



## **A Tale of Three Cities: Mobile Methane Measurement and Isotopic Characterisation in London, Kuwait and Hong Kong**

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Mobile methane measurement surveys and sampling for isotopic analysis have been undertaken by the RHUL greenhouse gas group since early 2013. While encompassing different projects with different aims the UN CCAC International Methane Studies midstream and downstream (cities) gas distribution emissions project has brought this in to focus with detailed surveying across Greater London. Here we compare provisional findings on the distribution of methane sources across London, with the findings of surveys from two other large but contrasting cities, Kuwait in a dry desert environment, and Hong Kong in a humid sub-tropical environment.

In all three cities the dominant methane sources on the city periphery are landfill sites. Despite very different practices the carbon isotopic signatures are consistent at  $-58 \pm 3\text{‰}$  for active landfills and  $-54 \pm 2\text{‰}$  for closed landfills, representing a small degree of oxidation in the latter. Sewage treatment plants follow similar procedures but with a wide range of isotopic signatures from  $-59\text{‰}$  for anaerobic to  $-45\text{‰}$  for aerobic processes.

The big difference is in the natural gas leakage. The UK has a well developed and often ageing gas pipe network. Leaks tend to follow main roads and often multiple are found within a 5-10 km section. Town gas (hydrogen-rich) is used in Hong Kong. The Tai Po production plant was a significant point source, but no obvious pipe network leaks were detected. Kuwait City has no gas network and so no leaks. One satellite town, Ahmadi, has an old British-installed network utilising local gas, but also natural seepage from underground oil fields, and emissions were detected. The carbon isotopic signature of the gas is source region dependent. In Kuwait the signature is  $-50\text{‰}$  but in the range  $-42$  to  $-35\text{‰}$  for more thermogenic gas in Hong Kong and London.