

# THE FLUX-METER: IMPLEMENTATION OF A PORTABLE INTEGRATED INSTRUMENTATION FOR THE MEASUREMENT OF CO<sub>2</sub> AND CH<sub>4</sub> DIFFUSE FLUX FROM LANDFILL SOIL COVER.

E. GIOVENALI\*, L. COPPO\*, G. VIRGILI\*, D. CONTINANZA\*, I. MINARDI\*, B. RACO\*\*

\* WEST SYSTEMS via Don Mazzolari 25, 56025 Pontedera, Italy

\*\* IGG - CNR via Moruzzi 1, 56125 Pisa, Italy

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The municipal solid waste landfills are often considered as important sources of atmosphere contamination due to diffusive emissions of landfill gas (LFG) from the cover. As known LFG is composed by greenhouse gases, i.e. CH<sub>4</sub> and CO<sub>2</sub>, and other compounds present in trace with toxic and malodorous characteristics. In order to evaluate the health consequences and the contribution to the greenhouse effect, the D.Lgs. 152/2006, acknowledging the EU Directive 96/61/CE, imposes to monitor and to evaluate the LFG diffused from landfill soil cover. In this work a new portable integrated instrumentation based on the method of accumulation chamber, named FLUX-meter, is presented. The most important advantage of FLUX-meter is represented in the integration of high performance detectors, able to measure very low CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>S and VOC concentrations, in a portable instrumentation characterized by manageability, simple use and fast flux measurements. All these characteristics respond to the needs of scientists and engineers engaged in the determination of gas exchange at the soil-air interface linked to the gas escape from the landfill cover, from agricultural soil, from volcanic area and from geothermal exploration. The integrated instrument realized by West Systems consists of: an accumulation chamber with specific shape; detectors for the measurements of CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>S and VOC; a pneumatic system; battery; GPS and a Personal Digital Assistant (PDA). In particular, to meet the needs of the market, WEST Systems has developed a specific CH<sub>4</sub> detector, with the sensitivity, selectivity and stability necessary to measure diffuse flux down to extremely low levels. The new CH<sub>4</sub> detector is based on Infrared Tunable Diode Laser Absorption Spectroscopy (TDLAS) combined with a Herriot multi pass cell in order to augment the length of the optical path. Therefore very low detection limits are achieved, i.e. 0.1 ppm, allowing to measure low CH<sub>4</sub> concentration till to atmospheric levels (around 1.7 ppm). All the sensors with electronic interface, pump, pneumatic filters and light NiMH battery are installed in the backpack. In that way the instrument is easily moved and its total weight, including accumulation chamber, is less than 10 Kg. The entire instrument is managed by a small handheld computer, the PDA, based on MS Windows Mobile, which receives and exchanges information with the instrument via a Bluetooth wireless connection. A specific software allows the acquisition of specific specie (CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>S, VOC) concentration data vs time, of the position (GPS data) and other, such as pressure and temperature of the measuring cells of the detectors and the voltage of the battery of the whole system. Then the concentration data are represented in function of time, the flow curves acquired are visualized in real time and can be checked and validated by the operator, interacting via the touch screen. Therefore the portable FLUX-meter permits to carried out speedy (2-3 minutes time for a measurement) and reliable punctual measurements. The flux data can also be processed by Sichel software, developed by WEST Systems, in order to estimate the total amount of LFG discharged into the atmosphere and consequently lost by captured system. Besides, the elaboration of isoflux maps allow an easy visualization of zone of high fluxes.