



Methane Emissions from Kuwait: long-term measurement, mobile plume mapping and isotopic characterisation

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National and EDGAR inventories suggest that the dominant sources of methane in Kuwait are leaks from gas flaring and distribution (92%) and landfills (5%), with additional smaller emissions from sewage (wastewater) treatment and ruminant animals. New measurements during 2015 and 2016 suggest that the inventories differ greatly from observations.

Regular weekly bag samples have been collected from 3 sites in Kuwait, one NW of the city, one to the SE and one in the city from the rooftop of Kuwait College of Science. These take turns to have the highest recorded mole fractions, depending on wind direction. Associated with higher mole fraction is a consistent depletion in ^{13}C of methane, pointing to a national source mix with $[\text{U}+\text{F}064]^{13}\text{C}$ of -54.8‰ . This is significantly different from the calculation using inventories that suggest a mix of -51.3‰ .

Mobile plume identification using a Picarro G2301 analyser, coupled with Tedlar bag sampling for isotopic analysis (Zazzeri et al., 2015), reveals that by far the largest observed source of methane in Kuwait is from landfill sites ($[\text{U}+\text{F}064]^{13}\text{C}$ of -57‰ , with smaller contributions from fossil fuel industry (-51‰ , wastewater treatment (-50‰ and ruminant animals (cows, -62‰ camels – 60‰ sheep – 64‰).

Many of these isotopic signatures are close to those observed for the same source categories in other countries, for example landfill emission signatures have the same range as those calculated for UK and Hong Kong (-60 to -55‰ , even to the level that older closed and capped landfills emit smaller amounts of methane at more enriched values (-55 to -50‰ , due to small % of topsoil oxidation.

Our findings suggest that many more top down measurements must be made to verify emissions inventories, particularly in middle eastern countries where a significant proportion of emissions are unverified calculations of fossil fuel emissions.

Zazzeri, G. et al. (2015) Plume mapping and isotopic characterization of anthropogenic methane sources, Atmospheric Environment, 110, 151-162, doi.org/10.1016/j.atmosenv.2015.03.029