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Calculation of Landfill Gas Flux Rates through the Surrounding Soil Profile and the Water Bodies of the Karadiyana Municipal Solid Waste (MSW) Open Dumpsite in Sri Lanka**Herath P.L.* , Jayawardana D.T., Bandara N.J.G.J., Gunathilake B.M.***Centre for Forestry and Environment, Department of Forestry and Environmental Science, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
priyathpriyara@gmail.com*Abstract**

Open filling of Municipal solid waste has increased rapidly worldwide due to the increase in world waste generation. Numerous investigations on landfill gas generation, emission, and impact have been conducted, but only a small number of studies have documented the calculation of landfill gas flux rates through the surrounding area with the effect of the dumpsite. The current study aimed to investigate flux rates of some selected landfill gases around the Karadiyana landfill, including methane (CH₄), ammonia (NH₃), hydrogen sulfide (H₂S), and Total Volatile Organic compounds (TVOCs), which have been operational for more than 35 years in Sri Lanka. The surrounding area was split into five different cells by considering the land use, and the map was digitised using ArcGIS. The static flux chamber method was used. Chamber volume and surface coverages were 0.1 m³ and 0.2 m², respectively. The self-designed floating chamber, an air-filled tube fixed to make it floatable, was used when measuring the flux rates from the water bodies. Random sampling method was employed, and three sampling campaigns were done monthly from October to December 2024. Atmospheric pressure, temperature, and relative humidity were measured during the sampling. The results indicate that the highest flux rates of CH₄, NH₃, H₂S, and VOCs through the waterbodies (352.2±310.8, 8.9±9.95, 4.07±4.52, and 5.31±6.35 mg m⁻² h⁻¹), while the lowest values were in settlement areas (54.38±36.69, 1.57±1.59, 0.31±0.41, 0.00±0.00 mg m⁻² h⁻¹), respectively. Secondly highest values were in free floating hydrophytes areas (233.0±212.5, 6.78±4.44, 3.54±3.76, 3.91±3.68 mg m⁻² h⁻¹), and open areas (95±108.1, 2.24±1.53, 0.51±0.64, 0.00±0.00 mg m⁻² h⁻¹) and vegetation areas (51.11±44.56, 2.38±1.58, 0.36±0.54, 0.07±0.43 mg m⁻² h⁻¹) shows considerably low gas emission flux rates. Leachate was directly released to the water canals and Bolgoda river, with higher amounts of dissolved landfill gas and organic matter, resulting in higher flux rates. Lateral gas migration, human and animal activities around the dumpsite, and leachate mixing were the reasons for higher flux rates through the surrounding soil profile. Leachate collection and purification are impactful practices for the mitigation of landfill gas emissions, and site management practices are critical for emission reduction.

Keywords: *Gases, Flux rates, Calculation, Water bodies, Soil profile*