



Monitoring fugitive CH₄ and CO₂ emissions from closed landfills: the case of Arico's landfill, Tenerife, Canary Islands

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Landfills constitute one of the ways to manage waste materials following environmental best practices. Nevertheless, they may face threats such as groundwater pollution and the release of landfill gases (CH₄, volatile organic compounds, etc.) to the atmosphere. These devices should be cautiously filled, checked and preserved while they are active and controlled for up to 30 years after their closure. Even after years of having ceased its activity, a significant amount of landfill gas is released to the atmosphere through its surface in a diffuse fugitive way. In this research, we have studied the spatial-temporal distribution of the surface fugitive emission of CO₂ and CH₄ into the atmosphere in a cell in the Arico's municipal landfill (0.3 km²) in Tenerife, Canary Islands, Spain, during the period 1999-2017. This cell was active until 2004, when it was filled and closed. In order to obtain information of how this closed landfill is degassing, we have performed 10 gas emission surveys during the study period. Surface landfill CO₂ efflux measurements were carried out at around 450 sampling site by means of a portable non-dispersive infrared spectrophotometer (NDIR) model LICOR Li800 following the accumulation chamber method. Landfill gases taken in the chamber were analyzed using a double channel VARIAN 4900 micro-GC. CH₄ efflux measurements were computed combining CO₂ efflux measurements and CH₄/CO₂ ratio in the landfill's surface gas. To quantify the total CH₄ emission, CH₄ efflux contour map was constructed using sequential Gaussian simulation (sGs) as interpolation method. In general, a decrease in the CO₂ emission is observed since the cell was closed (2004) to the present. The total CO₂ and CH₄ diffuse emissions estimated in the 2017 survey were $2.37 \pm 0.08 \text{ t d}^{-1}$ ($865 \pm 29 \text{ t y}^{-1}$) and $0.15 \pm 0.05 \text{ t d}^{-1}$ ($54 \pm 3 \text{ t y}^{-1}$), respectively. These types of studies are really useful to learn how a landfill degasses and serves to public and private entities to establish effective systems for extraction of biogas. This aims not only to achieve higher levels of controlled gas release from landfills resulting in a higher level of energy production but will also contribute to minimize air pollution.