

## Introduction

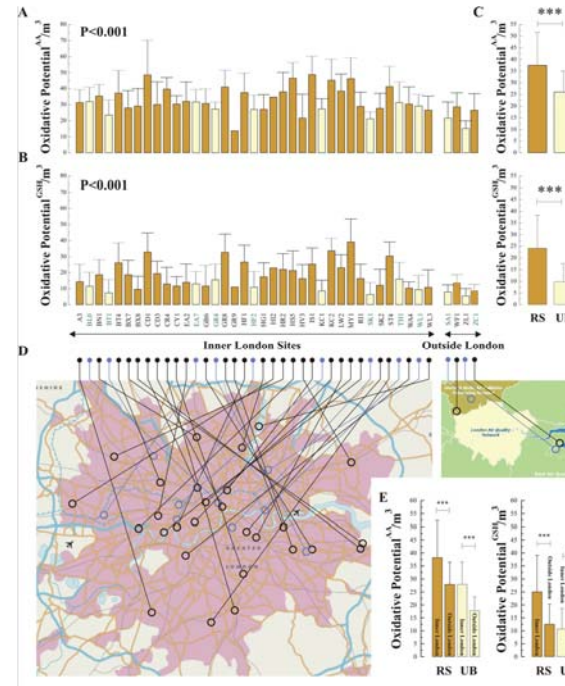
- The primary aim of the London Low Emission Zone (LEZ) is to reduce PM<sub>10</sub> concentrations across Greater London by targeting the most heavily polluting diesel vehicles – older Heavy Goods Vehicles (HGVs), buses and coaches.
- The zone, introduced in February 2008, is the first in the UK and the largest in the world covering an area of 2644 km<sup>2</sup> in which more than 8 million people reside.
- The London-wide LEZ offers a unique opportunity for estimating the impact of vehicle emissions on air quality and health.
- Prior to undertaking such an investigation we have accumulated a robust dataset of air quality and PM oxidative activity within Greater London, and have developed a method for using primary care databases for evaluating the health outcome of the LEZ.

## Objectives

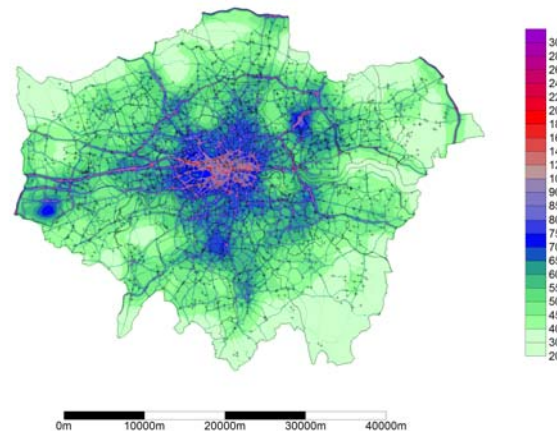
- To produce model predictions of the effects of the LEZ and to estimate the areas in London that show the greatest change in atmospheric concentration and population exposure.
- To design a comprehensive LEZ impacts monitoring network to maximise the potential for detecting a signal in pollution metrics, using experience gained from the HEI-funded London Congestion Charging Scheme study.
- To characterise the oxidative properties and water soluble metal content of ambient PM<sub>10</sub> and PM<sub>2.5</sub> in London prior to the implementation of the LEZ.
- To develop procedures and methodology to extract health information from the primary care network to facilitate future health-based studies.

## Results

- The emissions modelling exercise to estimate the overall impact and identify locations of likely greatest change was completed first (**map**).
- This allowed the identification of 6 key 'indicator' sites as being of primary importance. Four sites required upgrading to monitor a wider range of pollutants, and a seventh site was installed where the analysis identified a lack of existing monitoring.
- Automatic traffic count and automatic number plate recognition cameras adjacent to each indicator site were also installed.
- PM10 filters were obtained from 37 LAQN sites within Greater London (28 roadside (RS) and 9 urban background (UB) sites, including the 7 LEZ indicator sites) over the period July 2005 to August 2006. PM extracts were incubated in a synthetic model of human respiratory tract lining fluid (RTLFL) to assess oxidative potential.



**Figure:** Mean  $\pm 1\sigma$  ascorbate (panel A) and glutathione dependent (panel B) oxidative activities, expressed per m<sup>3</sup> of sampled air, for PM<sub>10</sub> samples collected from each of the 41 sites studied. Samples are grouped to illustrate whether the site is located within central London, or falls outside the metropolitan area, with orange bars reflecting roadside and yellow bars urban background sites.



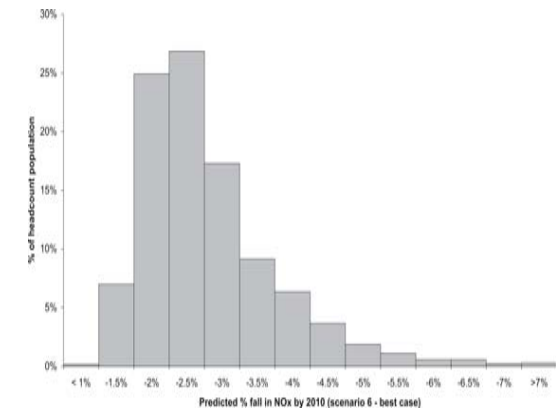
**Map:** Contour map of modeled NO<sub>x</sub> (ppb) for London in 2005 with location of general practices shown as crosses.

## Results (continued)

- PM oxidative potential varied markedly throughout the London metropolitan area, with evidence that PM samples collected from roadside locations processed more activity per unit mass than samples derived from urban background locations. These differences were extenuated when the oxidative potential parameters were expressed per m<sup>3</sup> (**Figure**).
- There was evidence that PM from both RS and UB locations within the city were more active than those collected from sites outside the metropolitan area (**Figure**).
- A comparison of PM10 soluble metals illustrated enhanced concentrations of Cu, Ba and Mo at roadside sites.
- To assist in a future evaluation of the impact on health in London following the implementation of the LEZ we developed a novel method using primary care databases of consultations and prescriptions.
- The ethical and operational feasibility of linking modelled air pollution estimates to electronic primary care records using postcodes was established.
- With the resulting datasets and analyses we explored issues of outcome definition, statistical approach and power as well as confounding by smoking, deprivation and ethnicity.

## Future research

- In the second phase of this work we will use these new approaches to examine the impact of the LEZ on air quality and health across London.



**Distribution of population by modelled difference in NO<sub>x</sub> between 2010 base case and LEZ scenario 6.**