Evaluation and application of site-specific data to revise the first-order decay model for estimating landfill gas generation and emissions at Danish landfills - DTU Orbit (08/11/2017)

Evaluation and application of site-specific data to revise the first-order decay model for estimating landfill gas generation and emissions at Danish landfills

Methane (CH4) generated from low-organic waste degradation at four Danish landfills was estimated by three first-order decay (FOD) landfill gas (LFG) generation models (LandGEM, IPCC, and Afvalzorg). Actual waste data from Danish landfills were applied to fit model (IPCC and Afvalzorg) required categories. In general, the single-phase model, LandGEM, significantly overestimated CH4 generation, because it applied too high default values for key parameters to handle low-organic waste scenarios. The key parameters were biochemical CH4 potential (BMP) and CH4 generation rate constant (k-value). In comparison to the IPCC model, the Afvalzorg model was more suitable for estimating CH4 generation at Danish landfills, because it defined more proper waste categories rather than traditional municipal solid waste (MSW) fractions. Moreover, the Afvalzorg model could better show the influence of not only the total disposed waste amount, but also various waste categories. By using laboratory-determined BMPs and k-values for shredder, sludge, mixed bulky waste, and street-cleaning waste, the Afvalzorg model was revised. The revised model estimated smaller cumulative CH4 generation results at the four Danish landfills (from the start of disposal until 2020 and until 2100). Through a CH4 mass balance approach, fugitive CH4 emissions from whole sites and a specific cell for shredder waste were aggregated based on the revised Afvalzorg model outcomes. Aggregated results were in good agreement with field measurements, indicating that the revised Afvalzorg model could provide practical and accurate estimation for Danish LFG emissions. This study is valuable for both researchers and engineers aiming to predict, control, and mitigate fugitive CH4 emissions from landfills receiving low-organic waste.Implications: Landfill operators use the first-order decay (FOD) models to estimate methane (CH4) generation. A single-phase model (LandGEM) and a traditional model (IPCC) could result in overestimation when handling a low-organic waste scenario. Site-specific data were important and capable of calibrating key parameter values in FOD models. The comparison study of the revised Afvalzorg model outcomes and field measurements at four Danish landfills provided a guideline for revising the Pollutants Release and Transfer Registers (PRTR) model, as well as indicating noteworthy waste fractions that could emit CH4 at modern landfills.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Mou, Z. (Intern), Scheutz, C. (Intern), Kjeldsen, P. (Intern)
Number of pages: 13
Pages: 686-698
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of the Air and Waste Management Association
Volume: 65
Issue number: 6
ISSN (Print): 1047-3289
Ratings:

Web of Science (2015): Indexed yes

BFI (2008): BFI-level 1

Web of Science (2005): Indexed yes

Web of Science (2004): Indexed yes

Web of Science (2002): Indexed yes
Original language: English
DOIs:

10.1080/10962247.2015.1008653
Source: FindIt
Source-ID: 2263352256
Publication: Research - peer-review › Journal article – Annual report year: 2015