

METHODOLOGY DEVELOPMENTS FOR MEASURING BIOGAS EMISSIONS FROM LANDFILL SURFACE

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According to the Kyoto's Protocol and the European Directive EPER (European Pollutant Emission Register), the assessment of landfill gas (LFG) emissions is becoming an important issue. The improvement of landfill cover quality and gas recovering systems are the main actions undertaken. As a part of the quality control, leakage detection is a main issue for assessing the reduction of LFG emissions. To achieve this task, two kinds of outputs are sought: (i) identification of local leakage areas and (ii) global estimation (at landfill scale) of biogas emission fluxes.

Classical techniques usually focus on only one of these issues. Some of them propose assessment techniques for the total biogas emission of a whole landfill but without precise locations of leakage areas. The other ones provide these local data, but the spatial distribution of emission zones often requires a too high density of measurement points for an accurate evaluation of landfill total emission.

For 10 years, ISSeP is developing a simple and low cost local surveying method consisting in dense biogas concentration measurements achieved all over landfill surface with portable gas analysers. It is similar to instantaneous surface monitoring (ISM) methodology. The portability of the used devices and the measurement quickness allow designing high resolution gridded spatial sampling campaigns, providing high resolution estimated concentration map. Nevertheless, these mapped values may not be considered as LFG fluxes, which require the use of flux chambers measurements in order to correlate the methane concentrations observed on emitting surface for real significant meaning.

In 1996, INERIS patented its own system, based on a specific flux chamber coupled with gas analysis devices. This method yields meaningful biogas fluxes measurements. However, INERIS's measuring system is less portable and requires longer acquisition times. Also, due to the longer field work with flux chamber, flux chamber surveys need to focus the characterisation on medium to high fluxes in order to minimize errors on the emissions measurement.

This work aims at combining the advantages of both ISSeP and INERIS methodologies. The final objective of the project is to propose a standard methodology for drawing LFG emission fluxes maps. Those maps should combine adequately sparse reference fluxes measurements with high spatial density concentration measurements. This calls for defining an optimal sampling design and which type of geostatistical processing has to be undertaken in order to achieve this combination at best. The produced LFG emission fluxes maps may finally be used at the same time to identify emission hot spots in order to plug them, and to calculate landfill scale emission fluxes estimates to fulfil the information required within the framework of the climate change related regulations.

This paper focuses on a preliminary step involving the investigation of the relationship between concentration and fluxes measurements. Fluxes measurement protocol has been established by INERIS and will be used as it. The challenge is to define a standardised concentration measure protocol that

provides the best possible relationship with fluxes emissions estimates. Several issues have to be investigated:

- The choice of the support (sampling area) of a single measurement: reliability of measurements obtained with Ø20 cm standard bell probes have to be compared with values obtained with the Odotech Ø50 cm bell probe.
- The choice of the sampling protocol: if the small bell probe is chosen, is a unique measure sufficient or gives the mean of a composite sample of 5 measurements in a cross-design better correlation with fluxes measurements?
- The choice of a measurement device: FID device (PortaFID) and IR-probe (Ecoprobe) are routinely used by ISSeP. The first one has a sensitivity window ranging from nearly 0 to 11 000 ppm while the sensitivity of the second ranges from 300 to 500 000 ppm. May one of them be used alone or should they be coupled in order to cover the whole range of values?
- Which value should be put in relationship with the fluxes: the mean concentration? The maximal concentration? The maximum slope of the time running concentration curve?

Additional issues which will be investigated are related with the influence of weather (and especially wind) conditions and the interference of biogas pumping wells.

Several survey campaigns are in progress or planned on a SITA's landfill set in Charleroi (Belgium), to answer those questions. The paper will present the results of these campaigns and propose a standard concentration measurement protocol and a methodology for establishing the relationship between concentration and fluxes measurements.

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