New Air Quality Targets and Interim Goals for Fine Particulate Matter ($PM_{2.5}$):

Implications for the West Midlands

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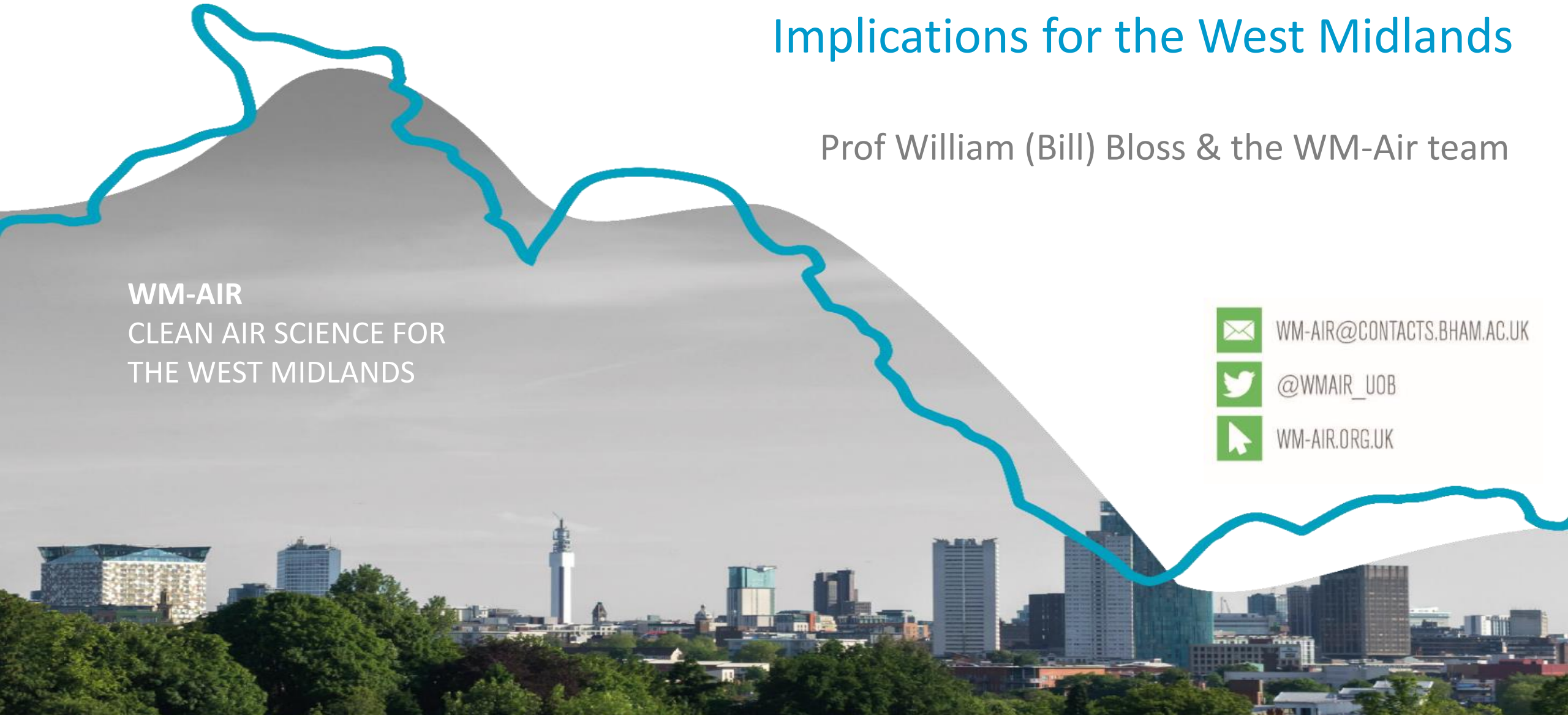

Aims for Today

- Welcome

- $PM_{2.5}$ targets and implications
- WMCA Air Quality Framework — Jackie Homan

- AQ-LAT: Predicting health impacts of future air quality scenarios — Suzanne Bartington
- AQ-PET: Evaluating the impact of air quality policy interventions — Zongbo Shi

- Networking

What is WM-Air ?

- ‘Clean Air Science for the West Midlands’
- NERC-funded Regional Impact of Science of the Environment project
- Running 2019 – 2024
- Aim is to apply environmental science expertise to deliver **regional impact** - in societal, economic and policy terms - in support of improved air quality and health.

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NERC SCIENCE OF THE ENVIRONMENT

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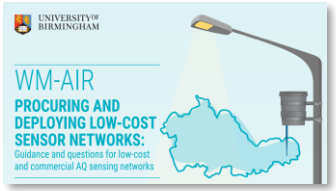
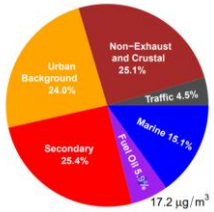
CERC · Coventry City Council · Dudley · Forest Research · Greater Birmingham & Solihull · H.E.A.T. · HS2

Low Emission Strategies · West Midlands · NATURAL ENGLAND · NetworkRail · RICARDO · Sustainable Development Unit · sustrans

TEMPLE · The Floow · Transport for West Midlands · Trees for Design Action Group · Walsall Council · West Midlands Combined Authority · INNOVATION ALLIANCE for the West Midlands

Observational Capability

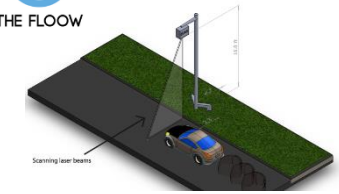




Real World Vehicle Emissions

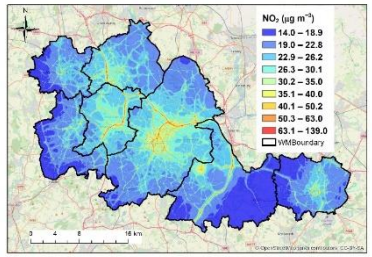
heat
Hager Environmental & Atmospheric Technologies

THE FLOOW

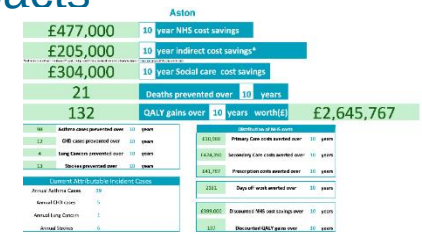


Predicting Air Quality vs Policy

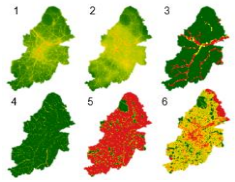
CERC

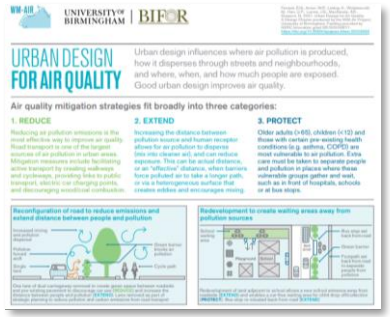


Health & Economic Impacts



Urban Design & Green Infrastructure





Case Study Applications

BIRMINGHAM 2022

Transport for West Midlands

West Midlands Combined Authority

Birmingham City Council

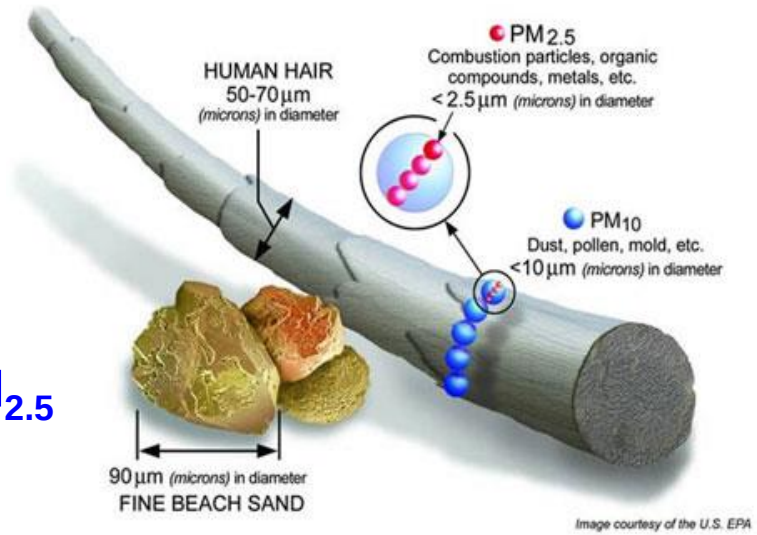
Save Today Play Tomorrow

Clean & Active Travel

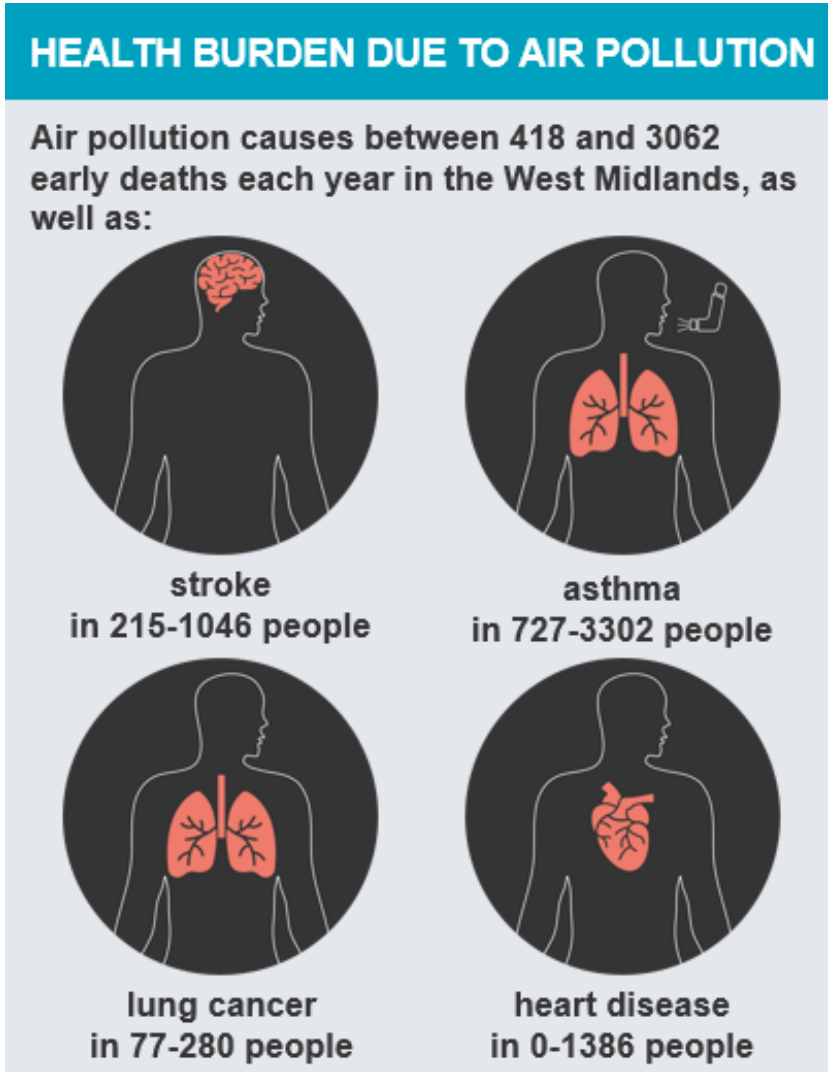
NHS
University Hospitals Birmingham
NHS Foundation Trust

Key Air Pollutants

Fine Particles, **$PM_{2.5}$**



Nitrogen dioxide gas, **NO_2**



$PM_{2.5}$: Not just transport !

Fig 1. Direct emissions of $PM_{2.5}$ from sources within the WMCA region, data drawn from the National Atmospheric Emissions Inventory. The data were simplified by grouping source sectors. © Crown 2022 copyright Defra & BEIS via naei.beis.gov.uk, licenced under the Open Government Licence (OGL).

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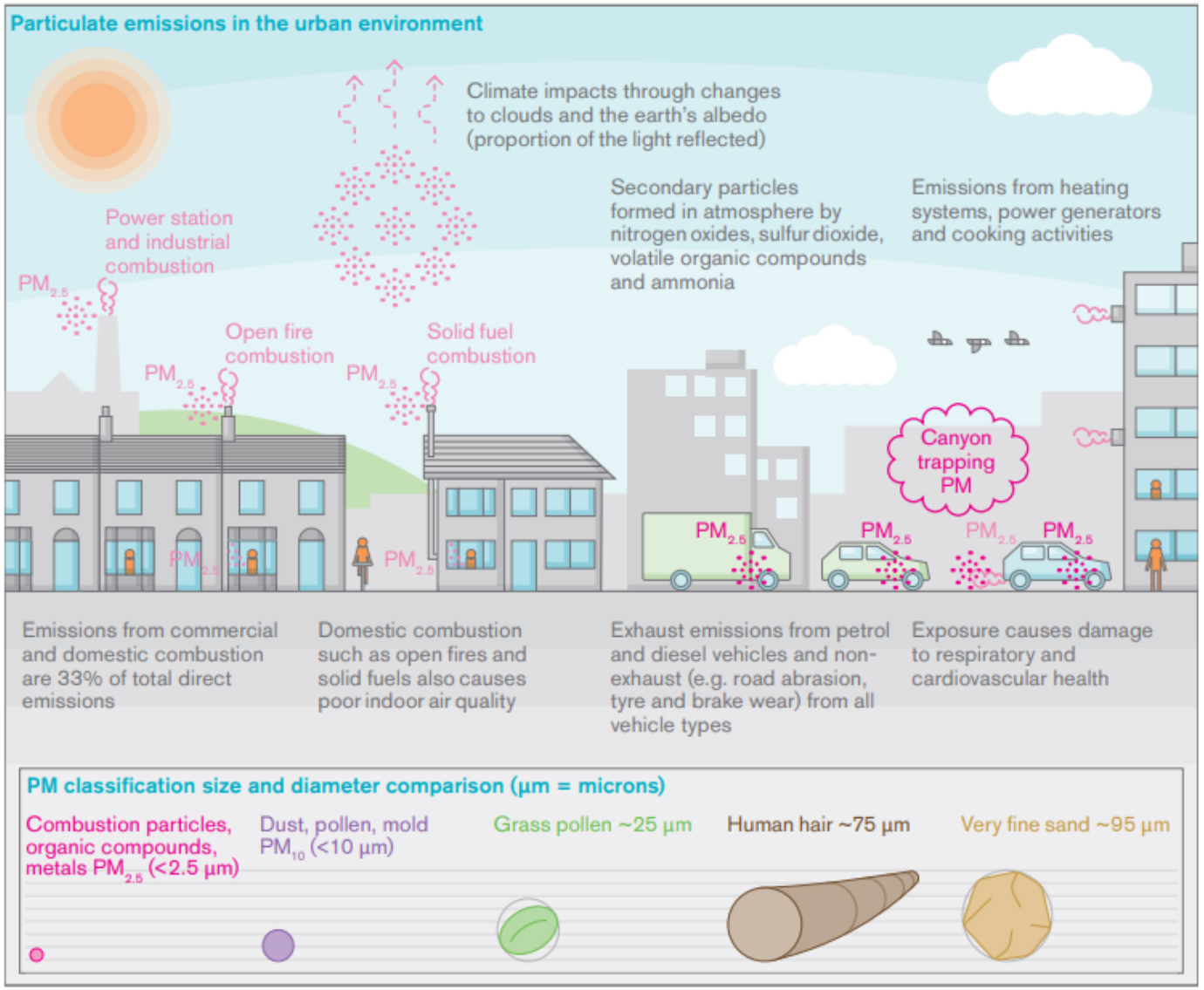
WHAT IS $PM_{2.5}$?

Particulate matter (PM) is a term used to describe very small solid and liquid particles suspended in the air. These particles can be of natural or man-made origin and impact human health and the climate.

re described by their indicating particles with or below and $PM_{2.5}$ r of 2.5 µm or below. re those with a diameter ($PM_{0.1}$).



UK legislation background

- Existing air quality targets and objectives – drawn from EU legislation

  Protect public health and the environment by maintaining acceptable levels of pollutants in ambient air

- WHO Air Quality Guidelines

  Levels of ambient air pollutants at which there are impacts on health. Updated 2021: Advisory.

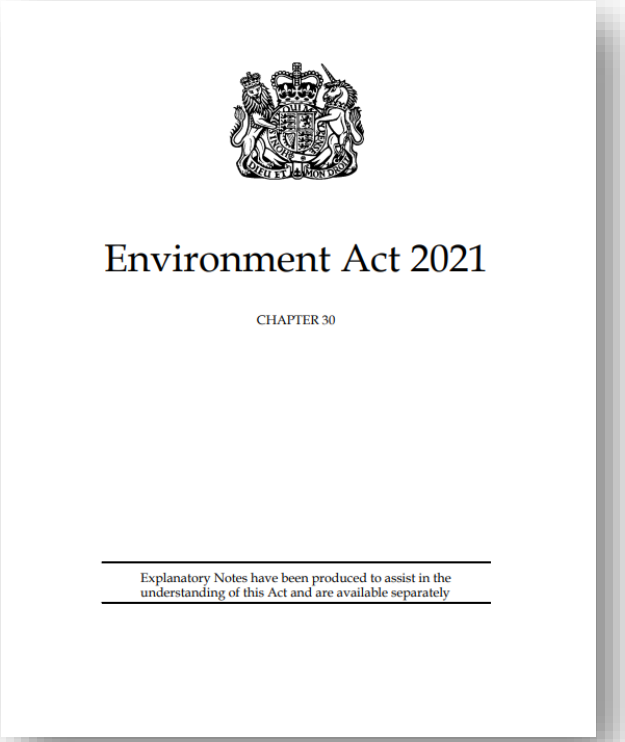
- Environment Act 2021

  Required Sec of State to set new targets (2022) for fine particulate matter, $PM_{2.5}$

  Introduces new powers and obligations locally/regionally, and with partners

- Air Quality Strategy (updated April 23)

  Framework for Local Authority Delivery



New Air Quality Targets and Interim Goals for $PM_{2.5}$

Table 1. 2040 $PM_{2.5}$ threshold target (England) set by the Environment Act 2021, UK $PM_{2.5}$ objectives (England) set by the Air Quality Standards Regulations 2010, and WHO 2005 and 2021 global $PM_{2.5}$ (health-based) guidelines for annual mean $PM_{2.5}$ concentrations.

Environment Act 2021 $PM_{2.5}$ Target ($\mu g\ m^{-3}$)	Air Quality Standards Regulations 2010 $PM_{2.5}$ Objective ($\mu g\ m^{-3}$)	WHO 2005 $PM_{2.5}$ Guideline ($\mu g\ m^{-3}$)	WHO 2021 $PM_{2.5}$ Guideline** ($\mu g\ m^{-3}$)
10*	20	10	5

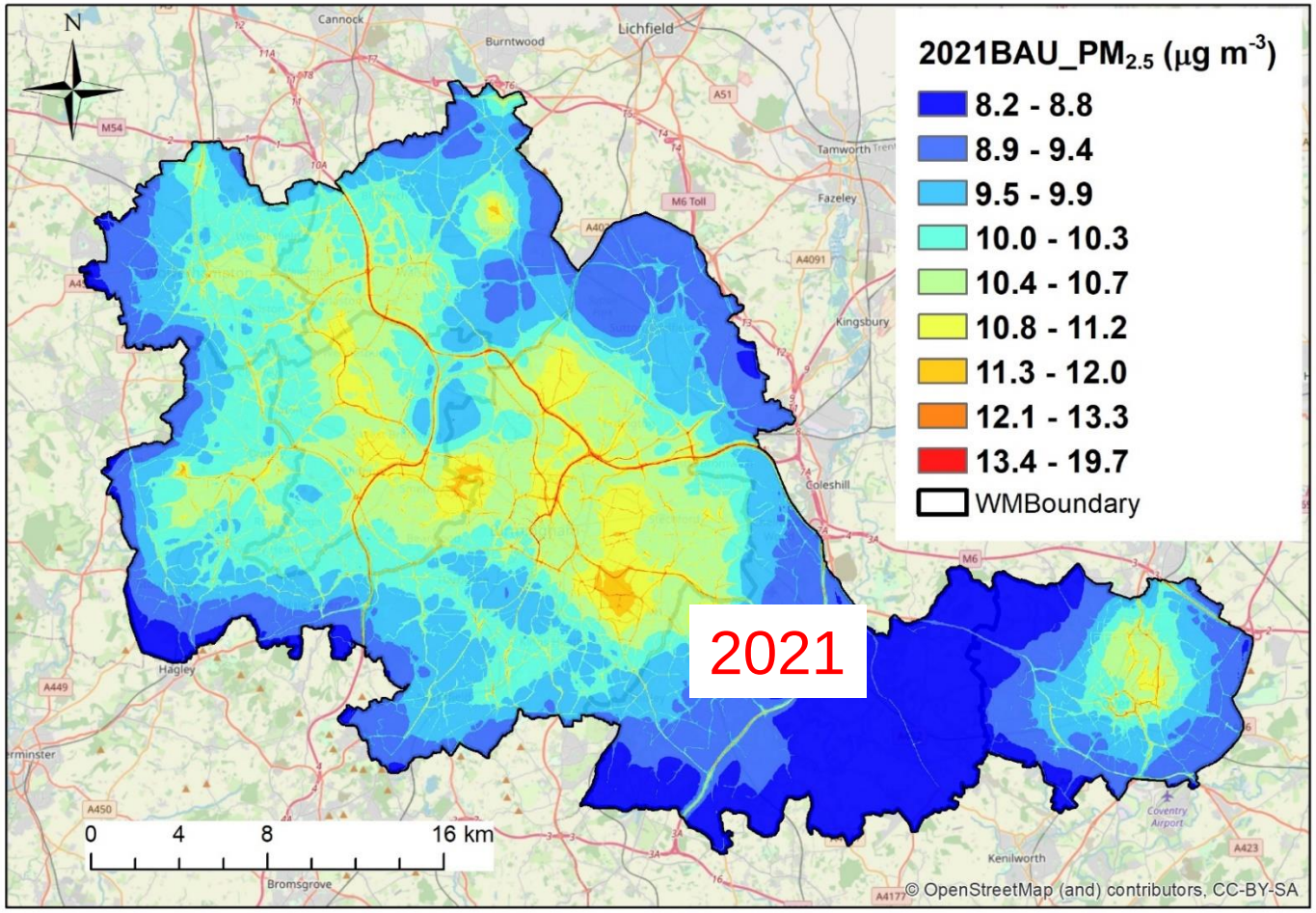
Notes: *According to the Environment Act 2021, the new $PM_{2.5}$ threshold target of 10 $\mu g\ m^{-3}$ for annual mean concentrations must be attained by 2040. **See also the WM-Air briefing on 2021 WHO air quality guidelines for detailed information on the subject.

December 2022 - two new $PM_{2.5}$ targets were set for England following AQ legislation introduced by the Environment Act 2021:

- An Annual Mean Concentration Target for $PM_{2.5}$ levels of **10 $\mu g\ m^{-3}$ or less by 2040**, with an interim target of 12 $\mu g\ m^{-3}$ or less by 2028.

- A Population Exposure Reduction Target to reduce $PM_{2.5}$ population exposure by **35% by 2040 compared to 2018**, with an interim target of at least 22% by 2028.

Modelled $PM_{2.5}$ Concentrations in the West Midlands



- Modelled $PM_{2.5}$ ranges from 8 to 20 µg m^{-3} (within existing AQ objective for England).
- But significant areas (41%) exceed 2040 threshold target of 10 µg m^{-3} or less.
- Over half of the 192 wards across the region (in all LAs) have ward-averaged annual means >10 µg m^{-3}.
- 60% of the region's population living in wards where ward-average >10 µg m^{-3} in 2021

Clean Air & Climate / Carbon

- Air Pollutants – directly harmful to health: $PM_{2.5}$, NO_2
- Carbon Dioxide CO_2 – not directly harmful to health*, drives climate change

- Many common sources – combustion of fossil fuels

- Many actions to improve air quality also reduce carbon emissions (co-benefits)
- The air quality benefits are largely local / regional

    Local change improves local air quality and local health

Future predictions

Now

Current AQ Actions

Climate Policy: EV Focus

Climate Policy: Full Net Zero

Table 2. Estimated annual mean $PM_{2.5}$ concentrations in the WMCA region for 'Present Day' (2021, BAU), and 2030 under three different policy scenarios.

Scenario	(I) Estimated annual mean $PM_{2.5}$ ward-level averaged in the WMCA region ($\mu g\ m^{-3}$)			(II) Estimated no. wards where annual mean $PM_{2.5} > 10\ \mu g\ m^{-3}$ *	(III) Estimated % population [total 2.9 million] living in wards where annual mean $PM_{2.5} > 10\ \mu g\ m^{-3}$ *	(IV) Estimated no. wards where annual mean $PM_{2.5}$ > WHO 2021 (health-based) guidelines ($5\ \mu g\ m^{-3}$) *
	Mean	Min	Max			
Present Day (2021, BAU)	10.0	8.4	11.1	104	57	192
Scenario A (2030, NECD)	9.4	7.7	10.4	28	16	192
Scenario B (2030, EV)	9.3	7.7	10.4	26	15	192
Scenario C (2030, Net Zero)	8.9	7.6	9.9	0	0	192

Notes: The values in the table above are a function of the spatial resolution / averaging approach. For the $PM_{2.5}$ levels (I) the figures quoted are estimated from the ward mean values across the WMCA region. For columns (II), (III) and (IV), model outputs are averaged to ward level, and combined with ward population figures. *The ward-level averaging approach significantly smooths out the highest (and lowest) $PM_{2.5}$ values from the original model simulations (which have higher spatial resolution). Segments of the population will be exposed to both higher and lower annual mean concentrations than the ward-level average. The model 2021 BAU scenario does not account for Covid impacts on activity.

Future predictions

Now

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	Mean
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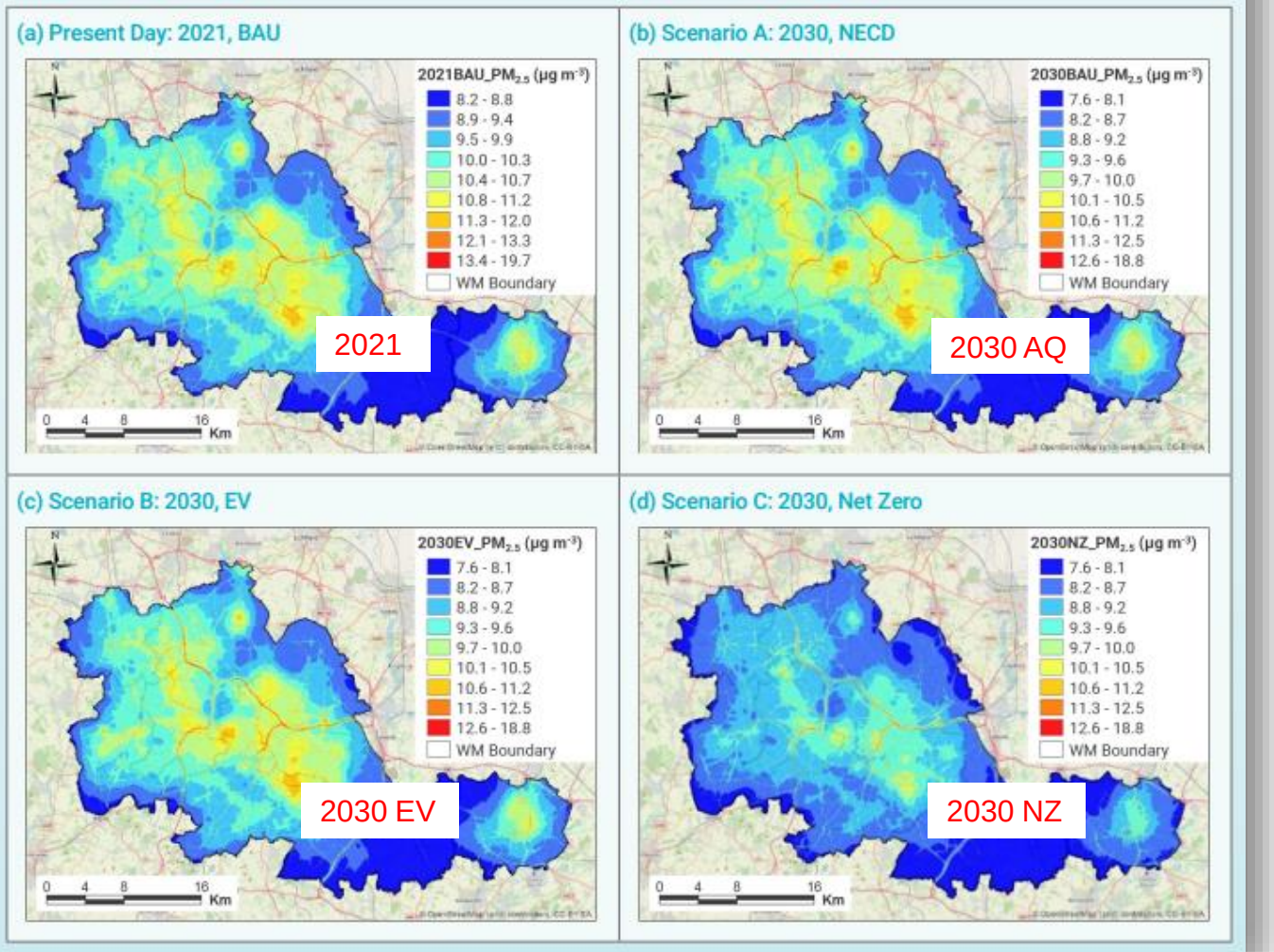
Scenario A (2030, NECD)	9.4
Scenario B (2030, EV)	9.3
Scenario C (2030, Net Zero)	8.9

Notes: The values in the table quoted are estimated from th to ward level, and combined w (and lowest) $PM_{2.5}$ values fror be exposed to both higher and account for Covid impacts on

Fig 2. Spatial distribution of estimated annual mean $PM_{2.5}$ concentrations in the WMCA region for 'Present Day' (2021, BAU) (a) and 2030 under three different policy scenarios (b-d).



Local Air Quality Management

- From: https://www.gov.uk/government/publications/the-air-quality-strategy-for-england/air-quality-strategy-framework-for-local-authority-delivery

3.2 Local action to reduce PM2.5

- As well as meeting local objectives, local authorities play a role in contributing to national targets. The government recognises that as a regional pollutant, many of the sources of PM2.5 are outside of local authority control. However, there are sources of PM2.5 over which local authorities do have control. Therefore, while PM2.5 is not currently part of the Local Air Quality Management framework, the government still expects all local authorities to effectively use their powers to reduce PM2.5 emissions from the sources which are within their control.

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- We have been clear in guidance to local authorities since 2016 that we expect local authorities to use their powers to reduce PM2.5. We still have not seen sufficient action from the majority of local authorities. In light of the new targets, if we consider further action to be insufficient, we will consult on introducing a standalone legal duty on local authorities to take action to reduce PM2.5 emissions.

Actions for local partners: 4

- All local authorities should support the delivery of national PM2.5 targets by taking action to reduce emissions from sources within their control.
- If the government considers local action has not gone far enough, we will consider introducing a statutory duty on local authorities.

Opportunities and Challenges

- Requires increased attention and action by policy makers at local, regional and national levels.

Need to understand and quantify:

- the health benefits achieved through different intervention options
- the predominant sources of air pollution in the region
- the partition between local emissions and pollution transported from elsewhere

- Achieving the new targets will require clean air policies to broaden actions beyond road transport to include solid fuel combustion in households and industry, and regional and national coordination to address imported pollution.

- The increased evidence of health impacts of even low levels of $PM_{2.5}$ and NO_2 challenges current compliance-based frameworks: need for new strategies and policies to achieve clean air health benefits in the West Midlands.

WM-Air Briefing Note

- https://wm-air.org.uk/news/

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Baldo, C., Zhong, J., Hall, J.A., Muller, C., Barrington, S.E., Bloss, W.J. & the WM-Air Team. New Air Quality Targets and Interim Goals for Fine Particulate Matter – $PM_{2.5}$: Implications for the West Midlands. WM-Air Project, University of Birmingham. Funding provided by NERC grant NE/S003487/1. https://doi.org/10.25500/epapers.bham.00004251

New Air Quality Targets and Interim Goals for Fine Particulate Matter – $PM_{2.5}$: Implications for the West Midlands

A report from the WM-Air project team

Contact: wm-air.org.uk; @WMAir_UoB; wmair@contacts.bham.ac.uk

This document provides a comprehensive overview of the implications of more stringent $PM_{2.5}$ targets on air quality and public health in the West Midlands. By examining the sources and levels of $PM_{2.5}$ pollution, exploring potential air quality scenarios and strategies, and estimating the health burden, this document seeks to inform stakeholders and decision makers in their efforts to improve air quality and reduce associated health risks and inequalities. The document is structured as follows:

- Health Risks and Inequalities Associated with Exposure to $PM_{2.5}$ Pollution
- Sources of $PM_{2.5}$ in the West Midlands
- New Air Quality Targets and Interim Goals for $PM_{2.5}$
- Modelled $PM_{2.5}$ Concentrations in the West Midlands
- Air Quality Scenarios for the West Midlands: Potential Impacts of Policy Decisions
- Estimated Health Burden of Air Pollution in the West Midlands
- Opportunities and Challenges
- Strategies and Initiatives for Improving Air Quality and Public Health in the West Midlands

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