TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall apply the general guidelines to the SSC CDM methodologies, information on additionality (attachment A to Appendix B) and general guidance on leakage in biomass project activities (attachment C to Appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

III.F. Avoidance of methane emissions through composting

Technology/measure

1. This methodology comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS), or in an animal waste management system (AWMS), or in a wastewater treatment system (WWTS). In the project activity, controlled aerobic treatment by composting of biomass is introduced.

2. The project activity does not recover or combust landfill gas from the disposal site (unlike AMS-III.G "Landfill methane recovery"), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS-III.E "Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment"). Project activities that recover biogas from wastewater treatment shall use methodology AMS-III.H "Methane recovery in wastewater treatment". Project activities involving co-digestion of organic matters shall apply methodology AMS-III.AO "Methane recovery through controlled anaerobic digestion".

3. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

4. This methodology is applicable to the composting of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure.

5. This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility. For project activities that increase capacity utilization at existing facilities, project participant(s) shall demonstrate that special efforts are made to increase the capacity utilization, that the existing facility meets all applicable laws and regulations and that the existing facility is not included in a separate CDM project activity. The special efforts should be identified and described.

6. This methodology is also applicable for co-composting wastewater and solid biomass waste, where wastewater would otherwise have been treated in an anaerobic wastewater treatment system without biogas recovery. The wastewater in the project scenario is used as a source of moisture and/or nutrients to the biological treatment process e.g. composting of empty fruit bunches (EFB), a residue from palm oil production, with the addition of palm oil mill effluent (POME) which is the wastewater co-produced from palm oil production.

7. In case of co-composting, if it can not be demonstrated that the organic matter would otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero, whereas project emissions shall be calculated according to the procedures presented in this methodology for all co-composted substrates.

8. The location and characteristics of the disposal site of the biomass, animal manure and co-composting wastewater in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions, using the provisions of AMS-III.G, AMS-III.E (concerning stockpile), AMS-III.D "Methane recovery in animal manure management systems" or AMS-III.H respectively.

Project activities for composting of animal manure shall also meet the requirements under paragraphs 1, and 2 (c) of AMS-III.D. Further no bedding material is used in the animal barns or intentionally added to the manure stream in the baseline. Blending materials may be added in the project scenario to increase the efficiency of the composting process (e.g. to achieve a desirable C/N ratio or free air space value), however, only monitored quantity of solid waste or manure or wastewater diverted from the baseline treatment system is used for emission reduction calculation. The following requirement shall be checked *ex ante* at the beginning of each crediting period:

(a) Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or

(b) Establish that it is common practice in the region to dispose off the waste in solid waste disposal site (landfill)/stockpile(s).

9. The project participants shall clearly define the geographical boundary of the region referred in paragraph 8 (b), and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the source of the waste i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. Once defined, the region should not be changed during the crediting period(s).

10. In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.

11. In case produced compost is treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.

12. In case produced compost is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual organic content shall to be taken into account and calculated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".

Boundary

13. The project boundary is the physical, geographical site:

(a) Where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity;

(b) In the case of projects co-composting wastewater, where the co-composting wastewater would have been treated anaerobically in the absence of the project activity;

(c) Where the treatment of biomass through composting takes place;

(d) Where the products from composting (compost) is handled, disposed, submitted to soil application, or treated thermally/mechanically;

(e) And the itineraries between them (a, b, c, and d), where the transportation of waste, wastewater, where applicable manure, product of treatment (compost) occurs.

Baseline

14. The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter (including manure where applicable) are left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass solid waste or manure. When wastewater is co-composted, baseline emissions include emissions from wastewater co-composted in the project activity. The yearly Methane Generation Potential for the solid waste is calculated using the first order decay model as described in the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site". Baseline emissions from the manure composted are calculated as per the procedures of AMS-III.D.

Baseline emissions shall exclude emissions of methane that would have to be captured, fuelled or flared to comply with national or local safety requirement or legal regulations.

$$BE_y = BE_{CH4,SWDS,y} + BE_{ww,y} + BE_{CH4,manure,y} - MD_{y,reg} * GWP\_CH_4 \quad \textbf{(1)}$$

Where:

$BE_{CH4,SWDS,y}$	Yearly methane generation potential of the solid waste composted by the project activity during the years *x* from the beginning of the project activity (*x*=1) up to the year *y* estimated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (tCO_2e). The tool may be used with the factor "f=0.0" assuming that no biogas is captured and flared. With the definition of year *x* as 'the year since the project activity started diverting wastes from landfill disposal, *x* runs from the first year of crediting period (*x*=1) to the year for which emissions are calculated (*x*=*y*)'
$MD_{y,reg}$	Amount of methane that would have to be captured and combusted in the year *y* to comply with the prevailing regulations (tonne)
$BE_{CH4,manure,y}$	Where applicable, baseline emissions from manure composted by the project activities, as per the procedures of AMS-III.D
$BE_{ww,y}$	Where applicable, baseline emissions from the wastewater co-composted, calculated as per the procedures in AMS-III.H
GWP_CH_4	*GWP* for CH_4 (value of 21 is used)

Project Activity Emissions

15. Project activity emissions consist of:

(a) CO_2 emissions due to incremental transportation distances;

(b) CO_2 emissions from electricity and/or fossil fuel consumption by the project activity facilities;

(c) Methane emissions during composting process;

(d) Methane emissions from runoff water;

(e) In case the compost is stored under anaerobic conditions and/or delivered to a landfill: the methane emissions from the disposal/storage of compost.

$$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,comp} + PE_{y,runoff} + PE_{y,res\ waste} \quad \textbf{(2)}$$

Where:

PE_y	Project activity emissions in the year *y* (tCO_2e)
$PE_{y,transp}$	Emissions from incremental transportation in the year *y* (tCO_2e)

$PE_{y,power}$	Emissions from electricity or fossil fuel consumption in the year *y* (tCO_2e)
$PE_{y,comp}$	Methane emissions during composting process in the year *y* (tCO_2e)
$PE_{y,runoff}$	Methane emissions from runoff water in the year *y* (tCO_2e)
$PE_{y,res\ waste}$	In case produced compost is subjected to anaerobic storage or disposed in a landfill: methane emissions from the anaerobic decay of the residual organic content (tCO_2e)

16. Project emissions due to incremental transport distances ($PE_{y,transp}$) are calculated based on the incremental distances between:

(i) The collection points of biomass and/or manure and the compost treatment site as compared to the baseline solid waste disposal site or manure treatment site;

(ii) When applicable, the collection points of wastewater and treatment site as compared to baseline wastewater treatment site;

(iii) Treatment sites and the sites for soil application, landfilling and further treatment of the produced compost.

$$PE_{y,transp} = (Q_y / CT_y) * DAF_w * EF_{CO2} + (Q_{y,treatment} / CT_{y,treatment}) * DAF_{treatment} * EF_{CO2} \quad (3)$$

Where:

Q_y	Quantity of raw waste/manure treated and/or wastewater co-treated in the year *y* (tonnes)
CT_y	Average truck capacity for transportation (tonnes/truck)
DAF_w	Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck)
EF_{CO2}	CO_2 emission factor from fuel use due to transportation ($kgCO_2$/km, IPCC default values or local values may be used)
$Q_{y,treatment}$	Quantity of compost produced in year *y* (tonnes)
$CT_{y,treatment}$	Average truck capacity for compost transportation (tonnes/truck)
$DAF_{treatment}$	Average distance for compost transportation (km/truck)

17. For the calculation of project emissions from electricity and/or fossil fuel consumption by the project activity facilities ($PE_{y,power}$) all the energy consumption of all equipment/devices

installed by the project activity shall be included e.g. energy used for aeration and/or turning of compost piles/heaps, chopping of biomass for size reduction, screening, drying of the final compost product and for the runoff wastewater treatment. Emission factors for grid electricity used shall be calculated as described in AMS-I.D "Grid connected renewable electricity generation". For project activity 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.

18. Methane emissions during composting ($PE_{y,comp}$) shall be calculated as follows:

$$PE_{y,comp} = Q_y * EF_{composting} * GWP\_CH_4 \quad \textbf{(4)}$$

Where:

$EF_{composting}$	Emission factor for composting of organic waste and/or manure (t CH_4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default values are 10 g CH_4/kg waste treated on a dry weight basis and 4 g CH_4/kg waste treated on a wet weight basis. $EF_{composting}$ can be set to zero for the portions of Q_y for which the monitored oxygen content of the composting process in all points within the windrow are above 8%. This can be done via sampling with maximum margin of error of 10% at a 90% confidence level. For this purpose a portable oxygen meter can be used with lancets of at least 1 m length. In the case of forced aerated in-vessel and forced aerated pile composting systems continuous measurements may also be done using online sensors

19. Project emissions from runoff water from the composting yard ($PE_{y,runoff}$) are calculated as follows:

$$PE_{y,runoff} = Q_{y,ww,runoff} * COD_{y,ww,runoff} * B_{o,ww} * MCF_{ww,treatment} * UF_b * GWP\_CH_4 \quad \textbf{(5)}$$

Where:

$Q_{y,ww,runoff}$	Volume of runoff water in the year *y* (m^3)
$COD_{y,ww,runoff}$	Chemical oxygen demand of the runoff water leaving the composting yard in the year *y* (tonnes/m^3) For e*x ante* estimation, the volume of runoff water may be based in the area of the composting yard and the yearly average rainfall, and the COD for domestic wastewater may be used. For *ex post* calculations the measured volume and COD shall be used
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC default value of 0.25 kg CH_4/kg COD)
$MCF_{ww,treatment}$	Methane correction factor for the wastewater treatment system where the runoff water is treated (*MCF* value as per relevant provisions in AMS-III.H)
UF_b	Model correction factor to account for model uncertainties (1.12)[1]

20. Methane emissions from anaerobic storage and/or disposal in a landfill of the produced compost from the biological treatment ($PE_{y,res\ waste}$) are calculated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site". In addition, if storage of biomass under anaerobic conditions takes place due to the project activity that doesn't occur in the baseline situation, methane emissions due to anaerobic decay of this biomass shall also be considered.

Leakage

21. If the project technology is the equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects are to be considered (LE_y).

Monitoring

22. In the case of construction of new composting facilities or expansion of capacity of existing composting facilities, the emission reduction achieved by the project activity will be measured as the difference between the baseline emission and the sum of the project emission and leakage.

$$ER_y = BE_y - (PE_y + LE_y) \qquad \textbf{(6)}$$

Where:

ER_y	Emission reduction in the year *y* (tCO_2e)
LE_y	Leakage emissions in year *y* (tCO_2e)

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

In the case of increase of capacity utilization of existing composting facilities, the emission reduction achieved by the project activity will be measured as the difference between the baseline emission and the sum of the project emission and leakage, multiplied by the factor *r* as follows:

$$ER_y = (BE_y - PE_y - LE_y) * (1 - r) \quad \textbf{(7)}$$

The value for *r* is defined as:

$$r = WCOM_{BAU} / TWCOM_y \quad \textbf{(8)}$$

Where:

$TWCOM_y$	Total quantity of waste composted in year of (tonnes) at the facility
$WCOM_{BAU}$	Registered annual amount of waste composted (tonnes) at the facility on a business as usual basis calculated as the highest amount of annual compost production in the last five years prior to the project implementation

23. In case of projects involving increase of capacity utilization of existing composting facilities, the historical records of annual amount of waste treated at the facility in the last five years prior to the project implementation and additional information to cross check the historical records (e.g. invoices of compost sales) shall be provided for project activity validation.

24. The operation of composting facilities shall be documented in a quality control program, monitoring the conditions and procedures that ensure the aerobic condition of the waste during the composting process (e.g. temperature, moisture during different composting stages).

25. Soil application of the compost or slurry in agriculture or related activities will be monitored. This includes documenting the sales or delivery of the compost final product/slurry. It shall also include an in situ verification of the proper soil application of the compost/slurry to ensure aerobic conditions for further decay. Such verification shall be done at representative sample of user sites. The conditions for proper soil application ensuring aerobic conditions can be established by a local expert taking into account the soil conditions, crop types grown and weather conditions.

Project activity under a programme of activities

26. 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.

27. Relevant parameters shall be monitored as indicated in the Table III.F.1 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.F.1: Parameters for monitoring during the crediting period

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
1	Q_y , $Q_{y,treatment,i}$	Quantity of solid waste(excluding manure), produced compost	tons	Monthly	On-site data sheets recorded monthly using weigh bridge. Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier), also cross check with sales of compost
2	$Q_{y,ww,runoff}$	The runoff wastewater from composting yard	m³	Monitored with periodic measurements sufficient to comply with confidence/precision level of 90/10	Measurements are undertaken using flow meters or direct measurement of the accumulative volume overtime. Consisting of the wastewater applied in excess (i.e. moisture over and above the field capacity of the biomass being composted) and rainwater in the case of unroofed sites
3	$COD_{y,ww,runoff}$	The chemical oxygen demand of the runoff wastewater from composting yard	t COD/m³	Samples are representatively taken from unfiltered wastewater and measurements shall ensure a 90/10 confidence/precision level	Measure the COD according to national or international standards. COD is measured through representative sampling

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III.F. Avoidance of methane emissions through composting (cont)

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
4	CT_y, $CT_{y,treatment}$	Average truck capacity for transportation	tons/truck		On site measurement
5	DAF_w, $DAF_{treatment}$	Average incremental distance for raw solid or product transportation	km/truck	Annually	On site measurement, assumption to be approved by DOE
6	$TWCOM_y$	Total quantity of waste composted in year y at the facility	tons	Monthly	In the case of increase of capacity utilization of existing composting facilities, it is used for the calculation of the factor *r*
7		Check of aerobic conditions of the composting process			Technical measures shall be provided to ensure the aerobic conditions of the composting process. Oxygen content of the gas phase inside the windrows needs to be monitored, it can be done via multiple sample measurements throughout different stages of the composting process, with maximum margin of error of 10% at a 90% confidence level. For this purpose a portable oxygen meter can be used with lancets of at least 1 m length to measure oxygen in representative points within the spatial dimensions of windrow.

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III.F. Avoidance of methane emissions through composting (cont)

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
					In the case of forced aerated in-vessel and forced aerated pile composting systems continuous measurements may also be done using online sensors. O_2-measurement-instrument will be subject to periodic calibration (in accordance with stipulation of instrument-supplier)
8		Parameters related to emissions from electricity and/or fuel consumption			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
9		Parameters related to methane emissions from anaerobic disposal in a landfill of the solid waste (excluding manure)/compost			As per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"

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III.F. Avoidance of methane emissions through composting (cont)

No.	Parameter	Description	Unit	Monitoring/ recording Frequency	Measurement Methods and Procedures
10		Parameters related to baseline methane emissions from animal manure			As per relevant provisions in AMS-III.D
11		Parameters related to baseline emissions from wastewater co-composted			As per relevant provisions in AMS-III.H

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History of the document

Version	Date	Nature of revision
10	EB 59, Annex 5 18 February 2011	To correct the equation for emission reductions calculation in the case of an increase in capacity utilization of existing composting facility.
09	EB 58, Annex 21 26 November 2010	To deconsolidate AMS-III.F to limit the methodology to composting only; anaerobic digestion of biomass will be covered in the new methodology AMS-III.AO.
08	EB 48, Annex 20 17 July 2009	To include composting of manure and to clarify that the baseline waste disposal methods are to be assessed *ex ante*.
07	EB 47, Annex 24 28 May 2009	Provide more guidance regarding the calculation of project emissions from the compost taking into account specific characteristics of the composting technology/measure employed.
06.1	09 February 2009	Corrected title of the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”.
06	EB 41, Annex 19 02 August 2008	The applicability of the methodology is expanded to include controlled anaerobic digestion of solid organic waste which otherwise would have been left to decay in a waste disposal site.
05	EB 33, Annex 34 27 July 2007	Revision of the approved small-scale methodology AMS-III.F to allow for its application under a programme of activities (PoA)
04	EB 31, Annex 25 04 May 2007	Includes project activities that enhance the capacity utilization of existing compost facilities and provides methods to determine the eligible increased capacity utilization based on the historical records of the annual amount of waste composted at the facility.
03	EB 28, Annex 28 15 December 2006	The applicability of the category is expanded to include co-composting of wastewater along with biomass solid wastes; Methods to calculate baseline emissions from the co-composted wastewater are included and parameters for avoided methane emissions from the composted solid waste are revised. See paragraph 50 of the EB 28 meeting report. Removed the interim applicability condition i.e. 25 ktCO2e/y limit from all Type III categories.

02	EB 24, Meeting Report, Para. 64 12, May 2006	Introduced the interim applicability condition i.e. 25 ktCO2e/y limit from all Type III categories.
01	EB 23, Annex 22 24 February 2006	Initial adoption.
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