EMISSION MEASUREMENTS AS A TOOL TO IMPROVE METHANE EMISSION ESTIMATES

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Due to a successful national waste management policy the amount of organic materials processed on Dutch landfills has significantly decreased. At the same time the composition of the waste has changed. Landfills nowadays contain less biodegradable material and less moisture. This most likely reduces the amount of methane that is produced per tonne of organic material. Application of the IPCC-methodology to quantify national methane emissions from landfills probably will overestimate future emissions in the Netherlands. Consequently the emission reduction achieved in the period 1990-2010 as a result of current waste policy could be underestimated. This motivated the research effort to improve methods to quantify methane emission of Dutch landfills through emission measurements, as presented in this paper.

Two strategies were defined to improve national LFG emission estimates: either measure all landfills or measure enough representative landfills and validate the existing models. The Dutch government has chosen for model validation. The objective of an estimate determines the best measurement technique or strategy. National estimates of methane emissions from landfills require other types of measurements than determination of the effect of measures taken at a single landfill site. The objective of this research was to develop and compare measurement methods that would be useful both to landfill operators and the national government, ultimately resulting in methods that can measure emissions of a whole landfill, for longer times at acceptable costs. The methods selected to develop were the mass balance method (MBM) and the stationary plume method (SPM) (Scharff et al., 2001). Due to the small sampling area and the high spatial variability of emissions box-methods are considered less suitable (conclusions workshop on LFG emission measurements, Sardinia 2001). Plume measurements (FTIR, TDL) are considered the most reliable method to obtain whole landfill emission estimates at a specific moment in time, but too expensive for all-year monitoring. So plume measurements were used as reference.

Table 1. Production, extraction and emission in m³/hr

Landfill	Nauerna	Braambergen	Merwedehaven	Wieringermeer
Surface m²	720,000	296,000	350,000	180,000
Waste Mton	7.7	1.7	5.3	1.6
Emission MBM	527 ± 25%	109 ± 25%	386 ± 25%	83 ± 25%
SPM	750 ± 780	440 ± ?	820 ± 700	227 ± 194
1st TDL	1,400 ± 370	540 ± 108	390 ± 100	166 ± 43
2nd TDL	900 ± 150			
3rd TDL	496 ± 222			

* using parameter values obtained from the validation by Oonk et al. (1995).

On all landfills the emission was between 0.5 and 2.5 l/m².h. Plume measurements performed on different days gave different results: so emissions vary significantly from time to time. This confirmed our first preassumption, that more plume measurements are required to obtain a more reliable estimate, which makes the method rather costly.

The method of validation is comparison with other measurement methods and with prognosis of landfill gas formation. It should be noted that information on amounts of waste, age and especially composition is often not accurately known. In this situation it is not useful to pursue very accurate measurements.

LFG formation models are hardly validated by sufficient field data. For validation whole landfill data should be available from a larger group of landfills. The only validations known to us that meet these requirements are the studies of Oonk et al. (1995) and Huitric et al. (1997) for the Netherlands and California respectively. These formation models are considered quite satisfactory and on average about 20-25% accurate. Both studies used the results of landfill gas recovery projects to obtain validated models. Oonk et al. performed emission measurements in addition for further evaluation of the applicability of the models.

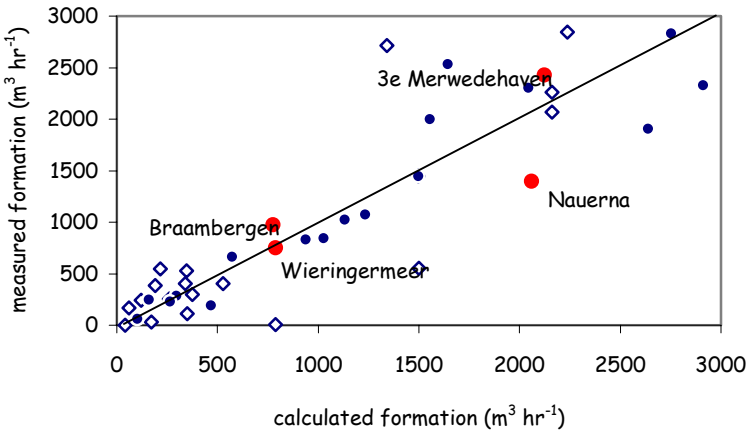

Figure 1. Data of this research in relation to validation of Oonk (1995).

Concluding remarks

The measurements and experience indicate that SPM and TDL measurements give results in the same order of magnitude; however the inaccuracy of both methods is large. MBM results in lower emissions and at the moment we are evaluating whether this is an artifact of this method, e.g. due to the central position of the equipment that never measures a possibly increased emission at the leeward side or due to inaccurate determination of background concentrations. The results of the MBM-measurements however suggest that LFG formation models are not that bad, also for the new situation.

References

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