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Landfill gas production factoids

1. The general process of MSW is as follows:

Biodegraded organic matter + CH4 + CO2 + Other gasses

bacteria

MSW + H2O

Source: (Cabaraban and Paclijan, 2015; <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.736.1252&rep=rep1&type=pdf>

1. The EPA (LandGEM) and IPCC use a first-order decay process to model CH4 emissions from landfills. The basic equation is as follows:



Where: Qm = maximum LFG generation (m3/yr); CCH4= methane concentration (volume fraction); I = 1 year increment; n = target year – initial year of waste acceptance; j = 0.1 time increment; k = methane generation rate; Lo = ultimate methane generation potential (m3/yr); Mi = mass of waste disposed of in the *ith* year; tij = age of the jth section of waste disposed of in the ith year.

1. Approximately 15% of all LFG escapes collection under the best circumstances.
2. In 2014 234 million tonnes of waste was generated in the US. Of that approximately 53% was disposed of in landfills. (Lee et al., 2017).
3. Not all degradable carbon is converted to LFG.
4. The IPCC has the concepts degradable organic carbon (DOC) and the fraction of DOC that decomposes to LFG (DOCf)
5. DOCf varies, but an average value of 0.50 is used by Lee et al.2017 and the IPCC (https://www.ipcc-nggip.iges.or.jp/public/gp/english/5\_Waste.pdf). Thus, for every metric ton of DOC that enters the landfill, 500 kg will actually decompose to LFG.
6. The IPCC estimates that for the US the DOC value is 0.18 – 0.21 (table 6-1; <https://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch6ref1.pdf>)
7. Using the DOC of 0.20 and a DOCf of 0.5, we can assume that for every metric ton of MSW entering the landfill, .5 metrics tons will decompose to LFG.
8. The IPCC suggest that between 40 and 60% of LFG is CH4.
9. We do not account for CH4 lost via oxidation. The IPCC says that well managed sanitary landfills have relatively high oxidation rates. A default of 10% is used by the IPCC for industrialized countries.
10. Using the recommendations, we get the following: Note that this assumes a single “blast” of CH4 during the first year. This will be spread out over 5-60 years.

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| MSW (tonne) | DOC | DOC-F | CH4 fraction | Ox loss | CtoCH4 | tons of C to methane | kg CH4 | kg ch4 per m3 | m3 CH4 |
| 1 | 0.2 | 0.5 | 0.5 | 0.1 | 1.3 | 0.0067 | 6.7 | 0.7 | 9.3 |