage is estimated for different treatment types. Emissions from the subsequent treatment stage are calculated following the approach outlined above, but volatile solids (VS_{rate}) must be adjusted to account for the reduction in the preceding treatment stage by multiplying the initial VS_{rate} value in the preceding stage by $(1 - RVS)$, where RVS is the relative reduction of volatile solids from the previous stage. The relative reduction of volatile solids (RVS) depends on the treatment technology and should be estimated in a conservative manner. Default values for different treatment technologies can be found in the table in the Appendix **Anaerobic unit process performance**;

- (e) Methane Conversion Factors (*MCF*) values are determined for each anaerobic manure management system and represent the extent to which B_0 is achieved. Where available, country-specific *MCF* values that reflect the performance of the specific management systems used in given countries or regions shall be used. Alternatively, the default values provided in table 10.17 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 can be used, following the definitions of manure management systems provided in Table 10.18 for an applicable climate zone in figure 10A.1. The site's annual average temperature is taken from official data at the nearest meteorological station, or from historical on-site observations;
- (f) Fraction of the total VS from livestock type LT , that would have been treated by the baseline anaerobic animal manure management system MS , in year y , ($AWMS_{LT,MS,y}$) is determined based on the quantity of manure (dry basis) from livestock type LT that is treated in a baseline manure management system MS in the pre-project scenario, divided by the total mass of manure generated by livestock type LT in a given year, y . In case all manure generated from animal type LT is treated in a single system, this parameter takes the value of 1. For Greenfield and capacity addition project activities, it is identical to $AWMS_{LT,MS,pj,y}$, determined as per data and parameter table 15. In the case of a centralized plant project activity where animal manure is treated at each farm in the baseline, it is calculated as the weighted average by the livestock population at each farm;

$$AWMS_{LT,MS,y} = \frac{VS_{LT,MS,y}}{\sum_{MS} VS_{LT,MS,y}} \quad \text{Equation (4)}$$

- (g) The annual average number of animals ($N_{LT,y}$) is determined as follows:

$$N_{LT,y} = \left(\frac{N_{da,y}}{365} \right) \times N_{p,y} \quad \text{Equation (5)}$$

Where:

- $N_{da,y}$ = Number of days animal is on the farm in the year y (heads)
- $N_{p,y}$ = Number of animals produced annually of livestock type LT during year y

4.4. Project activity emissions

19. Project activity emissions consist of:

- (a) Physical leakage of biogas in the manure management systems which includes production, collection and transport of biogas to the point of use for energy production or flaring ($PE_{PL,y}$);
- (b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);
- (c) CO₂ emissions from use of fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$);
- (d) Where relevant, CO₂ emissions from transportation to centralized treatment plants ($PE_{transp,y}$);

(e) Emissions from degradable organic carbon in treated wastewater ($PE_{wwdischarge,y}$)

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{wwdischarge,y} \quad \text{Equation (6)}$$

Where:

- PE_y = Project emissions in year y (t CO₂e)
- $PE_{PL,y}$ = Emissions due to physical leakage of biogas in year y (t CO₂e)
- $PE_{flare,y}$ = Emissions from flaring or combustion of biogas in year y (t CO₂e)
- $PE_{power,y}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed project facilities in year y (t CO₂e)
- $PE_{transp,y}$ = Emissions from the incremental transportation to centralized treatment plants in year y (t CO₂e), as per relevant paragraphs in AMS-III.AO
- $PE_{wwdischarge,y}$ = Emissions from degradable organic carbon in treated manure wastewater from the treatment system in year y (t CO₂e) as per relevant paragraphs in AMS-III.H.

20. Project emissions due to physical leakage of biogas from the animal manure management systems used to produce, collect and transport the biogas to the point of destruction for energy use or by flaring are estimated as per relevant procedure in the methodological tool TOOL14. $PE_{PL,y}$ is equivalent to $PE_{CH_4,y}$ in the tool.
21. In case the recovered biogas is flared, project emissions from flaring are estimated using the procedures described in the methodological tool TOOL06. If the recovered biogas is combusted for energy use (heat or electricity), the methane destruction efficiency can be considered as 100%. The end use of the recovered biogas shall be included in the project boundary and its output shall be monitored in order to ensure that the recovered biogas is actually destroyed, even if the emission reductions from this component are not claimed.

Box 1. Non-binding best practice example 2: Monitoring of energy output as per paragraph 21

The project activity is to capture methane from manure that would be released to the atmosphere in the baseline scenario, in a swine farm. The methane is used to generate steam in a biogas fuelled boiler in an on-site food processing facility. The project participant would like to consider a methane destruction efficiency of 100% in the boiler. Hence on top of monitoring the required parameters as described in Section 5 below, the project participant will also monitor the steam output from the boiler

22. Project emissions from electricity and fossil fuel consumption are determined by following the methodological tool TOOL14, where $PE_{Power,y}$ is the sum of $PE_{EC,y}$ and $PE_{FC,y}$ in the tool.
23. Project emissions from degradable organic carbon in treated wastewater from the treatment system shall be calculated following the relevant requirements of AMS-III.H.

24. Project emissions from storage of manure before being fed into the anaerobic digester shall be accounted for only if, both condition (a) and condition (b) below apply:

(a) The storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic manure management system;

(b) The dry matter content of the manure in storage is less than 20%.

25. The following method shall be used to calculate project emissions from manure storage:

$$PE_{storage,y} = GWP_{CH_4} \times \sum_{LT,l} D_{CH_4} \times \left[\sum_{t=1}^{AI_{l,y}} \left(N_{LT,y} \times \frac{AM_{LT,y}}{1000} \times VS_{rate_{LT,y}} \times 365 \times N_{LT} \times VS_{LT,d} \right. \right. \quad \text{Equation (7)}$$

$$\times AWSS_{LT,l,y} \times MS\%_l \times (1 - e^{-k(AI_{l,y}-d)}) \times \frac{MCF_t}{100} \times MCF_t \left. \times B_{0,LT} \times B_{0,LT} \right]$$

Where:

$PE_{storage,y}$	=	Project emissions on account of manure storage in year y (t CO ₂ e)
$AI_{l,y}$	=	Annual average interval between manure collection and delivery for treatment at a given storage device <i>l</i> , up to 45 in year y (days)
$AWSS_{LT,l,y}$	=	Fraction of manure from livestock type <i>LT</i> stored in storage device <i>l</i> in year y
$VS_{LT,d}$	=	Amount of volatile solid production by type of animal <i>LT</i> in a day (kg VS/head/d)
$MS\%_l$	=	Fraction of volatile solids (%) handled by storage device <i>l</i>
k	=	Degradation rate constant (0.069)
d	=	Days for which cumulative methane emissions are calculated; runs from 1 up to $AI_{l,y}$
MCF_t	=	Annual methane conversion factor for the project manure storage device <i>l</i> from Table 10.17, Chapter 10, Volume 4 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

4.5. Leakage

26. It is determined by following the relevant procedure in ACM0010 or adopt as default factor 10% of baseline emissions. the methodological tool TOOL14.

4.6. Emission reductions

27. The emission reductions achieved by the project activity will be determined *ex post* through direct measurement of the amount of methane fuelled, flared or gainfully used. It is likely that the project activity involves manure treatment steps with higher methane conversion factors (MCF) than the MCF for the manure treatment systems used in the baseline situation, therefore the emission reductions achieved by the project activity are limited to the *ex post* calculated baseline emissions minus the project emissions using the actual monitored data for the project activity (i.e. $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_l$, AI_l , as well as $VS_{LT,y}$ in cases where adjusted values for animal weight are used). The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\ post} = \min[(BE_{y,ex\ post} - PE_{y,ex\ post}), (MD_y - PE_{y,ex\ post} - LE_y)] \quad \text{Equation (8)}$$

Where:

$ER_{y,ex\ post}$	=	Emission reductions achieved by the project activity based on monitored values for year y (t CO ₂ e)
$BE_{y,ex\ post}$	=	Baseline emissions calculated using equation 1 (for projects using option in paragraph 17) using <i>ex post</i> monitored values of $N_{da,y}$, $N_{p,y}$ and if applicable, $VS_{rate,LT,y}$. For projects using option in paragraph, the <i>ex post</i> monitored values for $Q_{manure,LT,MSpj,y}$ ⁵ and $SVS_{LT,y}$ are used
$PE_{y,ex\ post}$	=	Project emissions calculated using equation 6 using <i>ex post</i> monitored values of $N_{LT,y}$, $AM_{LT,y}$, $AWMS_{LT,MSpj,y}$, $AWSS_{LT,y}$, $AI_{i,y}$, $Q_{manure,MS,y}$ and if applicable $VS_{rate,LT,y}$
MD_y	=	Methane captured and destroyed by the project activity in year y (t CO ₂ e)
PE_{PL}	=	Emissions due to physical leakage of biogas in year y (t CO ₂ e) from the use of fossil fuel or electricity for the operation of the installed project facilities based on monitored values in the year y (t CO ₂ e)

28. Biogas flared or combusted, (MD_y) shall be determined using the flare efficiency and methane content of biogas.

$$MD_y = BG_{burnt,y} \times w_{CH_4,y} \times D_{CH_4} \times FE_y \times GWP_{CH_4} \quad \text{Equation (9)}$$

Where:

$BG_{burnt,y}$	=	Volume of biogas flared or combusted at reference condition in year y (m ³)
$w_{CH_4,y}$	=	Volume fraction of methane in biogas in year y (fraction)
FE_y	=	Flare efficiency in year y (fraction)

29. The method for integration of the terms in equation above to obtain the results for one year of measurements within the confidence level, as well as the methods and instruments used for metering, recording and processing the data obtained, shall be described in the project design document and monitored during the crediting period.

30. Alternatively, if project activities utilize the recovered methane for power generation, MD_y may be calculated as follows, based on the amount of monitored electricity generation, without monitoring methane flow and concentration:

$$MD_y = \frac{EG_y \times 3600}{NCV_{CH_4} \times EE} \times 0.67 \times 10^{-3} \times GWP_{CH_4} \quad \text{Equation (10)}$$

Where:

EG_y	=	Total electricity generated from the recovered biogas in year y (MWh)
3600	=	Conversion factor (1 MWh = 3600 MJ)
NCV_{CH_4}	=	NCV of methane (MJ/kg) (use default value: 50 MJ/kg)
EE	=	Energy conversion efficiency of the project equipment, which is determined by one of the following:
		— Specification provided by the equipment manufacture. The equipment shall be designed to utilize biogas as fuel, and efficiency specification is for this fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation;
		— Default efficiency of 40 %.

31. Project proponents shall provide evidence to a validating DOE that only the biogas recovered through the project anaerobic manure management system is used for power generation; no other gas or fuels, except a start-up fuel⁶, is used.
32. For biogas utilization component of the project activities covered under paragraph 6, the relevant procedures in AMS-III.H. shall be followed.
33. Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy, may apply the flare efficiency to the portion of the biogas used for energy, if separate measurements of the respective flows are not performed. When the amount of methane that is combusted for energy and that is flared is separately monitored, or when only the biogas flow to the flare is monitored and the biogas combusted for energy is calculated based on electricity generation, a destruction efficiency of 100% can be used for the amount that is combusted for energy.
34. Where applicable, the conditions of soil application (not resulting in methane emissions) of the residual waste shall be monitored.

⁶ If a fuel is defined as a start-up fuel, it should not represent more than 1% of the total fuel utilized in the process, on energy basis.

35. The monitoring plan should include on-site inspections for each individual farm included in the project boundary where the project activity is implemented for each verification period.
36. If the option in paragraph 17 is chosen for baseline emission determination, the following apply:
37. The PDD shall describe the system used for monitoring the fraction of the manure handled in the animal manure management system ($AWMS_{LT,MSpj,y}$), the average mass of the livestock ($AM_{LT,y}$) and the livestock population ($N_{LT,y}$) taking into account the average number of days the animals are on the farm in a specific year. The consistency between these values and indirect information (records of sales, records of food purchases) shall be assessed. Significant changes in livestock population and average mass shall be explained.
38. If developed country B_0 or VS_rate values are being used the following shall be monitored:
- Genetic source of the production operations livestock originates from an Annex I Party;
 - The formulated feed rations (FFR).
39. If the option in paragraph 17 is chosen for baseline emission determination, the PDD shall describe the approach used for monitoring the quantity of animal manure treated in the project anaerobic manure management system ($Q_{manure\ LT,MSpj,y}$) and the specific volatile solid ($SVS_{LT,y}$) content.

5. Monitoring methodology

40. Relevant parameters shall be monitored as indicated in section 5.1 below. The applicable requirements specified in the “General Guidelines for SSC CDM methodologies” (e.g. calibration requirements, sampling requirements) are also an integral part of the monitoring guidelines specified below and therefore shall be referred by the project participants.

5.1. Data and parameters monitored

Data / Parameter table 1.

Data / Parameter:	$VS_rate_{LT,y}$
Data unit:	kg VS/1,000 kg animal mass/day, dry basis
Description:	volatile solid excretion rate for livestock type LT per 1000 kg of animal mass in year y
Source of data:	-
Measurement procedures (if any):	Only required when data from national published source are not available or IPCC default value from the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10.13A is not used. When country-specific excretion rates is to be estimated from feed intake levels as indicated in the paragraph 18(b), via the enhanced characterisation method (Tier 2) described in section 10.2 in the 2019 Refinement to the 2006 IPCC Guidelines for National

	<i>Greenhouse Gas Inventories Volume 4 chapter 10</i> , parameters of GE_{LT} , DE_{LT} , UE , ASH and ED_{LT} shall be monitored. When developed country values are to be used in the project, relevant parameters specified in the paragraph 18(c) and 38 shall be monitored/documented
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	$N_{da,y}$
Data unit:	Number
Description:	Number of days animal is on the farm in the year y
Source of data:	-
Measurement procedures (if any):	The PDD should describe the system for monitoring the number of livestock population. The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed sales, records of food purchases) should be assessed
Monitoring frequency:	Annually, based on monthly records
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	$N_{p,y}$
Data unit:	Number
Description:	Number of animals produced annually of type LT for the year y
Source of data:	-
Measurement procedures (if any):	The PDD should describe the system on monitoring the number of livestock population. The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed
Monitoring frequency:	Annually, based on monthly records
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	$AM_{LT,y}$
Data unit:	kg
Description:	Average animal mass of a defined livestock population at the project site in year y
Source of data:	-
Measurement procedures (if any):	Sampling procedures can be used to estimate this variable as per the "Standard for sampling and surveys for CDM project activities and Programmes of Activities"

Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Box 2. Non-binding best practice example 3: Procedure to measure AM_{LT}

The project activity will collect and treat the manure from dairy cattle by anaerobic digestion process, and use the biogas generated during the treatment process for electricity generation. The project participant would like to use the sampling procedures from the approved methodology ACM0010": "Consolidated baseline methodology for GHG emission reductions from manure management systems" version 10 (Parameter 29). The following provides an illustration for the sampling plan:

Sampling design

1. Objective and reliability requirements: The objective of the sampling plan is to determine the average weight of the cattle. The confidence/precision level of 90/10 will be applied.
2. Target population: The target population is the 30,000 cattle in the farm, classified into 5 age categories, i.e. dry cow, milk cow, young cow, growing cow and calf.
3. Sampling method: Stratified random sampling will be carried out. The cattle population will be classified into 5 age categories as above.

Sample size: Approximate equation from the section 2.1.8 of Appendix 1 of "Guideline: Sampling and surveys for CDM project activities and programmes of activities" version 03.0 is used. A coefficient of variation (V) of 1 is used. The sample size is calculated as 271. After applying a response rate of 90% and 10% contingency, the sample size is rounded up to 333. (Please see Appendix 1 of "Guideline: Sampling and surveys for CDM project activities and programmes of activities" version 03.0 for the example of the calculation of sampling size. Or alternatively use the sample size calculator available at <https://cdm.unfccc.int/Reference/Guidclarif/index.html> .

5. Sampling frame: Sampling frame is worked out independently by taking categories as sampling unit. Sampled group will be changed in each monitoring period. Based on the data available on 13/12/2012, when some cows have not been put into the farm, the sample size for each age category is determined as follows:

Category	Number of animal up to 13/12/2012	Percentage	Number of animal expected	Sample size based on number of animal expected
Milk cow	7373	30%	9093	101
Dry cow	4188	17%	5165	57
Young cow	6282	26%	7748	86
Growing cow	3444	14%	4248	47
Calf	3037	12%	3746	42
Total	24324	100%	30000	333

Data

1. Field Measurements: For each sampled cow, the weight will be monthly monitored with the scale installed at the farm by project owner.
2. Quality Assurance/Quality Control: Every technician to monitor the sampled cow will fill in the date and signature; the monitor forms will be collected, summarized and kept by the project participant. In addition, the scale will be calibrated annually.
3. Data analysis: The primary monitoring data are collected and used to calculate GHG emission reductions.

Implementation plan

The project participant will establish the detailed measurement plan and train the employees in the farm to collect the data, and the data shall be summarized and analyzed by the CDM manager

Data / Parameter table 5.

Data / Parameter:	BG_{burnt,y}
Data unit:	m ³
Description:	Biogas volume in year y at reference condition
Source of data:	-
Measurement procedures (if any):	The amount of biogas recovered and fuelled, flared or used gainfully shall be monitored ex post, using flow meters. If the biogas flared and fuelled (or utilized) is continuously monitored separately, the two fractions can be added to determine the biogas recovered. In that case, recovered biogas need not be monitored separately. The system should be built and operated to ensure that there is no air ingress into the biogas pipeline. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place, and on the same basis (wet or dry)
Monitoring frequency:	Annually, based on continuous flow measurement with accumulated volume recording (e.g. hourly/daily accumulated reading)
QA/QC procedures:	-
Any comment:	Correct to 0 °C and 1 atm

Data / Parameter table 6.

Data / Parameter:	W_{CH₄}
Data unit:	%
Description:	Volume fraction of methane in biogas in year y
Source of data:	-
Measurement procedures (if any):	The fraction of methane in the biogas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) or, with periodical measurements at a 90/10 confidence/precision level by following the "Standard for sampling and surveys for CDM project activities and Programme of Activities". Alternatively a default value of 60% methane content (dry basis) can be used. The option chosen should be clearly specified in the PDD. In case measured, it shall be measured using equipment that can directly measure methane content in the biogas; the estimation of methane content of biogas based on measurement of other constituents of biogas such as CO ₂ is not permitted. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place, and on the same basis (wet or dry)
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-In case measured, correct to 0 °C and 1 atm

Box 3. Non-binding best practice example 4: Application of the default value of methane content in biogas

The project activity will capture methane from manure in a covered anaerobic lagoon in a poultry farm. The captured methane will be used for electricity generation in a gas engine. The project participant opts to use the default value of 60% dry basis instead of measuring the methane content. Therefore, the project participant monitors the flow of biogas ($B_{burnt,y}$) on a dry basis

Data / Parameter table 7.

Data / Parameter:	T
Data unit:	°C
Description:	Temperature of the biogas at the flow measurement site
Source of data:	-
Measurement procedures (if any):	As per the relevant procedure in AMS-III.H.
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 8.

Data / Parameter:	P
Data unit:	Pa
Description:	Pressure of the biogas at the flow measurement site
Source of data:	-
Measurement procedures (if any):	As per the relevant procedure in AMS-III.H.
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Box 4. Non-binding best practice example 5: Measurement of temperature and pressure of the biogas (Data/Parameter table 7 and 8)

The project participant wishes to carry out sampling to determine the temperature of the biogas with 90/10 confidence/precision level. The project proponent estimates the average temperature of the biogas (*mean*) to be 34 °C. Based on the information from other CDM projects or other projects in the region, the project participant estimates the standard deviation (*SD*) to be 6 °C. The number of measurements required to meet the 90/10 reliability is calculated according to:

$$n = \left(\frac{t_{n-1} \times SD}{0.1 \times \text{mean}} \right)^2$$

Where t_{n-1} is the value of the t-distribution for 90% confidence for a sample size of n . However, the sample size is not yet known, and so the first step is to use the value for 90% confidence when the sample is large, i.e. 1.645, and then refine the calculation:

$n = \left(\frac{1.645 \times 6}{0.1 \times 34} \right)^2 = 8.4$, rounded up to 9. The exact value for t_{n-1} can be acquired from any set of general statistical tables or using standard statistical software. For a sample size of 9 the value is 1.860. The calculation now gives $n = \left(\frac{1.860 \times 6}{0.1 \times 34} \right)^2 = 10.77$, which rounds up to 11. This process is iterated until there is no change to the value of n . Here the repeated calculation would result in a t-value of 1.812 and the calculation would yield $n = 10.22$, which would be rounded up to 11. The sample size calculation suggests that to accommodate 11 measurements per year, sampling every five weeks should be sufficient for 90/10 reliability. For simplification, monthly measurement, corresponding to 12 measurements per year, will be done.

For the biogas pressure, the same sampling plan also applies. Considering the expected biogas pressure of 900 mbar and the SD of 120 mbar, the calculation results in 7 measurements per year. For simplification, the sampling for biogas pressure will be done on a monthly basis, corresponding to 12 measurements per year, carried out at the same time as the measurement for the biogas temperature

Data / Parameter table 9.

Data / Parameter:	FE
Data unit:	%
Description:	Flare efficiency
Source of data:	-
Measurement procedures (if any):	As per the tool TOOL06. Regular maintenance shall be carried out to ensure optimal operation of flares
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 10.

Data / Parameter:	$Q_{\text{manure},LT,MSpj,y}$
Data unit:	Tonnes/year, dry basis
Description:	Quantity of manure from livestock type LT treated by project anaerobic manure management system $MSpj$ in year y
Source of data:	-

Measurement procedures (if any):	Volume or mass of manure shall be measured and converted to mass in dry basis. Sampling may be applied following Standard "Sampling and surveys for CDM project activities and programmes of activities". For a centralized treatment plant, the quantity of animal manure from different farms and different animal types shall be recorded separately for crosscheck. Records of the baseline animal manure management system(s) where the animal manure would have been treated anaerobically is also required. The moisture content can be determined as per
Monitoring frequency:	Annually, based on daily measurement and monthly aggregation
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 11.

Data / Parameter:	SVS _{i,LT,y}
Data unit:	tonnes VS/tonne —, dry basis
Description:	Specific volatile solids content of animal manure from livestock type LT in year y
Source of data:	-
Measurement procedures (if any):	Sampling may be applied following the "Standard for sampling and surveys for CDM project activities and programme of activities"
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 12.

Data / Parameter:	-
Data unit:	-
Description:	Parameters related to project emissions from incremental transportation distances in year y
Source of data:	-
Measurement procedures (if any):	Used to calculate $PE_{transp,y}$. As per the relevant procedure in AMS-III.AO.
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 13.

Data / Parameter:	-
Data unit:	-
Description:	Parameters related to TOOL06 of the residual gas stream in year y
Source of data:	-
Measurement procedures (if any):	Used to calculate $PE_{flare,y}$. As per the tool TOOL06

Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 14.

Data / Parameter:	-
Data unit:	-
Description:	Parameters related to emissions from electricity and/or fuel consumption in year y
Source of data:	-
Measurement procedures (if any):	Used to calculate $PE_{power,y}$. As per the procedure in the TOOL05 and/or TOOL03 . Alternatively, it shall be assumed that all relevant electrical equipment operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 15.

Data / Parameter:	AWMS_{LT,MSpj,y}
Data unit:	fraction
Description:	Fraction of the total annual VS from livestock type LT treated in anaerobic manure management system $MSpj$ in year y
Source of data:	-
Measurement procedures (if any):	If animal manure is treated in more than one type of treatment systems manure mass delivered to each system shall be directly measured or alternatively manure volume can be measured and converted to mass by multiplying by the density determined from a representative sample that would achieve For centralized treatment projects, the quantity of animal manure from different farms and different animal types shall be recorded separately to be cross-checked. Records of the baseline animal manure management system where the animal manure would have been treated anaerobically is also required
Monitoring frequency:	Annually, based on daily measurement and monthly aggregation
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 16.

Data / Parameter:	AI_{i,y}
Data unit:	Days
Description:	Annual average interval between manure collection and delivery for treatment at a given storage device i in year y , up to 45 days
Source of data:	-

Measurement procedures (if any):	It is to be used to calculate possible project emissions due the storage of animal manure, as per paragraph 25
Monitoring frequency:	Annually, based on monthly records
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 17.

Data / Parameter:	nd_y
Data unit:	Days
Description:	Number of days that the animal manure management system was operational in year y
Source of data:	-
Measurement procedures (if any):	If any farm has no operations on a given day it needs to be documented (e.g. logbook) and taken into account for the calculation of $BE_{ex\ post}$
Monitoring frequency:	Annually, based on daily records and monthly aggregation
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 18.

Data / Parameter:	AWSS_{l,y}
Data unit:	%
Description:	Fraction of volatile solids handled by storage device / in year y
Source of data:	-
Measurement procedures (if any):	It is to be used to calculate possible project emissions due the storage of manure, as per paragraph 25
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 19.

Data / Parameter:	B_{0,LT}
Data unit:	m ³ CH ₄ per kg of VS _d , dry basis
Description:	Maximum methane producing capacity of the volatile solid generated from animal type <i>LT</i>
Source of data:	-
Measurement procedures (if any):	Only when developed country values are to be used in the project, in such a case relevant parameters specified in the paragraph 18(c) shall be monitored/documentated
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 20.

Data / Parameter:	GE_{LT}
Data unit:	MJ/day
Description:	Daily average gross energy intake
Source of data:	-
Measurement procedures (if any):	Only when country-specific excretion rates are estimated from the feed intake levels as indicated in the para 18(b) (ii), via the enhanced characterisation method (Tier 2) described in section 10.2 of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 21.

Data / Parameter:	DE_{LT}
Data unit:	%
Description:	Digestible energy of the feed
Source of data:	-
Measurement procedures (if any):	If IPCC Tier 2 is used for VS_rate - 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Table 10.2, Chapter 10, Volume 4
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 22.

Data / Parameter:	UE
Data unit:	Fraction of GE
Description:	Urinary energy, expressed as fraction of GE
Source of data:	-
Measurement procedures (if any):	If IPCC Tier 2 is used for VS_rate as per 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Typically, 0.04GE can be considered urinary energy excretion by most ruminants (reduce to 0.02 for ruminants fed with 85% or more grain in the diet or for swine). Use country-specific values where available
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 23.

Data / Parameter:	ASH
Data unit:	Fraction of the dry matter feed intake
Description:	Ash content of the manure calculated as a fraction of the dry matter feed intake
Source of data:	-
Measurement procedures (if any):	If IPCC Tier 2 is used for VS_rate. Calculated as a fraction of the dry matter feed intake (e.g., 0.06 for sows: Dämmgen <i>et al.</i> 2011). Use country-specific values where available
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 24.

Data / Parameter:	ED_{LT}
Data unit:	MJ/kg-dm
Description:	Energy density of the feed in MJ/kg fed to livestock type LT
Source of data:	-
Measurement procedures (if any):	If IPCC Tier 2 is used for VS_rate. In its 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the IPCC, notes the energy density of feed, ED, is typically 18.45 MJ/kg-dm, which is relatively constant across a wide variety of grain-based feeds. The project proponent will record the composition of the feed to enable the DOE to verify the energy density of the feed
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 25.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Total electricity generated from the recovered biogas in year y
Source of data:	-
Measurement procedures (if any):	Only required for project activities that utilize the recovered methane for power generation as per paragraph 30
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 26.

Data / Parameter:	EE_y
Data unit:	%
Description:	Energy Conversion Efficiency of the project equipment

Source of data:	-
Measurement procedures (if any):	As per paragraph 30 Specification provided by the equipment manufacture. The equipment shall be designed to utilize biogas as fuel, and the efficiency specification is for this fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data/parameter table 27.

Data/parameter:	Sizing of the anaerobic manure management system
Data unit:	-
Description:	As per paragraph 4 (c) (i) above
Source of data:	Design specification of the anaerobic manure management system
Measurement procedures (if any):	Confirm that all components of the anaerobic manure management system including biodigesters are appropriately designed in terms of their sizing, considering the manure inputs and the demand for biogas. Justifications shall be provided in the project design document and monitoring reports to demonstrate that gasholders are sufficiently large to capture and store all the biogas that would be generated until consumption
Monitoring frequency:	Once at construction or installation of biogas digesters
QA/QC procedures:	-
Any comment:	-

Data/parameter table 28.

Data/parameter:	Compliance with standards and QA/QC system
Data unit:	-
Description:	Check against standards and implementation of a QA/QC system
Source of data:	- Comparison against national and/or international standards followed for biogas digesters - QA/QC system
Measurement procedures (if any):	As per paragraph 4 (c) (ii) above, confirm that the construction or installation of biodigesters (in the case of prefabricated plants) complies with relevant national and/or international standards and that a QA/QC system is put in place for the construction or installation
Monitoring frequency:	Once at construction or installation of biogas digesters
QA/QC procedures:	-
Any comment:	-

Data/parameter table 29.

Data/parameter:	Training for all users of biodigesters
Data unit:	-
Description:	As per paragraph 4 (c) (iii) above
Source of data:	Training records
Measurement procedures (if any):	Confirm that trainings are conducted for all users of biodigesters prior to their commissioning or installation. The trainings shall be documented in a verifiable manner (e.g. protocol of trainings, documentation of on-site visits)
Monitoring frequency:	At least once, prior to commissioning or installation of biogas digesters
QA/QC procedures:	-
Any comment:	-

Data/parameter table 30.

Data/parameter:	Periodic inspection and maintenance
Data unit:	-
Description:	Check as per paragraph 4 (c) (iv) above
Source of data:	Project implementation plan and monitoring surveys
Measurement procedures (if any):	Confirm that a plan for periodic inspection and maintenance is in place and rehabilitation services are available throughout the crediting period. Description of such technical support system shall be provided in the project design document and verified by the designated operational entity during verification
Monitoring frequency:	Once at construction or installation of biogas digesters and annually
QA/QC procedures:	If the rehabilitation is undertaken, the details (e.g. parts replaced, specifications followed, personnel conducting the repairs and date of retrofitting) on each biogas digester, methane recovery and combustion system shall be documented
Any comment:	-

Data / Parameter table 31.

Data / Parameter:	$W_{CH4,y}$; $BG_{burnt,y}$; $S_{I,PJ,y}$; $S_{final,PJ,y}$; $COD_{ww,untreated,y}$; $COD_{ww,treated,y}$; $COD_{ww,discharge,PJ,y}$; $Q_{ww,i,y}$
Data unit:	-
Description:	Parameters related to emissions from degradable organic carbon in treated wastewater as per AMS-III.H. in year y
Source of data:	-
Measurement procedures (if any):	Used to calculate $PE_{wwdischarge,y}$ as per AMS-III.H.
Monitoring frequency:	As per AMS-III.H
QA/QC procedures:	As per AMS-III.H
Any comment:	-

6. Project activity under a programme of activities

41. The following conditions apply for use of this methodology in a project activity under a programme of activities:
- (a) If the project activity involves the replacement of equipment, and the leakage effect of the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose, scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.

DRAFT

Appendix. Anaerobic unit process performance

Table. Anaerobic unit process performance

Anaerobic Treatment	HRT	COD	TS	VS	TN	P	K
	days	Per cent 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 digester effluent prior to storage	12-20	35-70	25-50	40-70	0	0	0
Covered first cell of two 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
Two-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=phosphorus; K=potassium; — =data not available.							

Source: Moser and Martin, 1999

Document information*

<i>Version</i>	<i>Date</i>	<i>Description</i>
22.0	01 October 2025	MP 98, Annex 2 • Call for input will be issued for this draft document. If no input is received, the draft document will be considered by the Board at EB 126. • Revision to address fugitive methane emissions from biogas digesters and incorporate updated methods by the IPCC.
21.0	22 September 2017	EB 96, Annex 9 Revision to clarify options to estimate volatile solids.
20.1	23 October 2015	Editorial revision to reflect the decision of EB 85 to classify the methodology under sectoral scope 13 and to include a table of content.
20.0	16 October 2015	EB 86, Annex 15 Revision to include non-binding best practice examples.
19.0	23 November 2012	EB 70, Annex 31. To include simplified requirements for project activities that utilize the recovered methane for power generation; and to include further guidance on additionality demonstration for project applying this methodology.
18	29 September 2011	EB 63, Annex 22. To include the monitoring table to clarify the monitoring requirements.
17	26 November 2010	EB 58, Annex 20. To cover centralized treatment of animal manure collected from different farms and to include provisions for determining baseline emissions based on the direct measurement of manure quantity and volatile solids.
16.1	01 June 2010	Editorial revision in paragraph 2(c): To change storage time from 5 days to 45 days.
16	26 March 2010	EB 53, Annex 16. To include additional guidance for long term storage of manure after removal from the animal barns.
15	17 July 2009	EB 48, Annex 18. To provide additional guidance on consideration of the storage time of animal manure taking into account the fact that the manure could be transported from locations other than the location of the anaerobic digester.

* This document, together with the 'General Guidance' and all other approved SSC methodologies, was part of a single document entitled: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities until version 07.

<i>Version</i>	<i>Date</i>	<i>Description</i>
14	14 March 2008	EB 38, Annex 11. To: - Clarify the use of the tier 2 approach of 2006 IPCC guidelines for emission reduction calculations for manure management systems; and - Expand the applicability of the methodology to include the possibility of pipeline transport of the recovered and upgraded biogas to the end-users, similar to the revision recommended to AMS-III.H.
13	27 July 2007	EB 33, Annex 32. Revision of the approved small-scale methodology AMS-III.D to allow for its application under a programme of activities (PoA).
12	04 May 2007	EB 31, Annex 22. To clarify that in the monitoring plan on-site inspections are to be conducted for each individual farm and includes additional guidance on how to determine the efficiency of the flaring process in an enclosed flare and in an open flare; To assign scope 15 to this methodology and exclude this methodology from sectoral scopes 10 and 13, and to clarify that that DOE functions (validation, verification etc.) of project activities applying earlier versions can only be performed by DOEs accredited to all of the sectoral scopes to which the earlier versions of these methodologies respectively belong to.
11	23 December 2006	EB 28, Meeting report, Para. 64. To remove the interim applicability condition that is 25 ktCO ₂ e/y limit from all Type III categories.
10	28 July 2006	EB 25, Annex 25. To expand its applicability to cover project activities that change manure management practices that is from 'lagoon', 'liquid/slurry', 'solid storage' or 'drylot' to 'anaerobic digestion' for the treatment of swine or cattle manure.
9	12 May 2006	EB 24, Meeting report, Para. 64. To introduce the interim applicability condition that is 25kt CO ₂ e/y limit for all Type III categories.
8	03 March 2006	EB 23, Annex 25. To clarify its applicability and align it with AMS-III.F, AMS-III.G, AMS-III.H. and AMS-III.I.

Decision Class: Regulatory

Document Type: Standard

Business Function: Methodology

Keywords: animal manure management systems, methane, simplified methodologies, type (iii) projects

History of the document: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities

Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities contained both the General Guidance and Approved Methodologies until version 07. After version 07 the document was divided into separate documents: 'General Guidance' and separate approved small-scale methodologies (AMS).

<i>Version</i>	<i>Date</i>	<i>Description</i>
07	25 November 2005	EB 22, Para. 59. References to "non-renewable biomass" in Appendix B deleted.
06	20 September 2005	EB 21, Annex 22. Guidance on consideration of non-renewable biomass in Type I methodologies, thermal equivalence of Type II GWhe limits included.
05	25 February 2005	EB 18, Annex 6. Guidance on 'capacity addition' and 'cofiring' in Type I methodologies and monitoring of methane in AMS-III.D included.
04	22 October 2004	EB 16, Annex 2. AMS-II.F was adopted, leakage due to equipment transfer was included in all Type I and Type II methodologies.
03	30 June 2004	EB 14, Annex 2. New methodology AMS-III.E was adopted.
02	28 November 2003	EB 12, Annex 2. Definition of build margin included in AMS-I.D, minor revisions to AMS-I.A, AMS-III.D, AMS-II.E.
01	21 January 2003	EB 7, Annex 6. Initial adoption. The Board at its seventh meeting noted the adoption by the Conference of the Parties (COP), by its decision 21/CP.8, of simplified modalities and procedures for small-scale CDM project activities (SSC M&P).

Decision Class: Regulatory

Document Type: Standard

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