Abstract submitted for poster session

BIOGAS FUGITIVE EMISSION ON LANDFILL SURFACE -COMPARATIVE TEST OF "ON SITE GAS ANALYSIS DEVICES"

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BACKGROUNG

Fugitive emissions through landfill capping system consist mainly of methane and carbon dioxide. These gases imply direct and indirect greenhouse effect and contribute to contamination of the atmosphere. Methane emissions are energy and heat reducer as it escapes to the atmosphere prior to valorization and then cause a cut in exploitation efficiency.

As regards on site measurements of biogases concentration in such emissions, it's a challenge for devices manufacturer to provide a good compromise between linearity of answer, detection limit, reliability, exactitude and flexibility in use (BRGM, 2000).

For 10 years, ISSeP have been controlling the gaseous and liquid emissions of several landfills in Wallonia. Within this framework, flame ionisation detector (FID) is used for methane emission detection and localisation in landfill capping system. Portable devices used for this task (PORTAFID m2 and M3K) give semi-quantitative measurements of methane concentration within the range of 0-10.000 ppm. Such technical performances only allow distinguishing zones with significant degasification from those producing negligible emissions. Within the zones with strong release (>10.000 ppm), the intensity of emission remains unknown. In addition, portable FID works on CH4 exclusively, without providing any information on the other components of biogas (CO2, Hydrocarbons, O2).

OBJECTIVE AND METHODOLOGY

The objective of present research is to test another type of portable gas analyser, based on IR technology and to compare its performances on surface biogas emission with traditional FID devices.

The tested detector (ECOPROBE 5 – RS Dynamics), is equipped with a multi-channel probe. It has been developed with the main vocation of detecting and characterizing soils contaminated with any hydrocarbons. Its theoretical performances in CH4 detection should be better than FID by giving a response in a 50-500.000 ppm range (according to manufacturer's technical chart). Furthermore, it offers simultaneous measurement of Temperature, CO2 (IR probe) and O2 (paramagnetic probe) and should be able to detect ionisable hydrocarbons (PID probe). In other words, announced performances of ECOPROBE 5 should let it able to supplant definitively FID detectors.

The comparative study aims to validate CH4 concentrations measured with ECOPROBE by comparing them with measurement achieved with other devices. Giving the wide working range of ECOPROBE5, various others detectors has been used for the validation:

- Range 0-1.000 ppm : PORTAFID M2/M3K, Static FID HC51M (Environnement S.A.);
- Range 1.000 ppm-1% : PORTAFID M2/M3K ;
- Range 1-50% : CH4 IR field-analyser GA2000 (Geotechnical Instruments Ltd).

The comparative test has been carried out on three series of gas samples:

- The first batch is obtained by diluting, at various ratios, a 50% CH4/air etalon gas.
- The second series results of similar dilution protocol but starting from some "natural landfill biogas" taken at the production unit of Hallembay's landfill.
- The samples of the third series have been sampled directly on the surface of a capped landfill cell by volumetric pump connected with the sampling cane of FID apparatus.

RESULTS AND DISCUSSION

Tested Field CH4 detectors give more than a binary response (presence or absence of CH4); they furnish a value aiming to be the CH4 concentration measured in the air. However, the precision of CH4 quantification depends on many parameters varying from one to other device and-or sampling method. Comparing performances between detectors is really not easy, especially when the working range is wide.

ECOPROBE5 comprise many advantages compared with traditional FID apparatus:

- Wider working range for CH4 measurements (up to 50 time the upper limit of FID) ;
- Very good linearity and precision in this range ;
- Wider spectrum of component (CH4, CO2, O2, T°).

Moreover, ECOPROBE5 is easy to use on field, stores results in a dischargeable electronic file, can be used as "fix station" with automatic sampling during log period of time. According yo the manufacturer, it is insensible to humidity and flow variations. Nevertheless, the measured detection limit does really not reach the announced value of 50 ppm. It is due to the calibration system. Standard version of ECOPROBE is optimised for being able to give a response to a wide range of soil contamination problems. This optimisation increases the detection limit when measuring CH4 in a landfill biogas in which it is extremely prevailing on other components.

PID detector seems to be useless in the particular case of COV's measurement in landfill biogas. It is probably due to quenching problems (masking of COV's caused by the high concentrations of CH4 in the gas).

CONCLUSIONS AND PERSPECTIVES

There is currently no universal solution for resolving the problem of on site CH4 concentration measurement in fugitive emissions through landfill capping. The needed detection range (50-50000 ppm) is too wide to be covered by any existing apparatus, at least in their "standard calibrated" version.

Among existing devices, ECOPROBE5 is one of the most polyvalent, and offers the wider working range. However, in its commercial version, the measured detection limit is 10 to 20 times higher than the needed 50 ppm. According to the manufacturer, it is technically possible to change the intern software of "inter-component correction" in order to obtain lower detection limit for CH4. Another research perspective is to couple the FID detector with a system of on site gas dilution. So, it should be possible to measure indirectly CH4 concentration higher than the 10.000 threshold by analysing the gas after being preliminary diluted with a known ratio.