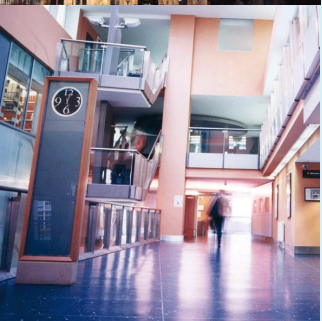
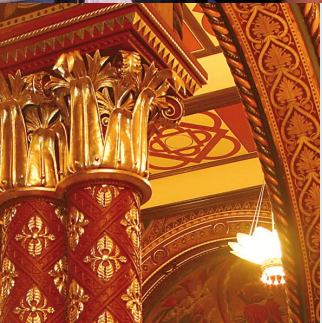


# PM2.5 in London and the UK

## Concentrations and sources

Gary Fuller, King's College London



# Contents

- The Public Health Framework PM2.5 health indicator
- What is PM2.5?
- PM2.5 health impacts
- How does PM2.5 vary spatially?
- How does PM2.5 vary in time?
- PM2.5 sources to be controlled.
- Public air quality information.

# Contents

## **3.1 The mortality effect of anthropogenic particulate air pollution (measured as fine particulate matter, PM<sub>2.5</sub>\*) per 100,000 population.**

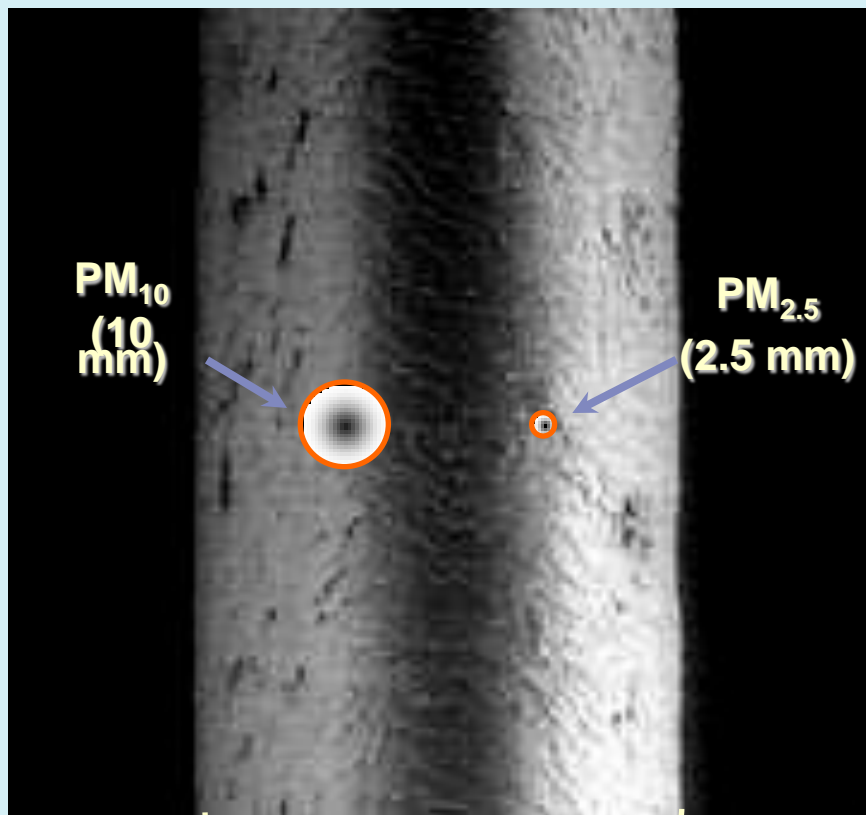
Mortality Burden: To be expressed as attributable deaths and associated years of life lost. (a) Attributable deaths are obtained by multiplying local PM<sub>2.5</sub> data (population-weighted modelled background anthropogenic PM<sub>2.5</sub> concentrations, to be supplied by Defra – see below) by annual deaths (age 30+)\*\* and the Committee on the Medical Effects of Air Pollutants (COMEAP)-recommended relative risk of 6% increase in mortality per 10 µg/m<sup>3</sup> PM<sub>2.5</sub>. (b) Years of life lost associated with these attributable deaths are then calculated (eg by summing age-specific life expectancies for each attributable death). Data on the resident population can be used to express the burden per 100,000 people.

\* PM<sub>2.5</sub> means the mass (in micrograms) per cubic metre of air of individual particles with an aerodynamic diameter generally less than 2.5 micrometers. PM<sub>2.5</sub> is also known as fine particulate matter.

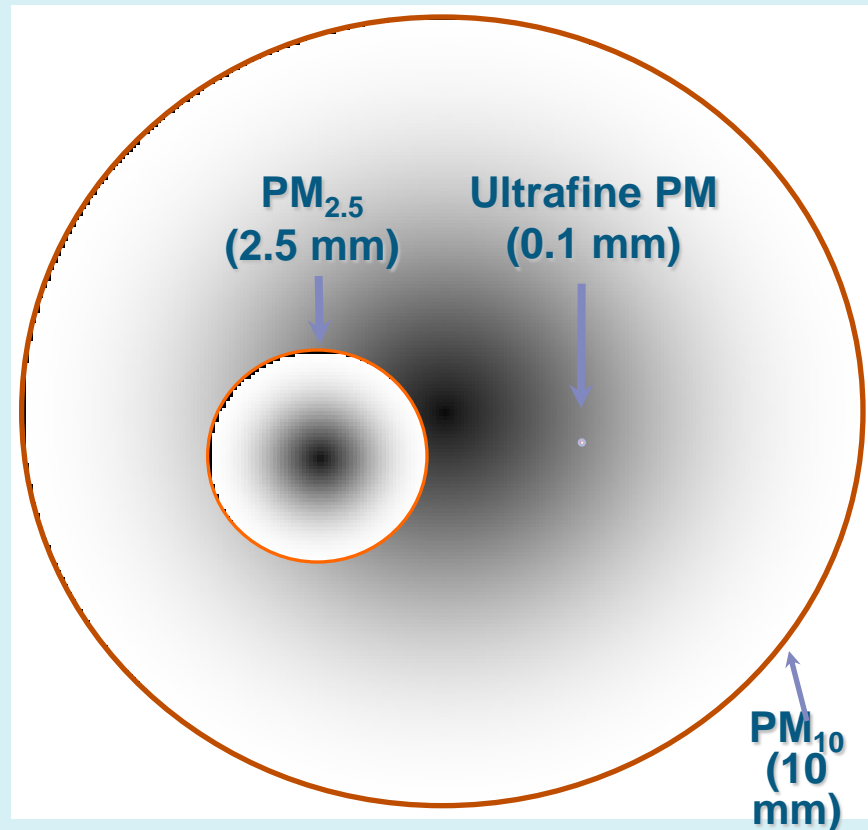
\*\* The national estimates (COMEAP, 2010) have been calculated using data on deaths at ages 30+, as this reflects the study in which the relative risk was reported. COMEAP considers that it might be appropriate to calculate local estimates using data on total deaths.

DoH, 2012

# Particulate matter associated with health effects is invisible



**Human Hair  
(60 μm diameter)**



**Relative size of particles**

# PM<sub>2.5</sub> associations with life expectancy

(Pope et al, NEJM, 2009, 360: 376-386)

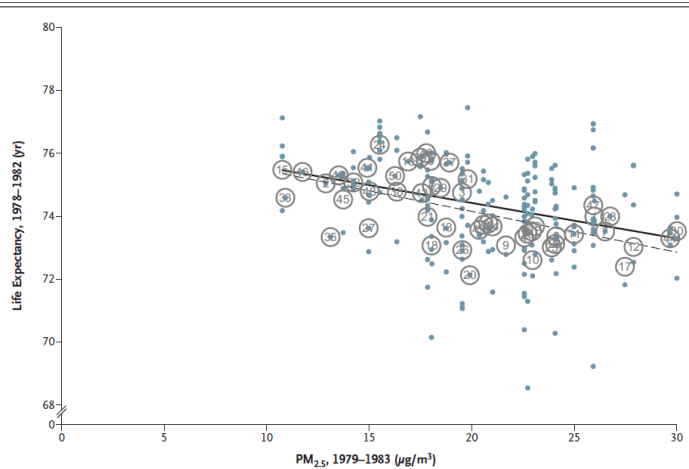


Figure 2. Cross-Sectional Life Expectancies for 1978–1982, Plotted against PM<sub>2.5</sub> Concentrations for 1979–1983.

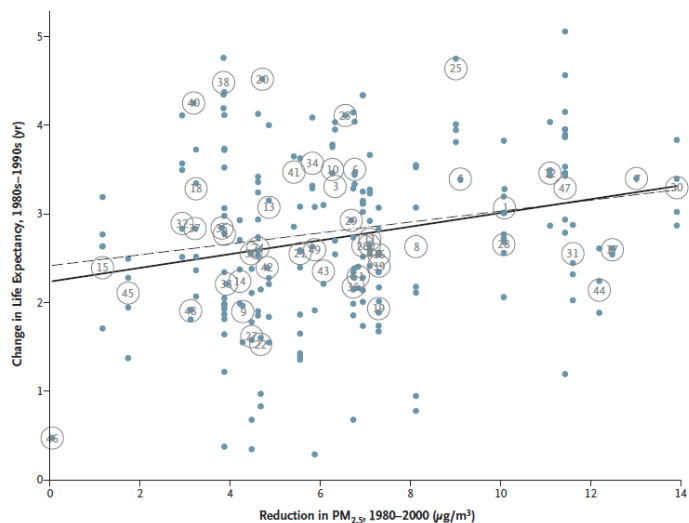
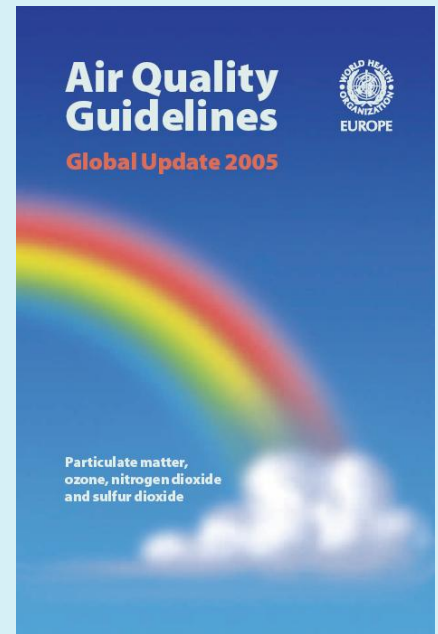


Figure 4. Changes in Life Expectancy for the 1980s–1990s, Plotted against Reductions in PM<sub>2.5</sub> Concentrations for 1980–2000.





COMMITTEE ON THE MEDICAL EFFECTS OF AIR POLLUTANTS

*The Mortality Effects of  
Long-Term Exposure to  
Particulate Air Pollution  
in the United Kingdom*

A report by the  
Committee on the  
Medical Effects of  
Air Pollutants

## Across the UK PM<sub>2.5</sub>.....

- equivalent of 29,000 premature deaths due to breathing tiny particles released into the air (in 2008 data)
- the average loss of life was 6 months, (although the actual amount varies between individuals, from a few days to many years)
- Economic cost of the order of £8-20 billion per year (from IGCB)

Published December 2010



WORKING FOR A HEALTHY FUTURE

Consulting report P951-001  
June 2010

## Report on estimation of mortality impacts of particulate air pollution in London

Dr Brian G Miller

RESEARCH CONSULTING SERVICES

Multi-disciplinary specialists in Occupational and Environmental Health and Hygiene

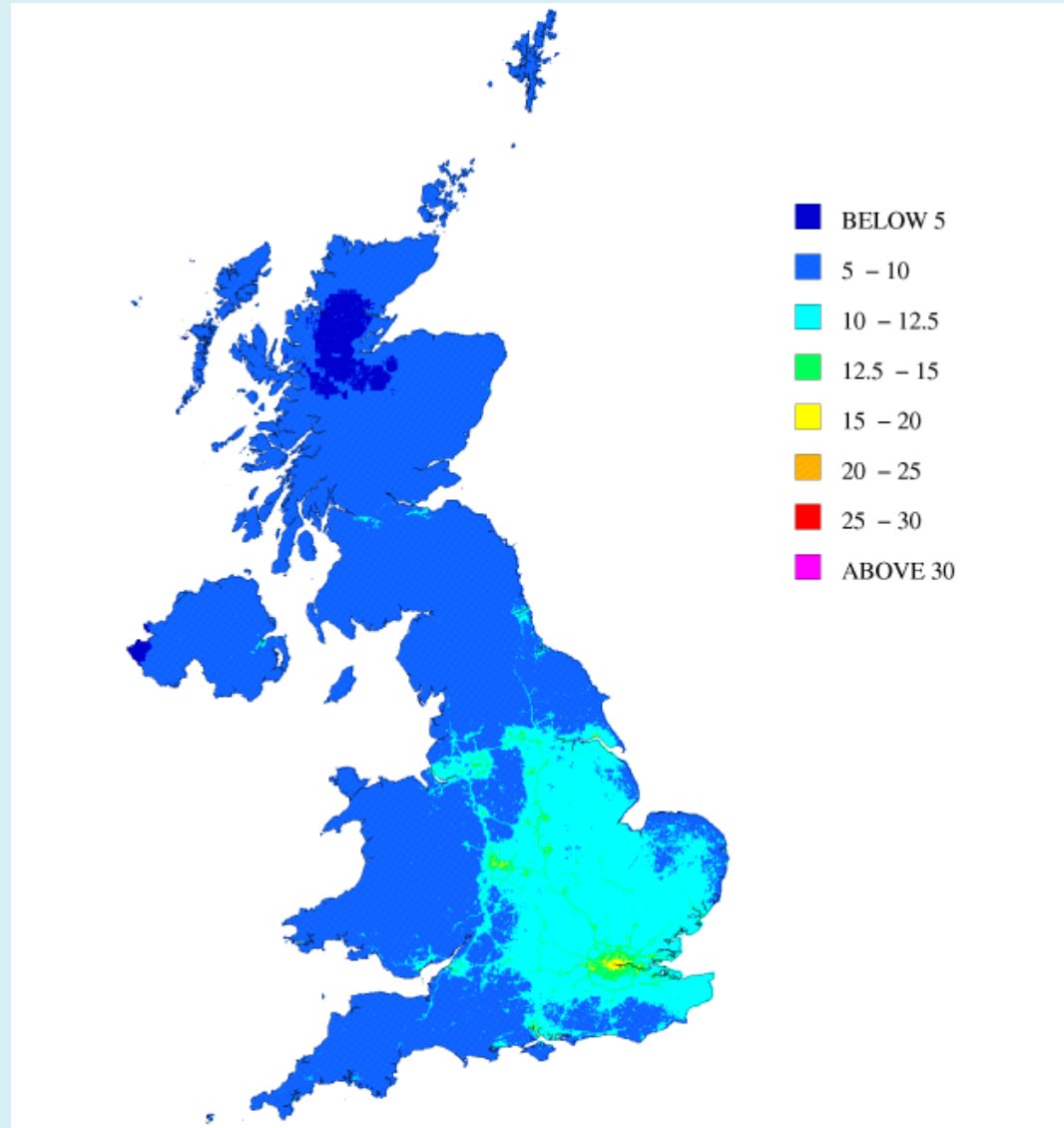
[www.iom-world.org](http://www.iom-world.org)

## Across London PM2.5....

- an impact on mortality equivalent to 4,267 deaths in London in 2008, within a range of 756 to 7,965.
- A permanent reduction in PM2.5 concentrations of  $1\mu\text{g}/\text{m}^3$  would gain 400,000 years of life for the current population (2008) in London and a further 200,000 years for those born during that period.
- followed for the lifetime of the current population, a  $1\mu\text{g}/\text{m}^3$  decrease would yield a life gain equivalent to an average 3 weeks per member of the 2008 population.

# Background PM2.5 across the UK 2008

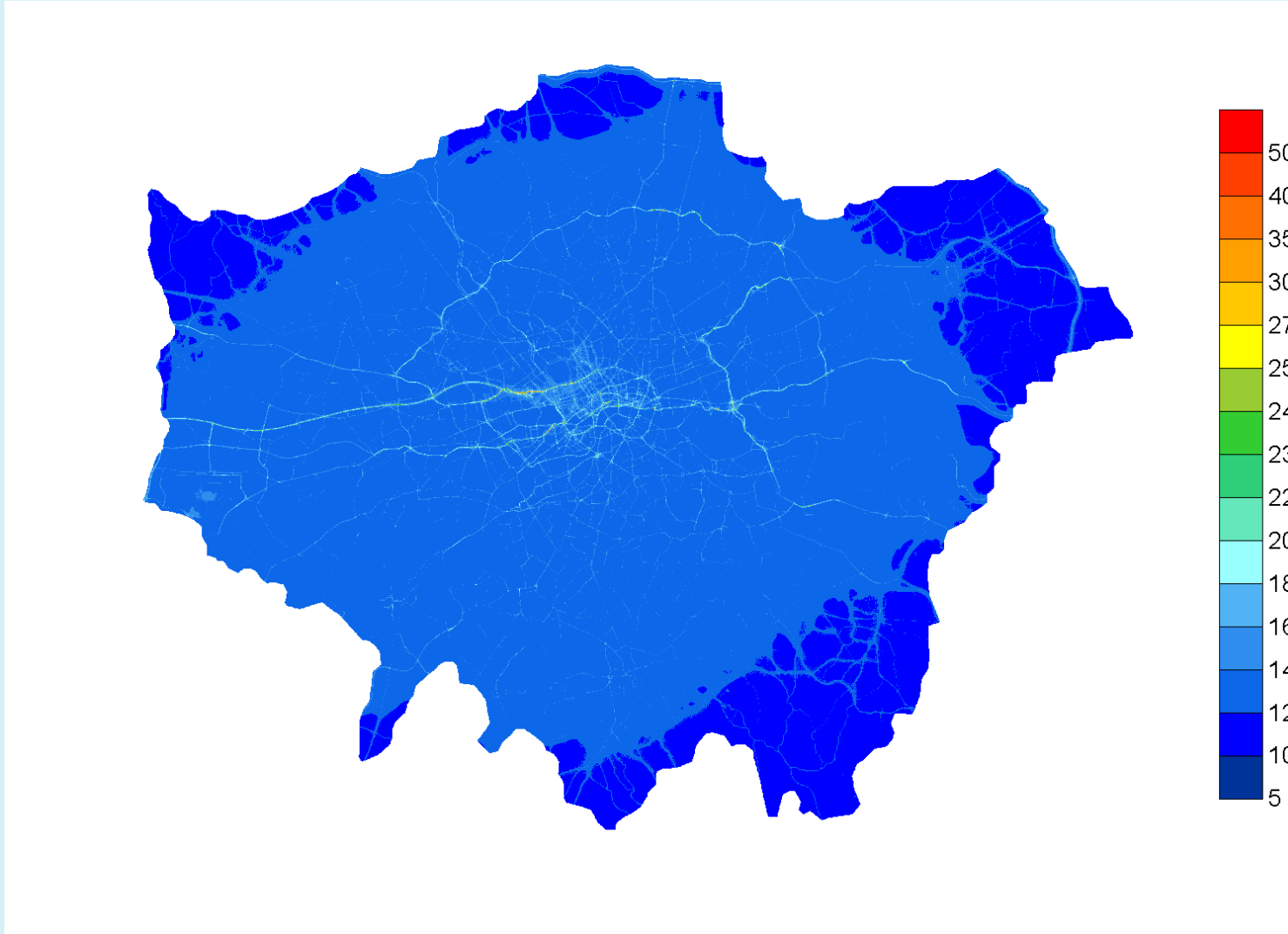
Brookes et al 2012 for Defra





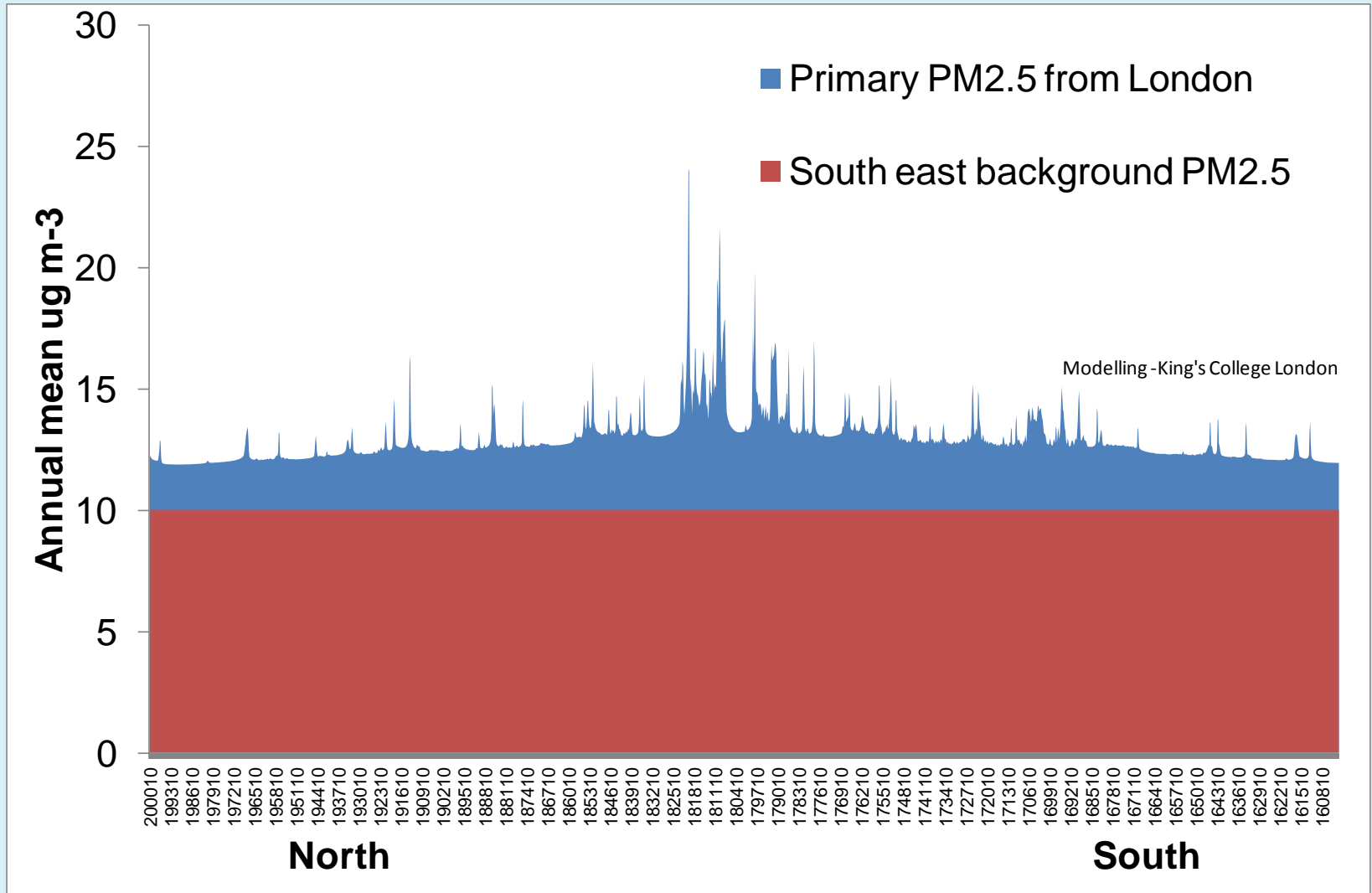
# PM2.5 across London 2008

King's College London



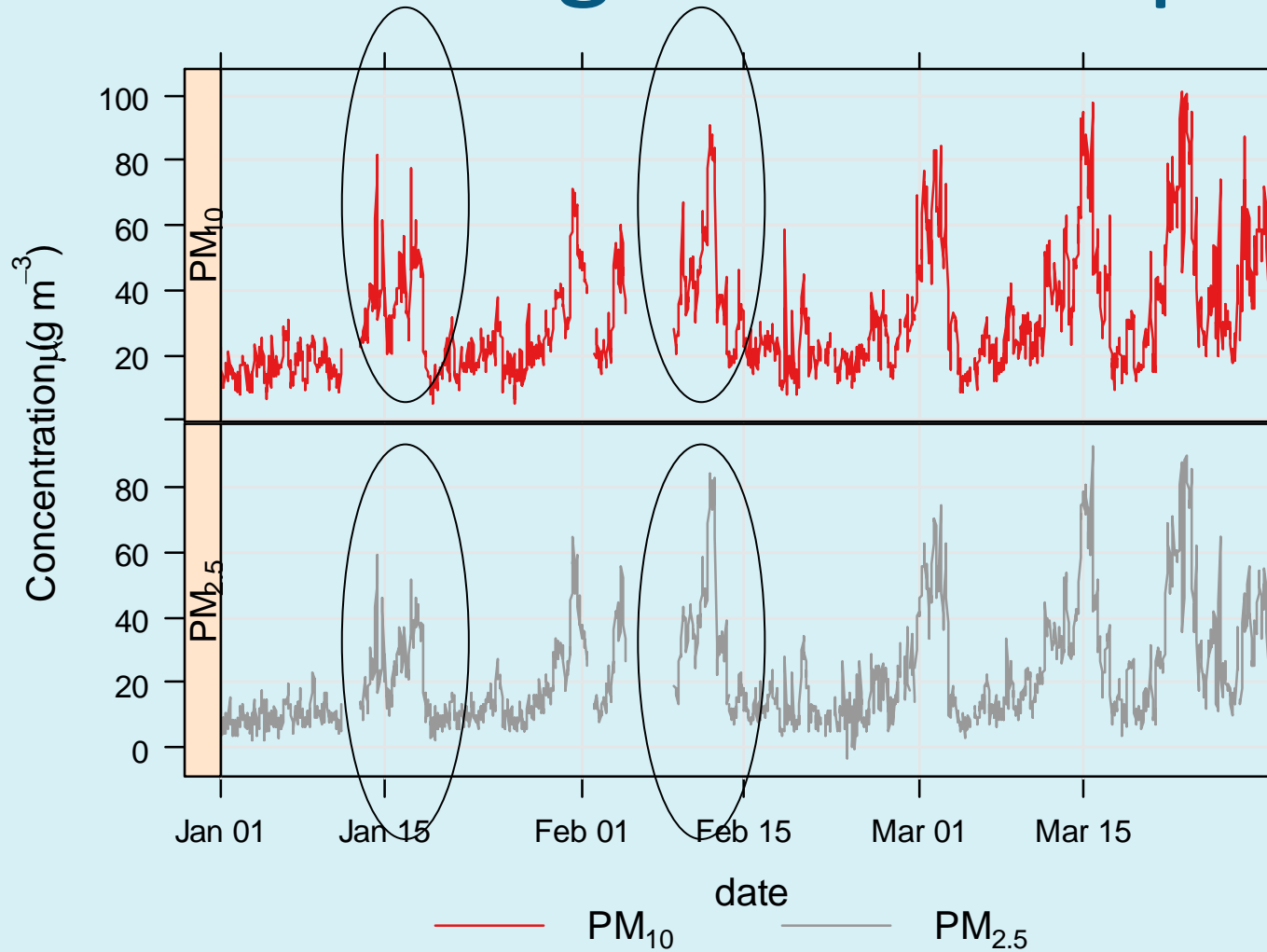
# Annual mean PM2.5 across London 2009

(After Lenschow et al 2001)

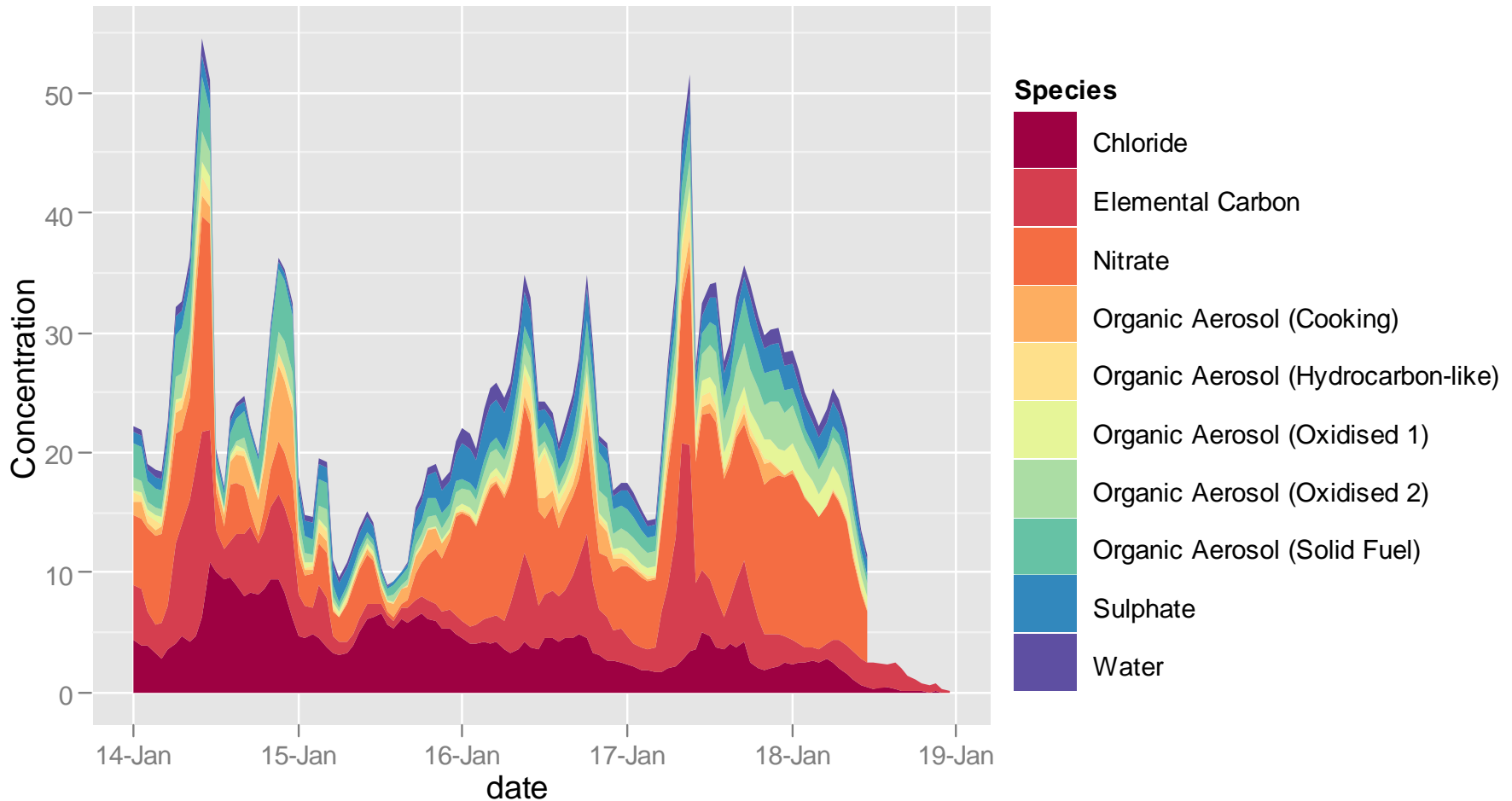


# PM2.5 variation in time

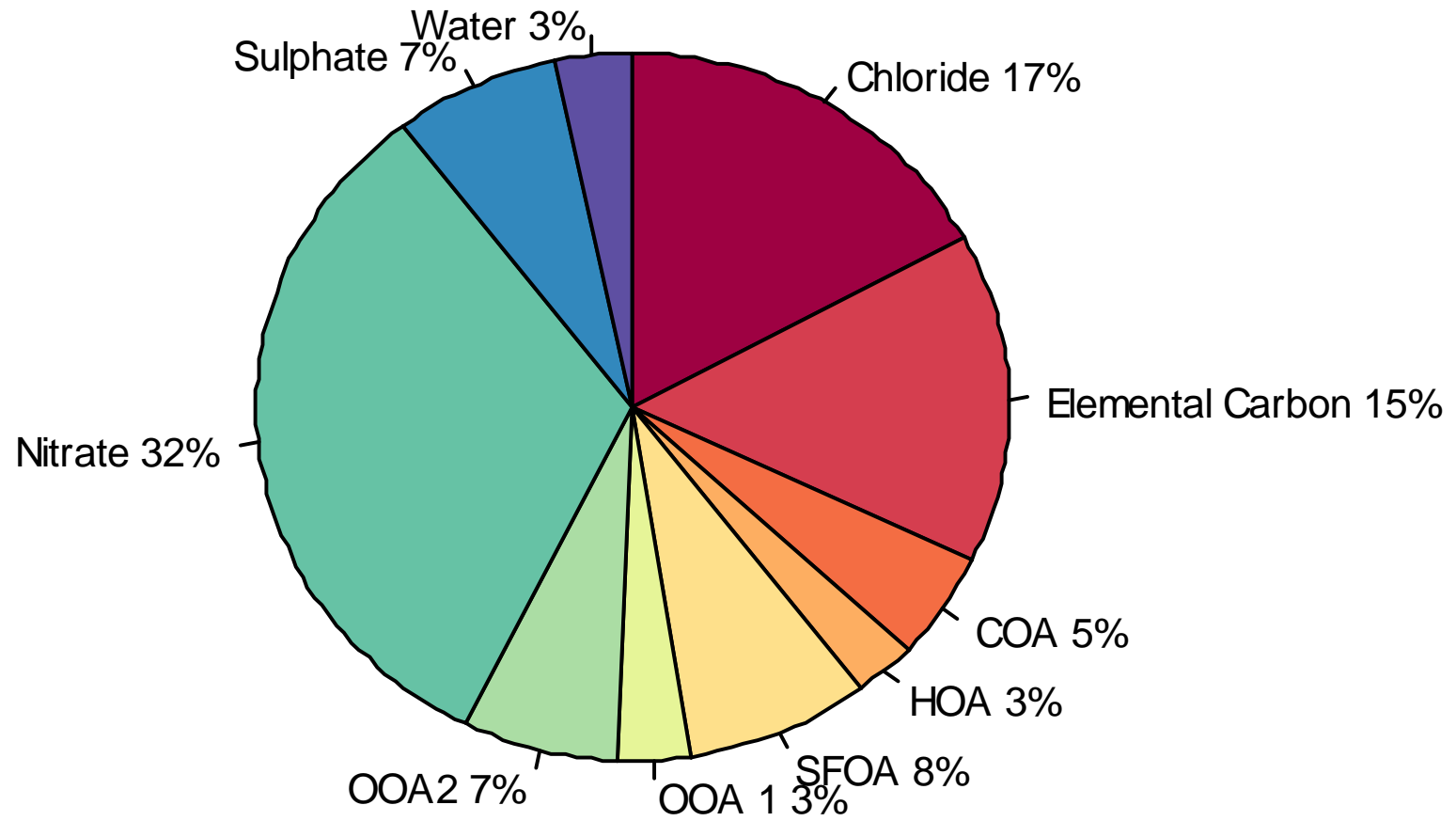
## North Kensington Jan – Apr 2012



# Episode 1 – 14<sup>th</sup>-18<sup>th</sup> January

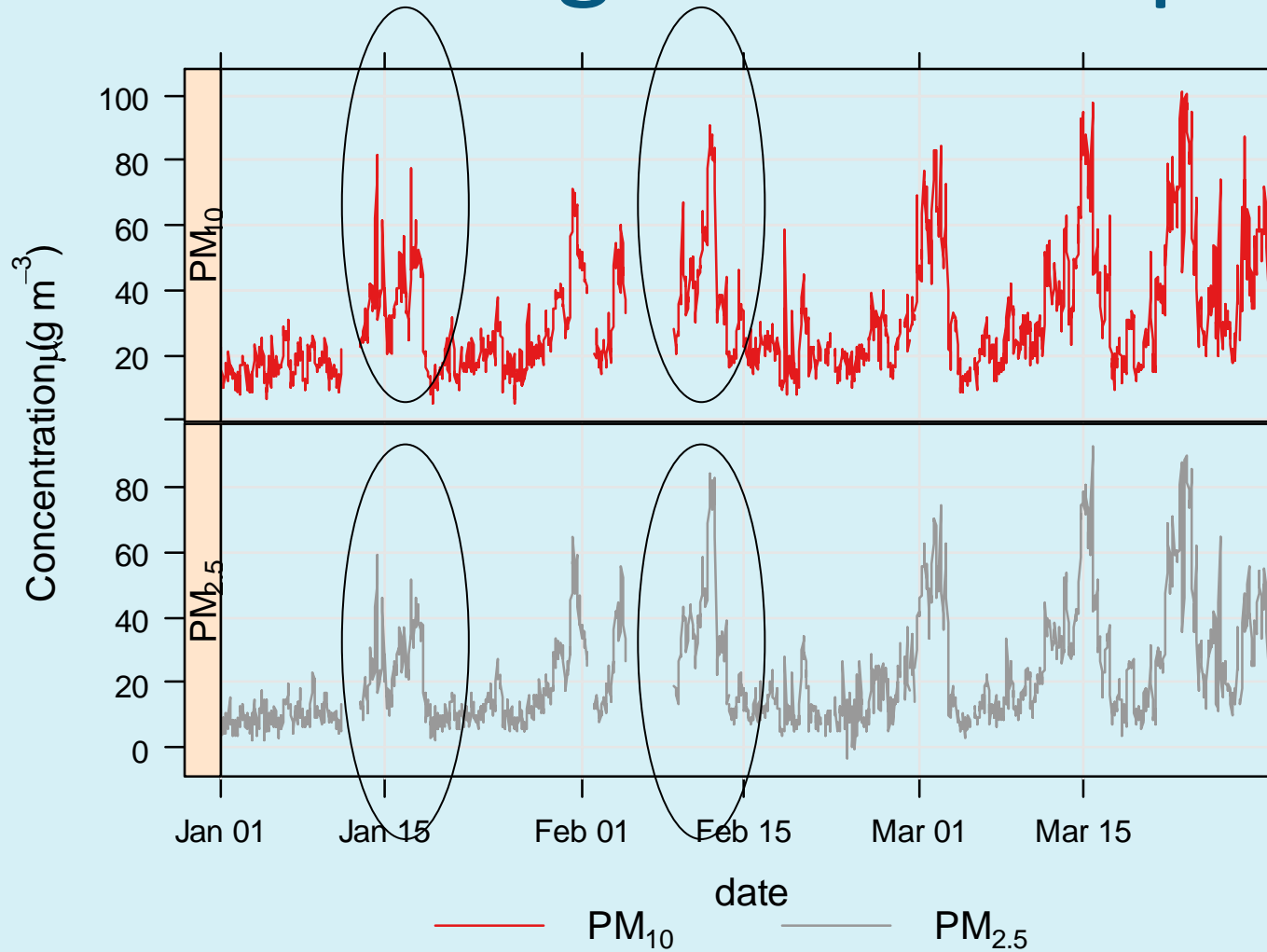


# Episode 1 – 14<sup>th</sup>-18<sup>th</sup> January



# PM2.5 variation in time

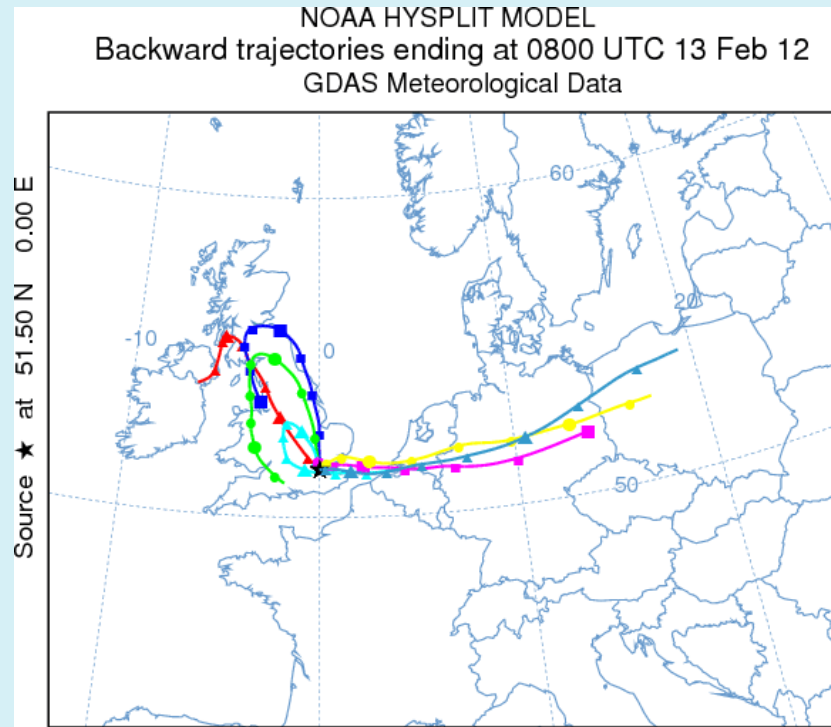
## North Kensington Jan – Apr 2012



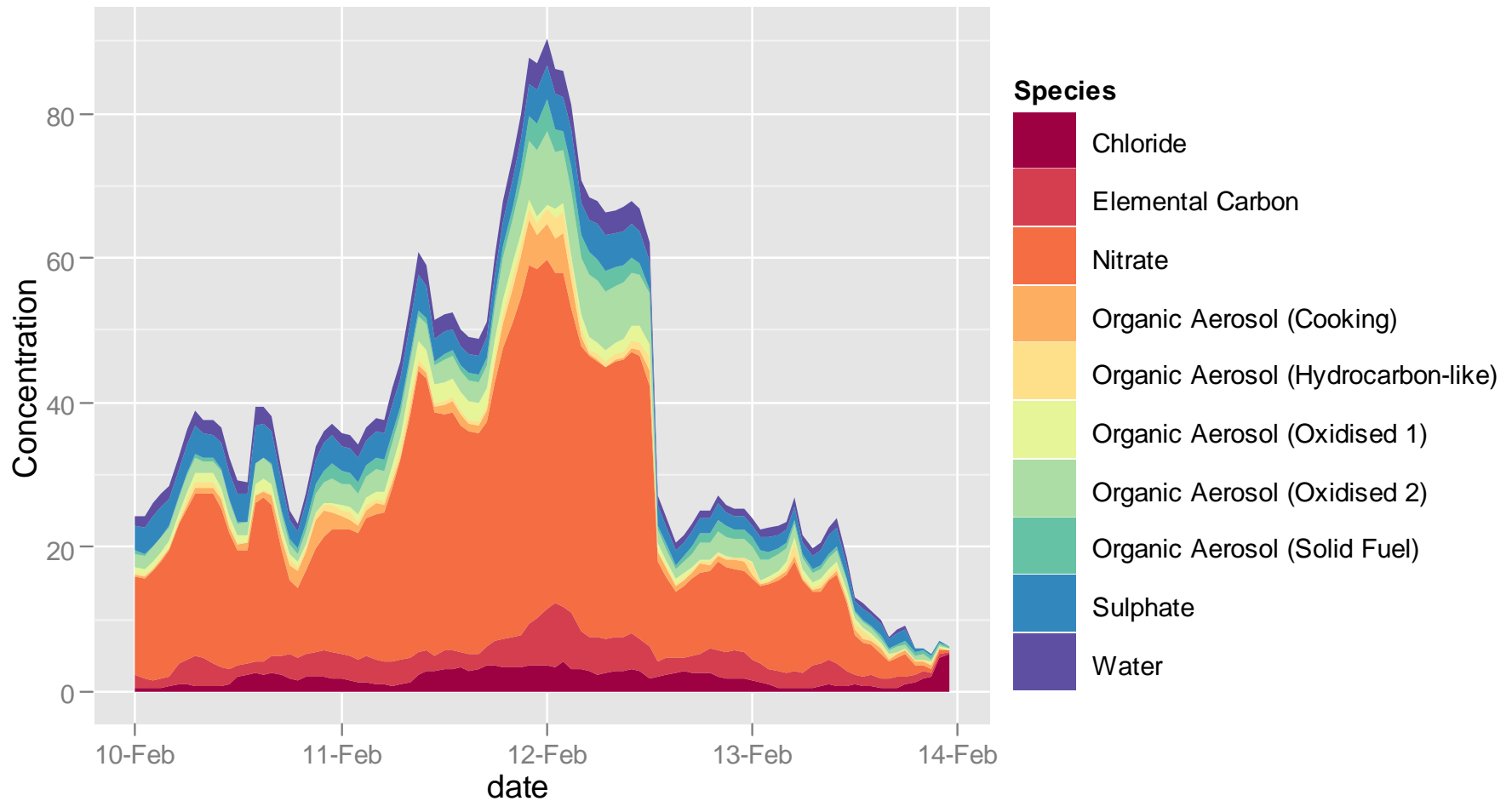
# Episode 2 – 10<sup>th</sup> -14<sup>th</sup> February

Low temperature

Long Range transport

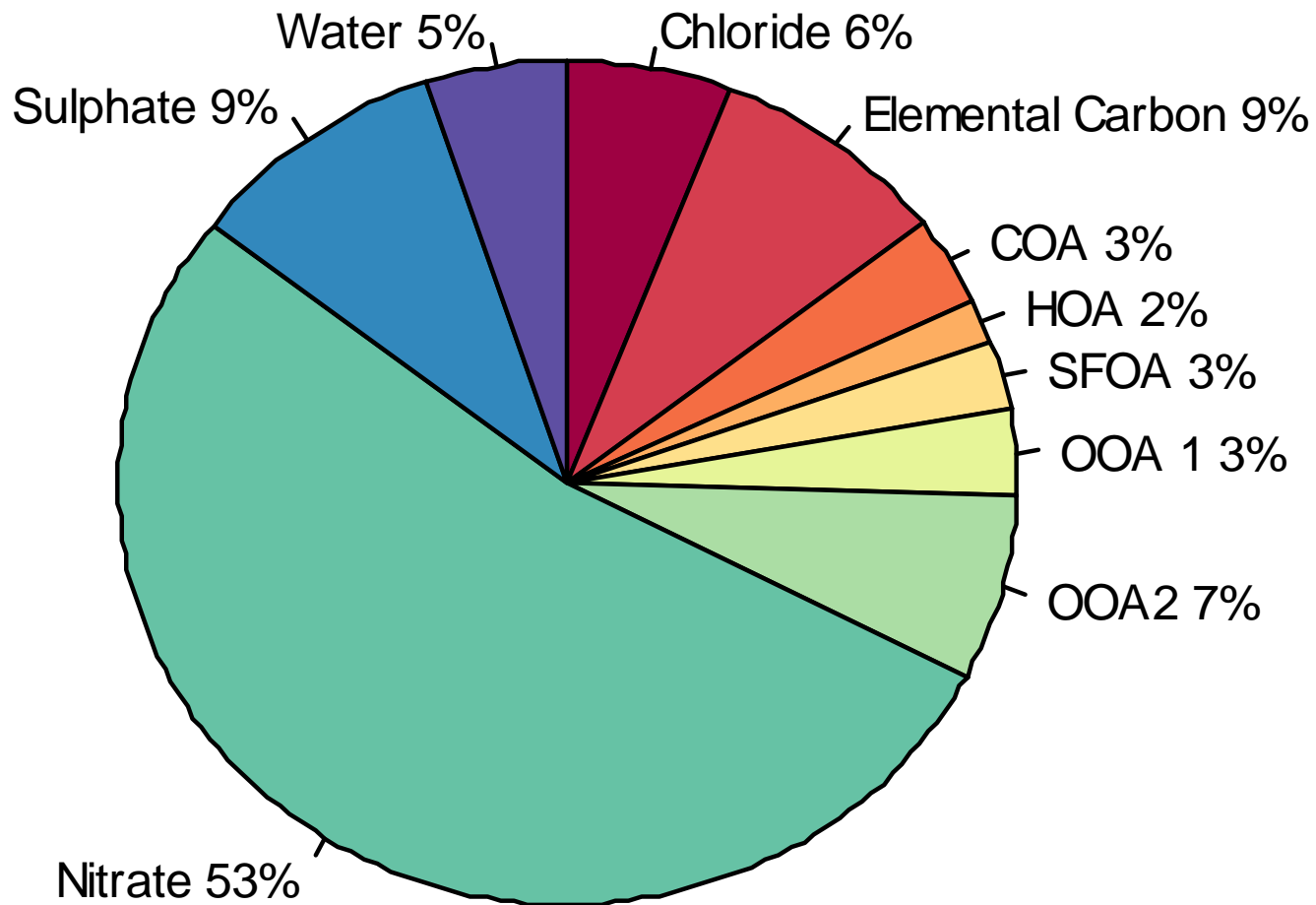


# Episode 2 – 10<sup>th</sup>-14<sup>th</sup> February

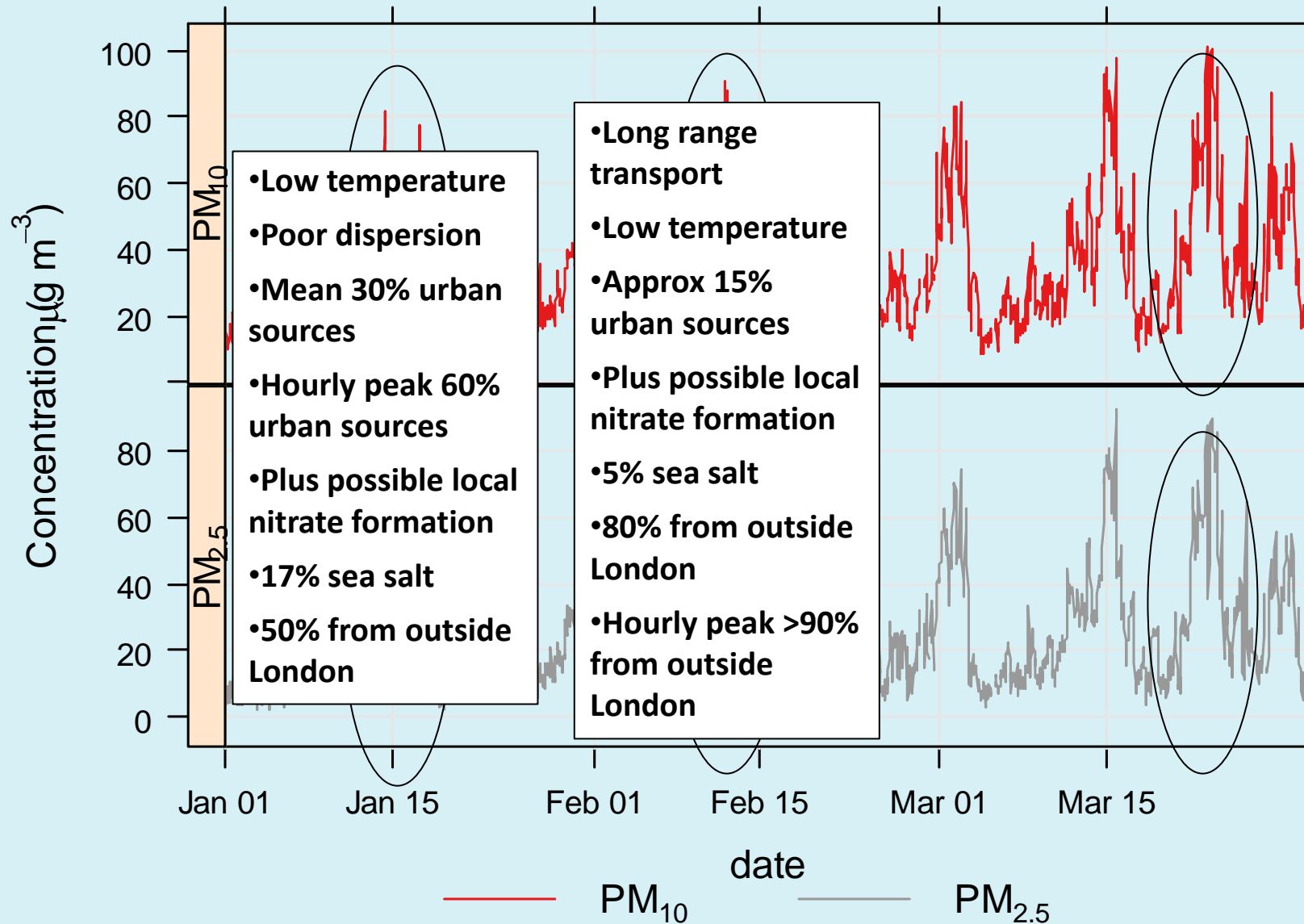




# Episode 2 – 10<sup>th</sup>-14<sup>th</sup> February



# North Kensington Jan – Apr 2012



# Air pollution this morning

London Air

PUBLIC POLICY SCIENCE

KING'S College LONDON

You are on this page: Bulletin Maps

### LAQN Pollution Levels

Enter postcode or area:

Map Satellite Hybrid

Select a monitoring site to view:

All Species  Include closed sites:

Show Authorities (OS Data):

Show WHO standards: (More Information)

Air pollution levels for Wednesday 24 October 2012, 10:00-11:00BST

Low (1-3)	Moderate (4-6)	High (7-9)	Very High (10)	Predicted	No index	Closed

How is the Air Pollution Index calculated?

RSS: [Subscribe to Moderate Bulletin](#)

[Bulletins](#) [Site Details](#) [Statistics](#) [Pollution Episodes](#)

This map shows the daily air quality index from LAQN pollution analysers. Not all analysers in the network are contacted every hour, so some sites may show 'no data'. Data have undergone automatic validity checks.

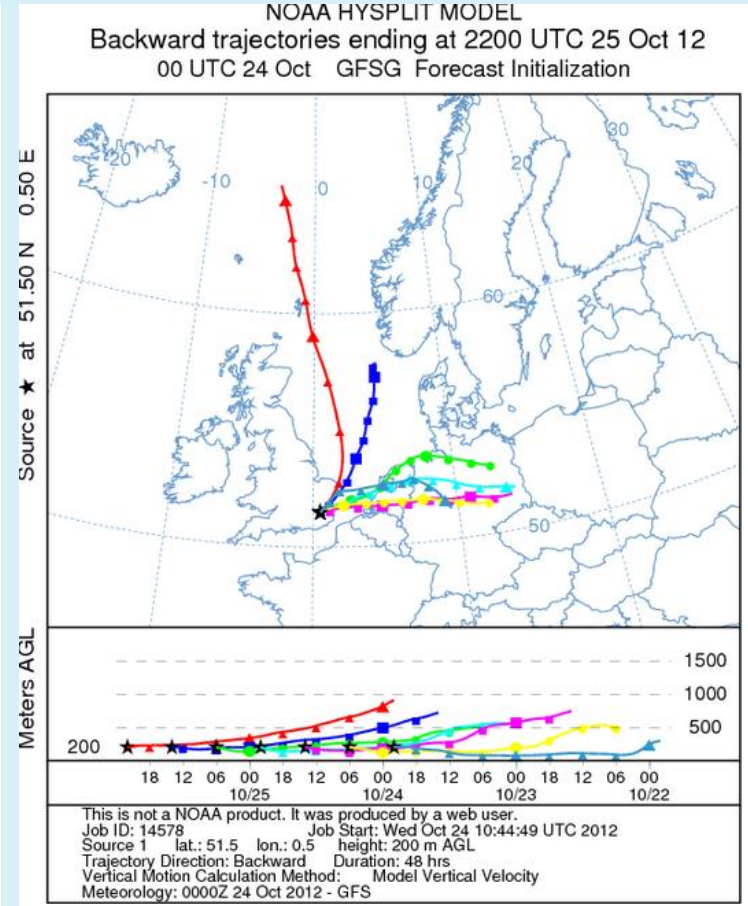
You can find out more information about each location (monitoring site) by clicking on its dot on the map. Once selected you can find out further information by clicking the 'Site Details' link above.

Click the 'Statistics' link above to see results from this site compared to national limit values. Past pollution episodes can be seen by clicking on the 'Episodes' link.

Alternatively, click on the button below to see a graph of this week's pollution levels.

[Show latest daily bulletin \(Tuesday\)](#)

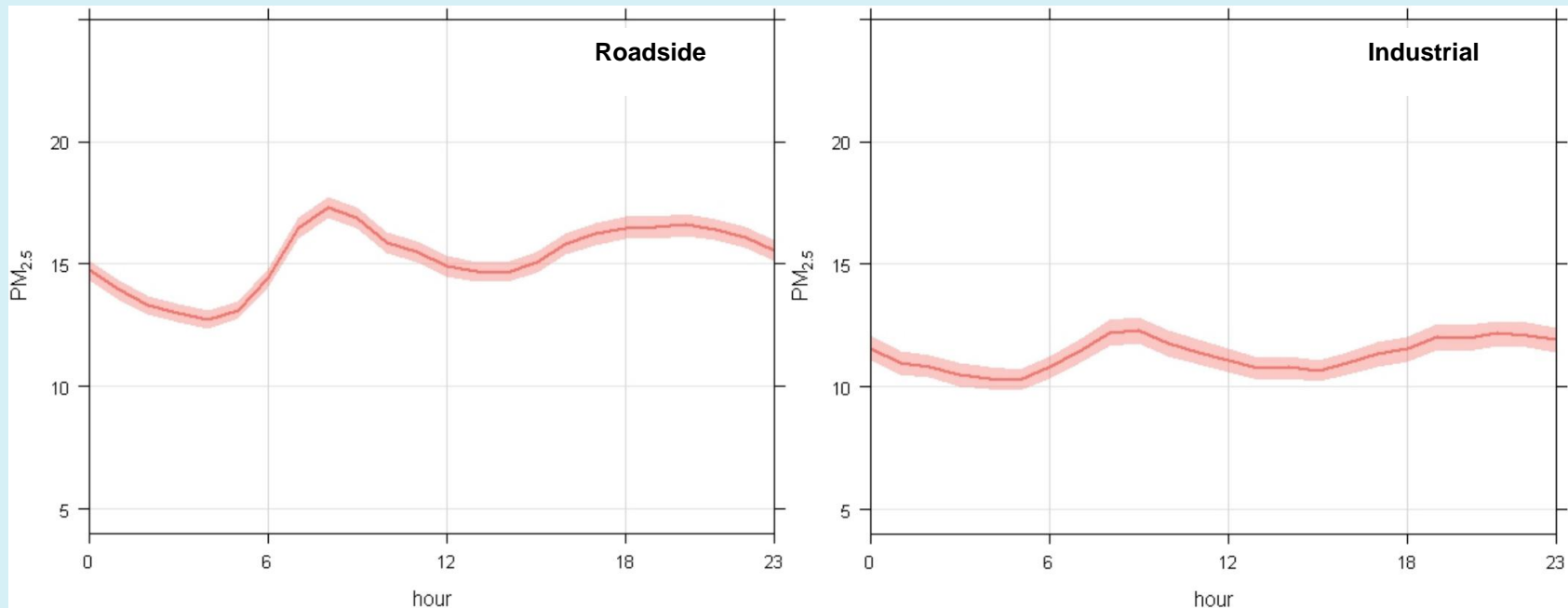
Change the bulletin date (dd/mm/yyyy):



# Daily variation in PM<sub>2.5</sub> across the UK

Daily mean concentrations close to roads and industry

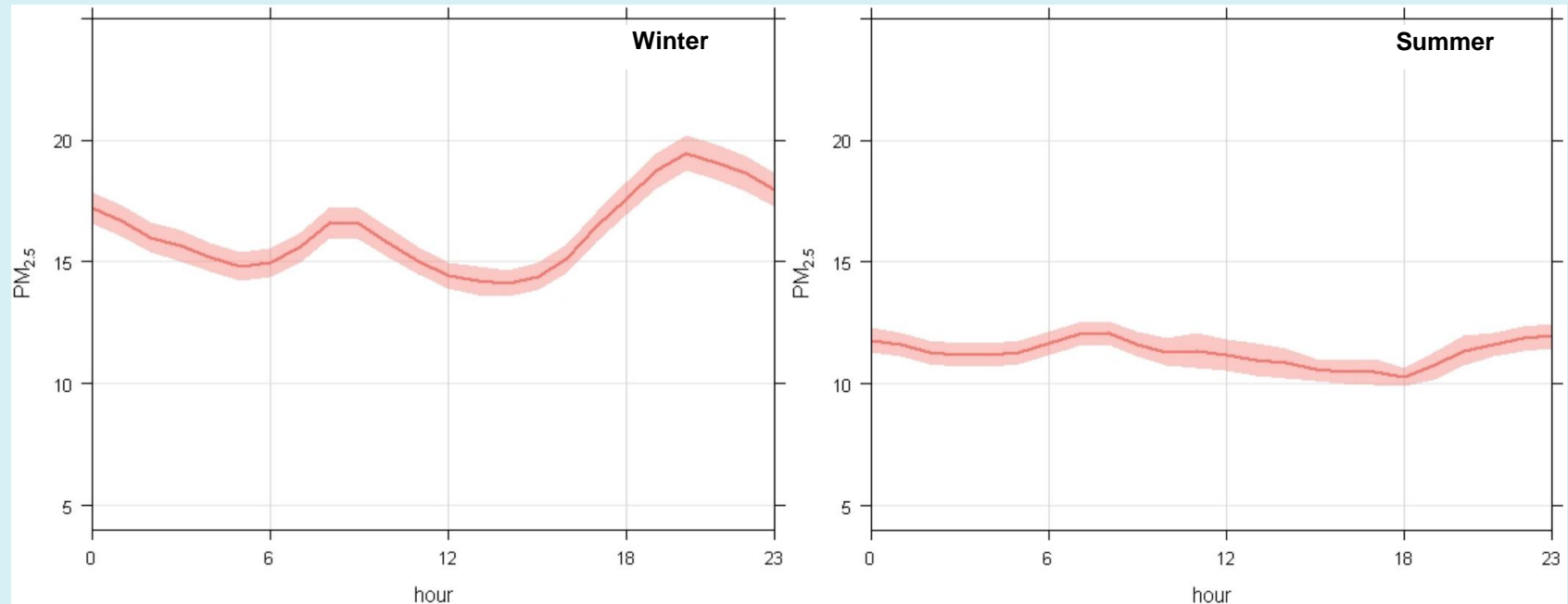
Laxon et al 2012, AQEG 2012 (draft).



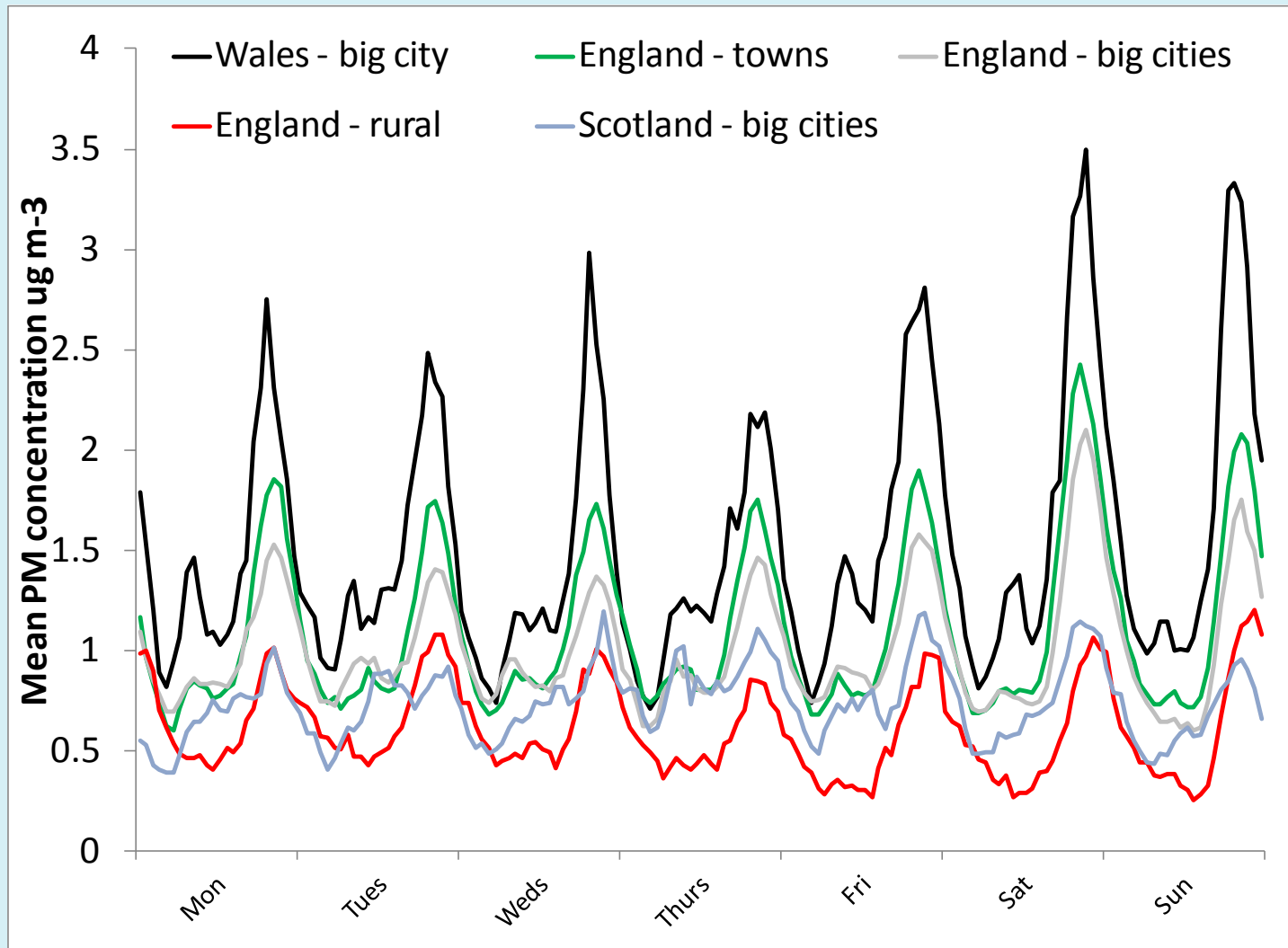
# Daily variation in PM<sub>2.5</sub> across the UK

Daily mean concentrations in urban background areas

Laxon et al 2012, AQEG 2012 (draft).



# PM from wood burning



# Controlling PM2.5

## Controlling the regional background

Heavy industry, shipping, diesel road transport

(ammonia from agriculture!)

But are secondary inorganic pollutants the most toxic?

## Controlling urban sources

Diesel road transport , solid fuel heating (wood, coal in N Ireland).

(Catering???)

Some evidence points to urban sources as having proportionally greater toxicity

## Minimising exposure

Increased public awareness to reduce emissions and change travel patterns in highly polluted areas. Could be part of an active travel agenda.

# Air quality information UK-Air

defra Department for Environment Food and Rural Affairs

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  - Latest pollution summary
  - Forecasting
  - Interactive monitoring networks map
  - Air quality news
  - About UK-AIR
  - Subscribe to mailing list and bulletins
  - Related links

### UK-AIR: Air Information Resource

#### Latest UK pollution summary



Number of UK AURN monitoring sites in each band:  
**Low: 125** **Moderate: 0**  
**High: 0** **Very High: 0**  
**No Data: 5**

Latest data: 23/10/2012 16:00:00

- Latest pollution summary
- Current measured levels
- Interactive networks map
- Daily Air Quality Index & health advice about pollution bandings

#### Forecast for next 24 hours



Air pollution is expected to be **Low** at all locations in all regions for the next 24 hours as a period of unsettled weather affects the UK. The situation is expected ...[read full forecast](#)

- View full and detailed UK air pollution forecast

#### Latest air quality news



- Air Pollution in the UK 2011: UK's Annual Report to the Commission  
Date: 28/09/2012
- UK-AIR now on Twitter  
Date: 18/05/2012
- Air quality indicator for sustainable development 2011 - Final Results  
Date: 11/05/2012

[Read all news stories](#)

#### Quick Links



- What are the causes of air pollution?
- What are the effects of air pollution?
- View latest pollution levels in Google Earth
- The latest 'Air Pollution in the UK' annual report

#### You may also be interested in...

- Air quality information from Defra
- National atmospheric emissions inventory (NAEI)
- Local air quality management (LAQM)
- Air Quality in Scotland
- Air Quality in Wales
- Northern Ireland Air

#### Stay updated...

- Follow UK-AIR on Twitter
- RSS Air Pollution Forecast
- Email the UK-AIR team

[Find out more about UK-AIR on Twitter](#)

#### Devolved administrations



The Scottish Government



Llywodraeth Cymru  
Welsh Government



DOE

### Welcome to UK-AIR

These are the UK-AIR (Air Information Resource) webpages providing in-depth information on air quality and air pollution in the UK. A range of information is available, from the latest pollution



# Air quality information LondonAir



### Local Authorities

Barking and Dagenham	1
Barnet	2
Bexley	2
Brent	2
Brentwood	1
Bromley	1

**What is a forecast?**

The new forecast tool, 'Forecast', which is a link service to other current pollution levels in real time across London in comparison with the Government's Air Quality Index. It is created by combining readings taken within the last hour and an pollution forecast in London. As you zoom in to map you will see which areas are currently experiencing higher pollution levels than others, usually those areas closest to busy roads. More information about the Air Quality Index and health advice associated with each index level can be seen here.

**Why forecast?**

Measurements from monitoring stations are only able to report air quality at that particular place. The forecast combines these measurements with our selected models to show a prediction of what air quality is like across the whole of Greater London.

**Why do your forecasts show air pollution?**

The two most common types of air pollution which are known to have an effect on health within London are able to be predicted with this model. Levels of nitrogen dioxide (NO2) are now being tracked and considered to be harmful to health, and emissions of sulphur dioxide (SO2) are no longer considered to create a risk using this method. The tool is not designed to create a map using this method. The tool is not designed to create a map using this method. The tool is not designed to create a map using this method.

**Why does pollution appear to be low everywhere?**

Other air pollution levels in most areas of London are currently not to be classified as low according to the air quality index. When this index was created there would have been a problem with the way...

**ARE SOME PEOPLE MORE SENSITIVE TO AIR POLLUTION?**

Just as not all smokers suffer from tobacco-related diseases, not all people are affected by ambient air pollution. Sufferers from lung diseases, such as chronic obstructive pulmonary disease (COPD) and asthma, as well as heart disease, may find that their symptoms become worse on days with higher air pollution.

Children are more likely to be affected by air pollution due to their higher breathing and metabolic rates as well as a developing lung and immune system. The unborn are also vulnerable due to accumulating disease and an aging body.

Individuals mentioned above are often sensitive to a range of ambient pollutants and so air pollution should be regarded as one of the factors that may affect their health. If you are sensitive you can take steps to prevent or reduce the effects of air pollution as you would other triggers. These may include avoiding going outdoors or exercising when levels are elevated, and following the advice of your doctor, adjusting your use of medication accordingly.

Those not sensitive to air pollution may not notice higher pollution days, but are still at risk through the associated health effects of air pollution.

**You can see daily advice on air pollution health benefits**

A 2011 report on [changing the UK air quality index has good advice on how to stay healthy.](#)

You can find out current street by street pollution levels using our [London Air Index](#) that are available.

You can use our [mobile applications](#) when you are away from your computer.

Pollution	Monitoring	Information	Tools	Access	Website
Forecast	Local Authorities	Local Authorities	Data Download	Mobile Site	Help
Index	Local Authorities	Local Authorities	Graph Drawing	Mobile Apps	Site map
Annual Status	Local Authorities	Local Authorities	Statistics	Accessibility	About
Forecast	Local Authorities	Local Authorities	Openair		Contact

### London Air Quality Network Mobile

moderate means authorities

Updated: 21 September 2011, 08:00 - 09:00 BST

Putney High Street 4

### Sustainable City Award Quality Innovation ...

### News: Pollutionwatch September 2011

Information: News, Guide, Videos, Reports

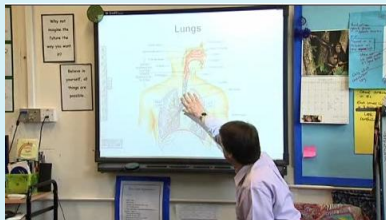
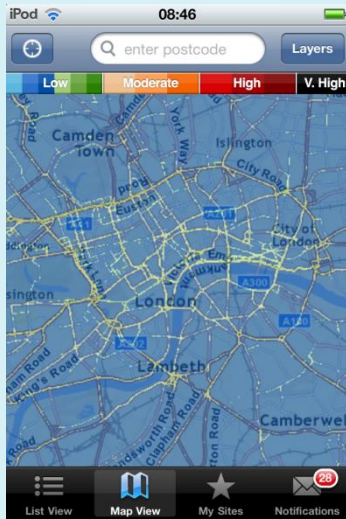
Tools: Data Download, Graph Drawing, Statistics, Openair

Access: Mobile Site, Mobile Apps, Accessibility

Website: Help, Site map, About, Contact



# Air quality information LondonAir



# Acknowledgements

- Funders
  - Defra, Natural Environment Research Council & the London boroughs who support the LAQN
- Colleagues at King's
  - David Dajnak and Sean Beevers.
  - David Green, Anja Tremper, Max Priestman, Anna Font, Ana Beckett, Andrew Grieve, Ellie Norris
- National Physical Laboratory
  - David Butterfield, Sonya Beccaceci
- University of Manchester
  - James Allan, Nicky Young

# Controlling PM2.5

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