Landfill cover soil methane oxidation underestimated

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Landfilled waste decomposes in the absence of oxygen and results in the production of methane. Landfills are classified as the second-largest human-made source of CH4 in the U.S. Additionally, landfill gas contains numerous non-methane hydrocarbons that are either volatilized directly from waste materials or produced through biochemical reactions during waste degradation.

Microbial methane oxidation reduces the emissions of methane and other volatile hydrocarbons from landfills. Determining the importance of this process is one of the major uncertainties in estimating national or global CH4 emissions from landfills. Landfill gas that is not collected passes through landfill cover soils on the way to being released to the environment. Bacteria in the soil consume methane and other volatile hydrocarbons that are produced by decomposition in the underlying waste by reacting it with oxygen.

A value of 0 to 10% oxidation has been recommended by the Intergovernmental Panel on Climate Change guidelines for national greenhouse gas inventories. Currently, for regulatory purposes the USEPA has recommended a default value for landfill cover CH4 oxidation of 10% due to the uncertainty involved and the lack of a standard method to determine oxidation rate.

Drs. Jeffrey Chanton, David Powelson, and Roger Green of Florida State University and Waste Management Inc. reviewed and compiled literature results from 42 determinations of the fraction of methane

oxidized and 30 determinations of methane oxidation rate in a variety of soil types and landfill covers. The results were published in the March-April issue of the Journal of Environmental Quality. The means for the fraction of methane oxidized upon transit across the differing types of soil covers ranged from 22% in clayey soil to 55% in sandy soil. The overall mean fraction oxidized across all studies was 36% with a standard error of 6%. For a subset of fifteen studies conducted over an annual cycle the fraction of methane oxidized ranged from 11 to 89% with a mean value of 35 ± 6%, a value that was nearly identical to the overall mean.

The literature summarized in this paper indicates that the fraction of methane oxidized in landfill cover soils is considerably greater than the default value of 10%. Of the 42 determinations of methane oxidation only four reported values of 10% or less. One reported a value of 10%. This particular study was the first to report a well constrained value for the fraction of methane oxidized in a specific landfill, and because of this, it has received undue weight in the determination of regulations. The default value of 10% should be updated based upon technological advancements in soil engineering and state-of-the-practice applications in cover design as well as recent studies detailed journals such as *Journal of Environmental Quality*.

More information: View the abstract at jeq.scijournals.org/cgi/content/abstract/38/2/654 .

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