UNIVERSITY OF BIRMINGHAM

WM-Air Impact Case Study

Sooty Skies: Identifying the sources of fine particulate matter ($PM_{2.5}$) in the West Midlands

The dominant sources of $PM_{2.5}$ include **biomass burning, resuspended dust and traffic emissions, and secondary aerosols**

Local and regional policy interventions could lead to a **major reduction in $PM_{2.5}$ concentrations**

Changes in domestic burning are essential for reducing particulates and would **significantly decrease mortality and life-years lost**

Knowledge Exchange – with local and regional authorities

Policy and legislations – AQ Framework

Environmental – reducing PM

Partners

Birmingham City Council

Sandwell Metropolitan Borough Council

West Midlands Combined Authority

WM-Air investigated fine particulate matter ($PM_{2.5}$) sources in the West Midlands with key $PM_{2.5}$ sources determined to be biomass burning (25%), resuspended dust and traffic emissions (22%), and secondary aerosols (25%). The high contribution from biomass burning highlights the need for changes in behaviours around domestic burning. The work also suggests local and regional policies could reduce $PM_{2.5}$ by over 50%, significantly decreasing mortality and life-years lost due to air pollution. The WM-Air team are working with local and regional authorities to inform clean air policies in order to address PM.

Background - why does this work matter?

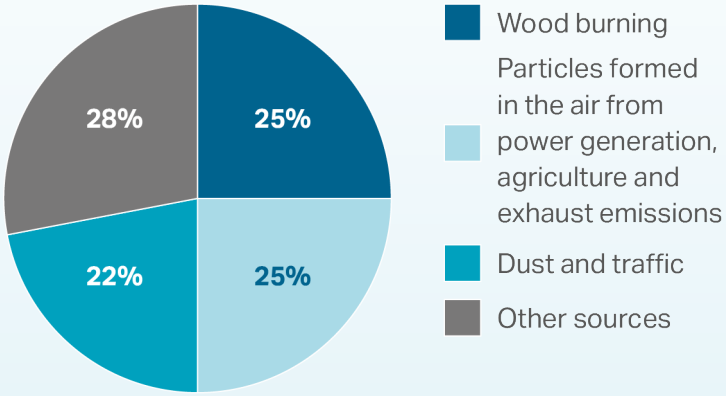
The health effects of short- and long-term exposure to fine particles ($PM_{2.5}$) are well-documented and include increased respiratory and cardiovascular morbidity and mortality. In the UK, 28,000-36,000 premature deaths each year are attributable to exposure to air pollution. The World Health Organisation (WHO) guidelines for $PM_{2.5}$ concentration (5 µg m^{-3} annual mean) are exceeded in most urban areas in England. In June 2021, air quality was raised as an issue at the WMCA annual meeting, and questions were asked about whether the region could do more, beyond addressing transport emissions alone. Therefore, this work was designed to provide a quantitative assessment of $PM_{2.5}$ sources in the West Midlands.

Method – what did we do?

WM-Air collected samples of PM over a period of 1 year (2021-2022) at BAQS and Ladywood (Birmingham) in order to undertake a detailed analysis of the sources of $PM_{2.5}$ in the West Midlands. This work was used to generate awareness of the seasonal variation in $PM_{2.5}$ contributions, particularly the significant impact of biomass burning in winter, and was presented to stakeholders at engagement events, and a workshop on wood burning organised by Smallwoods. These knowledge exchange activities provided delegates with a *'greater awareness of amount of particulate pollution relates to different sources and how much control we can have over those sources'* (Anonymous feedback from Clean Air Night event). These findings were also presented directly to Local Authority officers through the West Midlands Environmental Protection officers Group (WMEPG).

What tools/outputs were developed?

A new source apportionment dataset for PM in Birmingham was produced, along with WM-Air Briefing Notes on 'The impact of woodburning on air quality' and 'What is $PM_{2.5}$?'. A journal article outlining the source apportionment work is currently under review (2024). An additional briefing note will be produced once this article has been accepted.



Outcomes, Impacts and Benefits delivered

Data-driven insights were used to support the formulation of local and regional policies aimed at reducing $PM_{2.5}$ emissions, including:

- The West Midlands AQ Framework
- Targeted local policies to reduce traffic-related $PM_{2.5}$ emissions, including promoting electric vehicles, public transportation, and road dust management (e.g. Birmingham)
- Local policies, educational campaigns and materials to raise awareness about the impact of woodburning and traffic emissions on air quality and health (e.g. Sandwell)
- Advocacy for regional and local emission reduction targets to address secondary aerosols influenced by industrial and agricultural activities (e.g. WMCA)

Looking to the Future/Legacy

The impact of this work is yet to be fully realised, but the results and insights will also be used to help underpin future air quality interventions in Sandwell Council's 2025-2030 Air Quality Action Plan (AQAP), with a focus on $PM_{2.5}$, and serve as an input into Birmingham City Council's new Clean Air Strategy, in order to inform targeted interventions such as the expansion of smoke control orders. A Policy Briefing Note identifying best practise and opportunities for air quality improvement is currently being prepared to support these endeavours.

Future sampling and analysis of PM is also being undertaken, including wood smoke sampled around Birmingham using an aethalometer mounted in a car to identify hotspots areas, and FAAM-aircraft measurements with the aim of estimating the contribution of regional and local sources – both activities will further inform policy interventions.

Underpinning Science

- Comparative receptor modelling for the sources of Fine Particulate Matter ($PM_{2.5}$) at urban sites in the UK (Srivastava et al., 2024?) - under review

About WM-Air: Clean Air Science for the West Midlands

WM-Air ("Clean Air Science for the West Midlands") is a NERC-funded initiative, led by the University of Birmingham, working in collaboration with over 20 cross sector partners, to apply environmental science research expertise to improve air quality in the West Midlands, delivering health, economic and environmental benefits. **wm-air.org.uk**

UKRI Natural Environment Research Council

"Source apportionment data from the WM-Air team strengthened our arguments for implementing the Smoke Control Area, as it highlighted the significant contribution of particulate matter created from biomass burning across the West Midlands."

Elizabeth Stephens – Air Quality Team Manager, Sandwell Council

"Birmingham City Council's on-going collaboration with WM-Air has been key to addressing the challenges it faces in improving the air quality (AQ) for our city ...we are building a deeper understanding and awareness of the sources of air pollution and the actions we can take to improve it which will directly translate into the next iteration of the Brum Breathes Clean Air Strategy, promoting modal shift towards cleaner, healthier forms of travel."

Steve Arnold – Head of CAZ, BCC

More info and URLs: