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 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. The recovered methane from the above measures may also be utilised for the following applications instead of flaring or combustion:

   (a) Thermal or electrical energy generation directly; or

   (b) Thermal or electrical energy generation after bottling of upgraded biogas; or

   (c) Thermal or electrical energy generation after upgrading and distribution using one of the following options:

      (i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; or

      (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or

   (d) Hydrogen production.

3. If the recovered methane is used for project activities covered under paragraph 2 (a), that component of the project activity shall use a corresponding category under type I.

4. If the recovered methane is used for project activities covered under paragraph 2 (b) or 2 (c) relevant provisions in AMS III.H related to upgrading of biogas, bottling of biogas, injection of biogas into a natural gas distribution grid and transportation of biogas via a dedicated piped network shall be used.

5. If the recovered methane is used for project activities covered under paragraph 2 (d) that component of the project activity shall use corresponding methodology AMS III.O.

6. 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

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

Yearly Methane Generation Potential

8. 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[1]. The tool may be used:

- With the-factor "f=0.0" assuming that no methane is captured and flared.
- With the definition of year x as 'the 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)'.

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

9. 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

10. 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:

$$\boldsymbol{BE_y = BE_{CH4,SWDS,y} - MD_{reg,y}} \qquad \textbf{(1)}$$

Where:

$\boldsymbol{MD_{reg,y}}$	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

11. 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.

Monitoring

12. 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 or gainfully used. ~~The~~

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

~~maximal emission reduction in any year is limited to the value of the yearly methane generation potential calculated in the project design document for that year multiplied by the efficiency of the recovery system. The value of the efficiency of the recovery system used shall be lower than 50%.~~

13. The amount of methane recovered and gainfully used, 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.

14. In case of project activities covered under paragraph 2(b), 2(c) and/or 2(d), the project participants shall maintain a biogas (or methane) balance based on:

(a) Continuous measurement of the amount of biogas captured at the landfill gas recovery system;

(b) Continuous measurement of the amount of biogas used for various purposes in the project activity: e.g. heat, electricity, flare, hydrogen production, injection into natural gas distribution grid, etc. The difference is considered as loss due to physical leakage and deducted from the emission reductions.

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.[2]

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:

$$ER_{y,estimated} = BE_y – PE_y - Leakage \qquad \textbf{(2)}$$

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

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

$$ER_{y,calculated} = MD_y - MD_{reg,y} - PE_y - Leakage \quad (3)$$

Where:

MD_y	Methane captured and destroyed/gainfully used by the project activity in the year "y" (tCO_2 e). In case of flaring/fuelling it shall be ~~that will be~~ measured using the conditions of the flaring process:

$$MD_y = LFG_{burnt,y} * w_{CH4,y} * D_{CH4,y} * FE * GWP_{CH4} \quad (4)$$

Where:

$LFG_{burnt,y}$	Landfill gas[3] flared or used as fuel in the year "y" (m^3).
$w_{CH4,y}$	Methane content[3] 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 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.

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

Project activity under a programme of activities

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

19. 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.

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