Gas and water transport in landfill final cover soils during precipitation

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It has been reported that landfill sites are significant sources of greenhouse gases. A part of gases produced in the landfill waste layer are emitted to the atmosphere through the landfill final cover soil. Therefore, it is important to understand how gases move through the final cover soil in order to accurately estimate the greenhouse gases emission from the landfill site. High intensity precipitation events likely induce a gas eruption due to a soil-gas compression following water infiltration. Gas compression also rises soil air pressure and thus reduces water infiltration rates, which restricts amount of leachate from the landfill sites. However, the effects of precipitation on gas and water transport in the final cover soils are not fully understood.
In this study, one-dimensional column transport experiments were conducted to examine the effects of intensity of precipitation, dry bulk density of the cover soil, and gas production rate on gas eruption and rainwater infiltration. A disturbed soil sample (sandy loam) used as a landfill final cover soil was collected. A 5% methane gas or a 5% oxygen gas was injected to the soil column (dia. 10 cm, height 30.5 cm) packed with variable dry bulk densities (1.4, 1.5, 1.6 g / cm^3) from the bottom with variable gas fluxes. Precipitations of variable intensities were applied from the top of the column. Oxygen concentrations inside the column and an outlet chamber placed at the top of the column were measured continuously. Methane concentrations inside the column was measured before and after the precipitation while the methane concentration in the outlet chamber was measured periodically during the precipitation. Soil gas pressure, water contents and temperature inside the column were also monitored during the experiment.

Keywords: landfill, gas eruption, soil, infiltration, precipitaiton, methane

