

Air Quality.

Jim McQuaid

2026 Northern Air Quality Conference
30th June 2026



j.b.mcquaid@leeds.ac.uk

[@jimmcquaid](https://twitter.com/jimmcquaid)



“Take us wherever you want”

Jim McQuaid

2026 Northern Air Quality Conference
30th June 2026



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[@jimmcquaid](https://twitter.com/jimmcquaid)



**On average you breathe
12000 - 15000 litres of air
every day... at ~1.29 g/L that
is in excess of 15 kg, that is
several times more than you
consume as food/drink.**

Clean Air (Human Rights) Bill

AKA – “Ella’s Law”.

Baroness Jenny Jones
‘introduced’ the Clean Air
(Human Rights) Bill to the House
of Lords on 5 July 2018 i.e. the
62nd anniversary of the first
Clean Air Act receiving Royal
Assent and the National Health
Service’s 70th birthday.

<https://cleanair.london/legal/clean-air-is-a-human-right/>





CHAPTER 52

An Act to make provision for abating the pollution of the air.
[5th July, 1956]

BE it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

ELIZABETH II



1968 CHAPTER 62

An Act to make further provision for abating the pollution of the air.
[25th October 1968]

BE IT ENACTED by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—



Clean Air Act 1993

1993 CHAPTER 11

An Act to consolidate the Clean Air Acts 1956 and 1968 and certain related enactments, with amendments to give effect to recommendations of the Law Commission and the Scottish Law Commission.
[27th May 1993]

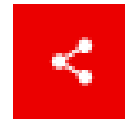
**17/12/20 - Coroner's report
concluded that Ella died aged 9
(2013) from acute respiratory failure,
asthma and "air pollution exposure".
THE ONLY PERSON ON THE PLANET!**



Air Quality includes damp (mould).

Awaab Ishak: Mould in Rochdale flat caused boy's death, coroner rules

🕒 15 November



FAMILY HANDOUT

Awaab Ishak's father had reported the mould several times to Rochdale Boroughwide Housing

Air Pollution

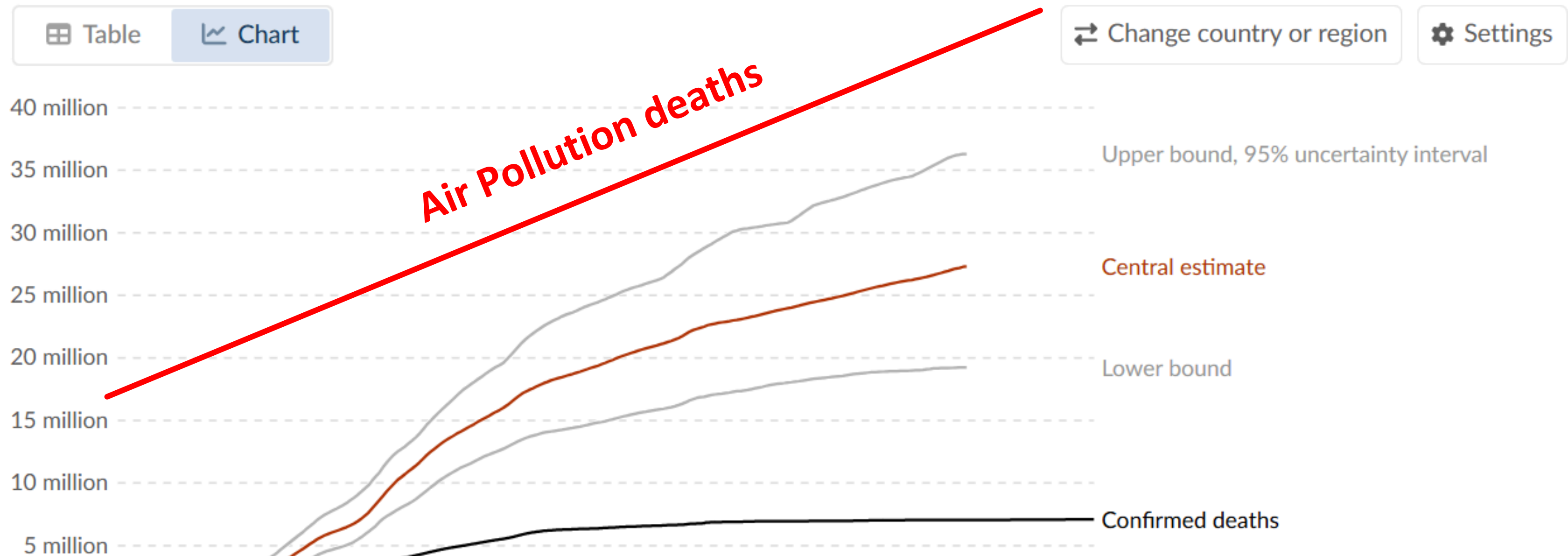
Why isn't it bigger
news???

Food for thought..... Global Deaths from COVID-19 are LESS than from Air Pollution!

Estimated cumulative excess deaths during COVID-19, World

Our World
in Data

For countries that have not reported all-cause mortality data for a given week, an estimate is shown, with uncertainty interval. If reported data is available, that value only is shown. For comparison, cumulative confirmed COVID-19 deaths are shown.



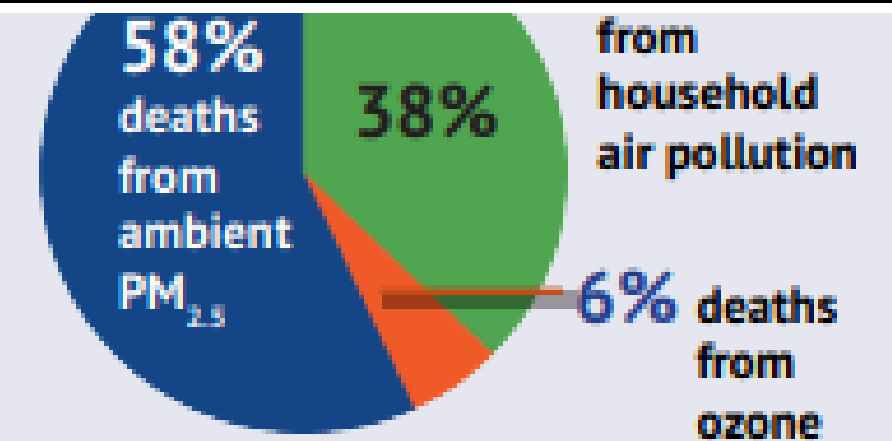
COVID data <https://ourworldindata.org/grapher/excess-deaths-cumulative-economist-single-entity>

AQ deaths <https://www.stateofglobalair.org/resources/report/state-global-air-report-2024>

Air Pollution results on over 8 million deaths EVERY YEAR!

GLOBAL AIR / 2024

8.1 million total deaths due to air pollution in 2021



2nd

largest risk factor of deaths in 2021

Countries in South Asia and Africa face the highest burden of disease.

Global Risk Factors for Death

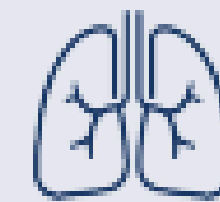
1. High blood pressure
2. Air pollution
3. Tobacco
4. Diet
5. High fasting plasma glucose

Since 2000

The disease burden for household air pollution (HAP) has decreased largely due to reductions in exposure in China and South Asia.

There has been a **36%** decline in deaths from HAP.

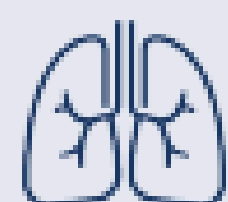
Air pollution is responsible for



30% of deaths from lower respiratory infections.



28% of deaths from ischemic heart disease.



48% of deaths from chronic obstructive pulmonary disease.

Lower respiratory infection deaths are

2021 - WHO Air Quality Guidelines



New WHO Global Air Quality Guidelines aim to save millions of lives from air pollution

<https://www.who.int/news/item/22-09-2021-new-who-global-air-quality-guidelines-aim-to-save-millions-of-lives-from-air-pollution>

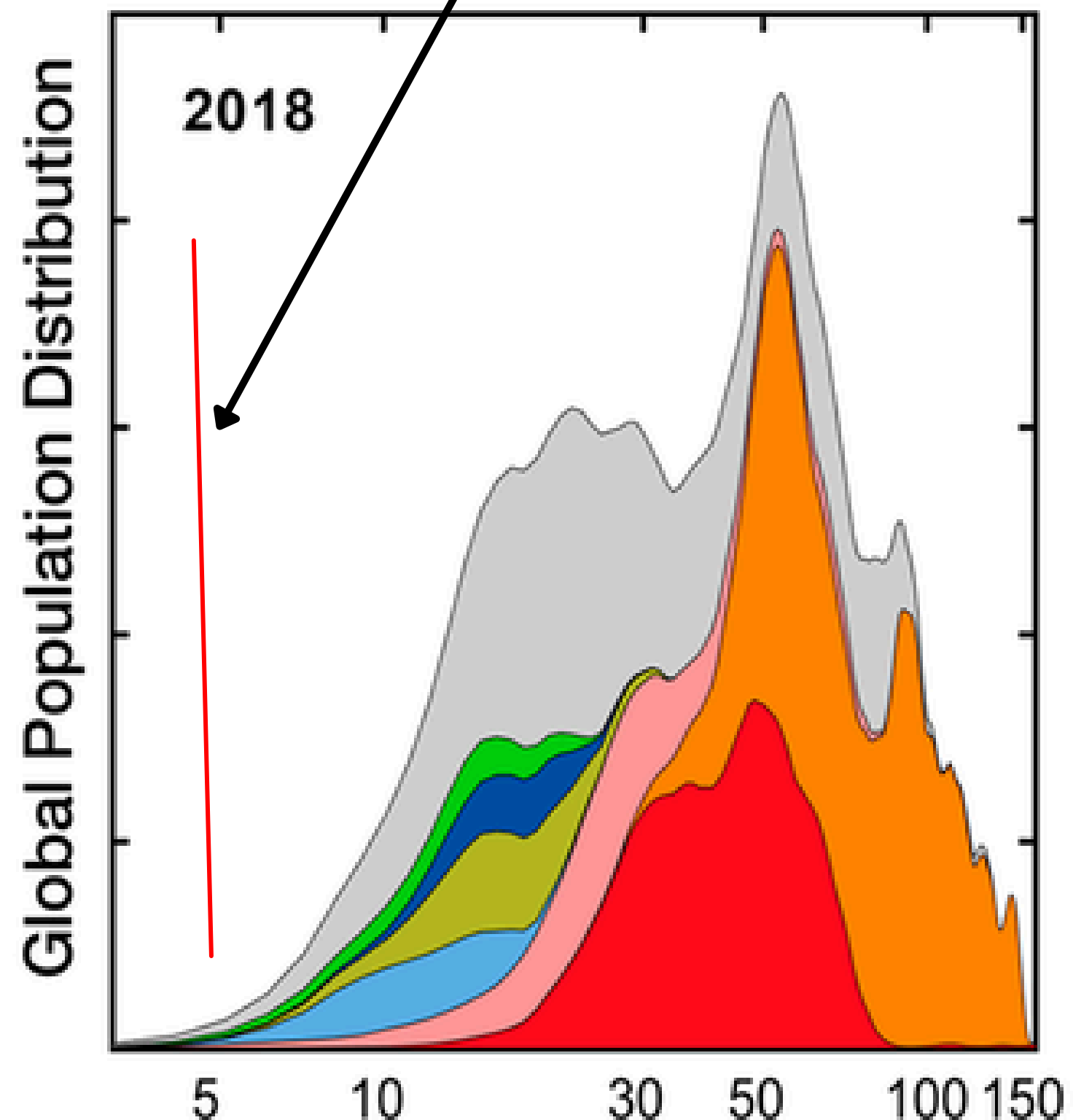


Josh Apte
@joshapte

...

The new @WHO air quality guidelines present a bold new vision for environmental health. Meeting the new 5 $\mu\text{g}/\text{m}^3$ guideline for PM_{2.5} will save millions of lives per year. Only a tiny sliver of the world population meets this target today. Let's get to work!

Nearly everyone on earth breathes air more polluted than the new WHO PM_{2.5} air quality guideline



AGG(AQI)

Good

Moderate

Sensitive

Unhealthy

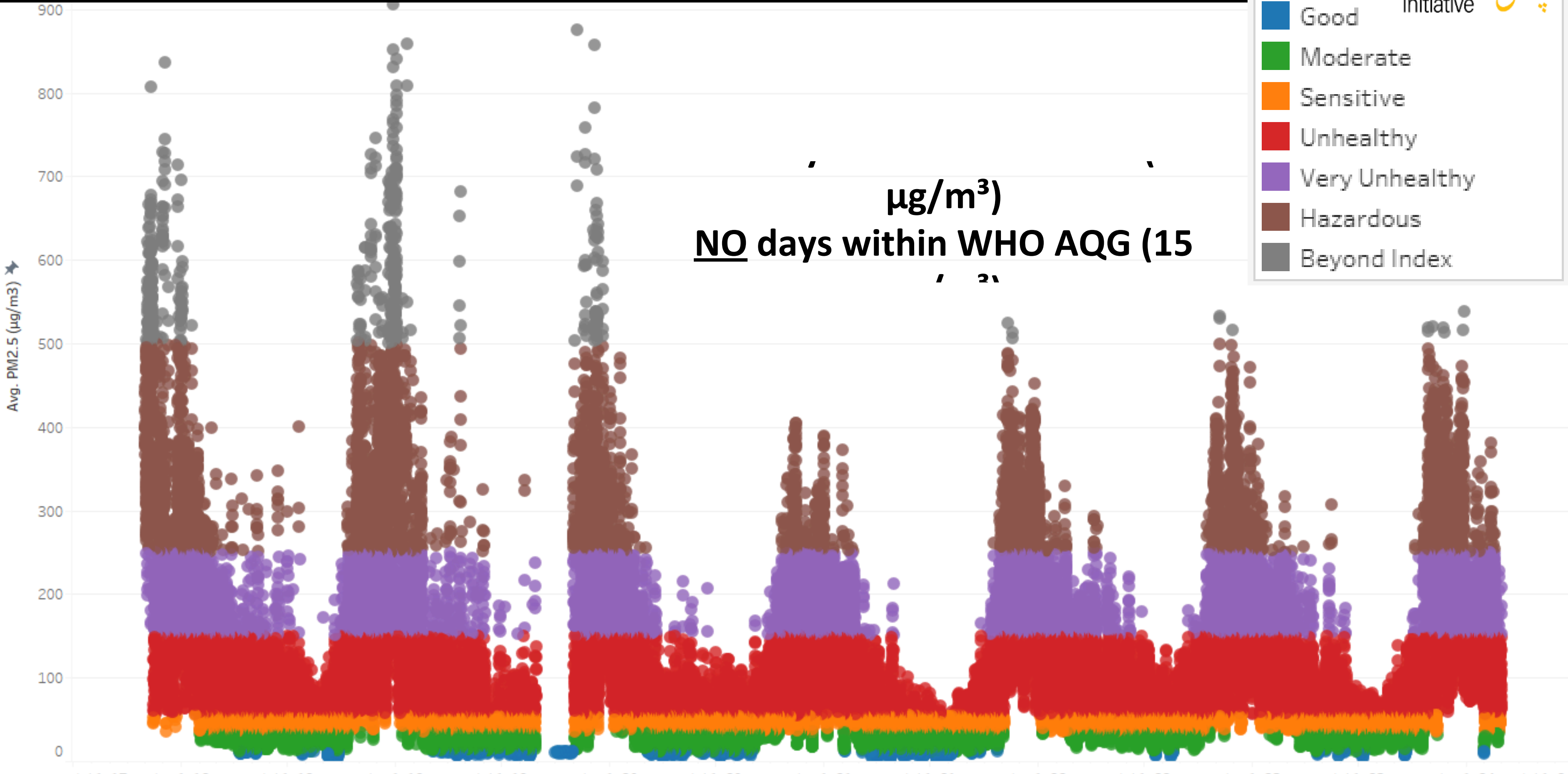
Very Unhealthy

Hazardous

Beyond Index

Pakistan
Air Quality
Initiative

پاک
کی



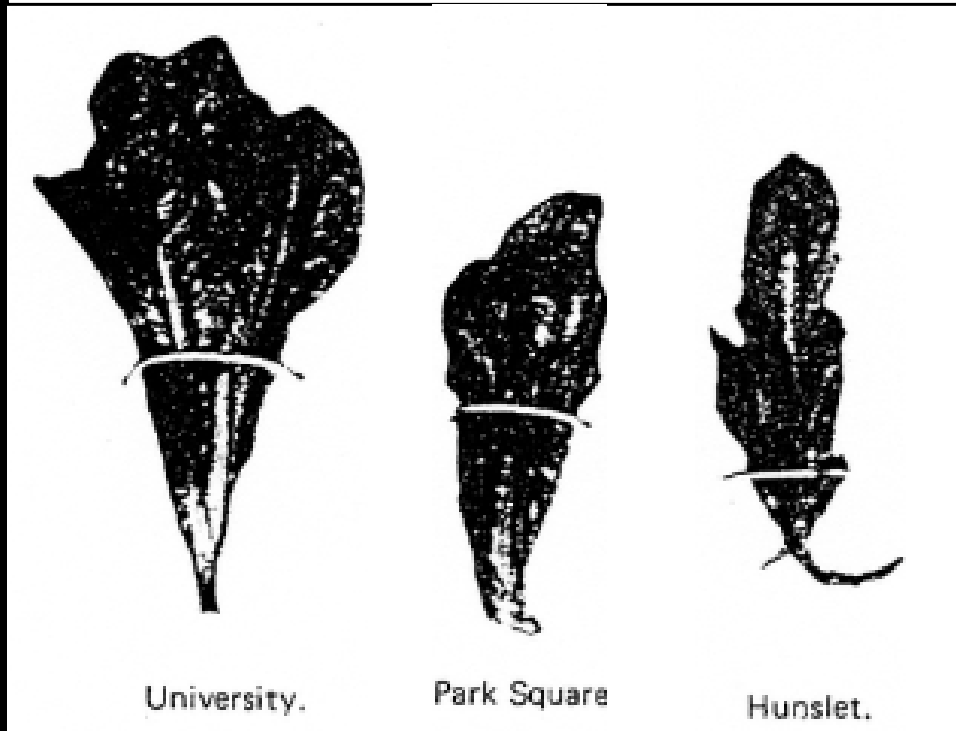
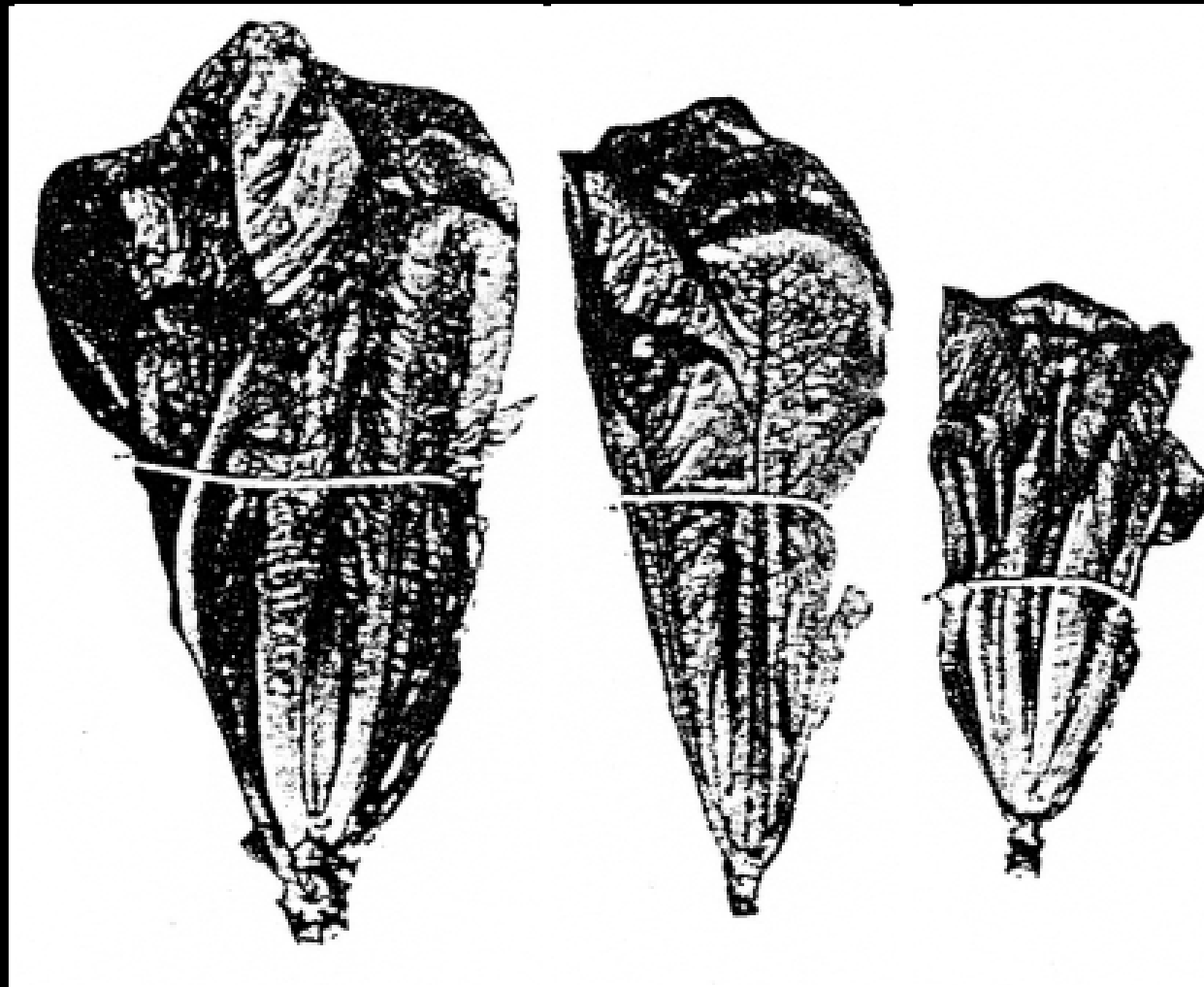
µg/m³

NO days within WHO AQG (15

Air Pollution

History Lesson

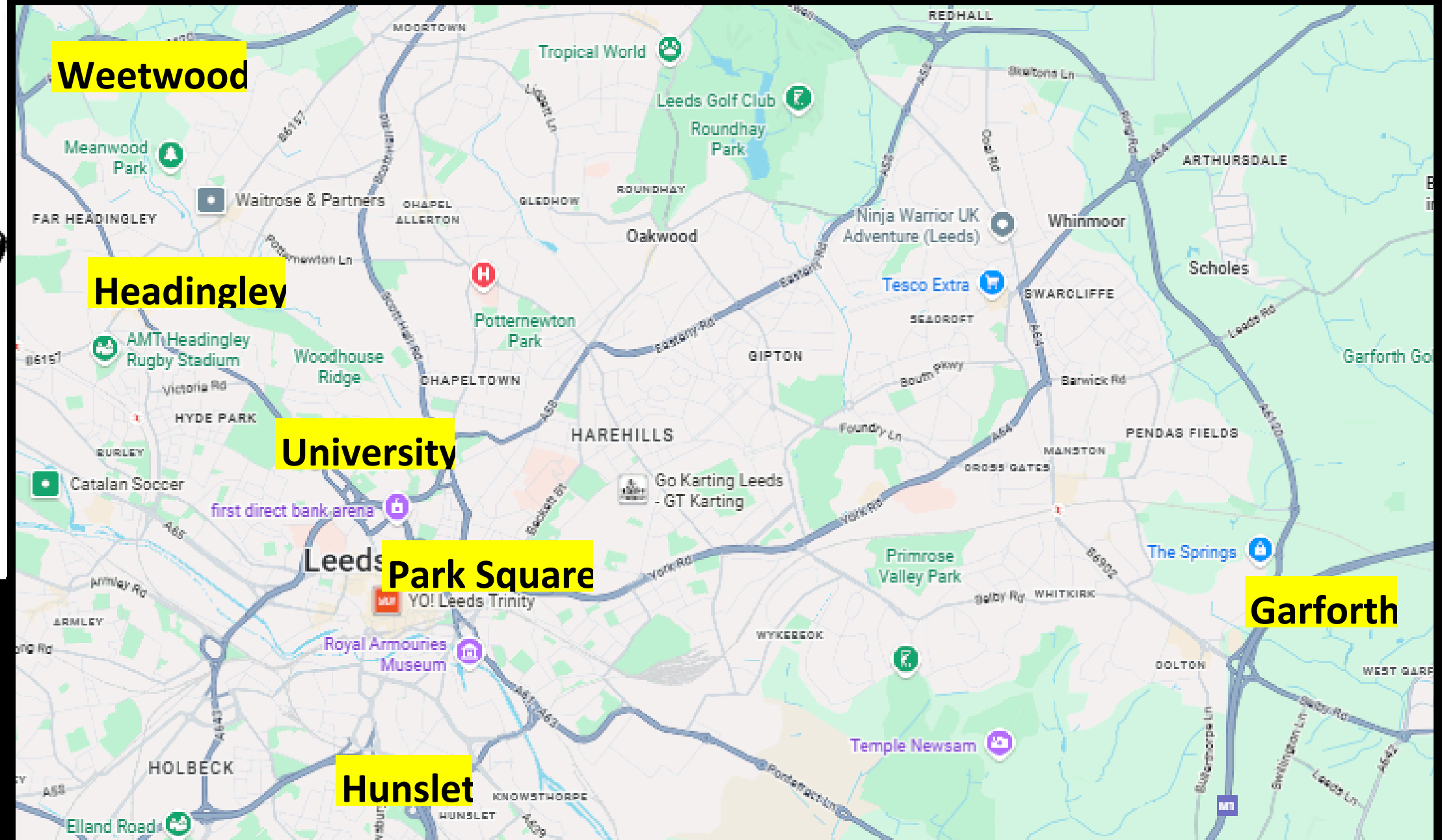
The 1911 Leeds Lettuce Experiment



University.

Park Square

Hunslet.



The effect of the air in Leeds and its suburb on plants. Lettuce plants were grown in a standard soil at various locations in/around the city.

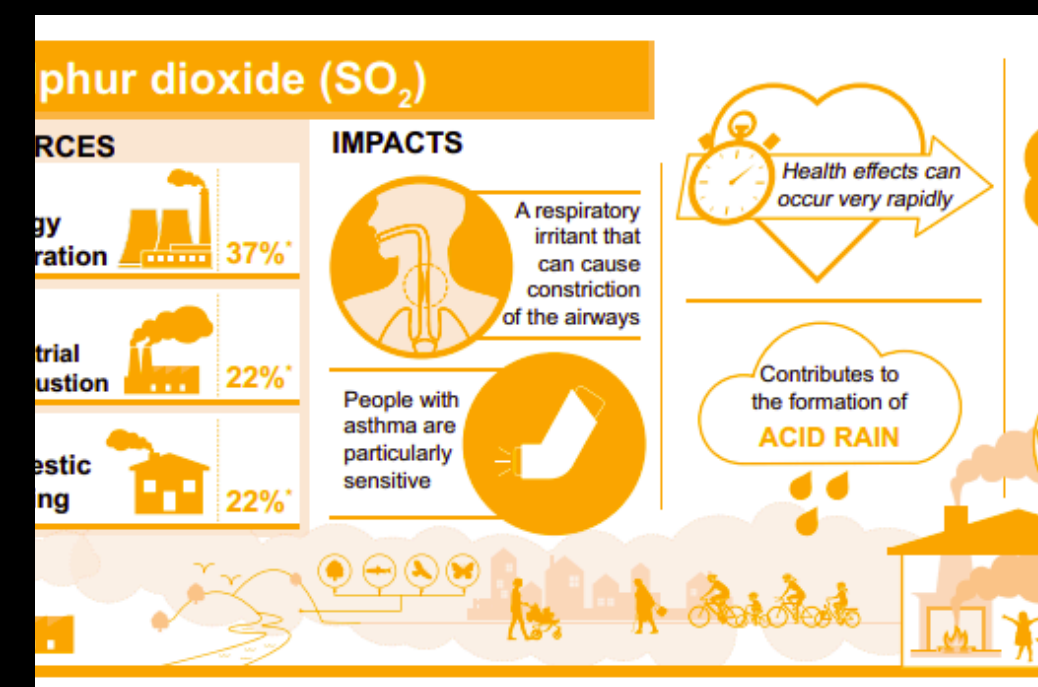
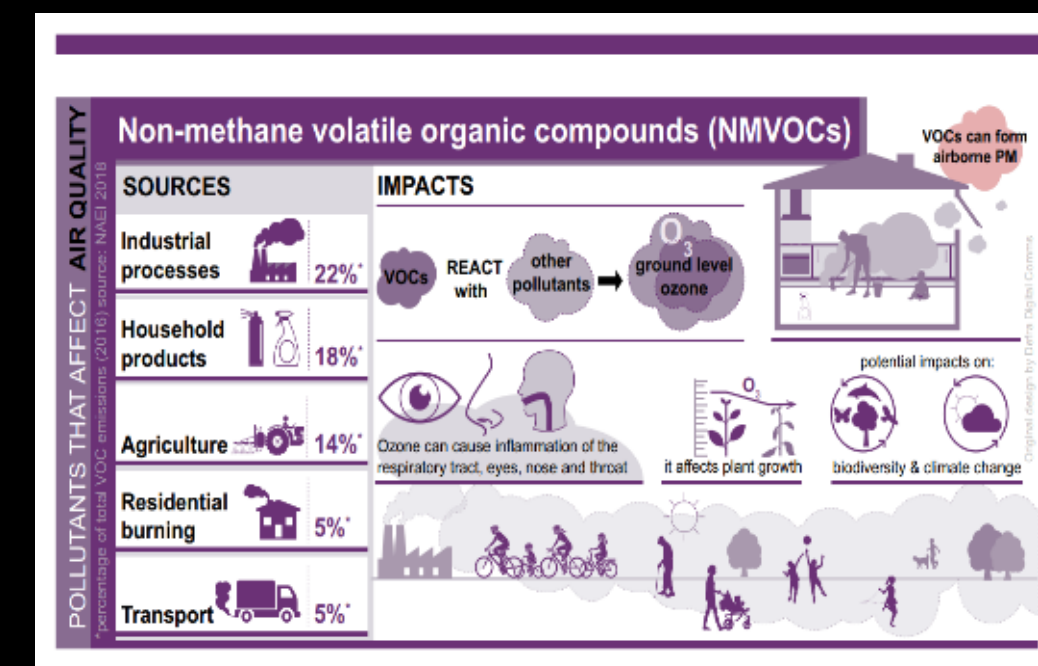
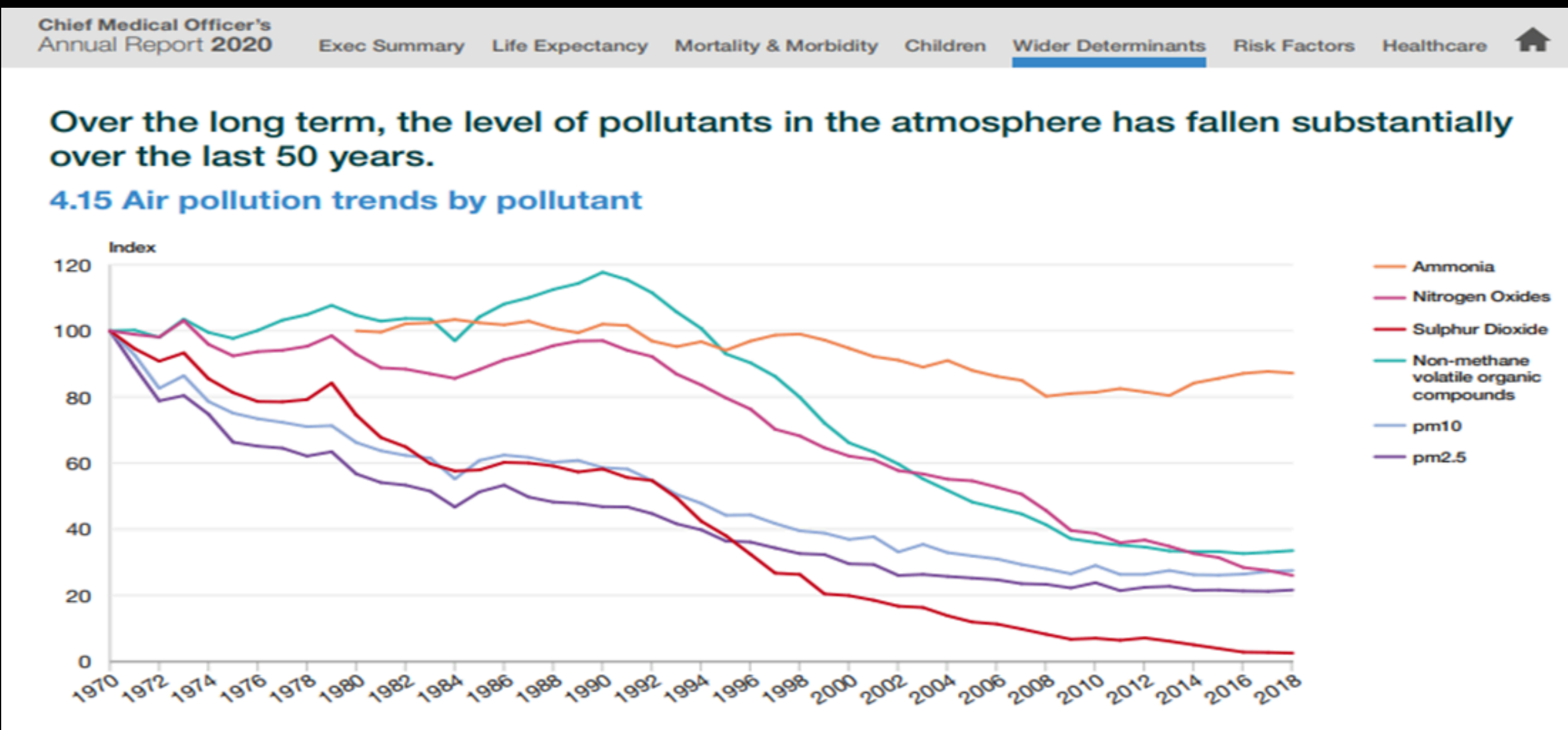
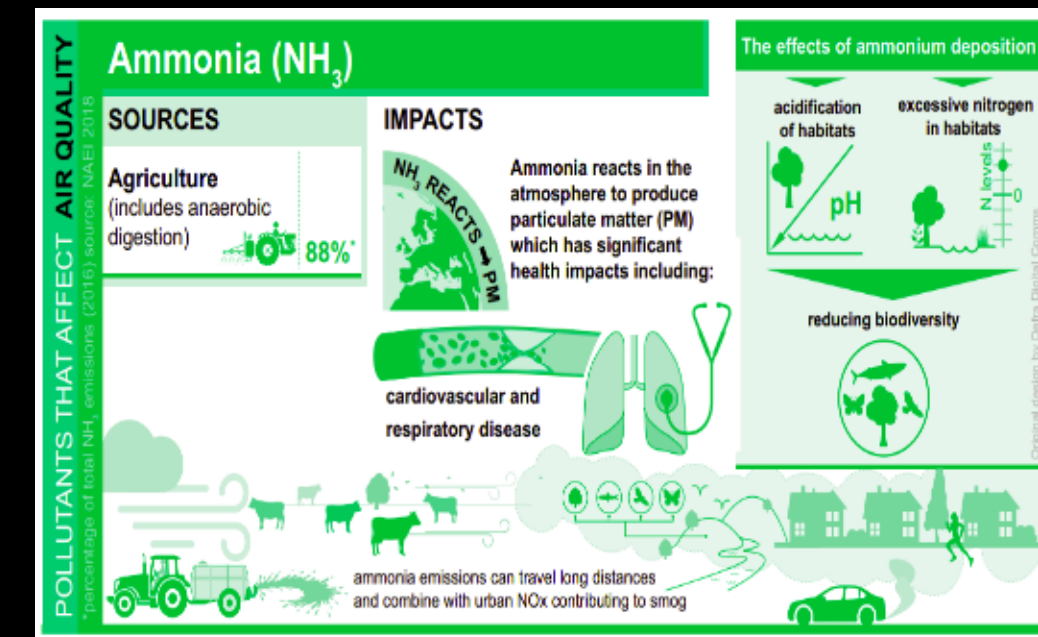
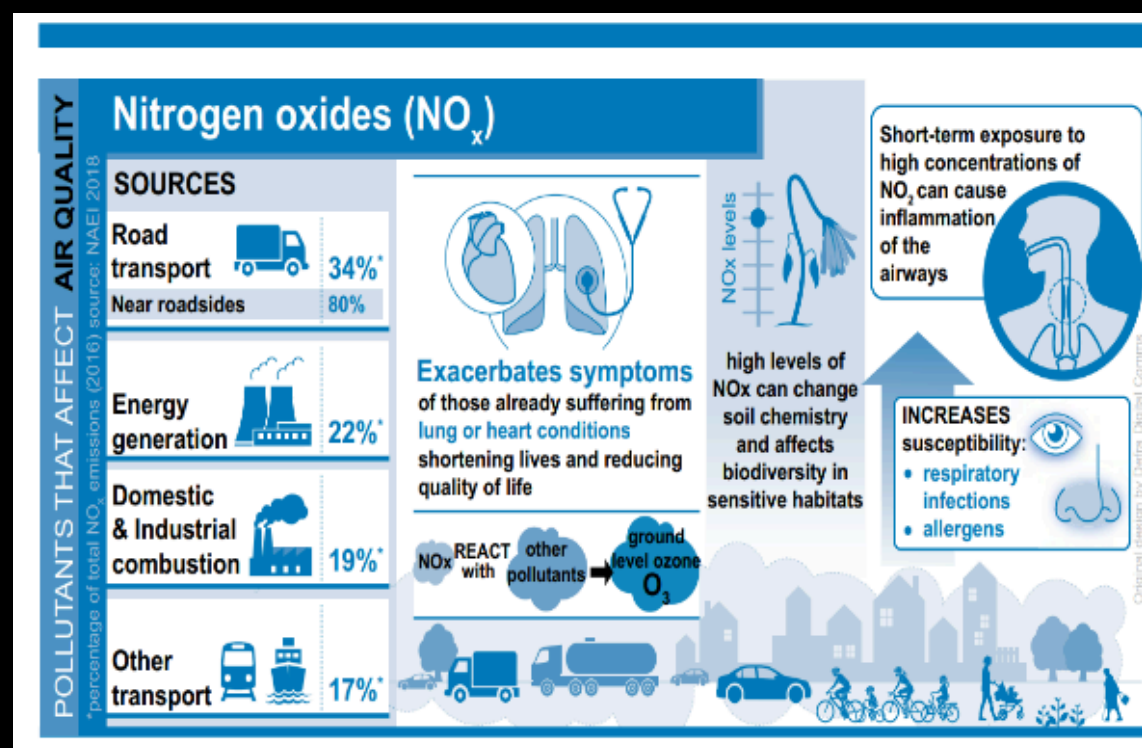
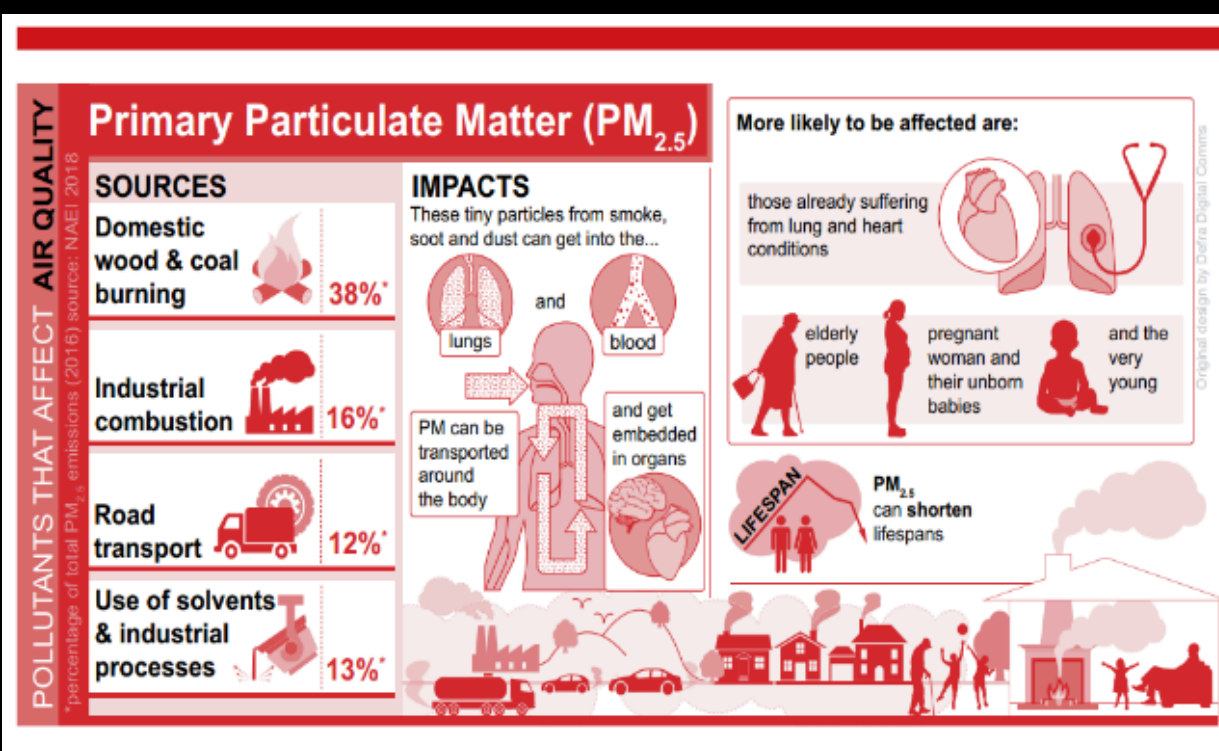
Final weight correlated with " the freedom from sulphur".

What to measure???

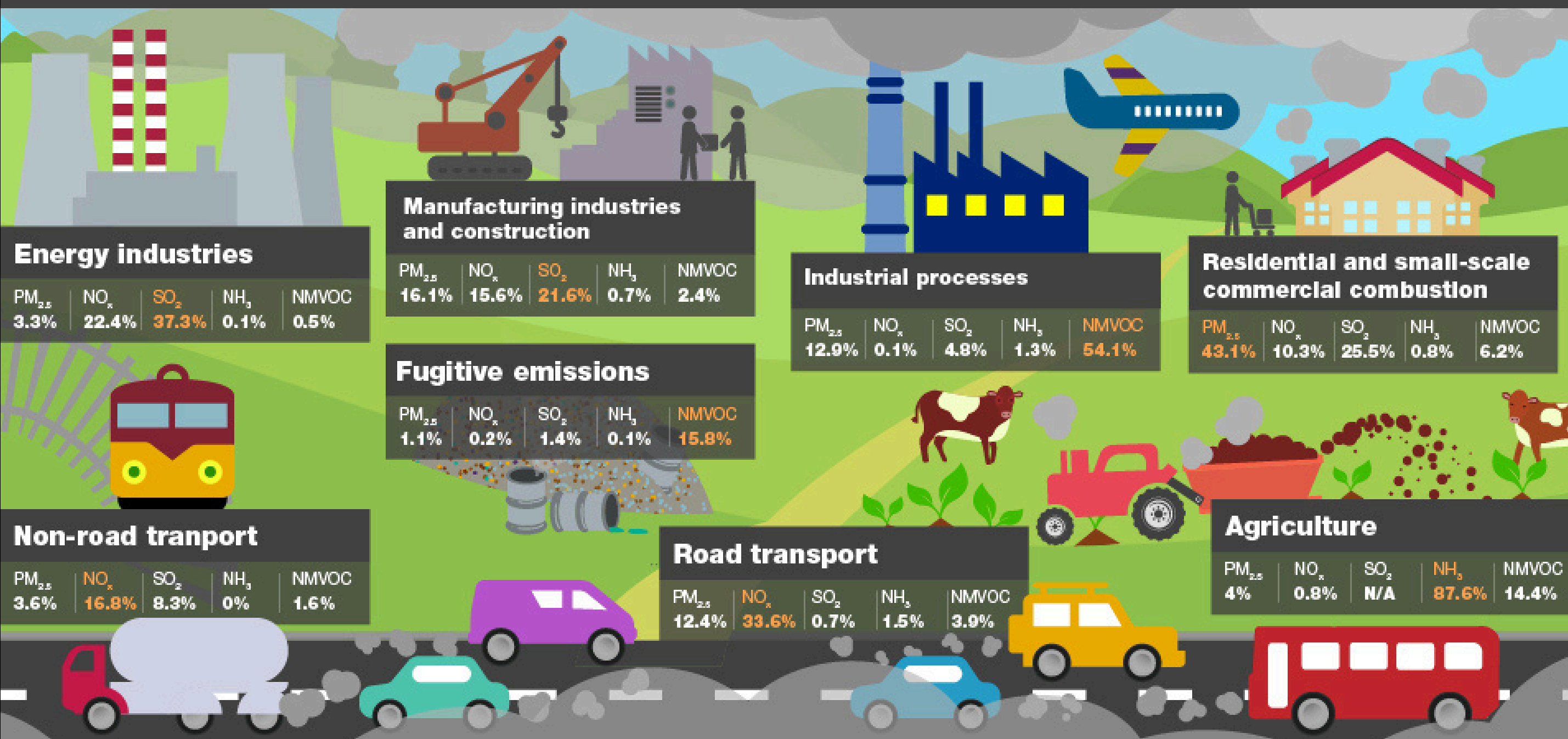
Chemical
Cocktail

Air Pollution – Many (many) sources....





Sources of air pollution



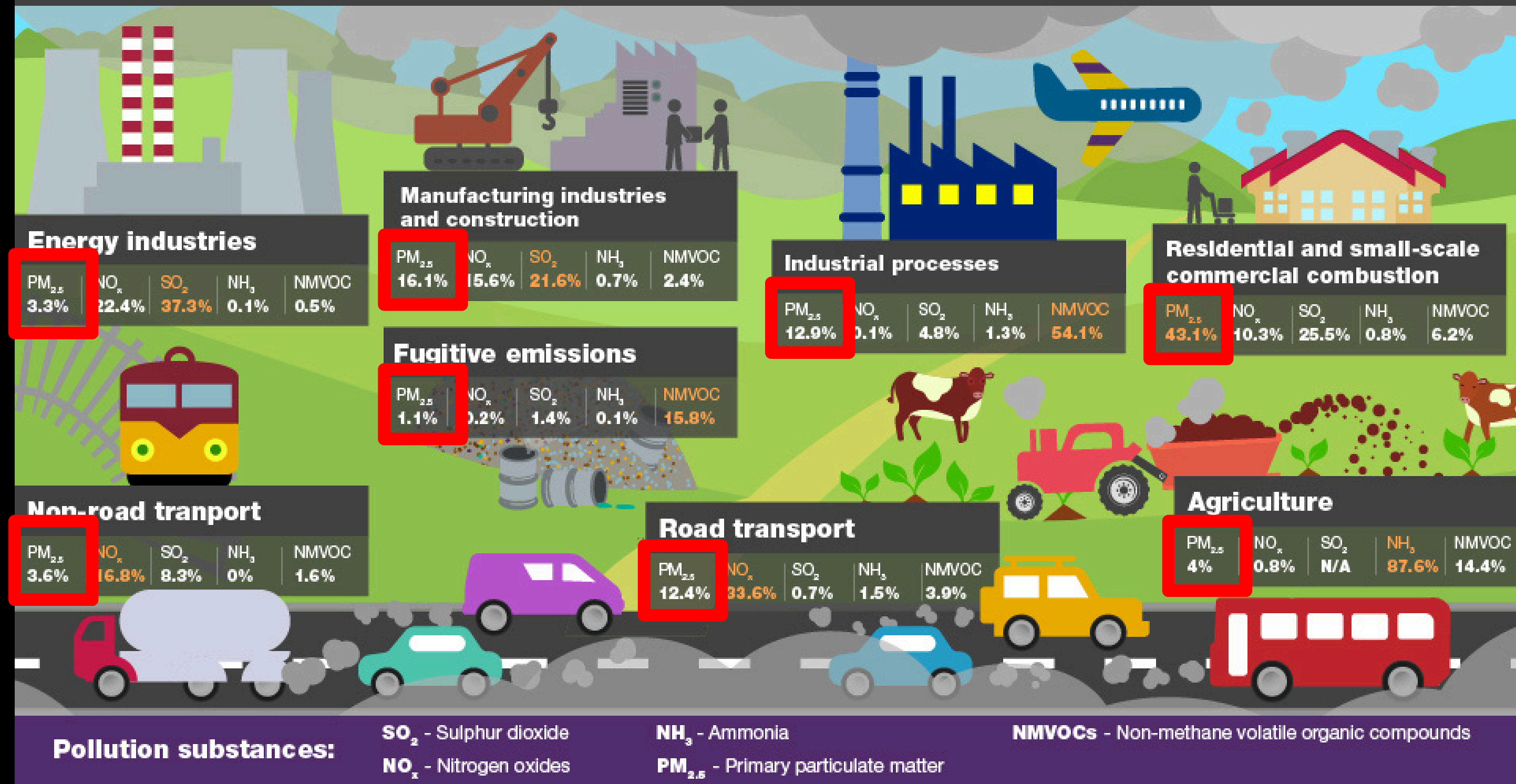
Pollution substances:

SO₂ - Sulphur dioxide
NO_x - Nitrogen oxides

NH₃ - Ammonia
PM_{2.5} - Primary particulate matter

NMVOCs - Non-methane volatile organic compounds

Sources of air pollution



PRIMARY PARTICULATE

Indoor Air Quality

Nature, February 2023

COMMENT | 08 February 2023

Hidden harms of indoor air pollution – five steps to expose them

Dirty outdoor air might grab the headlines, but learning how pollutants inside buildings form, accumulate and affect our health is equally crucial.

Alastair C. Lewis, Deborah Jenkins & Christopher I. M. Whitty 

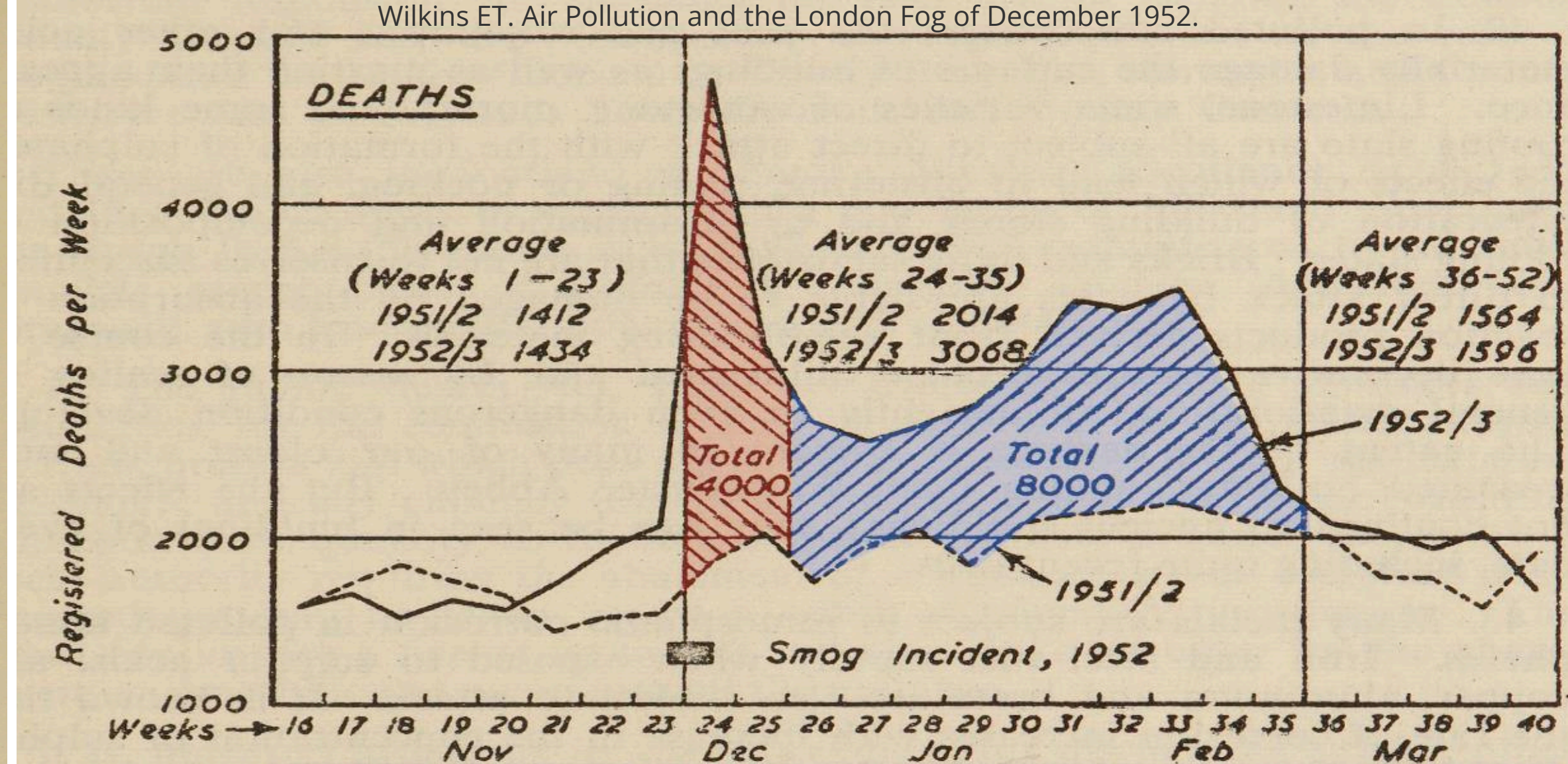
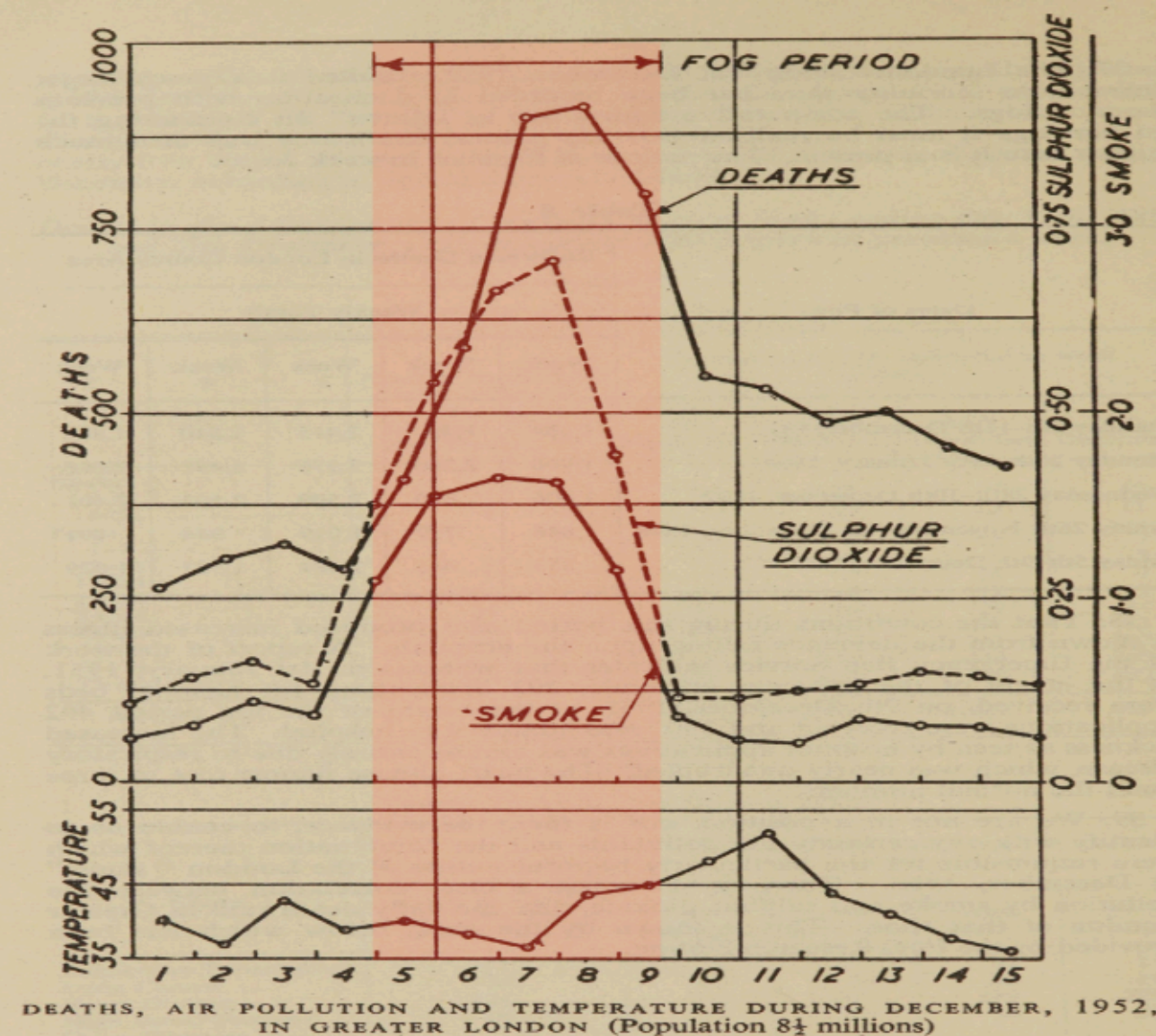
~1 in 9 deaths are due to Air Pollution (4.5m outdoor / 2.3m Indoor)

**YOU can do more about indoor air
pollutants than outdoor**



**This Saharan dust travelled over 5000 km before it landed on
my car in Leeds!**

Health Impacts

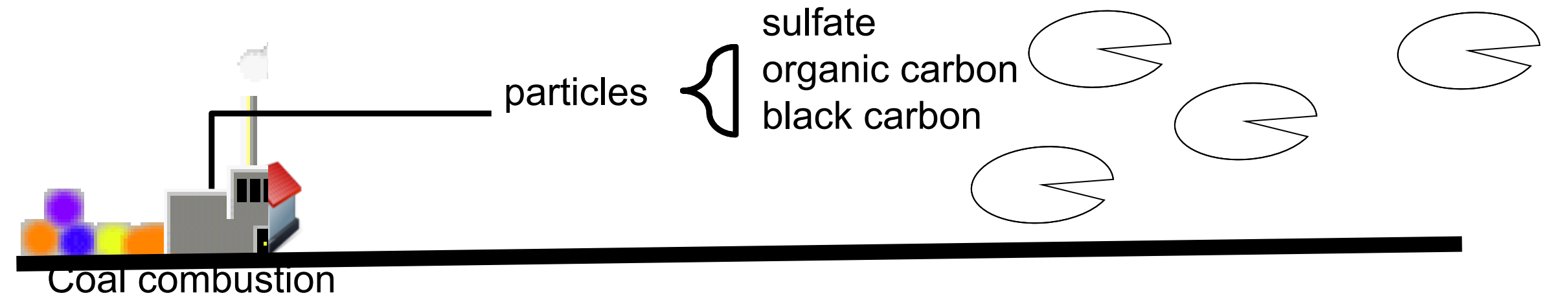


Altitude

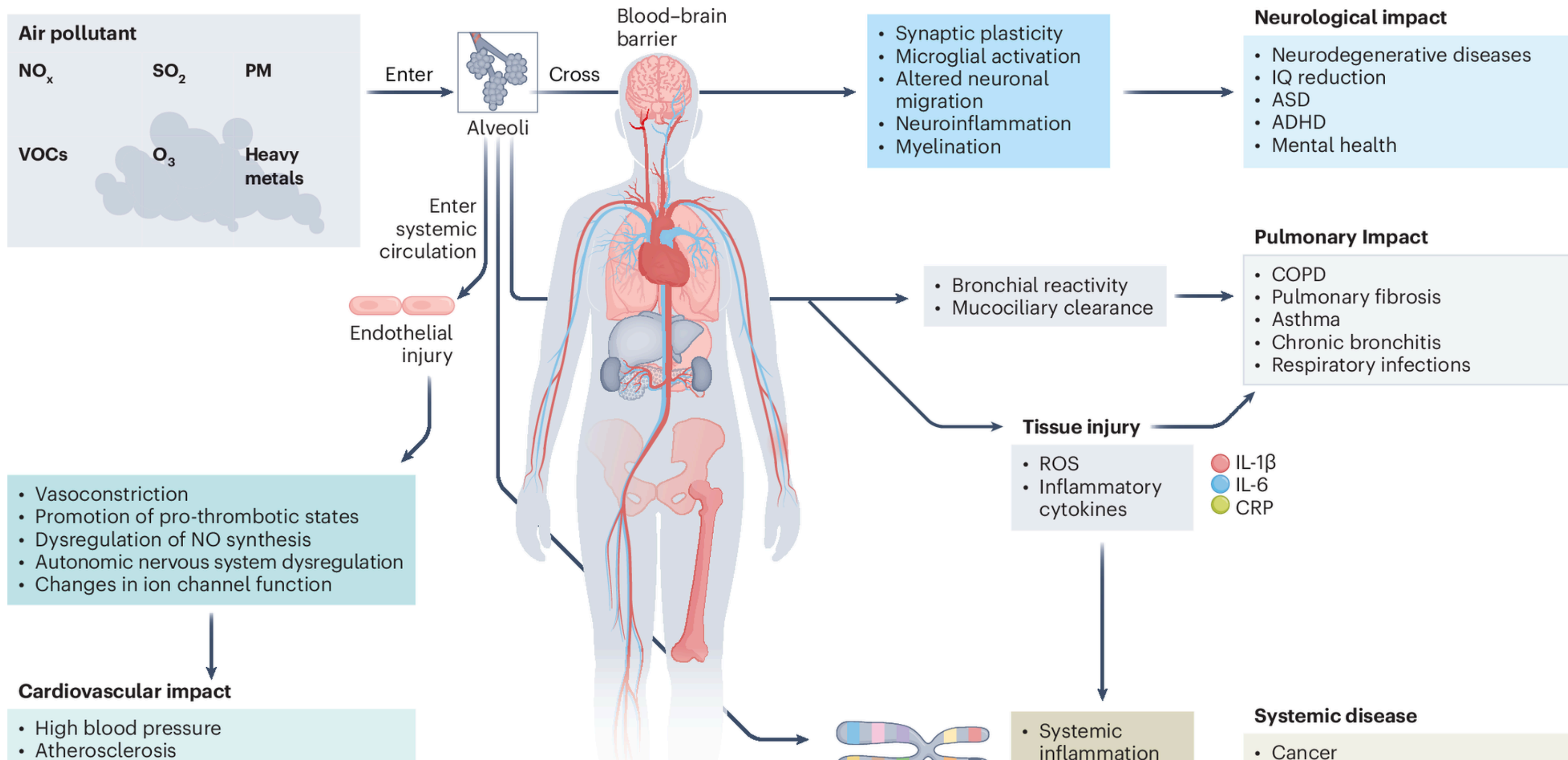
< 1km

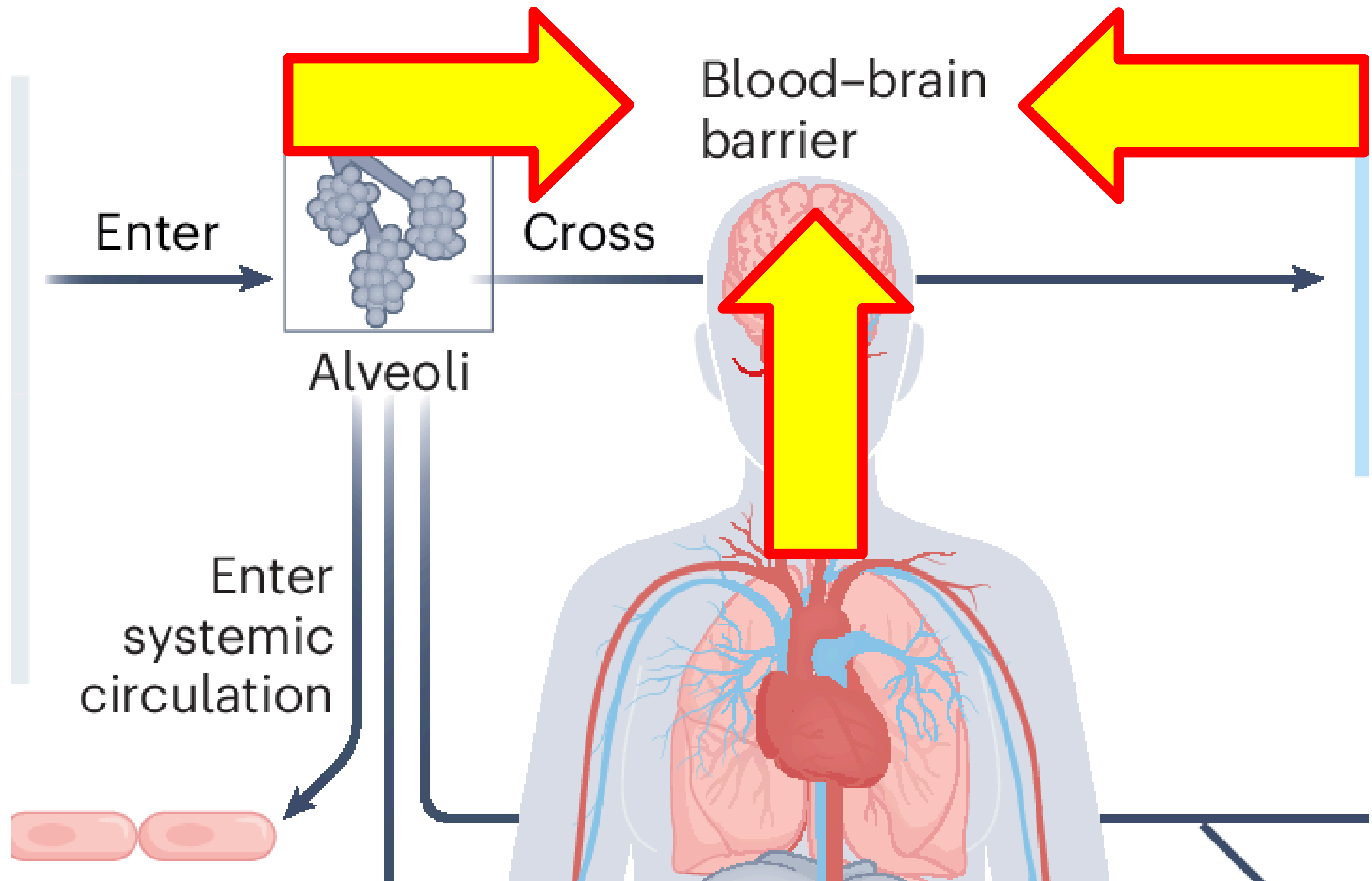
inversion

Temperature



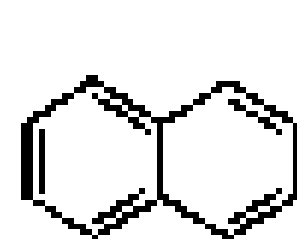
- Cold weather – heavy domestic fuel use.
- Persistent high-pressure, stagnant conditions.
- Air thick with stench of rotten eggs – sulfur compounds.
- “Faces, clothes and even petticoats blackened”



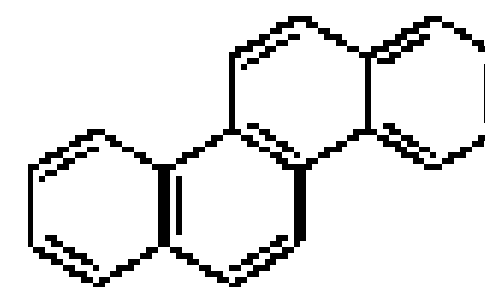




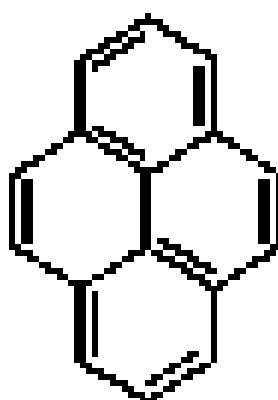
Polycyclic Aromatic Hydrocarbons



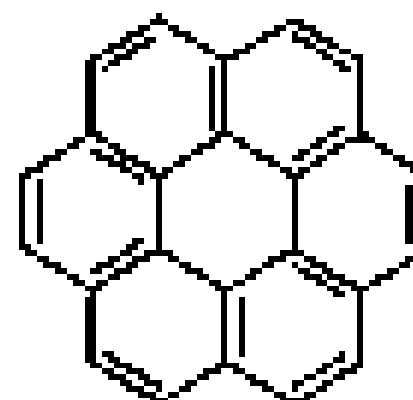
Napthalene
 $C_{10}H_8$



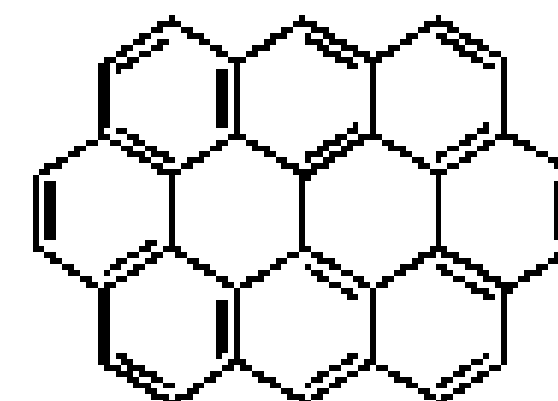
Chrysene
 $C_{18}H_{12}$



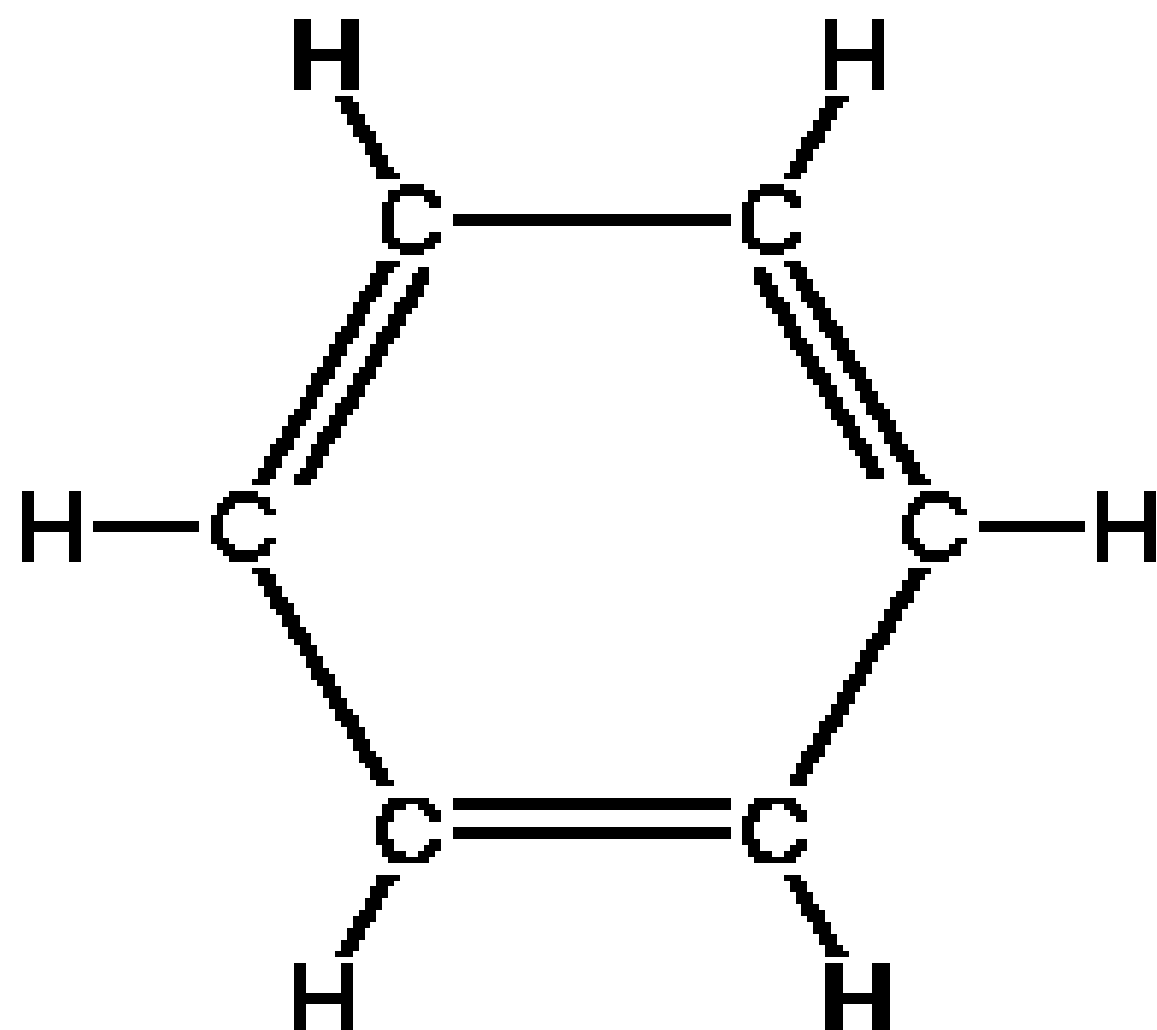
Pyrene
 $C_{16}H_{10}$



Coronene
 $C_{24}H_{12}$



Ovalene
 $C_{32}H_{14}$



of fresh air

Responding to the
health challenges
of modern air pollution



Royal College
of Physicians

With impacts on both mortality and healthy life expectancy, the effects of toxic air on individuals, society, the economy and the NHS are huge. The RCP report estimates that:
In 2019 alone, costs for healthcare, productivity losses and reduced quality of life due to air pollution cost the UK upwards of **£27 billion** – and may be as much as **£50 billion** when wider impacts, such as dementia, are accounted for.



HOUSE OF COMMONS

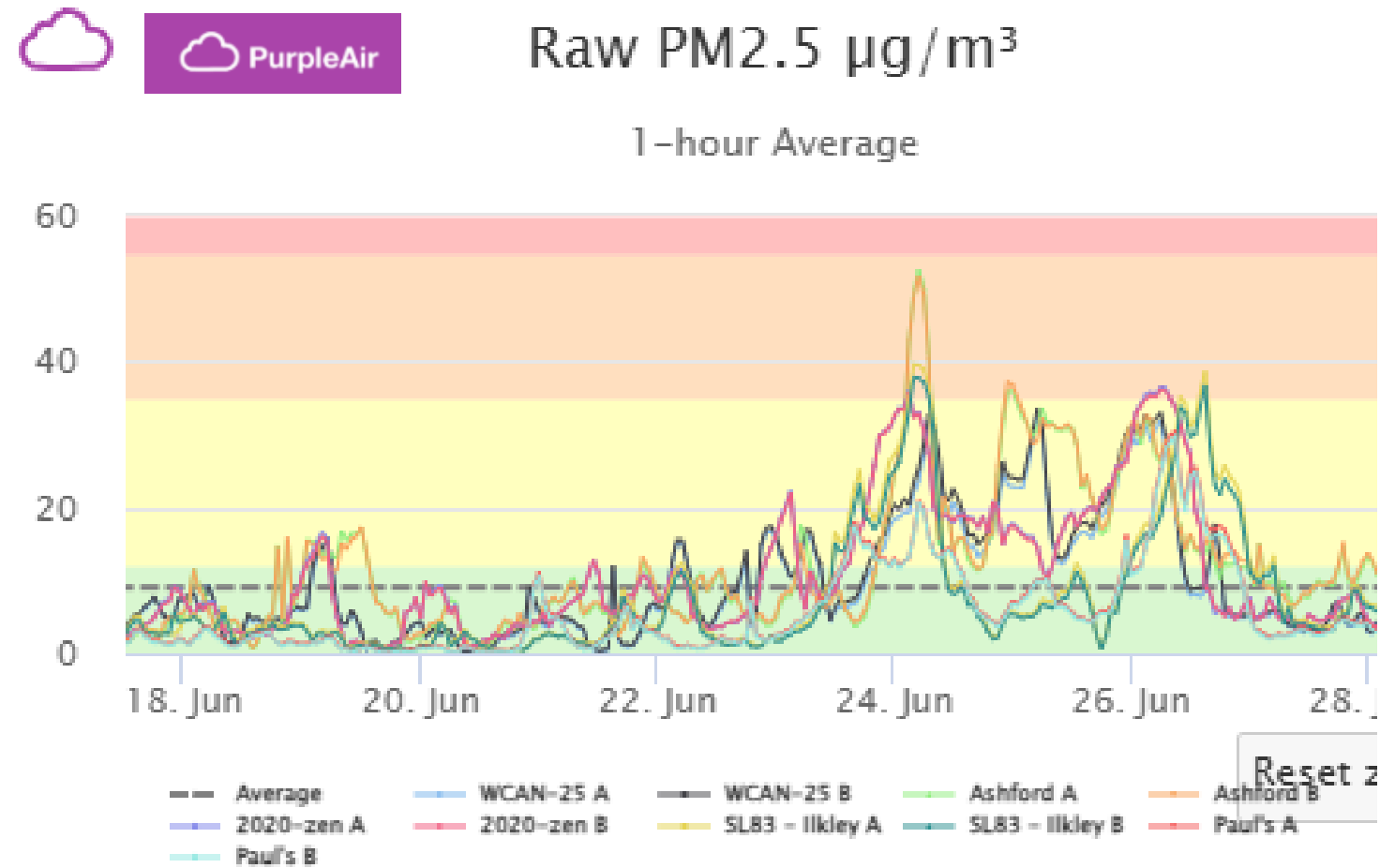
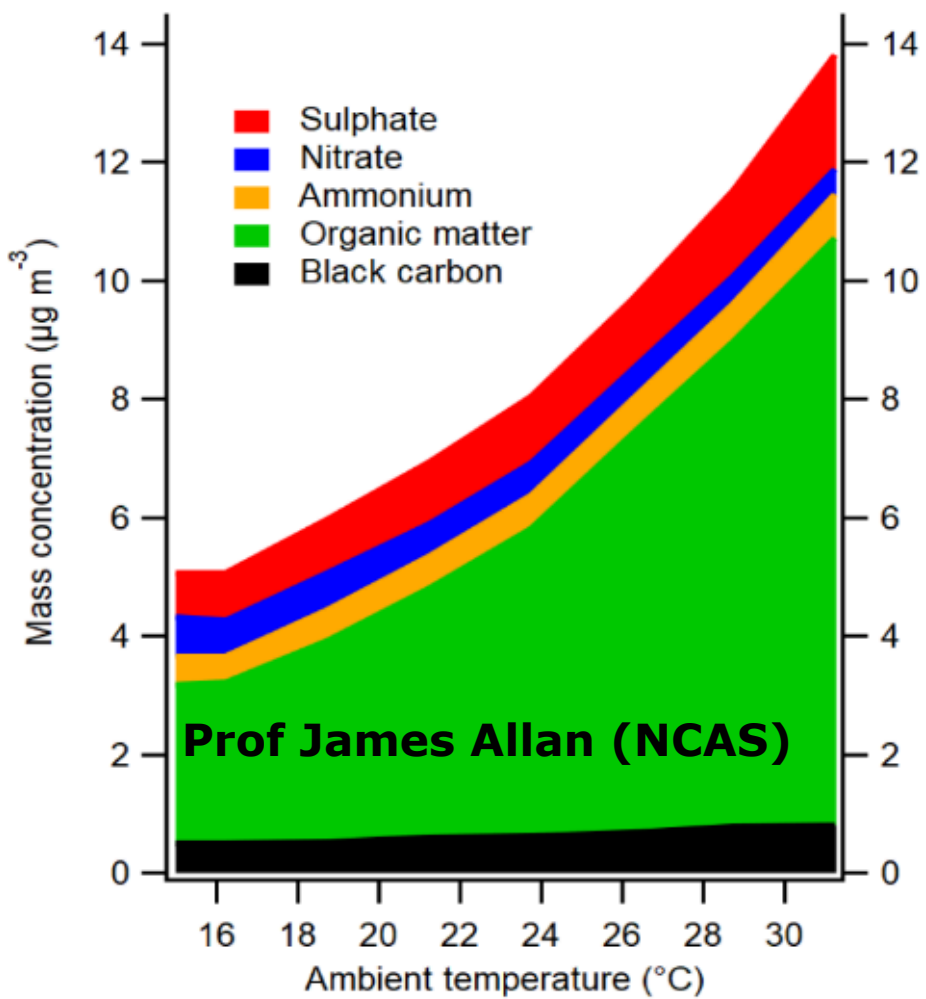
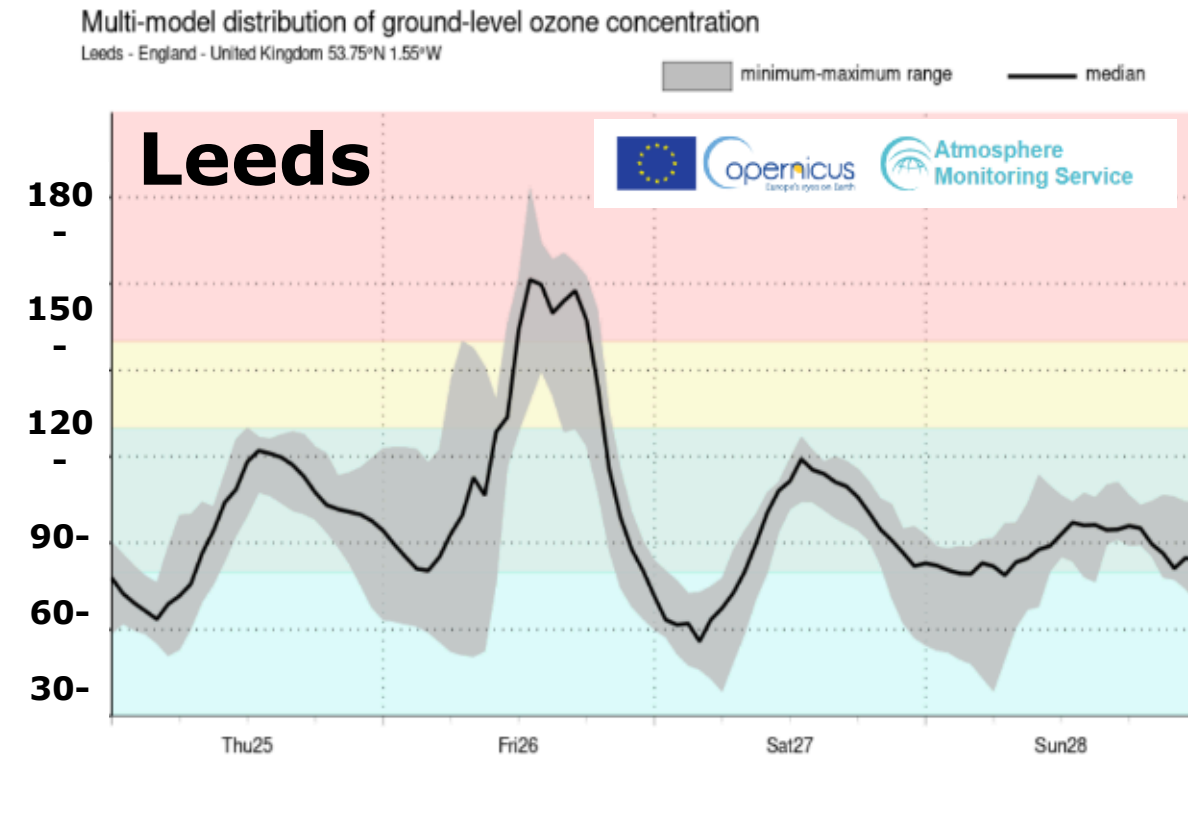
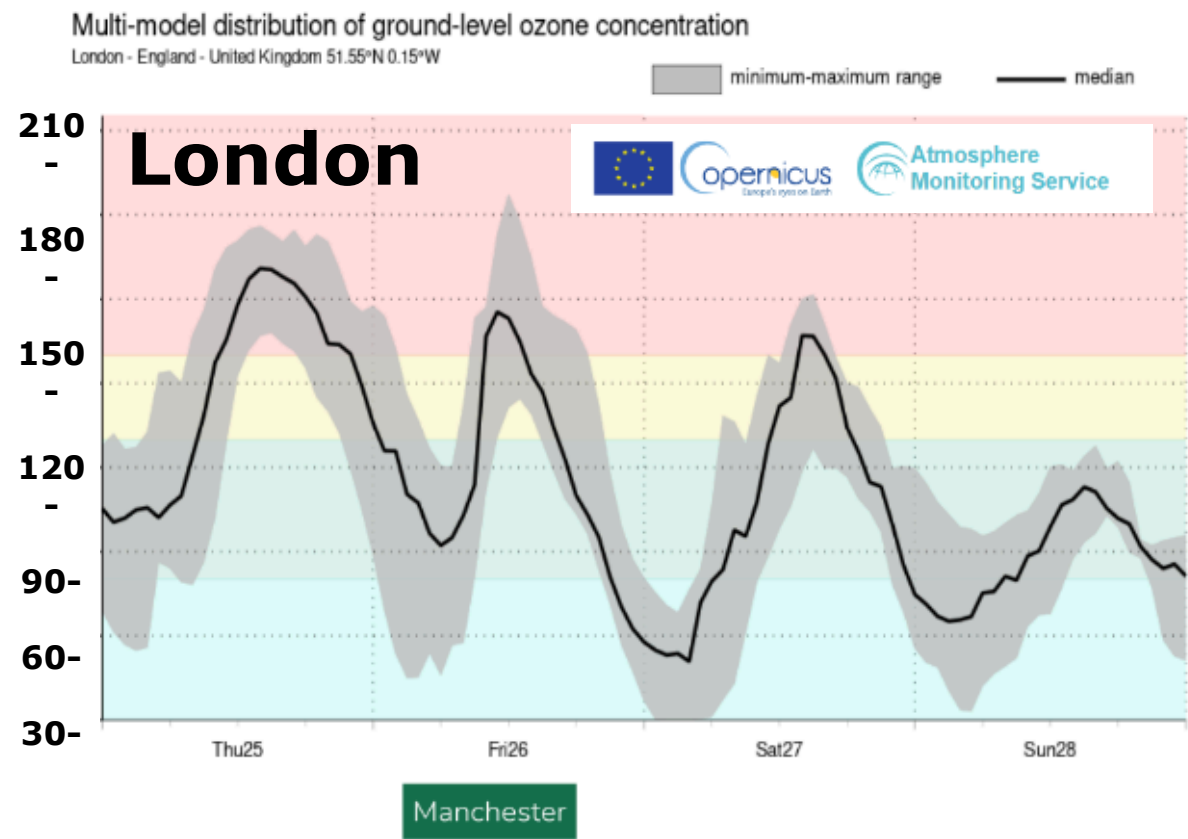
Chair: Sir Stephen, do you feel that policy has been framed more around achievability and cost rather than that public and environmental health imperative?

Sir Stephen Holgate:

Out of 840 diseases in the medical lexicon—all the different diseases that impact humans, 700 of them have now been linked to poor air quality.

“That just gives you an indication. We are just scratching the surface, and the numbers we are dealing with at the moment are going to be a gross underestimate”

Heatwaves ☐ “THE PERFECT STORM”



Monitoring Air Quality

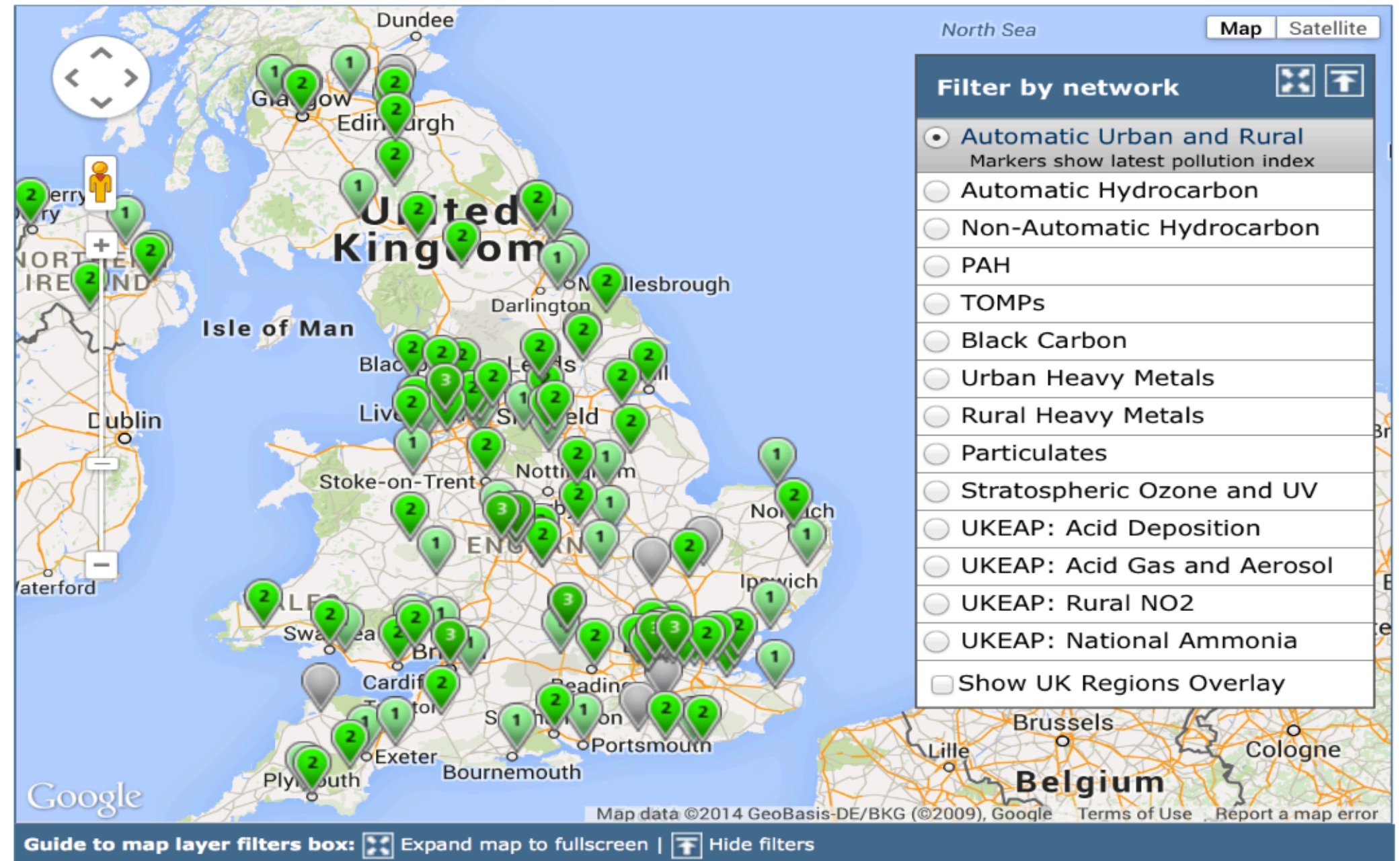
Defra Air Quality Index

Index Bands

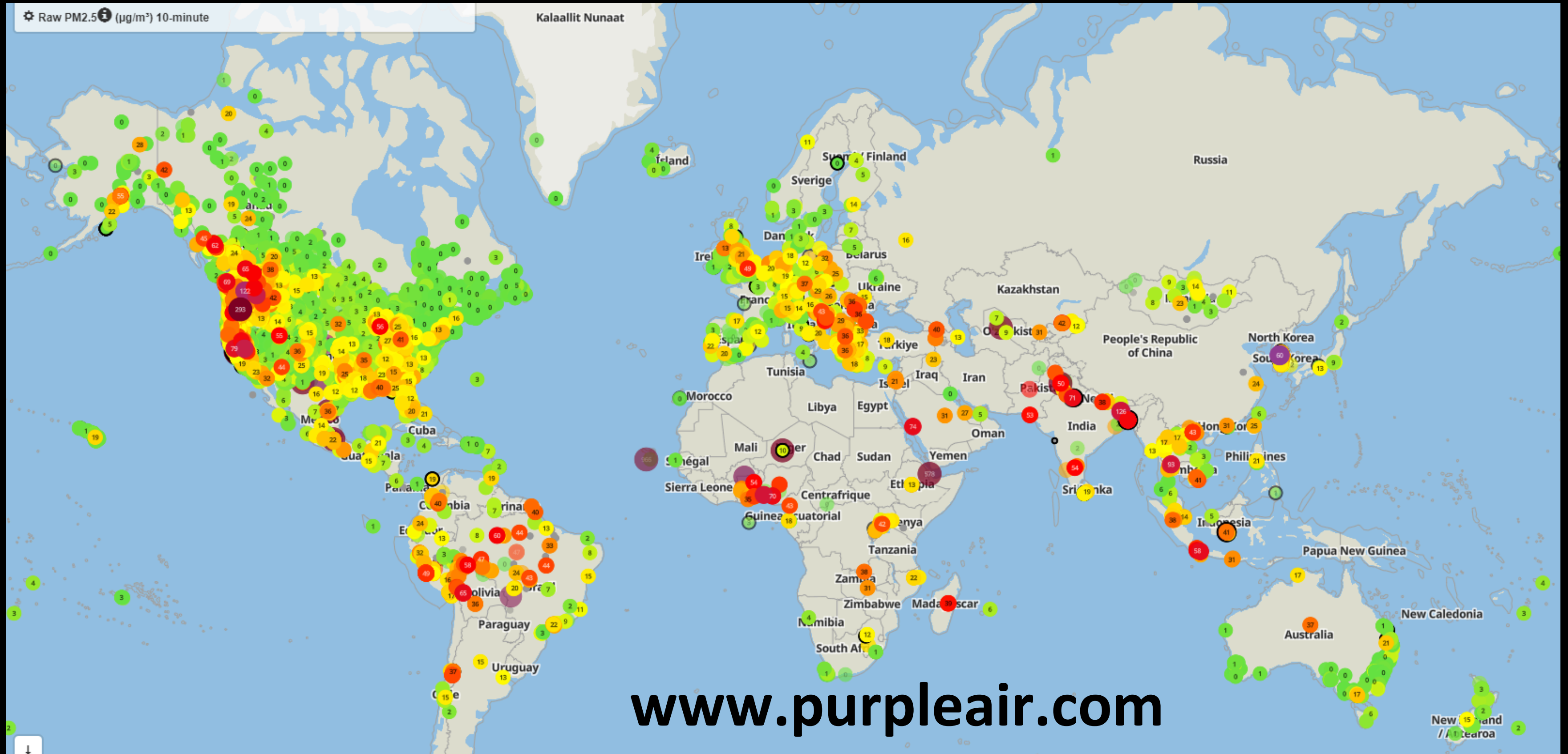


The overall air pollution index for a site or region is determined by the highest concentration of five pollutants:

- Nitrogen Dioxide
- Sulphur Dioxide
- Ozone
- Particles < 2.5 μ m (PM_{2.5})

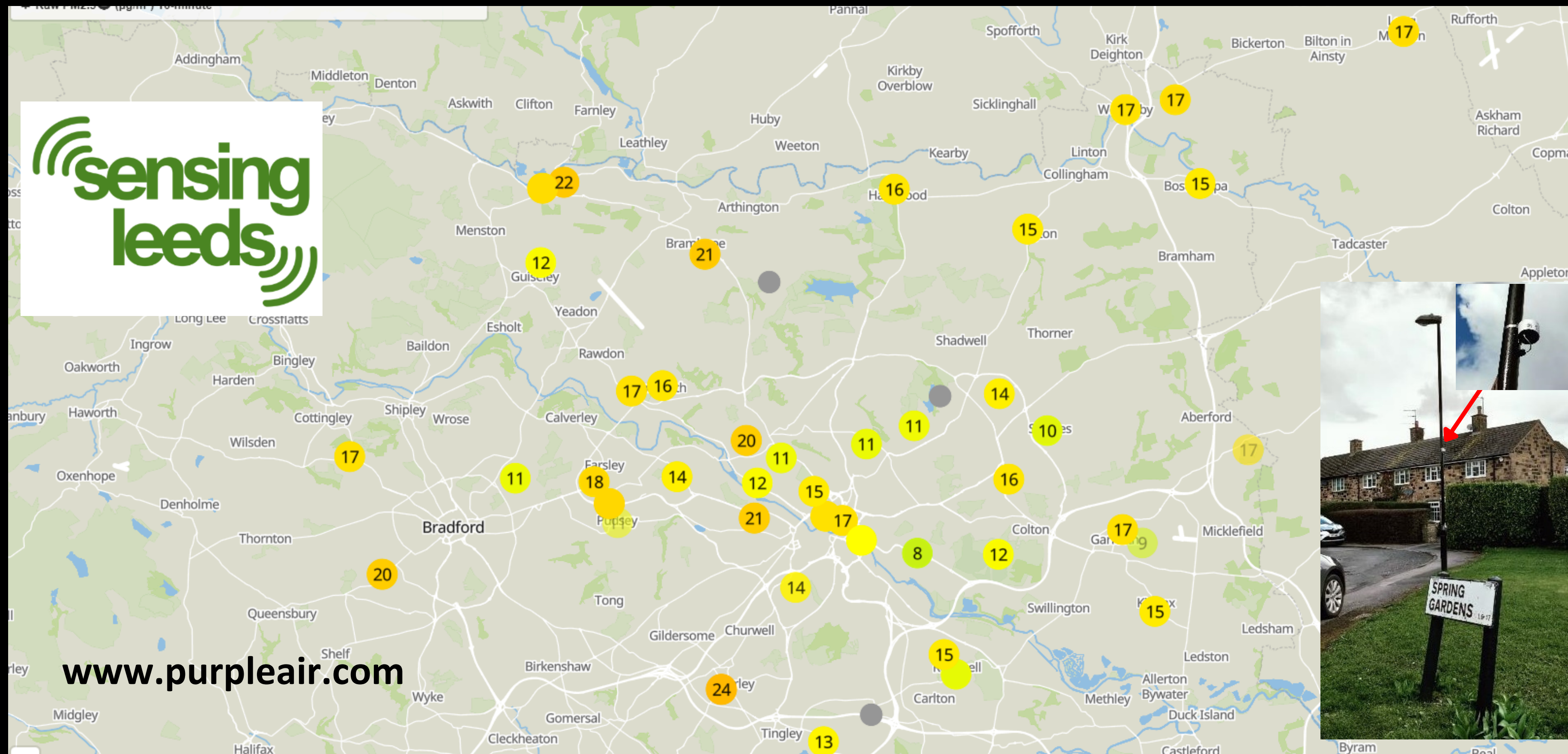


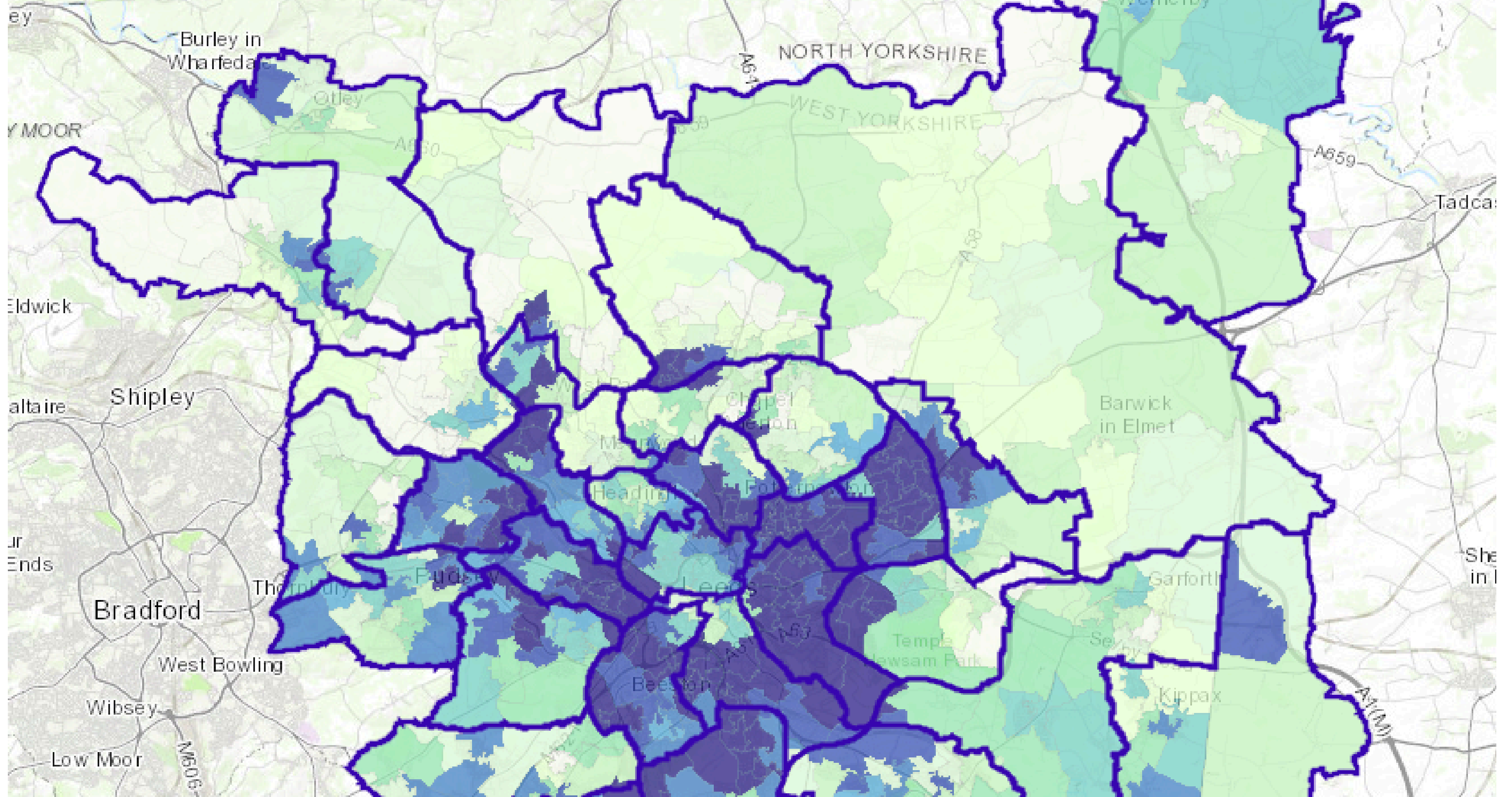
Low Cost Sensor Networks





www.purpleair.com





<https://storymaps.arcgis.com/stories/f74f5a2392854990a2db7b685e3151ab>

Harehills □ Wetherby

8 Dec 2021

How a bus journey in Leeds adds ten years to your life

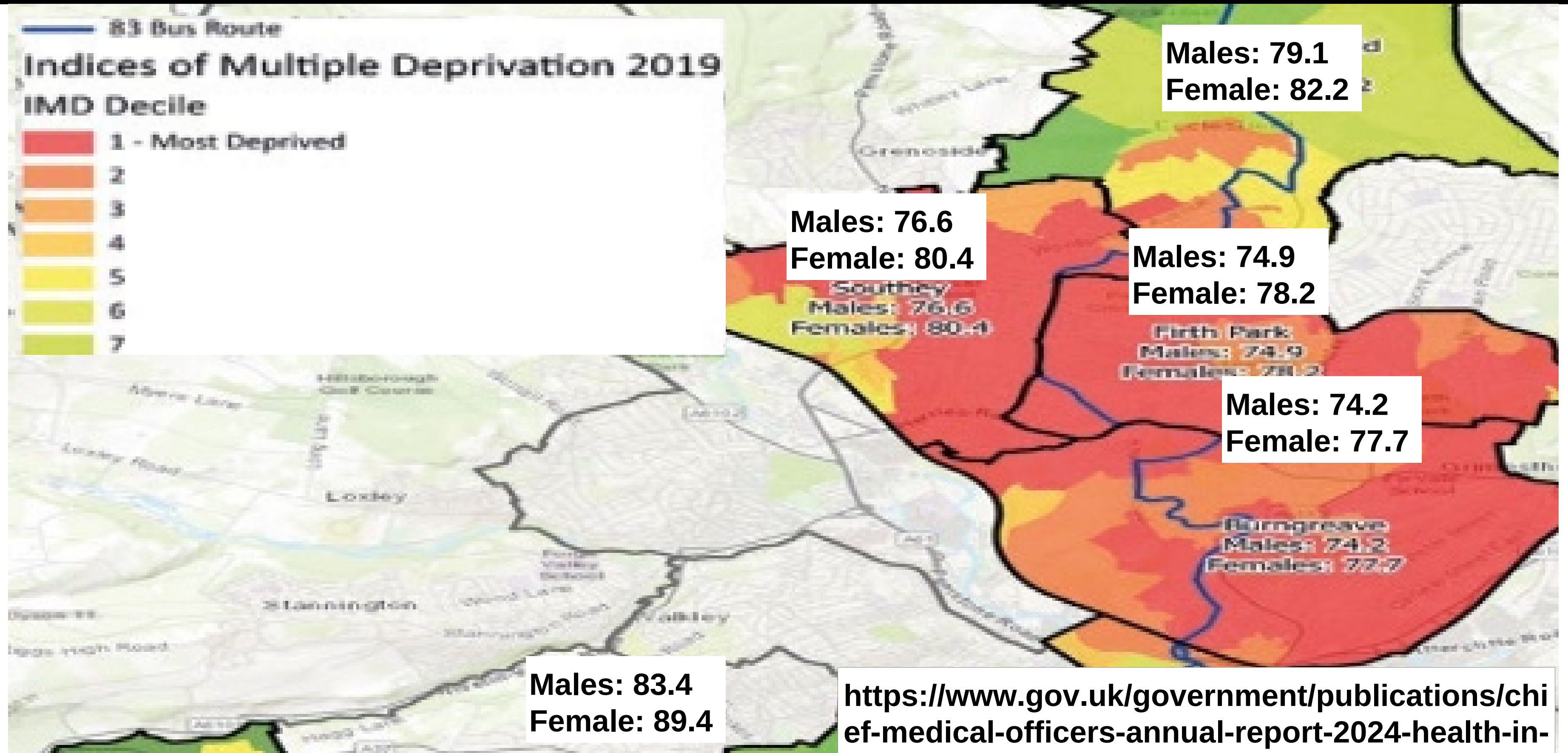


Life expectancy in Leeds increases from 75 to 85 along the bus routes from Harehills to Wetherby and other affluent suburbs, according to new report

<https://ageing-better.org.uk/news/how-a-bus-journey-in-leeds-adds-ten-years-to-your-life>

CMO Annual Report 2024 – Health in Cities

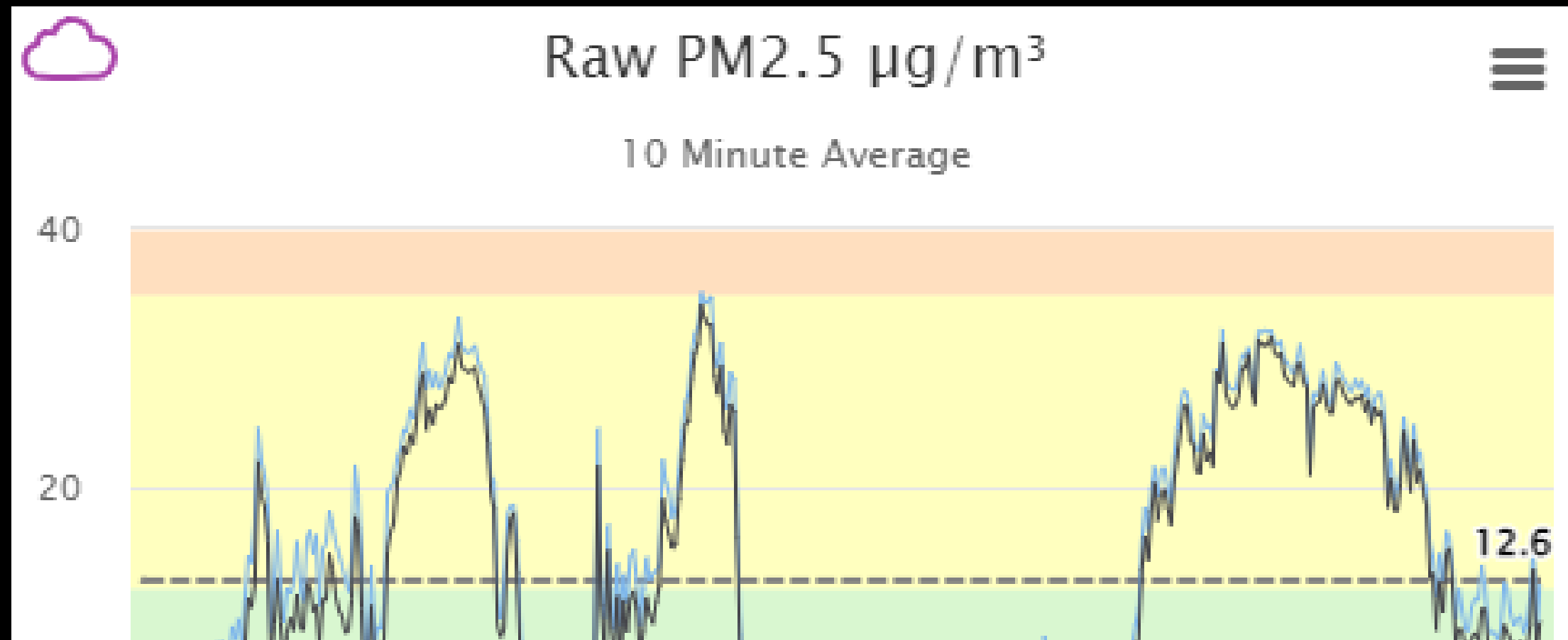
Life Expectancy across Sheffield



Leeds Corn Exchange

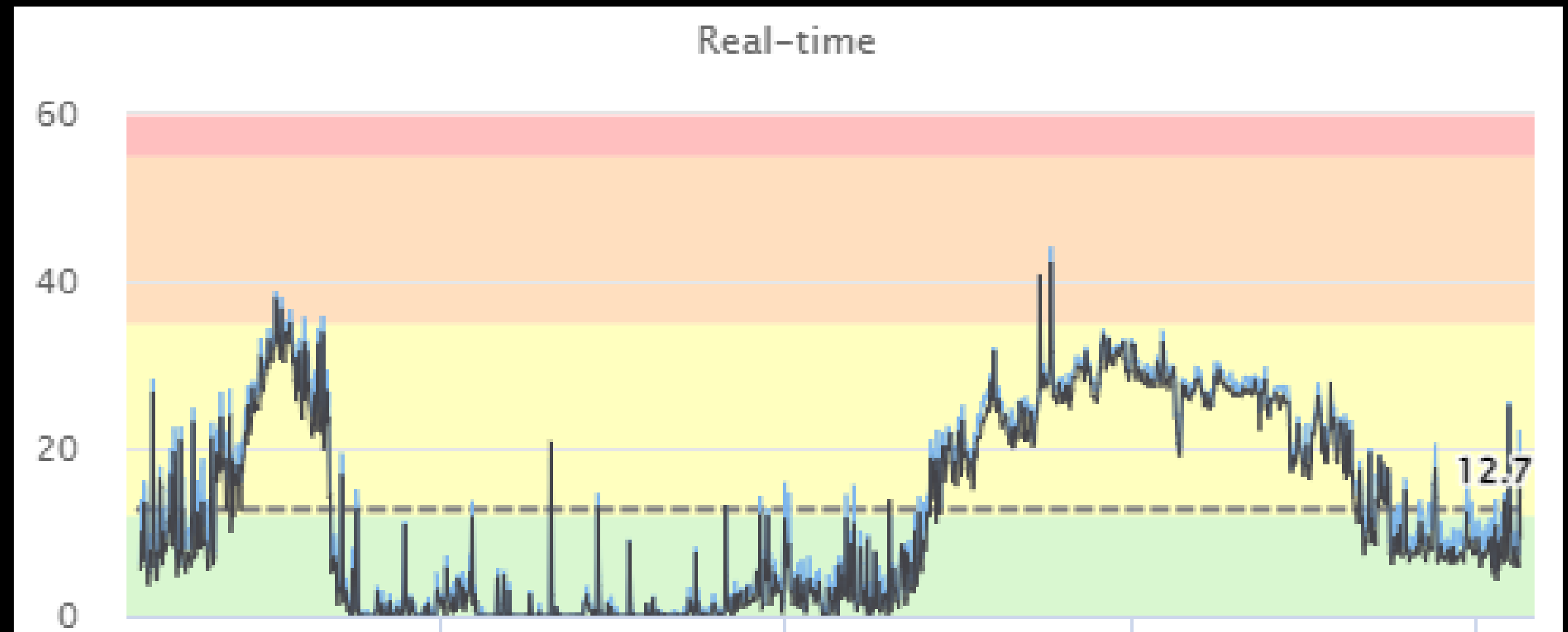


Corn Exchange.....

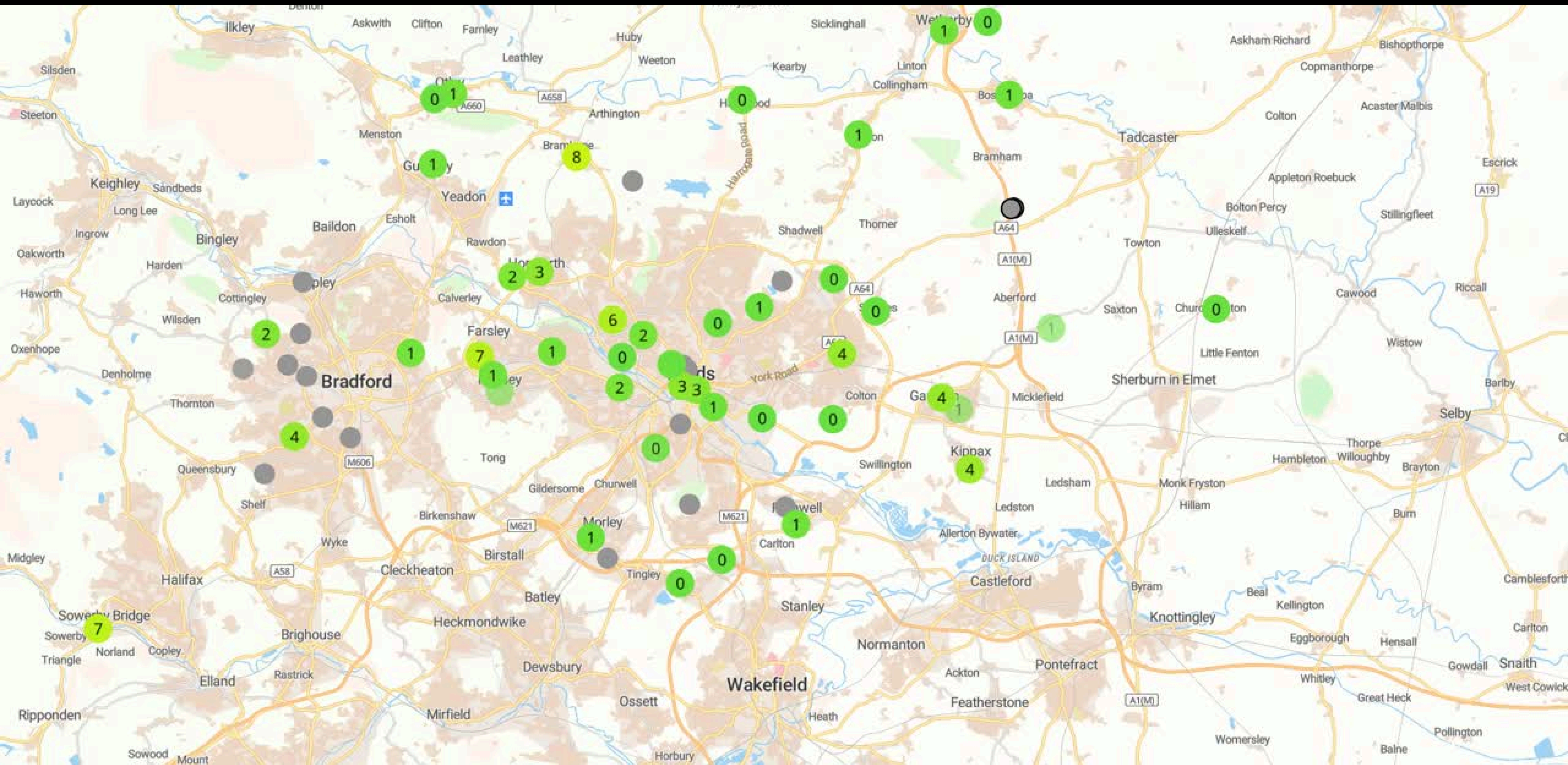


**Compare
to traffic
counts?**

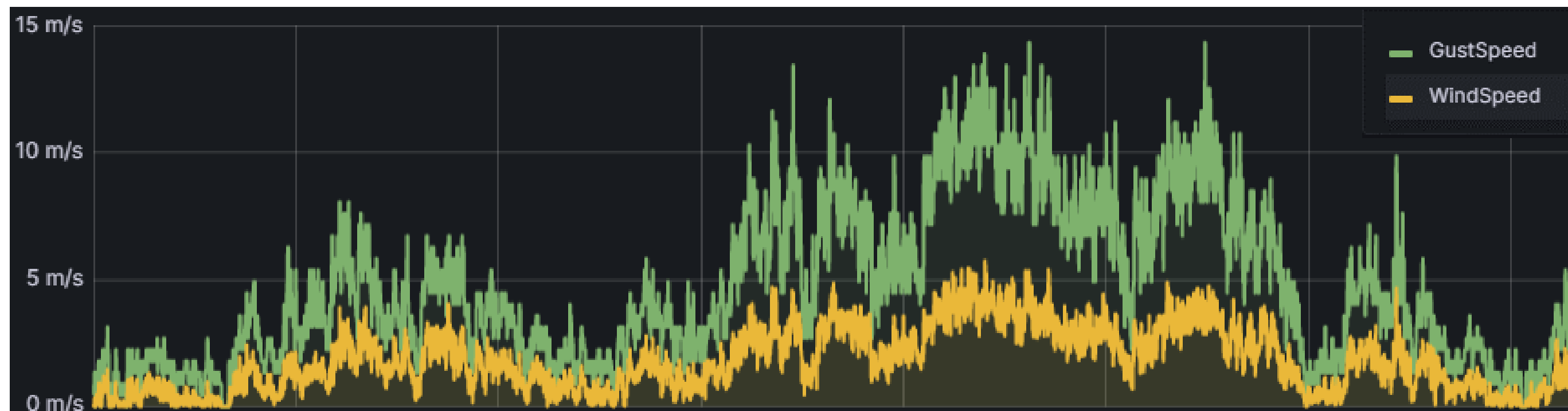
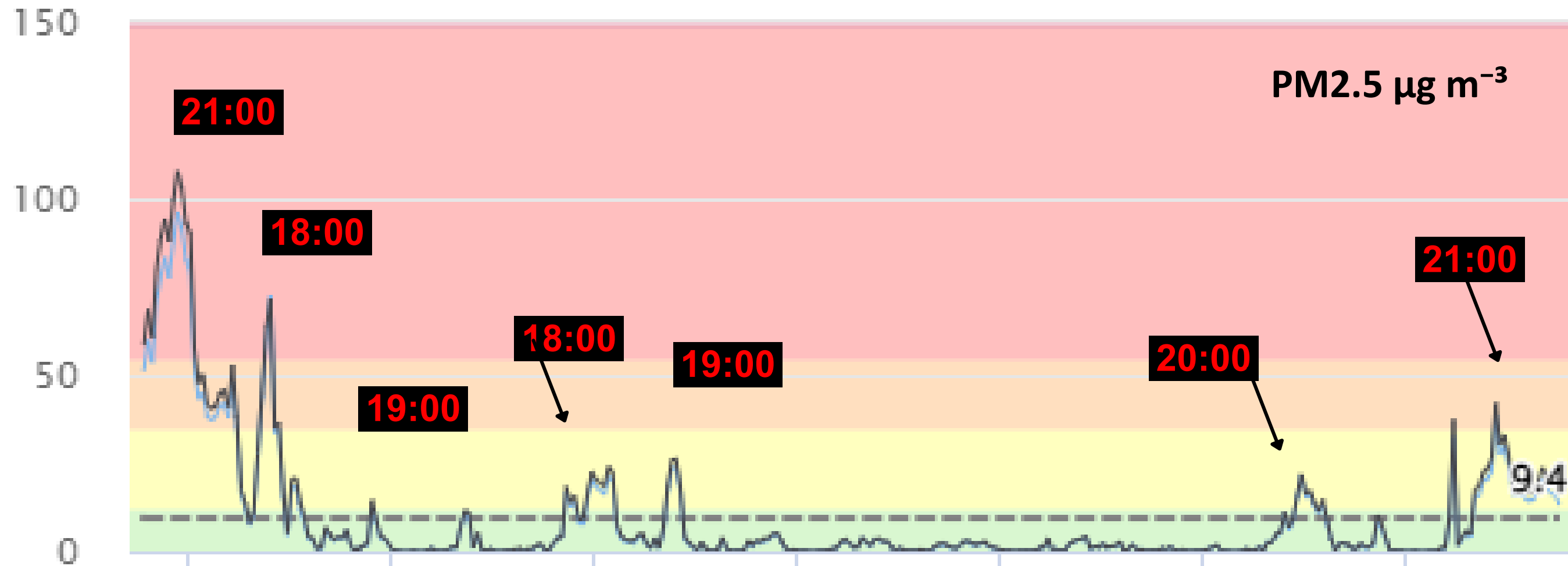
**Still need
to
“deweather”**



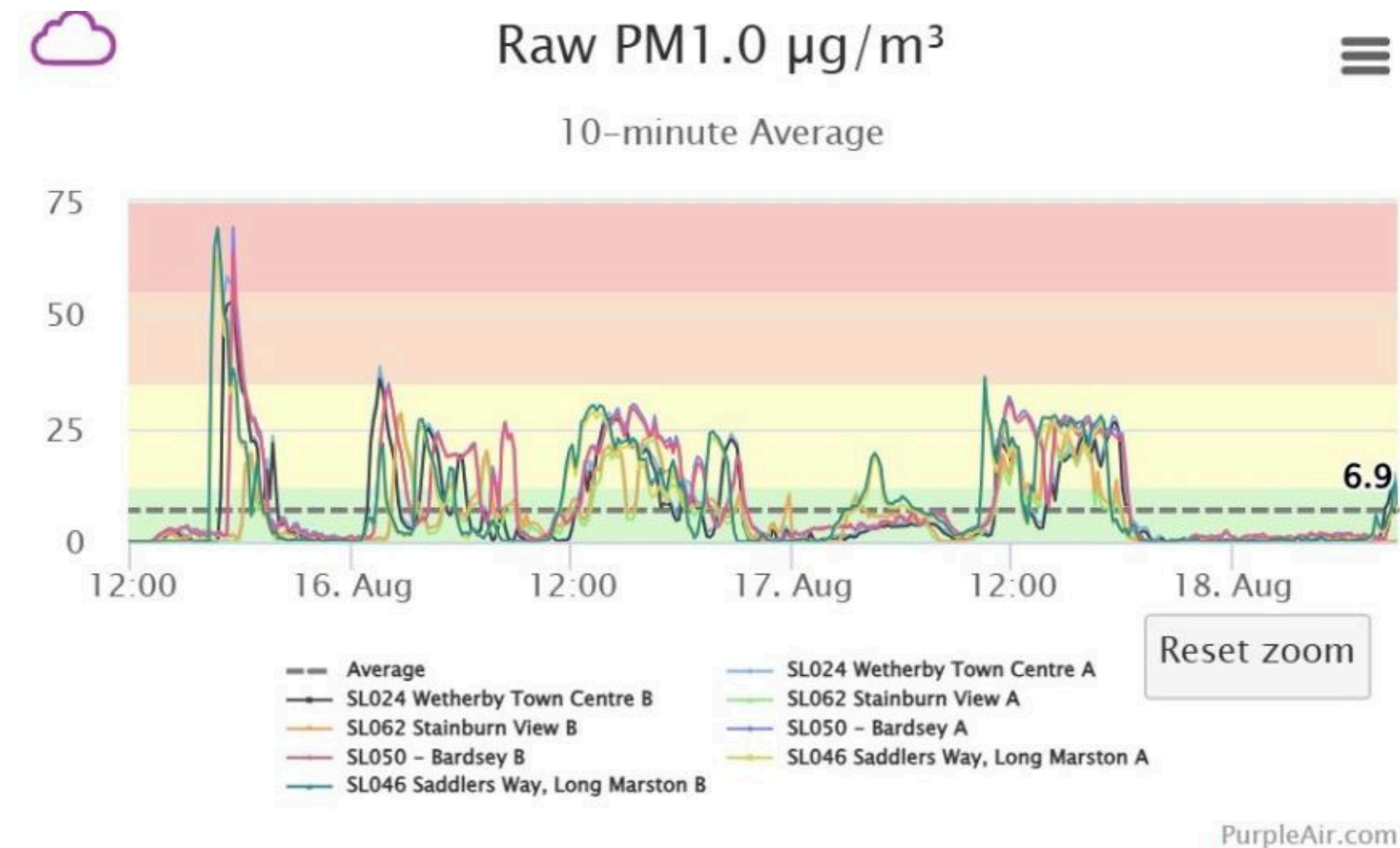
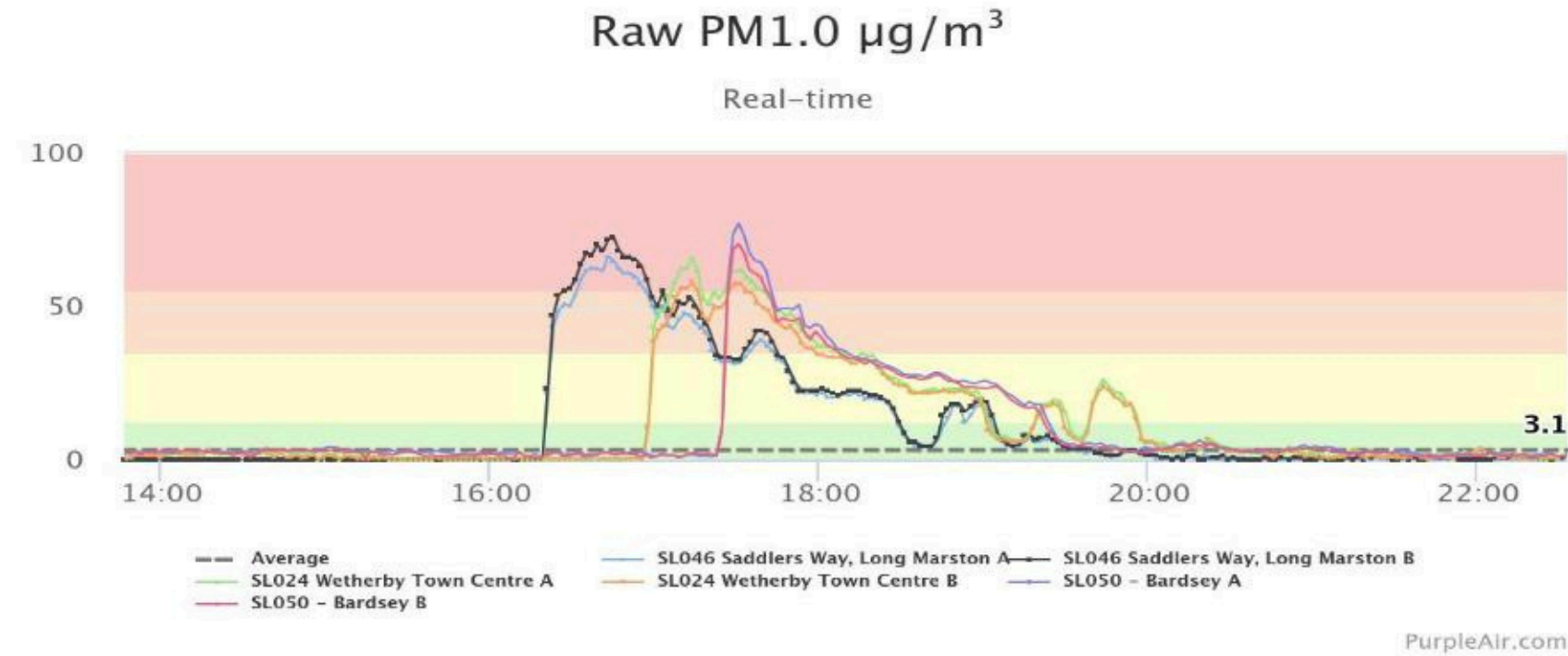
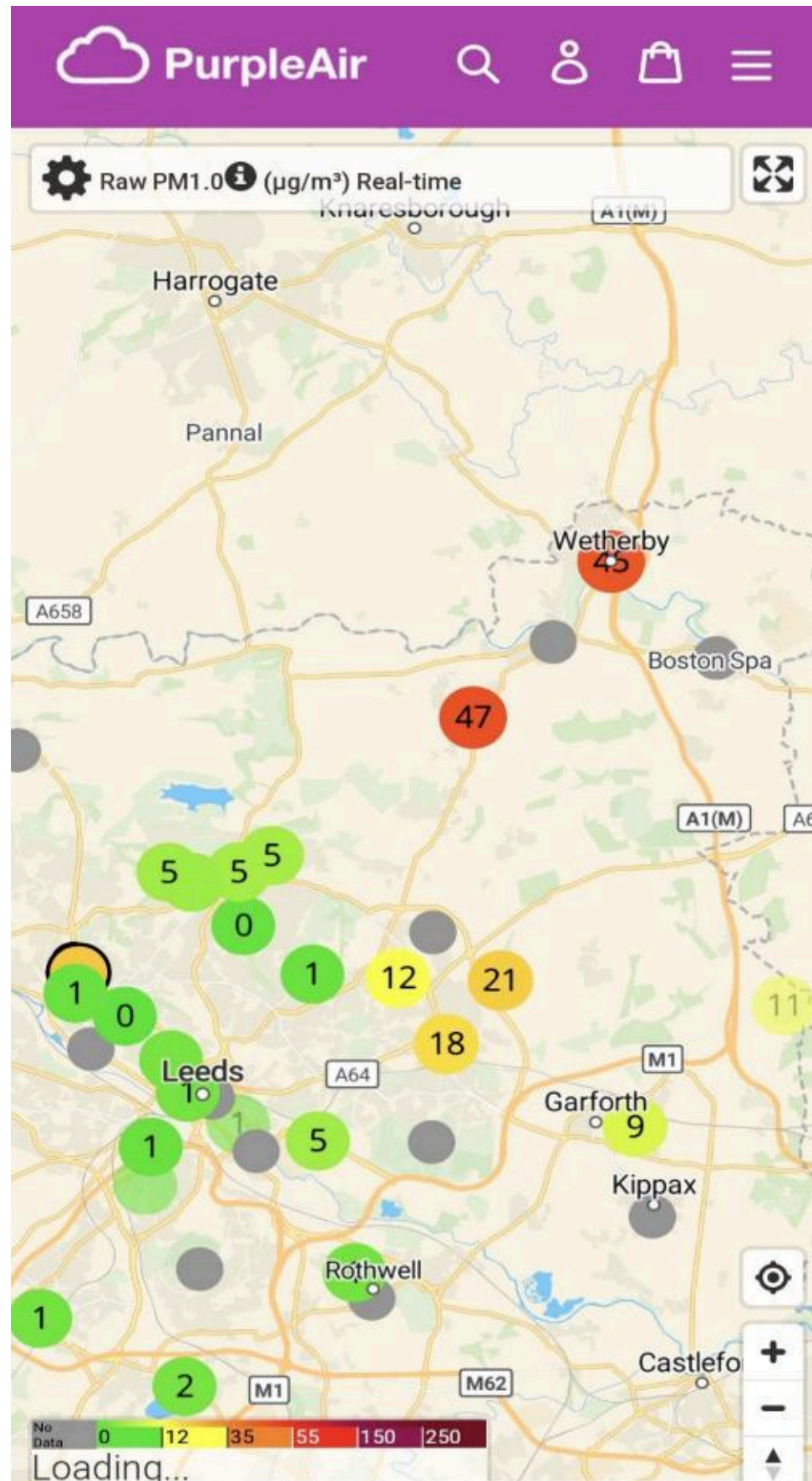
12:00 1st - 12:00 7th November 2023



Domestic Burning in Otley.....



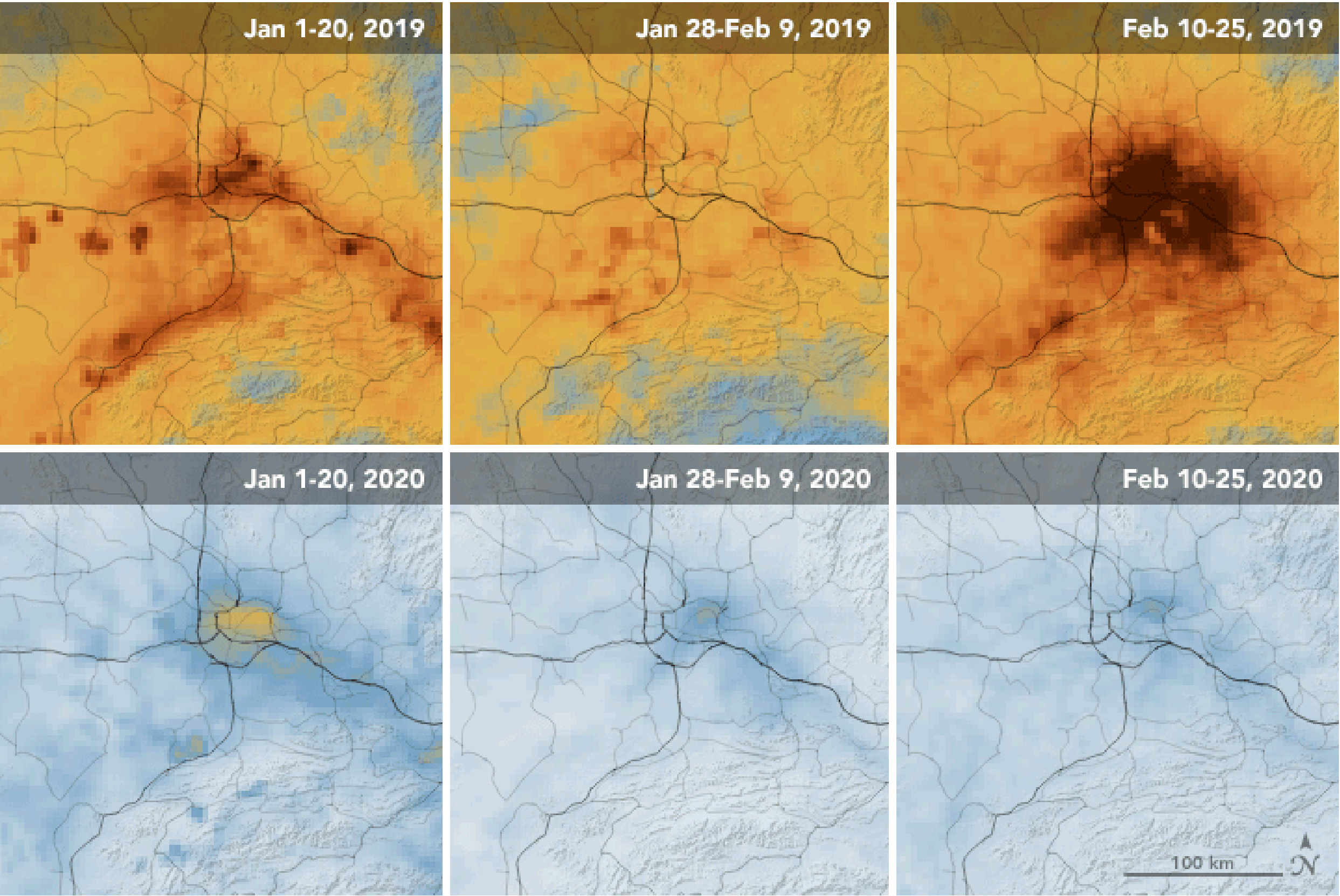
Langdale Fire (15th August)



Learning from COVID

Pollutant Drops in Wuhan—and Does not Rebound

Unlike 2019, NO₂ levels in 2020 did not rise after the Chinese New Year.



Mean Tropospheric NO₂ Density (μmol/m²)

0 125 250 375 500



AQ and COVID-19

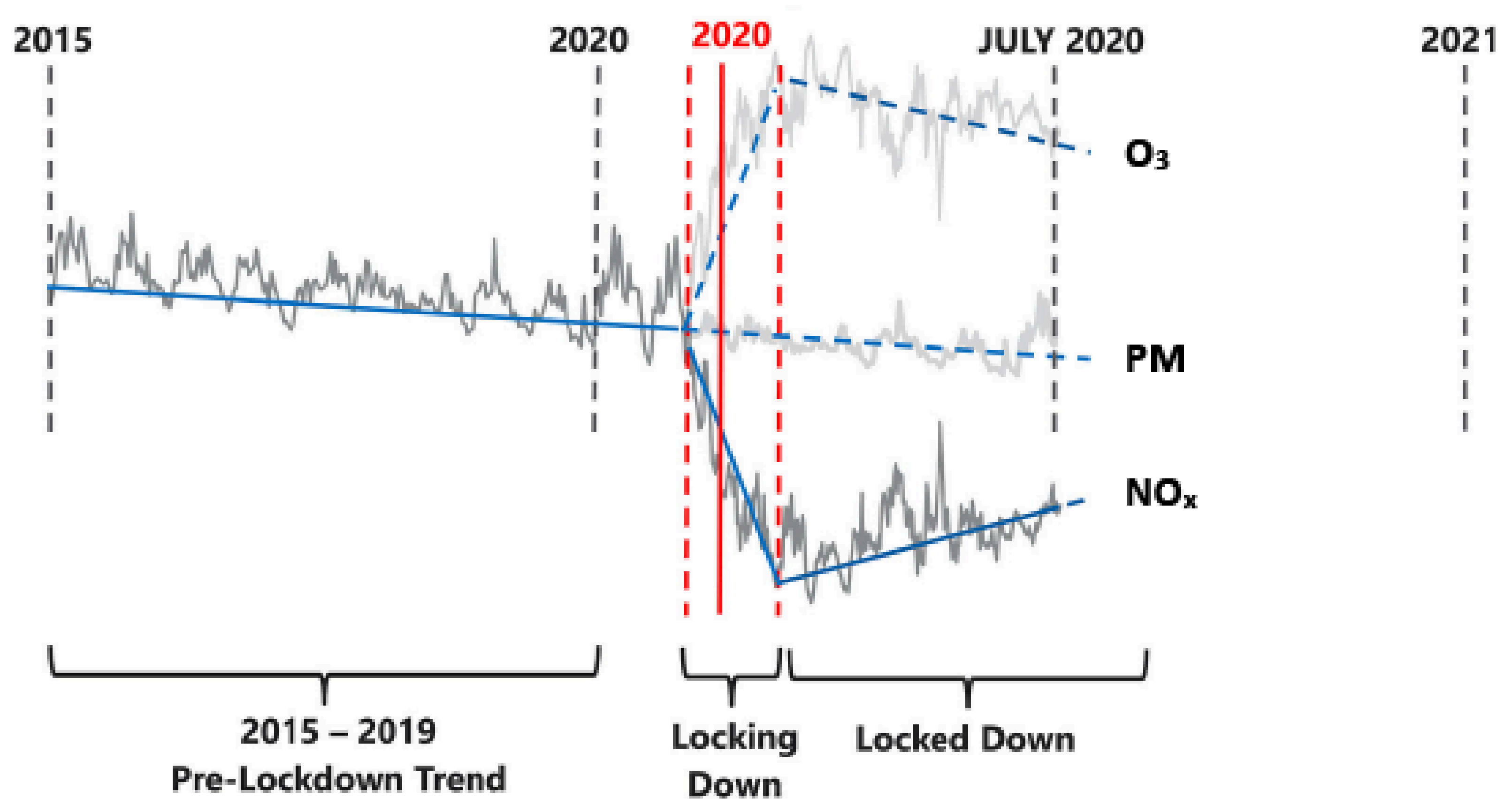
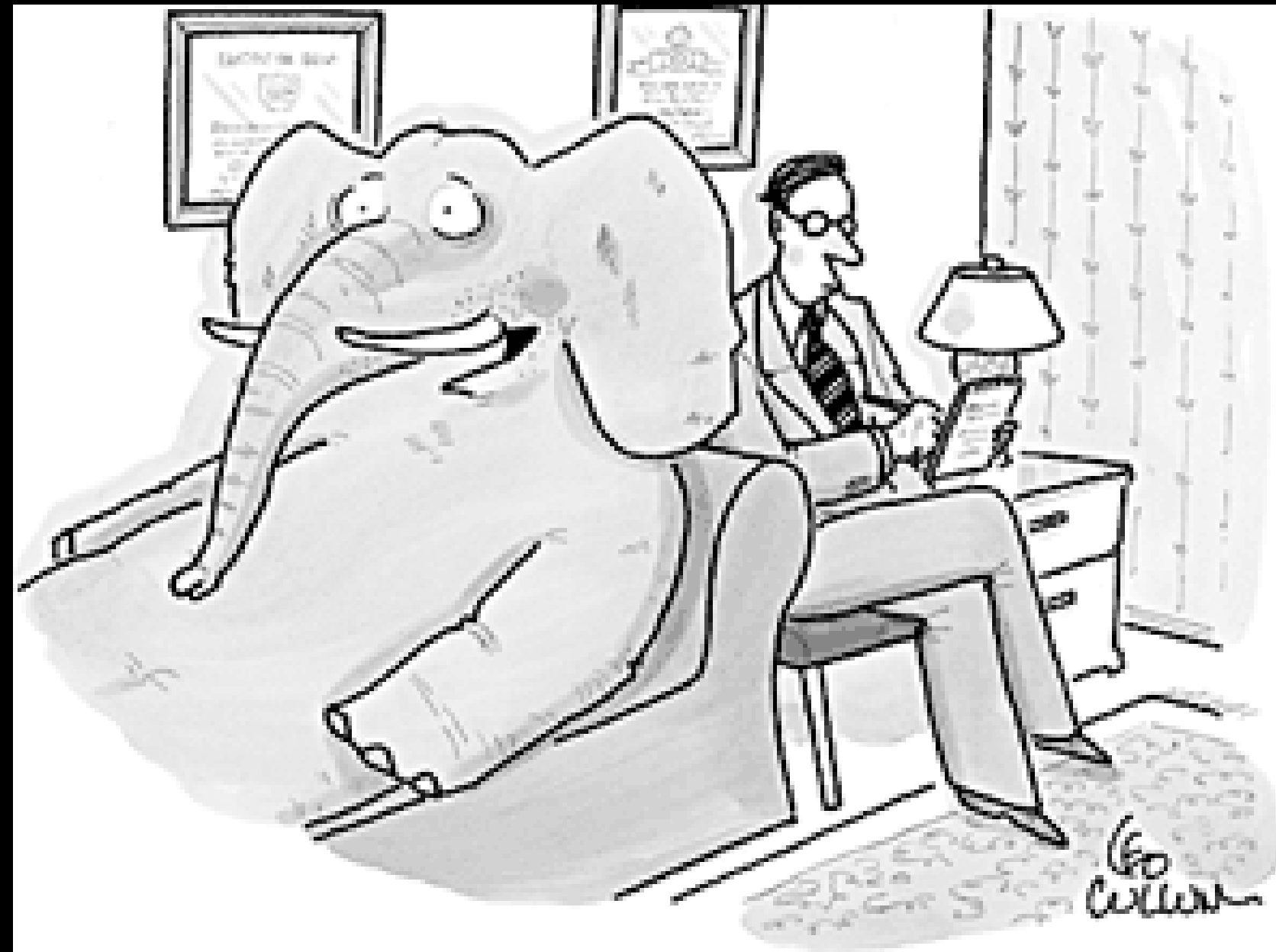


Figure 2.2: The impact of COVID-19 lockdown restrictions on NO_x , PM and O_3 in the UK

Where/What next.....?



"I'm right there in the room, and no one even acknowledges me."

New Yorker 9/18/2006

Low-smoke fuel: less smoke, more dangerous ultrafine particles

Share this page



Burning ‘low smoke’ manufactured fuels in home stoves may actually increase the number of tiny, potentially more harmful particles released into the air, new research led by the University of Galway has revealed.

Since October 31, 2022, Ireland has implemented a nationwide ban on the sale and distribution of bituminous (‘smoky’) coal to improve air quality. Under these regulations, only approved low-smoke fuels can legally be sold for home heating.



To quote from the Irish Government’s FAQ on the subject: *Low smoke fuel is a fuel permitted for sale in a Low Smoke Zone and emits less black smoke than comparable fuels. Black smoke contains high levels of PM2.5, which is harmful to the environment and to human health. Low smoke fuel emits some smoke while igniting, but when burning efficiently, emits less smoke.*

Aircraft emit millions of ultrafine particles over airports

Share this page



Aircraft taking off and landing at Zurich Airport release huge numbers of ultrafine particles, with levels spiking more than ten times higher than background air, new research has revealed.

Scientists from the Paul Scherrer Institute (PSI) conducted measurements approximately one kilometre downwind of the airport’s busiest runway, during the winter of 2022 and the summer of 2024.



Using specialised equipment that analysed particulate matter in near-real time, they detected up to 300,000 ultrafine particles per cubic centimetre of air, compared to just 30,000 at night when no aircraft were operating.

For the first time, the researchers also detected lubricating oil residue attached to these particles, recorded immediately after planes flew overhead at around 80 to 100 metres altitude. Every passing aircraft triggered a sharp spike in particle concentration.

Clean Air Fund launches major drive to cut soot emissions

Share this page



A £10 million initiative aimed at reducing black carbon emissions and improving public health has been launched by Clean Air Fund with support from the charitable foundation Wellcome.

The programme will fund research, policy development and advocacy efforts designed to accelerate global action on black carbon, a pollutant increasingly recognised for its role in both air pollution and climate change.

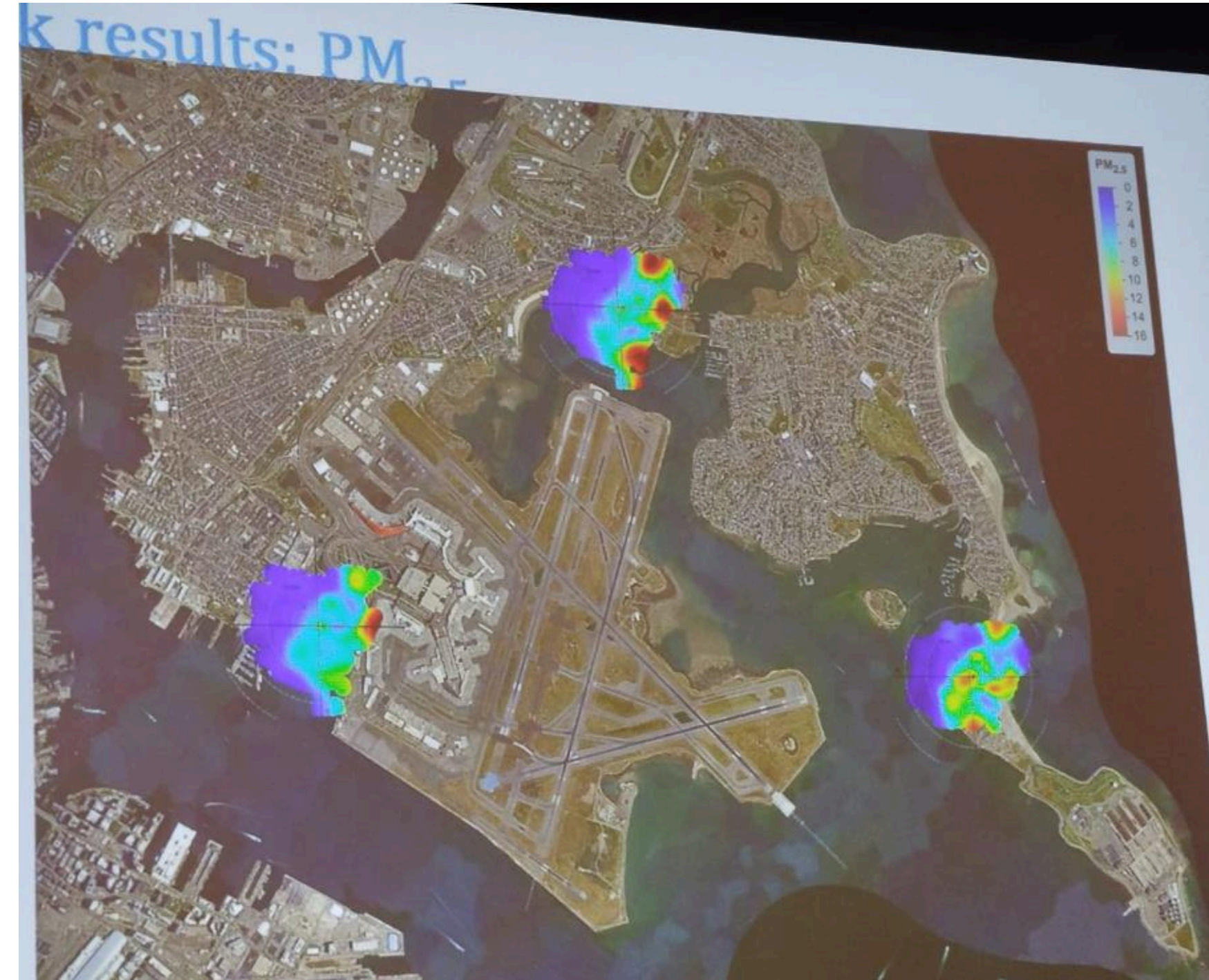


Black carbon, commonly known as soot, is produced through the incomplete burning of fossil fuels, biomass and other materials. It is a major component of PM2.5 and has been linked to a range of serious health conditions, including heart and lung disease. Emerging research has also suggested possible links to illnesses such as dementia and certain cancers.

Ultrafine Particles



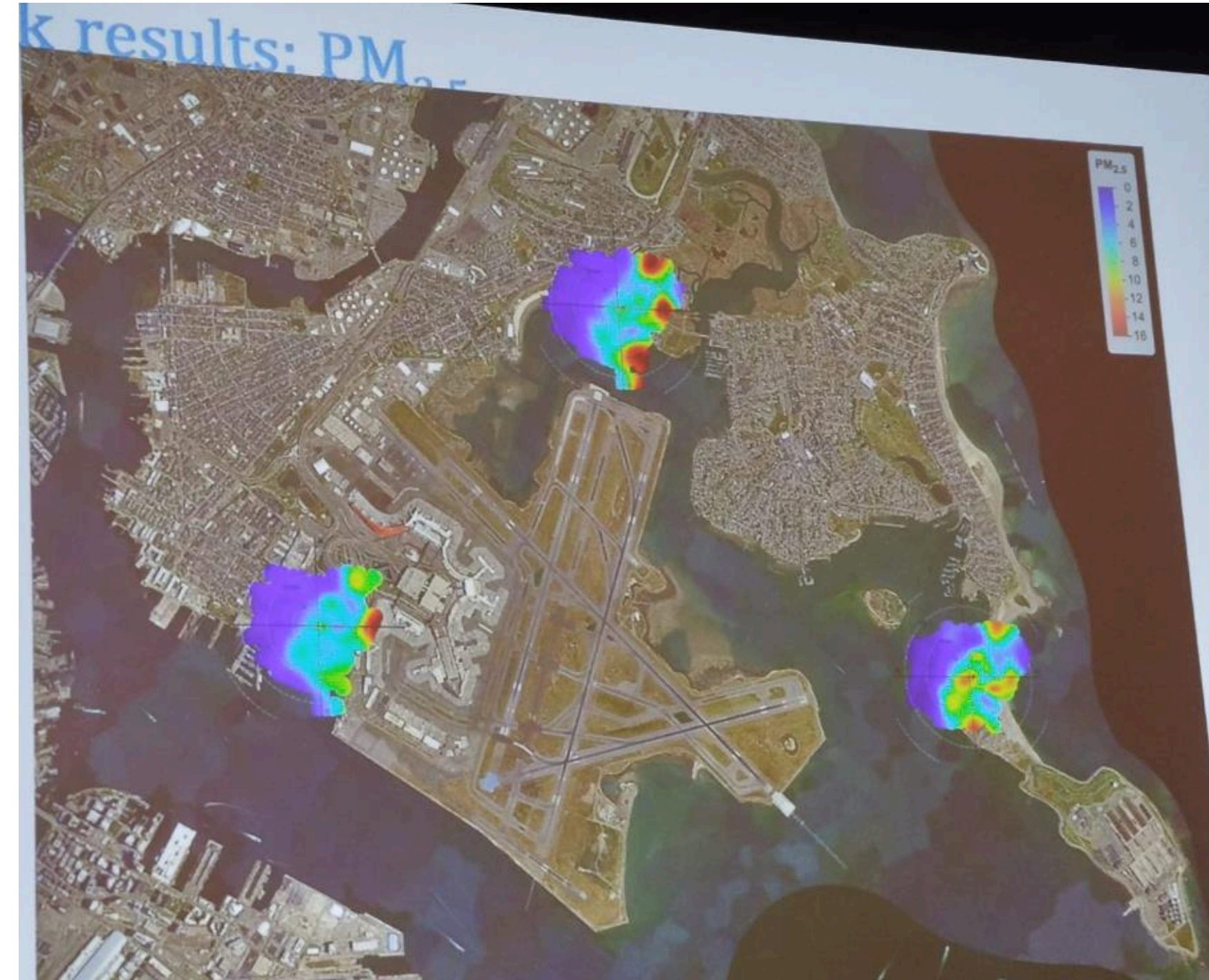
PM2.5 Particles



Ultrafine Particles



PM2.5 Particles



Just my thoughts...

- We CAN do something about it.
- People want data, but LOCAL & PERSONAL!
Turn ug/m3 into health impacts, Even better into ££££
£
- BUT Not ALL data is Equal – Regulated vs LCS
- Hidden in Plain Sight – Technology transferring PM2.5 to UFPs

ASL SPECIAL ISSUE
Sorting out AQ
The UK Clean Air Act
Clear Skies ahead?
OPEN NOW!



et zero
National Meeting (November)
Smog, Stories and Solutions:
70 Years since the UK Clean Air
Act



