



**Ricardo**  
**Energy & Environment**

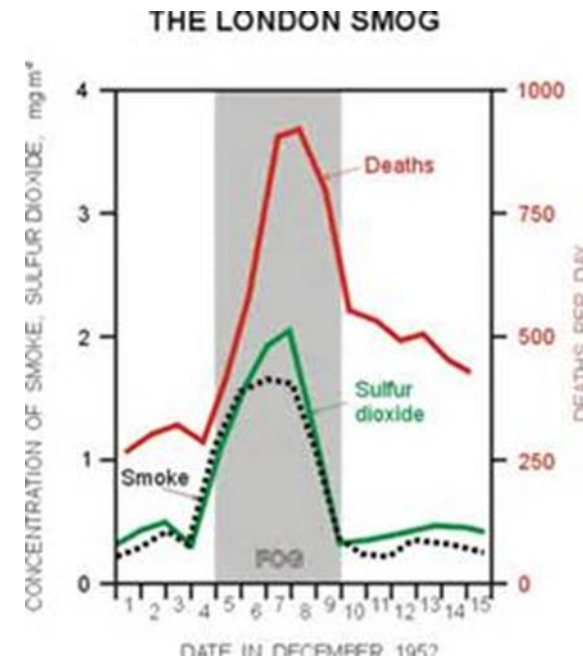
## **YRD Workshop on Transport Air Pollution Control**

### **LONDON Air pollution monitoring and policy implications**

Dr Beth Conlan, Technical Director

# London: Historical Air Pollution Monitoring

- Air pollution monitoring in London dates back to the 1952 smog
- Historically focus was on smoke and sulphur dioxide monitoring
- Installation of automatic monitors in early 1990s
- Supersites covering many pollutant species e.g Marylebone Road
- Introduction of Local Air Quality Management in 1995 put duties on local authorities



# London - a changed pollution climate

1950s



Present Day



Domestic/industrial coal burning  
("Pea-Souper": smoke and  $\text{SO}_2$ )

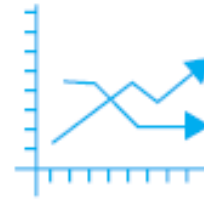
Traffic in our cities  
("SMOG":  $\text{PM}_{10}$ ,  $\text{NO}_2$ ,  $\text{O}_3$ , VOCs)

# Impacts of air quality in London Today



**9000+**  
LONDONERS

die early every year  
because of air pollution



**£3.7**  
BILLION

the cost of air pollution  
to London's economy



**20%**  
PRIMARY SCHOOLS

are in areas that breach the legal  
limit for NO<sub>2</sub> (air pollution)



**2x**  
AS LIKELY TO DIE

from lung diseases if you  
live in deprived vs affluent  
areas of London



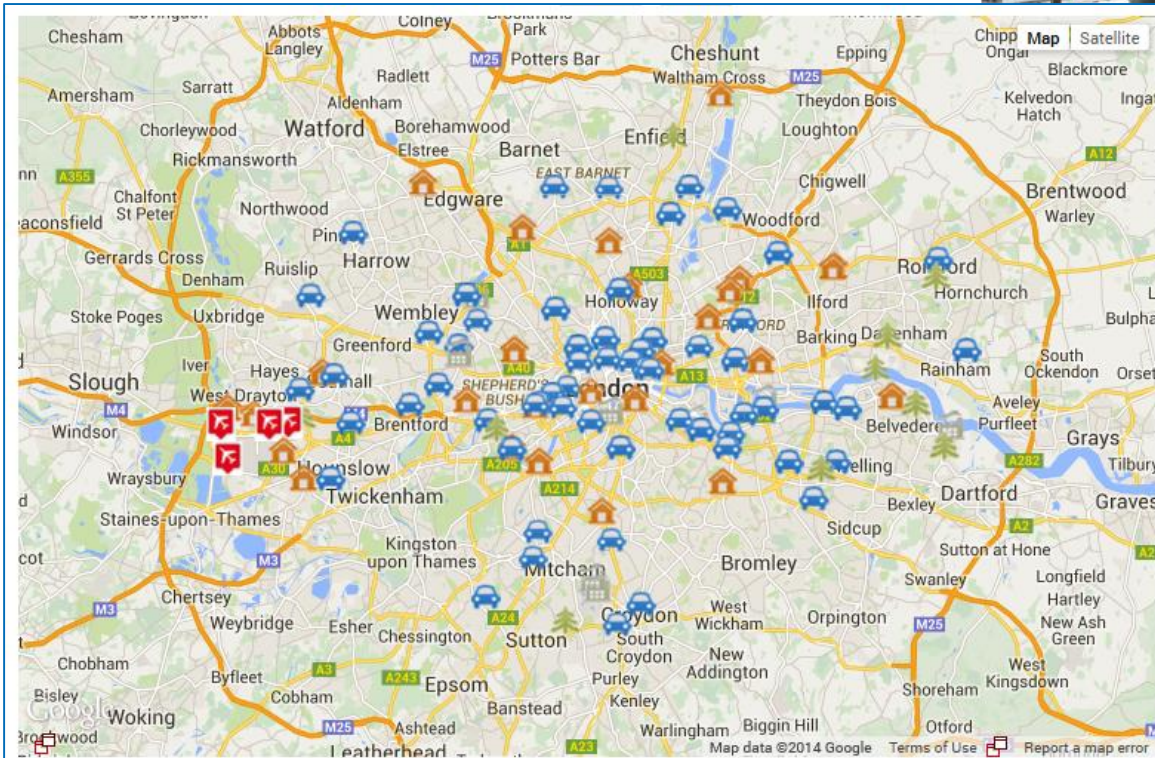
# Air quality management in London

- **Legislative measures working together**
- **Ambient Air Quality Directive:**
  - provides framework for local AQ monitoring and management
  - sets standards for range of pollutants to be met across the EU
  - health and environmental focus
- **Local Air Quality Management:**
  - National implementation of the EU air quality directive
  - Role of Local Authorities, Greater London Authority and Transport for London
  - 33 Local Authorities run over 1,000 diffusion tubes to monitor nitrogen dioxide



# Monitoring of Air Quality in London

- London has one of the most comprehensive monitoring networks of any world city, funded primarily by local authorities.
- There are approximately 140 high-accuracy automatic monitoring sites across the city, monitoring NO<sub>2</sub> and/or PM<sub>10</sub>





## London Borough of Newham



Use the tabs below to explore information about the current and historic air pollution levels in this local authority. You can select another local authority using the dropdown menu.

Select local authority/customer...

Pollution Summary

Create Graph

Index Bands Summary

Download Local Authority Data



Use the map above to explore the monitoring sites in for this local authority and the surrounding area. The table below shows a summary of sites within this local authority - you can click on the site names to get more detailed information.

### Active local authority funded monitoring sites

Monitoring Site	Ozone (O <sub>3</sub> )	Nitrogen Dioxide (NO <sub>2</sub> )	Sulphur Dioxide (SO <sub>2</sub> )	Carbon Monoxide (CO)	Particulate Matter (PM <sub>10</sub> )	Highest Pollution Band	Last Updated
<a href="#">Cam Road</a>	15 (1 Low)	52 (1 Low)	8 (1 Low)	0.2	n/a	Low (Index 1)	10/06/2014 11:00
<a href="#">Wren Close</a>	18 (1 Low)	38 (1 Low)	13 (1 Low)	0.2	n/a	Low (Index 1)	10/06/2014 11:00

» [Visit the Defra UK-AIR website for details of Defra funded AURN monitoring sites.](#)

Overall Pollution Summary:  
LOW ( Index 1)

Very High	10
High	9
	8
	7
Moderate	6
	5
	4
Low	3
	2
	1

#### Guide to map markers:

-  **LA monitoring sites**  
Bold border shows selected local authority
-  **Closed LA monitoring sites**
-  **AURN monitoring sites**  
Shown for information only

# Compliance Assessment Dashboard



HEATHROW  
AIRWATCH

HOME

LATEST AIR QUALITY  
SUMMARY

ABOUT AIR QUALITY

SUSTAINABLE TRAVEL TO  
HEATHROW

MONITORING DATA

COMPLIANCE DASHBOARD

REPORTS

RELATED LINKS

CONTACT HEATHROW  
AIRWATCH

CHILDREN'S AREA

## COMPLIANCE DASHBOARD

Note: This dashboard only shows data from the monitoring sites at Heathrow Airport.

Dashboard

PM<sub>10</sub> Detailed Data

NO<sub>2</sub> Detailed Data

The data below is updated automatically each day and shows how the monitoring sites within the network are progressing against national objectives.

### Dashboard Overview

The PM<sub>10</sub> and NO<sub>2</sub> dials show the monitoring site with the highest number of exceedances and may change each month according to the data.

Progress through the current year

PM<sub>10</sub> Exceedances to date

Average NO<sub>2</sub> concentration to date

Day 330 of 365

London Harlington  
6 exceedances  
-- 35 exceedances allowed

Heathrow LHR2  
47.6 µgm<sup>-3</sup>  
-- 40 µgm<sup>-3</sup> Limit Value

### PM<sub>10</sub>

#### Progress through year (24 hour exceedances)

Select monitoring site to view: London Harlington

London Harlington

Tip: you can click and drag within the chart area to zoom on the Y-Axis. Right click and select "View All" to zoom out.

## Heathrow Airwatch Website

### NO<sub>2</sub>

#### Progress through year (annual mean)

Month	London Harlington	Heathrow LHR2	Heathrow Oaks Road	Heathrow Green Gates
Jan	40	53	38	38
Feb	40	52	42	40
Mar	40	55	48	40
Apr	38	52	44	38
May	35	50	40	35
Jun	33	48	38	33
Jul	33	47	36	33
Aug	33	46	35	33
Sep	34	47	35	34
Oct	34	46	34	34
Nov	35	48	34	35

Tip: you can click and drag within the chart area to zoom on the Y-Axis. Right click and select "View All" to zoom out.



## C40 Low cost sensors London

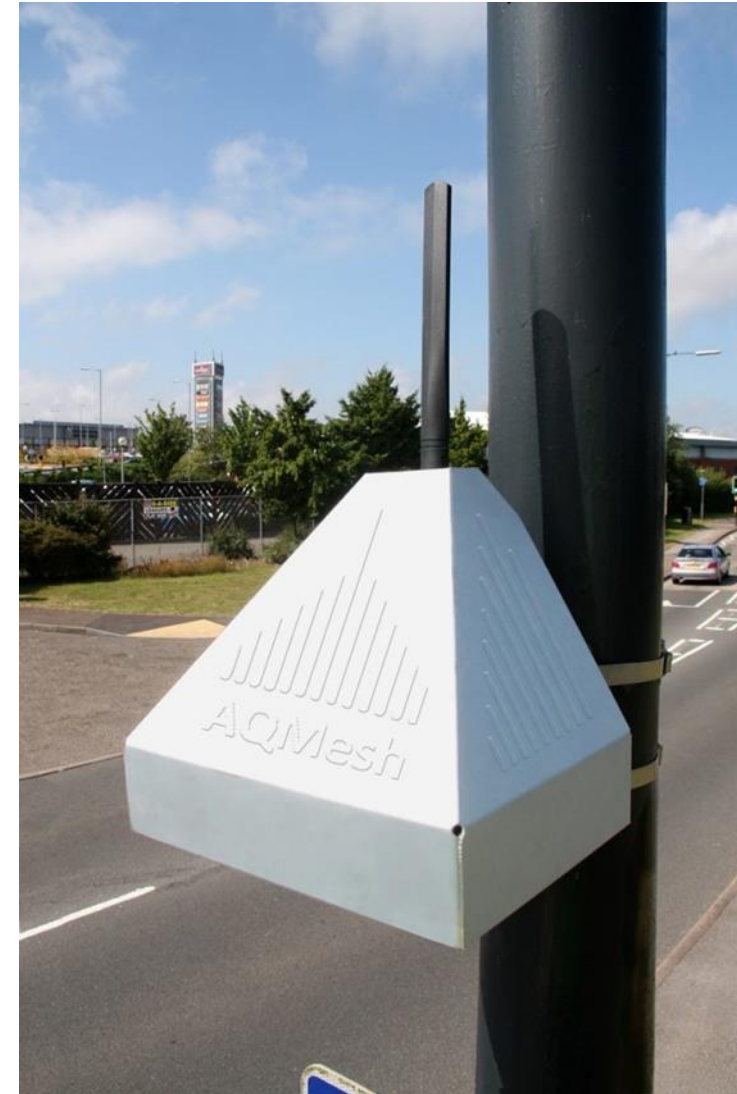


- New trial of low cost air quality sensors
- 100 sensors at hot spot sites across city including near schools, hospitals, construction sites and busy roads
- Sensors to be fitted to lampposts and buildings and sensitive locations
- Two dedicated Google Street View cars will be driving across the city, mapping pollution in detail
- Project run by the Greater London Authority in conjunction with C40 cities



## AQ Mesh – Low cost sensors

- NO, NO<sub>2</sub>, O<sub>3</sub>, , SO<sub>2</sub>, H<sub>2</sub>S, CO<sub>2</sub>, PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>4</sub>, PM<sub>10</sub>, TSP & P<sub>n</sub>
  - Temperature, Humidity, Pressure & Noise
- Heated inlet for PM where power is available
- Water rejection algorithm for PM<sub>mass</sub> where power is limited
- Plastic sunshield, GPS positioning
- Weatherproof power connectors for easy installation
- Faster transmits and more averaging options



# Data analysis – NO<sub>2</sub>

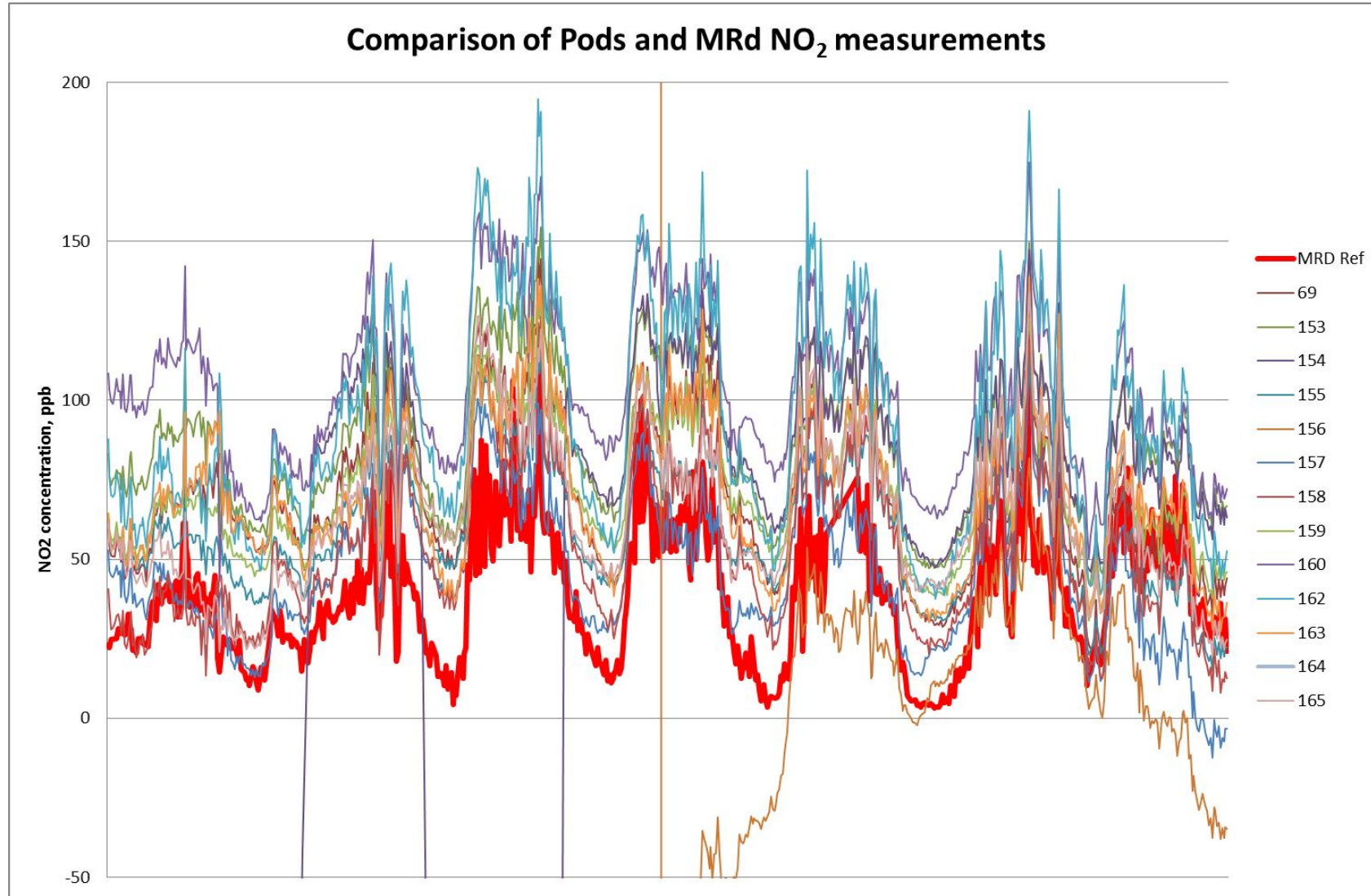
Trends look good, but wide scatter

Mostly higher than the ref

Ratios MRD-pod between 1.2 and 2.7  
(Averaged 1.9)

Some rogues

Baseline and scaling critical

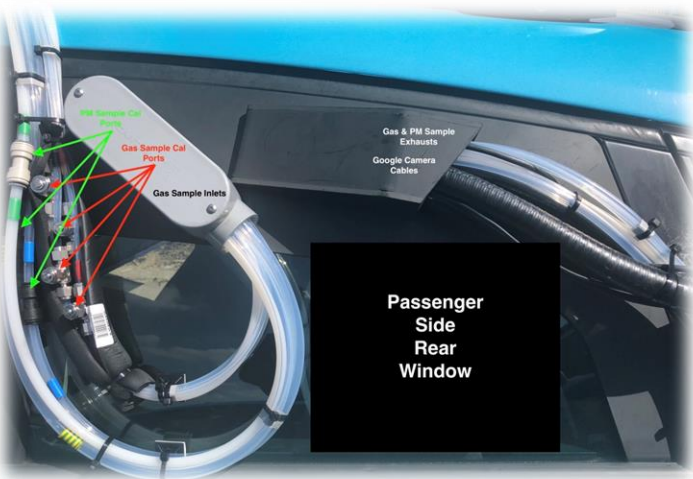




- 2 Google Street View Cars with reference grade monitors
  - BC, NO<sub>2</sub>(CAPS), NO<sub>x</sub>(Chemi), O<sub>3</sub>, CO<sub>2</sub> (LiCor), PM (FIDAS & PDr & Partector) plus accelerometer & GPS.
  - 1 Second time resolved data, uplinked in near real time.
    - (1 sec @ 30mph = data /13.4m)
  - Operating daily from NPL Teddington with instruments running 24/7
    - Several drivers on shifts, driving polygons and transects in greater London
  - ADMS model integration
- Managed by EDF



# Google Street View Cars – A.Q. Instrumentation





NO<sub>2</sub> (µg m<sup>-3</sup>)



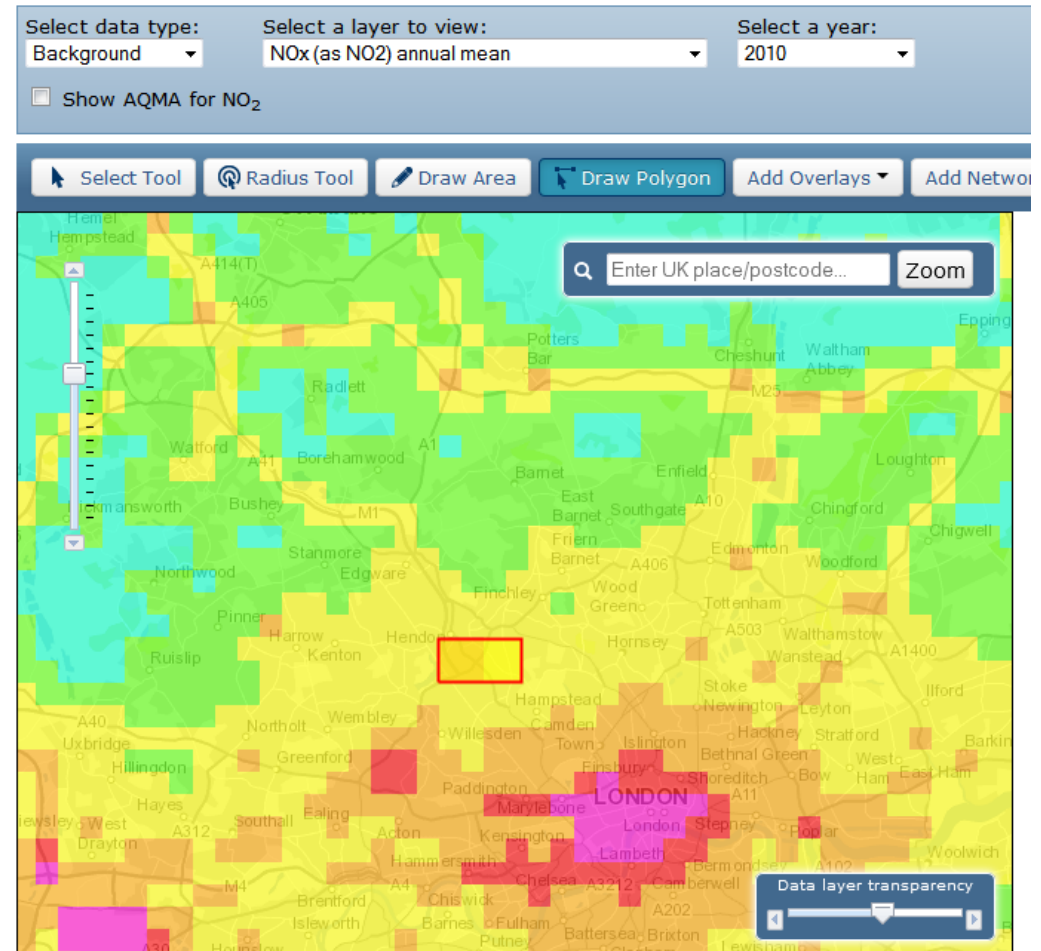
Contains Ordnance Survey data © Crown copyright and database right 2014.



# Local City Scale Models and Forecasts



- More local detail and knowledge
- Local accuracy improved
- Still a prediction, not real measurements.





High-resolution dispersion models can be used with diffusion tube and automatic monitoring data to confirm local hotspots.

RapidAir  
Road NO<sub>x</sub> model,  
3 x 3 m resolution  
for London



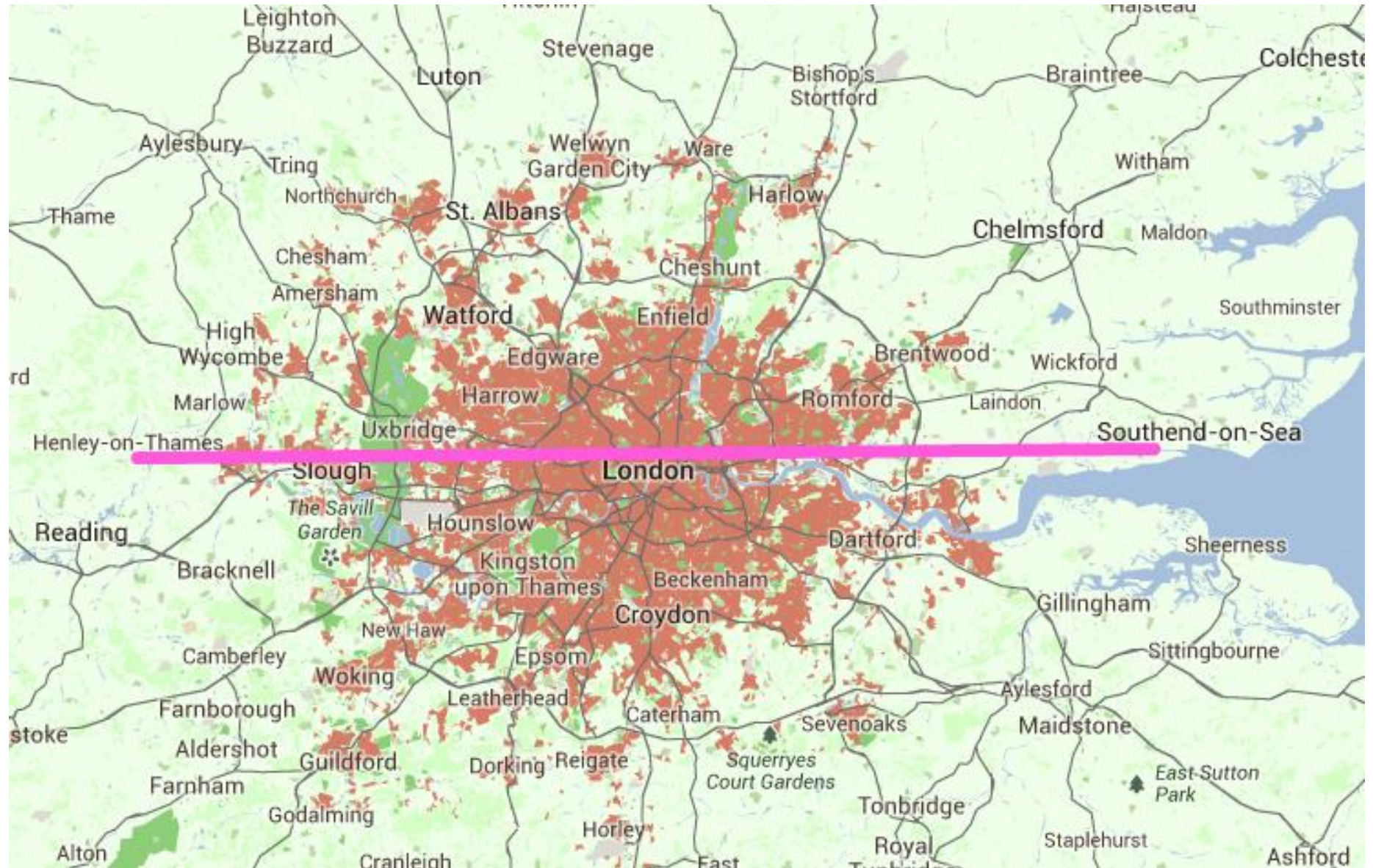
# $PM_{2.5}$

(LAEI2013UPDATE)

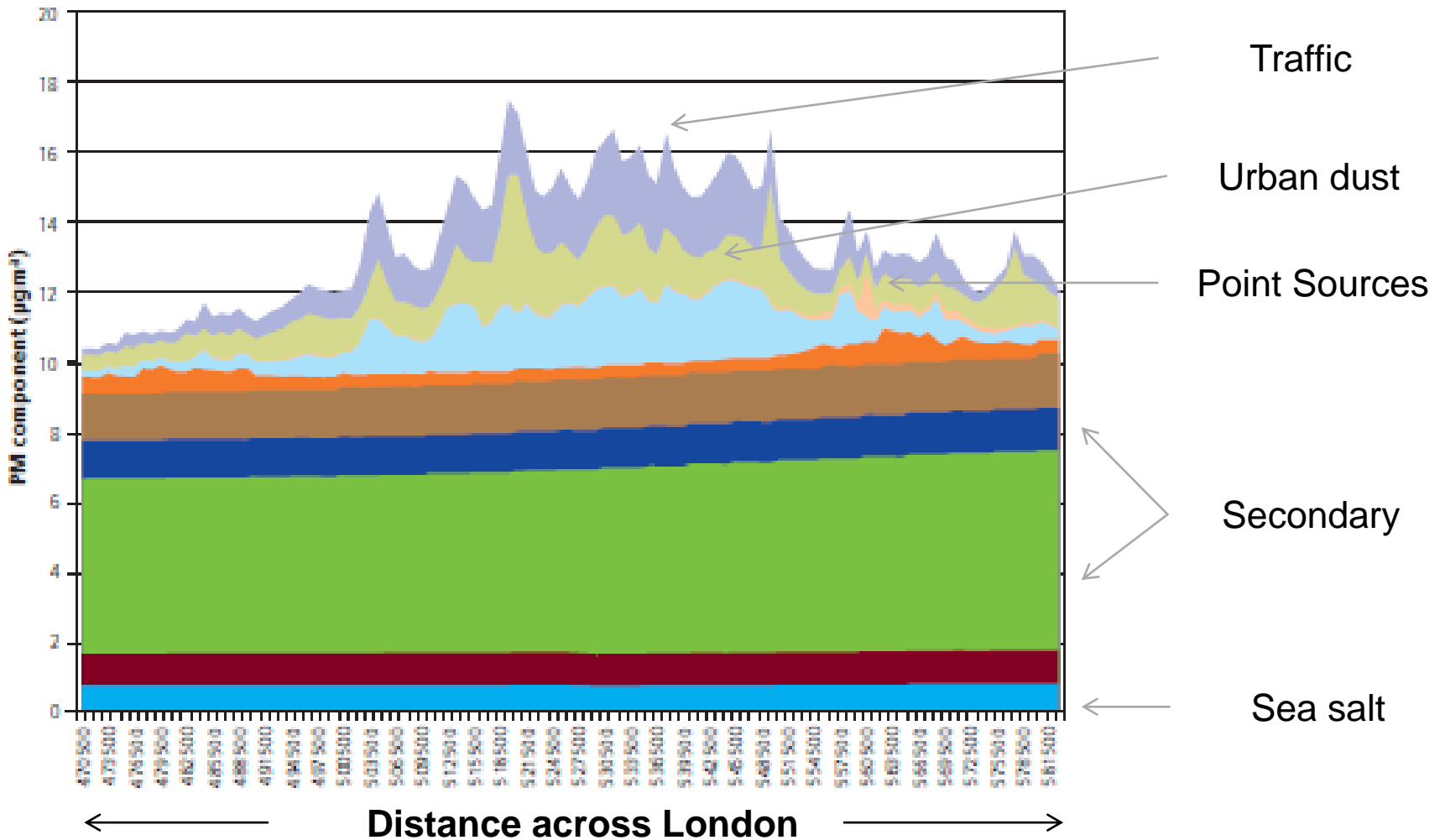




# PM modelling across London



# PM<sub>2.5</sub> sources in London



# Data is linked to websites, apps & alert services to provide pro-active health warnings

Heart condition,  
asthma or other  
breathing problems?

Affected by  
air pollution?  
Hazy about  
venturing out?

**KR**  
Know&Respond  
Scotland

Get **FREE** alerts  
when poor air quality  
is forecast for the  
day ahead.

Visit [www.scottishairquality.co.uk](http://www.scottishairquality.co.uk)  
To get FREE alerts for yourself or people in your care



**Mayor of London** @MayorofLondon · Jan 23

The shameful state of London's toxic air today has triggered a 'very high' air pollution alert under my new air quality warning system.



267 848 869

airAlert

airAlert is a service that sends free messages direct to vulnerable people informing them about pollution levels in their area.

Please choose your county from the links below...

Current airAlert



Low  
Surrey

Current airAlert



Low  
Sussex

Current airAlert



Low  
Southampton

Current airAlert



Low  
Sevenoaks

1	76	Tottenham T H	due
2	26	Hackney Wick	1min
3	76	Tottenham T H	8min

High air pollution forecast today across London 27/08 to 29/08





## MAYOR OF LONDON

### London Environment Strategy:

- Focus on cross cutting policies
- Includes policies to ensure that reductions in climate change gas emissions, increased green space etc also benefit air quality

## MAYOR OF LONDON

### Mayor's Transport Strategy:

- Focus on transport policies
- Includes ambitious targets to improve Air Quality and reduce the need car use generally

Mayor's Transport Strategy

MARCH 2018

## MAYOR OF LONDON

**T  
L  
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DRA  
DEC

### The London Plan:

- Focus on the spatial policies needed to deliver London's ambitions.
- Key policies on "good growth" and design led solutions



- **Reducing exposure** of Londoners to harmful pollution across London – especially at priority locations like schools –and tackling health inequality;
- **Achieving legal compliance** with UK and EU limits as soon as possible, including by mobilising action from the London boroughs, government and other partners;
- Establishing and **achieving new, tighter air quality targets** for a cleaner London, meeting World Health Organisation (WHO) health-based guidelines by 2030 by transitioning to a zero emission London.





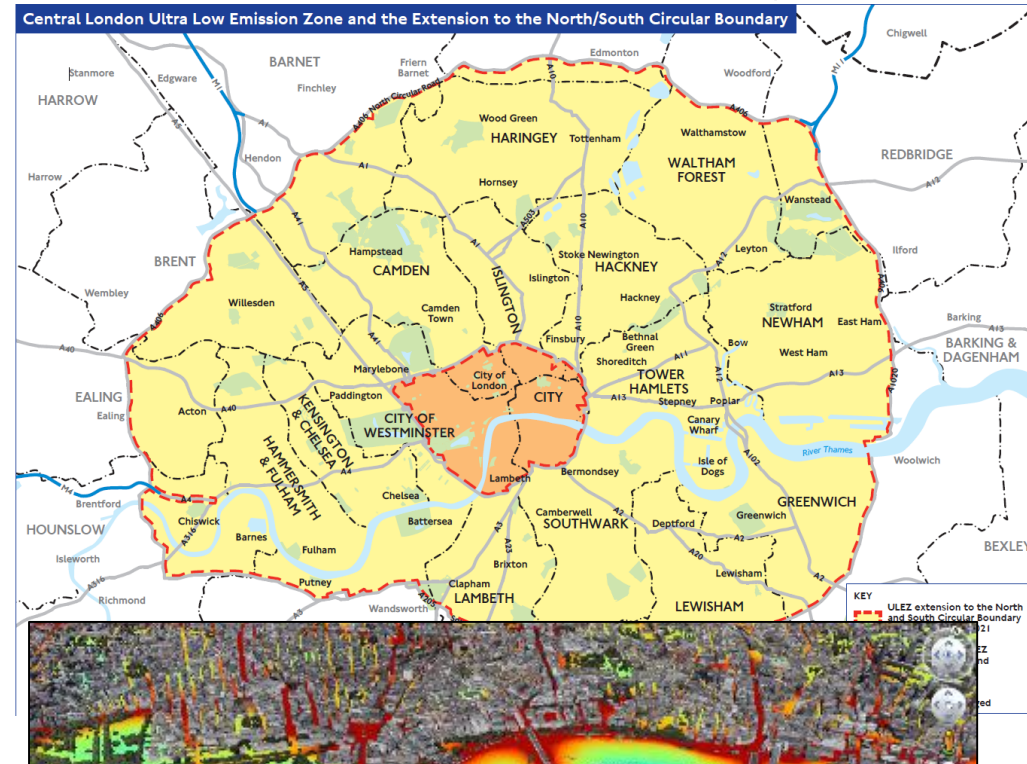
# London Low Emission Zone

- Started in 2008 to target oldest and most polluting HGVs, buses and coaches
- Covers the whole of Greater London (1,580 km<sup>2</sup>) operates 24/7, 365 days pa.
- Daily charge £100 –£200
- Compliance with current standards high at a buses and coaches, and 98 per cent for van
- Helped reduce PM emissions.



# Ultra Low Emissions Zone

- Charge during Congestion Charge Zone for older polluting vehicles
- On top of existing £11.50 Congestion Charge
- For pre-Euro 4/VI –toughest standard of any world city.





### Central London ULEZ in 2019 (all vehicles)



£12.50 per day



£100 per day



### London-wide ULEZ in 2020 (heavy vehicles)



Up to £100 per day



### Inner London ULEZ in 2021 (all vehicles)



Up to £100 per day



Up to £12.50 per day

### ULEZ standards

- Petrol: Euro 4
- Diesel: Euro 6
- Motorcycle and L-Cat: Euro 3



Exempt but new licensing requirements



- Expanding the ULEZ will lead to approximately 100,000 people no longer living in areas exceeding legal limits.
- In outer London there will be a 28 per cent reduction in NOx road transport emissions, and in inner London there will be around a 31 per cent reduction in NOx road transport emissions in 2021.
- Over 3,000 primary school children in polluted areas of London and Luton will have their lung health monitored over a four-year period in a new international study led by Queen Mary University of London.



**New double decks will be hybrid, hydrogen or electric from 2018; new single decks will be zero exhaust emission from 2020.**

**Target: Zero emission bus fleet by 2037 *at the latest***



**No more diesel taxis  
from 2018 and new taxis  
will need to be zero  
emission capable.**

**Target: Zero emission  
capable taxi fleet by 2033  
*at the latest***

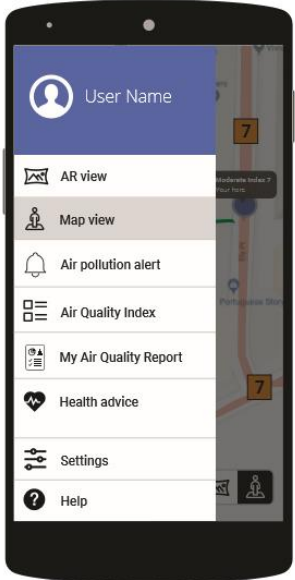
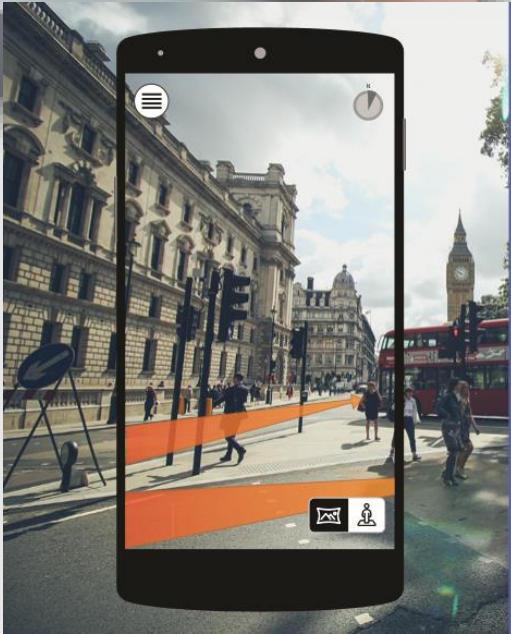




- New requirements for GLA fleets such as the Fire Brigade and Police force
- 'ULEV only' streets brought in this year
- Zero Emission Zones to be introduced in town centres from 2020 and in central London from 2025



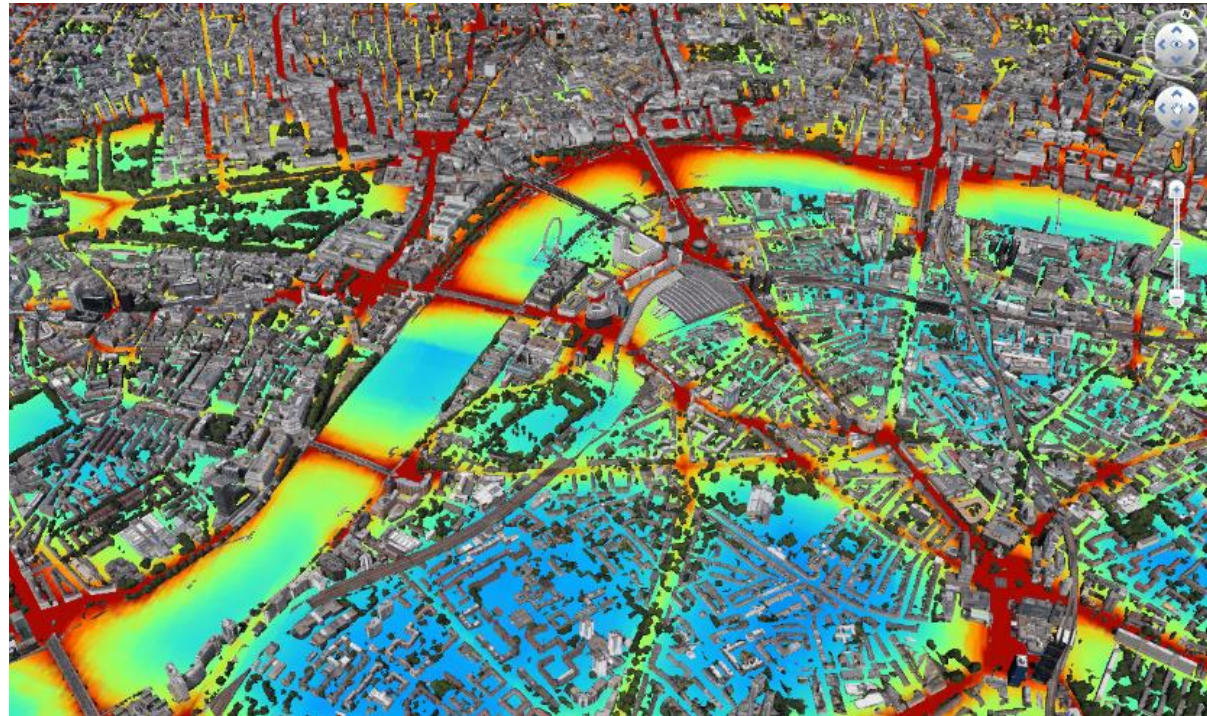
# The Future use of monitoring data? Augmented reality – pollution levels and routing maps





# Summary: monitoring underpins modelling and policy development

- Evaluation of national policy and regulation
- Understanding the levels and sources of air pollution in their region
- Designing effective local air quality improvement measures
- Maximising co-benefits for greenhouse gases
- Identifying delivery partners and mechanisms
- Engaging with stakeholders
- Implementing, enforcing and monitoring the measures





# Thanks for listening!

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