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Near-surface environmental studies: non-invasive methods applied to the case of Municipal Solid Waste landfills

A. Scozzari (1), B. Raco (1), G. Lippo (2)

(1) CNR Institute of Geoscience and Earth Resources, Pisa, Italy (a.scozzari@igg.cnr.it),
(2) PI S.r.l., Firenze, Italy (lippo@peisrl.com)

Landfilling has been up to now the most common technology for the management of industrial and municipal wastes produced by human activities. 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. With the aim of reducing the biogas release to the atmosphere, and also for energy production purposes, biogas is collected by a network of underground depressurizing pipes, to drain the largest possible part of the biogas produced by said chemical/organic activity from the core of the landfill. In this context, there's been a growing interest in the recent years into the monitoring of biogas leaks, diffused by the soil/atmosphere interface, even when a collection/drainage 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. In the framework of said optimisation, there are various non-invasive monitoring techniques, available to map sub-surface features, such as the mapping the superficial distribution of biogas emissions, and the thermal, mapping of the landfill surface by infrared radiometry. Such 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. Infrared radiometry and direct biogas flux measurement, with the use of an accumulation cham-

ber, are illustrated in this work, as a mean to determine the state of the LFG (LandFill Gas) recovery system. Gas flux measurement technique is discussed and presented, both in the form of local measurement surveys, and by means of a steady automatic measurement station; particular attention is given to data processing aspects, such as the influence of meteorological factors on long-term measurements. In addition, the study of the relationship between infrared radiometric measurements and direct flux measurements is discussed, in order to achieve a better knowledge of whole energy budget produced, and an evaluation of the lost energy, being an interesting parameter in the environmental assessment of the waste disposal site.