

DIAL for Remote Emissions Measurement

The NPL Differential Absorption Lidar (DIAL) is a sophisticated remote sensing system that provides rapid, accurate measurements of airborne atmospheric pollutants. The system is a completely self-contained mobile laboratory that carries a suite of additional measurement equipment to monitor meteorological parameters and ambient gas concentrations.



The DIAL system is able to monitor atmospheric pollutants remotely, at ranges of up to 1 km. 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.

The DIAL technique

The DIAL technique uses a laser source of tuneable 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 and this enables the concentration, and spatial distribution, of the atmospheric pollutants to be determined. This data is combined with wind information to provide a direct measurement of the emission rate of the target species.

Applications

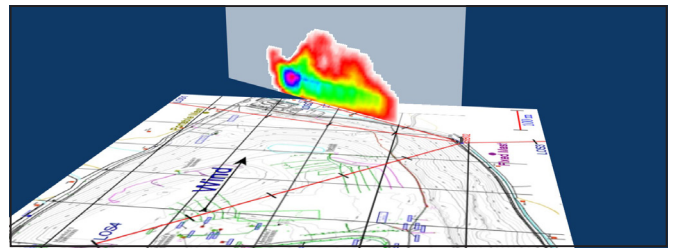
The DIAL technique can be used for a number of atmospheric monitoring campaigns, including:

- ▶ Remote measurements into inaccessible, hazardous or elevated areas
- ▶ Wide area surveys of diffuse sources, including methane from landfill sites
- ▶ Measurement of total industrial site emissions, including flares and tanks
- ▶ Boundary fence monitoring
- ▶ Identification and quantification of leaks and fugitive emissions
- ▶ Plume tracking and source identification from complex industrial plant
- ▶ Environmental impact assessment

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.



Concentration plot: Methane measured at a landfill site

Atmospheric Pollutants

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, ethene, ethyne, general hydrocarbons (HCs) including petroleum and diesel vapours, HCl, NO, NO₂, SO₂, benzene and toluene. Detection limits are shown in the following table:

Typical DIAL IR performance		
Species	Sensitivity (ppb)	Max Range (m)
CH ₄	80	600
C ₂ H ₆	20	600
C ₂ H ₄	130	600
C ₂ H ₂	30	600
HCs	30	600
HCl	15	800

Typical DIAL UV/Visible performance		
Species	Sensitivity (ppb)	Max Range (m)
NO	20	500
NO ₂	50	500
SO ₂	10	1000
Benzene	10	600
Toluene	10	600

NB: The sensitivities apply to typical measurement conditions (a signal to noise of 500 at 100 m from the DIAL for a 45 m wide plume)

Contact details	Further information
<p>National Physical Laboratory Hampton Road Teddington Middlesex United Kingdom TW11 0LW</p> <p>Switchboard: 020 8977 3222 Website: www.npl.co.uk</p>	<p>Instruments Team Customer enquiry line: 020 8943 6539 Email: instruments@npl.co.uk Website: npl.co.uk/instruments</p> <p style="text-align: right;">  </p>