Approved Baseline and Monitoring Methodology AM0003

Simplified Financial Analysis for Landfill Gas Capture Projects

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Selected Approach from Paragraph 48 of the CDM Modalities & Procedures

"Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment."

Applicability

To landfill gas capture project activities where:

- The captured gas is flared; or
- The captured gas is used to generate electricity, but no emission reductions are claimed for displacing or avoiding electricity generation by other sources.

It is applicable only where the only plausible outcomes are a business-as-usual scenario (with minor changes and modifications) and the proposed project, i.e., where a plausible outcome is substantial change in practice or technology.

Emission Reduction

$$ER_y = (MDproject_y - MDbaseline_y) \times GWP\_CH_4$$

Where:

ER_y = The greenhouse gas emission reduction achieved by the project activity during a given year (tonnes CO_2)

$MDproject_y$ = The amount of methane actually destroyed (tonnes)

$MDbaseline_y$ = The amount of methane destroyed in the absence of the project activity (tonnes)

= $MDproject_y$ X EAF

GWP_CH_4 = The approved Global Warming Potential value for methane

EAF = The “Effectiveness Adjustment Factor” , i.e. the effectiveness of the gas collection systems that would be imposed by regulatory or contractual requirements or similar circumstances at the time of inception of the project.

Then:

$$ER_y = MDproject_y\ (1 – EAF)\ \ x\ GWP\_CH_4$$

Taking into considerations that :

- The default value for the Effectiveness Adjustment Factor (EAF) is 20%.
- The approved GWP_CH_4 for the first commitment period is 21 tonnes CO_2e/tonne CH_4. (until December 31, 2012).

$$MDproject_y = MDflared_y + MDelectricity_y$$

$$MDflared_y = LFG_y * F\_CH_{4y} * FE * D\_CH_4$$

Where :

LFG_y = The quantity of landfill gas flared during the year measured in (m^3),

F_CH_{4y} = The methane fraction of the landfill gas as measured periodically during the year.

FE = The flare efficiency (the fraction of the methane destroyed) expressed as a fraction.

D_CH_4 = The methane density expressed in tonnes/m^3 of methane

$$MDelectricity_y = EG_y * HR / EC\_CH_4$$

Where:

EG_y = The amount electricity generated during the year measured in MWh

HR = The heat rate of the electricity generator measured in GJ/MWh.

EC_CH_4 =The energy content of methane measured in GJ/tCH_4.

Baseline

- It considers that some of CH_4 generated by the landfill may be captured and destroyed to comply with regulations or contractual requirements, or to address safety and odour concerns.
- EAF (The fraction of the methane captured and destroyed in the baseline) changes over the course of the crediting period, and shall be revised at the start of each new crediting period.
- The project proponents should demonstrate that there are no regulatory, contractual or other requirements that would require a larger fraction of CH_4 (than 20%) to be destroyed in the absence of the project.

Additionality

Step 1:

No plausible baseline scenario except the project & the BAU scenarios.

Step 2:

Calculate IRR for the proposed project activity excluding expected revenue from the sale of CERs & taking into considerations:

- The incremental investment cost,
- R+M costs,
- All other costs of upgrading the BAU scenario to the proposed project activity.
- All revenues generated by the project activity (from the sale of electricity and cost savings due to avoided electricity + cost saving due to avoided electricity purchases) except revenue from the sale of CERs.

Step 3:

If $IRR_{project}$ < The conservatively acceptable IRR

Then:

- The project is not an economically attractive course of action.
- The BAU alternative is the most economically attractive course of action and the most likely baseline scenario, i.e. the project is additional.

Step 4:

Analyze the anticipated development of the most likely baseline scenario during the crediting period and provide a summary description.

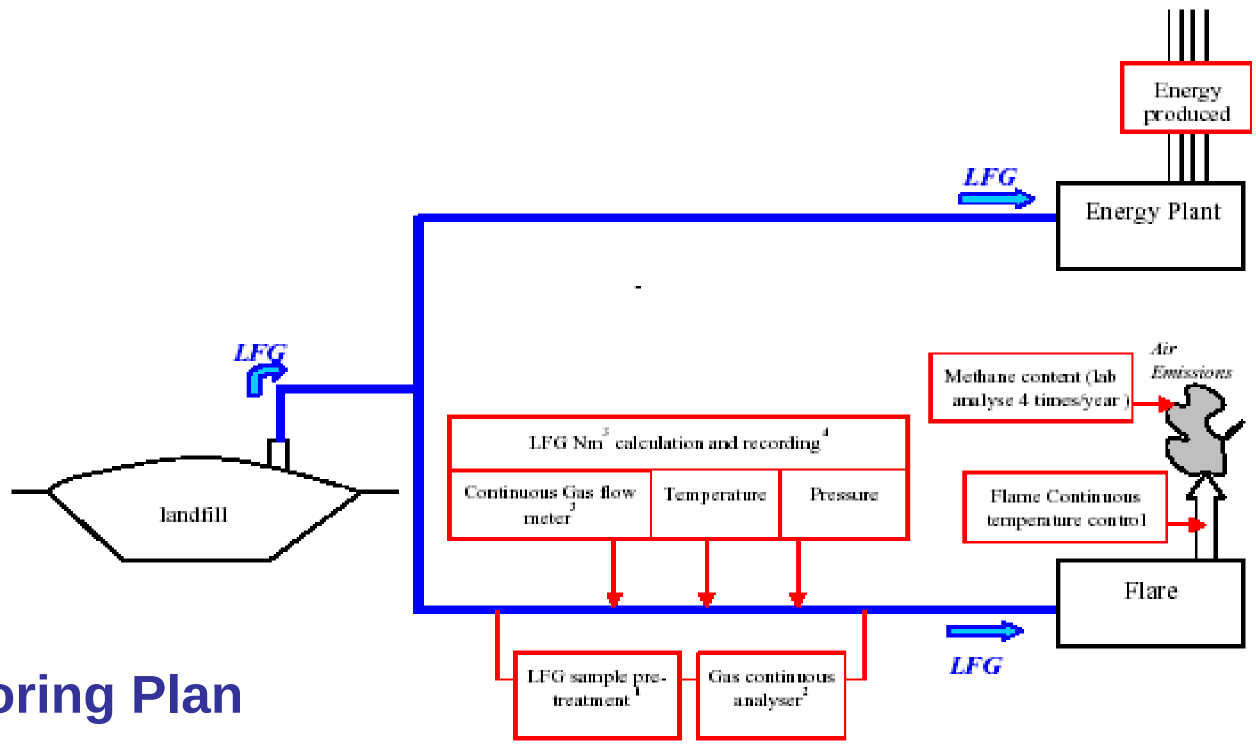
Leakage

Source : The emission from generating the electricity used to pump the landfill gas in the additional collection equipment.

No leakage : If sufficient electricity is generated from recovered landfill gas to operate the collection system.

Monitoring Methodology is based on **direct measurement** of :

- The amount of landfill gas captured and destroyed at the flare platform, &
- The electricity generating unit(s)



Monitoring Plan

- The main **variables** that need to be determined are :
  - o $MDflared_y$ [LFGy(m^3), F_CH_4(%) FE & flare working hours]
  - o $MDelectricity_y$ [EGy(MWh), HR(GJ/MWh) & EC_CH_4(GJ/tCH_4)]

- The electricity used by the pumping equipment for the collection system needs to be metered to estimate leakage. The electricity sold to the grid should be deducted from that purchased prior for the same reason.

- Continuous flow meter & continuous methane analyzer are needed:
  - To measure the actual quantity of landfill gas flared
  - To measure the methane content of the landfill gas flared as it can vary by more than 20% during a single day due to gas capture network conditions (dilutin with air at wellheads, leakage on pipes, etc.)

- A strong QC/QA procedure for the calibration of the measurement equipment for gas quality (humidity, particulate, etc.) is needed.

Data to be collected or used to monitor emissions from the project activity, and how this data will be archived

ID	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic : e / paper : p)	For how long is archived data kept?	Comment
1 LFG_y	Amount of landfill gas to flares	m^3	m	Continuous	100%	electronic	Duration of crediting period	Measured by a flow meter. Data will be aggregated monthly and yearly.
2 EG_y	Amount of electricity generated	MWh	m	Continuous	100%	electronic	Duration of crediting period	Measured by a kWh meter. Data will be aggregated monthly and yearly
3 HR	Heat rate of the generator	GJ/MWh	m and c	Semi-annual, monthly if unstable	n/a	electronic	Duration of crediting period	Data will be used to test and, if necessary, correct the generator's name plate heat rate
4 FE	Flare efficiency	%	m and c	Semi-annual, monthly if unstable	n/a	electronic	Duration of crediting period	Methane content of flare exhaust gas
5 F_CH4y	Methane fraction in the landfill gas	%	m and c	Continuous	100%	electronic	Duration of crediting period	Measured by continuous gas quality analyzer
6	Annual Carbon Dioxide Equivalent Avoided	%	e	Every 7 years	A minimum of 10 control sites	electronic	Duration of crediting period	

The approved monitoring methodology AM0002 (Greenhouse Gas Emission Reductions through Landfill Gas Capture and Flaring where the Baseline is established by a Public Concession Contract) also required monitoring of: the LFG temperature and pressure, flare temperature, and flare working hours. These variables shall also be monitored here unless the project developer can justify that this information is not needed in order to adequately estimate LFG_y.

Data to be collected or used to monitor leakage, and how this data will be archived

ID	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic : e / paper : p)	For how long is archived data kept?	Comment
3.1	Electricity	Total amount electricity used for gas pumping	[kWh]	m	Continuously	100%	Daily : e Monthly : p	Project lifetime	

Quality control (QC) and quality assurance (QA) procedures to be undertaken for the items monitored. *(see tables above)*

Appropriate quality control and quality assurance procedures are needed for the monitoring equipment and the data collected.

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
1 LFG_y	Low	yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
2 EG_y	Low	yes	Electricity meters will be subject to a regular maintenance and testing regime to ensure accuracy. Their readings will be checked by the electricity distribution company.
3 HR	Low	yes	Regular maintenance will ensure optimal operation of engines and generators. The heat rate will be checked semi-annually, with monthly checks if the heat rate shows significant deviations from previous values.
4 FE	Low	yes	Regular maintenance will ensure optimal operation of flares. Flare efficiency will be checked semi-annually, with monthly checks if the efficiency shows significant deviations from previous values.
5 F_CH4y	Low	yes	The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy.

Miscellaneous Parameters

Factor Used for Converting Methane to Carbon Dioxide Equivalents[1]

Factor used (CO_2e/CH_4)	Period Applicable	Source
21	1996-present	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories

[1] This table is updated as reporting guidelines are modified.

Conversion Factors[1]

	Factor	unit	Period Applicable	Description/Source
Methane Energy Content		GJ/tCH_4		
Methane Density	0.0006498	tonnes CH_4/m^3CH_4 (STP)	default	Density should be corrected for local climate and altitude.

[1] This table is updated as more scientific information becomes available or reporting guidelines are modified

Thanks