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Interaction of MSW landfills with the atmosphere: measurement experience and results

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Nowadays various human activities cause the production of industrial and municipal wastes. The landfilling has been up to now the most common technology for the management of them. One consequence of the landfill disposal is the production of biogas, due to anaerobic degradation of organic matter by methanogenic bacteria. Biogas is a mixture of CH4, CO2, and other organic compounds that are present in traces, which often are toxic and malodorous. Besides, large part of the biogas generated by the landfills is responsible for the greenhouse effect.

It is important also to stress that there are biogas leaks diffused by the soil/atmosphere interface even when a collection and combustion plant is active. Since said leaks are generally a noticeable percentage of the total production of biogas, both energy recovery and environmental impact mitigation require the optimisation of the biogas collection as a fundamental step to deal with.

With the aim of performing such optimisation, there are various monitoring techniques available, such as mapping the superficial distribution of biogas emissions and thermal mapping of the landfill surface.

Such mapping activities are necessary steps for planning any upgrade in the biogas collection and in the landfill coverage, as well as for checking the efficiency of both.

These tasks can be accomplished by the direct measurement of carbon dioxide and methane fluxes coming from the surface with an accumulation chamber and the thermal mapping with a longwave infrared radiometer.

The correlation between infrared thermography images and biogas flux maps is dis-

cussed here; the possibility of using the radiometric information as guidance for the local flux measurements is also investigated.

Particular attention in this work has been paid to the geostatistical data processing approach and to the evaluation of the energy balance in terms of LFG (LandFill Gas) recovery. In addition to that, thermography may represent an effective support to locate the main areas of heat loss. Also, experience has shown that heat flux and biogas flux anomalies do not necessarily match, proving that the association between the two measurement methods is particularly informative, thanks to their not complete correlation.

The main applications for the LFG recovered are: direct heating, electricity generation, chemical feedstock, purification to pipeline quality and heat recovery (EIA Renewable Energy Annual 1996, USA).

In this work the results from several biogas soil flux surveys that have been carried out in recent years are presented. The final products of each survey are an overall estimation of total diffused biogas, a thermal map and an isoflux map.

Moreover, such measurement surveys allowed us to compare the estimation of total biogas emission (diffused plus collected) to the results obtained from the theoretical production models. This comparison has shown a good accordance between the two figures in the various experiments that have been performed up to now.

This comparison also offers a very effective cross-check approach to validate the production model, in addition to the monitoring of the collection system efficiency.