Odorous Trace Gas Emission Rate Estimation From the Tipping Area of An Active Landfill Site Using A Network of Remote Ambient Air Monitoring Sensors

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ABSTRACT

Odorous trace gas emission rates were estimated by inverse modelling using electronic ambient air monitoring sensor data from a commercial system around the tipping area of a Municipal Solid Waste Landfill (MSW) in London Ontario Canada for August, September, and October 2022. The system was designed and implemented by a third party and based on an internet of things (IoT) metal oxide electronic ambient air monitoring sensors for the selective odorous gases of hydrogen sulfide, ammonia, and total volatile organic compounds (VOC). A simple iterative technique was applied where by high concentration events for hydrogen sulfide, ammonia, and VOC at each sensing station location was used to inversely determine the potential emissions rate of odorous trace gas from the tipping area. The technique paired the Gaussian Plume Model along with a source influence parameter to find when the landfill tipping area was the source of peak concentration for each of ambient hydrogen sulfide, ammonia, and VOC. An estimation for the emissions rate was then found for each peak case and fed into an AERMOD model to iteratively converge on an emissions rate such that the receptor concentrations at ground level from the AERMOD model output matched the ambient air monitoring station concentration data for each case. Emissions rates of between 6 grams per-second to 23 grams per-second were found over the months of August, September, and October 2022. However, the accuracy of the emissions rate technique using electronic ambient air monitoring sensors could not be directly determined. In addition, the use of the AERMOD dispersion model limited the convective and temporal effects on the determination of the true emission rates of odorous gases. A combined technique measuring ambient fugitive gas and ground flux emission rate was implemented for direct emissions rate measuring in the tipping area to resolve the limitations with using the third party electronic ambient air monitoring system as a rate determining tool.