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The Air We Breathe

William Bloss



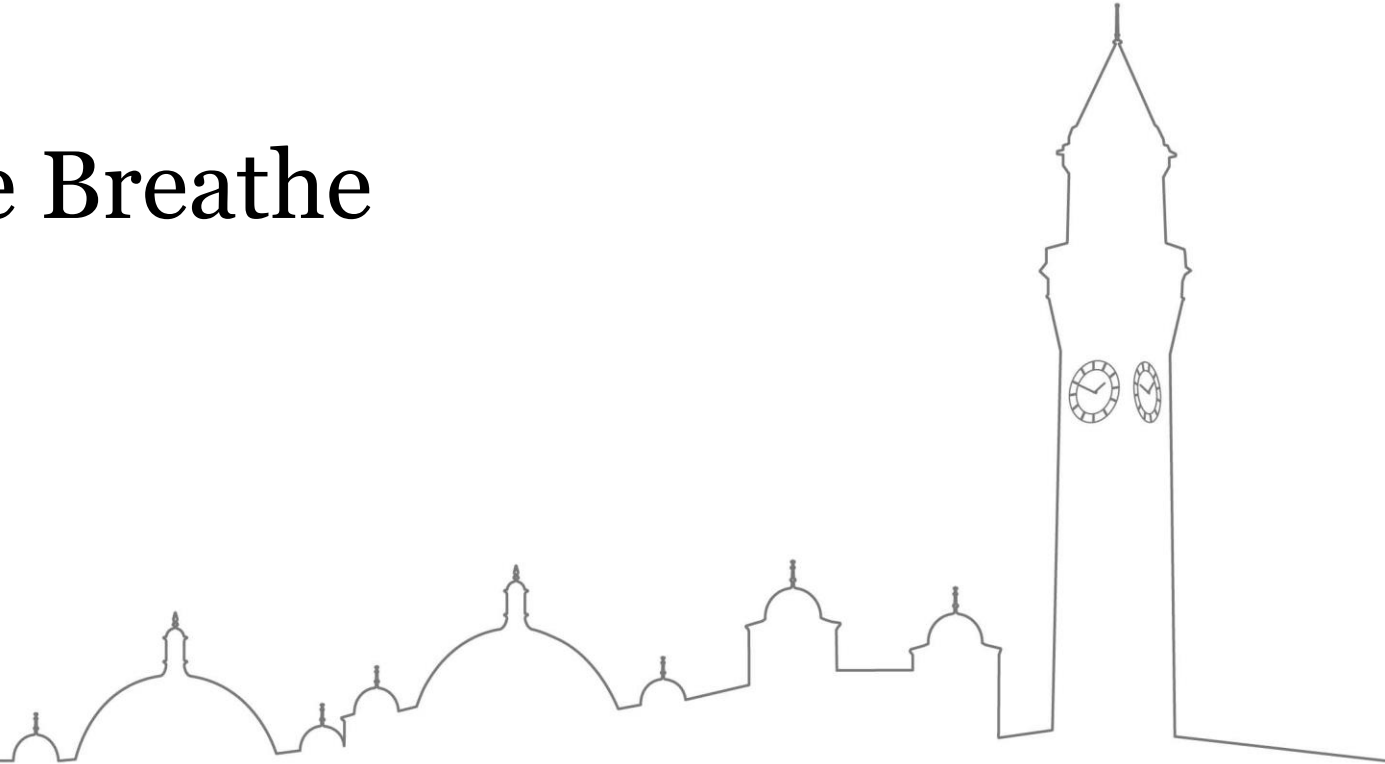
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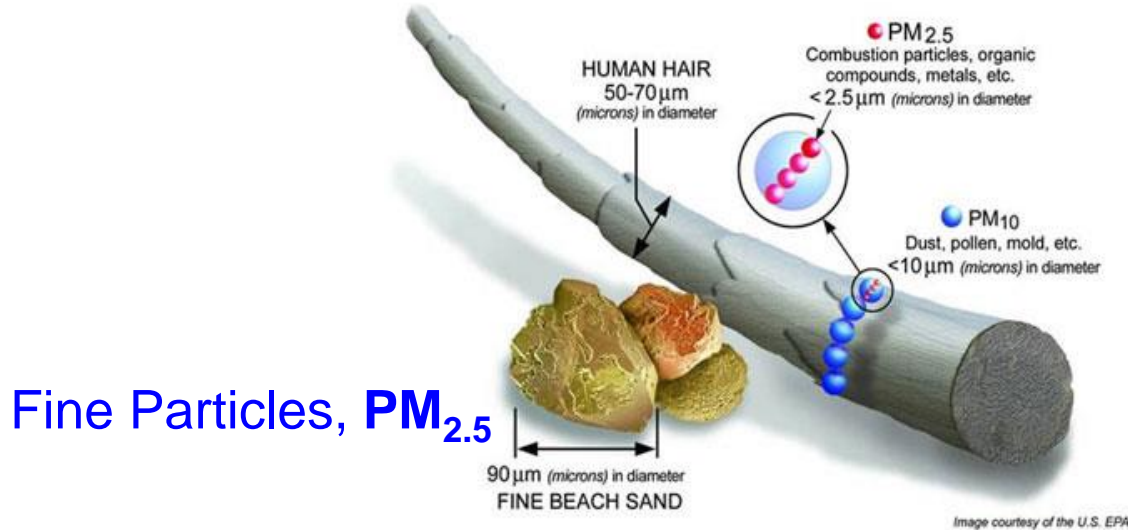
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Key air pollutants

Nitrogen dioxide gas, NO_2



Carbon Dioxide, CO₂

- Formed from burning fuels – wood, coal, petrol, oil...
- Not harmful to people in outside air
- Drives climate change

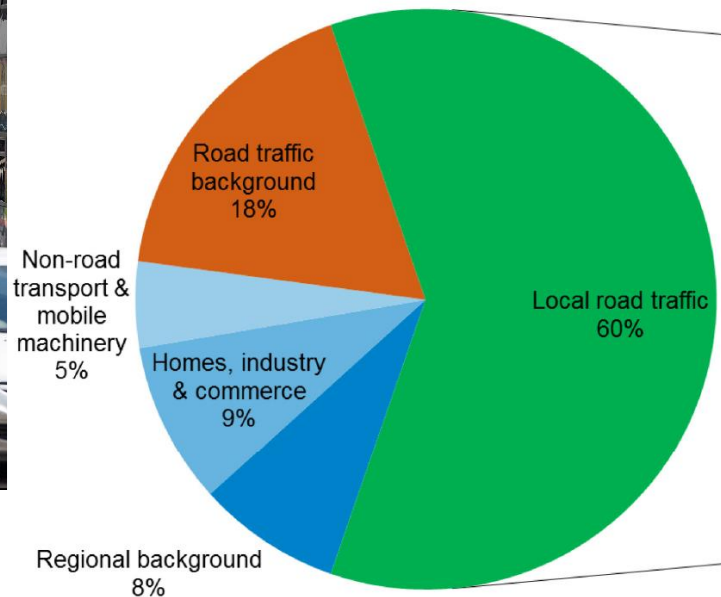
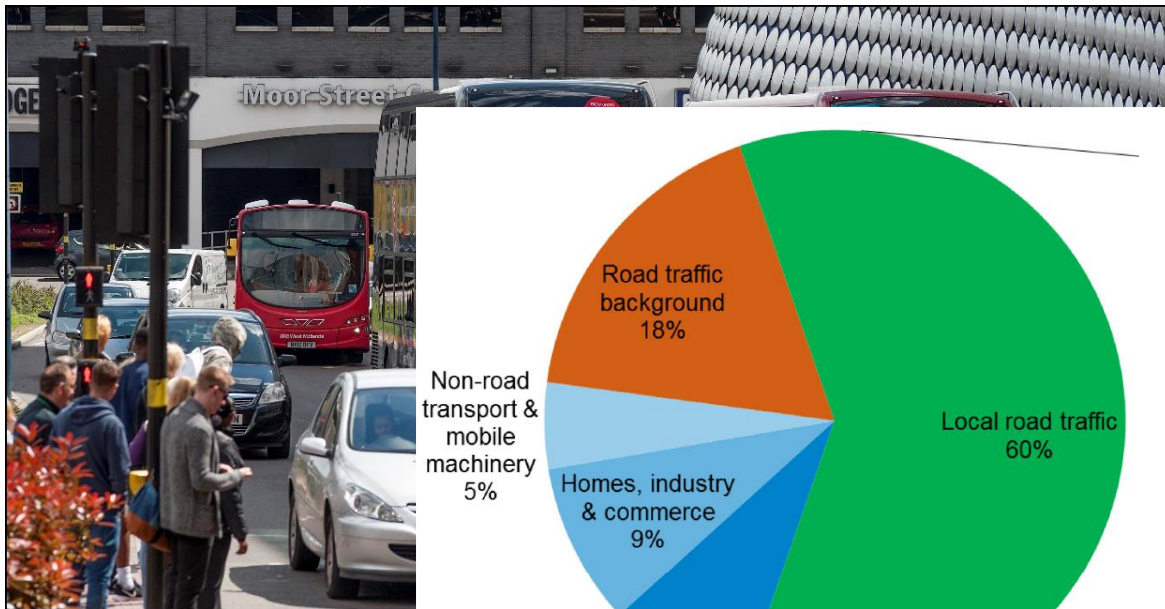


Sources of NO₂

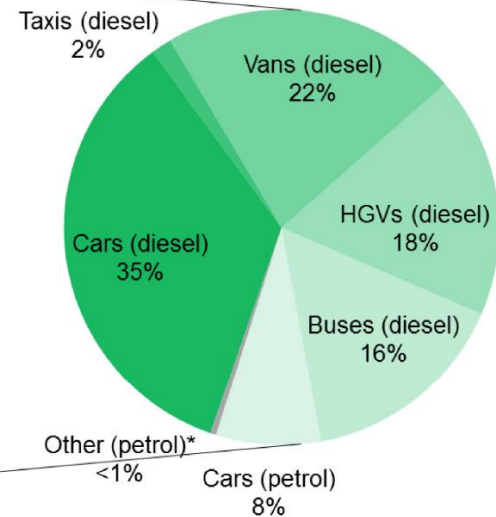
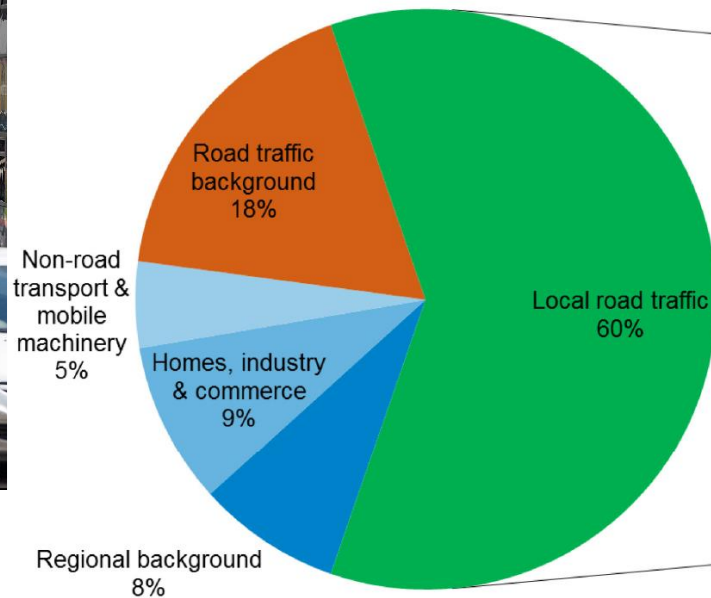
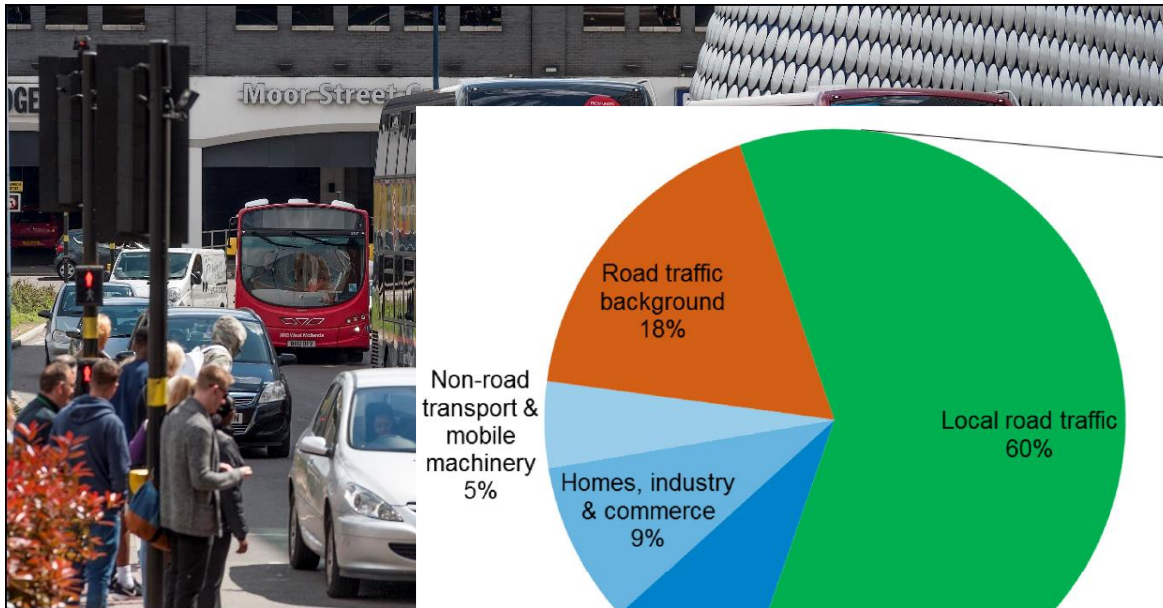


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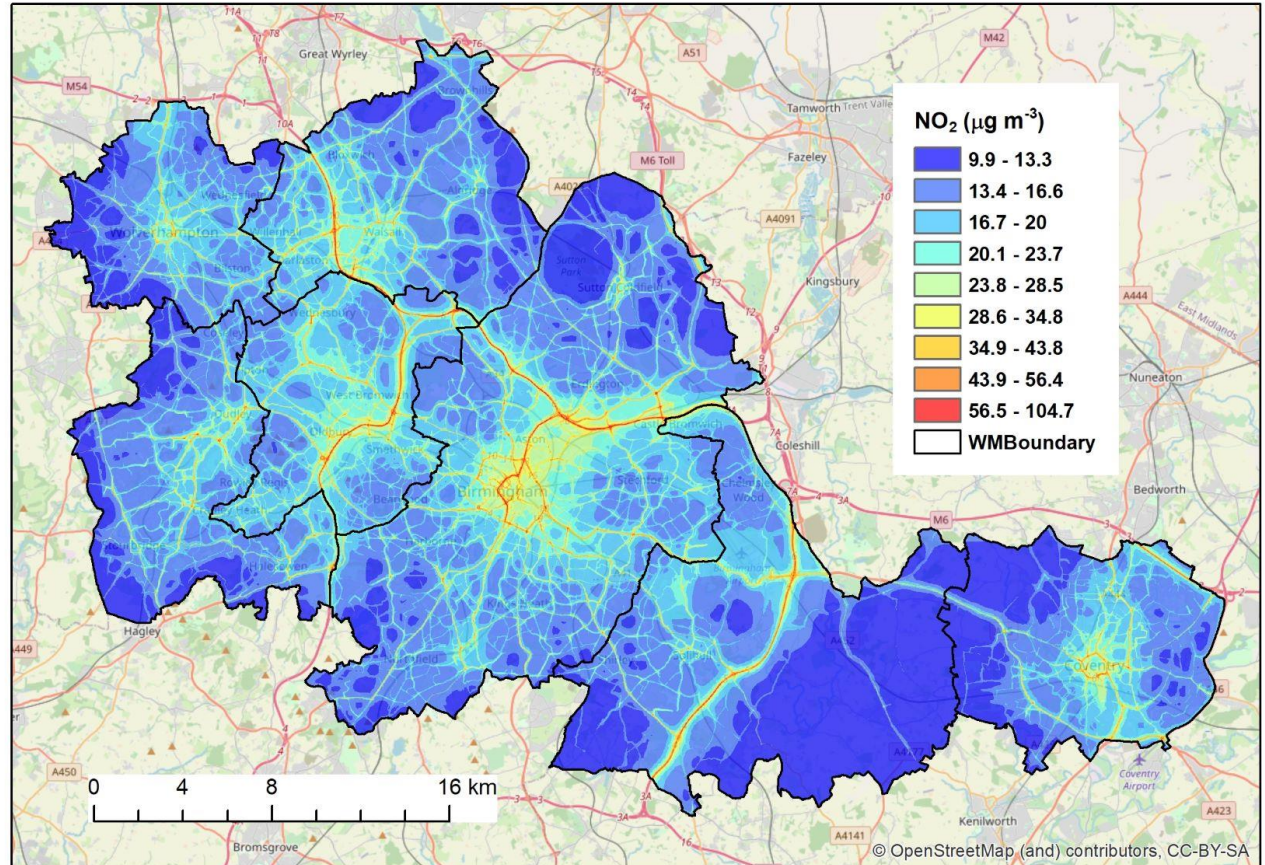
Sources of NO₂



Sources of NO₂



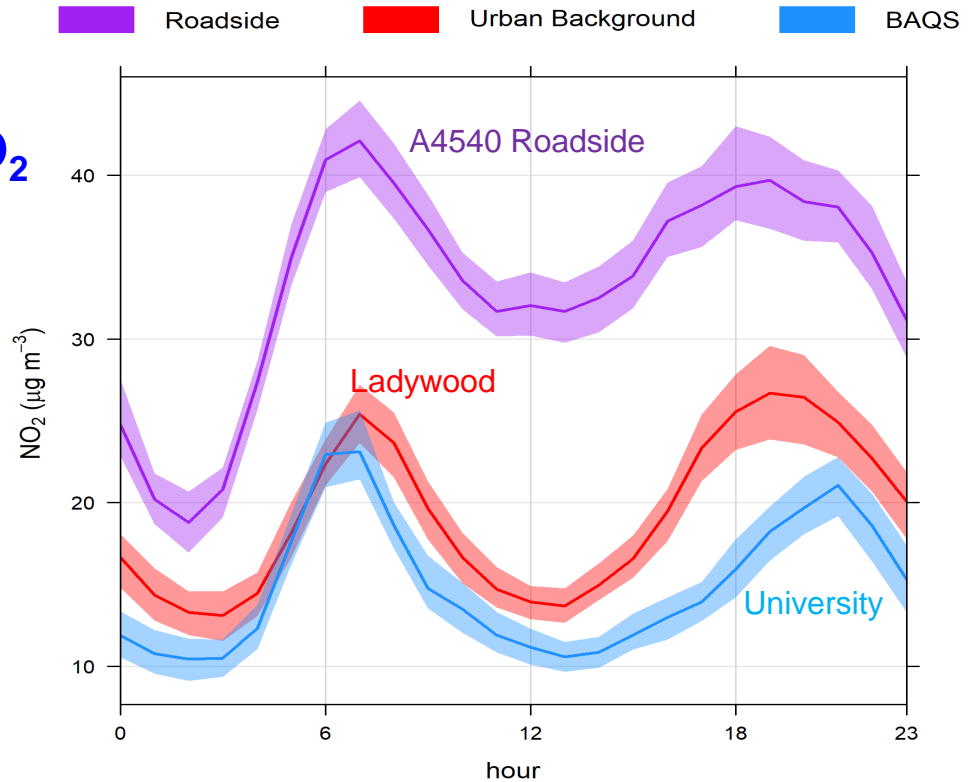
NO₂ across the West Midlands



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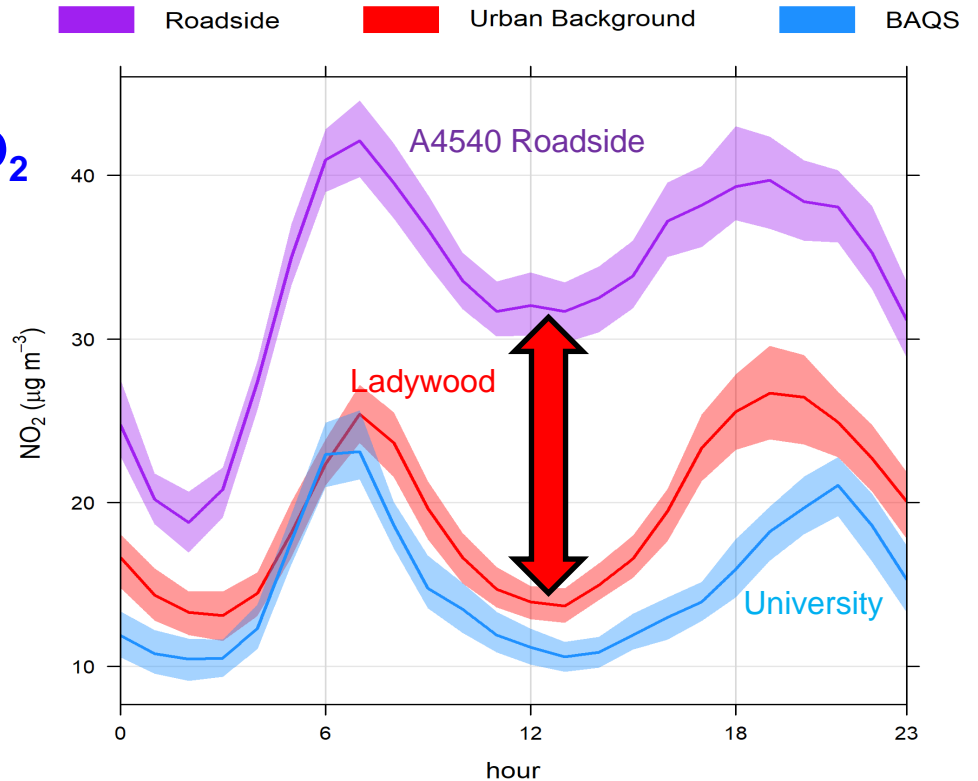
How do levels change with time of day ? NO_2

Nitrogen dioxide gas, NO_2



How do levels change with time of day ? NO_2

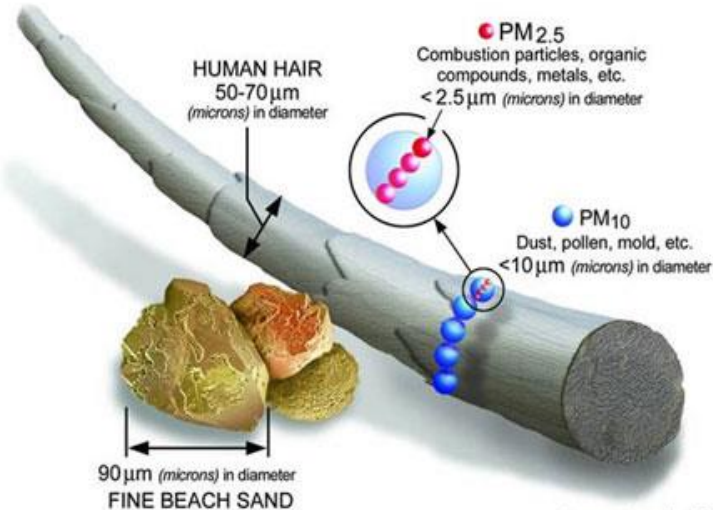
Nitrogen dioxide gas, NO_2



Key air pollutants

Nitrogen dioxide gas, **NO₂**


Fine Particles, **PM_{2.5}**



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Image courtesy of the U.S. EPA

Sources of PM_{2.5}



Construction sites and non-road mobile machinery (NRM) are significant and often localised sources of PM and NO_x.

Aircraft contribute to NO_x emissions, particularly at take-off.

Farming creates primary PM and emissions from fertilizer can create secondary PM.

Bonfires and fireworks create significant PM.

Industrial processes, particularly combustion processes, create primary PM and NO_x. Additional gases emitted from industry can also contribute to secondary PM.

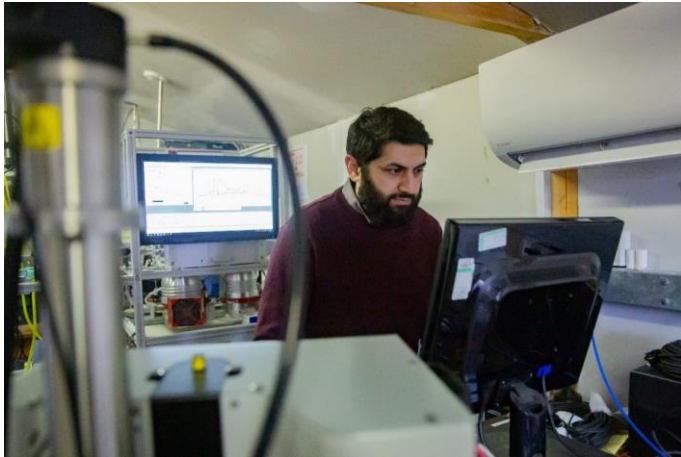
Road transport is a significant source of primary PM and NO_x. PM is emitted both from exhausts as well as from brake and tyre wear as well as road surface abrasion. Other gases emitted from exhausts can add to secondary PM. Rail can contribute to PM and NO_x.

Home and commercial heating contributes to NO_x. Solid fuel burning in homes creates significant PM.

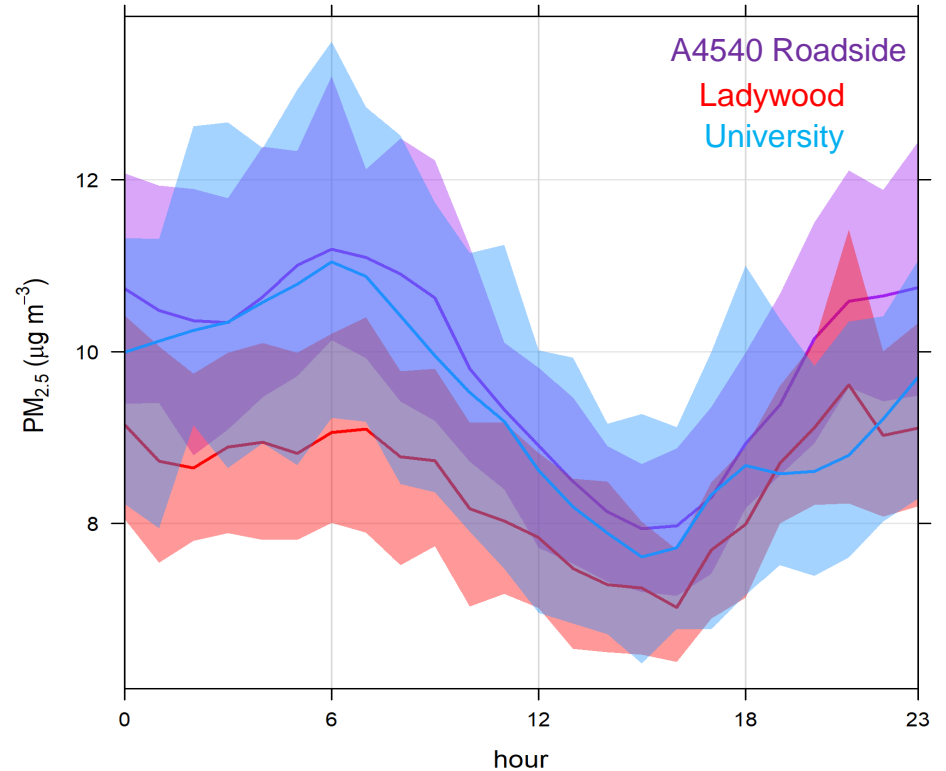
Shipping creates PM and NO_x.

How do levels change with time of day ? $\text{PM}_{2.5}$

Fine Particles, $\text{PM}_{2.5}$



Roadside Urban Background BAQS



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What are the air quality targets?

- Current **UK government limits** (Air Quality Objectives)

NO₂ **40** μg m⁻³

PM_{2.5} 20 μg m⁻³

New Env Act: **10** μg m⁻³ (by 2040)



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- **World Health Organisation** Air Quality Guidelines (not legal limits)

NO₂ **10** μg m⁻³

PM_{2.5} **5** μg m⁻³



Air Quality & Climate Change

- Air pollutants harmful to health: **NO₂, PM_{2.5} ...**
- Greenhouse Gases: **CO₂**
- Common sources:
 - Fossil Fuel** Combustion (transport, power, heating, industry)
 - Agriculture



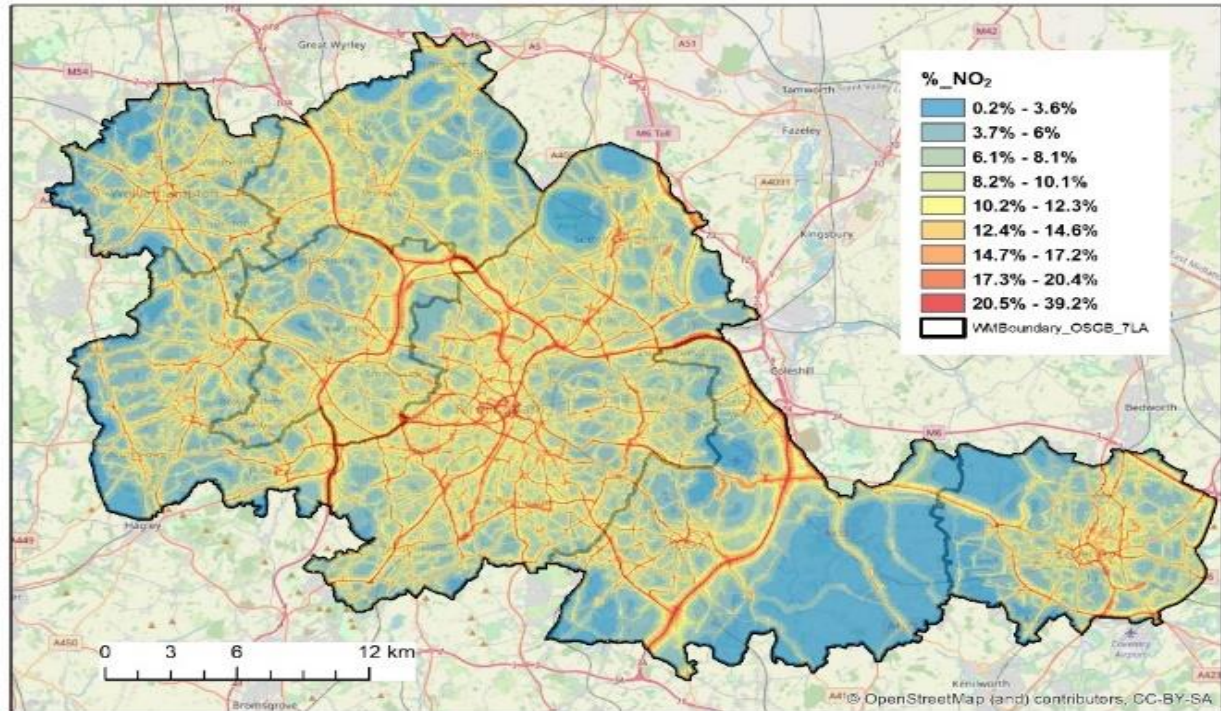
Reducing our emissions...



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Net Zero / Carbon & Air Quality **Co-Benefits**

- Change in NO₂: Make all buses + 50% of light goods vehicles electric



How should we decide what to do ?

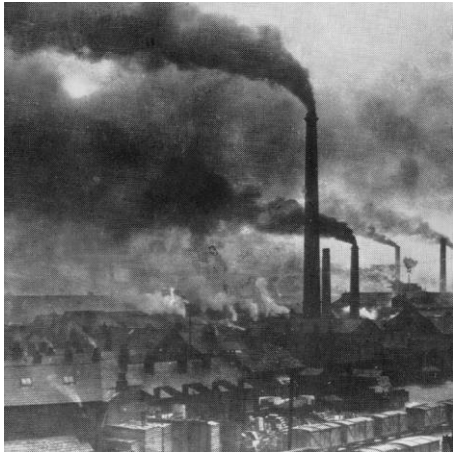
Reduce – Extend – Protect

(in that order)

- **Reduce** emissions
- **Extend** the distance from emission to people
- **Protect** people from air pollution

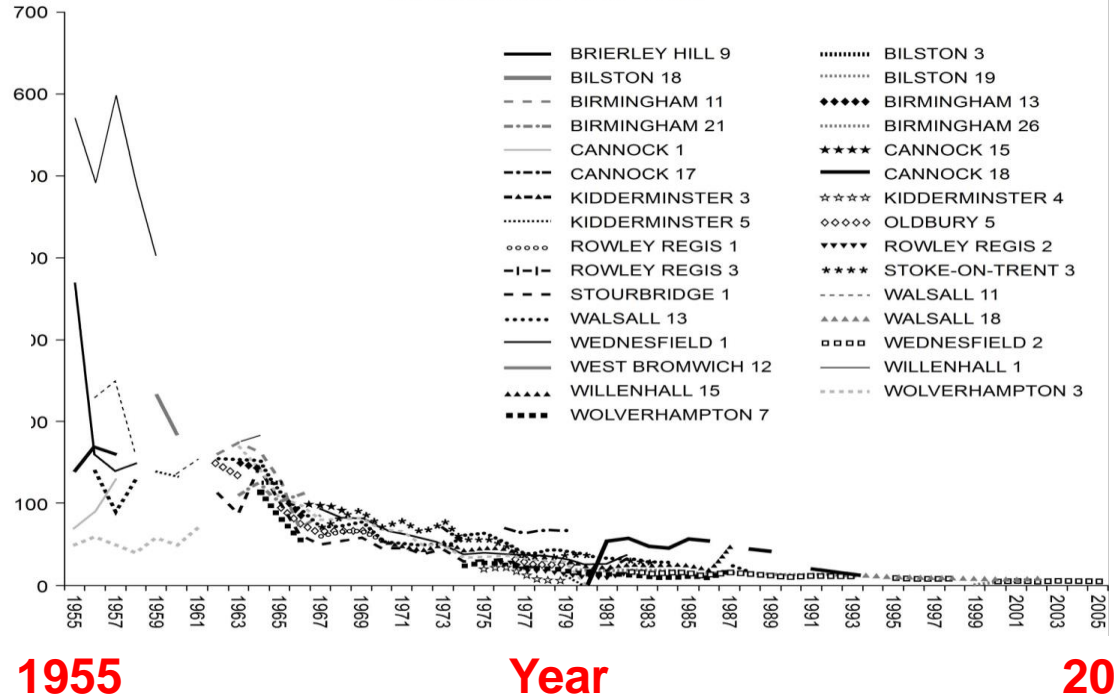


We are making progress !



**“Black
Smoke”**

Suspended Matter (Black Smoke) ($\mu\text{g}/\text{m}^3$) in the West Midlands, 1955 - 2005



Some conclusions...

- NO₂: Road transport, especially older diesel; industry/power generation
Newer vehicles, EVs (affordability, fairness, non-exhaust emissions); travel choices
- PM_{2.5}: Combustion: domestic, industry, coal / wood; agriculture, transport
Domestic and commercial heating and burning; transport / travel; agriculture
- Climate: Carbon and Air Quality reduction co-benefits
Local action to reduce local emissions brings local health benefits



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