

MRC-HPA Centre for Environment & Health

Traffic proposal

Introduction and overview

Sean Beevers

MRC Structure

KING'S COLLEGE LONDON

IMPERIAL COLLEGE LONDON

F Kelly (Deputy Director)

R Anderson, R Atkinson
S Beevers D Carslaw
G Fuller, I Mudway
S Sturzenbaum
H Walton, M Williams

Inhalational Toxicology
Air Pollution
Epidemiology

N Best, M Blangiardo
M Toledano,
S Richardson
Statistical Methods

School of Public Health

P Vineis
Biomarkers
J Gulliver
Environmental Modelling

IS Division

A Boobis
Toxicology
Biomarkers

P ELLIOTT (Director)

SORA Division

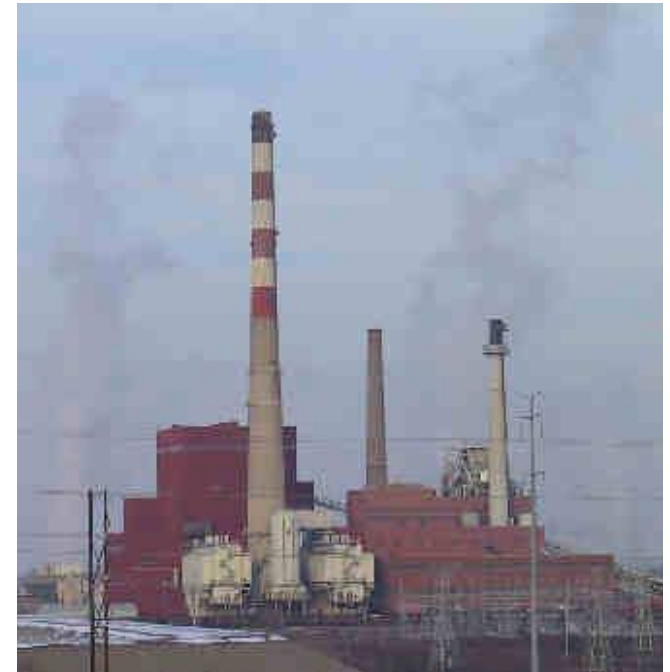
J Nicholson E
Holmes T
Athersuch
Metabonomics
Biomarkers

NHLI Division

P Burney, P Cullinan
D Jarvis, T Tetley
Respiratory Epidemiology
Toxicology

Vision

- ❑ To be an international centre of excellence
 - Multidisciplinary research & training on health effects of environmental pollutants
- ❑ To translate this knowledge
 - National and international policies to improve health
- ❑ To provide national resource for government/agencies and Research Councils
 - Respond to emerging issues and policy needs



MRC – ‘Traffic’ project

MRC-HPA Centre for Environment and Health

Imperial College
London



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The Problem:

Uncertainties about the health effects of Traffic Pollution (HEI 2009)

- Wide and expanding range of health effects
- Sources and components
- Population exposure
- Exposure-response relationships

Why London?

- Traffic pollution (> EU limits for PM and NO₂)
- Variability in population exposure
- Traffic interventions (Congestion charging, Low emissions zone)
- High density monitoring network (London AQ Network)
- Extensive traffic data (including Automatic Number Plate recognition ANPR data)
- Fine spatial scale models (20x20m)
- Detailed daily analysis of chemical composition and oxidative potential of PM (ClearfLo)
- Availability of a health outcomes from cradle to grave
- Multidisciplinary consortium of experienced investigators

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WP1: PM Oxidative Potential and Exploitation of NERC ClearLo project

1. Oxidative potential and metal composition
 - 2yrs 24hr samples from urban background site
2. Collection and analysis of ClearLo data
 - PM size, number, source apportionment
3. Time-series analysis of ClearLo data to investigate relative toxicity of PM metrics.
 - Data from 1 and 2 and daily deaths and hospital admissions.

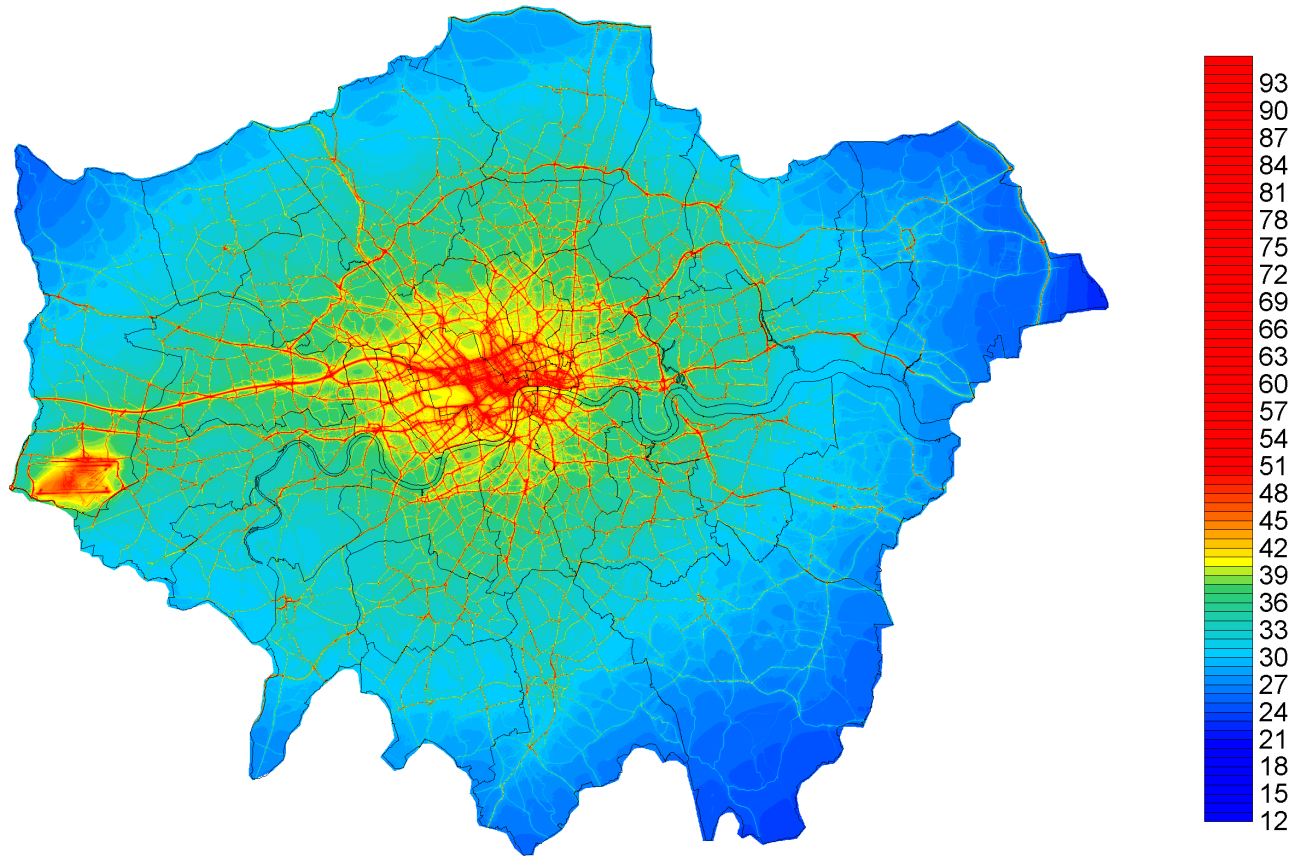
WP2: Modelling of population exposure to traffic pollution

1. Development of hybrid model of time activity and human exposure to traffic pollution
 - Apply to policy scenarios – Mayor's AQ Strategy
2. Develop GIS-based noise modelling and mapping capabilities across Greater London
3. Apply traffic pollution exposure models to spatio-temporal epidemiological studies
 - Existing model at 20x20m² grid linked to address/postcode (NO_x, NO₂, exhaust- and non-exhaust PM₁₀ and PM_{2.5})
 - Noise
 - Traffic weighted proximity to roads

WP3: Epidemiological Studies of Health Effects of Long-term Exposure to Traffic Pollution

1. Adverse birth outcomes – low birthweight, preterm birth
2. Early markers and risk factors for vascular disease, markers of chronic inflammation and lung function in primary school children
3. Primary care records: incidence and exacerbation of cardiovascular and respiratory conditions
4. Mortality, hospital admissions, survival after admission for acute coronary syndrome

Current exposure estimates



Annual mean: NO_x , NO_2 , PM_{10} , $\text{PM}_{2.5}$ and O_3
1990's to 2025

Assessing the impacts of air pollution and climate change.

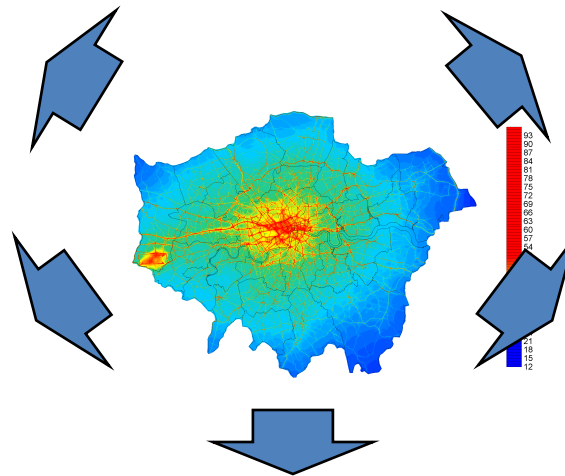
Woodcock et al. *Lancet* 2009; 374:1930-43. Used as part of the at the Copenhagen climate change conference.

Traffic management and epidemiology

Kelly et al. 2010. Congestion Charging and Low Emissions Zone. Health Effects Institute (in press).

Oxidative potential and PM time series epidemiology

Tonne et al. *Occup Environ Med* 2010 (in press)



EU projects

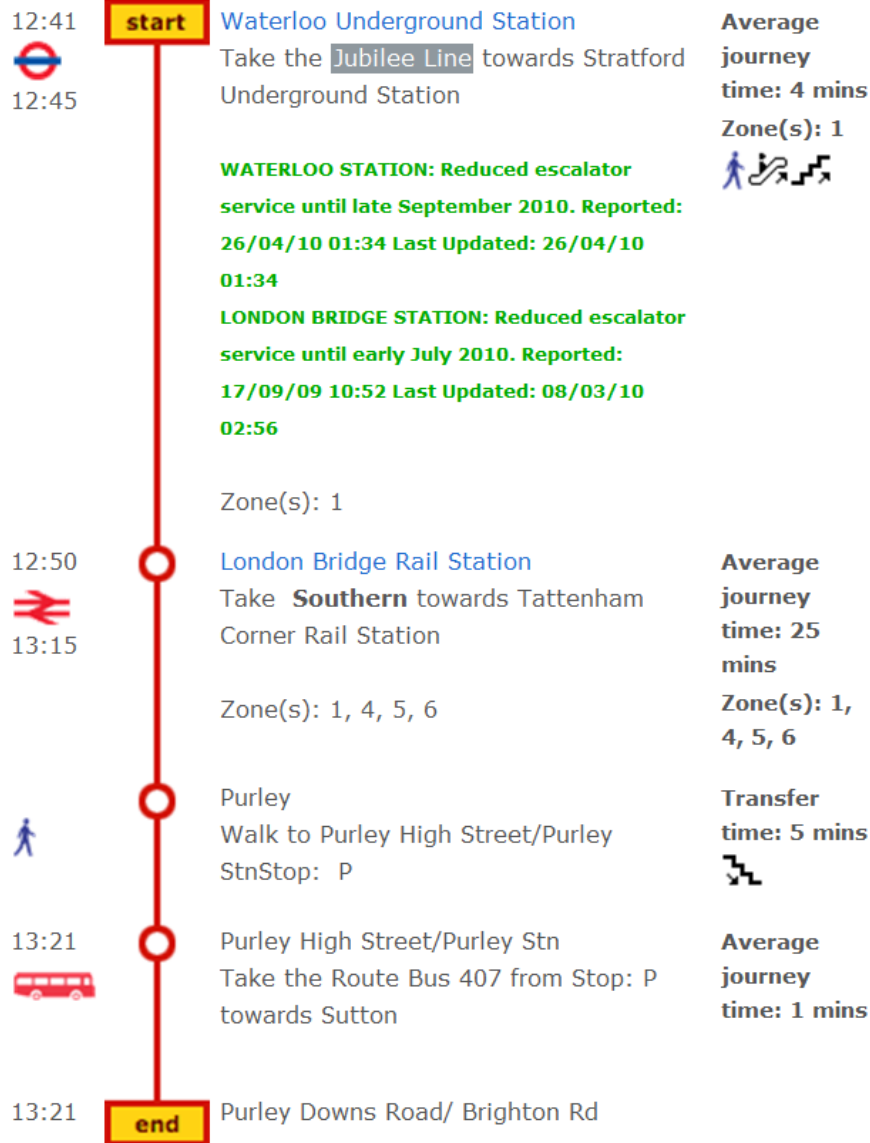
MEGAPOLI and BRIDGE.

Pollutant mixtures

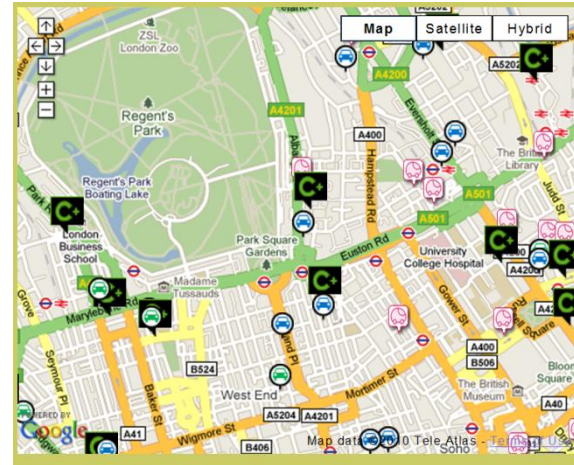
Exposure to NO₂, PM and noise around Heathrow (Hansell, IC)

Characterising Multi-Pollutant Patterns of Exposure (Molitor, IC)

Exposure limitations

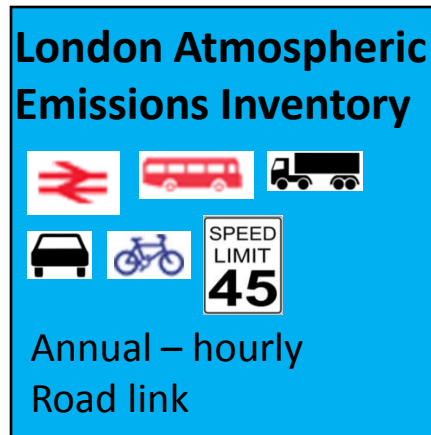
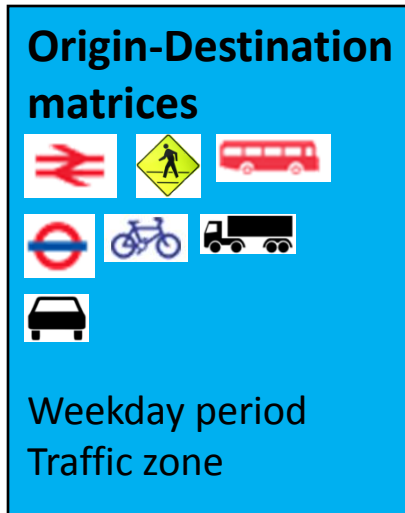
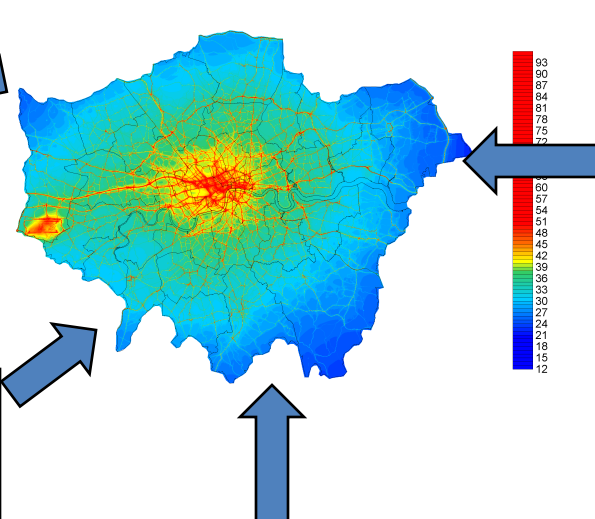
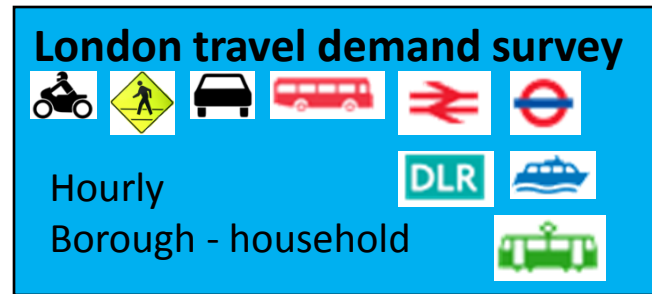
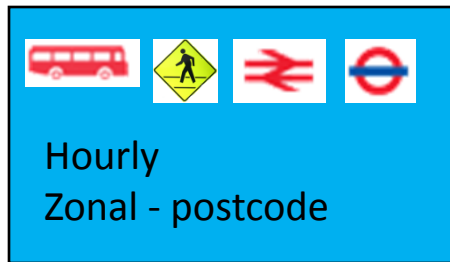


Travel by car



Opt to stay at home!

Exposure model

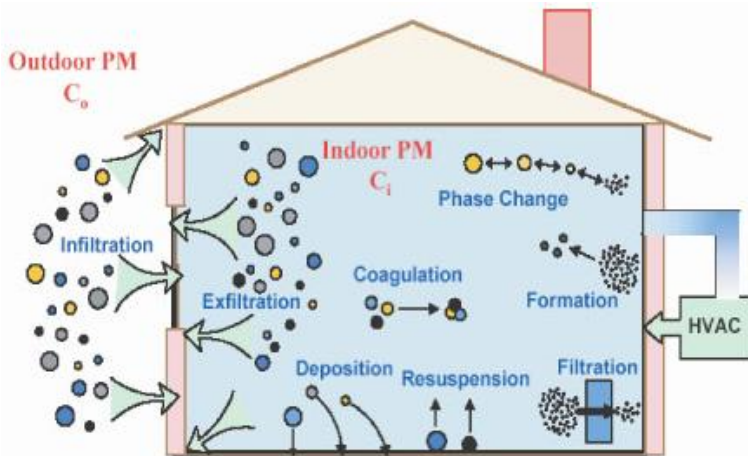


Household / types of people	Transport related factors
Inner/outer London (boroughs in the future)	Access to private vehicles
Household size	Vehicle details (type/fuel/power/age)
	Vehicle licences held
Age	Use of transport modes
Gender	Ticket types/Oyster/travel passes
Ethnicity*	Journeys that enter the CC zone
Household relationships (e.g. father/daughter)	Usual modes of transport to work/education
	Journey purposes
Socio economic codes (NS-SEC)	Parking
Resident/visitor to London	
Household income and housing tenure	
Disabilities/impairments	
Employment/Education status	
First/second home	
Access to the internet	

Exposure model – continued

Transport micro-environmental exposure above ambient concentrations predicted by the AQ model will be estimated using results from the literature in combination with published mass balance methods.

The contribution of traffic emissions to indoor air quality will be addressed using a combination of the modelled concentrations and published indoor-outdoor ratios.



Use of the system

Investigate the exposure misclassification between the current exposure metrics and new exposure based upon space-time-activity and how MAQS strategies influence exposure.

Implications

Direct link between policy (TfL/DEFRA) and exposure science

Development of smarter science led policies – modal shift/multiscale/OP

Development of dose-response relationships that are more appropriate for actual human exposure. Ross to tell us more.

Future analysis

Exposure in specific micro-environments – the tube.

Adding an indoor model.

Personal exposure measurements

Climate change adaptation.

Thanks for your attention...