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Are closed landfills free of CH_4 emissions? A case study of Arico's landfill, Tenerife, Canary Islands

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Landfills are authentic chemical and biological reactors that introduce in the environment a wide amount of gas pollutants (CO_2, CH_4, volatile organic compounds, etc.) and leachates. Even after years of being closed, a significant amount of landfill gas could be released to the atmosphere through the surface in a diffuse form, also known as non-controlled emission. The study of the spatial-temporal distribution of diffuse emissions provides information of how a landfill degassing takes place. The main objective of this study was to estimate the diffuse uncontrolled emission of CH_4 into the atmosphere from the closed Arico's landfill (0.3 km^2) in Tenerife Island, Spain. To do so, a non-controlled biogenic gas emission survey of nearly 450 sampling sites was carried out during August 2015. Surface gas sampling and surface landfill CO_2 efflux measurements were carried out at each sampling site by means of a portable non-dispersive infrared spectrophotometer (NDIR) model LICOR Li800 following the accumulation chamber method. Landfill gases, CO_2 and CH_4, were analyzed using a double channel VARIAN 4900 micro-GC. The CH_4 efflux was computed combining CO_2 efflux and CH_4/CO_2 ratio in the landfill's surface gas. To quantify the total CH_4 emission, CH_4 efflux contour map was constructed using sequential Gaussian simulation (sGs) as interpolation method. The total diffuse CH_4 emission was estimated in 2.2 t d^{-1}, with CH_4 efflux values ranging from 0-922 mg m^{-2} d^{-1}. This type of studies provides knowledge of 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 also will contribute to minimize air pollution caused by them.