METHANE GUIDING PRINCIPLES

EDF ENVIRONMENTAL DEFENSE FUND
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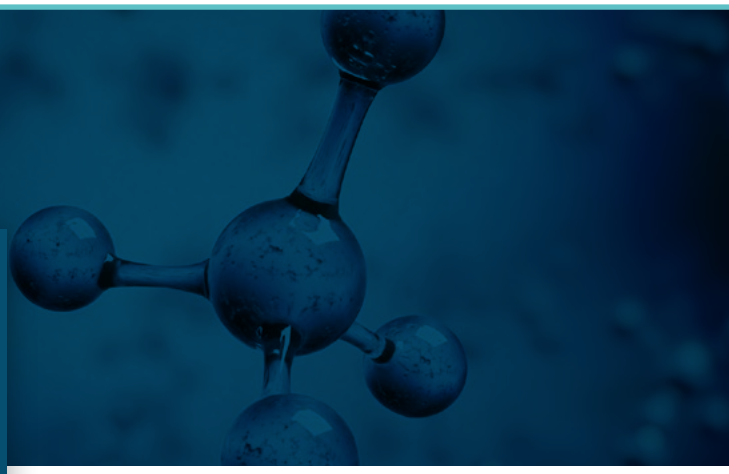


CASE STUDY

Detecting and quantifying gas distribution leaks: cities in North America and Europe

Mobile measurement platforms have been used to characterize emissions from local distribution networks across different cities in North America and Europe. These methods can quickly survey large urban areas, identify leaks, quantify the emissions distribution and support estimates of total emissions from distribution networks. This case study provides further details on such efforts to detect and quantify methane leaks in urban areas.

Context

Methane emissions can occur at any point during production, processing, transport, up to and including end use of gas and other fossil fuels. Measurement campaigns have suggested that actual emissions across different end-use environments are often underestimated, including in cities and households. Leaks in gas distribution networks are not only an environmental issue, but also a health and safety concern, especially in urban areas.

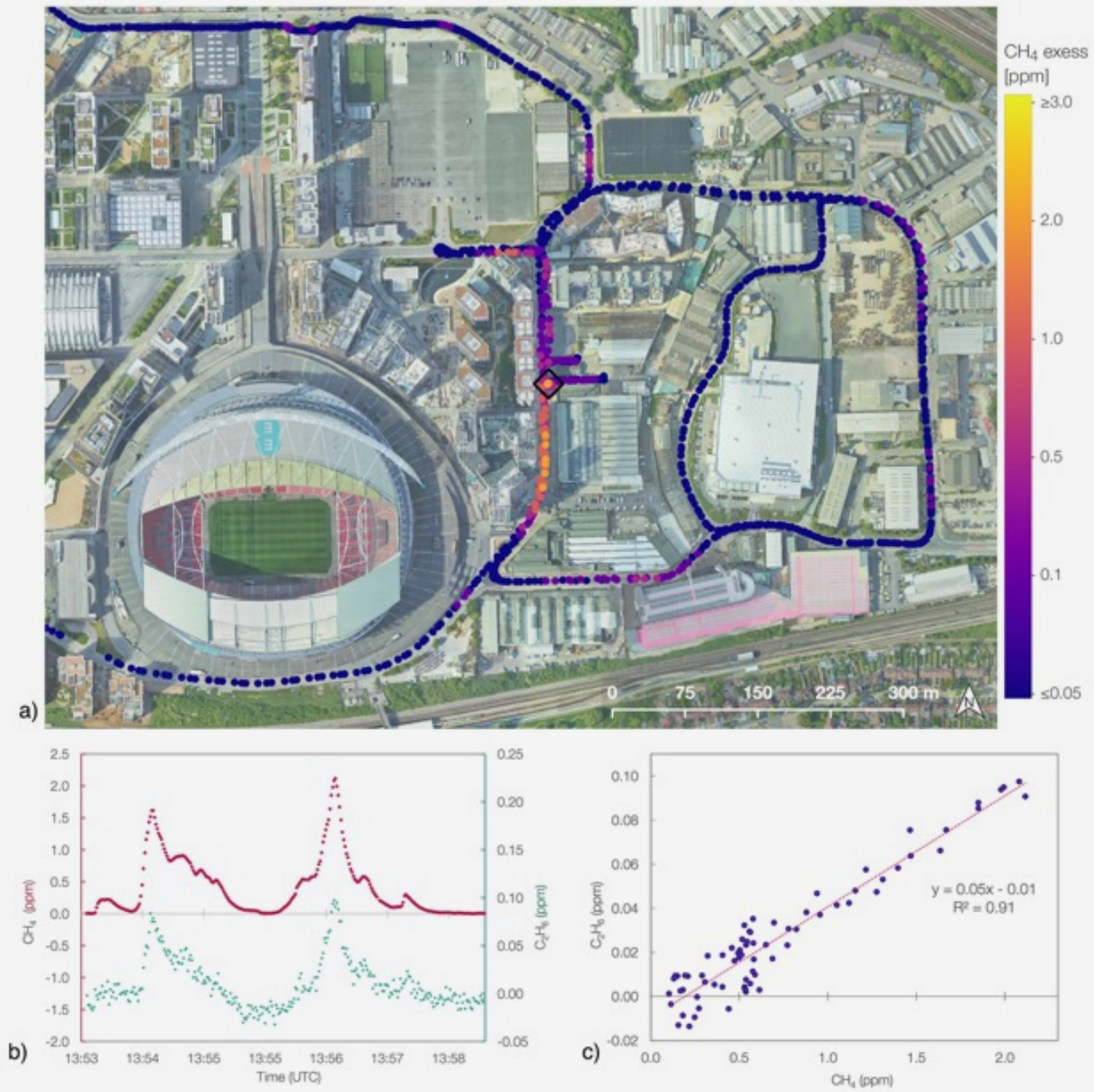
Leak identification, apportionment, and quantification

Mobile measurement platforms have been used to characterize emissions from local distribution networks across different cities. These identify more leaks than traditional surveys and can support improved estimates of total emissions from distribution networks by providing information on the frequency and size of leaks. Studies from several cities have shown that a few large natural gas leaks are responsible for a significant proportion of methane emissions.

Typical mobile laboratory for methane emission characterization

The Royal Holloway University Greenhouse Gas Emissions Monitoring Vehicle V1, with capability to sample methane, ethane and carbon dioxide approximately every second. The vehicle is also equipped with high resolution GPS for precise location, an anemometer and the ability to take discrete samples for laboratory analysis post survey. Source: Royal Holloway University of London.

Typically, Natural Gas Distribution Network (NGDN) companies use walk over surveys with handheld instrumentation to assess leaks. This method is limited due to the reliance on pre-knowledge of likely location for leaks through public reporting due to smell, local knowledge within the company or through pressure losses in the NGDN system. More sophisticated methods for leak detection from NGDNs have been developed over the last years, primarily with the development of laser-based instruments able to detect methane at the ppb level with fast measurement cell turnover and ~1Hz measurement rates. One of the first cities to be measured using drive-around surveys was Boston, with over 3,300 leaks of methane discovered across 790 miles of road.



a) Driving track and CH4 excess highlighting a natural gas where the diamond indicates the location of a leak indicator and sampled air for an isotopic source signature. b) C2H6 vs CH4 excess plotted against time showing fluctuations of emissions. c) Linear regression of CH4 vs C2H6 where the C2:C1 value is calculated. Note: Highly correlated methane and ethane peaks recorded at a ratio comparable with London NGDN gas. Source: J. Fernandez et al., Fugitive street-level emissions to the atmosphere from the Gas Distribution Network in London, UK (in prep).

Measuring multiple species allows immediate source attribution of methane enhancements. For NGDN leaks, the isotopic analysis of the carbon isotopes in methane and ethane (C2H6) as a co-emitted species has provided vital information to allow source apportionment within cities to be attained (see figure above). This is exemplified in surveys of Bucharest where total emissions of methane in the city are heavily influenced by emissions from the sewage network, which without continuous ethane measurements may have been mistakenly assumed to be from the NGDN. The proportion of methane being emitted to the atmosphere from NGDN leaks can also be assessed through monitoring towers, allowing comparison of results from mobile emissions monitoring with city-wide regional estimates and existing inventories.

Multiple methods to quantify emission rates from NGDNs do not require intervention during mobile surveys and can be performed entirely post-campaign. Algorithms to estimate emission rates based on mobile measurements of methane concentrations have delivered excellent high-level information on the relative size and number of emissions per city, allowing comparative studies across Europe and the US. Despite differences between cities, a clear pattern is that the top 10% of emitters are typically responsible for 60-85% of citywide NGDN related emissions, highlighting the value of mobile studies to find these super emitters and enable mitigation.

For more about different methane measurement technologies, see Monitoring and managing methane emissions or other case studies that explore different Monitoring Pathways.

Find out more

- EDF in-depth resources
- Environmental Defense Fund
- EDF Policy instrument options for addressing methane emissions from the oil and gas supply chain

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