



# Building a cleaner London

David Green

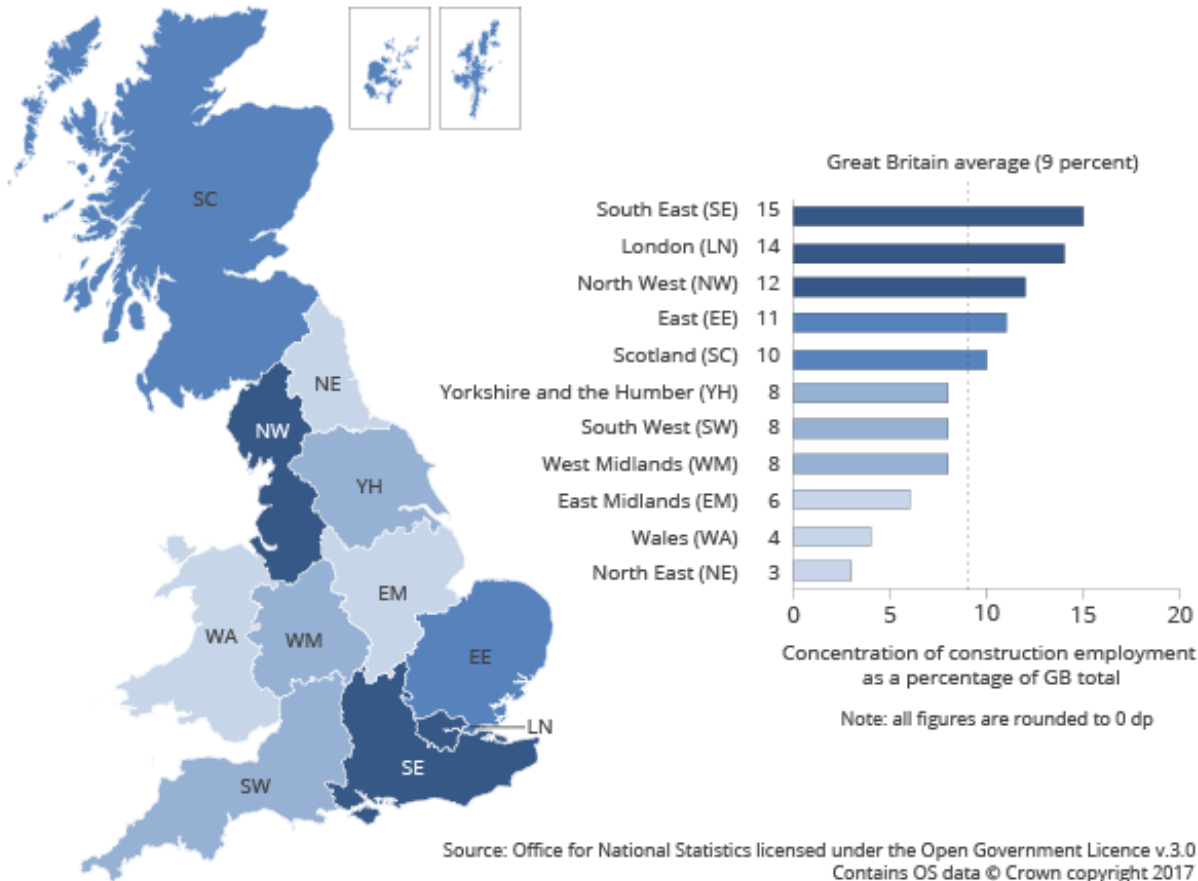
School of Population Health and Environmental Sciences

# Aim

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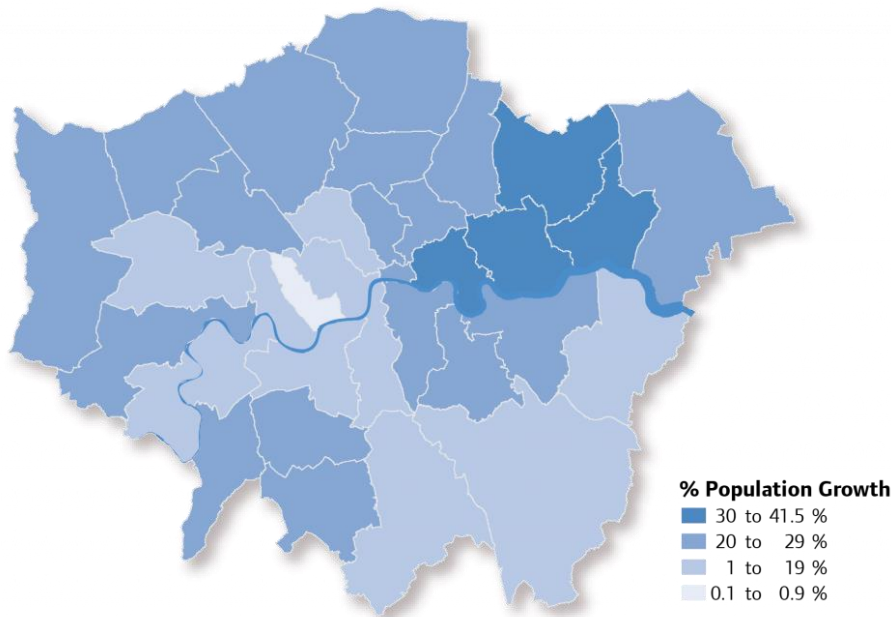
- **Outline the importance of construction emissions now and in the future**
- **Examine the work that ERG have been doing to:**
  - quantify the impact of construction emissions
  - work with government industry and policy makers to reduce it
  - implications for public and worker exposure
- **Look to the future to highlight what is needed to improve our understanding and drive down emissions**

# Construction Industry



- Construction is the third largest economic sector in the UK
- GB construction output 2018 growth of 2.1% to £159.6 bn.
- Despite Brexit, 2018 is still forecast to be the highest level of construction output on record
- Future growth reliant on infrastructure projects - HS2 and the Northern Powerhouse

# Growing urban populations

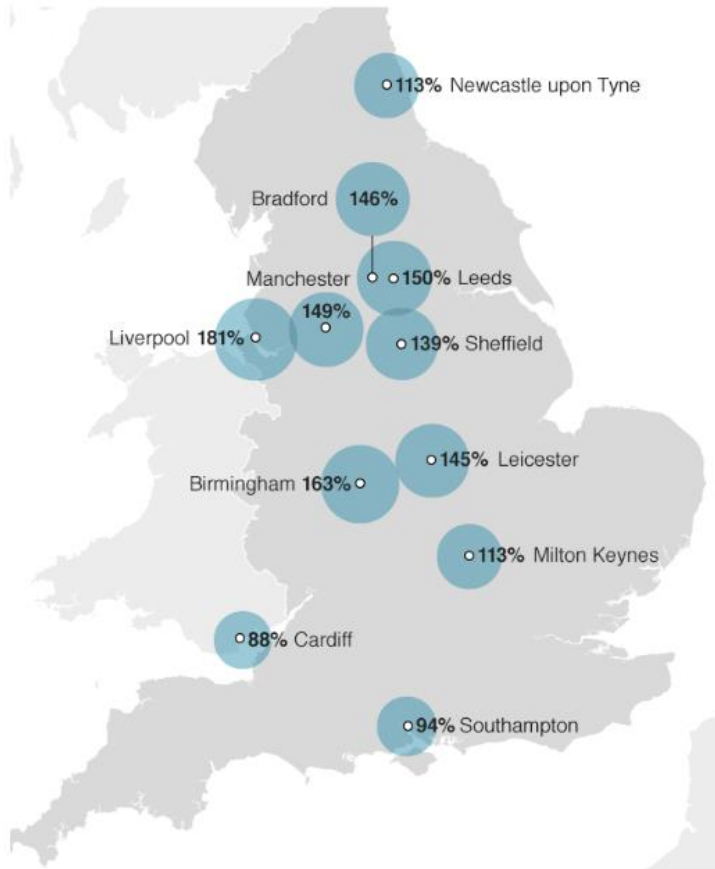


© GLA 2013 Round Population Projections  
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- GLA central predictions: 9.2 million in 2021 rising to >10 million in 2036
- Across UK many cities have grow by 50%.
- Internationally, urban population in 2014 was 54% of the total global population (WHO).
- The global urban population is expected to grow by 1.44-1.84% pa to 2030.
- Dependent on the provision of affordable housing and infrastructure provided by the construction industry with consequential impacts on urban air quality.
- Emissions from the construction industry will continue to increase in importance and therefore require quantification and regulation by urban and national governments.
- Consequently included in air quality policy development nationally and in regional government (London & Wales)

# Growing urban populations

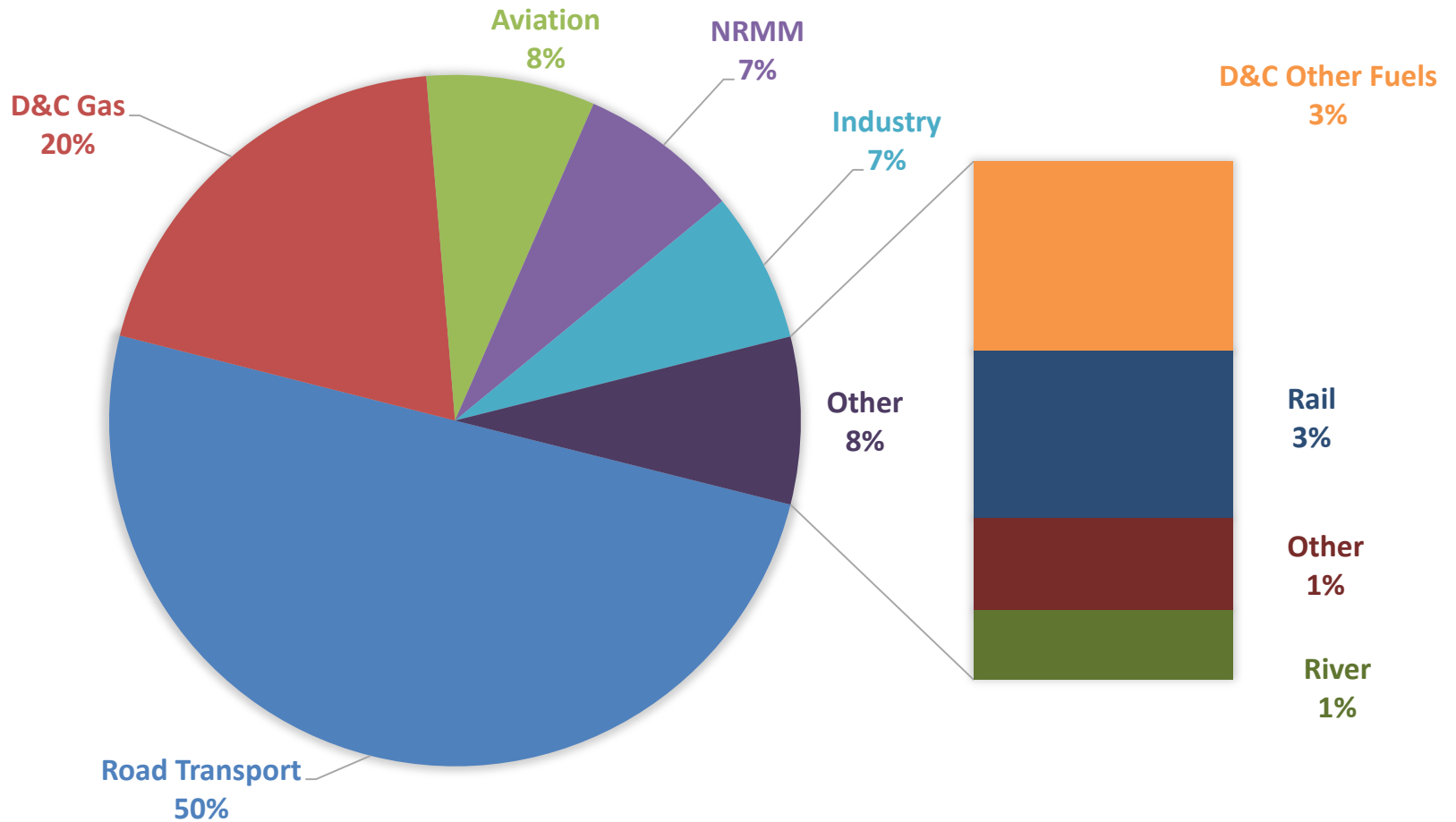
Fastest growing city centre populations  
2002-2015



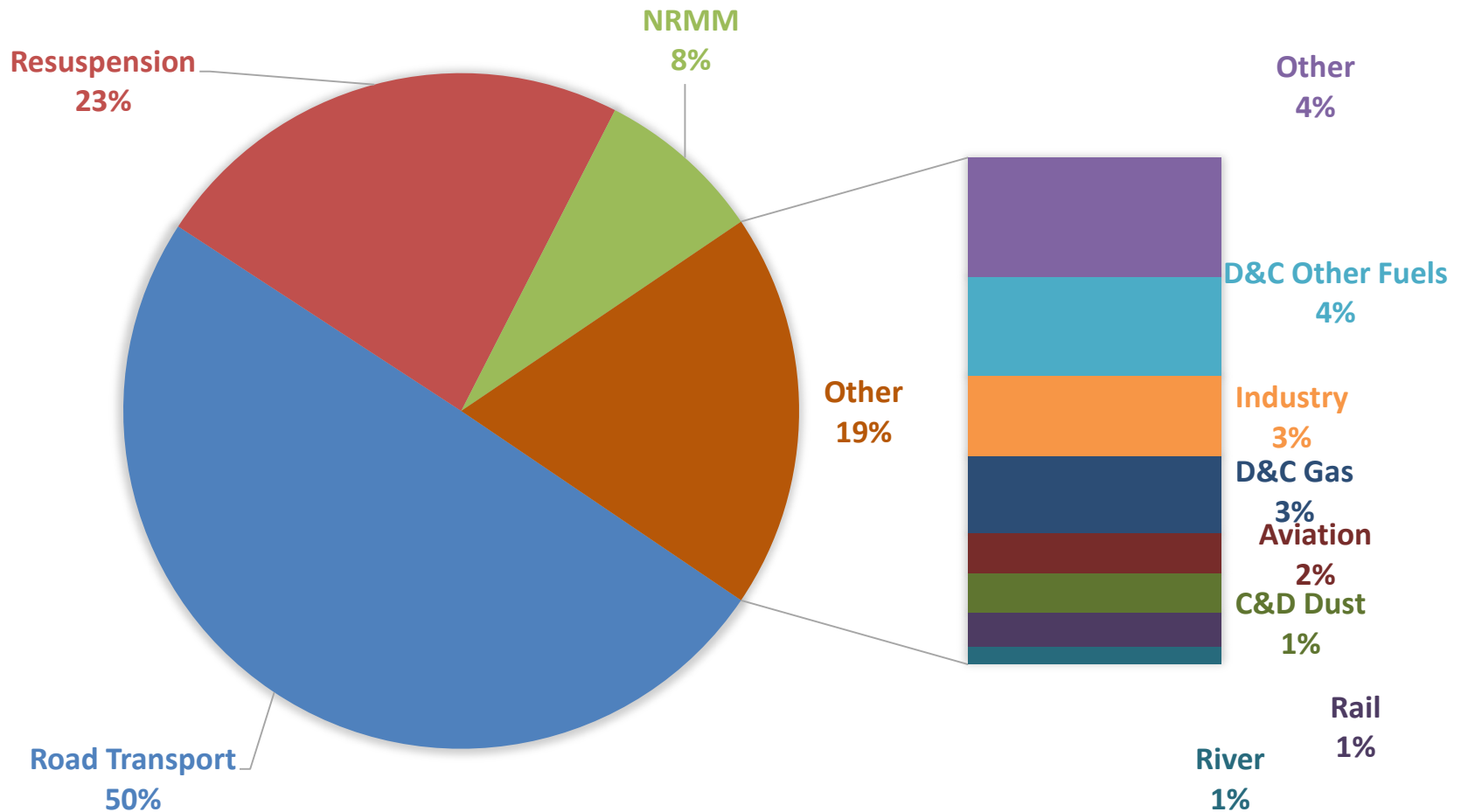
City centre defined as a 0.8 mile radius from the centre of cities with 550,000 to 4m residents and a 0.6 mile radius from the centre of towns and cities with 135,000 to 550,000 residents.

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# NO<sub>x</sub> Emissions Inventory



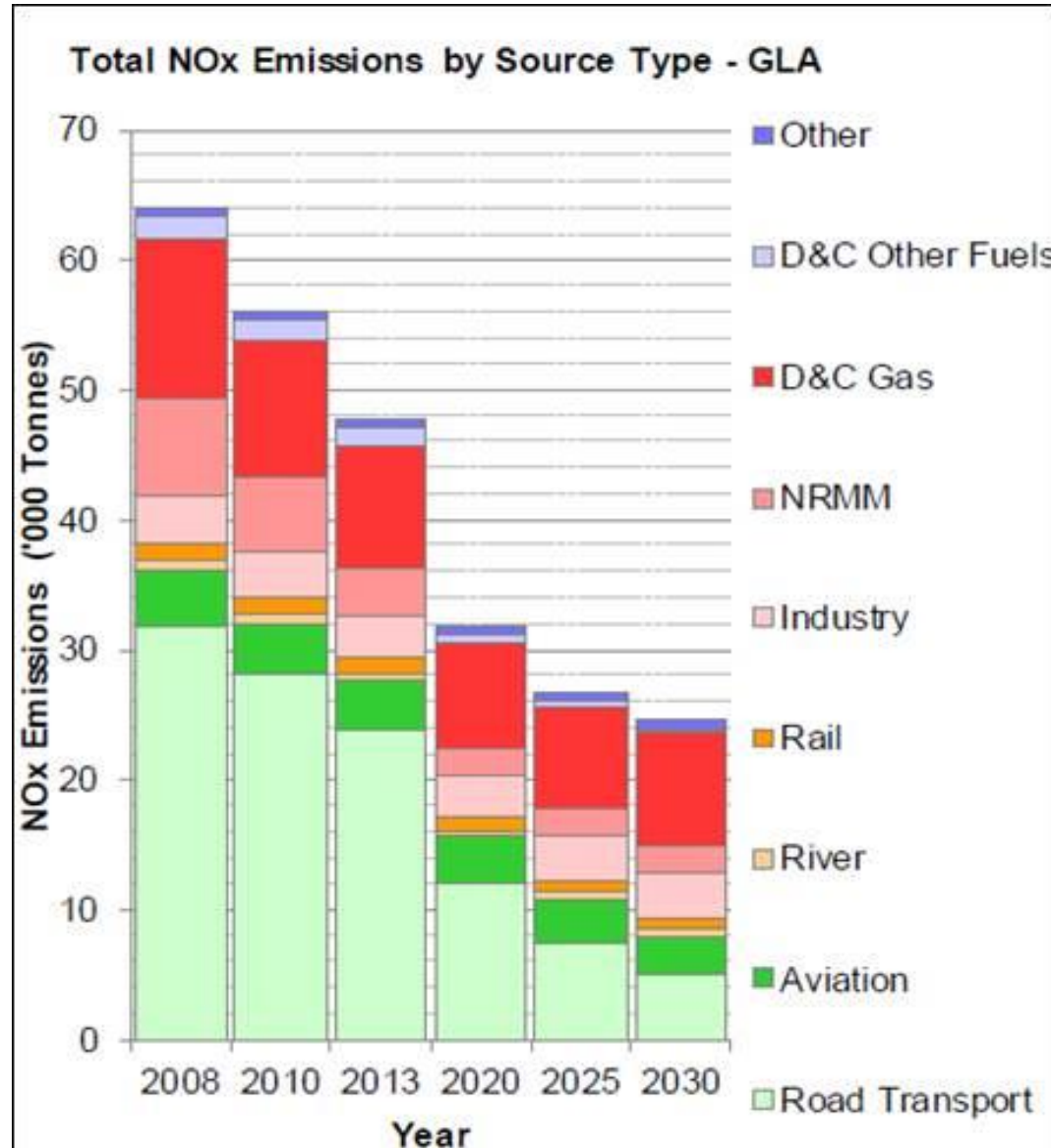
# PM10 Emissions Inventory



London Atmospheric Emissions Inventory  
(LAEI) 2013



# NO<sub>x</sub> Emissions Inventory Forecast





# Future

## MAQF - London Low Emission Construction Partnership (LLECP)

High Speed2

Dust Suppressants

Construction Logistic plans

MAQF - Heygate

NRMM Register

DEMiST

SPG Trigger Levels

NRMM Emissions Inventory PhD

Monitoring

Fugitive Dust Emissions

Exhaust Emissions

Working with Industry

Policy and Guidance

Worker Exposure

# CONSTRUCTION AND DEMOLITION

# Monitoring - Thresholds



AE International – Europe

Atmospheric Environment 38 (2004) 4993–5002

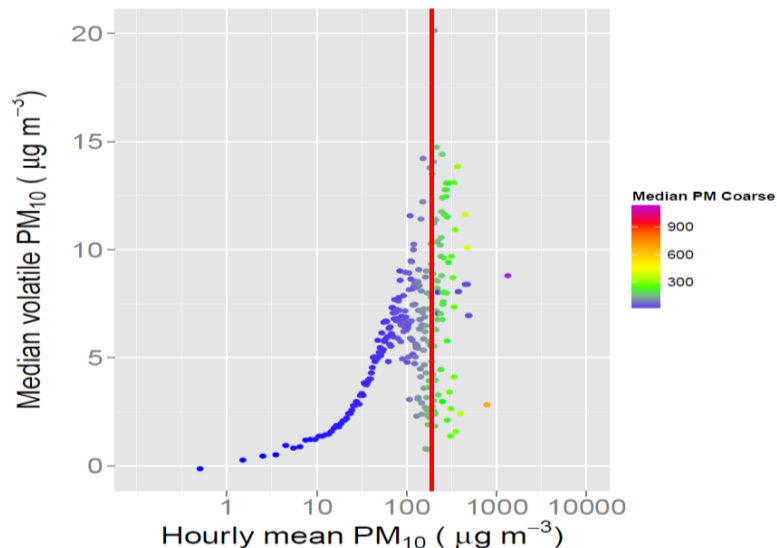


The impact of local fugitive PM<sub>10</sub> from building works and road works on the assessment of the European Union Limit Value

Gary W. Fuller\*, David Green

*Environmental Research Group, School of Health and Life Sciences, King's College London, Franklin Wilkins Building, 150 Stamford Street, London SE1 9NN, UK*

Received 26 January 2004; received in revised form 10 June 2004; accepted 17 June 2004



- 250 µg m<sup>-3</sup> 15 min threshold in the Construction and Demolition SPG
  - based on TEOM Measurements in Fuller & Green (2004)
- Alternatively 50 µg m<sup>-3</sup> above background as an hourly mean (FDMS measurements)
- Re-examined in work for HS2
  - Assembled database of 1.8 million reference equivalent measurements from nine construction sites.
  - Construction period vs pre & post scheme to determine “trigger” value
  - A revised trigger concentration of 190 µg m<sup>-3</sup> is recommended. This should be measured as an hourly mean.
  - False alarms should be limited to around 0.1 % of time

# Monitoring - Information



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## Projects Map

- Argent - King's Cross Central
- BAM Construction - South Camden
- BAM Construction - Swiss Cottage
- BAM Construction Ltd
- Berkeley Group, City Forum, Islington
- Camden - Freight Lane CMA trials
- Catalyst - Wornington Green
- Construction Demonstration
- Ealing - Horn Lane
- Environment Agency W4F, Orpington
- Keltbray - Earl's Court Exhibition Centre
- Laign O'Rourke - Nine Elms NLE
- Lend Lease - Heygate Estate
- Vinchi Bam - Victoria Station Upgrade

This map shows projects where measurements are available. Select a project from the list or map to show details. Access beyond this page is restricted to authorised users.

[Go back to the projects overview](#)



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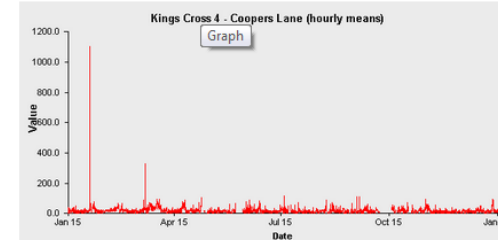
## Graphing tools

- Select time period: 1 Jan 2015 to 2 Jan 2018
- Select averaging period: Hourly

[replot the graph](#)

Warning: Data for species PM10 for selected period has not been ratified and must be considered with care. Why?

View Period » 1-Jan-2015 to 2-Jan-2016



### Air Pollution Forecast

Today

**Low**

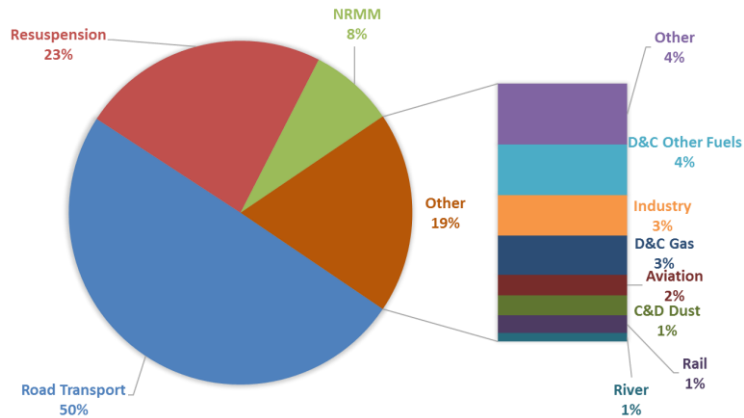
[More information and health advice](#)

### Tweets by @ConstruDustUK

- Construction Dust UK @ConstruDustUK  
#London boroughs can access the @LDN\_environment  
#construction #NRMM register for #planning #compliance & enforce... buff.ly/1NSXoHJ
- Construction Dust UK @ConstruDustUK  
Working together to improve #London's #air via @LDN\_environment

# Fugitive Dust

## PM<sub>10</sub> Emission Inventory

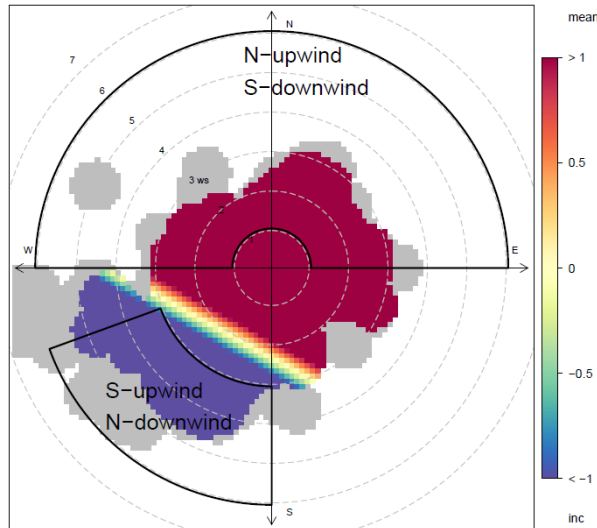


- The importance of fugitive dust tends to be localised
- Local control – damping down, mist cannons, removal of material, covering or seeding of stockpiles all effectively reduce impact
- Vehicle track out can see the impacts spread for larger distances – wheel washes, street sweeping and dust suppressants are all viable methods to minimise impacts
- Quantifying the impacts of these approaches in ambient environment is very challenging:
  - Need to control for temporal changes in emissions
  - Need to control for meteorology
  - Measurement uncertainty of indicative instruments  $\approx$  50%
  - Evidence is mixed...

# MAQF - Heygate Estate, Southwark



- Applications of water, Calcium Magnesium Acetate (CMA) once and twice a day
- Tarmac & unpaved road
- CMA was more effective than water on tarmac road
- No methods were effective on unpaved road
- Impact was greatest during dry conditions (>66% for CMA)

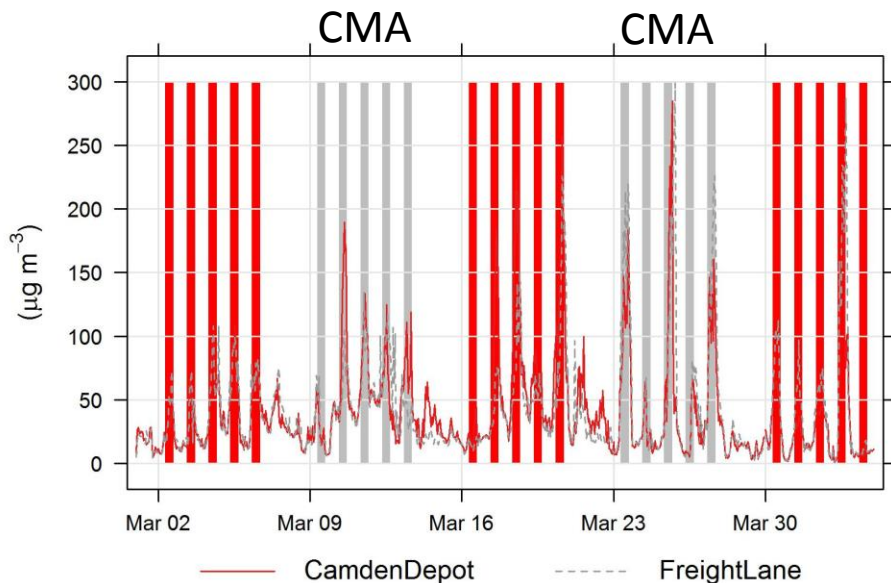




# MAQF – Freight Lane, Camden

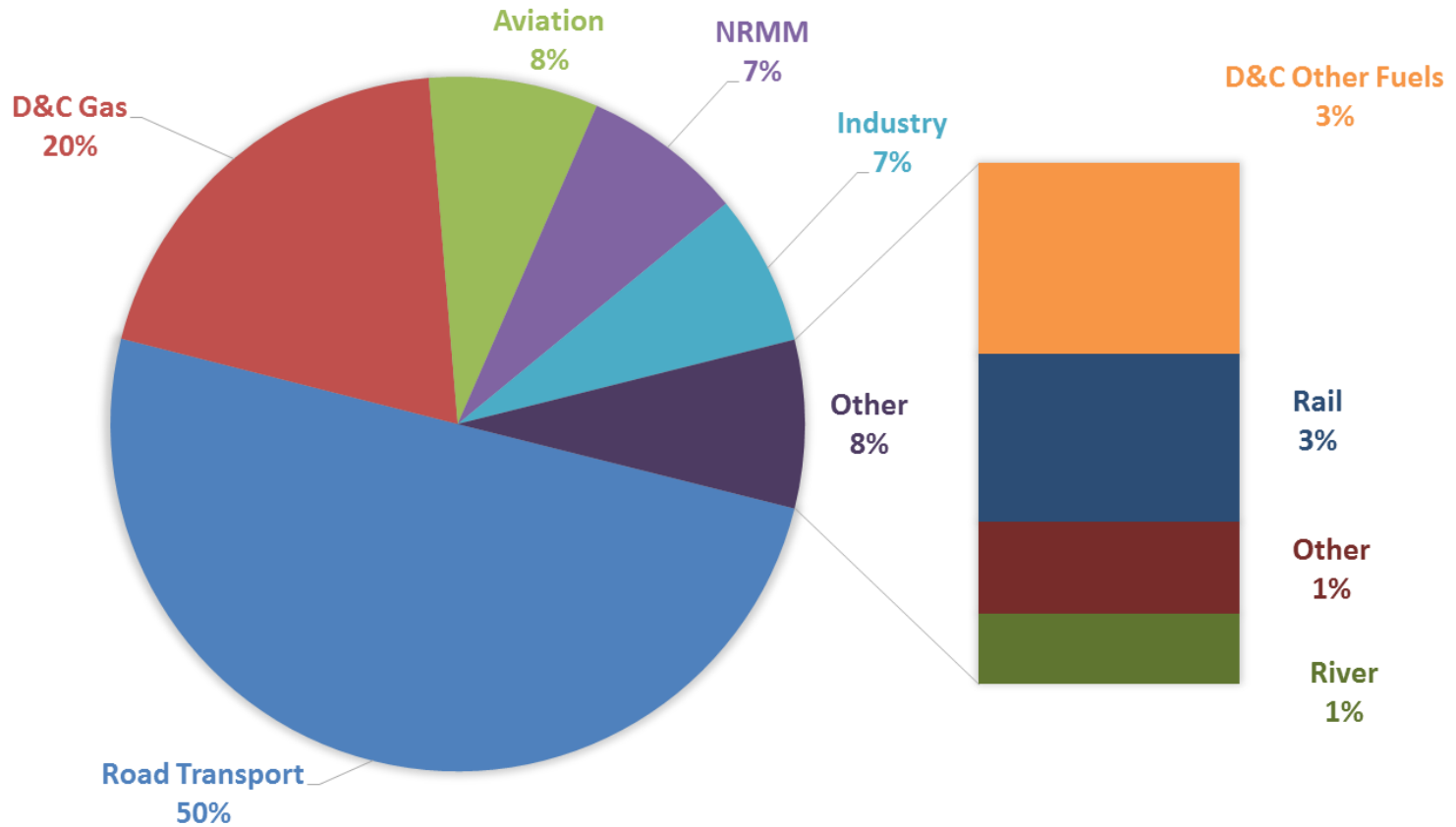


- Compare the mean values during operational hours (8am – 5pm) for the weekdays of application against those when there was no CMA applied
- Increases in concentrations 3 out of 4 comparisons
- Reason for lack of response likely due to:
  - variations in vehicle flow
  - inadequate application of CMA to last for 9 hour analysis period
- Evidence for efficacy of CMA is mixed
- CMA is expensive - £800 per application day



# Exhaust Emissions

## NO<sub>x</sub> Emissions Inventory





# How far do off-road EU emission limit values lag behind the on-road sector?

Emission limits PM

Euro IV truck/bus (LEZ compliant) = 0.02 g/kWh

Stage IIIA Excavator = 0.2-0.6 g/kWh

Stage IV Excavator = 0.025 g/kWh

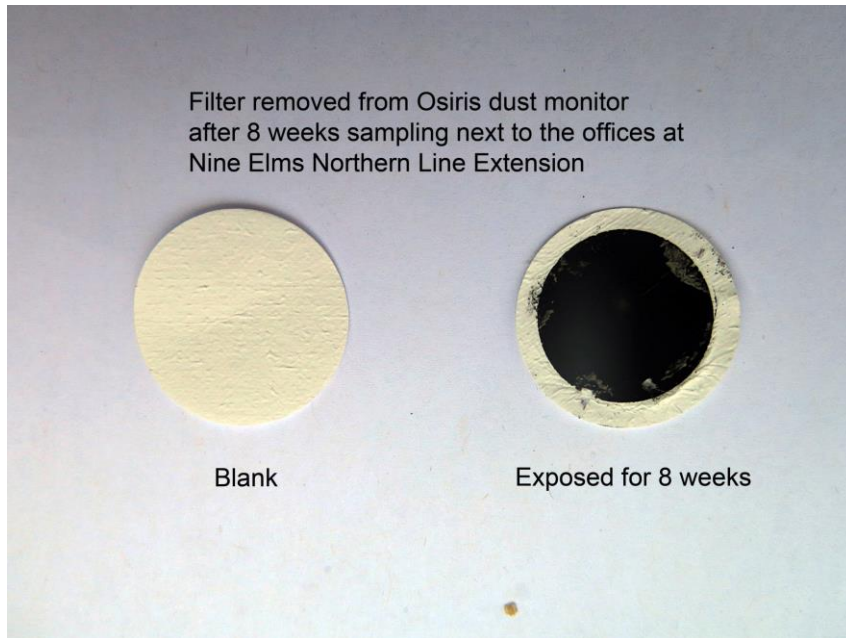


Stage IIIA Excavator

=



# Worker Exposure



- Construction dust (silica, wood, lower tox dusts)
- 40% of new cancer registrations/deaths are to construction workers (CITB)
- Estimated that more than 500 construction workers die from exposure to silica dust every year....more than 10 per week (CITB)
- Exposure regulated by Workplace Exposure Limits (WEL) for inhalable and respirable dust
- WHO classified diesel engine exhaust as carcinogenic to humans (Group 1)
- WEL for NO at (2 ppm or 2.5 mg m<sup>-3</sup>) by 31<sup>st</sup> August 2018.

# DEMiSt Crossrail



- Characterise driver/operative exposure to inhaled diesel emissions
- Identification of dominant variables
- Identify potential intervention methods









# LONDON LOW EMISSION CONSTRUCTION PARTNERSHIP



**Working with industry**



# Industry Outreach


CleanAirUK and 1 other Retweeted

**IAQM** @IAQM\_UK · Jul 20

More speakers for #RTCA have been announced @danielmarsh will be talking about building a cleaner future for London [iaqm.co.uk/event/routes-t...](http://iaqm.co.uk/event/routes-t...)




THE LONDON BUILD  
**SUSTAINABILITY**  
SUMMIT 2017



“GIVING A PRESENTATION ON DIESEL EMISSION - LONDON LOW EMISSION CONSTRUCTION PARTNERSHIP”

**Daniel Marsh**  
Senior Air Quality Analyst, London Low Emission Construction Partnership

**LONDON BUILD 2017 EXPO**

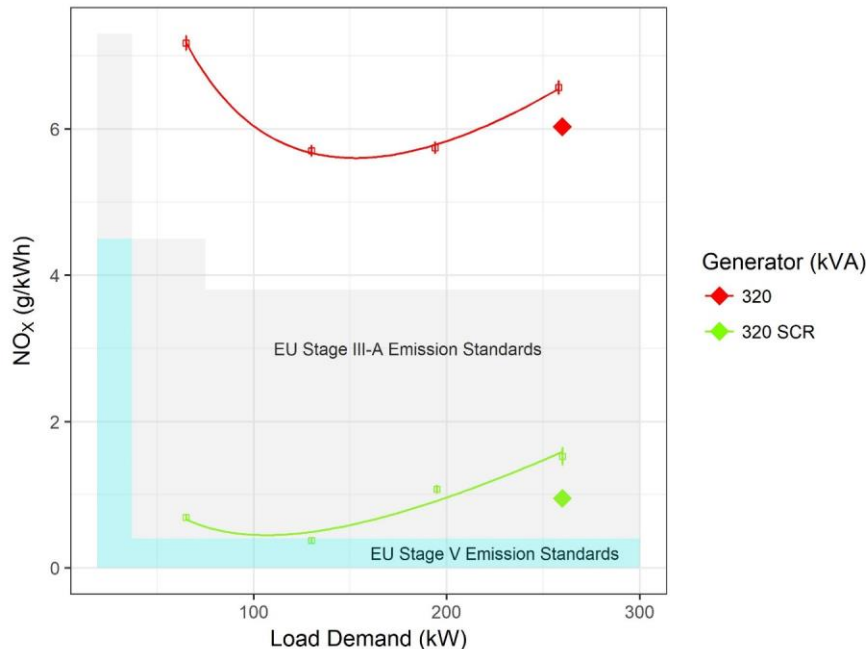
**REGISTER TODAY FOR YOUR FREE TICKETS**  
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**OCTOBER 25<sup>TH</sup> & 26<sup>TH</sup>**  
#londonbuildexpo

# SCR DPF Stage IIIA Generator Retrofit



- Stage IV generators not available until 2021 at earliest
- Regulations jump straight to Stage V with NRMM register exemptions as standard
- Availability of low emission generator could potentially substantially reduce NO<sub>x</sub> and PM<sub>2.5</sub> emissions

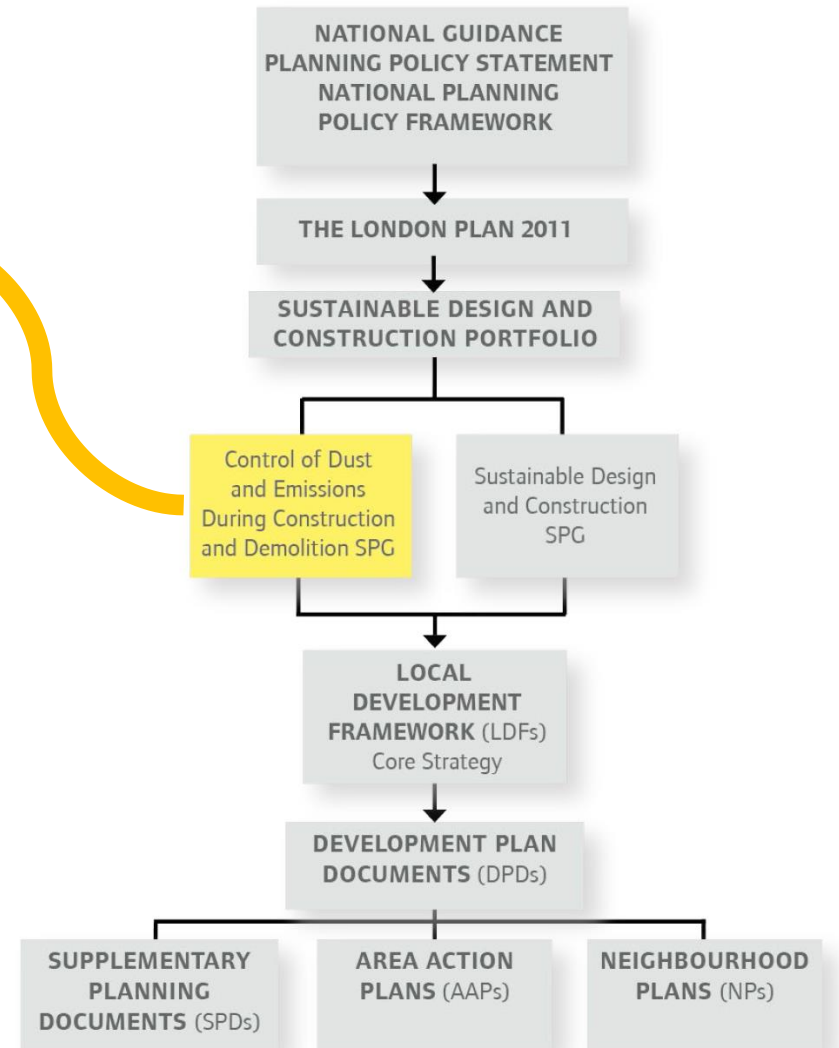


LLECP worked with Aggreko and Green Urban to devise a solution and PEMS test 320 kVA generator before and after retrofit



# Policy and Guidance

- Planning
- Dust Risk Assessment
- Emission Control Measures
- Site Monitoring
- **Cleaner Construction Machinery**



# London's LEZ for NRMM

1st September 2015

- NRMM (net power 37-560kW)
- 'central activity zone' & Canary Wharf Stage IIB
- Major development Stage IIIA

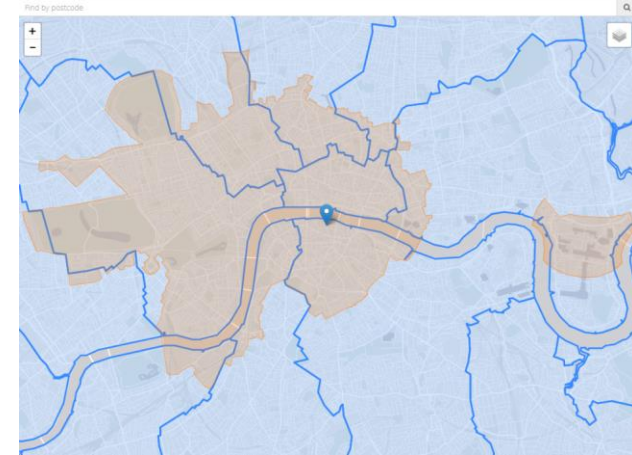
1st September 2020

- CAZ, Canary Wharf Stage IV
- Greater London Stage IIB

2025?

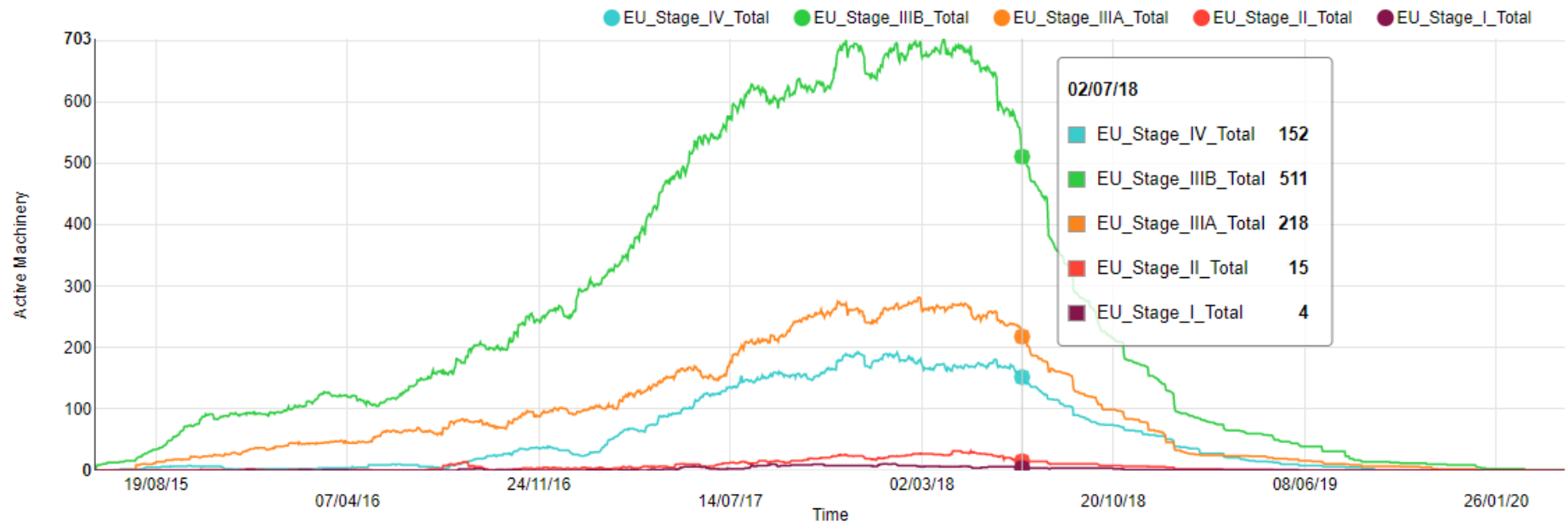
- Introduction of Stage V as a minimum standard

Achieved by - reorganisation, replacement, retrofit or re-engineering



nrmmlondon

# NRMM register – measuring policy impact



***Wider uptake of Stage III B and Stage IV outside CAZ!***



# THE CONTROL OF DUST EMISSIONS DURING CONSTRUCTION AND DEMOLITION SUPPLEMENTARY PLAN

JULY 2014

LONDON PLAN 2011 IMPLEMENTATION FRAMEWORK

IAQM Institute of Air Quality Management

Guidance on the assessment of air quality impacts from demolition and construction

Version 1.1

Engineers for a Cleaner London

A report into civil engineering and construction's contribution to London's air pollution

Final Report



GREAT LONDON AUTHORITY

LONDON LOW EMISSION CONSTRUCTION PARTNERSHIP

SUPPORTED BY MAYOR OF LONDON

Non-Road Mobile Machinery (NRMM) Practical Guide

September 2017



LONDON LOW EMISSION  
CONSTRUCTION PARTNERSHIP

## ***‘Best in class’ guidance***

- LLECP running since 2014
- Current 3 year funding ends in March 2019
- Encourage uptake of low emission approaches
  - ‘Best in Class’
- 5 years of:
  - Industry outreach
  - Measurement methodologies
  - Emissions abatement approaches
- Guidance Document for local authorities (for industry also)
- This will aim to
  - condense all the information and learnings from both rounds of the LLECP
  - publish in one of the Institute of Civil Engineering Journals.
  - integrate this into the LLECP website to create a live resource
  - Delivered in Mar 2019



Small sensors Active site management	Dust suppressants Street sweeping Active site management	Engine technology Retrofit Cleaner fuels Hybrids Hydrogen	Innovation from OEMs CLPs Consolidation centres	Improved EI's Tighter emissions regulation NRMM LEZ in other cities	Increased awareness of exhaust emissions Diesel exposure in H&S
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**MAQF - London Low Emission Construction Partnership (LLECP)**

High Speed2	Dust Suppressants	Construction Logistic plans			DEMIST
MAQF - Heygate		NRMM Register			
SPG Trigger Levels		NRMM Emissions Inventory PhD			

Monitoring	Fugitive Dust Emissions	Exhaust Emissions	Working with Industry	Policy and Guidance	Worker Exposure
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**CONSTRUCTION AND DEMOLITION**

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**MAYOR OF LONDON**



THE ROYAL BOROUGH OF  
**KENSINGTON  
AND CHELSEA**



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keltbray



Hanson  
HEIDELBERGCEMENT Group

Sir Robert  
McALPINE

Lend Lease

Berkeley  
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AND  
PARK ROYAL  
DEVELOPMENT  
CORPORATION



mace

LAFARGE  
TARMAC

hs  
engine for growth



energy  
saving  
trust



CANARY WHARF  
CONTRACTORS



ENERGY SOLUTIONS

British  
Land

# Acknowledgements

Daniel Marsh

Carl Desouza

Gary Fuller

Anna Font

John Casey

**Thank you for  
listening!**

MRC-PHE

Centre for Environment & Health

