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

TYPE III - OTHER PROJECT ACTIVITIES

~~All the approved small-scale methodologies, general guidance to the methodologies, information on additionality and abbreviations can be found at: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html~~ Project participants shall take into account the general guidance to the methodologies, information on additionality, abbreviations and general guidance on leakage provided at http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html .

III.G. Landfill Methane Recovery

Technology/measure

1. This project category comprises measures to capture and combust methane from landfills (i.e., solid waste disposal sites) used for disposal of residues from human activities including municipal, industrial, and other solid wastes containing biodegradable organic matter.

2. If the recovered methane is used for heat or electricity generation the project can use a corresponding methodology under type I project activities.

3. ~~This category is applicable for project activities resulting in annual emission reductions lower than 25,000 ton CO_2e. If the emission reduction of a project activity exceeds the reference value of 25,000 ton CO_2e in any year of the crediting period, the annual emission reduction for that particular year is capped at 25,000 ton CO_2e~~

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

Boundary

5. The project boundary is the physical, geographical site of the landfill where the gas is captured and destroyed/used.

~~**Project Activity Direct Emissions**~~

6. ~~Total annual project activity related emissions shall be less than or equal to 15 kilo tonnes of CO_2 equivalent. Project activity emissions consists of:~~

~~(a) Methane not captured by the project and released to the atmosphere, which is estimated as the difference between the yearly methane generation potential and the sum of the methane recovered and combusted by the project activity.~~

~~(b) CO_2 emissions related to the power used by the project activity facilities. Emission factors for grid electricity or diesel fuel use as the case may be shall be calculated as described in category I.D~~

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III.G. Landfill Methane Recovery (cont)

$$\cancel{PE_y = (MB_y - MD_{y,project}) * GWP_{CH4} + PE_{y,power}}$$

~~where:~~

~~PE_y project activity emissions in the year "y" (tonnes of CO_2 equivalent)~~
~~MB_y methane generation potential in the year y (tonnes of CH_4)~~
~~$MD_{y,project}$ Methane estimated ex-ante in the project design document to be destroyed by flaring or fuelling in the project activity during the year "y" (tonnes of CH_4).~~
~~GWP_{CH4} Global Warming Potential for methane (value of 21)~~
~~$PE_{y,power}$ emissions through electricity or diesel consumption in the year "y"~~

~~Yearly Methane Generation Potential~~

7. ~~The method below is used to evaluate the yearly methane generation potential in the landfill. The quantity of methane projected to be formed during a given year is estimated using a first order decay model based on the discrete time estimate method proposed in the IPCC Guidelines[1]~~

$$\cancel{MB_y = \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j=A}^{D} A_{j,x} \cdot DOC_j \cdot \left(1 - e^{-k_j}\right) \cdot e^{-k_j \cdot (y-x)}}$$

~~where:~~

~~F fraction of methane in the landfill gas (default 0.5)~~
~~DOC_j per cent of degradable organic carbon (by weight) in the waste type j~~
~~DOC_f fraction of DOC dissimilated to landfill gas (IPCC default 0.77)~~
~~MCF Methane Correction Factor (fraction, IPCC default 1.0)~~
~~$A_{j,x}$ amount of organic waste type j landfilled in the year x (tonnes/year)~~
~~k_j decay rate for the waste stream type j~~
~~j waste type distinguished into the waste categories (from A to D), as illustrated in the table below~~
~~x year since the landfill started receiving wastes: x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)~~
~~y year for which LFG emissions are calculated~~

~~Table III.G.1. Waste stream decay rates (k_j) and associated IPCC default values for DOC_j~~

~~Waste stream A to E~~	~~Per cent DOC_j (by weight)~~	~~Decay-rate (k_j)~~
~~A. Paper and textiles~~	~~40~~	~~0.023~~
~~B. Garden and park waste and other (non-food) putrescibles~~	~~17~~	~~0.023~~
~~C. Food waste~~	~~15~~	~~0.231~~
~~D. Wood and straw waste 1)~~	~~30~~	~~0.023~~
~~E. Inert material~~	~~0~~	~~0~~

[1] *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000)*

~~1) Excluding lignin-C~~

~~8. The amount of organic waste type "j" landfilled in each year "x" ($A_{j,x}$) should be known. Alternatively, it can be considered as constant through the years. If the pre-existing amount and composition of the waste in the landfill are unknown, they can be estimated by comparison with other landfills with similar conditions in regional or national levels, using parameters related to the attended population. For projects in which the landfill will be operated during the crediting period, the waste amount and composition shall be monitored.~~

Yearly Methane Generation Potential

9. The estimation of the methane emission potential of a solid waste disposal site ($BE_{CH4,SWDS,y}$, in tCO_2e) shall be undertaken using the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", found on the CDM website[2]. The tool may be used with the oxidation factor (OX = 0.0), assuming no oxidation of methane in the covering layers, and the factor "f=0.0" assuming that no methane is captured and flared. The amount of waste type "j" deposited in each year "x" ($W_{j,x}$) shall be determined by sampling (as specified in the tool), in the case wastes are generated during the crediting period. Alternatively, for existing SWDS, if the pre-existing amount and composition of the wastes in the landfill are unknown, they can be estimated by using parameters related to the attended population or industrial activity, or by comparison with other landfills with similar conditions in regional or national levels.

Project Activity Emissions

10. Project activity emissions consist of CO_2 emissions related to the power used by the project activity facilities. Emission factors for electricity shall be calculated as described in category I.D.

Baseline

11. The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. Baseline emissions shall exclude methane emissions that would have to be removed to comply with national or local safety requirement or legal regulations:

$$\cancel{BE_y = (MB_y - MD_{reg,y}) \cdot GWP_{CH4}}$$

$$BE_y = BE_{CH4,SWDS,y} - MD_{reg,y}$$

Where:

$MD_{reg,y}$	methane emissions that would be captured and destroyed to comply with national or local safety requirement or legal regulations in the year "y" (tCO_2e)

Leakage

12. If the methane recovery technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects are to be considered.

[2] http://cdm.unfccc.int/Reference/Guidclarif

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Monitoring

13. Emission reductions achieved by the project activity in each year will be assessed ex-post through direct measurement of the amount of methane fuelled or flared. The maximal emission reduction in any year is limited to the yearly methane generation potential calculated in the project design document for that year.

14. The amount of methane recovered and fuelled or flared shall be monitored ex-post, using continuous flow meters. The fraction of methane in the landfill gas should be measured with a continuous analyser or, alternatively, with periodical measurements at a 95% confidence level. Temperature and pressure of the landfill gas are required to determine the density of methane combusted.

15. 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. One of the two following options shall be used to determine the efficiency of the flaring process in an enclosed flare:

a. To adopt a 90% default value or

b. To perform a continuous monitoring of the efficiency.[3]

If option (a) is chosen, continuous check of compliance with the manufacturers specification of the flare device (temperature, biogas flow rate) should be done. If in any specific hour any of the parameters is out of the range of specifications, 50% of default value should be used for this specific hour. For open flare 50% default value should be used, as it is not possible in this case to monitor the efficiency. If at any given time the temperature of the flare is below 500^{0}C, 0% default value should be used for this period.

16. The emission reduction achieved by the project activity can be estimated ex-ante in the PDD by:

$$ER_{y,estimated} = BE_y - PE_y - Leakage$$

The actual emission reduction achieved by the project during the crediting period will be ~~measured~~ calculated using the amount of methane recovered and destroyed by the project activity, calculated as:

$$ER_{y,calculated} = MD_y - MD_{reg,y} - PE_y - Leakage$$

Where:

MD_y methane captured and destroyed by the project activity in the year "y" (tCO_2 e), that will be measured using the conditions of the flaring process:

$$\cancel{ER_{project,y} = LFG_{burnt,y} * w_{CH4,y} * D_{CH4,y} * FE * GWP_{CH4}}$$

$$MD_y = LFG_{burnt,y} * w_{CH4,y} * D_{CH4,y} * FE * GWP_{CH4}$$

[3] The procedures described in the Methodological Tool to determine project emissions from flaring gases containing methane shall be used.

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III.G. Landfill Methane Recovery (cont)

Where:

~~$ER_{project,y}$~~	~~emission reduction of the project activity in the year "y" (tonnes of CO2 eq.)~~
$LFG_{burnt,y}$	landfill gas[4] flared or ~~fuelled~~ used as fuel in the year "y" (m^3).
$w_{CH4,y}$	methane content[4] in landfill gas in the year "y" (mass fraction).
$D_{CH4,y}$	density of methane at the temperature and pressure of the landfill gas in the year "y" ($tonnes/m^3$).
FE	flare efficiency in the year "y" (fraction).

17. ~~The method for the integration of the terms in the equation above and 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.~~

18. 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.

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

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[4] Landfill gas and methane content measurements shall be on the same basis (wet or dry)