Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall take into account the general guidelines to the SSC CDM methodologies, information on additionality (attachment A to Appendix B) provided at: <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis.*

III.D. Methane recovery in animal manure management systems

Technology/measure

1. This methodology covers project activities involving the replacement or modification of anaerobic animal manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane. It also covers treatment of manure collected from several farms in a centralized plant. This methodology is only applicable under the following conditions:

(a) The livestock population in the farm is managed under confined conditions;

(b) Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries), otherwise AMS-III.H "Methane recovery in wastewater treatment" shall be applied;

(c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C;

(d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and in case of anaerobic lagoons in the baseline, their depths are at least 1 m;

(e) No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario.

2. The project activity shall satisfy the following conditions:

(a) The residual waste from the animal manure management system shall be handled aerobically, otherwise the related emissions shall be taken into account as per relevant procedures of AMS-III.AO "Methane recovery through controlled anaerobic digestion". In case of soil application, proper conditions and procedures (not resulting in methane emissions) must be ensured;

(b) Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared;

(c) The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the anaerobic digester. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not apply.

3. Projects that recover methane from landfills shall use AMS-III.G "Landfill methane recovery" and projects for wastewater treatment shall use AMS-III.H. Project for composting of animal manure shall use AMS-III.F "Avoidance of methane emissions through composting". Project activities involving co-digestion of animal manure and other organic matters shall use the methodology AMS-III.AO "Methane recovery through controlled anaerobic digestion".

4. Different options to utilise the recovered biogas as detailed in paragraph 3 of AMS-III.H are also eligible for use under this methodology. The respective procedures in AMS-III.H shall be followed in this regard.

5. New facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the "General Guidelines to SSC CDM methodologies".

6. The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General Guidelines to SSC CDM methodologies".

7. Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO_2 equivalent annually from all Type III components of the project activity.

Boundary

8. The project boundary includes the physical, geographical site(s) of:

(a) The livestock;

(b) Animal manure management systems (including centralised manure treatment plant where applicable);

(c) Facilities which recover and flare/combust or use methane.

Baseline

9. 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 one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (B_o);

(b) Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (*SVS*) content.

10. In case option in paragraph 9 (a) is chosen, baseline emissions are determined as follows:

$$BE_y = GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j} \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in year y (tCO_2e)
GWP_{CH4}	Global Warming Potential (GWP) of CH_4 (21)
D_{CH4}	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure)
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
$B_{0,LT}$	Maximum methane producing 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)
$VS_{LT,y}$	Volatile solids for livestock LT entering the animal manure management system in year y (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system j
UF_b	Model correction factor to account for model uncertainties (0.94)[1]

(a) The maximum methane-producing capacity of the manure (B_o) varies by species and diet. The preferred method to obtain B_o measurement values is to use data from country-specific published sources, measured with a standardised method (B_o 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_o 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 can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site;

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

(b) Volatile solids (*VS*) are the organic material in livestock manure and consist of both biodegradable and non-biodegradable fractions. For the calculations the total *VS* excreted by each animal species is required. The preferred method to obtain *VS* 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 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10. If country specific VS values are not available IPCC default values from 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 feed intake levels;

(c) In case default IPCC values for *VS* are adjusted for a site-specific average animal weight, it shall be well explained and documented. The following equation shall be used:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y \quad \textbf{(2)}$$

Where:

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, this data is sourced from IPCC 2006 (kg)
$VS_{default}$	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)
nd_y	Number of days in year *y* where the animal manure management system is operational

(d) B_o or *VS* values applicable to developed countries can be used provided 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.

(e) In case of sequential treatment stages, the reduction of the volatile solids during a treatment stage is estimated based on referenced data for different treatment types. Emissions from the 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 - *RVS*), where *RVS* is the relative reduction of volatile solids from the previous stage. The relative reduction (*RVS*) 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 the table in annex 1;

(f) Methane Conversion Factors (*MCF*) values are determined for a specific manure management system and represent the degree to which B_o is achieved. Where available country-specific *MCF* values that reflect the specific management systems used in particular countries or regions shall be used. Alternatively, the IPCC default values provided in table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 can be used; The site annual average temperature is taken from official data at the nearest meteorological station, or from data available from historical on site observations;

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

$$N_{LT,y} = N_{da,y} * \left(\frac{N_{p,y}}{365} \right) \quad \textbf{(3)}$$

Where:

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

11. In case option in paragraph 9(b) is chosen, baseline emissions are determined based on directly measured quantity of manure and its specific volatile solids content, as follows:

$$BE_y = GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{0,LT} * Q_{manure,j,LT,y} \cdot SVS_{j,LT,y} \quad \textbf{(4)}$$

Where:

$Q_{manure,j,LT,y}$	Quantity of manure treated from livestock type *LT* and animal manure management system *j* (tonnes/year, dry basis)
$SVS_{j,LT,y}$	Specific volatile solids content of animal manure from livestock type *LT* and animal manure management system *j* in year *y* (tonnes/tonnes, dry basis)

MCF_j	Annual methane conversion factor (*MCF*) for the baseline animal manure management system *j,* as per paragraph 10 above
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type *LT* (m^3 CH_4/kg dm), as per paragraph 10 above

Project Activity Emissions

12. 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 flaring/combustion or gainful use ($PE_{PL,y}$);

(b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);

(c) CO_2 emissions from use of fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$);

(d) CO_2 emissions from incremental transportation distances;

(e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y} \qquad \textbf{(5)}$$

Where:

PE_y	Project emissions in year *y* (tCO_2e)
$PE_{PL,y}$	Emissions due to physical leakage of biogas in year *y* (tCO_2e)
$PE_{flare,y}$	Emissions from flaring or combustion of the biogas stream in the year *y* (tCO_2e)
$PE_{power,y}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* (tCO_2e)
$PE_{transp,y}$	Emissions from incremental transportation in the year *y* (tCO_2e), as per relevant paragraph in AMS-III.F
$PE_{storage,y}$	Emissions from the storage of manure (tCO_2e)

13. 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 flaring or gainful use is estimated as:

(a) 10% of the maximum methane producing potential of the manure fed into the management systems implemented by the project activity:[2]

(i) In case option in paragraph 9(a) is chosen, it is determined as:

$$PE_{PL,y} = 0.10 * GWP_{CH4} * D_{CH4} * \sum_{i,LT} B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{i,y} \quad \textbf{(6)}$$

Where:

$MS\%_{i,y}$ Fraction of manure handled in system *i* in year *y*

If the project activity involves sequential manure management systems, the procedure specified in paragraph 10 (e) shall be used to estimate the project emissions due to physical leakage of biogas in each stage.

(ii) In case option in paragraph 9 (b) is chosen, it is determined as:

$$PE_{PL,y} = 0.10 * GWP_{CH4} * D_{CH4} * \sum_{i,LT} B_{0,LT} * Q_{manure,LT,y} \cdot SVS_{LT,y} * MS\%_{i,y} \quad \textbf{(7)}$$

(b) Optionally a default value of 0.05 m³ biogas leaked/m³ biogas produced may be used for both options in paragraph 9 (a) and (b) as an alternative to calculations per equation 6 and equation 7.

14. In case of flaring/combustion of biogas, project emissions are estimated using the procedures described in the "Tool to determine project emissions from flaring gases containing methane".

15. Project emissions from electricity consumption are determined as per the procedures described in AMS-I.D "Grid connected renewable electricity generation". For project emissions from fossil fuel consumption the emission factor for the fossil fuel shall be used (tCO_2/tonne). Local values are to be used, if local values are difficult to obtain, IPCC default values may be used. If recovered methane is used to power auxiliary equipment of the project it should be taken into account accordingly, using zero as its emission factor.

16. Project emissions on account of storage of manure before being fed into the anaerobic digester shall be accounted for if both condition (a) and condition (b) below are satisfied:

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

(b) The dry matter content of the manure when removed from the animal barns is less than 20%.

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 guidelines specify a default value of 10% of the maximum methane producing potential (Bo) for the physical leakages from anaerobic digesters.

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

$$PE_{storage,y} = GWP_{CH_4} * D_{CH_4} * \sum_{LT,l}\left[\frac{365}{AI_l}\sum_{d=1}^{AI}(N_{LT,y} * VS_{LT,d} * MS\%_l * (1 - e^{-k\ (AI_l - d)}) * MCF_l * B_{0_{LT}})\right] \quad \textbf{(8)}$$

Where:

$PE_{storage,y}$	Project emissions on account of manure storage in year *y* (tCO_2e)
AI_l	Annual average interval between manure collection and delivery for treatment at a given storage device *l* (days)
$VS_{LT,d}$	Amount of volatile solid production by type of animal *LT* in a day (kg VS/head/d)
$MS\%_l$	Fraction of volatile solids (%) handled by storage device *l*
k	Degradation rate constant (0.069)
d	Days for which cumulative methane emissions are calculated; d can vary from 1 to 45 and to be run from 1 up to AI_l
MCF_l	Annual methane conversion factor for the project manure storage device l from Table 10.17, Chapter 10, Volume 4

Leakage

17. No leakage calculation is required.

Emission Reductions

18. 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 is limited to the *ex post* calculated baseline emissions minus project emissions using the actual monitored data for the project activity ($N_{LT,y}$, $MS\%_{i,y}$, $MS\%_l$, AI_l, and in case adjusted values for animal weight are used as defined in paragraph 10 (c): $VS_{LT,y}$). The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\,post} = \min[(BE_{y,ex\,post} - PE_{y,ex\,post}),(MD_y - PE_{power,y,ex\,post})] \quad \textbf{(9)}$$

Where:

$ER_{y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year *y* (tCO_2e)
$BE_{y,ex\ post}$	Baseline emissions calculated using equation 1 (for projects using option in paragraph 9 (a)) using *ex post* monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$. For projects using option in paragraph 9 (b), the *ex post* monitored values for $Q_{manure,j,LT,y}$ and $SVS_{j,LT,y}$ are used
$PE_{y,ex\ post}$	Project emissions calculated using equation 5 using *ex post* monitored values of $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_{l}$, AI_l, $Q_{res\ waste,y}$ and if applicable $VS_{LT,y}$
MD_y	Methane captured and destroyed or used gainfully by the project activity in year *y* (tCO_2e)
$PE_{power,y,ex\ post}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year *y* (tCO_2e)

19. In case of flaring/combustion MD_y will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4} \tag{10}$$

Where:

$BG_{burnt,y}$	Biogas flared or combusted in year *y* (m^3)
$w_{CH4,y}$	Methane content in biogas in the year *y* (volume fraction)
FE	Flare efficiency in the year *y* (fraction)

20. 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.

21. In case of project activities covered under paragraph 4, the relevant procedure in AMS-III.H shall be followed.

22. ~~The amount of biogas recovered and fuelled,[3] flared or used gainfully shall be monitored *ex post*, using flow meters. The system should be built and operated to ensure that there is no air ingress into the biogas pipeline. The fraction of methane in the biogas should be measured with a continuous analyser or, with periodical measurements at a 90/10 confidence/precision level or, alternatively a default value of 60% methane content can be used. Option chosen should be clearly specified in the PDD. Temperature and pressure of the biogas are required to determine the density of methane combusted. If the biogas flow meter employed measures flow, pressure and temperature~~

[3] ~~If the biogas flared and fuelled (or utilized) are continuously monitored separately, the two fractions can be added to determine the biogas recovered. In that case, recovered biogas need not be monitored separately.~~

~~and displays/outputs normalised flow of biogas, there is no need for separate monitoring of pressure and temperature of the biogas.~~

23. ~~Regular maintenance should ensure optimal operation of flares. The flare efficiency, defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process, shall be monitored and calculated as per the provision in the "Tool to determine project emissions from flaring gases containing methane".~~

24. Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy may consider applying 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, a destruction efficiency of 100% can be used for the amount that is combusted for energy.

25. ~~Flow meters, sampling devices and gas analysers shall be subject to regular maintenance, testing and calibration to ensure accuracy.~~

26. ~~The annual fossil fuel or electricity used to operate the facility or power auxiliary equipment shall be monitored. 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.~~

27. ~~Where relevant in accordance with paragraph 16, the fraction of manure handled in the storage devices ($MS\%_i$) and the interval between manure collection and commencement of treatment in anaerobic digester (AI_i) shall be monitored.~~

28. Where applicable, the proper soil application (not resulting in methane emissions) of the residual waste shall be monitored.

29. 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.

30. In case option in paragraph 9 (a) is chosen for baseline emission determination,

(a) The PDD shall describe the system used for monitoring the fraction of the manure handled in the animal manure management system ($MS\%_{,i,y}$), the average weight of the livestock (W_{site}) and the livestock population ($N_{LT,y}$) taking into account the average number of days the animals are alive in 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 weight shall be explained;

~~(b) The number of days that the animal manure management system capturing methane and flaring/combusting or gainfully using methane was operational (nd_y) shall be monitored;~~

(c) In case developed country *VS* values are being used the following shall be monitored:

(i) Genetic source of the production operations livestock originate from an Annex I Party;

(ii) The formulated feed rations (*FFR*). If equation 2 is used to estimate the value $VS_{default}$ (kg-dm/animal/day), the default average animal weight of a defined population (kg) shall be recorded and archived.

31. ~~In case option in paragraph 9 (b) is chosen for baseline emission determination, direct measurement of manure weight (~~$\cancel{Q_{manure,j,LT,y}}$~~) and specific volatile solids (~~$\cancel{SVS_{j,LT,y}}$~~) are to be undertaken.~~ $\cancel{SVS_{j,LT,y}}$ ~~can be on sample basis (maximum margin of error of 10% at a 90% confidence level). Manure weight shall be directly measured or alternatively manure volume can be measured together with the density determined from representative sample (90/10 precision). The quantity of animal manure from different farms and different animal types shall be recorded separately for crosscheck. Recording of the baseline animal manure management system where the animal manure would have been treated anaerobically is also required.~~

32. Relevant parameters shall be monitored as indicated in the Table below. The applicable requirements specified in the "General Guidelines to 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.

Table III.D.1: Parameters for monitoring during the crediting period

No.	**Parameter**	**Description**	**Unit**	**Monitoring/recording Frequency**	**Measurement Methods and Procedures**
1	$VS_{LT,y}$	Volatile solids for livestock *LT* entering the animal manure management system in year *y*	kg dry matter/animal/year	Annually	Only required when data from national published source are not available or IPCC default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A-4 to 10 A-9 are not used. When country-specific excretion rates is to be estimated from feed intake levels as indicated in the para 10(b), via the enhanced characterisation method (tier 2) described in section 10.2 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10, parameters of GE_{LT}, DE_{LT}, UE, ASH and ED_{LT} shall be monitored as detailed below to derive this value. When developed country values are to be used in the project, relevant parameters specified in the paragraph 10(d) and 30(c) shall be monitored/documented. In case IPCC default values are to be adjusted for a site-specific average animal weight as specified in para 10(c), the average animal weight of a defined livestock population at the project site (W_{site}) shall be monitored as detailed below.

2	$N_{da,y}$	Number of days animal is alive in the farm in the year y	Number	Annually, based on monthly records	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.
3	$N_{p,y}$	Number of animals produced annually of type LT for the year *y*	Number	Annually, based on monthly records	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.
4	W_{site}	Average animal weight of a defined livestock population at the project site	Kg	Annually	When IPCC values of VS are adjusted for site specific animal weight as per Para 10(c) and equation 2 sampling procedures can be used to estimate this variable as per General guidelines for sampling and surveys for SSC project activities.
5	$BG_{burnt,y}$	Biogas volume in year y	m^3	Annually, based on continuous flow measurement with accumulated volume recording (e.g. hourly/daily accumulated reading)	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).

6	$w_{CH4,y}$	Methane content in biogas in the year *y*	%		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 General guidelines for sampling and surveys for SSC project activities, or, alternatively a default value of 60% methane content can be used. Option chosen should be clearly specified in the PDD. 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).
7	*T*	Temperature of the biogas at the flow measurement site	^oC		As per the relevant procedure in AMS-III.H.
8	*P*	Pressure of the biogas at the flow measurement site	Pa		As per the relevant procedure in AMS-III.H.
9	FE	The flare efficiency	%		As per the "Tool to determine project emissions from flaring gases containing Methane". Regular maintenance shall be carried out to ensure optimal operation of flares.

10	$Q_{manure,j,LT,y}$	Quantity of manure treated from livestock type *LT* at animal manure management system *j*	Tonnes DM/year	Annually, based on daily measurement and monthly aggregation	As the case in para 9(b), manure weight shall be directly measured or alternatively manure volume can be measured together with the density determined from representative sample (90/10 precision). The quantity of animal manure from different farms and different animal types shall be recorded separately for crosscheck. Recording of the baseline animal manure management system where the animal manure would have been treated anaerobically is also required.
11	$SVS_{j,LT,y}$	Specific volatile solids content of animal manure from livestock type *LT* and animal manure management system *j* in year *y*	tonnes VS/tonnes DM	Annually	In case animal manure is treated in a centralized plant, as the case in para 9(b), testing shall be performed according to the guideline in Annex 2 of AM0073. It can be on sample basis by following General guidelines for sampling and surveys for SSC project activities , with a maximum margin of error of 10% at a 90% confidence level.
12		Parameters related to project emissions from incremental transportation distances in year *y*			Used to calculate $PE_{transp,y}$. As per the relevant procedure in AMS-III.AO.
13		Parameters related to project emissions from flaring of the residual gas stream in year *y*			Used to calculate $PE_{flare,y}$. As per the "Tool to determine project emissions from flaring gases containing Methane".

14		Parameters related to emissions from electricity and/or fuel consumption in year *y*			Used to calculate $PE_{power,y}$. As per the procedure in the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". 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.
15	$MS\%_{i,y}$	Fraction of manure handled in system i in project activity in year y	%	Annually, based on daily measurement and monthly aggregation	In case animal manure is treated in different treatment systems manure weight delivered to each system shall be directly measured or alternatively manure volume can be measured together with the density determined from representative sample (90/10 precision). The quantity of animal manure from different farms and different animal types shall be recorded separately for crosscheck. Recording of the baseline animal manure management system where the animal manure would have been treated anaerobically is also required.
16	AI_l	Annual average interval between manure collection and delivery for treatment at a given storage device *l*	Days	Annually, based on monthly records	It is to be used to calculate possible project emissions due the storage of animal manure, as per para 16.
17	nd_y	Number of days that the animal manure management system was operational	Days	Annually, based on daily records and monthly aggregation	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 $BE_{ex-post}$.

18	$MS\%_l$	Fraction of volatile solids handled by storage device *l*	%	Monthly	It is to be used to calculate possible project emissions due the storage of animal manure, as per para 16.
19	$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type *LT*	m^3 CH_4/kg dm	Annually	Only when developed country values are to be used in the project, in such a case relevant parameters specified in the paragraph 10(d) shall be monitored/documented.
20	GE_{LT}	Daily average gross energy intake in MJ/day	MJ/day	Annually	Only when country-specific excretion rates are to be estimated from feed intake levels as indicated in the para 10(b), via the enhanced characterisation method (tier 2) described in section 10.2 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10.
21	DE_{LT}	Digestible energy of the feed in percent	%		If IPCC tier 2 is used for VS determination. IPCC 2006 Table 10.2, Chapter 10, Volume 4
22	UE	Urinary energy expressed as fraction of GE	Fraction of GE		If IPCC tier 2 is used for VS determination. 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.

23	ASH	Ash content of the manure calculated as a fraction of the dry matter feed intake	Fraction of the dry matter feed intake		If IPCC tier 2 is used for VS determination. Use country-specific values where available.
24	ED_{LT}	Energy density of the feed in MJ/kg fed to livestock type LT	MJ/kg DM		If IPCC tier 2 is used for VS determination. 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.

Project activity under a programme of activities

33. The following conditions apply for use of this methodology in a project activity under a programme of activities:

In case 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.

Annex 1

ANAEROBIC UNIT PROCESS PERFORMANCE

Table III.D.2: Anaerobic Unit Process Performance

Anaerobic Treatment	**HRT**	**COD**	**TS**	**VS**	**TN**	**P**	**K**
	days	Percent 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

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Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

III.D. Methane recovery in animal manure management systems (cont)

History of the document *

Version	Date	Nature of revision
18	EB 63, Annex XX 29 September 2011	To include the monitoring table to clarify the monitoring requirements
17	EB 58, Annex 20 26 November 2010	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 para 2(c): • To change storage time from 5 days to 45 days.
16	EB 53, Annex 16 26 March 2010	To include additional guidance for long term storage of manure after removal from the animal barns.
15	EB 48, Annex 18 17 July 2009	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.
14	EB 38, Annex 11 14 March 2008	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	EB 33, Annex 32 27 July 2007	Revision of the approved small-scale methodology AMS-III.D to allow for its application under a programme of activities (PoA).
12	EB 31, Annex 22 04 May 2007	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	EB 28, Meeting report, Para. 64 23 December 2006	Removed the interim applicability condition i.e., 25 ktCO2e/y limit from all Type III categories.
10	EB 25, Annex 25 28 July 2006	To expand its applicability to cover project activities that change manure management practices e.g. from ‘lagoon’, ‘liquid/slurry’, ‘solid storage’ or ‘drylot’ to ‘anaerobic digestion’ for the treatment of swine or cattle manure.
9	EB 24, Meeting report, Para. 64 12 May 2006	Introduced the interim applicability condition i.e., 25ktCO2e/y limit for all Type III categories.
8	EB 23, Annex 25 03 March 2006	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		

[*] 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.

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).		
Version	**Date**	**Nature of revision**
07	EB 22, Para. 59 25 November 2005	References to "non-renewable biomass" in Appendix B deleted.
06	EB 21, Annex 22 20 September 2005	Guidance on consideration of non-renewable biomass in Type I methodologies, thermal equivalence of Type II GWhe limits included.
05	EB 18, Annex 6 25 February 2005	Guidance on 'capacity addition' and 'cofiring' in Type I methodologies and monitoring of methane in AMS-III.D included.
04	EB 16, Annex 2 22 October 2004	AMS-II.F was adopted, leakage due to equipment transfer was included in all Type I and Type II methodologies.
03	EB 14, Annex 2 30 June 2004	New methodology AMS-III.E was adopted.
02	EB 12, Annex 2 28 November 2003	Definition of build margin included in AMS-I.D, minor revisions to AMS-I.A, AMS-III.D, AMS-II.E.
01	EB 7, Annex 6 21 January 2003	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 **Business Function**: Methodology		