

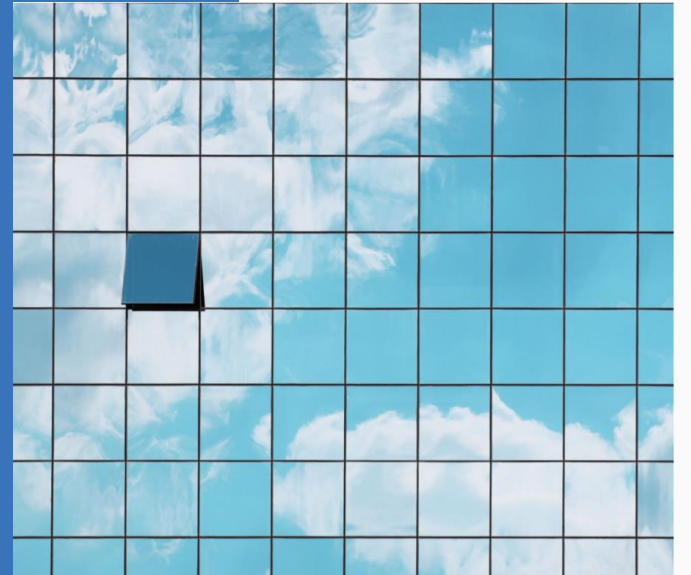
# Opportunities to improve air pollution around schools

& Clean Air Champions - the next three years....

Dr Gary Fuller,  
Clean Air Champion  
Imperial College London

[garyfuller@imperial.ac.uk](mailto:garyfuller@imperial.ac.uk)

t: [@drgaryfuller](https://twitter.com/drgaryfuller)



[www.ukcleanair.org](http://www.ukcleanair.org)



# SPF Clean Air – Two waves

## Wave 1 - Clean Air: Analysis & Solutions

Developing solutions to air pollution to help policymakers and businesses protect health and work towards a cleaner economy. (£20.5m)



## Wave 2 - Clean Air: Addressing the Challenge of the Indoor/Outdoor Continuum

The programme aims to equip the UK to proactively tackle new air quality challenges related to changing emissions and exposure patterns, in order to protect human health and support clean growth. (£22m)



# Clean Air Champions

The Champions will continue to bring together the UK's world-class air quality research and community.



Professor Sir Stephen Holgate



Dr Suzanne Bartington



Dr Gary Fuller

To support the Champions and programme an engagement ambassador and KE champion join the team.



Dr Noel Nelson



Dr Sarah Moller

# Investing in early & mid career researchers

## Clear air research futures group:

- To discuss the research challenges of the future
- Small sensors, pathways to WHO guidelines, tracking inequalities and vulnerabilities in air pollution exposure.....

## Media and communications training:

- Specific to environment and air pollution to compliment your own university's training
- With real journalists

## Jenny Baverstock travel bursary:

- To visit other SPF projects

# Knowledge exchange

## A new knowledge exchange champion will join the team:

- Supported by a part-time KE fellow
- Focused on KE with government

## Knowledge exchange group:

- Around 12 experts and people from allied fields, health, climate etc. including policy
- Sounding board to help you amplify the policy impact of your work
- Act as ambassadors for the SPF findings

## Round tables and workshops:

- e.g. toxicology, merging health and air quality data, flame retardants
- developing ideas for an indoor air quality observatory

## We need to know about your findings, papers etc.







Dr Sarah Moller

# Anticipate – new systems thinking



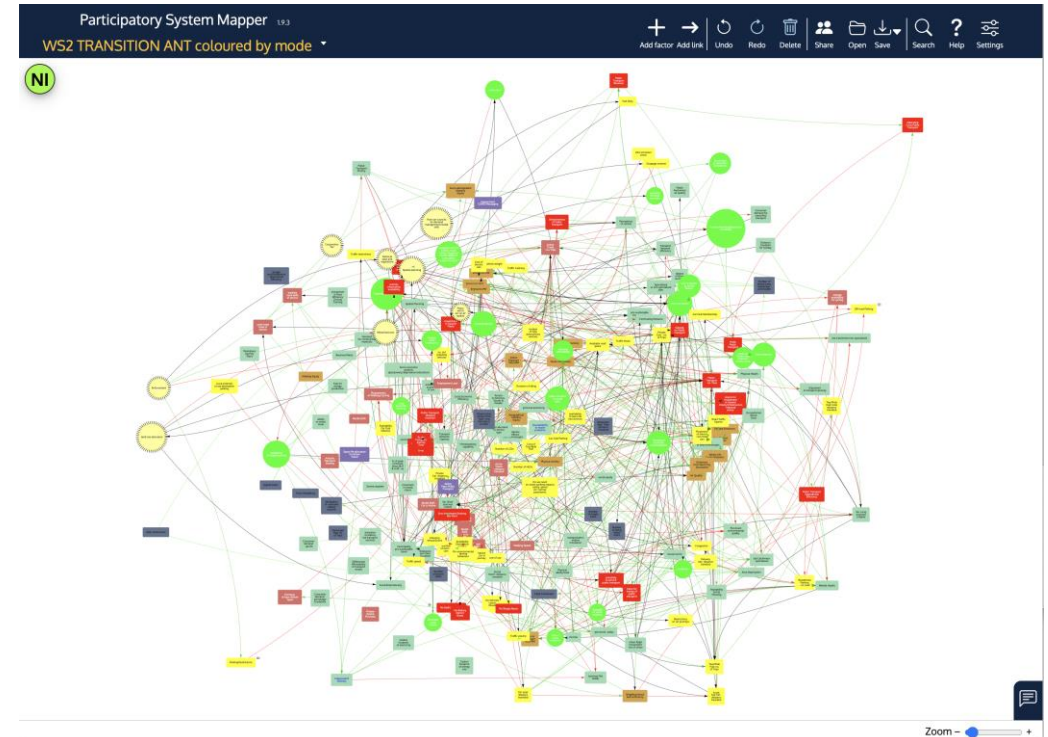
Article

## Adopting a Whole Systems Approach to Transport Decarbonisation, Air Quality and Health: An Online Participatory Systems Mapping Case Study in the UK

Alexandra S. Penn<sup>1,\*</sup>, Suzanne E. Bartington<sup>2,\*</sup> , Sarah J. Moller<sup>3</sup> , Ian Hamilton<sup>4</sup>, James G. Levine<sup>2,5</sup> , Kirstie Hatcher<sup>1</sup> and Nigel Gilbert<sup>1</sup> 

*EVs present multiple challenges for air quality, mobility and health, including risks from non-exhaust emissions (NEEs) and increasing reliance on vehicles for short trips.*

*Understanding the interconnected links between electric mobility, human health and the environment, including synergies and trade-offs, requires a whole systems approach to transport policymaking.*



# AutoAlign – reducing tyre wear pollution

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News website of the year

News Opinion Sport Culture Lifestyle More

Environment ► Climate crisis Wildlife Energy **Pollution**

**Pollutionwatch**  
Air pollution

## Pollutionwatch: how wheel misalignment can affect air quality

Nearly half of cars have imbalanced wheels, data shows, with slight misalignment hugely affecting tyre wear

**Gary Fuller**  
@drgaryfuller  
Fri 23 Apr 2021 06:00 BST



► A worker adjusts the wheel alignment on a TX electric black cab at a plant in Coventry.  
Photograph: Bloomberg via Getty Images



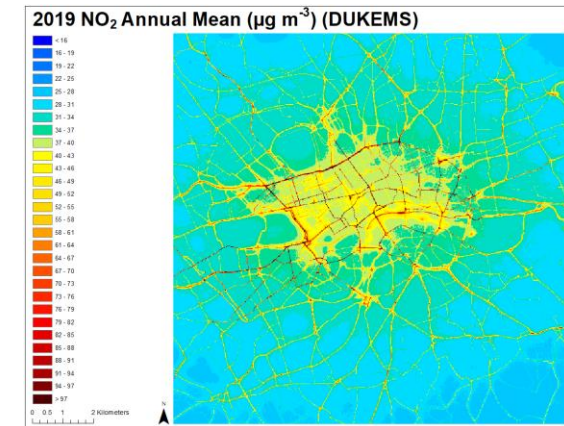
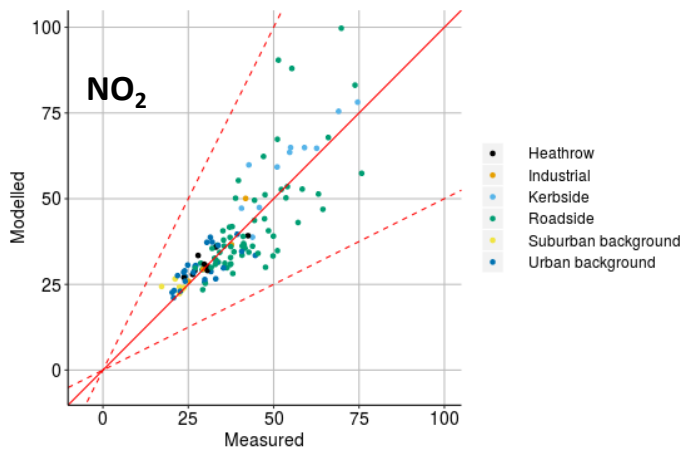
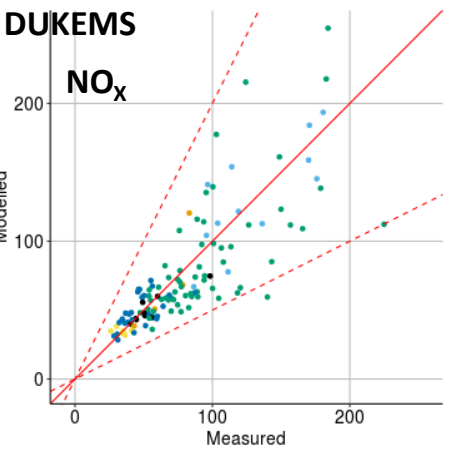
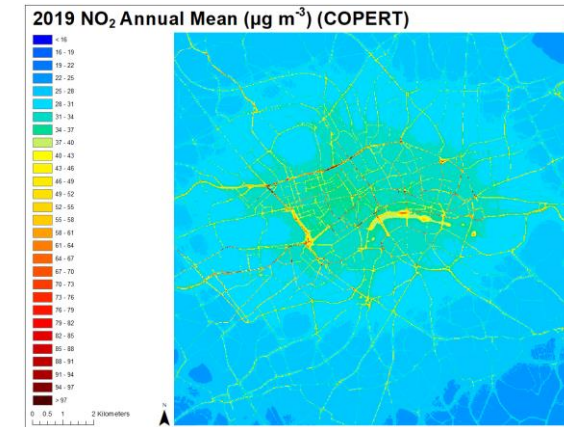
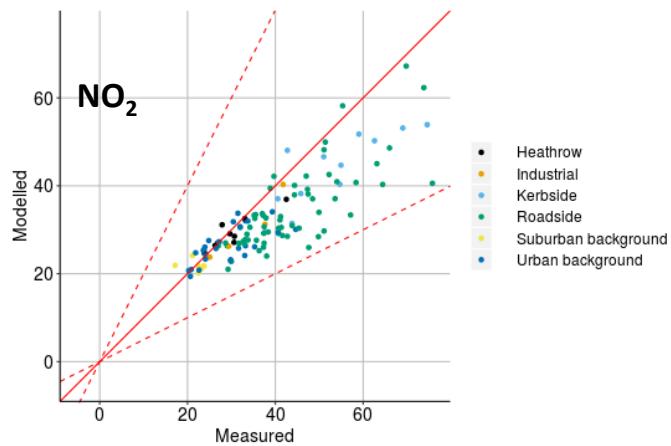
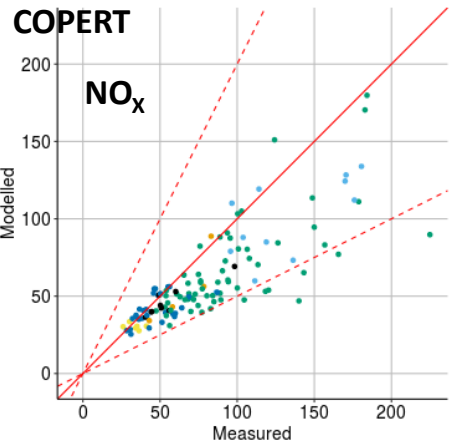
## Misalignment effects

**AutoAlign ROI = 3.3 months**

- **Fuel:** misalignment costs truck operators £810 per truck per annum
- **Tyres:** misalignment costs truck operators £108 per truck per annum
- **CO<sub>2</sub>:** misalignment increases truck operators carbon footprint
- **Particulates:** health effects

**Annual cost benefit £882 per truck**

# DUKEMS – new emission factors (including traffic)



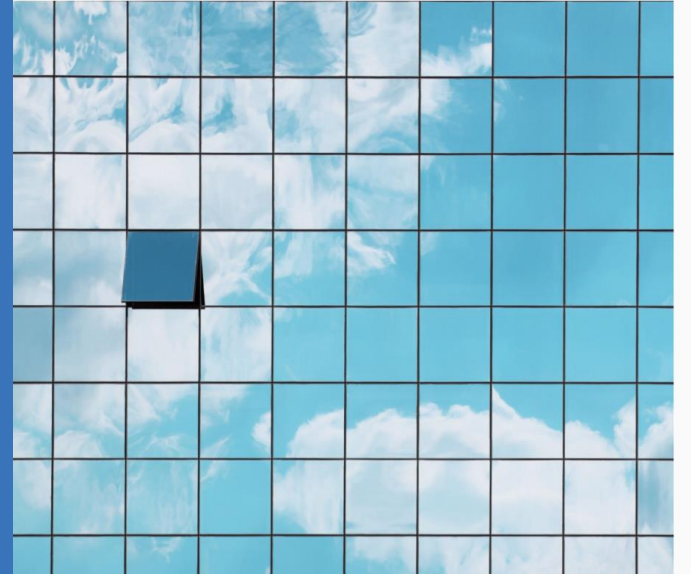


# Opportunities to improve air pollution around schools

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# PM2.5 and the Environment Act 2021

... to meet WHO (2005) guideline by 2040 and reduce average PM2.5 exposure by 35%



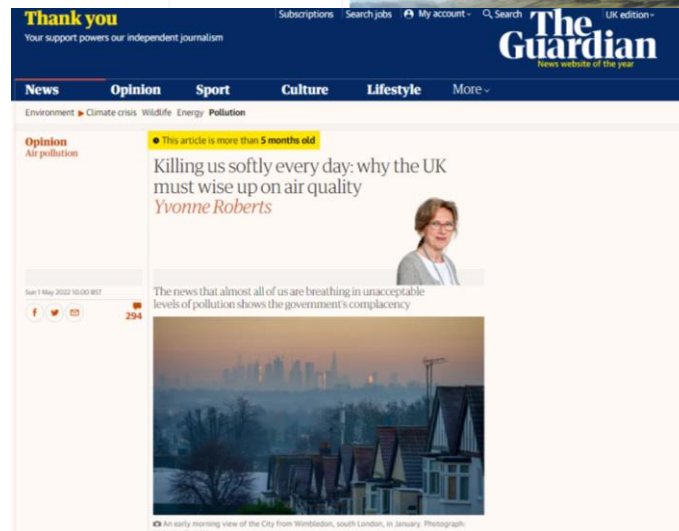
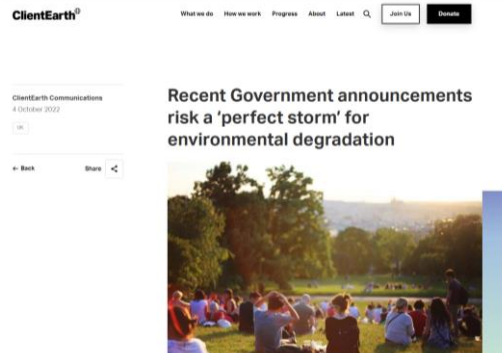
## Environment Act 2021

### 2021 CHAPTER 30

An Act to make provision about targets, plans and policies for improving the natural environment; for statements and reports about environmental protection; for the Office for Environmental Protection; about waste and resource efficiency; about air quality; for the recall of products that fail to meet environmental standards; about water; about nature and biodiversity; for conservation covenants; about the regulation of chemicals; and for connected purposes.

[9th November 2021]

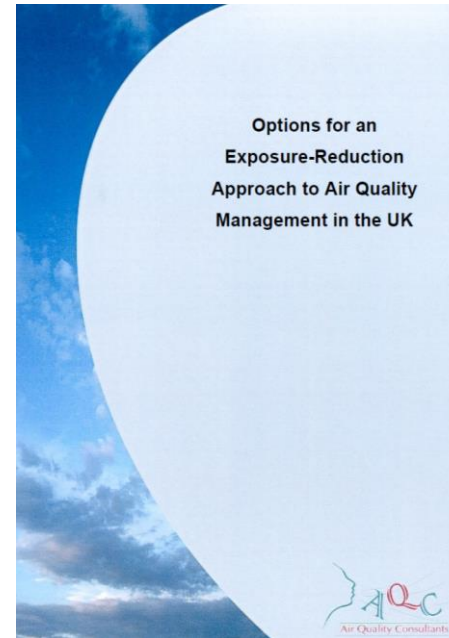
BE IT ENACTED by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—



# Science of the late 1990s / early 2000s

## Limit values and exposure reduction

### Evidence of impacts of PM2.5 long term exposure and no threshold :



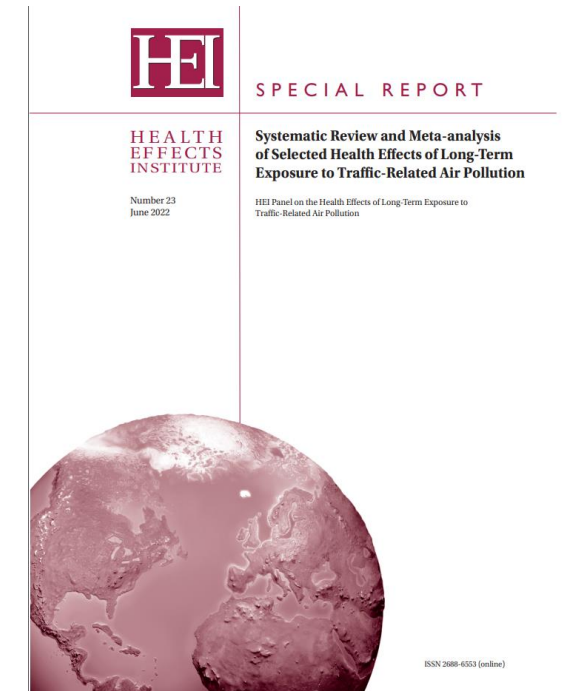
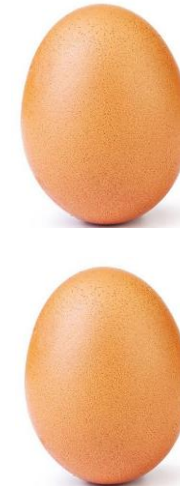
Laxon and Moorcroft, 2006



“Exposure reduction” aims to reduce average exposure

# The emerging science of today

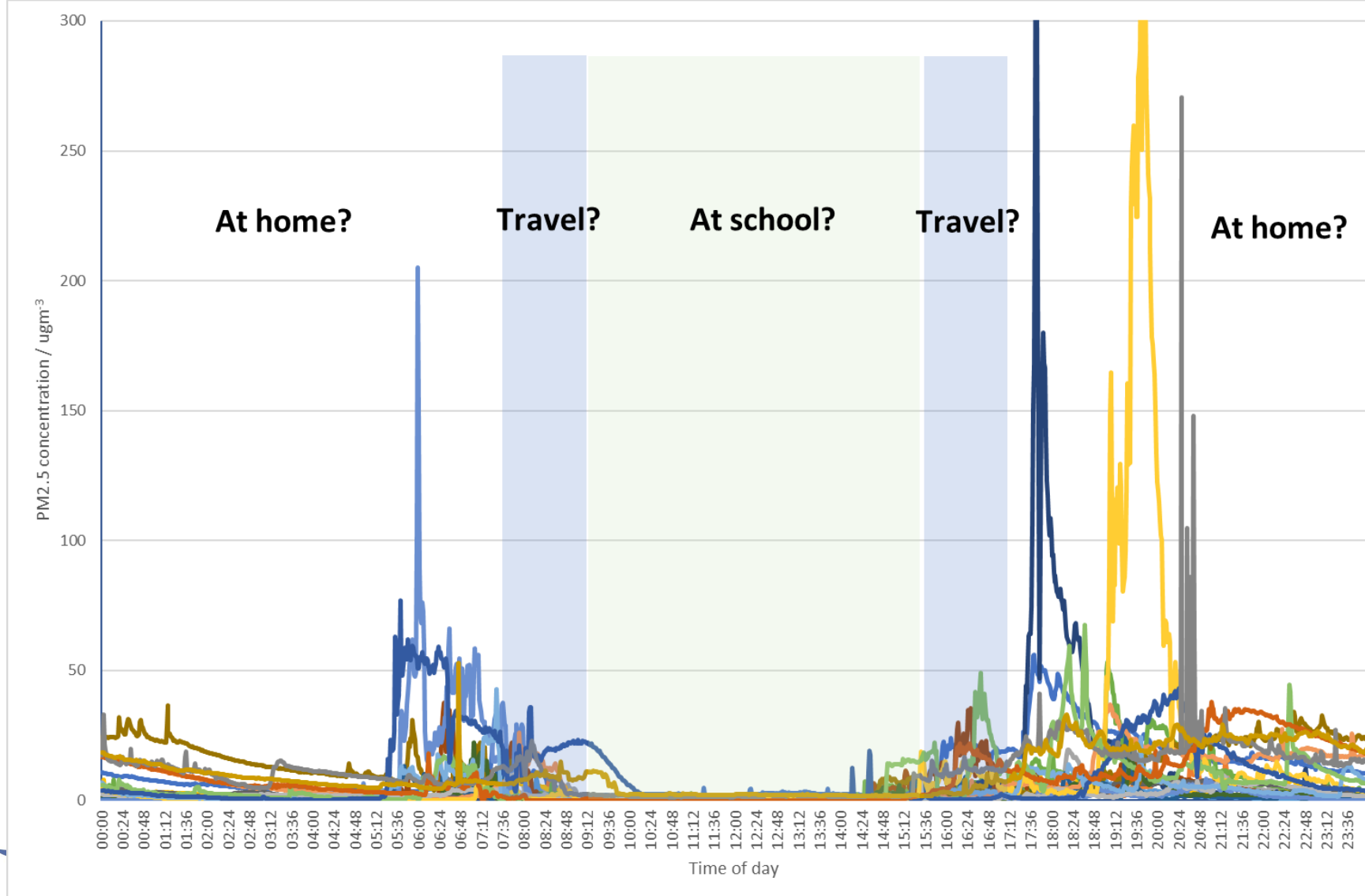
## Growing evidence that air pollution impacts on early life:



“Exposure reduction” aims to reduce average exposure – can we do better?

# Where should we focus our efforts?

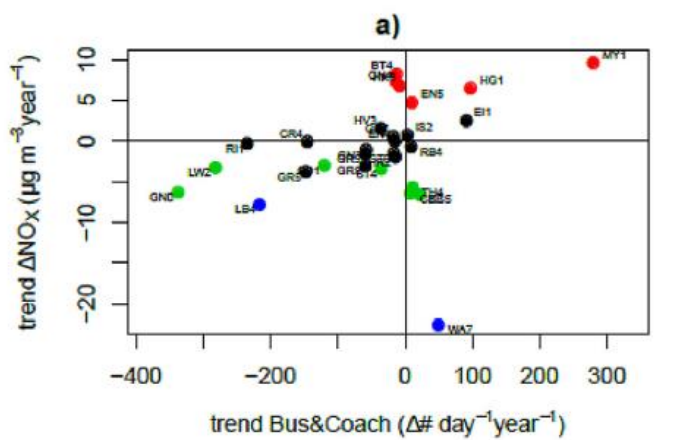
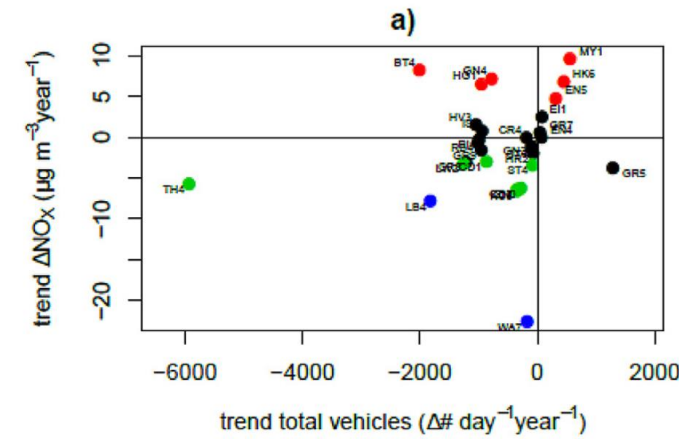
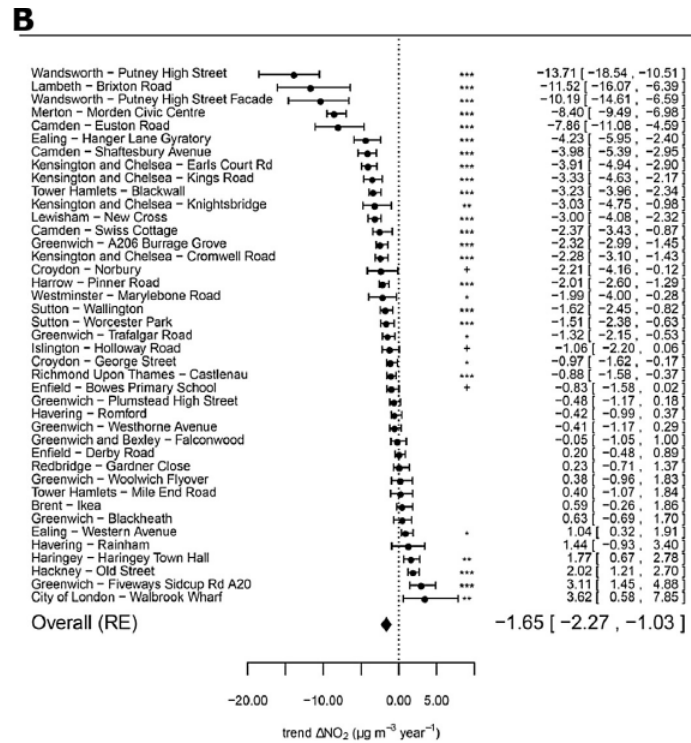
(thanks to Ben Barratt and team at Imperial)



# Optimising air quality management

## City-wide policies to do not have equal effects

- Trends in roadside air pollution in London pre-ULEZ
- Can localised policies be optimised for schools?



Environmental Pollution 218 (2016) 463–474

Contents lists available at ScienceDirect

**Environmental Pollution**

journal homepage: [www.elsevier.com/locate/envpol](http://www.elsevier.com/locate/envpol)

ELSEVIER

Did policies to abate atmospheric emissions from traffic have a positive effect in London?<sup>☆</sup>

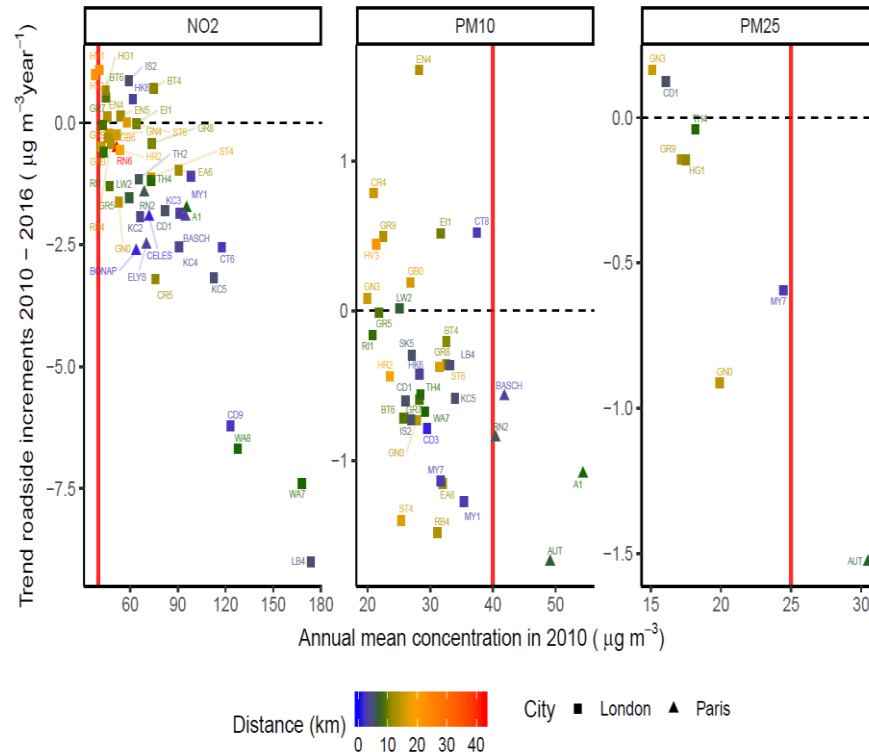
Anna Font<sup>\*</sup>, Gary W. Fuller

Environmental Research Group, MRC PHE Centre for Environment and Health, King's College London, London, SE1 9NH, United Kingdom

# Optimising air quality management

## City-wide policies to do not have equal effects

- Trends in roadside air pollution in London pre-ULEZ
- Targeted low emission zones near and on routes to schools?



A tale of two cities: is air pollution improving in Paris and London?\*

Anna Font <sup>a, b, \*</sup>, Lionel Guiseppin <sup>c</sup>, Marta Blangiardo <sup>b, d</sup>, Véronique Ghersi <sup>c</sup>, Gary W. Fuller <sup>a, b</sup>



# Optimising air quality management

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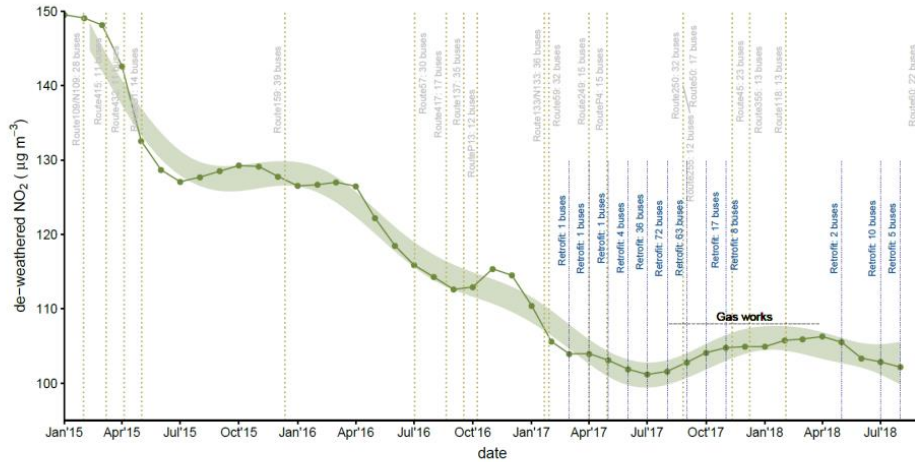


Figure 10. NO<sub>2</sub> trends at Lambeth-Brixton Road from 2015 to August 2018 for the de-weathered time series. Vertical lines indicate the start of new contracts (green dotted lines) and the number of retrofitted buses each month (blue dotted lines). The period when gas works took place on the A23, 1 mile north of the monitoring site, is indicated with a black dotted line.

### AT LAMBETH – BRIXTON ROAD

ANNA FORT & GARY FULLER - KING'S COLLEGE LONDON  
AUGUST 2018

**RATIONALE**

The monitoring site Lambeth – Brixton Road has consistently exceeded the NO<sub>2</sub> Limit Values established by the EU Directive 2008/50/EC. This set an annual mean limit value of 40 µg m<sup>-3</sup> and required less than 18 hours per year with NO<sub>2</sub> concentrations greater than 200 µg m<sup>-3</sup>. The limit values for NO<sub>2</sub> were not to be met by 2010. The concentrations of NO<sub>2</sub> in Lambeth – Brixton Road observed a significant downward trend since 2010 (Fort & Fuller, 2018), but the limit values have not been met (Table 1 in this report). To reduce ambient NO<sub>2</sub> concentrations, the Mayor of London implemented a Low Emission Zone (LEZ) on the Brixton to Streatham route in December 2017. Buses running in this route must meet the latest emission regulations, i.e. Euro VI. This has been achieved through new contracts with bus companies for Euro VI buses and retrofitting pre-Euro VI vehicles. The number of hours exceeding the 200 µg m<sup>-3</sup> threshold decreased from 539 in 2016 to 75 in 2017. However, from January to August 2018, the number of hours exceeding the hourly limit value was 81, higher than for the whole of 2017.

This study aims to understand the increase in the number of measured hourly exceedances measured at Lambeth – Brixton Road in 2018 compared to 2017. Specific focus is given to changes in the meteorological conditions that might rise the number of exceedances.

Contact email: anna.fort@kcl.ac.uk; gary.fuller@kcl.ac.uk



### How Low Emission Bus Zones and electric fleets are helping to reduce pollution

An evaluation of the zones found emissions of NO<sub>2</sub> and NO were down by an average of 90 per cent.

Partners: CHRYSLER, GOVERNMENT OF GREAT BRITAIN, LONDON, MET OFFICE, RAILWAY GROUP, SUEZ

REPORT: 2018/04/02





# Targeting air quality management

## London's ULEZ

- Improved air pollution outside a lot of schools that are on main roads

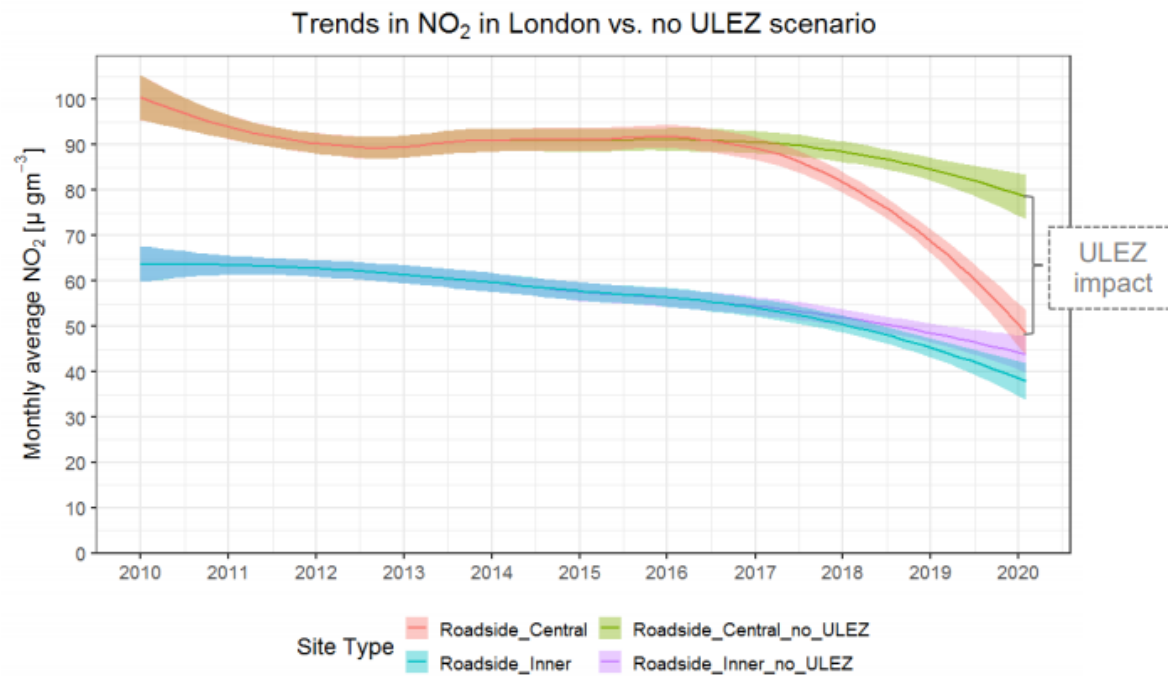


Figure 2: Monthly average NO<sub>2</sub> concentrations in London with and without ULEZ

# London Mayor's school audits

## Summary of Measures

7

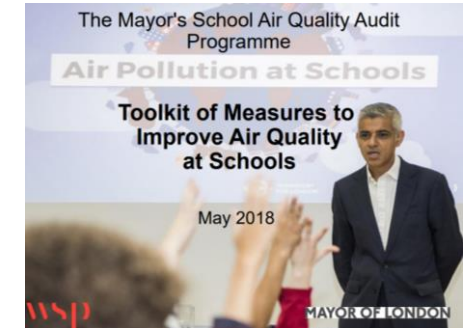
1. HIGHWAY MEASURES	
<b>A</b>	<b>Anti-idling</b>
A1	Fines
A2	Campaigns, including driver engagement
A3	Information signage
<b>B</b>	<b>Reducing traffic flow</b>
B1	'School Streets'
B2	Collapsible bollards
B3	'Play Streets' (temporary measure)
B4	Road closure
B5	Filtered permeability
B6	One-way streets/ No entry restrictions
B7	ULEV-only streets
B8	Width restriction (e.g. 7ft)
B9	Environmental weight limit signs
B10	Reallocate roadspace
B11	Weight restrictions
<b>C</b>	<b>Smoothing traffic flow/speed</b>
C1	Modify traffic calming
C2	Optimise traffic signals
C3	Junction improvements
<b>D</b>	<b>Reducing drop-off activity</b>
D1	Public Space Protection Orders
D2	School Keep Clear markings
D3	Double/single yellow lines
D4	Improve enforcement of restrictions
<b>E</b>	<b>Improved pedestrian and cyclist environment</b>
E1	Improved pedestrian environment - footway widening, kerb build-outs
E2	Improved crossing facilities on desire lines
E3	Traffic calming
E4	Improve Visibility of the School
E5	Cycle hangers
<b>F</b>	<b>Promote a switch to low emission vehicles</b>
F1	Ultra-low Emission Zone (ULEZ) & Low Emission Zone (LEZ)
F2	Comprehensive charging provision for ULEVs

<b>G</b>	<b>Parking/loading</b>
G1	Identify a Park & Stride site
G2	Remove or relocate parking/ loading bays and/or amend restrictions
G3	Introduce kerb blip loading restrictions
G4	Enforce parking restrictions
G5	Additional parking charges for more polluting vehicles
G6	Introduce or amend CPZ restrictions around school to restrict non-residents parking
G7	Parking rationalisations with ULEV car clubs
<b>H</b>	<b>Buses</b>
H1	Bus stop relocation
H2	Low emission buses
<b>I</b>	<b>Freight and Deliveries</b>
I1	Engage with local businesses to reduce freight/ delivery emissions
I2	Promote low emission vehicles for freight and deliveries
I3	Delivery Servicing Plans (DSPs) for new developments
I4	Re-time Borough commercial waste collection
<b>J</b>	<b>Construction</b>
J1	Planning conditions to reduce impacts of freight traffic
J2	Managing the impact of dust and emissions during construction and demolition
J3	Retrospective discussions with already permitted developments to lessen the impacts
J4	Non-Road Mobile Machinery Audit
<b>K</b>	<b>Planning Policy and Strategy</b>
K1	Healthy Streets approach, sustainable transport and roadspace reallocation from vehicular traffic
<b>L</b>	<b>Green Infrastructure</b>
L1	Green screens
L2	Trees, shrubs, planters
L3	Green Gateways
L4	Pocket parks

2. SCHOOL SITE MEASURES	
<b>M</b>	<b>School Grounds</b>
M1	Additional scooter/ cycle parking
M2	Staff car parking
M3	Anti-idling for deliveries
M4	Re-timing for deliveries
M5	Reduce number of deliveries, staff/visitor vehicle trips and/or use more sustainable modes
M6	Relocate pedestrian entrances
M7	Green screens
M8	Trees/ shrubs/ planters
M9	Green spaces
M10	Pupil & staff cycle parking
M11	Reduced waiting times to enter school grounds
M12	Relocate playgrounds and free flow spaces
M13	Co-ordinate start/ finish times with nearby schools
M14	Reconsider playground layouts to reduce exposure
M15	Sheltered waiting areas for parents/ guardians
<b>N</b>	<b>School Building</b>
<b>N</b>	<b>School boilers/ heating</b>
N1	Upgrade aging boilers
N2	Install Optimising Compensator Control System for School Boilers
N3	Boiler flues and extraction equipment
N4	Reducing over-heating and tackling heat gain
N5	Replace aging radiators
<b>O</b>	<b>Improve product choice (e.g. cleaning products)</b>
O1	Improve product choice (e.g. cleaning products)
<b>P</b>	<b>Regular service &amp; maintenance of appliances and equipment</b>
P1	Regular service & maintenance of appliances and equipment
<b>Q</b>	<b>Improve school building insulation</b>
Q1	Improve school building insulation
Q2	Upgrade windows
Q3	Replace temporary classrooms with permanent structures
Q4	Green Roofs
<b>R</b>	<b>Ventilation / Air Filtration</b>
R1	Installation of Air Conditioning Units
R2	Introduce Air Filtration Systems
R3	Install HEPA Filters in Air Handling Units
R4	Other air filtration systems - air purifiers
<b>S</b>	<b>Other</b>
S1	Air quality monitoring and information provision eco-monitors and walking route maps.

3. BEHAVIOURAL MEASURES	
T1	Attain improved STARS accreditation status, ultimately Gold status.
T2	Promote cleaner walking routes to school
T3	Promoting Park & Stride
T4	Promoting car sharing
T5	Walking Route Maps / Leaflets
T6	Parent and Public Workshops
T7	Prepare 'Welcome Packs' for new pupils / parents
T8	Deliver Air Quality focused lesson/s to children
T9	Awareness raising session amongst staff
T10	Daily monitoring of London Air website/ app
T11	Add Air Quality to Junior Citizenship Scheme
T12	Anti-idling campaign
T13	Attain an improved Award in Healthy Schools London, ultimately a Gold Award
T14	Awareness raising events amongst the wider community
T15	Cycle training and promotional initiatives
T16	Gamification to promote active travel
T17	Restrict or reduce personal deliveries
T18	CPD supporting teachers subject knowledge on air quality
T19	Walking Buses

4. WIDER MEASURES	
U1	Targeted scrappage scheme for polluting vehicles entering London
U2	Reform Vehicle Excise Duty
U3	Promote a transition to electric heating and heat pumps
U4	Reform Buildings Regulations to promote heat pumps
U5	Zero emission zones



# School streets – started in Bolzano, Italy

- It halved accident rates



<https://www.youtube.com/watch?v=j8xKUjzaK8c>

# School streets – turning the road outside the school from problem to asset



AQMesh measurements at 16 London schools

18 % decrease in children being driven to school

23% decrease in NO2

## Co-benefits

Inc carbon emissions, safety, community and active travel



# School zones – turning the streets around the school from problem to asset



Waltham Forest



Hackney



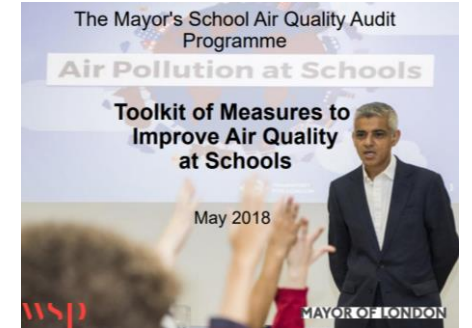
Haringey



Trees on carriageway outside school. Provides visual road narrowing and encourages considerate driving behaviour



Trees and planting introduced on footway buildout outside school in Waltham Forest. Narrowed road also deters drop-off activity. Planting area provides sustainable drainage.



## Co-benefits

Reduced exposure to and from school.

Inc carbon emissions, safety, community and active travel

# Let me take you to Yerbury School



# Let me take you to Yerbury School



# Protected development zones around schools?



Liam Frost, the deputy headteacher, said:

“The 450 children at our school are obliged to come here each day and breathe the air, regardless of how clean it is. Children deserve to know the adults in their lives are caring for them and their future.

“The school street has showed the children how we can work together to improve the local environment, but this is totally undermined by the plans for the depot at the back of the building.”



# Protected development zones around schools?



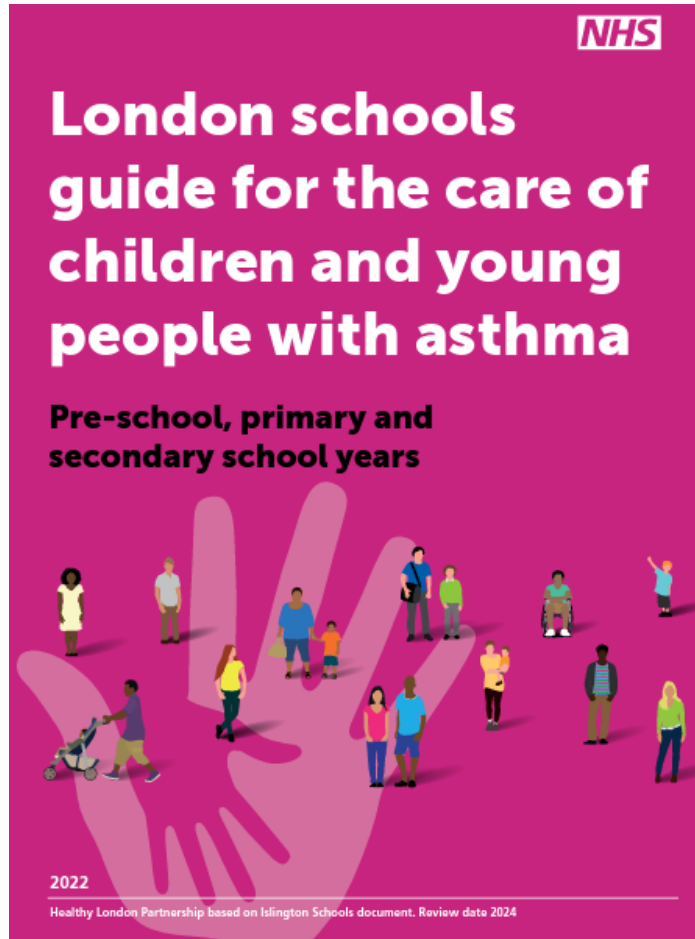
An Ocado spokesperson said: “Ocado is committed to having a positive impact on the local community. This would be the greenest and quietest grocery facility in the UK....

...and install a green ‘living wall’ along the boundary.

# Green walls?



# Air pollution in asthma friendly schools



Gary Fuller chats with Rodrigues, Deputy Mayor for environment and energy in London

[https://soundcloud.com/user-95072702-837482268/how-london-is-addressing-air-pollution-to-help-young-people-with-asthma?si=34efc44e449c4c1d9930a4d2c573de2b&utm\\_source=clipboard&utm\\_medium=text&utm\\_campaign=social\\_sharing](https://soundcloud.com/user-95072702-837482268/how-london-is-addressing-air-pollution-to-help-young-people-with-asthma?si=34efc44e449c4c1d9930a4d2c573de2b&utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing)

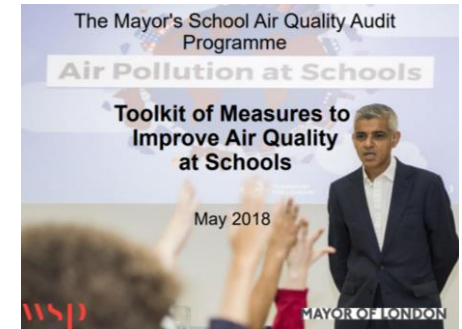
# School heating systems



Heat pump condenser units (centralised & stand alone)



Aging gas fired boiler



# School heating systems

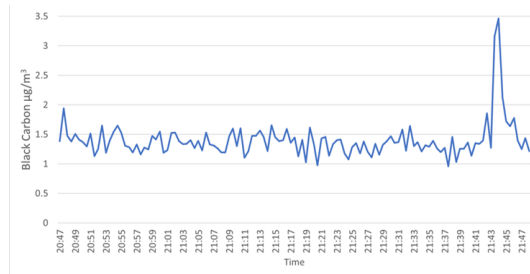
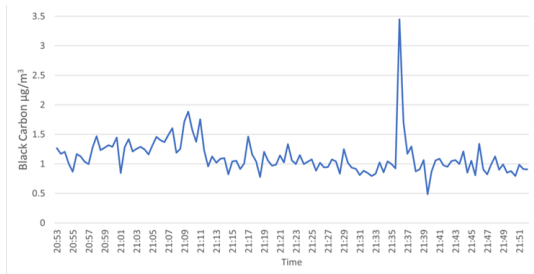


“The Low Carbon Building Programme, Wood Energy Business Scheme (Wales), Scottish Biomass Heat Scheme and the Bioenergy Capital Grant Scheme, and of course the RHI drove quite a lot of installations too.

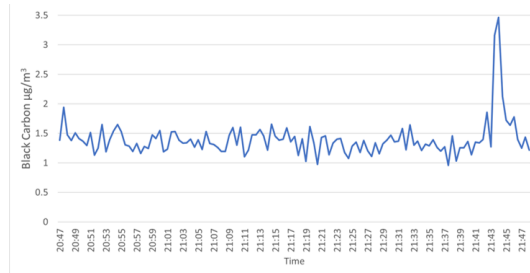
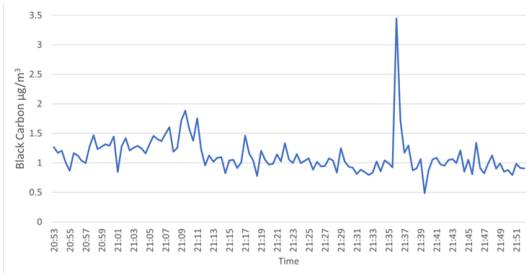
I am aware of biomass installations in schools in Durham, Middlesbrough, South Yorkshire, Highland, Argyll and Bute, East and North Ayrshire, Perthshire, Northumberland, Lancashire, Cumbria, many parts of Wales, Oxfordshire, Hull and Dumfries and Galloway”

Many thanks to the dedicated and brilliant Neil Harrison, reheatUK for some market intelligence

# School heating systems



# School heating systems



# So summing up

**Time to start managing our air based on the science of today and not that of the 20<sup>th</sup> century.**

New health evidence suggests that we should optimise our air pollution policies to reduce exposure for children.

Examples from London and elsewhere show how this could be incorporated into policy and practice.

- School streets and school zones could bring many co-benefits
- Wide-area and localised low emission zones can work
- Protected development zones around schools

Do we need to check school heating?

A right to clean air to protect children's exposure?

(P.S. Please tell us about your impactful results and papers)



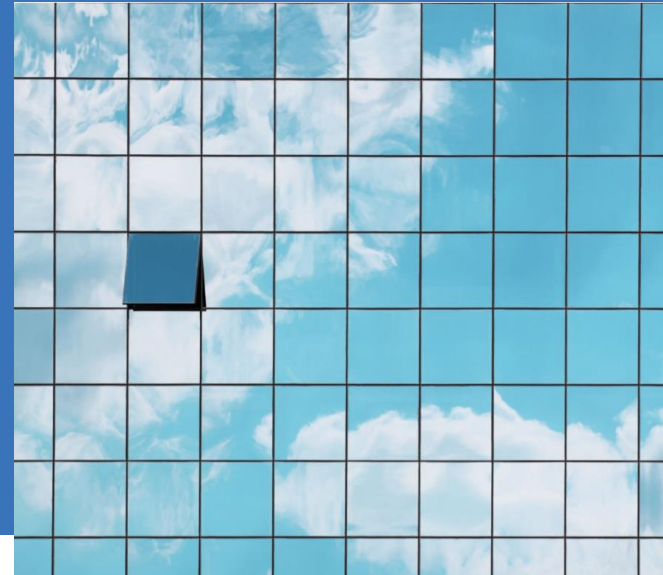
# SPF Clean Air

Clean Air Champions - The next three years....

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<https://www.theguardian.com/profile/gary-fuller>



[www.ukcleanair.org](http://www.ukcleanair.org)

