TRANSITION Clean Air Network contact: info@transition-air.org.uk
Project Lead, Gordon Allison: gordona@dustscan.co.uk

Progressing Real Time Source Identification for Particulate Matter

A key step towards reducing people's exposure to air pollution, and its impacts on their health, is identifying the source(s) of that pollution. This usually requires very expensive instruments, limiting use to relatively few sites at any one time. To increase coverage, *DustScan* has developed, with the University of Birmingham, new techniques to differentiate between particulate matter (PM) from (1) construction dust, (2) vehicle brake/tyre/road wear, and (3) regional background PM using 'low-cost' PM sensors.

Key Messages

- Low-cost sensors can be used to extend PM source identification beyond the coverage achievable with regulatory grade instruments.
- There are many environments in which low-cost PM source identification could benefit our understanding of, and ability to reduce, public exposure to PM (e.g., indoor environments).

Next Steps

- Use of more than one sensor to 'triangulate' the source(s) of PM arriving in a given location.
- Use of complementary measurements of particle *number* concentration (in addition to *mass* concentration) to increase the accuracy of PM source identification still further.

What did we do?

These new techniques, build upon University of Birmingham research (Bousiotis et al., 2021, 2022: https://amt.copernicus.org/articles/14/4139/2021/ and https://doi.org/10.5194/amt-2022-84). DustScan made PM measurements with its *Cloud* sensor at two sites: a hard rock quarry in the Midlands; and the construction site for the new Curzon Street HS2 station in central Birmingham. DustScan then analysed these measurements (publicly available via link below) with weather data, and developed a methodology for real-time analysis in the 'cloud'. DustScan's full report (link below) also evaluates two statistical methods to characterise PM *size* distributions derived from Optical Particle Counter measurements.

What did we learn?

- Specific PM size patterns and number distributions can act as fingerprints for PM from different sources (e.g., different activities in the quarry/construction sites monitored).
- This fingerprinting technique, applicable to low-cost measurements of PM size distributions combined with weather data, enables real-time source apportionment.
- Different statistical methods for characterising PM size distributions have different merits: 'positive matrix factorisation' aids separation of PM sources whilst 'k-means clustering' yields more insight into site conditions at source.

Full Report

https://transition-air.org.uk/di-allison-report

Data

https://transition-air.org.uk/di-allison-data

The TRANSITION Clean Air Network is a UK-wide network, led by the University of Birmingham in collaboration with nine universities and over 20 cross-sector partners, aiming to optimise the air quality and health outcomes of transport decarbonisation; it is funded by UKRI via the UK Clean Air Strategic Priorities Fund, administered by **NERC [NE/V002449/1]**.