Annex 13

GUIDELINES TO CALCULATE THE FRACTION OF METHANE IN THE LANDFILL GAS FROM PERIODICAL MEASUREMENTS

(Version 01)

I. Background

1. In its 47th meeting, the Board noted that the revised version of ACM0001 (version 11), to allow only the option of continuous measurement of methane content of the landfill gas, addressed the issues for new projects to be registered under the methodology, however the issue of periodic monitoring had to be addressed for the projects which were under validation/registration or already registered, or for those projects which would use the older version due to applicable grace period. The following guidelines provide a description on how to perform periodic monitoring of the fraction of methane in the landfill gas and how to use the results of these measurements in the methodology. This guidance is applicable to all the older versions (from version 1 to version 10) of ACM0001, and methodologies consolidated under ACM0001 (AM0002, AM0003, AM0010, AM0011).

II. Guidelines and procedure

- A systematic **random** sampling scheme should be implemented. All samples taken on the fraction of methane in the landfill gas should be included in the calculations. The project proponents should explain the systematic random sampling undertaken e.g., Starting at Hour *i* in Month *j* with increment *k* hours throughout the project year;
- A minimum of 4 measurements of fraction of methane in the landfill gas per year should be conducted. However, it should be noted that choosing a low number of measurements will result in a wider 95% confidence interval and hence in a lower value of methane content ($w_{CH4,y}$);
- Based on the set of data collected, the value correspondent to the lower bound of the 95% confidence level should be calculated. The following formulae explains how to calculate the fraction of methane in the landfill gas ($w_{CH4,y}$).

(1) Calculate sample mean (μ).

$$\mu_{WCH4,y} = \frac{\sum_{m=1}^{n_m} w_{CH4,m,y}}{n_m} \quad \textbf{(1)}$$

Where:

$\mu_{WCH4,y}$ = Mean of the fraction of methane in the landfill gas in year *y* (m^3CH_4/m^3 LFG)
$w_{CH4,m,y}$ = Monitored fraction of methane in the landfill gas in measurement *m* in year *y* (m^3CH_4/m^3 LFG)
n_m = Number of measurements *m* in year *y* (minimum is 4)

(2) Calculate the sample standard deviation (σ).

$$\sigma_{WCH4,y} = \sqrt{\frac{\sum_{m=1}^{n_m}(w_{CH4,m,y} - \mu_{CH4,y})^2}{n_m - 1}} \quad \textbf{(2)}$$

Where:

$\sigma_{WCH4,y}$ = Standard deviation of the fraction of methane in the landfill gas in year *y* (m^3CH_4/m^3 LFG)

(3) Calculate the 95% confidence interval.

$$\mu_{WCH4,y} - t \cdot \frac{\sigma_{WCH4,y}}{\sqrt{n_m}} \leq w_{CH4,y} \leq \mu_{WCH4,y} + t \cdot \frac{\sigma_{WCH4,y}}{\sqrt{n_m}} \quad \textbf{(3)}$$

Where:

t = Value from standard *t* distribution for a confidence level of 95% with degrees of freedom n_m-1

(4) Use the lower bound of the 95% confidence interval obtained below to ensure conservativeness.

$$w_{CH4,lb,y} = \mu_{WCH4,y} - t \cdot \frac{\sigma_{WCH4,y}}{\sqrt{n_m}} \quad \textbf{(4)}$$

Where:

$w_{CH4,lb,y}$ = Lower bound of the 95% confidence interval of fraction of methane in the landfill gas (m^3CH_4/m^3 LFG)

(5) The value of $w_{CH4,lb,y}$ estimated in equation 4 should be used in the methodology as the final value for fraction of methane in the landfill gas in the year y.

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History of the document

Version	Date	Nature of revision(s)
01	EB 48, Annex 13 17 July 2009	Initial adoption.
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