Quantifying sources of methane and light alkanes in the Los Angeles Basin, California

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We use ambient measurements to apportion the relative contributions of different source sectors to the methane (CH_4) emissions budget of a U.S. megacity. This approach uses ambient measurements of methane and C_2-C_5 alkanes (ethane through pentanes) and includes source composition information to distinguish between methane emitted from landfills and feedlots, wastewater treatment plants, tailpipe emissions, leaks of dry natural gas in pipelines and/or local seeps, and leaks of locally produced (unprocessed) natural gas. Source composition information can be taken from existing tabulations or developed by direct sampling of emissions using a mobile platform. By including C_2-C_5 alkane information, a linear combination of these source signatures can be found to match the observed atmospheric enhancement ratios to determine relative emissions strengths.

We apply this technique to apportion CH_4 emissions in Los Angeles, CA (L.A.) using data from the CalNex field project in 2010. Our analysis of L.A. atmospheric data shows the two largest CH_4 sources in the city are emissions of gas from pipelines and/or from geologic seeps (47%), and emissions from landfills (40%). Local oil and gas production is a relatively minor source of CH_4, contributing 8% of total CH_4 emissions in L.A.

Absolute CH_4 emissions rates are derived by multiplying the observed CH_4/CO enhancement ratio by State of California inventory values for carbon monoxide (CO) emissions in Los Angeles. Apportioning this total suggests that emissions from the combined natural and anthropogenic gas sources account for the differences between top-down and bottom-up CH_4 estimates previously published for Los Angeles. Further, total CH_4 emission attributed in our analysis to local gas extraction represents 17% of local production. While a derived leak rate of 17% of local production may seem unrealistically high, it is qualitatively consistent with the 12% reported in a recent state inventory survey of the L.A. oil and gas industry.