



Measured roadside AQ improvements after the  
introduction of low emission buses

October 2017

# TRL – who we are

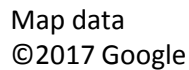
- TRL was established in 1933 within the British Government as the UK's Transport Research Laboratory and was subsequently privatised in 1996. Today, TRL has more than 1,000 clients across 145 countries, driving positive societal and economic benefit worldwide.



# TRL – who we are

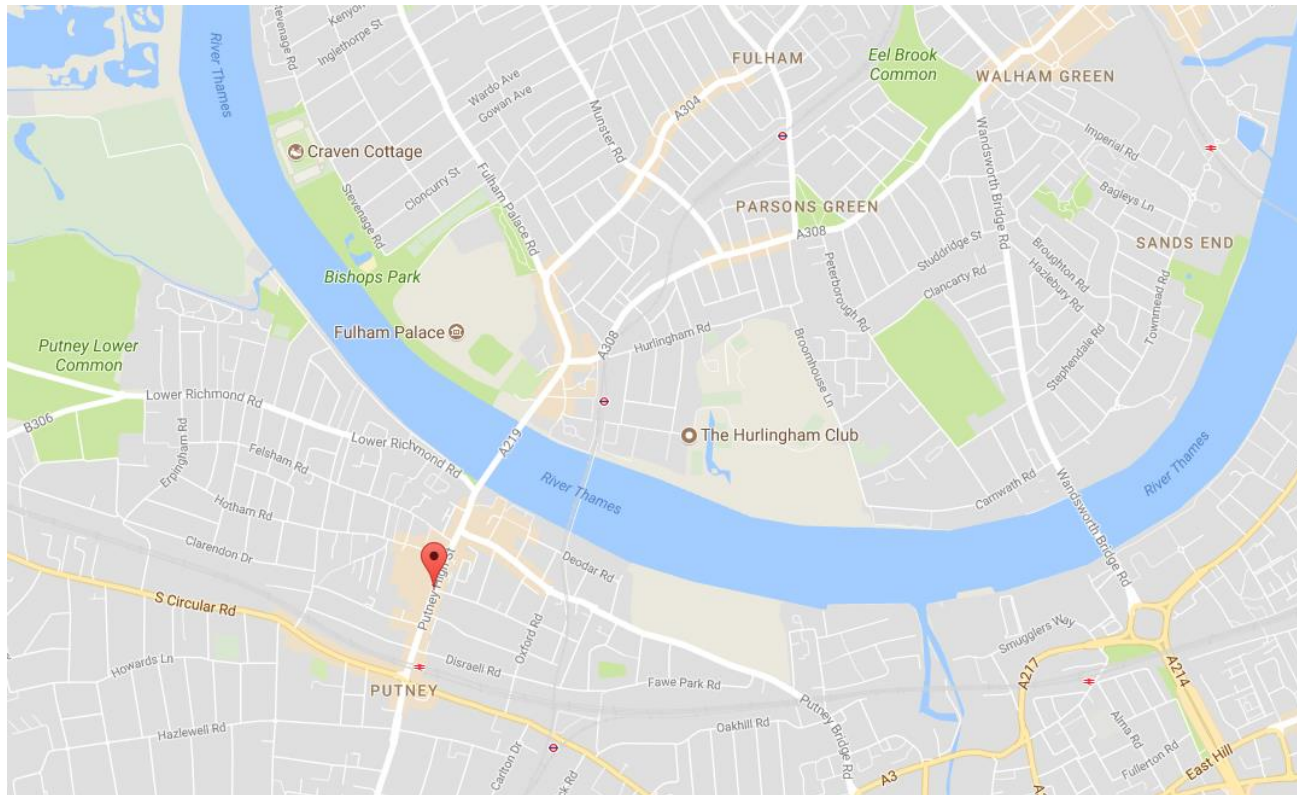
- Headquarters in Wokingham, Berkshire
- Offices in Bristol, Birmingham, Manchester and Edinburgh
- Vehicle safety
- Road safety
- Pavement structures
- Emissions & air quality
- ULEVs
- Recent news
  - Platooning







# Putney High Street



Map data  
©2017 Google

# Putney High Street

- Street canyon
- Busy
- Lots of buses



Image ©2017 Google

# Putney High Street

- Street canyon
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Image ©2017 Google

# Putney High Street



Map data  
©2017 Google

**North bound buses  
17:00 to 17:30**

**27 scheduled buses**

Route	Destination	Time
93	Putney Bridge	17:01
14	Warren Street	17:01
430	South Kensington	17:01
74	Baker Street	17:02
39	Putney Bridge	17:03
430	South Kensington	17:07
39	Putney Bridge	17:10
93	Putney Bridge	17:10
93	Putney Bridge	17:11
14	Warren Street	17:11
85	Putney Bridge	17:11
424	Fulham, Craven Cottage	17:12
74	Baker Street	17:12
430	South Kensington	17:15
93	Putney Bridge	17:15
39	Putney Bridge	17:17
85	Putney Bridge	17:18
14	Warren Street	17:19
74	Baker Street	17:22
430	South Kensington	17:23
39	Putney Bridge	17:23
93	Putney Bridge	17:26
85	Putney Bridge	17:27
14	Warren Street	17:27
39	Putney Bridge	17:28
85	Putney Bridge	17:28
430	South Kensington	17:30



# Putney High Street – AQ monitoring



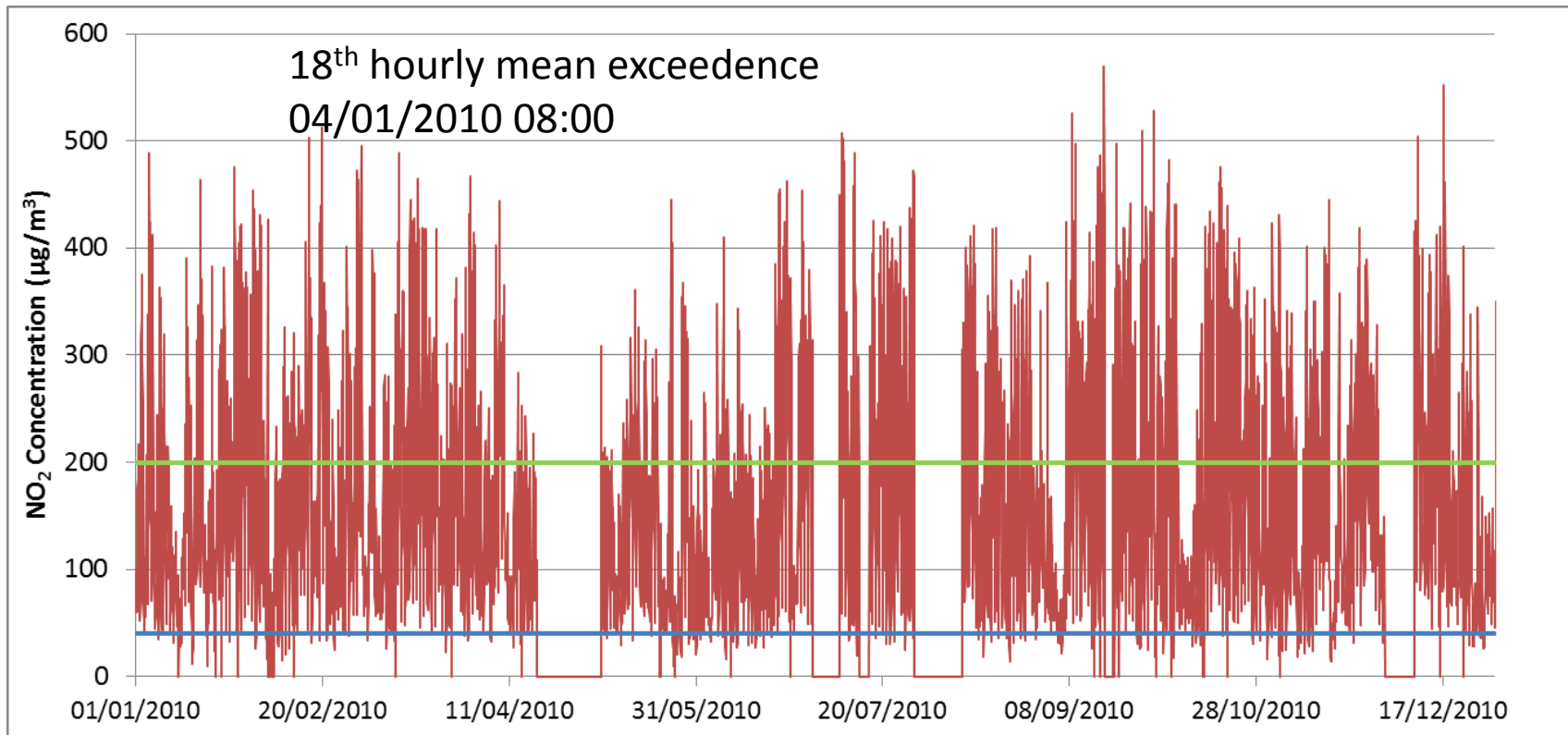
Image ©2017  
Google

# Putney High Street – AQ monitoring

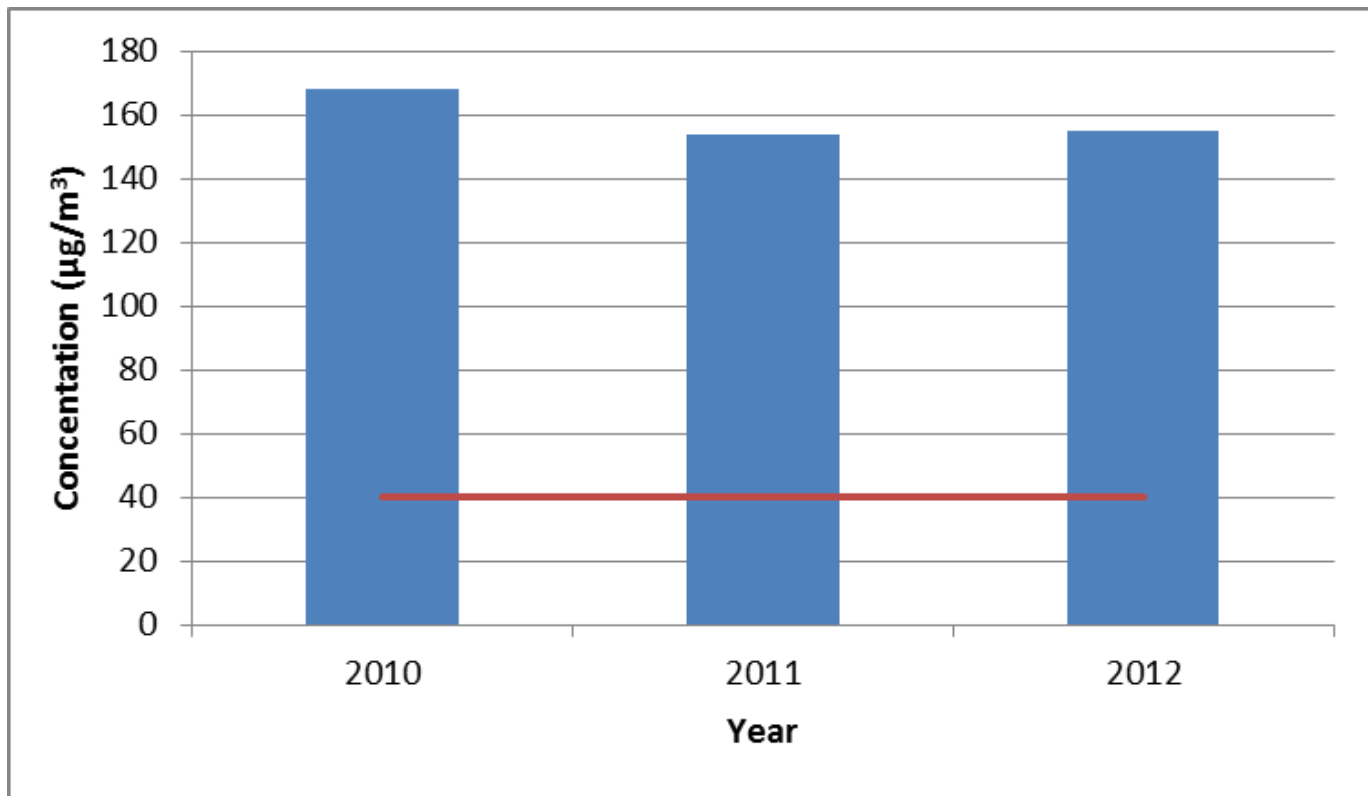


Image ©2017  
Google

# NO<sub>2</sub> hourly concentrations, 2010

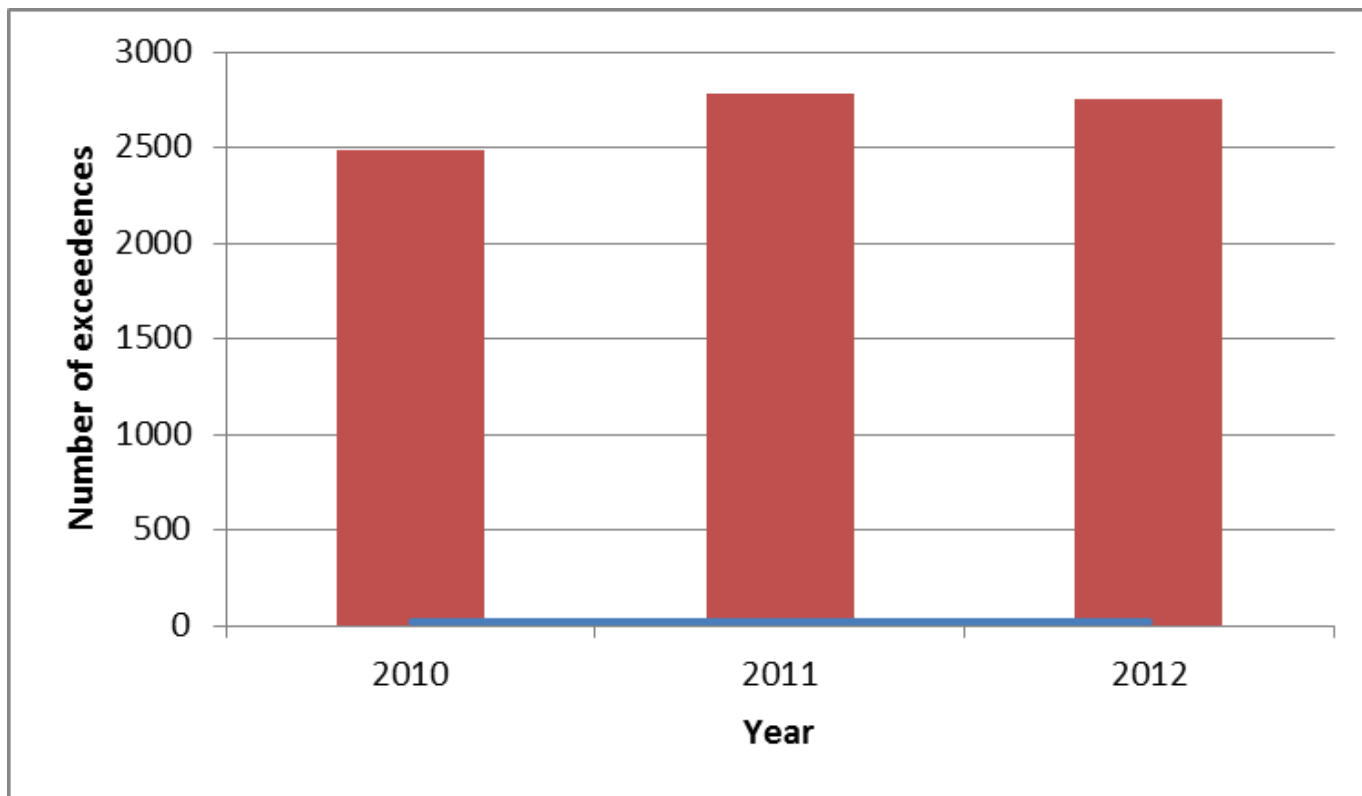


# Annual mean NO<sub>2</sub>, 2010-2012





# Number of exceedences of hourly $200 \mu\text{g}/\text{m}^3$ $\text{NO}_2$ , 2010-2012

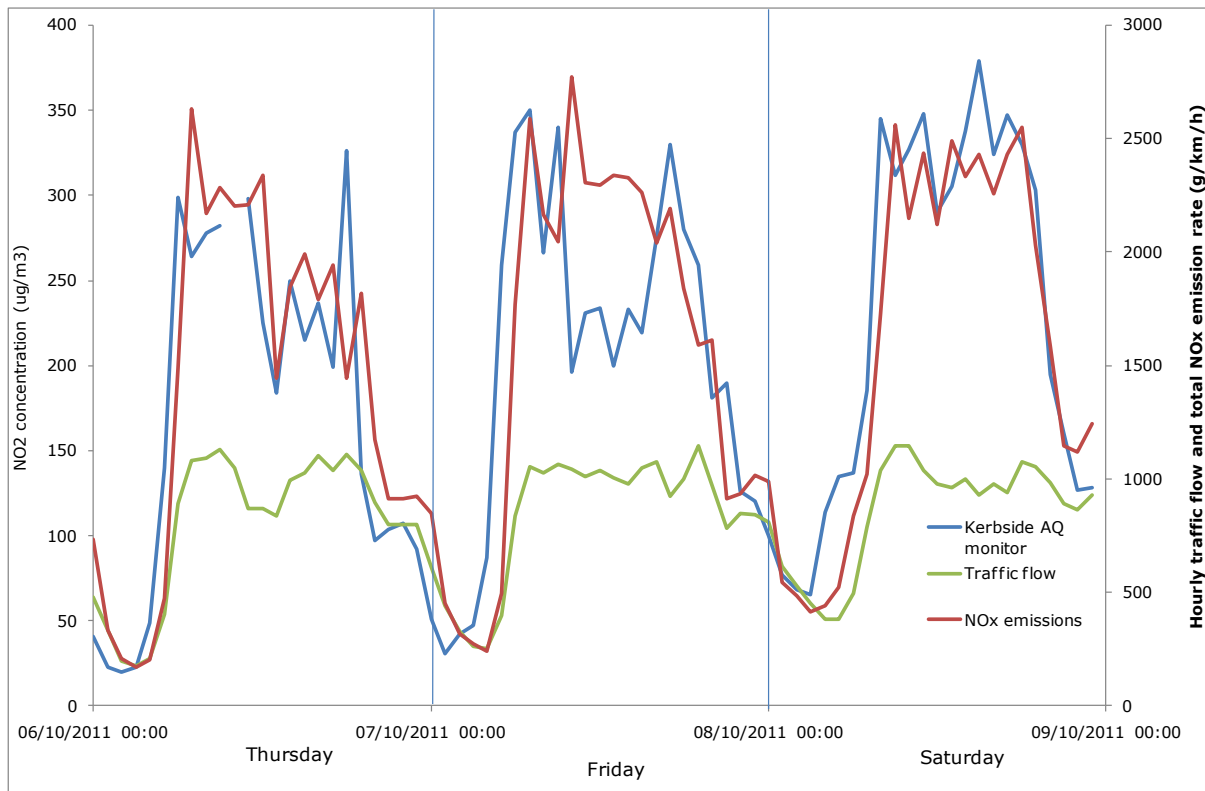


# TRL – source apportionment 2011



- ANPR study over three days – Thursday, Friday & Saturday
- Four cameras (two at north end, two at south end)
- Use registration numbers to get detailed vehicle details from DVLA:
  - Make; model; fuel; size; age (~ Euro standard)
- Derive detailed fleet composition
- Use standard emission factors in Defra's Emissions Factors Toolkit (EFT v4.2.2)
- Compile results by vehicle type

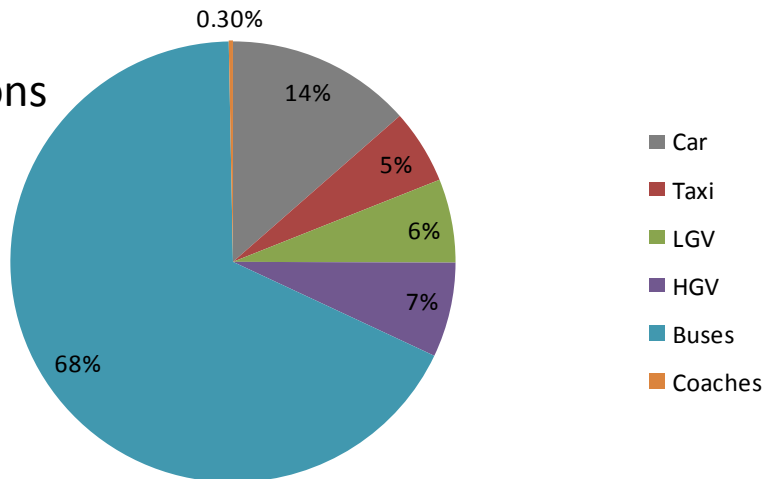
# TRL – source apportionment 2011



# TRL – source apportionment 2011

	Car	Taxi	LGV	HGV	Buses	Coaches
Percent of movements	67%	7%	14%	2%	10%	0%
Percent of NO <sub>x</sub> emissions	14%	5%	6%	7%	<b>68%</b>	0.30%
Percent of PM emissions	35%	14%	23%	7%	21%	0.27%

NO<sub>x</sub>  
emissions



Published Project Report  
PPR595

Creating the future of transport

## Emissions source apportionment – Putney High Street

A Savage and K Turpin

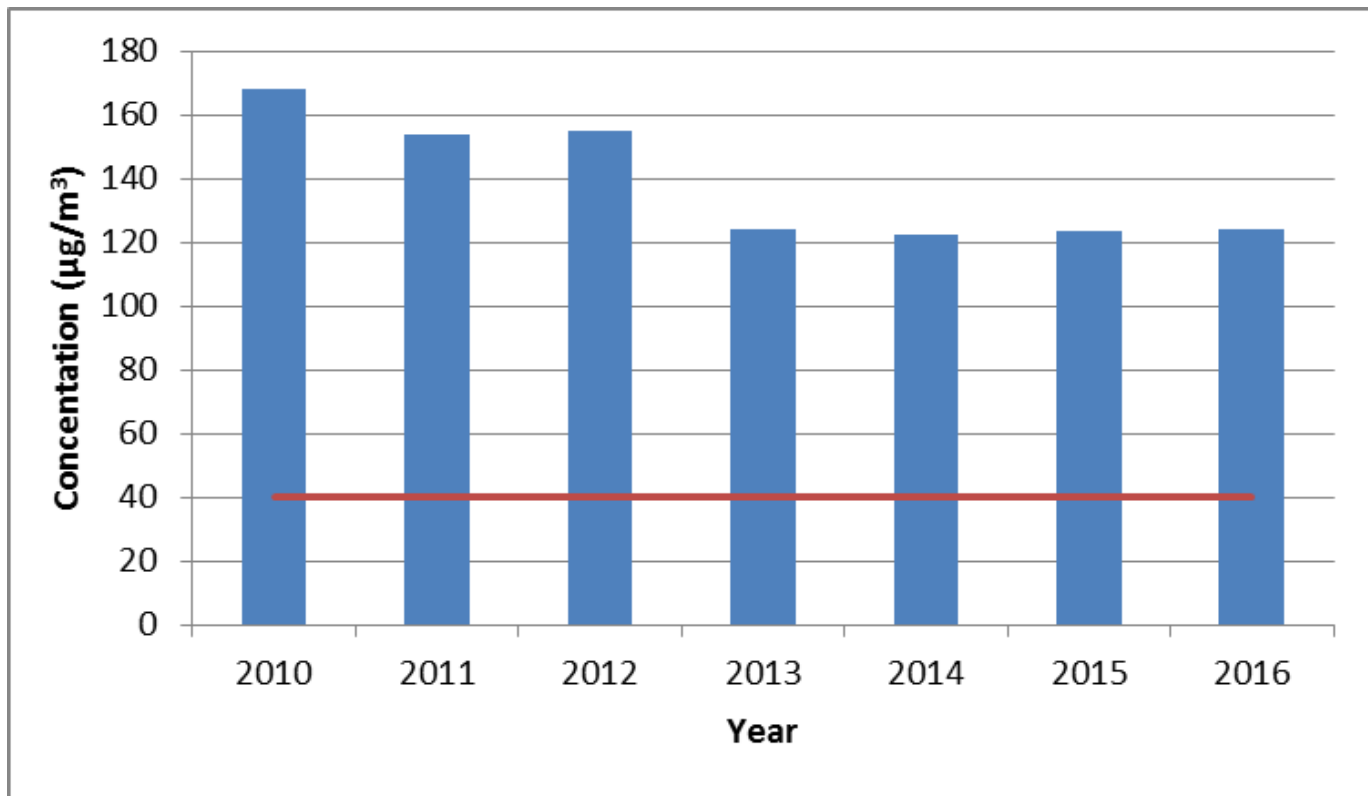




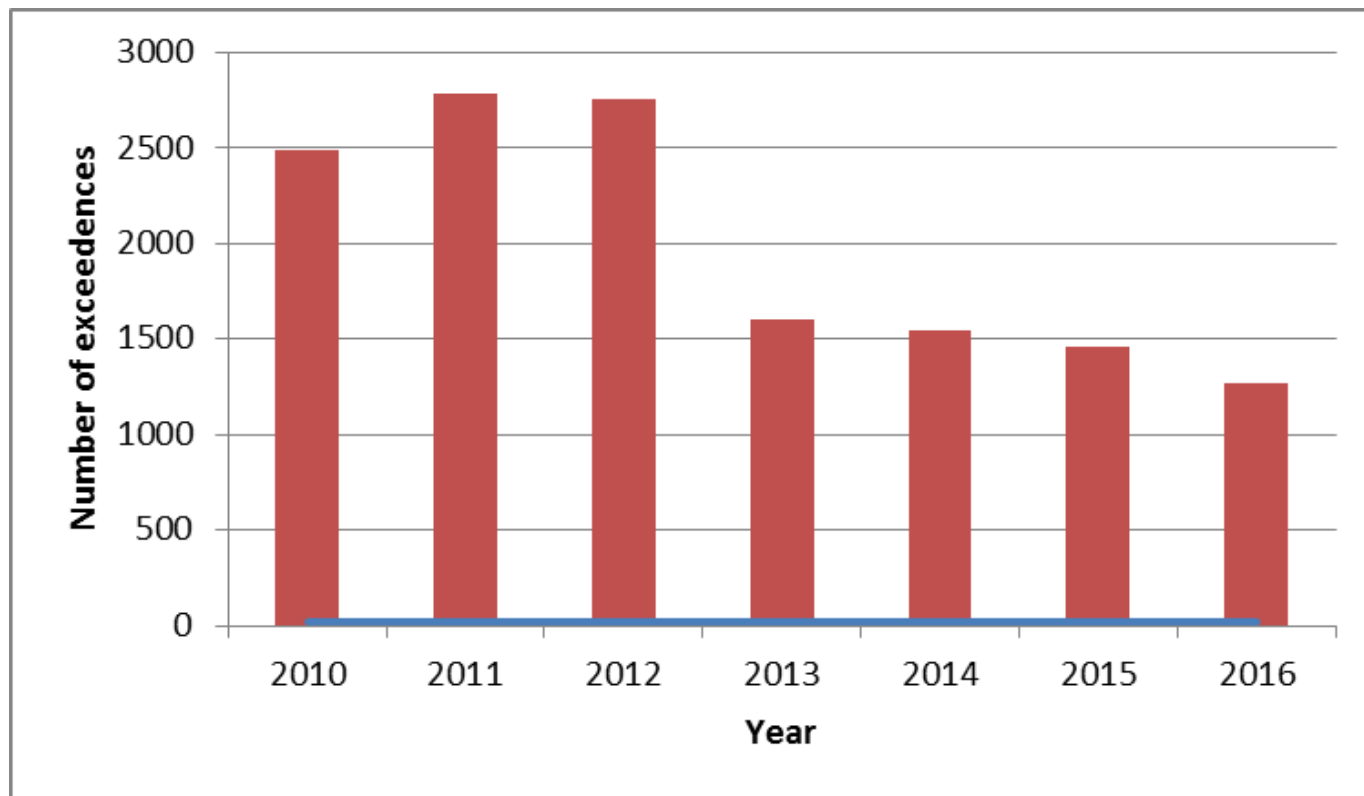
# Bus Retrofit Programme

- 2012: TfL & DfT funded the retrofitting of Euro III buses with SCR
- Putney High Street identified as a focus area
- Optimised SCR system developed between TfL and manufacturers
- Fitted to 93 Euro III double decker buses from Putney Bus Garage
  - January to May 2013
- June 2014: report by King's College London:
  - *"Impact of the bus retrofit programmes on NO<sub>2</sub> concentrations along Putney High Street"*
  - 9% reduction in NO<sub>x</sub> concentrations
  - 14% reduction in NO<sub>2</sub> concentrations

# Annual mean NO<sub>2</sub>, 2010-2016



# Number of exceedences of hourly $200 \mu\text{g}/\text{m}^3$ $\text{NO}_2$ , 2010-2016



# Low Emission Bus Zone

- March 2017 :

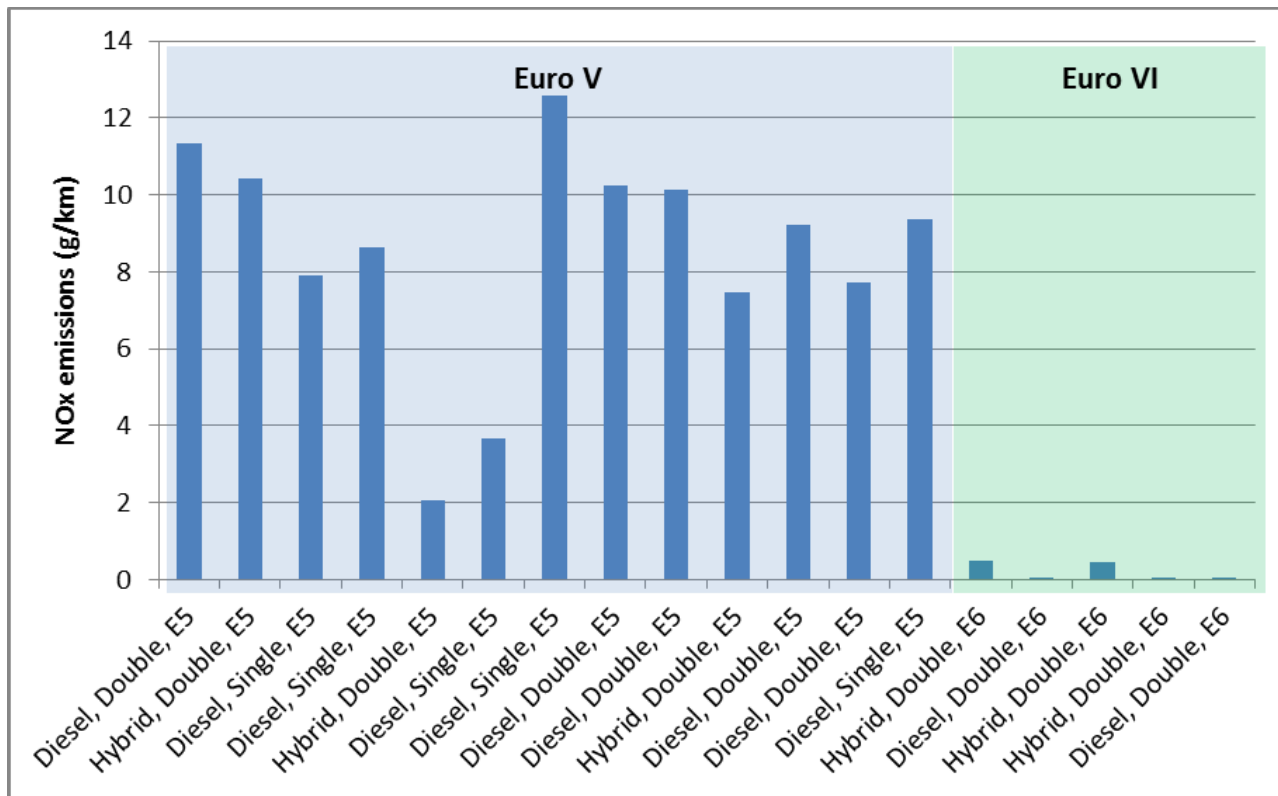
*The Mayor of London, Sadiq Khan, today delivered the capital's first ever Low Emission Bus Zone in one of the most polluted areas of London, Putney High Street. The clean bus zone, which runs a total of 145 buses on seven scheduled routes, will now be serviced by cleaner buses in a bold move to cut harmful nitrogen oxide (NOx) emissions.*

<https://tfl.gov.uk/info-for/media/press-releases/2017/march/gla---mayor-launches-first-low-emission-bus-zone>

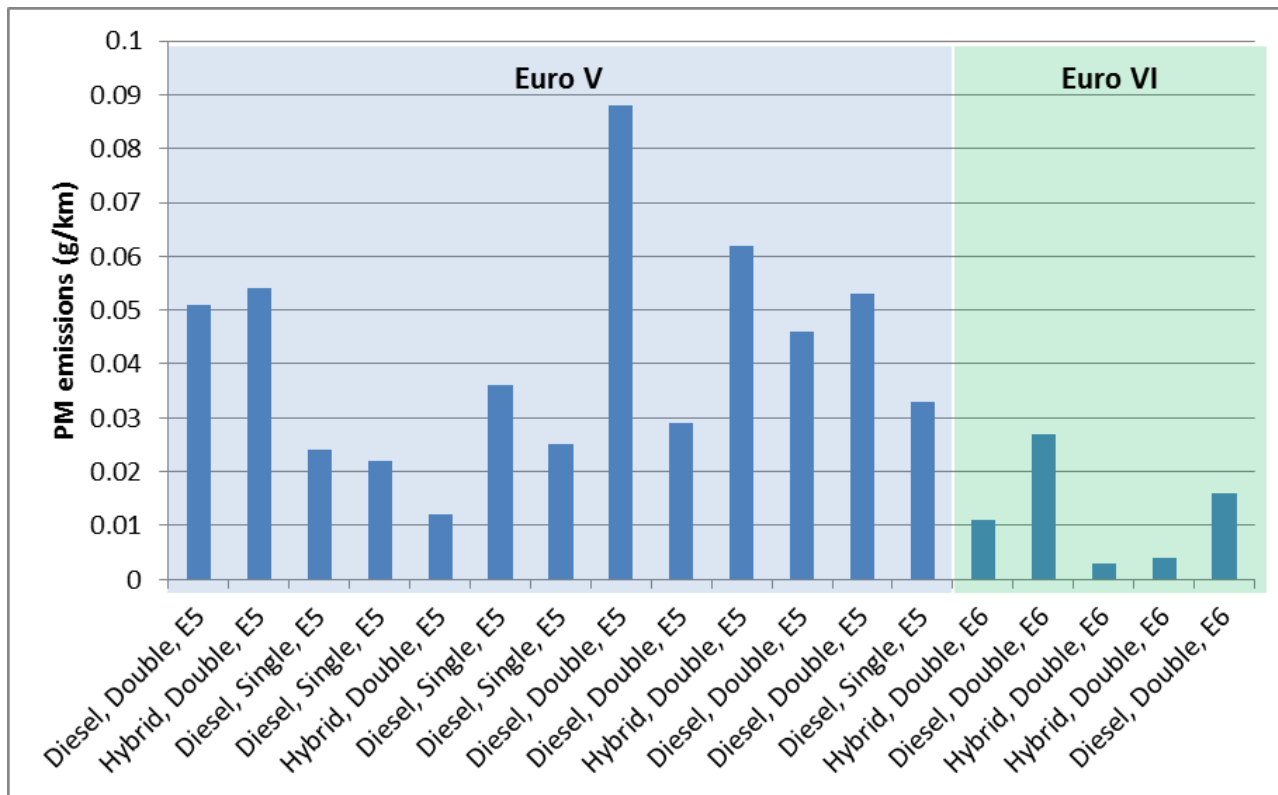
All old buses replaced by Euro VI buses



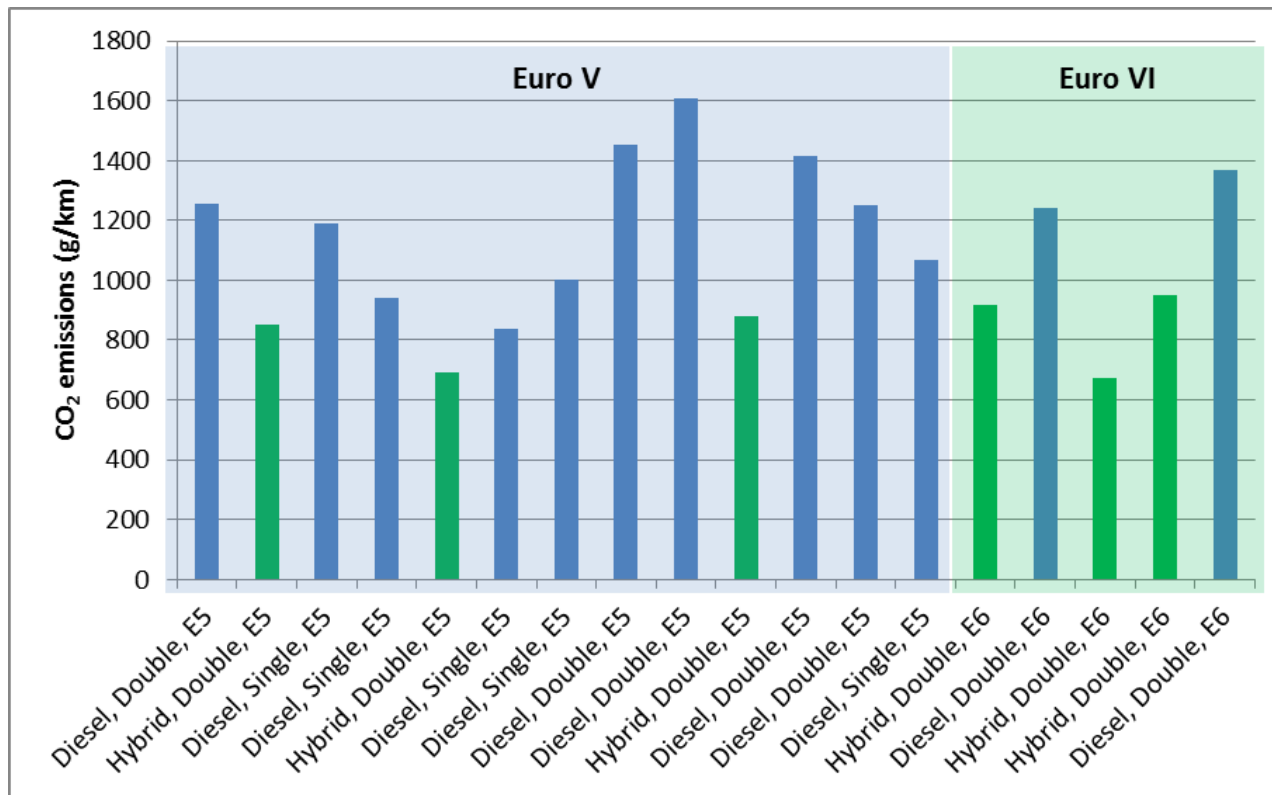
# Bus emissions - NOx



# Bus emissions – PM



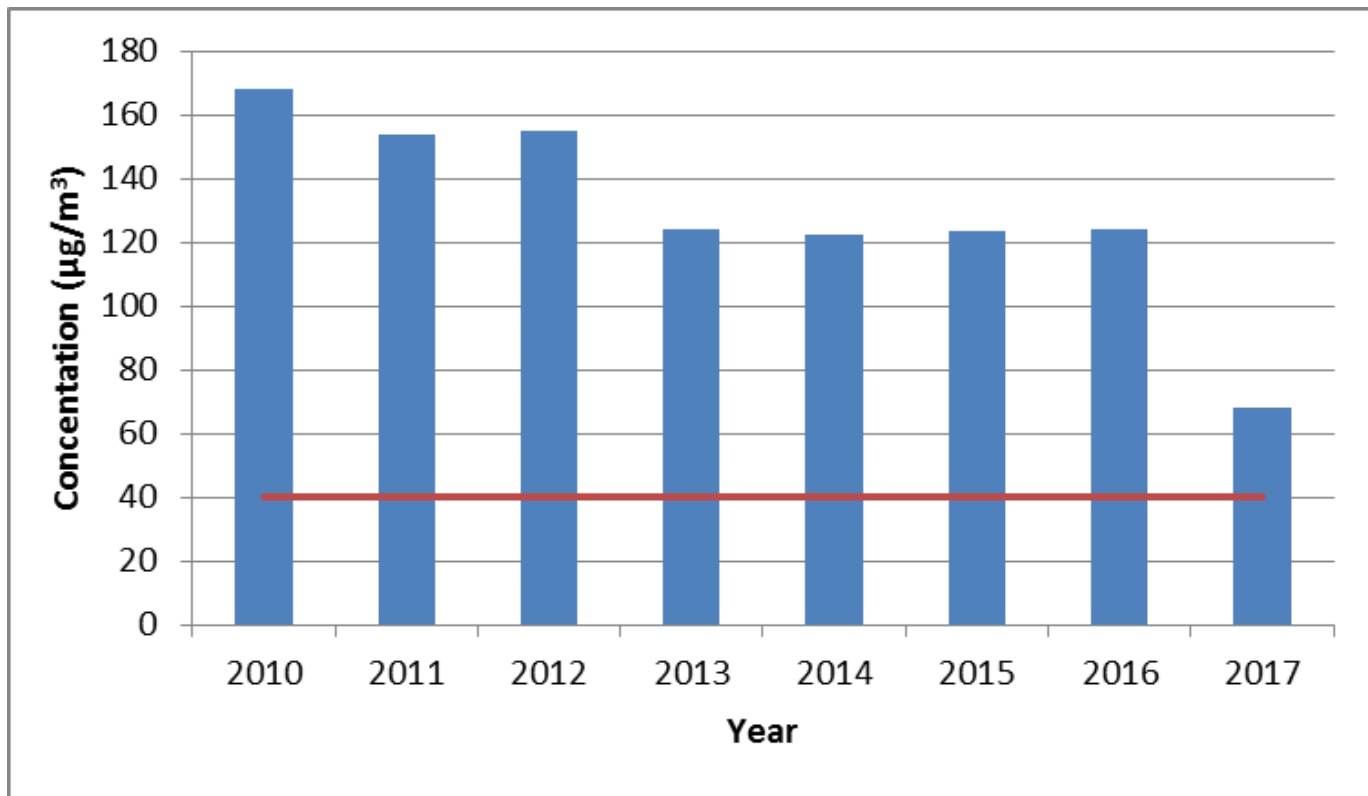
# Bus emissions – CO<sub>2</sub>



## 2017 Monitoring Data

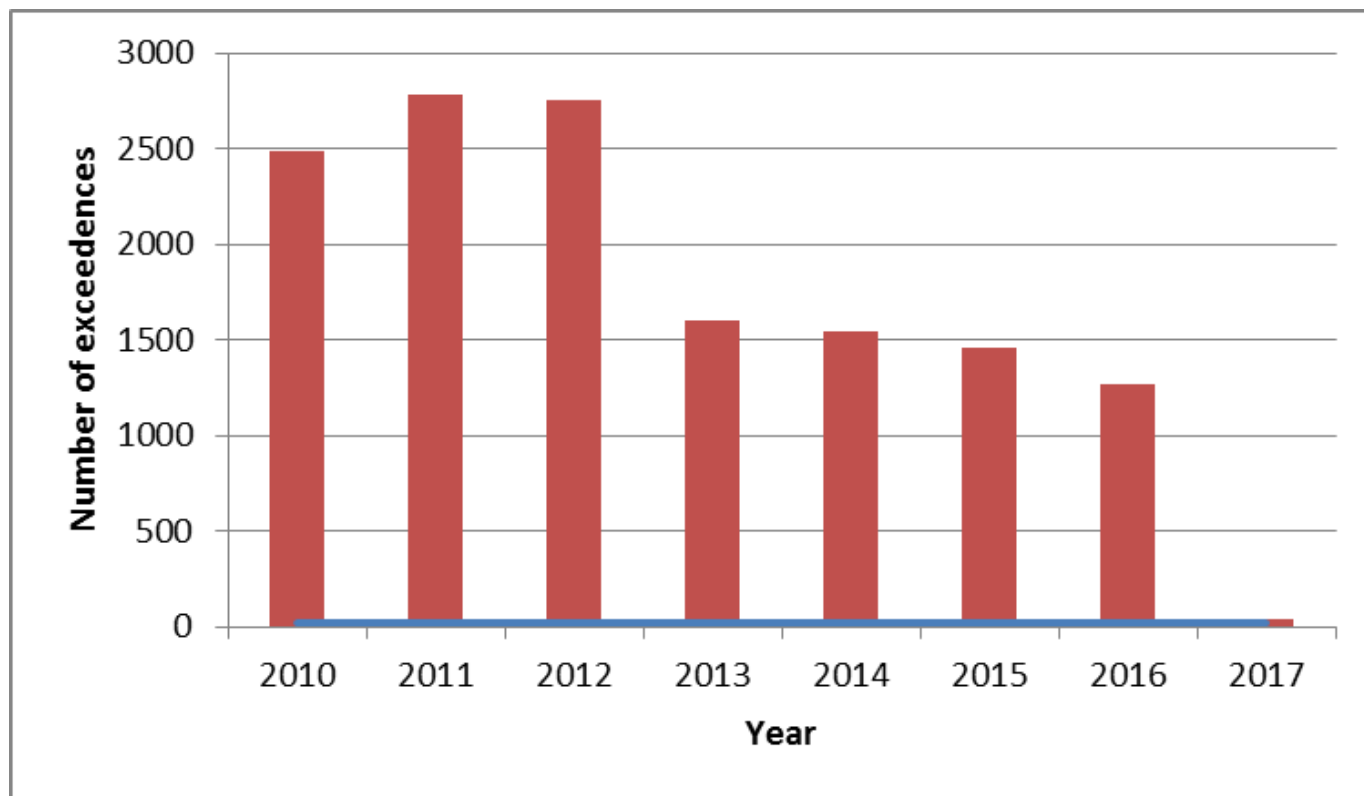
- Warning: Provisional Data
- 1 January 2017 to 4 October 2017

# Annual mean NO<sub>2</sub>, 2010-2017

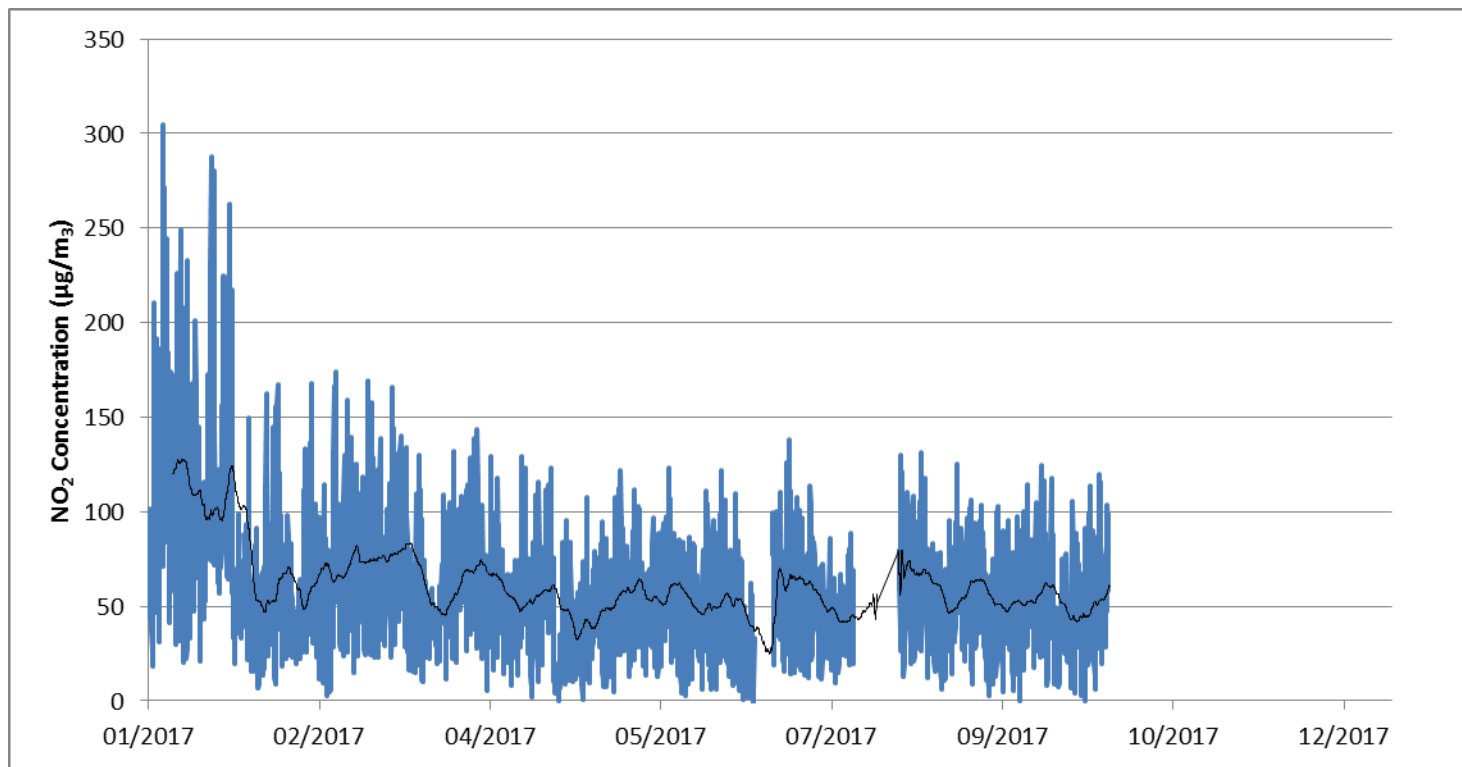




# Number of exceedences of hourly $200 \mu\text{g}/\text{m}^3$ $\text{NO}_2$ , 2010-2017



# Putney Façade - 2017



And finally



# DfT & OLEV - LEBS

- *Department for Transport and Office for Low Emission Vehicles*
- **Low Emission Bus Scheme**
  - Increase the take up of low and ultra-low emission buses, speeding up the transition to an ultra-low emission bus fleet in this country
  - Help improve local air quality in our towns and cities
- The LEBS competition opened during March 2015. The initial winners under the first round of LEBS were announced on 25 July 2016. Further winners were announced on 28 August 2017.
- DfT expect to launch a second round of LEBS in the coming months. This will provide funding to help put more buses on the road over the period 2018 to 2021. More details will be published later in 2017.

# DfT & OLEV – LEBS Winners, 25 July 2016

Bidder	Type of technology	No. of buses	Funding for buses	Funding for infrastructure	Total amount funded
Birmingham City Council and Transport for London	Hydrogen fuel cell	42	£2,814,000	£1,000,000	£3,814,000
Kingston University	Hybrid	7	£347,400		£347,400
Arriva and Merseytravel	Biomethane, Electric, Hybrid	72	£4,701,629	£280,720	£4,982,349
Milton Keynes Borough Council	Electric	11	£1,630,121	£127,500	£1,757,621
Nottingham City Council	Electric			£921,154	£921,154
Nottinghamshire County Council	Electric	2	£301,900	£225,000	£526,900
Nottingham City Transport	Biomethane	53	£2,899,763	£1,533,638	£4,433,401
Reading Buses	Biomethane	16	£63,655	£1,658,000	£1,721,655
Sheffield City Region Combined Authority	Hybrid	44	£1,320,000		£1,320,000
Transdev Blazefield	Electric	8	£1,440,000	£815,700	£2,255,700
Transport for London	Electric	34	£4,584,000	£416,000	£5,000,000
West Midlands Travel Limited	Hybrid, Electric	29	£2,399,620	£675,000	£3,074,620
West Yorkshire Combined Authority	Hybrid	8	£234,000		£234,000
<b>TOTAL</b>		<b>326</b>	<b>£22,736,088</b>	<b>£7,652,712</b>	<b>£30,388,800</b>

# DfT & OLEV – LEBS Winners, 28 August 2017

Bidder	Type of technology	No. of buses	Funding for buses	Funding for infrastructure	Total amount funded
<b>Denbighshire County Council</b>	<b>Electric</b>	<b>4</b>	<b>£468,000</b>	<b>£24,750</b>	<b>£492,750</b>
Go South Coast/Wiltshire County Council	Electric	3	£497,652	-	£497,652
West of England	Bio-Methane	110	£3,082,035	£1,708,875	£4,790,910
Surrey County Council	Electric	9	£1,492,578	£56,250	£1,548,828
The Big Lemon	Electric	3	£475,626	£38,326	£513,952
York City Council	Electric	24	£2,704,000	£600,000	£3,304,000
<b>TOTAL</b>		<b>153</b>	<b>£8,719,891</b>	<b>£2,428,201</b>	<b>£11,148,092</b>





# Questions?

## Contact Name

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