FLAME IONISATION DETECTOR AND LINEAR KRIGING METHOD FOR LANDFILL CAP LEAKAGE DETECTION

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Introduction

Landfills have been reported as the largest anthropogenic source of atmospheric methane in the world (Bogner *et al.,* 1997) and as a significant contributor to global warming in greenhouse gaz scenarios (IPPC, 1996). According to IPPC, landfills accounts for about 10% of the annual global emission of methane to the atmosphere.

In landfills, methane emissions are energy and heat reducers as the gas escapes into the atmosphere prior to valorisation and then causes a cut in exploitation efficiency. In landfills, methane emission can be reduced considerably by the use of improved management practices. Gas extraction has been proposed as a means of achieving such a reduction (Richards, 1989). Unfortunately, caps are not always sealed. In fact, some leaks due to minor features such as fissures and other disruptions may appear in them. These leaks have to be detected, localised so that, it is finally possible to obtain indication for improving the final cover in order to reduce the loss of greenhouse gas and thus achieve the high energy savings and avoid an undesirable environment impact (Cioni *et al.,* 2003).

Various methods, including static and dynamic closed chambers, mass balance or micrometeorological methods can be used for methane fluxes assessment on landfill surface cover (Taramini *et al.,* 2003). These methods are however expensive for the control need.

In fact, for environment protection control stakeholders need to assert that there is no release of methane in the landfill atmosphere so as to avoid landfill contribution to greenhouse gas effect and world global warming (IPPC, 1996). To attain this objective, it is not necessary to know fluxes of methane into the atmosphere, perhaps only the relative intensity of releasing (weak, average or high). In this case, improved methods that are easy to implement, less expensive can be useful.

Research objective and method

This study presents a method that enables to detect methane emission at the landfill top cover system and to map out zones of emission with highlight of relative intensity of emission. The method is illustrated by three campaigns of methane emission detection through the top cover surface of the landfill of Cour-au-Bois managed by Biffa Waste Service s.a. The campaigns were carried out in March 2000, October 2002 and June 2004. The method is easy to implement and not expensive.

Methane emissions detection is achieved with a portative FID. Measurements are taken according to a square grid of 20 side meter over the site. At each point, four specific measurements were recorded by application of the bell probe on the ground and waiting a certain time (30 sec. to 3 min.) until the stabilization of the measured result appeared on the LCD screens. The end value obtained represents the average of the four measurements on the point.

The data treatment consists in processing methane emission data measured with flame ionisation detector (FID) with Geological Data Management (GDM)® program using linear kriging method. The kriging method enables to extrapolate value where measures have not been taken. This data processing enables detection and localisation of methane escaping through landfill top cover at the soil interface and to map them after data processing

Results and discussion

The study results are mapped as a picture plotted curves of isoconcentration for the FID with interval values from 0 to 100 ppm, from 100 to 500ppm, from 500 to 1000 ppm and superior to 1000 ppm. The site map processed allows localisation of the zones where methane escapes through the top cover site leaks and give relative intensity of the emission. Figure 1 represents the result obtained for the October 2002 campaign.

Comparatively with the results obtained at the time of first FID campaign in March 2000, we can observe that the landfill of Cour-au-Bois presents more important methane emissions through the landfill surface in 2002. In particular the C3 cell shows obvious signs of degasification at the time of the 2002 campaign. Indeed, we observed high values of methane emission intensity which we did not measure in 2000. This increase in methane emission through the landfill capping surface between the 2000 and 2002 campaigns is confirmed with the 2004 campaign which shows nonetheless less spots of methane degassing zones. The remaining spots between 2002 an 2004 are still observed in the cells border.

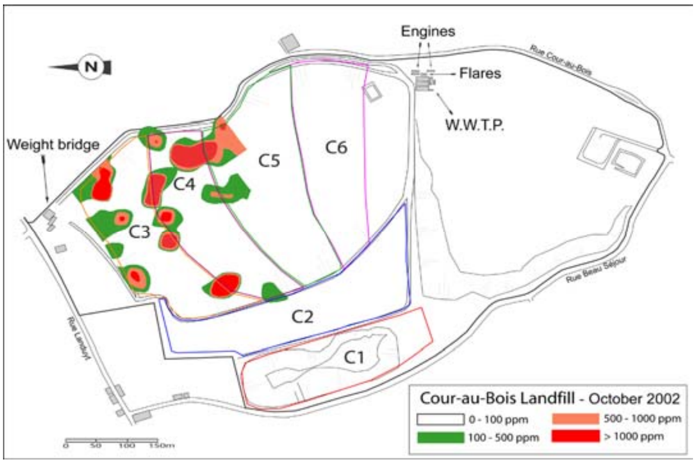

Figure 1. Methane emission through the landfill capping during the October 2002 campaign

Conclusions

Measurements of methane emission intensity obtained are qualitative. Indeed, the measuring instrument used does not allow carrying out quantitative measurements because of particular non control of parameters such as the duration of measurement or the pressure control inside the bell. Nevertheless, this instrument is sufficient to determine the presence of gaseous emissions in a point of measurement to localise a zone of emission and to give a relative importance of emission.

The method presented in this paper can be used by landfill operators and environmental control agents to assert methane emissions through the capping system and localise zones of emission. The method also enables observation of the relative intensity of methane degassing. Nevertheless, attention should be paid to the fact that (1) methane degassing intensity assessed is not quantitative and (2) methane measured is underestimated as, in the more shallow layers of the soil, methane can be oxidized into carbon dioxide