



National Physical Laboratory



# Shale gas extraction work within the FuME project

FuME: Quantifying Fugitive Methane Emissions from  
hard-to-tackle sites and sources

Presentation for DECC

6<sup>th</sup> January 2014

# Aim of FuME project

To create a commercial Methane Measurement Service for municipal waste water treatment plants, shale gas extraction and gas distribution industries

- Apply and enhance two existing technologies (models, DIAL)
- Develop and test new continuous monitoring instrument (boundary fence methane monitors)
- Applications in three industries: municipal waste water treatment, shale gas extraction, natural gas grid
- Focus on sectors where
  - fugitive emissions are hard to measure and monitor as a result of a large number of small sources
  - sector is fairly new and opportunities not yet exploited
  - sector anticipates regulation

# Justification

- High GWP of methane; increased in IPCC AR5 to 34-86 CO<sub>2</sub>e (100 or 20 year timeframe)
- Regulation of methane is increasingly likely for target sectors
- Cost-effective mitigation:
  - Low cost abatement opportunities
  - Recovered methane is a saleable gas; 35% of methane abatement options have a net profit

# Current state of the art

- Differential Absorption Lidar (DIAL) provides identification and quantification of methane emissions from fugitive and area sources
  - Mainly applied so far to landfill and large gas / refinery / petrochemical facilities
  - Provides relatively short term 'spot' measurements
- Point sensors provide continuous measurement at a specific location
  - Cavity ring down systems (e.g. Picarro, Tiger Optics) accurate but high cost
  - Can use reverse modelling to estimate emissions – but need methodology to define best locations for sensors
  - A number of low cost sensors commercially available
- Open path systems
  - Developed for other gases, generally used for safety monitoring in methane context
- Models provide forecast emissions based on knowledge of source terms
  - Relatively complex to implement
  - Not validated for target sectors

# Products

Three products/services aimed at cost effective continuous monitoring of fugitive methane

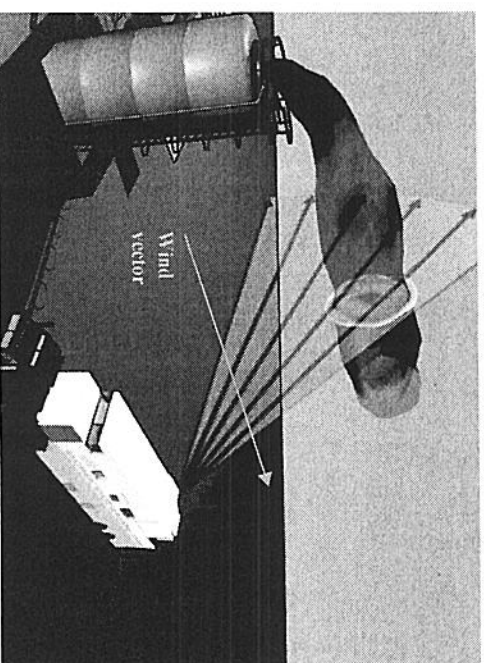
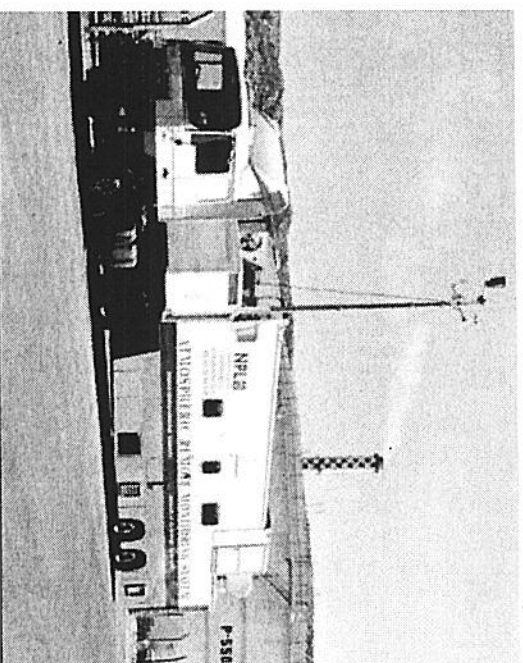
- Dispersion model to predict emissions and plan location of low cost point sensors
  - Includes emissions factors and process knowledge specific to industry
- Open path sensor for long term boundary fence measurements
- Application of DIAL remote sensing measurements to provide high-accuracy snapshot and calibrate sensors
  - Includes meteorological model and measurements

All of the above will be combined into a service for the target sectors.



# DIAL system

- Optical Radar
- Range up to 1 km with a spatial resolution ~10 metres
- UV and IR capability, able to measure wide range of species with a measurement sensitivity typically 50 ppb
- Direct measurements of emissions from hazardous /inaccessible areas
- Range-resolved concentration maps



# Shale gas work package: Cuadrilla objectives

- Why is Cuadrilla collaborating in the project?
  - Fugitive methane emissions public and environmental NGO's concern
  - Reports in the USA differ significantly in assessment and understanding
  - Regulation uncertainty
- Cuadrilla objectives
  - Reduce public concern in the process
  - Understand the scale of the issues
  - Be on the front foot with regulations
  - Shape industry best practice and provide a benchmark
  - Show we are a good community operator
  - Corroborate studies in the USA (incl EDF and Texas Uni)

# Shale gas work package: Practicalities

- Cuadrilla is unfunded industry partner, providing:
  - Minimum of 2 sites at different stages in the process: drilling, hydraulic fracturing, well-testing.
  - Expertise in operational processes on site
  - Information about current monitoring methods, Best Available Technology (BAT) guidelines
- Likely sites to be covered
  - North West based sites, Elswick, Balcombe
- Other VOCs
  - Canister samples will be collected and analysed using gas chromatography and mass spectrometry (GC/MS) in the lab, to provide speciated measurements of VOCs
- Used to provide additional information to feed into the emission models.



# Shale gas work package: outputs

- Mitigation measures identified and included in Cuadrilla business strategy
- Guidelines for fugitive methane emission measurement best practice in the shale gas industry
- Contribution to standards
  - feeding our work into a CEN standard that NPL is already developing on fugitive emissions from the oil and gas sector
  - proposing a new work item on fugitive emissions detection methodology to committee TC264
  - feed into the relevant Best Available Technology Reference (BREF) committees at the JRC
- Short reports summarising the results from each site
- Information that could contribute to an emissions factor for the hydraulic fracture process (start to end)

# For discussion

- Thoughts on the project
- Do you / how far do you want to be involved?
- Anyone else we should engage with at this stage?
- Anything we can tag onto the project of use to DECC?
- What additional fugitive emissions measurement will DECC require?
  - 'there should be a detailed scientific research programme of methane measurement, aimed at better understanding and characterising sources and quantities of methane emissions associated with shale gas operations'

Thank you