



Emission Measurement Using Differential Absorption LIDAR (DIAL)

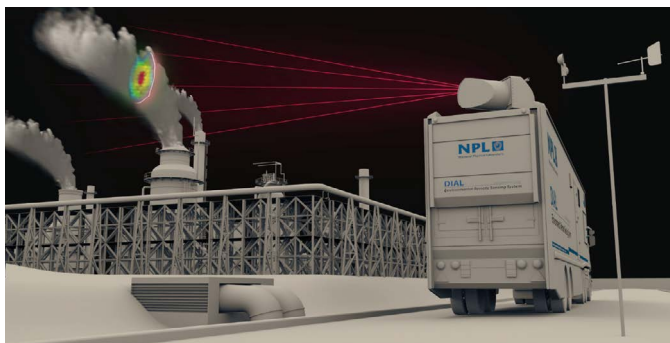
The NPL Differential Absorption Lidar (DIAL) is a sophisticated remote sensing system that provides rapid, accurate measurements of airborne pollutants and greenhouse gases (GHGs) following the protocol described in the European Standard EN 17628. The system is a completely self-contained mobile laboratory that provides 3D mapping of emission concentrations and, when combined with wind information, enables quantification of emission rates for a wide range of target species.



The DIAL system is able to monitor atmospheric pollutants remotely, at ranges of up to 500 m. DIAL measurements are real-time, directly traceable to primary standards of gas concentration and are free from interference and contamination. DIAL is particularly useful for measurements of emissions from process areas, tanks, flares and diffuse sources, e.g. landfill sites (Innocenti et al., Remote Sensing 2017, 9, 953; Innocenti et al., Remote Sensing 2022, 14, 4291).

The DIAL Technique

The DIAL technique uses a laser source of tunable wavelength that is transmitted over the measurement region. A small fraction of this light is scattered back by the aerosols and particulates that are present in the atmosphere; this is collected with a telescope and a fast, sensitive detector. The extent of the absorption is known from accurate laboratory data, enabling the concentration and spatial distribution of the atmospheric pollutants to be determined. This data is combined with wind information, which is continuously measured across the site, to provide a direct measurement of the emission rate of the target species. (Robinson et al., J. Environ. Monit. 2011, 13, 2213).

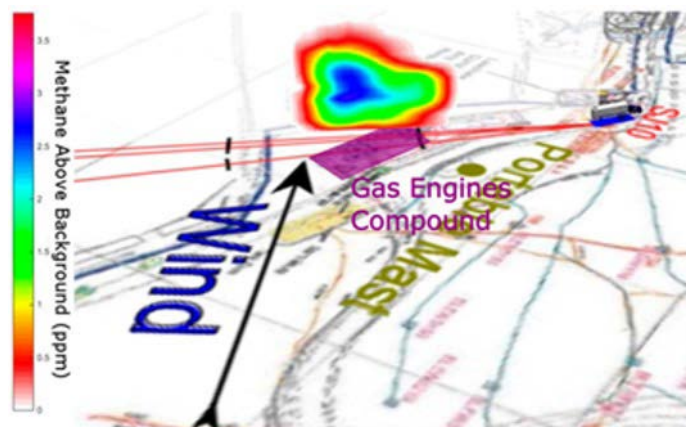


Atmospheric Pollutants and GHGs

DIAL can collect real-time data for gaseous species with characteristic absorptions from the ultraviolet through to the mid-infrared spectral region, including methane, ethane, volatile organic compounds (VOCs), HCl, SO₂ and benzene.

Data Analysis and Interpretation

DIAL's unique software enables total site emissions to be visualised via a series of multi-dimensional concentration plots, in a way that highlights key emission points and their concentrations. A team of experts at NPL is available to give advice on data analysis and interpretation. The team has an in-depth technical knowledge of the operations of industrial plants, an awareness of potential emissions and extensive experience in solving complex atmospheric measurement problems.



Validation

Field validation exercises, against known reference emissions, have confirmed that the DIAL method used by NPL yields measurements of mass emission rates which are linear with release rate, fall within the stated variability for the measurements, and that the systematic biases in the DIAL measured emission rate are less than 4%.

As part of the development of the European Standard (EN 17628), a DIAL measurement (defined as a set of at least four scans) was validated against controlled reference emissions and found to be consistent. The variability between scans is representative of the measurement uncertainty.

Contact details	Further information
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