

# 2010 Air Quality Progress Report for *Royal Borough of Kensington and Chelsea*

In fulfillment of Part IV of the Environment Act 1995  
Local Air Quality Management

May 2010



THE ROYAL BOROUGH OF  
KENSINGTON  
AND CHELSEA

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# Executive Summary

Under the Government's Air Quality Strategy, the Council is required to assess air quality within the borough annually. In 2000, as a result of our review, the whole borough was declared an Air Quality Management Area (AQMA) on the basis that certain government air quality objectives, for nitrogen dioxide and particulate matter, would not be met. In 2003, the Council published its first Air Quality Action Plan (AQAP), which set out the steps the Council is taking to work towards meeting these objectives. In September 2009 the Council published a revised Action Plan to develop new ideas following an extensive consultation with residents and other stakeholders.

This latest Progress Report provides information on the review and assessment of air quality in the borough. An examination of monitoring data collected during 2009 has been undertaken for the strategy pollutants; these are nitrogen dioxide (NO<sub>2</sub>), particulate matter (PM<sub>10</sub>), carbon monoxide, benzene, 1,3-butadiene, lead, sulphur dioxide and ozone. Information on benzo(α)pyrene which is used as a marker for a complex group of hydrocarbons (PAH), ozone and PM<sub>2.5</sub> are also included, though there is no requirement to do so. This report also provides a summary of the implementation of the actions contained in the new AQAP 2009-2014 in Section 9.

The review of the monitoring data shows that most pollutants remain well within their respective objective levels. However levels of **NO<sub>2</sub> continue to exceed objective levels** at many locations. Whilst some of the background monitoring locations have shown a downward trend for NO<sub>2</sub>, significant reductions (up to 50µg/m<sup>3</sup>) at the worst affected locations are required to meet objective levels.

For PM<sub>10</sub>, levels are just below the annual mean objective at the monitoring sites but **continue to exceed the daily mean objective at one monitoring site**. As the annual mean objective for PM<sub>10</sub> has only been achieved over a relatively short time period, and uncertainty over the extent of exceedences of the daily average objective means that no change to the approach being taken is proposed.

Following the previous Updating and Screening Assessment, a review of pollution sources had determined that a detailed assessment of nitrogen dioxide in the vicinity of the Paddington to Swansea railway line was required. Subsequent monitoring shows that this is not likely to be a significant source. The borough has already been declared an AQMA on the basis of exceedences therefore no changes are required to the Air Quality Management Order.

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# 1 Introduction

## 1.1 Description of Local Authority Area

The Royal Borough of Kensington and Chelsea is a high density urban environment located to the west of central London. The borough extends from Chelsea Embankment in the south, through Kensington, Notting Hill and Ladbroke Grove up to Kensal Green to the north. It is bounded by Kensington Gardens to the east and by the West London Railway Line to the west. Kensington and Chelsea has very little open space compared to other boroughs, however it has 26 public parks and open spaces, eight of which are categorised as major parks due to a combination of size and range of facilities. It is home to many major museums and universities.

At the time of the 2001 census, the borough had a population of approximately 160,000 (more recent estimates place it around 175,000) and the highest population density (131 people per hectare) of all local authorities in England and Wales. However, with the exception of the City of London it is the smallest London borough. In addition to the resident population thousands of people come into the borough each day to work and visit. About 30,000 visitors stay each night.

The borough is primarily a residential area with a large volume of commuter traffic, people both travelling into the area and local residents travelling within and outside the borough. The area is relatively well served by the London Underground network with the Circle, District, Central, Piccadilly and Hammersmith and City Lines running through the borough. There is no currently over-ground rail service within the borough, although there are stations just outside the borough at Kensington Olympia, West Brompton, and Shepherd's Bush. There is an extensive bus network in the borough.

There are 207 km (127.6 miles) of roads in the borough; 28 km (17 miles) (13.5 per cent) are A roads, ten km (six miles) (4.8 percent) are B roads and the remaining 169 km (105 miles) (81.6 per cent) are C roads or unclassified. Six per cent (12.5 km (7.8 miles)) of the roads in the borough are designated as part of the Transport for London Road Network (TLRN) managed by TfL. These routes are: Westway (A40), Cromwell Road (A4), Earl's Court one-way system (A3220), Chelsea Embankment (A3212).

The restrictions on the available north/south or east/west routes mean that those routes that are available are heavily trafficked. These routes are also often major retail areas with heavy pedestrian flows. The transport infrastructure has changed relatively little since its major development in the nineteenth century. The most notable changes in recent history have been the construction of the Westway flyover and the decline in the use of the River Thames. However the demands placed upon it have continued to change and the demand for movement of people, goods and services has increased.

The emission sources of pollutants from within the borough are therefore mainly from transport, residential and commercial activities. A large proportion of the pollution

however arises from beyond the borough's immediate area including neighbouring boroughs, the city as a whole and further afield from national and European sources.

## 1.2 Purpose of Progress Report

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

## 1.3 Air Quality Objectives

The air quality objectives applicable to Local Air Quality Management (LAQM) **in England** are set out in the Air Quality (England) Regulations 2000 (SI 928), and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043). They are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre  $\mu\text{g}/\text{m}^3$  (for carbon monoxide the units used are milligrammes per cubic metre,  $\text{mg}/\text{m}^3$ ). Table 1.1 includes the number of permitted exceedences in any given year (where applicable).



**Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England**

<b>Pollutant</b>	<b>Concentration</b>	<b>Measured as</b>	<b>Date to be achieved by</b>
<b>Benzene</b>	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
<b>1,3-Butadiene</b>	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
<b>Carbon monoxide</b>	10.0 $\text{mg}/\text{m}^3$	Running 8-hour mean	31.12.2003
<b>Lead</b>	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
<b>Nitrogen dioxide</b>	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
<b>Particles (PM<sub>10</sub>) (gravimetric)</b>	50 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
<b>Sulphur dioxide</b>	350 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

## 1.4 Summary of Previous Review and Assessments

### 1.4.1 First Round of Review and Assessment

#### Stages One - Three

The Council completed the first round of Review and Assessment in 2000. It consisted of three stages which involved examining the sources, identifying the contribution of each source followed by a review of monitoring data, and finally a prediction of concentrations for the key deadlines using modelling. By the end of stage three after a process of elimination the following conclusions were reached.

**Table 1.2 Summary of Results of First Round of Review and Assessment**

Pollutant	Assessment
<b>NO<sub>2</sub></b>	High likelihood the borough would exceed the annual mean, and hourly mean objective along many of the major roads in the borough.
<b>PM<sub>10</sub></b>	High likelihood that the borough would exceed the 24 hour mean objective at a few locations.
<b>SO<sub>2</sub></b>	Virtually no likelihood that the borough would exceed the objectives for sulphur dioxide.
<b>CO</b>	No likelihood that the borough would exceed the objectives for carbon monoxide.

Following a major public consultation in the summer of 2000 a decision was reached by the full Council to declare the whole of the borough as an Air Quality Management Area (AQMA). The Order making the declaration came into force on the 6th December 2000 and was based on exceedences of nitrogen dioxide (NO<sub>2</sub>) and particulate matter (PM<sub>10</sub>).

**Figure 1:1 Map of AQMA Boundary**

## Stage Four

Stage four was carried out to check the results of the previous reports in light of the latest air monitoring results at the time and further modelling work. This was completed in August 2003. It also took into account the revised information gathered on road traffic emissions, which essentially acknowledged that the exhaust emissions of newer vehicles were not as clean as previously claimed. There were some differences between the modelling undertaken previously, but exceedences were still being predicted for both NO<sub>2</sub> and PM<sub>10</sub>. In addition the further work eliminated any concerns regarding carbon monoxide and sulphur dioxide. Alongside this, the Council's first Air Quality Management Plan was produced, setting out 25 actions that the Council should take to work towards improving air quality.

### 1.4.2 Second Round of Review and Assessment

An Updating and Screening Assessment (USA) was conducted as part of the second round. This was published in April 2004. The purpose of a USA is to identify whether any changes have taken place with the seven pollutants, highlighted in Table 1.1, since the previous assessment. A Detailed Assessment (DA) must then be undertaken if this is the case. We concluded that a DA was unnecessary. The following year we submitted a combined Air Quality and Action Plan Progress report.

### **1.4.3 Third Round of Review and Assessment**

A further USA was undertaken as part of the third round of assessment in 2004/05. Each pollutant was dealt with individually and considered against the updated guidance checklist at the time. Progress reports are undertaken in years when USAs are not required.

### **1.4.4 Fourth Round of Review and Assessment**

An USA was conducted in 2009. New monitoring data was reported for each pollutant and a re-examination of sources using the checklists provided in the Department of Environment, Food and Rural Affairs' (Defra) Local Air Quality Management Technical Guidance LAQM TG (09) was used to identify any significant changes since the previous rounds of review and assessment. Following changes to guidance issued in 2009 it was concluded that a further assessment was required in relation to emissions from the Paddington to Swansea railway line. This assessment is included in this report in Section 2.3.

All reports since 2003 are available for download from the Council's air quality WebPages:

<http://www.rbkc.gov.uk/environmentandtransport/airquality/reportsanddocuments.aspx>

## **2 New Monitoring Data**

### **2.1 Summary of Monitoring Undertaken**

#### **2.1.1 Automatic Monitoring Sites**

We have automated continuous monitoring at five sites in the borough. Figure 2.1 shows the locations of the continuous sites in the borough. Detailed information about each is contained in Table 2.1.

In addition information is included for the West London and Cromwell Road sites operated by Defra because data from these sites are included in the report. Whilst the West London site was closed by Defra in 2007 it is retained in the table as long term trends includes data from this site. We also have one gravimetric instrument, a partisol located at the Earl's Court site. This type of instrument samples air continuously but does not provide real time data (see glossary in Appendix C) as the filters must be weighed manually.

#### **Changes in 2009**

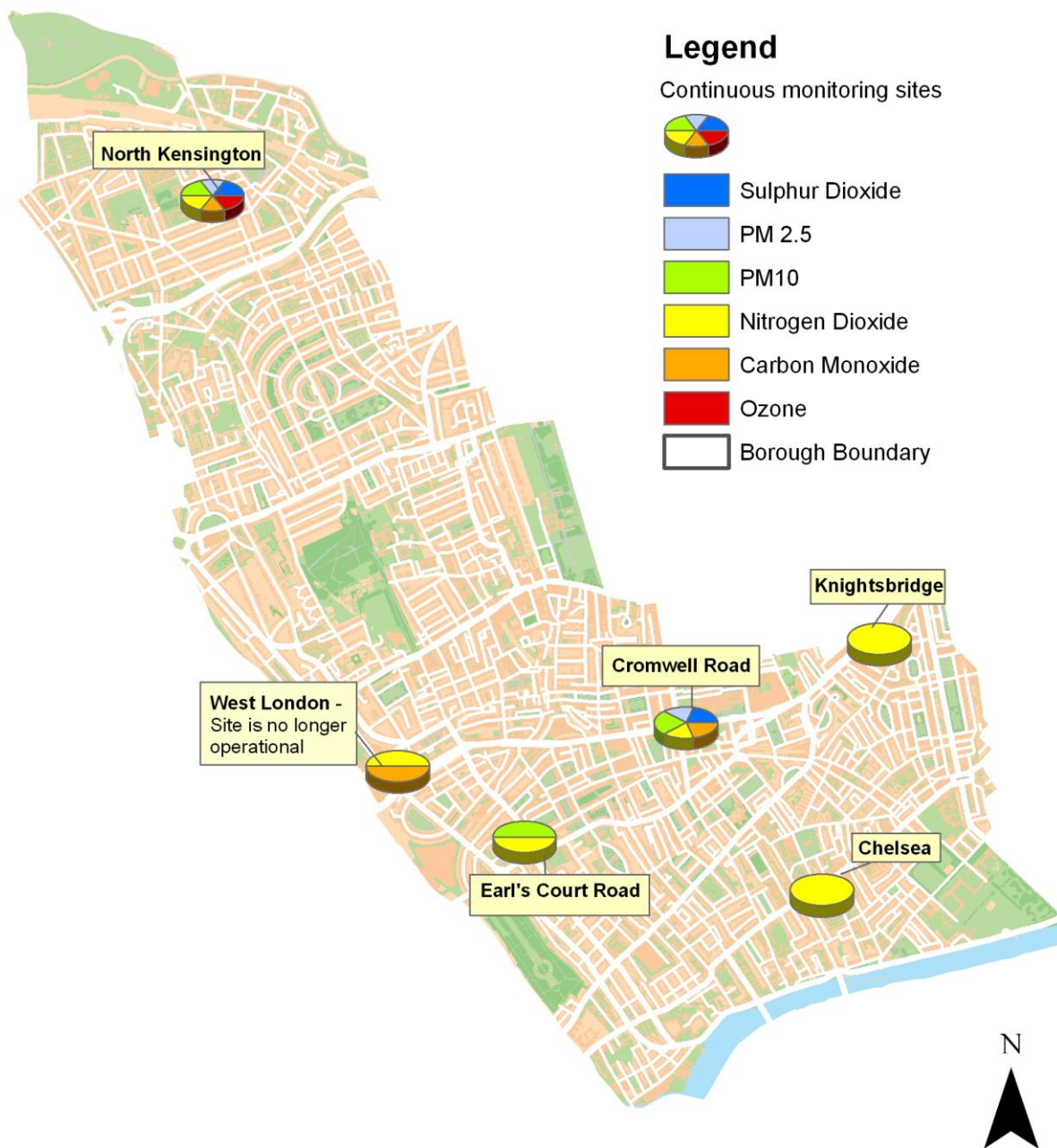
The North Kensington TEOM was replaced with an FDMS analyser at the start of 2009. In spring 2009 the TEOM at the Cromwell Road monitoring station was upgraded to an FDMS unit and a further FDMS instrument measuring PM<sub>2.5</sub> was also installed.

Air quality data for 2009 has been included in the report where it is available but is largely provisional. The map overleaf shows sites operating between 2006 and 2009.

#### **Quality Control and Assurance**

Calibrations are carried out at fortnightly intervals by contractors. Automated data that we collect is subject to quality control and audit procedures by Kings Environmental Research Group (Kings ERG) and is disseminated via the London Air Quality Network (LAQN). In addition independent consultants carry out audits annually. An equipment service unit is also contracted to service equipment twice annually and to investigate and repair faults to maintain high quality data and good data capture. The North Kensington site is further scrutinised by Defra's contractors as it is affiliated to the Automatic Urban and Rural Network (AURN). Further information on data collection and quality control is included in Appendix A.

Figure 2:1 Map of Automatic Monitoring Sites



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Status: Final  
Date: March 2010  
Author:EQPHT



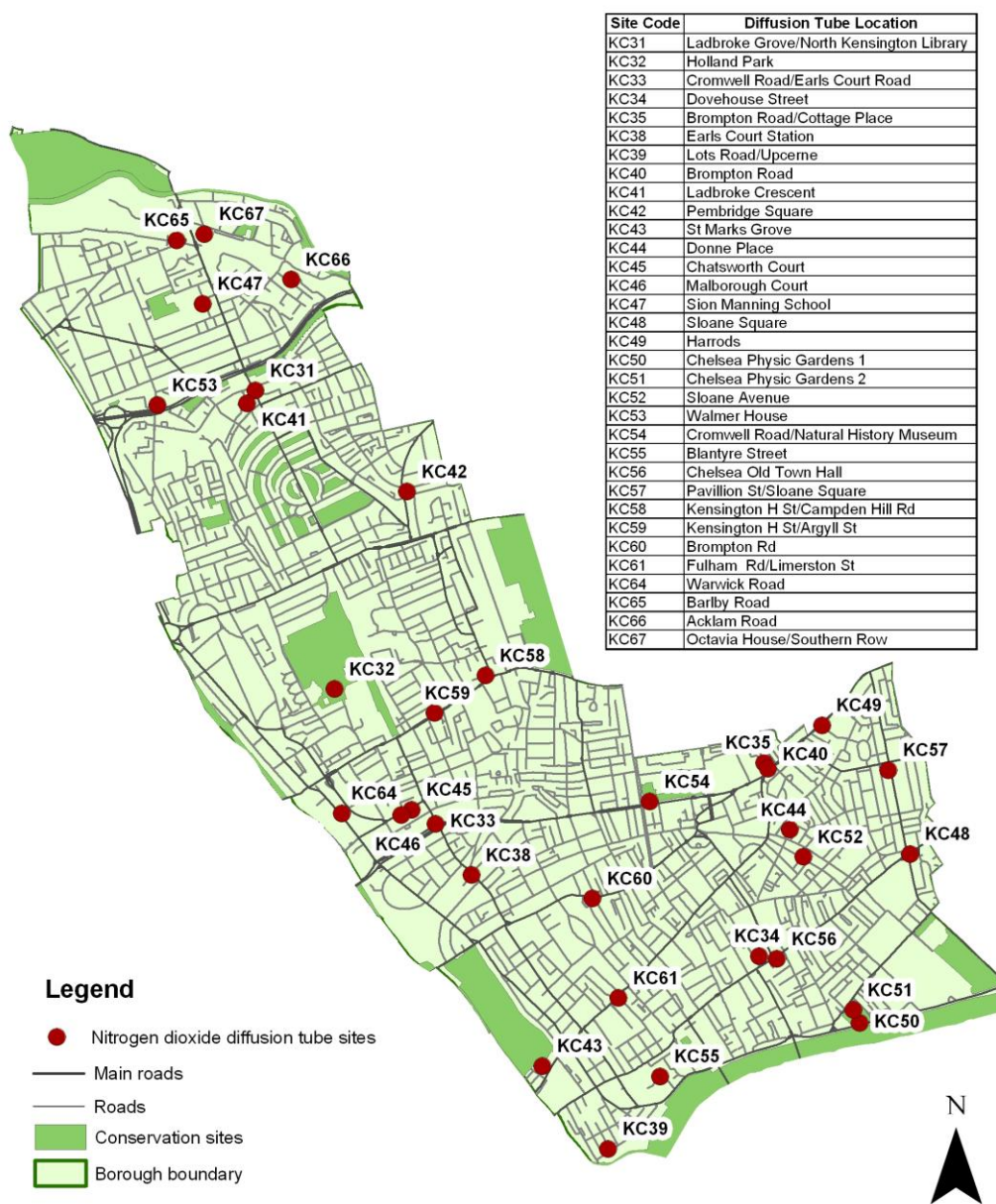
**Table 2.1 Details of Automatic Monitoring Sites**

Site Code	Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring Technique	In AQMA ?	Relevant Exposure ? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
KC1	North Kensington	Urban background LAQN & AURN affiliate	X 524045	Y 181752	Nitrogen oxides PM <sub>10</sub> Carbon monoxide Sulphur dioxide Ozone Other Defra/ERG monitoring undertaken: PM <sub>10</sub> & PM <sub>2.5</sub>	Chemiluminescent FDMS and TEOM GFC Fluorescence UV Photometric  FDMS and Partisols	Y	Y	N/A	N
AURN	Cromwell Rd/ Cromwell Rd 2	Roadside, AURN	X 526524	Y 178965	Nitrogen oxides Carbon monoxide Sulphur dioxide Other monitoring undertaken: Lead and heavy metals	Chemiluminescent GFC Fluorescence UV  partisol	Y	Y	3.5m from Cromwell Road	N
KC2	Cromwell Rd 2	Roadside, LAQN	X 526524	Y 178965	PM <sub>10</sub> PM <sub>2.5</sub>	FDMS FDMS	Y	Y	Approx within 8m of Cromwell Rd and 5m of Queens Gate.	N
AURN	West London	Urban background AURN	X 525026	Y 178741	Nitrogen oxides Carbon monoxide	Chemiluminescent	Y	Y	50m from Warwick Rd	N
KC3	Knightsbridge	Kerbside, LAQN	X 527518	Y 179395	Nitrogen oxides	Chemiluminescent	Y	Y	Located on the kerb of Hans Road and 4m from Brompton Rd	Y
KC4	Kings Rd Chelsea	Roadside, LAQN	X 527268	Y 178089	Nitrogen oxides	Chemiluminescent	Y	Y	Approx 8m from Kings Rd	N
KC5	Earls Court	Kerbside, LAQN	X 525695	Y 178363	PM <sub>10</sub> gravimetric Nitrogen oxides	Partisol plus Chemiluminescent	Y	Y	Sited on the kerb of Earls Court Rd	Y

### 2.1.2 Non-Automatic Monitoring

Monitoring data for benzene and NO<sub>2</sub> (in addition to continuous monitoring) is collected using passive diffusion techniques. The borough participates in the London Wide Environmental Programme (LWEP) offered by Bureau Veritas for the provision and analysis of diffusion tubes. Further information on the laboratory, method, bias adjustment and quality control issues are provided in Appendix A. In 2009, three new sites were added to the Council’s existing network to assess the impact of the Paddington-Swansea rail line. Figures 2.2 and 2.3 show the NO<sub>2</sub> and Benzene networks respectively. Marlborough Court (NO<sub>2</sub> survey) is now no longer monitoring but is shown as data from this site is included in the report.

**Figure 2:2 Map of Non-Automatic Nitrogen Dioxide Monitoring Sites**



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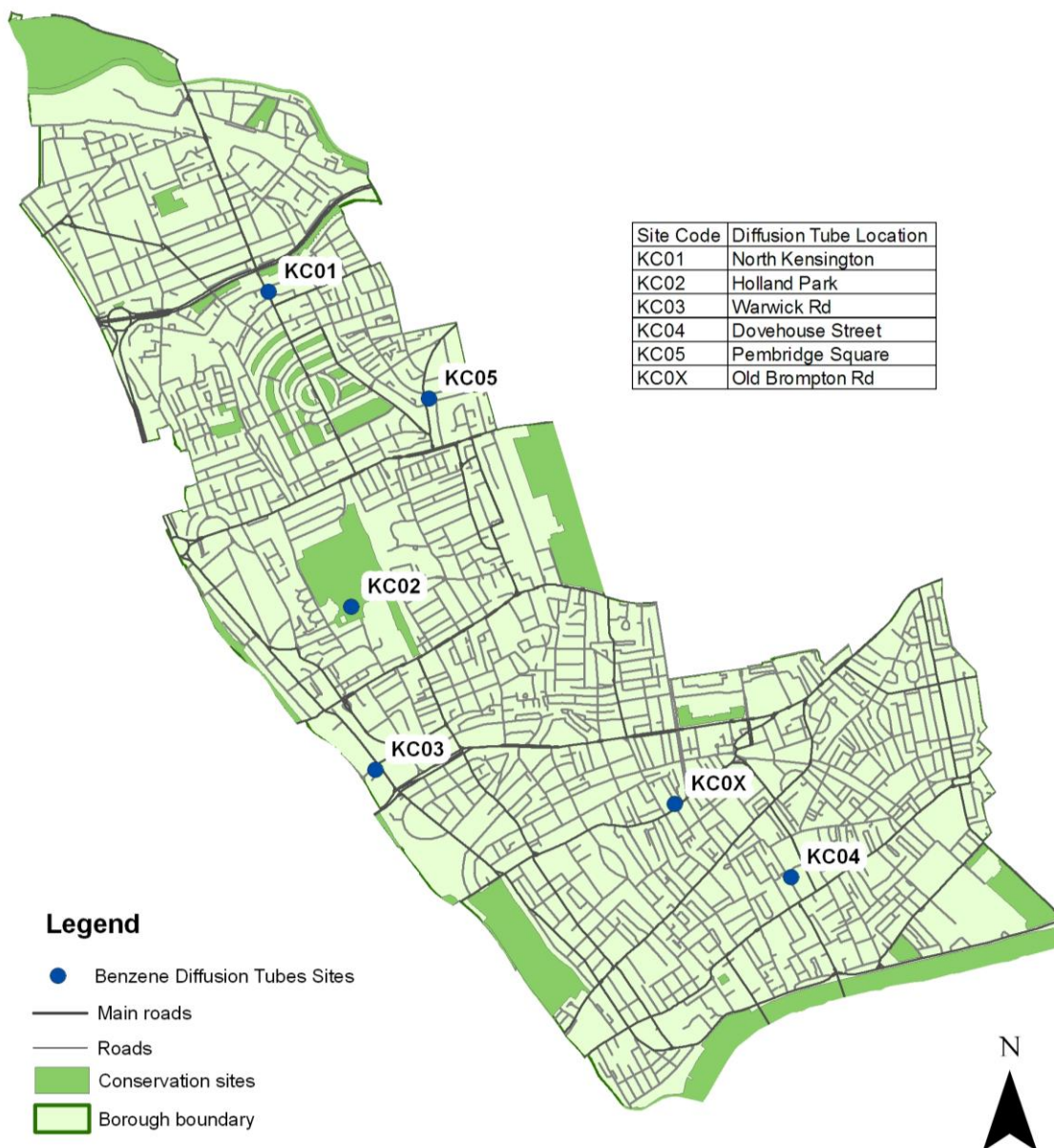
Status: Final  
Date: March 2010  
Author:EQPHT





The figure below shows all locations where benzene has been monitored however only five sites are currently operational; the Warwick Road petrol station site is now closed.

**Figure 2:3 Map of Non-Automatic Benzene Monitoring Sites**



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Date: March 2010  
Author:EQPHT



Table 2.2 overleaf provides details of thirty three NO<sub>2</sub> and six benzene diffusion tube sites operating in the borough in 2009/10.

**Table 2.2 Details of Non- Automatic Monitoring Sites**

Site ID	Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
KC31	Ladbroke Grove/Nth Ken Library	Roadside	X 524342	Y 181271	NO <sub>2</sub>	Y	Y	3.5m	No
KC32	Holland Park	Urban Background	X 524784	Y 179599	NO <sub>2</sub>	Y	Y	380m	No
KC33	Cromwell Rd/ Earls Court Rd	Roadside	X 525355	Y 178841	NO <sub>2</sub>	Y	Y	1.1m	Yes
KC34	Dovehouse Street	Urban Centre	X 527164	Y 178103	NO <sub>2</sub>	Y	Y	26m	No
KC35	Brompton Road/ Cottage Place	Roadside	X 527192	Y 179185	NO <sub>2</sub>	Y	Y	8m	No
KC38	Earls Court Station	Roadside	X 525548	Y 178556	NO <sub>2</sub>	Y	Y	1.7m	Yes
KC39	Lots Road/ Upcerne Road	Roadside	X 526317	Y 177022	NO <sub>2</sub>	Y	Y	8.1m	No
KC40	Brompton Road	Urban Centre	X 527214	Y 179153	NO <sub>2</sub>	Y	Y	65m	No
KC41	Ladbroke Crescent	Urban Background	X 524294	Y 181200	NO <sub>2</sub>	Y	Y	70m	No
KC42	Pembridge Square Library	Roadside	X 525191	Y 180705	NO <sub>2</sub>	Y	Y	6m	No
KC43	St Marks Grove	Urban Background	X 525950	Y 177487	NO <sub>2</sub>	Y	Y	38m	No
KC44	Donne Place	Urban Background	X 527335	Y 178810	NO <sub>2</sub>	Y	Y	55m	No
KC45	Chatsworth Court	Roadside	X 525263	Y 178936	NO <sub>2</sub>	Y	Y	13m	No
KC46	Marlborough Court	Roadside	X 525157	Y 178892	NO <sub>2</sub>	Y	Y	8m	No
KC47	Sion Manning School	Urban Background	X 524046	Y 181758	NO <sub>2</sub>	Y	Y	8.5m	No
KC48	Sloane Square	Roadside	X 528011	Y 178675	NO <sub>2</sub>	Y	Y	7m	No
KC49	Harrods	Urban Centre	X 527516	Y 179395	NO <sub>2</sub>	Y	Y	4m	Yes
KC50	Chelsea Physic Garden (Gate)	Roadside	X 527726	Y 177727	NO <sub>2</sub>	Y	Y	4m	No
KC51	Chelsea Physic Garden (Met Station)	Urban Background	X 527690	Y 177800	NO <sub>2</sub>	Y	Y	92m	No

Site ID	Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
KC52	Sloane Avenue	Roadside	X 527411	Y 178659	NO <sub>2</sub>	Y	Y	2.6m	No
KC53	Walmer House	Urban Background	X 523792	Y 181189	NO <sub>2</sub>	Y	Y	12.5m	No
KC54	Cromwell Rd/ Natural History Museum	Roadside	X 526550	Y 178968	NO <sub>2</sub>	Y	Y	3.1m	No
KC55	Blantyre St	Urban Background	X 526608	Y 177429	NO <sub>2</sub>	Y	Y	100m	No
KC56	Chelsea Old Town Hall	Roadside	X 527268	Y 178089	NO <sub>2</sub>	Y	Y	9m	No
KC57	Pavillion St/ Sloane Ave	Roadside	X 527889	Y 179145	NO <sub>2</sub>	Y	Y	3m	No
KC58	Kensington H St/Kensington Church St	Roadside	X 525630	Y 179674	NO <sub>2</sub>	Y	Y	13m	No
KC59	Kensington High St/Argyll St	Kerbside	X 525342	Y 179464	NO <sub>2</sub>	Y	Y	0.7m	No
KC60	Old Brompton Rd/ Draycott Ave	Kerbside	X 526231	Y 178425	NO <sub>2</sub>	Y	Y	0.7m	No
KC61	Fulham Rd/ Limerston St	Roadside	X 526377	Y 177867	NO <sub>2</sub>	Y	Y	10m	No
KC64	Warwick Road	Roadside	X 524825	Y 178902	NO <sub>2</sub>	Y	Y	3.5m	No
KC65	Barlby Road	Roadside	X 523899	Y 182113	NO <sub>2</sub>	Y	Y	0.5m	No
KC66	Acklam Road	Railway	X 524541	Y 181893	NO <sub>2</sub>	Y	Y	16m	No
KC67	Southern Row	Railway	X 524056	Y 182148	NO <sub>2</sub>	Y	Y	38m	Yes
KC01	Ladbroke Grove/Nth Ken Library	Roadside	X 524342	Y 181271	Benzene	Y	Y	3.5m	No
KC02	Holland Park	Urban Background	X 524784	Y 179599	Benzene	Y	Y	380m	No
KC03	Warwick Rd - Petrol Station (forecourt) now closed	Petrol station	X 524911	Y 178736	Benzene	Y	Y	N/A	No
KC04	Dovehouse Street	Urban Background	X 527111	Y 178165	Benzene	Y	Y	45m	No
KC05	Pembridge Square Library	Roadside	X 525191	Y 180705	Benzene	Y	Y	6m	No
KC0X	Old Brompton Rd/Clareville Grove Petrol Station	Petrol station	X 526496	Y 178553	Benzene	Y	Y	N/A	No

## 2.2 Comparison of Monitoring Results with Air Quality Objectives

### 2.2.1 Nitrogen Dioxide

There are two objectives for Nitrogen Dioxide (NO<sub>2</sub>). A short term objective of 200µg/m<sup>3</sup> not to be exceeded more than 18 times as a one hour mean, and a longer term objective of 40µg/m<sup>3</sup> as an annual mean. The deadline for achieving these objectives was the end of 2005. The whole of the borough was declared an Air Quality Management Area in 2000 on the basis that NO<sub>2</sub> (and PM<sub>10</sub> to a lesser extent) would fail to meet its objectives.

#### Monitoring Data

Automatic chemiluminescent analysers and passive diffusion tubes are used to monitor NO<sub>2</sub> in the borough. The latter method provides more limited data but does allow levels to be compared to the annual mean objective at a greater number of locations than would be practicable by continuous methods alone.

#### Automatic Monitoring Data

Continuous monitoring is undertaken at five sites in the borough. Details of these sites are included in Table 2.31. The West London monitoring site was closed in 2007 following a review by Defra of its monitoring network. The automatic monitoring results are shown in Tables 2.3 and 2.4. Another site in London, Marylebone Rd, has also been included for comparison purposes. The results have been assessed against the annual mean and the hourly mean objectives. All sites are located at distances which are representative of residential building facades with the exception of Earls Court which is relevant for short term exposure.

Caution must be applied to the 2009 data as it is provisional. However, any subsequent adjustments are unlikely to affect the overall conclusions.

**Table 2.3 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective**

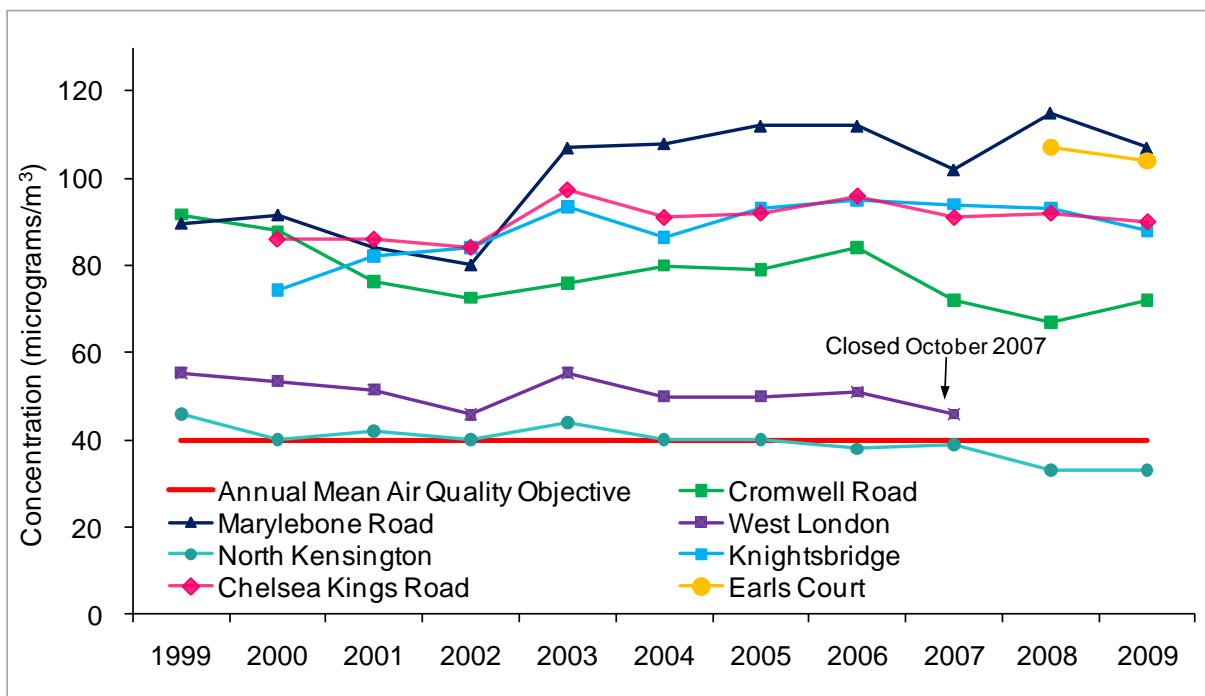
Site ID	Location	Within AQMA?	Data Capture for full calendar year 2009 %	Annual mean concentrations (µg/m <sup>3</sup> )			
				2006	2007	2008	2009
KC1	North Kensington	Y	97	38	39	33	33
AURN	West London*	Y	closed	<b>51</b>	<b>46</b>	-	-
KC5	Earls Court*	Y	97	-	-	<b>107 (72%)</b>	<b>104</b>
AURN	Cromwell Rd 2	Y	87	<b>84</b>	<b>72</b>	<b>67</b>	<b>72</b>
KC3	Knightsbridge	Y	97	<b>95</b>	<b>94</b>	<b>94</b>	<b>88</b>
KC4	Kings Road Chelsea	Y	99	<b>96</b>	<b>91</b>	<b>93</b>	<b>90</b>
AURN	Marylebone Rd	Y	99	<b>112</b>	<b>102</b>	<b>115</b>	<b>107</b>

\* These sites have operated for part of a year. Data capture for West London site in 2007 was 82%; Data capture for Earls Court site in 2008 is 72%. Means should normally be “annualised” if monitoring is less than 9 months however this has not been undertaken. Source: Londonair.org.uk. Data in *italics* (2009) is provisional and should be treated with caution. **Bold** indicates an exceedence of the annual objective (Table 1.1).

Preliminary monitoring results for 2009 at continuous sites show that exceedences of the average NO<sub>2</sub> annual mean objective level have occurred at all sites in the borough apart from the North Kensington background site. Most of the monitoring sites showed a slight decrease in the annual mean level compared to 2008 apart from North Kensington which remained at the same level and Cromwell Road which increased. The increase at Cromwell Road may be in part due to the lower data capture rate for the site in 2008.

The chart below shows the longer term trend since 1999; only North Kensington, Cromwell Road and West London (until it was closed) have shown an overall downward trend. However, over the same period the sites at Chelsea and Knightsbridge have shown an overall increase in the annual mean level.

**Figure 2:4 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites**



**Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective**

Site ID	Location	Within AQMA ?	Data Capture for full calendar year 2009 %	Number of Exceedences of hourly mean (200 µg/m <sup>3</sup> ) Where valid data is less than 90% the 99.8 <sup>th</sup> percentile of hourly means is shown in brackets			
				2006	2007	2008	2009
KC1	North Kensington	Y	97	0	17 (201)	0 (122)	1
AURN	West London*	Y	closed	0	0	-	-
KC5	Earls Court*	Y	97	-	-	<b>384 (242)</b>	<b>368</b>
AURN	Cromwell Rd 2	Y	87	4	2	1 (147)	3
KC3	Knightsbridge	Y	97	<b>389</b>	<b>440</b>	<b>520</b>	<b>346</b>
KC4	Kings Road Chelsea	Y	99	<b>136</b>	<b>77</b>	<b>122</b>	<b>43</b>
AURN	Marylebone Rd	-	99	<b>676</b>	<b>452</b>	<b>822</b>	<b>477</b>

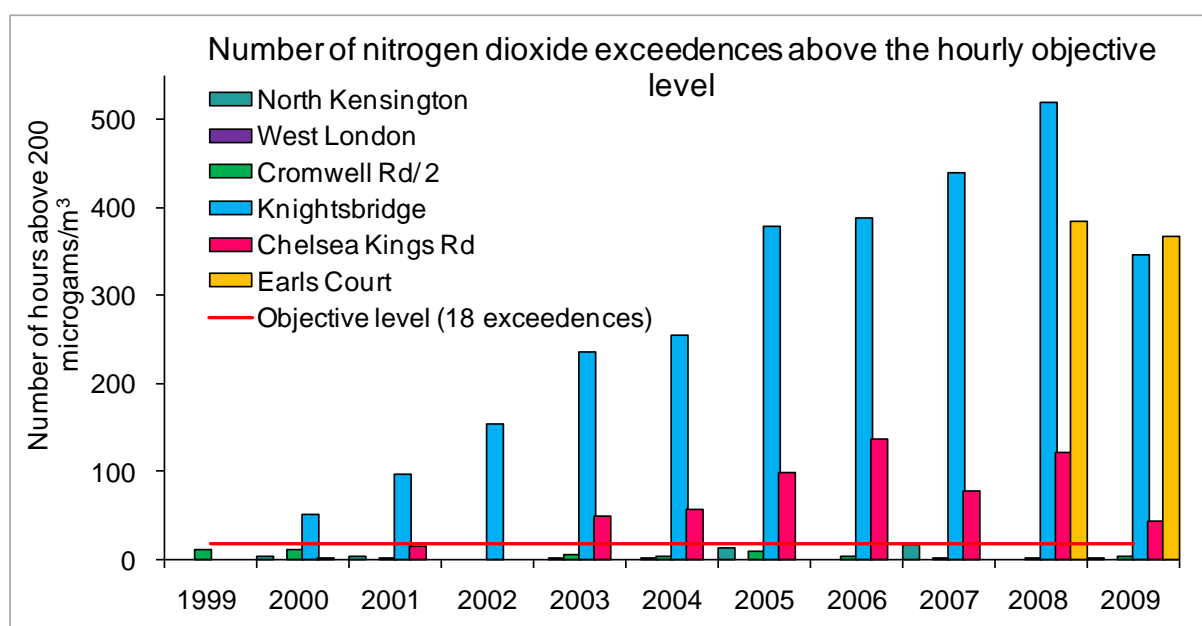
2009 data (in italics) is provisional and should be treated with caution. Source Londonair.org.uk.

Data in *italics* (2009) is provisional and should be treated with caution. **Bold** indicates an exceedence of the hourly mean objective (Table 1.1).

The hourly exceedences vary from site to site considerably from only one exceedence of the hourly mean (above  $200\mu\text{g}/\text{m}^3$ ) at the background site to 368 at the Earls Court Site. Three of the five sites (Knightsbridge, Chelsea Kings Road and the Earls Court) exceeded the objective in 2009.

The chart below shows the number of hourly exceedences at sites in the borough since 1999. Overall the number of hours above  $200\mu\text{g}/\text{m}^3$  has increased at roadside locations over the 10 years shown.

**Figure 2:5 Trends in the Hourly Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites**



All the sites are representative of public exposure for either one or more of the objective values.

### Diffusion Tube Monitoring Data

Diffusion tube data for  $\text{NO}_2$  was collected at 32 locations in the borough in 2009. This includes three new sites which were identified following the completion of the USA in 2009. Monitoring began at these sites in May 2009 near to the Paddington rail line and data for eleven months is included in this report. This data is discussed in Section 2.3. The details of all the diffusion tube sites can be found in Table 2.2.

Table 2.5 presents annual mean concentrations for 33 sites, 32 of which operated in 2009 (full dataset of monthly mean values is included in Appendix B). The data is adjusted to take into account any potential difference between the continuous monitoring and the diffusion tube methods. The bias adjustment factor is calculated by Bureau Veritas using data collected through the London Wide Environmental Programme co-location study at a number of sites. The bias adjustment factor for 2009 has been calculated as 1.0. Details of the analytical laboratory and bias adjustment methodology are described in Appendix A. In effect this means that no adjustment of the data is required this year.

The results indicate that six out of 32 sites were below the objective level. These include sites located at Holland Park, Chelsea Physic Garden and Sion Manning School. The remainder are above the objective level. Of these a further eleven, that is, sites where the annual mean is above  $60\mu\text{g}/\text{m}^3$ , are at risk of exceeding the hourly mean objective (shaded cells). This is consistent with the results from continuous monitoring sites. A comparison of levels measured in 2008 and 2009 show no clear overall trend; a smaller number of sites have shown small reductions in levels whilst others show an increase.

**Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes**

Site ID	Location	Within AQMA?	Data Capture for monitoring period <sup>a</sup> %	Data Capture for full calendar year 2009 %	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ ) Adjusted for bias		
					2007	2008	2009 <sup>#</sup>
KC31	Ladbroke Grove/Nth Ken Library	Y		100	<b>63.4</b>	<b>58.2</b>	<b>57.7</b>
KC32	Holland Park	Y		100	32.5	32.3	31.7
KC33	Cromwell Road/Earls Court Rd	Y		100	<b>89.3</b>	<b>85.3</b>	<b>90.9</b>
KC34	Dovehouse Street	Y		100	<b>48.1</b>	<b>45.6</b>	<b>47.2</b>
KC35	Brompton Road/Cottage Place	Y		100	<b>65.4</b>	<b>64.0</b>	<b>67.9</b>
KC38	Earls Court Station	Y		100	<b>99.2</b>	<b>98.2</b>	<b>101.2</b>
KC39	Lots Road/Uperne Road	Y		100	<b>43.0</b>	<b>43.5</b>	<b>41.4</b>
KC40	Brompton Road	Y		100	<b>51.6</b>	<b>49.5</b>	<b>51.6</b>
KC41	Ladbroke Crescent	Y		100	<b>41.8</b>	38.8	39.6
KC42	Pembridge Square Library	Y		100	<b>48.9</b>	<b>47.2</b>	<b>46.3</b>
KC43	St Marks Grove	Y		100	<b>42.1</b>	<b>40.2</b>	39.1
KC44	Donne Place	Y		92	<b>47.7</b>	<b>42.8</b>	<b>42.1</b>
KC45	Chatsworth Court	Y		100	<b>50.8</b>	<b>50.7</b>	<b>50.5</b>
KC46	Marlborough Court	Y		100	<b>52.6</b>	closed	closed
KC47	Sion Manning School	Y		100	37.2	36.0	35.6
KC48	Sloane Square	Y		92	<b>88.9</b>	<b>80.1</b>	<b>81.8</b>
KC49	Harrods	Y		100	<b>87.8</b>	<b>76.1</b>	<b>79.8</b>
KC50	Chelsea Physic Garden (Gate)	Y		100	<b>55.9</b>	<b>52.7</b>	<b>58.9</b>
KC51	Chelsea Physic Garden (Met Station)	Y		100	37.5	36.1	37.1
KC52	Sloane Ave. nr Marlborough school	Y		100	<b>61.3</b>	<b>60.2</b>	<b>59.4</b>
KC53	Walmer House	Y		92	<b>51.3</b>	<b>47.0</b>	49.6
KC54	Cromwell Rd/Natural History Museum	Y		100	<b>77.6</b>	<b>72.8</b>	<b>75.6</b>
KC55	Blantyre St	Y		100	<b>49.9</b>	<b>46.9</b>	43.2
KC56	Chelsea Old Town Hall	Y		100	<b>88.8</b>	<b>87.6</b>	<b>81.9</b>
KC57	Pavillion St/Sloane Ave	Y		100	<b>62.8</b>	<b>55.5</b>	<b>55.0</b>
KC58	Kensington H St/Kensington Church St	Y		92	<b>66.7</b>	<b>62.5</b>	<b>62.8</b>
KC59	Kensington H St/Argyll St	Y		100	<b>93.4</b>	<b>86.9</b>	<b>86.1</b>
KC60	Old Brompton Rd/Draycott Ave	Y		100	<b>75.0</b>	<b>72.2</b>	<b>76.4</b>
KC61	Fulham Rd/Limerston St	Y		100	<b>65.4</b>	<b>61.0</b>	<b>60.0</b>
KC64	Warwick Rd	Y		100	-	<b>51.2</b>	<b>51.7</b>
KC56	Barlby Road*	Y	91	-	-	-	39.6
KC66	Acklam Road*	Y	100	-	-	-	<b>43.4</b>
KC67	Southern Row*	Y	100	-	-	-	<b>41.6</b>

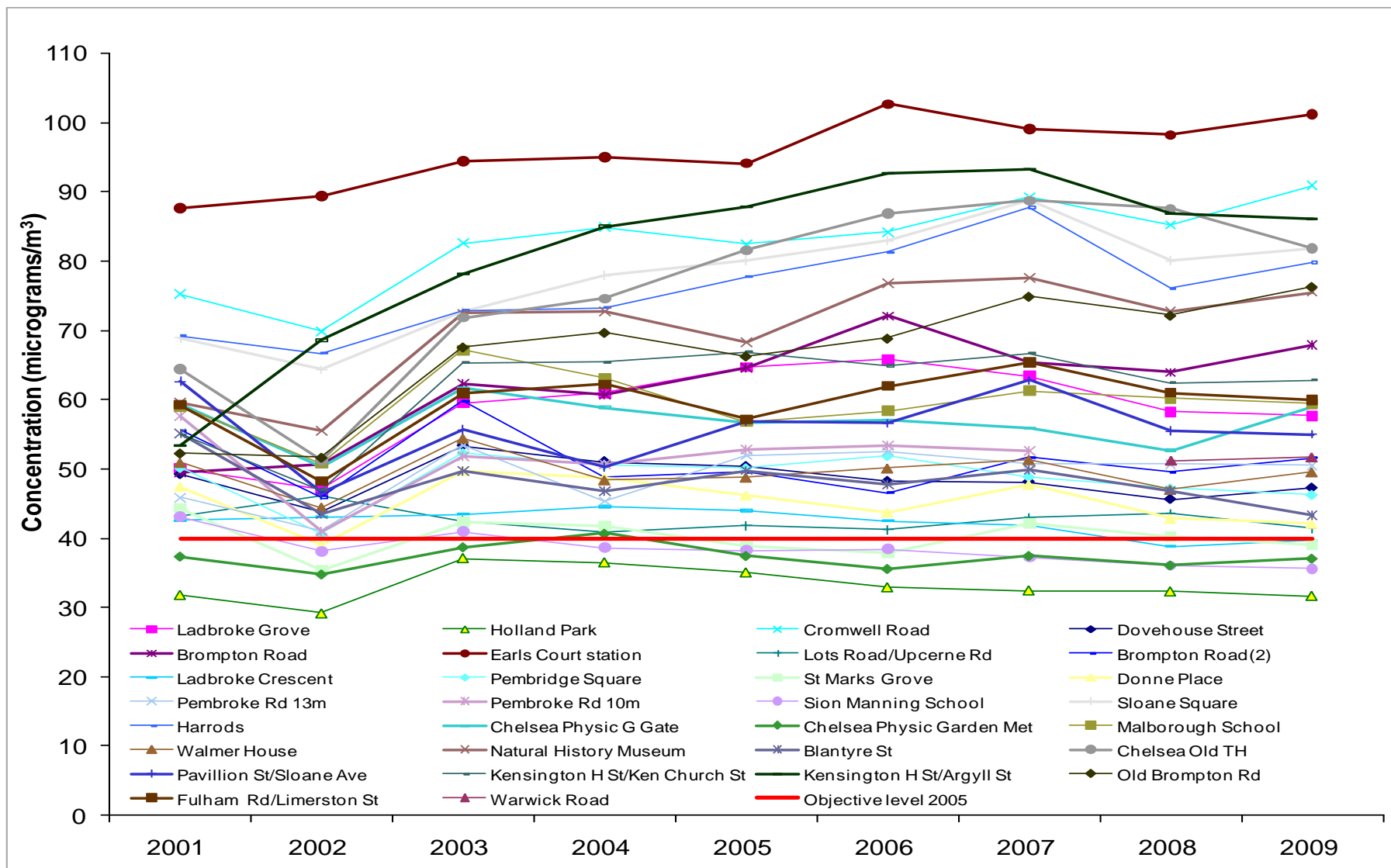
# Bias adjustment factor 2009 = 1.00; 2008 = 0.98; 2007 = 1.01 (see Appendix A), KC47 and KC54 are the mean results of triplicate exposure.

\*Monitoring period from May 2009- March 2010.

**Bold** indicates an exceedence of the annual mean objective (Table 1.1). Shaded areas indicate a risk that the 1-hour objective may also be exceeded.

Figure 2.6 illustrates the trend since 2001. Overall many sites (mainly roadside locations) have recorded increased levels, a few of the urban background sites have seen reductions whilst others have shown little overall change. Despite some recent signs of improvement there is no clear indication of a consistent downward trend.

Figure 2:6 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Diffusion Tube Monitoring Sites (Factored)





### **Overall Nitrogen Dioxide Conclusions**

Apart from relatively small improvements at some mainly urban background locations, the majority of the borough continues to exceed the annual mean objective. Reductions of around  $50\mu\text{g}/\text{m}^3$  are required at building facades location on busy and congested roads, e.g. at distances of 8m as typified by the Kings Road site. In less trafficked roads or where better dispersal characteristics exist, reductions of  $10\text{-}40\mu\text{g}/\text{m}^3$  are needed, whilst at the least trafficked residential roads, the reduction needed may only be a few micrograms.

The hourly mean is also exceeded at approximately a third of monitoring locations. These are predominately the busier roadside locations such as high streets. Hourly exceedences would have to be reduced by over 300 hours to meet the objective level (of no more than 18 exceedences of  $200\mu\text{g}/\text{m}^3$ ) at the worst affected locations.

### 2.2.2 Particulate Matter (PM<sub>10</sub>)

There are two objectives for Particulate Matter (PM<sub>10</sub>), to be achieved by 2004, which are incorporated in the Air Quality Regulations (see Table 1.1). Following the review of the Air Quality Strategy, the three more stringent provisional objectives for 2010 and 2015 were not adopted. The whole of the borough was declared an AQMA in 2000 partially based on exceedences of the 2004 PM<sub>10</sub> objectives at certain locations.

#### Monitoring Data

Monitoring of PM<sub>10</sub> is challenging because of its complex and varied composition. In addition there is a wide range of instruments and methods that are available and these in turn produce variations in the way that particulate matter is sampled resulting in differences in the measured concentrations. In recent years there has been much work on identifying 'equivalent' methods to the EU reference. This issue has meant that a consistent long term dataset, as exists with other pollutants, has been difficult to achieve.

Automatic monitoring of PM<sub>10</sub> (using TEOM instruments) first began in 1995 in North Kensington (urban background site) and later from 1998 at the Cromwell Road site (roadside). Whilst these instruments were recently identified as not being equivalent to gravimetric methods, the corrected data (factored by 1.3) from these sites was considered suitable for local air quality management purposes. However, following a successful bid for a Defra grant, the Council's two TEOMS were upgraded to FDMS units in 2009. This data can be reported without any correction applied. Further developments also mean that TEOM data from 2004 onwards has been adjusted using the Volatile Correction Method (VCM) to make it comparable to FDMS measurements. Data using TEOM\*1.3 has been included so that the effect of these changes can be seen in relation to new adjustment factors and the latest monitoring methods.

Defra operate partisol instruments (gravimetric samplers equivalent to the EU reference method) at the North Kensington site. However this monitoring was interrupted between 2007 and 2008 following a review of the Defra monitoring networks and concerns over the quartz filters used<sup>1</sup>. This data was collected by Defra for research purposes to compare different particle monitoring techniques. These instruments restarted in 2009.

The Council also has operated a partisol (gravimetric) sampler at the Earls Court Road (since May 2002) using Teflon coated glass fibre (Emfab) filters which are not affected by the same issues as the quartz filters. This site offers the longest data series in the borough which is unaffected by the various changes resulting from measurement issues that have occurred elsewhere.

North Kensington and Cromwell Road sites are representative of public exposure for both the long and short term objective values according to the definition in Defra's LAQM TG (09) whilst the Earls Court site which is as a kerbside location is not

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<sup>1</sup> Maggs, R., Harrison, D., Carslaw, D., Stevenson, K. (2009) Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom

considered representative. However it is important to note that for a number of reasons this is not a reasonable conclusion:

- The EU directive (which the air quality regulations transpose into UK legislation) state that the limit values should apply at all locations apart from where members of the public do not have access to, factory premises, or on the carriage way or central reservations of roads;
- The current objectives are weaker than the provisional more stringent objectives;
- And the non threshold effects of particles on health

Table 2.6 shows particulate data collected in the borough and at other central London locations using various methods and adjustments between 2006 and 2009. Data capture for some sites are especially low due to changes at sites and is included for indicative purposes only. Comparisons with objective levels need to be treated with caution where concentrations are close to the objective level.

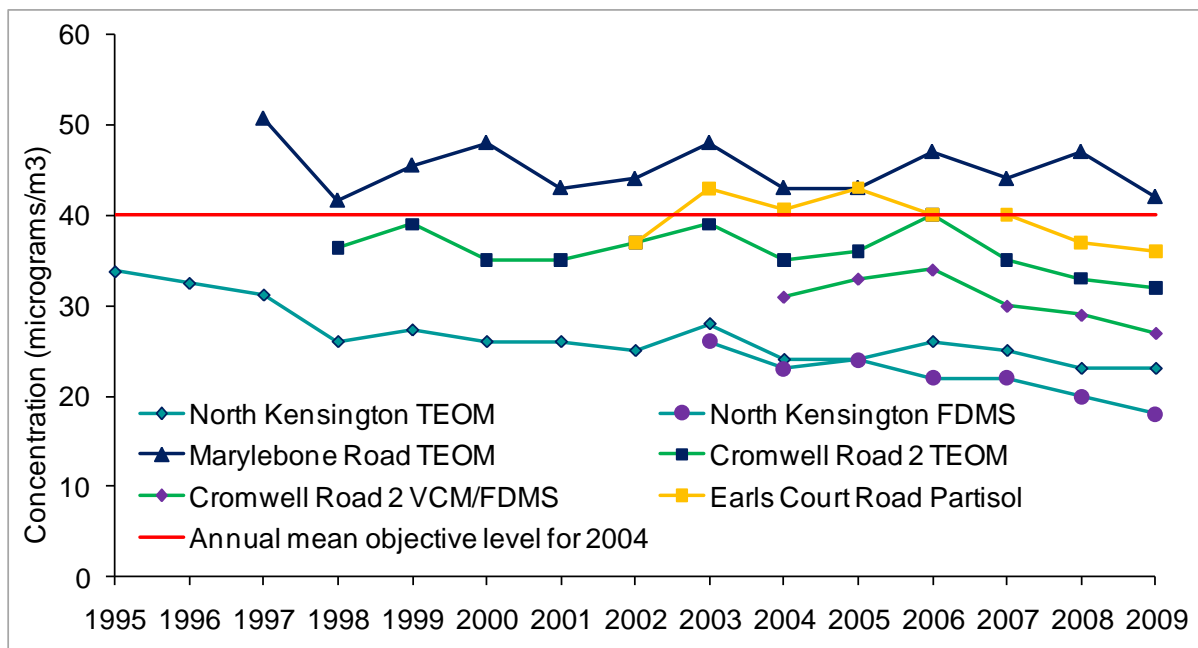
**Table 2.6 Results of PM<sub>10</sub> Automatic Monitoring: Comparison with Annual Mean Objective**

Site ID	Location	Method	Within AQMA?	Data Capture for previous years %	Data Capture 2009 %	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )			
						2006*	2007*	2008*	2009
KC1	North Kensington TEOM	1.3	Y	98	98	26	25	23	23
KC1	North Kensington FDMS		Y	98	98	22	22	21	18
AURN	N Kensington Partisol	None	Y	91, 73, 45	81	32	28	19	20
KC2	Cromwell Rd 2 TEOM	1.3	Y	98	57	40	35	33	32
KC2	Cromwell Rd 2 VCM/FDMS	VCM	Y	98	95	34	30	29	27
KC5	Earls Court Partisol	None	Y	86	95	40	40	37	36
AURN	Bloomsbury TEOM	1.3	-	98		30	29	26	23
AURN	Marylebone Rd TEOM	1.3	-	96		<b>47</b>	<b>45</b>	<b>47</b>	<b>42</b>
AURN	Marylebone Rd FDMS	none	-		96			35	34
AURN	Marylebone Rd Partisol	none	-	76, 66, 58	97	<b>46</b>	<b>47</b>	39	39

\* though means should be "annualised" as in Box 3.2 of LAQN TG(09), if monitoring was not carried out for the full year this has not been undertaken for the Marylebone Road or North Kensington partisol data. **Bold** indicates an exceedence of the annual mean objective (Table 1.1).

The results indicate that VCM corrected and FDMS measured data tend to be lower than data corrected using the old adjustment factor where both adjustment and/or monitoring techniques are undertaken at the same site. Levels measured by partisols tend to fall between the two methods. The results in 2009 are below the objective level. However there is a greater spread of results between the different instruments ( $42\text{--}33\mu\text{g}/\text{m}^3$ ) at the Marylebone Road site which is a roadside location. As the level is close to the objective level, it is prudent to be cautious about drawing definite conclusions. The annual mean level at the Earls Court site for 2009 was  $37\mu\text{g}/\text{m}^3$ ; this is below the objective level at this location and is slightly lower than in 2008. The chart below (Figure 2.7) shows that in general, levels appear to be declining in the borough.

**Figure 2:7 Trends in Annual Mean PM<sub>10</sub> Concentrations Measured at Automatic Monitoring Sites**

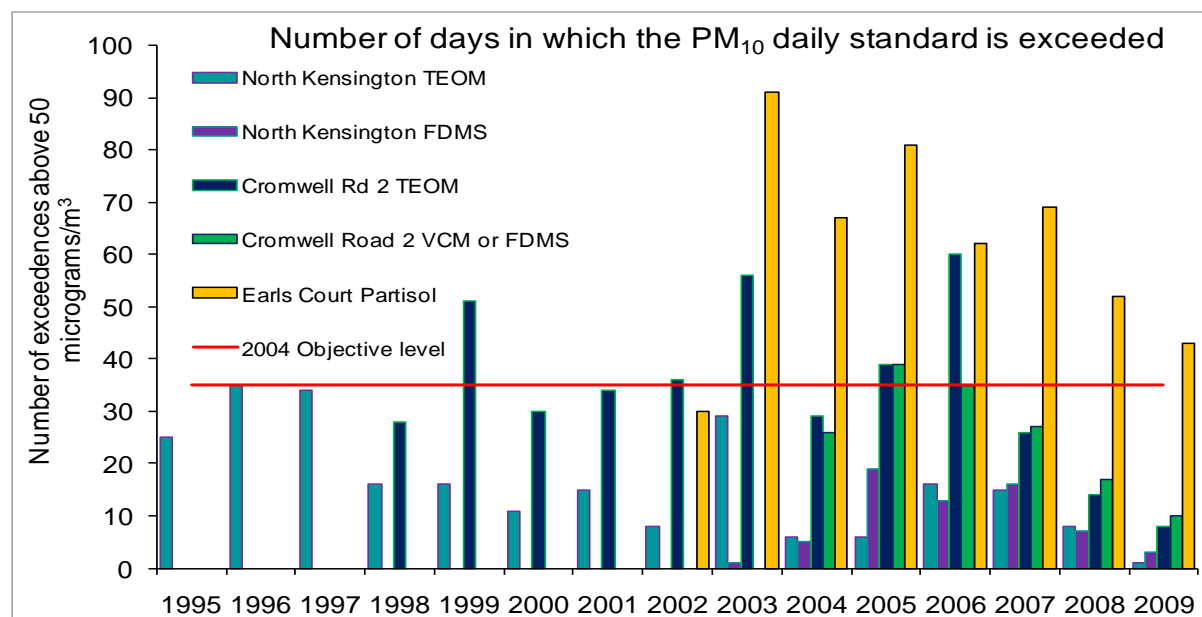


The table below shows data for exceedences of the daily mean objective for three sites in the borough and other sites (for comparative purposes). The data includes various monitoring methods. Two of the three sites in the borough meet the objective level. In 2009 the Earls Court site measured 43 exceedences, which is above the permitted number of 35.

**Table 2.7 Results of PM<sub>10</sub> Automatic Monitoring: Comparison with 24-hour Mean Objective**

Site ID	Location	factor	Within AQMA?	Data Capture for 2008 %	Data Capture 2009# %	Number of Exceedences of 24 hourly mean (50 µg/m <sup>3</sup> )			
						2006	2007	2008	2009
KC1	North Kensington TEOM	1.3	Y	98	98	16	15	8	1
KC1	North Kensington TEOM/FDMS	VCM	Y	98	67	13	18	11	6 (29.7)
AURN	N Kensington Partisol	None	Y	45	81	22	19	N/A	7
KC2	Cromwell Rd2 TEOM	1.3	Y	98	95	<b>60</b>	26	14	8
KC2	Cromwell Rd2 TEOM/FDMS	VCM	Y	98	57	<b>35</b>	27	15	15
KC5	Earls Court Partisol	None	Y	86	95	<b>62</b>	<b>69</b>	<b>52 (74.4)</b>	<b>43</b>
AURN	Bloomsbury TEOM	1.3	Y	81		21	13	9 (48.5)	9
AURN	Marylebone Rd TEOM	1.3	Y	96	97	<b>149</b>	<b>119</b>	<b>151</b>	<b>110</b>
AURN	Marylebone Rd Partisol*	none	-	58	97	<b>69</b>	<b>62</b>	N/A	36
AURN	Marylebone Rd FDMS	none	-		96	-	-	-	32

# i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%.)\* Partisol Data 2006 – 2007 < 90<sup>th</sup> percentile not calculated.

**Figure 2:8 Trends in Daily Mean PM<sub>10</sub> Concentrations Measured at Automatic Monitoring Sites**

### PM<sub>10</sub> conclusions

Monitoring trends in the borough reveal that the Earl's Court monitor (EU reference equivalent method) has only met the annual mean objective for PM<sub>10</sub> since 2008 and that levels continue to exceed the daily mean objective. As monitoring of particles is limited to three sites, it is not possible to determine whether there are exceedences in other areas of the borough. However, concentrations of NO<sub>2</sub> measured at the Kings Road and Brompton Road monitoring sites (which are comparable to levels at the Earls Court site) can be used as a proxy for road traffic contributions of PM<sub>10</sub>. This would indicate that other busy roads have the potential to exceed the daily mean objective.

### 2.2.3 Particulate Matter (PM<sub>2.5</sub>)

The latest Air Quality Strategy<sup>2</sup> set a cap of 25µg/m<sup>3</sup> for particulate matter (PM<sub>2.5</sub>) and a 15 per cent reduction in annual mean concentrations at urban background locations by 2020. This reduction approach is a replacement for the indicative 2010 objectives set for PM<sub>10</sub> in the 2000 strategy and 2003 addendum. However, there is no requirement for local authorities to report against these exposure reduction targets. Nevertheless as the PM<sub>10</sub> annual mean objective now appears to have been achieved across London, this PM<sub>2.5</sub> metric will become increasingly more relevant. Information on current levels has therefore been included below.

<sup>2</sup> Defra (2007) The Air Quality Strategy for England, Scotland, Wales, and Northern Ireland

## Monitoring data

Monitoring of PM<sub>2.5</sub> is only undertaken at a relatively small number of locations in the London area. PM<sub>2.5</sub> has been monitored in the borough at the North Kensington site by Defra using a gravimetric instrument since 2002. This monitoring was interrupted in October 2007 following concerns regarding the filters used in the instruments. Monitoring restarted in 2008 and is now additionally monitored with an FDMS instrument which is a continuous method.

**Table 2.8 Annual mean level of PM<sub>2.5</sub> Automatic Monitoring**

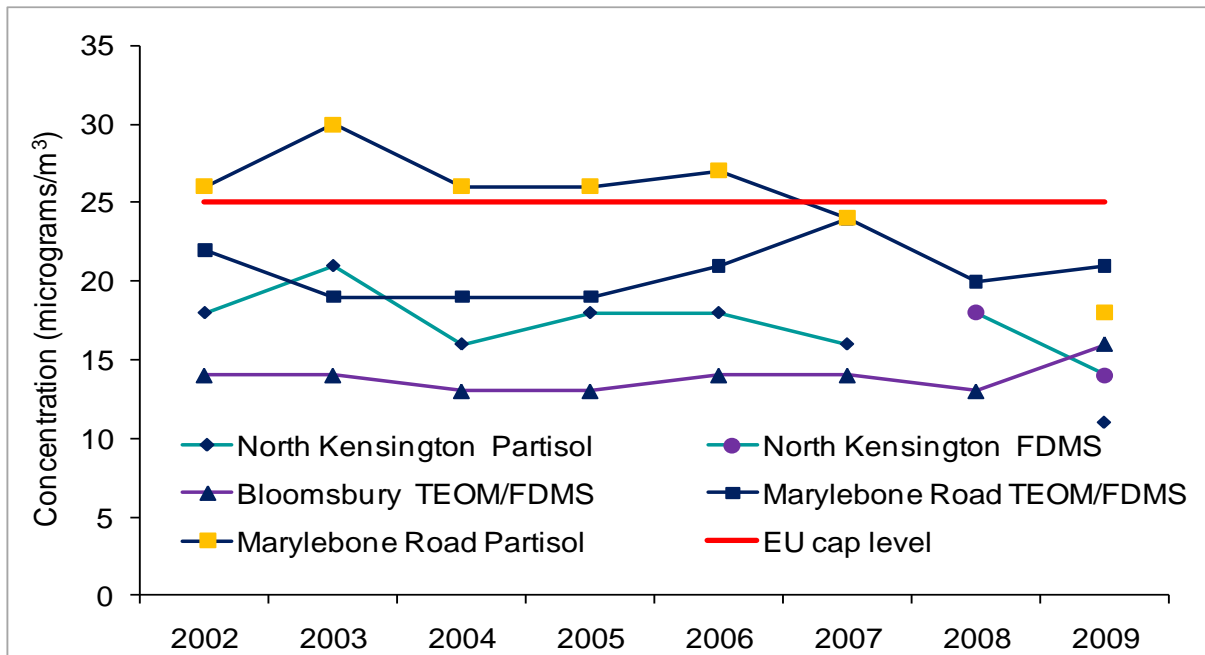
Year	Site	Annual mean µg/m <sup>3</sup> (TEOM FDMS)	Annual mean µg/m <sup>3</sup> (GRAV)	% Data Capture
<b>2002</b>	North Kensington (Partisol)	-	18	91
	Bloomsbury TEOM	14	-	87
	Marylebone Road (Partisol)	-	<b>26</b>	79
	Marylebone Road TEOM	22	-	96
<b>2003</b>	North Kensington (Partisol)	-	21	87
	Bloomsbury TEOM	14	-	96
	Marylebone Rd (Partisol)	-	<b>30</b>	83
	Marylebone Rd TEOM	19	-	93
<b>2004</b>	North Kensington (Partisol)	-	16	89
	Bloomsbury TEOM	13	-	98
	Marylebone Road Partisol)	-	<b>26</b>	88
	Marylebone Road TEOM	19	-	96
<b>2005</b>	North Kensington (Partisol)	-	18	93
	Bloomsbury TEOM	13	-	94
	Marylebone Rd (Partisol)	-	<b>26</b>	83
	Marylebone Rd TEOM	19	-	97
<b>2006</b>	North Kensington (Partisol)	-	18	94
	Bloomsbury TEOM	14	-	98
	Marylebone Road (Partisol)	-	<b>27</b>	87
	Marylebone Road TEOM	21	-	98
<b>2007</b>	North Kensington (Partisol)	-	16	76
	Bloomsbury TEOM	14	-	88
	Marylebone Rd (Partisol)	-	24	75
	Marylebone Rd TEOM	20	-	96
<b>2008</b>	North Kensington (Partisol)	<i>No data due to changes to network</i>		
	North Kensington TEOM FDMS	18		
	Bloomsbury TEOM	13		77
	Marylebone Rd (Partisol)	<i>No data due to changes to network</i>		
	Marylebone Rd TEOM	20		94
<b>2009</b>	North Kensington (Partisol)	-	11	89
	North Kensington-TEOM FDMS	14	-	97
	Cromwell Road-TEOM FDMS*	16.0	-	33
	Bloomsbury TEOM	16.3	-	91
	Marylebone Rd (Partisol)	-	18	81
	Marylebone Rd TEOM-FDMS	21	-	94

\*Monitoring of PM<sub>2.5</sub> at Cromwell Road began in 2009. Data in *italics* (2009) is provisional and should be treated with caution. **Bold** indicates an exceedence of the hourly mean objective (Table 1.1). *Italics* represents unratified data.

Recent data (2009) appears to suggest the cap concentration is met at the central London sites included in the table, however much of the data is not fully ratified and should be treated with some caution. In examining the longer term trends, it should be noted that the data series has been affected (interruption to monitoring), to a certain extent, due to changes to monitoring methodology and equipment.

The figure below compares concentrations with the EU cap level. This appears to show quite a significant reduction in 2009 at North Kensington urban background site for both FDMS and partisol derived data. However, the change in levels at Marylebone Road, a kerbside location, is less clear, whilst the partisol indicates a sharp drop off in concentrations, the FDMS appears to show a slight increase. This discrepancy may be partly due to the differences between the methods. An increase has been noted at the Bloomsbury site. Data for 2009 is not fully ratified.

**Figure 2:9 Trends in Annual Mean PM<sub>2.5</sub> Concentrations Measured at Automatic Monitoring Sites**



The exposure reduction target is based on the three year average from 2009 to 2011 at urban background locations. Based on annual mean concentrations currently being measured at urban background sites, this would indicate that a national exposure reduction target of 15 per cent, to be achieved by 2020, is likely to be applied.

It is therefore important that measures to reduce PM<sub>2.5</sub> are not deferred by an apparent meeting of PM<sub>10</sub> objectives.

### 2.2.4 Sulphur Dioxide (SO<sub>2</sub>)

Three objectives have been set for Sulphur Dioxide (SO<sub>2</sub>), a one hour mean of 350 µg/m<sup>3</sup> (not to be exceeded more than 24 times per year), a 24 hour mean of 125µg/m<sup>3</sup> (not to be exceeded more than 3 times per year) and a 15 minute mean of 266 µg/m<sup>3</sup> (not to be exceeded more than 35 times per year).

#### Monitoring Data

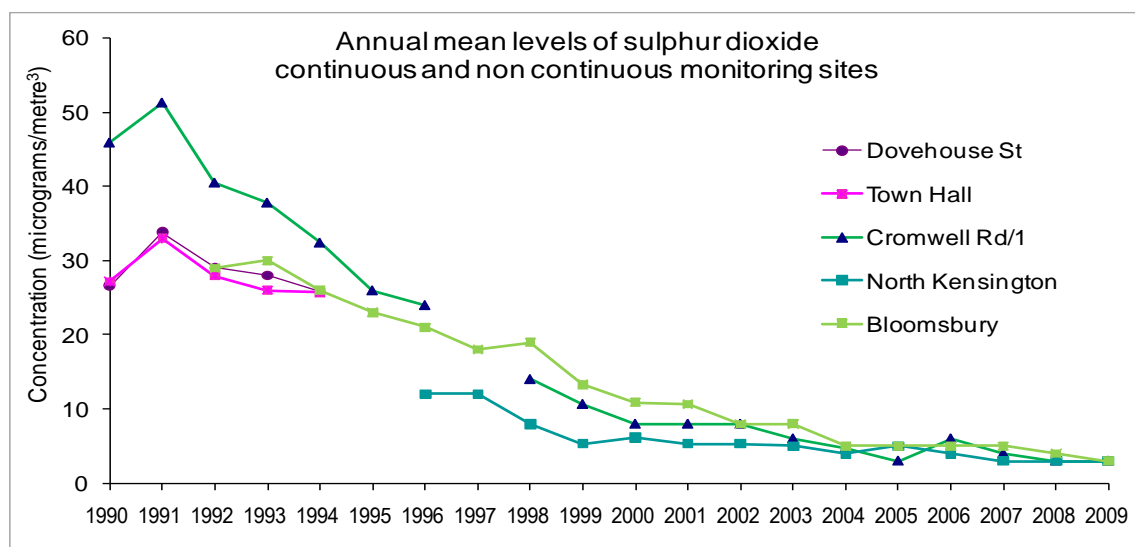
Monitoring data is currently collected at two sites in the borough and is shown in the table below. Data from Bloomsbury (outside the borough) is also included in the table below. Historical data based on non continuous ‘8 port bubbler’ method is also available from the Dovehouse Street and Town Hall sites. These monitoring sites are representative of residential areas away from busy roads and levels at the façade of residential buildings near busy roads.

**Table 2.9 Results of Sulphur Dioxide Automatic Monitoring: Comparison with Objectives**

Site ID	Location	Within AQMA	Data Capture 2009 %	Annual mean	Number of Exceedences		
					15-minute Objective (266 µg/m <sup>3</sup> )	1-hour Objective (350 µg/m <sup>3</sup> )	24-hour Objective (125 µg/m <sup>3</sup> )
KC1	North Kensington	Y	98	3	0	0	0
AURN	Cromwell Road	Y	98	3	0	0	0
AURN	Bloomsbury	N	99	3	0	0	0

No exceedences of any of the objectives have been observed in the past ten years at monitoring locations in the borough. Elevated SO<sub>2</sub> is most likely to be the result of plume grounding episodes arising from industrial sources in the East Thames area but none have resulted in any exceedences. The 15 minute, one-hour, and 24 hour mean objectives for SO<sub>2</sub> continue to be met in the borough.

**Figure 2:10 Trends in Annual Mean Sulphur Dioxide Concentration Measured at Automatic Monitoring Sites**





### 2.2.5 Benzene

Two objectives have been set for the assessment of benzene, a running annual mean of 16.25µg/m<sup>3</sup> to be met by 31.12.2003 and a more stringent annual mean of 5µg/m<sup>3</sup> to be achieved by 31.12.2010.

#### Monitoring Data

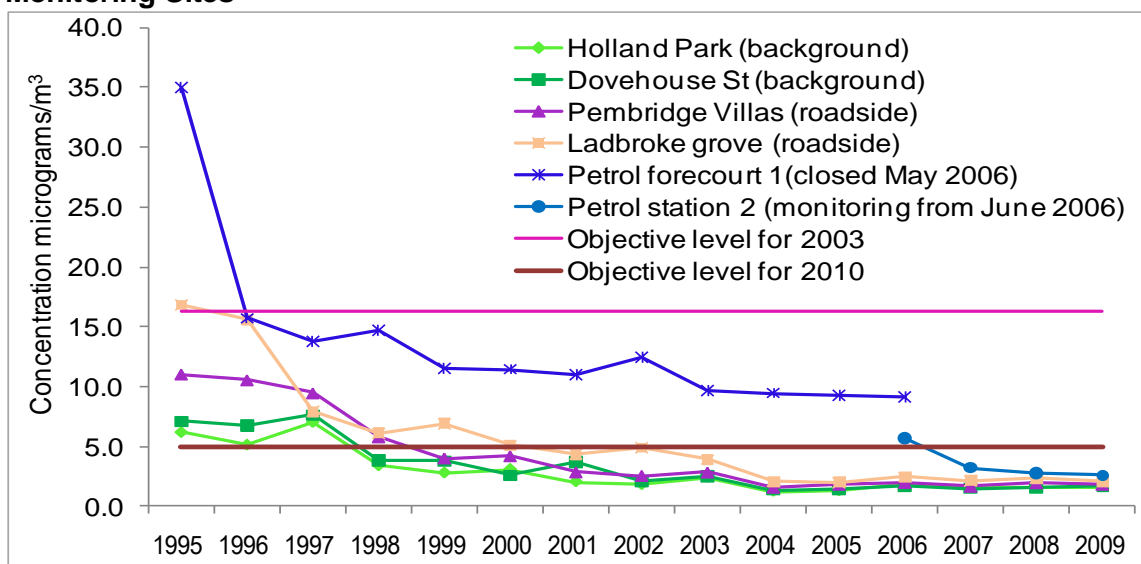
We currently undertake sampling at five locations using diffusion tubes, these include two roadside, two background, and one in close proximity to a petrol station forecourt. The petrol station has operated stage two (in addition to stage one) vapour recovery since 2007.

The highest levels of benzene have generally been recorded at the petrol station sites. The table below demonstrates that the 2003 (16.25µg/m<sup>3</sup>) objective has been met at all sites since 2000, and the 2010 objective since 2007 (the measured annual mean is assumed to be the equivalent of the running annual mean). Results for 2009 show a slight decline compared to 2008 levels (100% data capture was achieved for 2009).

**Table 2.8 Annual Average Benzene Levels Using Diffusion Samplers (µg/m<sup>3</sup>)**

Year	KC01 Ladbroke Grove/Nth Ken Library	KC02 Holland Park	KC03 Warwick Rd Petrol St. (forecourt)	KC04 Dovehouse St	KC05 Pembridge Square Library	KC0X Old Brompton Rd/ Clareville Grove Petrol station
2000	5.1	3.1	11.4	2.6	4.2	-
2001	4.3	2.0	11.0	3.7	2.9	-
2002	4.9	1.8	12.5	2.1	2.6	-
2003	3.9	2.4	9.6	2.5	2.9	-
2004	2.1	1.2	9.5	1.4	1.6	-
2005	2.0	1.3	9.2	1.4	1.8	-
2006	2.3	1.9	9.2	1.7	2.0	5.7
2007	2.2	1.6	Closed	1.5	1.7	3.2
2008	2.3	1.6	-	1.6	2.0	2.8
2009	2.1	1.6	-	1.7	1.8	2.6

**Figure 2:8 Trends in Annual Mean Benzene Concentration Measured at Diffusion Tube Monitoring Sites**



## 2.2.6 Other pollutants monitored

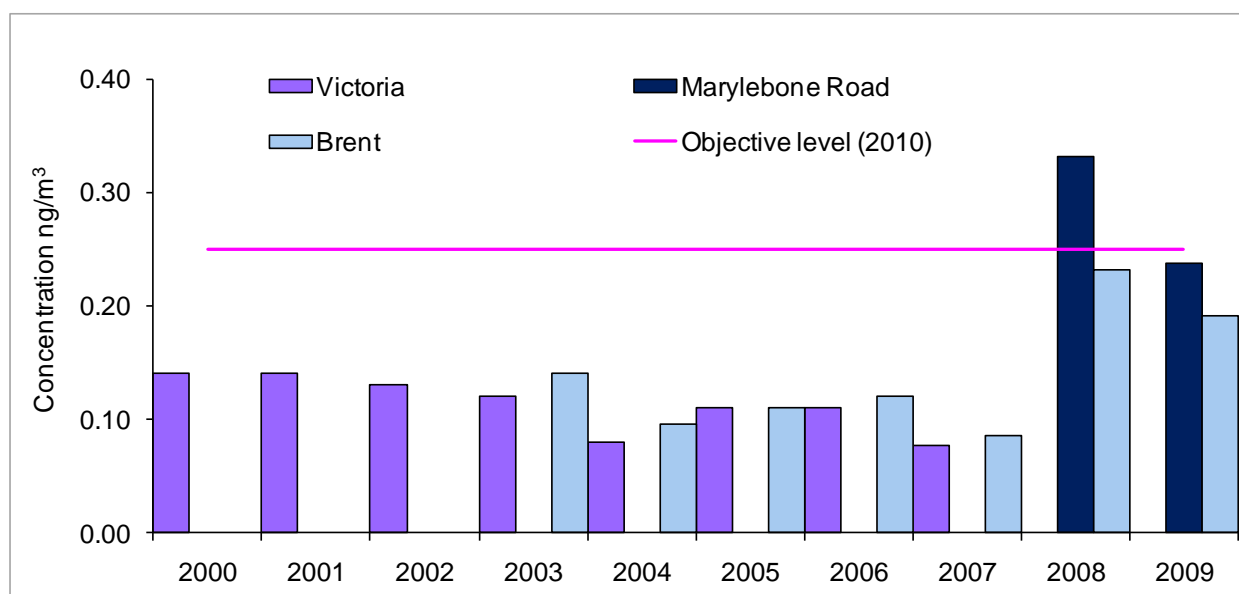
### Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are a complex mixture of organic compounds some of which are carcinogens. The Government has set an objective for these pollutants. It would be very difficult and expensive to monitor a selection of these pollutants, consequently, the Government has selected benzo(a)pyrene (b(a)p) as a marker for PAH and set an objective based on this pollutant:  $0.25\text{ng/m}^3$ <sup>(footnote 3)</sup> as an annual average to be achieved by the end of 2010.

Whilst this objective has been set, it has not been included in regulations for local air quality management purposes. However, monitoring data from the London area has been included in this report, for information. The main sources of b(a)p are industrial emissions, domestic coal and wood burning. Vehicles no longer appear to be a major source. Urban areas such as London without significant industrial activity have shown reductions in concentrations. This pollutant may become of increasing concern in the future if the use of biomass or biofuels becomes more widespread.

The most recent data available from monitoring at sites in Victoria and Brent indicate that at these locations concentrations have generally been declining and are within the objective level (data source Air Quality Archive). However data from Marylebone Road was above the objective level in 2008 but below the objective level in 2009.

**Figure 2:11 Trends in Annual Mean Benzo(a)pyrene Concentration Measured at Monitoring Sites in London**



As the borough has no industrial processes and very little coal and wood burning, concentrations of b(a)p would be expected to be similar to the levels indicated by the above monitoring results and are therefore more likely to be well within the 2010 objective.

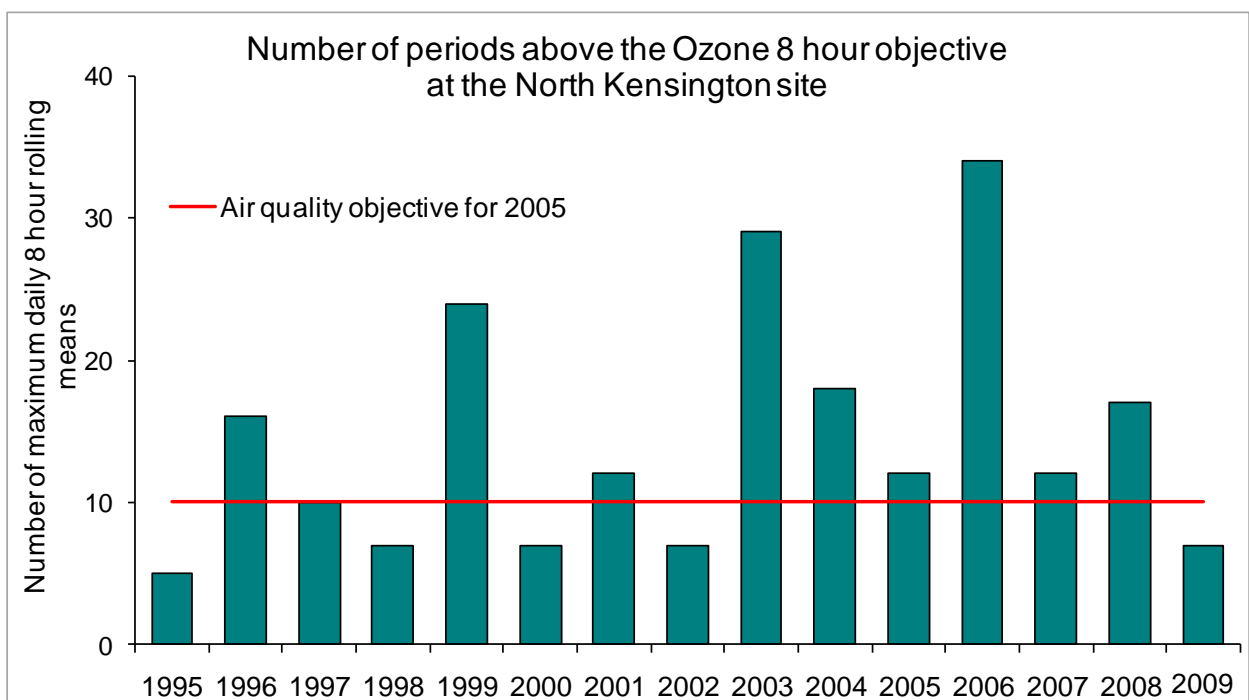
<sup>3</sup> ng stands for nanogram. A nanogram is one millionth of a milligram or one thousandth of one millionth of a gram

### 2.2.7 Ozone (O<sub>3</sub>)

The objective for ozone (O<sub>3</sub>) is 100µg/m<sup>3</sup> not to be exceeded more than 10 times a year (calculated as the daily maximum 8 hour mean) by 2005. This objective is not included in the LAQM process as ozone reduction requires action at a regional and European level. However, due to its health effects, monitoring is undertaken at the North Kensington background site. Ozone formation is dependent on high temperatures and sunny weather as well as the necessary precursor pollutants such as oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds. Unlike most pollutants, ozone tends to be higher at background locations away from busy roads, often the highest levels being reached in rural locations. This is because NO<sub>x</sub> emitted from vehicle exhaust and building flues will react with ozone resulting in a reduction of its level.

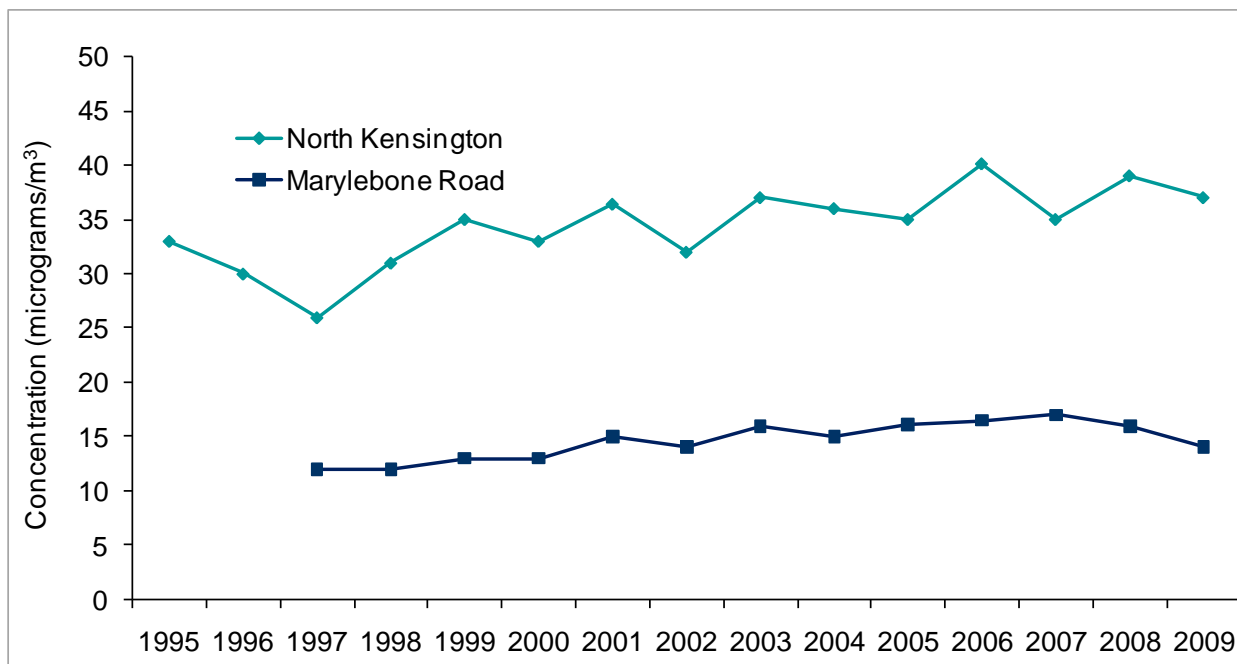
Figure 2:12 shows exceedences of the objective at a background location in the borough. Overall there has been an increase in the number of periods exceeding the objective; however this varies considerably from year to year. Between 2003 and 2008 the borough has exceeded the 2005 objective however, in 2009 the number of exceedences were below the objective level.

**Figure 2:12 Trends in the 8-hour Ozone Exceedences Measured at Automatic Monitoring Sites**



The figure overleaf shows the annual mean levels at the North Kensington site and a roadside location site (Marylebone Road) located outside the borough. The latter site is included to demonstrate the lower levels measured near to busy roads. This chart also shows that, overall, annual mean levels have increased since monitoring began but that there was a fall in 2009 compared to 2008.

**Figure 2:13 Trends in Annual Mean Ozone Concentrations Measured at Automatic Monitoring Sites**



### 2.2.8 Lead

There are two annual mean objectives for lead, 0.5 µg/m<sup>3</sup> (to be achieved by 2004) and an objective of 0.25 µg/m<sup>3</sup> (to be achieved by 2008).

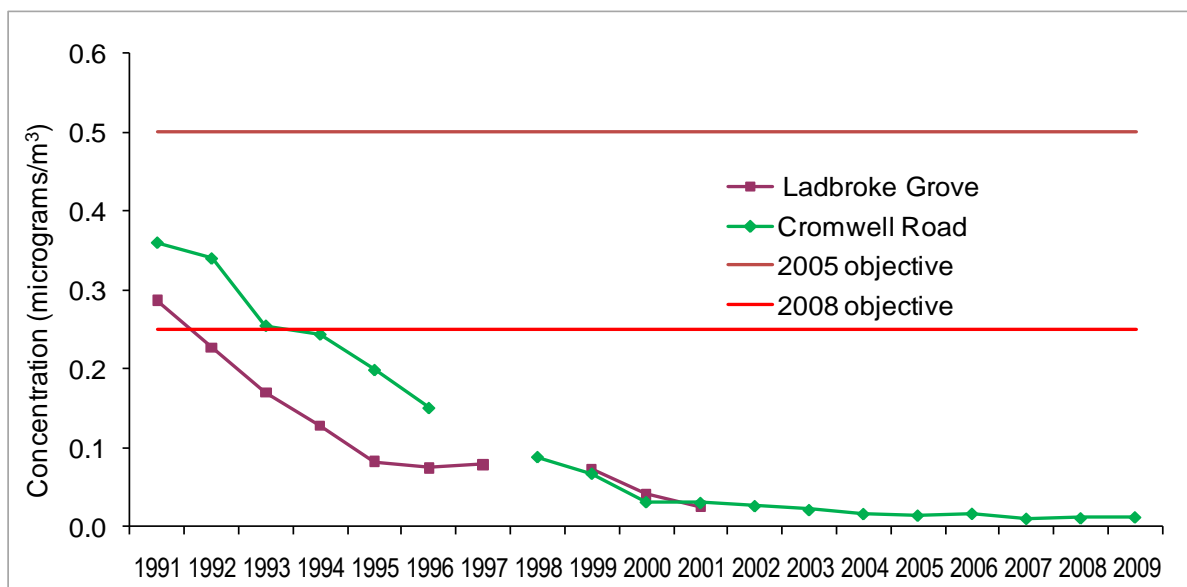
Lead monitoring in the borough is undertaken by Defra at the Cromwell Road monitoring site. Monitoring was previously undertaken by the Council at Ladbroke Grove. When leaded petrol was phased out, monitored levels dropped significantly so the decision was taken to close the site at the end of 2001. Monitoring data is shown in the table below.

**Table 2.10 Annual Mean Lead levels within the Borough**

Year	Ladbroke Grove (µg/m <sup>3</sup> )	Cromwell Rd (µg/m <sup>3</sup> )
1999	0.073	0.068
2000	0.041	0.032
2001	0.026	0.031
2002	-	0.027
2004	-	0.017
2005	-	0.015
2006	-	0.017
2007	-	0.011
2008	-	0.012
2009	-	0.013

As demonstrated in the chart below, monitoring data shows a downward trend at both Cromwell Road and Ladbroke Grove. The 2004 and 2008 objectives were met by 1992 at the Ladbroke Grove site and by 1994 at the Cromwell Road site.

**Figure 2:14 Trends in Annual Mean Lead Concentrations**



**2.2.9 Carbon Monoxide (CO)**

The objective for carbon monoxide (CO) is 10 mg/m<sup>3</sup> <sup>(4)</sup> as a maximum daily 8 hour running mean. We have looked at data from 2009 to check this objective continues to be met. All CO monitoring data since 2005 has been collated in Table 2.11, along with data from one other busy kerbside location from central London (Marylebone Road).

**Table 2.11 Concentrations of CO measured in the Borough and at one central London site**

Year	Site	Annual mean (mg/m <sup>3</sup> )	Max daily 8-hour running mean (mg/m <sup>3</sup> )	No. of hours above 10mg/m <sup>3</sup>	% Data capture
2005	North Kensington	0.4	3.1	0	96
	West London	0.4	2.1	0	94
	Cromwell Rd 2	0.7	3.5	0	94
	Marylebone Rd	0.9	3.6	0	98
2006	North Kensington	0.3	2.0	0	97
	West London	0.4	1.8	0	84
	Cromwell Rd 2	0.7	2.0	0	95
	Marylebone Rd	1.0	2.8	-	66
2007	North Kensington	0.3	2.6	0	98
	West London	0.4	2.0	0	82
	Cromwell Rd 2	0.6	2.3	0	96
	Marylebone Rd	0.8	2.7	0	94
2008	North Kensington	0.3	1.7	0	98
	Cromwell Rd 2	0.5	2.3	0	93
	Marylebone Rd	0.7	2.5	0	98
2009	North Kensington	0.3	1.7	0	98
	Cromwell Rd 2	0.4	2.3	0	97
	Marylebone Rd	0.7	2.5	0	98

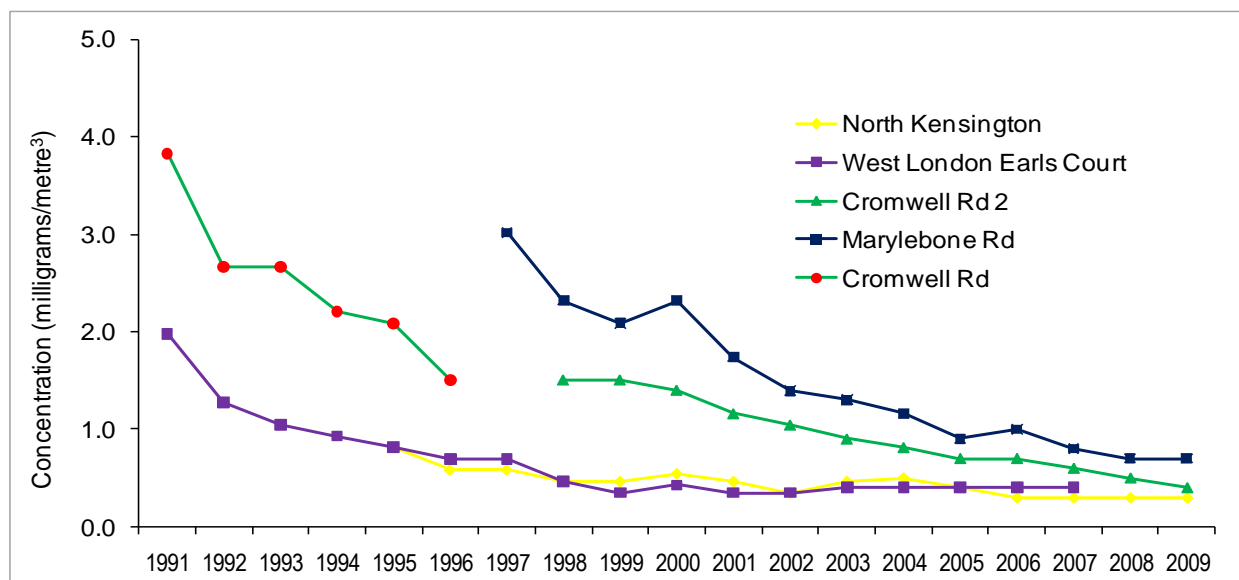
\* Low data capture at Marylebone Road

There were no exceedences of the objective in 2009 at any of the monitoring locations in the borough. Generally, annual mean levels at roadside locations are a little higher than concentrations at background locations, although this difference has become less

<sup>4</sup> mg (milligram) = one thousand of a gram

marked in recent years. The highest maximum daily 8 hour running mean value measured at any of the sites in the borough during 2009 was 2.3mg/m<sup>3</sup>. This is well below that 10 mg/m<sup>3</sup> objective level. The figure below shows the long term trend in annual mean levels, this demonstrates a steady downward trend with levels stabilising in the past few years.

**Figure 2:15 Trends in Annual Mean Carbon Monoxide Concentrations Measured**



### 2.2.10 1,3-Butadiene

For this pollutant, measurements should meet the 2003 objective as a running annual mean of 2.25µg/m<sup>3</sup>. 1,3-butadiene is not monitored in the borough, although data is collected by Defra. Whilst this is limited to a few sites within London, it can be used to indicate local levels (Table 2.12).

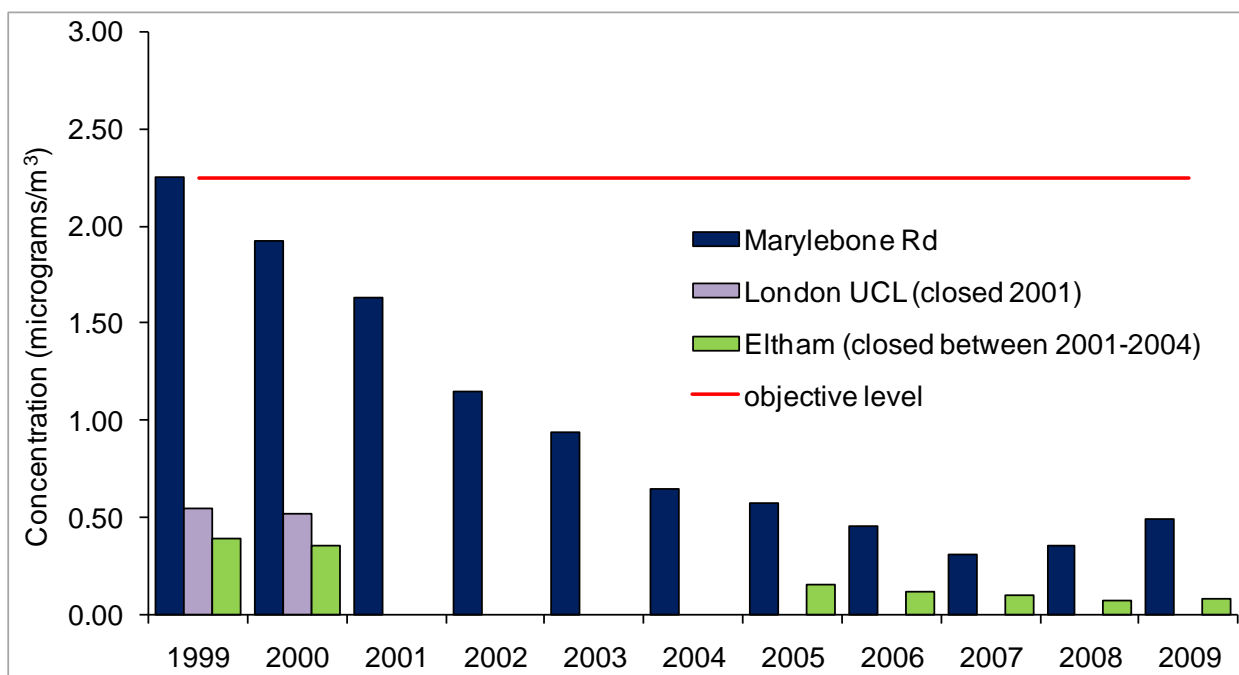
**Table 2.12 Levels of 1,3-butadiene (maximum annual running means) in London**

Year	Site	Annual Mean (µg/m <sup>3</sup> )	% Data Capture
2000	Marylebone Rd	1.63	91
	Eltham	0.27	86
2001	Marylebone Rd	1.12	86
	Eltham	-	-
2002	Marylebone Rd	0.95	96
	Eltham	-	-
2003	Marylebone Rd	0.64	92
	Eltham	-	-
2004	Marylebone Rd	0.57	81
	Eltham	0.15	91
2005	Marylebone Rd	0.45	89
	Eltham	0.11	94
2006	Marylebone Rd	0.45*	71
	Eltham	0.09	80
2007	Marylebone Rd	0.31	78
	Eltham	0.10	83
2008	Marylebone Rd	0.35	80
	Eltham	0.07	82
2009	Marylebone Rd	0.49	80
	Eltham	0.08	87

\*Incomplete data. Data in italics is provisional

The running annual mean concentration has been declining steadily at the Marylebone Road (roadside) site since 1999, dropping from  $2.25\mu\text{g}/\text{m}^3$  to  $0.35\mu\text{g}/\text{m}^3$  by 2008. The Eltham site which has operated intermittently has been well within the objective since 1999 when monitoring started. These results indicate that there are unlikely to be any exceedences of the 2003 objective in the borough.

**Figure 2:16 Trends in the Maximum Running Annual Mean 1,3-Butadiene Measured at Automatic Monitoring Sites**



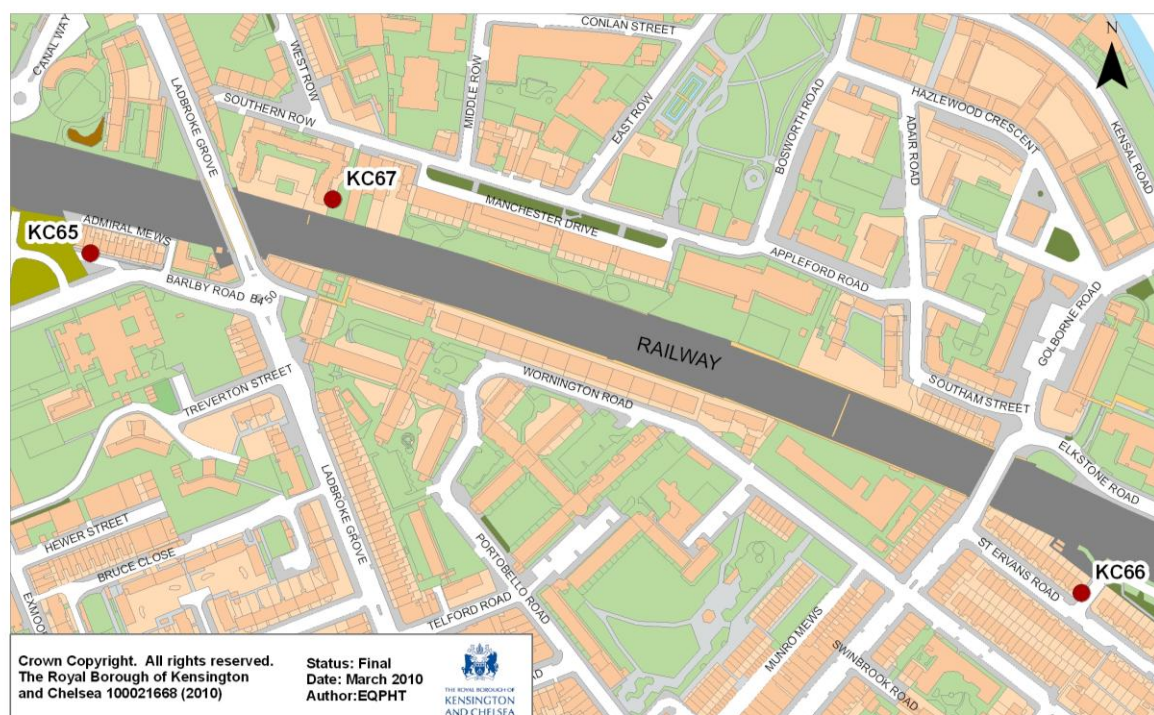
## 2.3 Detailed Assessment Railway Emissions

Following Defra's Technical Guidance LAQM.TG (09), the Council's 2009 USA, identified the Paddington to Swansea railway line as a potential significant source of NO<sub>2</sub> due to the presence of diesel passenger trains. The potential for relevant exposure was also identified at a number of locations within 15 metres of the railway track. The conclusions of Council's report were accepted by the GLA and Defra, however in their response they concluded that a Further Assessment rather than a Detailed Assessment should be carried out.

A Detailed Assessment would normally require an examination of the combined impact of locomotive emissions with those of local road traffic. The guidance however states that because modelling is not straight forward the assessment should focus on monitoring.

Monitoring of NO<sub>2</sub>, using diffusion tubes, began at a number of locations in May 2009 and 11 months of data have been collected. The monitoring period covered both summer and winter months and should be representative of the annual mean. The monitoring has been undertaken as part of the LWEP and is subject to the same quality control and co-location comparisons at continuous sites.

**Figure 2:17 Map of Railway Line with Monitoring Sites**



### 2.3.1 London Atmospheric Emissions Inventory

The London Atmospheric Emissions Inventory (LAEI) details the contribution of different sources by area, point and mobile sources. The NO<sub>x</sub><sup>5</sup> contribution from railway sources is estimated to be 15% of total emissions in the borough. Modelling of all sources

<sup>5</sup> Emissions of NO<sub>2</sub> are usually expressed in terms of NO<sub>x</sub> (NO and NO<sub>2</sub>) rather than NO<sub>2</sub> alone as NO<sub>2</sub> is a variable proportion of total NO<sub>x</sub> and NO is rapidly oxidised to NO<sub>2</sub>.



including the contribution from the railway has been undertaken by the GLA. Maps of modelled concentrations have been produced by the GLA using the 2006 LAEI. The maps appear to show very high concentrations along the length of the railway line. A comparison, of the predicted concentrations and the measured concentrations, is discussed below.

**Table 2.13 Comparison of monitored data and predicted levels near the railway line**

Site Code	Location	Predicted level* $\mu\text{g}/\text{m}^3$		Monitored level $\mu\text{g}/\text{m}^3$ 2009-2010	Dist. to rail line
		2006	2010		
KC65	Barlby Road/Admiral Mews	55-59	50-53	39.6	35m
KC66	Acklam Road	52-56	47-50	43.4	32m
KC67	Southern Row	55-58	50-53	41.6	16m

\* lowest and highest predictions based on GLA LAEI 2006 using different meteorology data

The site at Barlby Road/Admiral mews is below the objective value, whilst Acklam Road and Southern Row are just above. The locations are sited at distances between 16 to 35 m from the railway. In siting the diffusion tubes, busy roads have been avoided however, Barlby Rd/Admiral Mews and Southern Row sites are sited on no-through roads which have access for residential parking. The Acklam Road location is on a very minor road however, the concentration is the highest of the three sites suggesting that some of the elevated levels are attributable to the road.

When compared to other sites in the borough, the results are comparable to other sites on no-through roads e.g. Blantyre St, Donne Place, St Marks Grove and Ladbroke Crescent. This indicates that the emissions from the railway line are likely to be minor.

This conclusion is further supported by a comparison with the values predicted using the LAEI. The monitored levels are significantly lower. The difference between the measured levels and the predicted levels for 2010 are between 8-11 $\mu\text{g}/\text{m}^3$  and 10-13 $\mu\text{g}/\text{m}^3$  lower when compared to the nearest lowest prediction at the Southern Row and Barlby Road sites respectively. The difference in the Acklam road site annual mean is around 4-7 $\mu\text{g}/\text{m}^3$ , this may be because this site is affected by the road source more than the other sites. This would suggest that either the emissions are over estimated or that dispersion around the railway corridor is more effective.

There is little that can be undertaken by an individual authority in such a case where trains are moving through. This line will however be electrified and work began in 2009 on the Great Western Main Line between London and Swansea. It is however expected to take eight years to complete.

Electrification will enable the introduction of a predominantly electric high-speed train fleet. These trains will reduce air pollutant and carbon dioxide emissions compared to their diesel equivalents. The proposed fleet for an electrified Great Western Main Line to Swansea will include a proportion of 'bi-mode' trains. These trains have a diesel generator vehicle at one end and an electric transformer vehicle at the other end. This allows these trains to operate 'off the wires' (not electric) to maintain through services and provide diversionary services. This should gradually bring about improvements.

**Summary of Compliance with AQS Objectives**

Kensington and Chelsea Council has examined the results from new monitoring in the borough and other comparable sites. Concentrations of sulphur dioxide, benzene, lead, carbon monoxide and 1,3- butadiene continue to meet air quality strategy objectives. Ozone met the objective for the first time in 2009 since 2002.

However concentrations of nitrogen dioxide continue to exceed objective levels within the AQMA objectives at relevant locations. Whilst the latest results of PM<sub>10</sub> from monitoring indicate that levels appear to be currently meeting the objectives for PM<sub>10</sub> at distances representative of building facades it is considered that action on reducing particles should not cease; therefore the AQMA is to be retained.

## **3 New Local Developments**

### **3.1 Road Traffic Sources**

An application for the Earls Court road link, an access road for lorries running north of the Earls Court Exhibition centre, alongside the West London Line and beneath the West Cromwell Road was received in December 2008. The aim of this new route is to relieve traffic congestion around the Earls Court Centre. However as this entails re-routing traffic to other residential roads it was essential that the link road was operated in such a way as to reduce emissions to as low as possible and not to simply transfer traffic elsewhere. Following lengthy discussions over the air quality assessment and an evaluation of the number of people affected by the changes, various measures have been agreed to ensure that any impact is as low as possible.

### **3.2 Other Transport Sources**

No changes to other transport sources have been identified in the borough.

### **3.3 Industrial Sources**

No new industrial sources have been identified.

### **3.4 Commercial and Domestic Sources**

Biomass boilers are discouraged in the borough. There are no new/newly identified commercial or domestic sources which have not been considered as part of an air quality assessment.

### **3.5 New Developments with Fugitive or Uncontrolled Sources**

There have been no new/newly identified uncontrolled sources in the borough.

Kensington and Chelsea Council confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

## **4 Local / Regional Air Quality Strategy**

The Council is currently writing a short air quality policy statement to reinforce the recently renewed Air Quality Action Plan. The statement will reflect our concerns about the progressions being made to improve air quality and the acceleration that is needed in order to meet the objectives. In the longer term, the Council is intensely concerned about the previously understated health impacts of air pollution in inner urban areas. The statement will therefore set out the key issues that could make a difference to air quality in London and those we will lobby others about. We anticipate this will be adopted in September/October 2010.

## 5 Planning Applications

The Council ensures that air quality is a consideration from the early planning stages. Developers should follow the guidance within the Council's Air Quality Supplementary Planning Document, (SPD), adopted in June 2009 to ensure that the council's preferred approach is taken (for more information on the Council's planning policies see Section 6).

Major planning applications which have been granted permission during April 2009 – March 2010 subject to conditions or section 106 agreements that require a low emission strategy and that follow the best practice guide for demolition and construction phases include:

### **Wornington Green Estate**

The redevelopment of the Wornington Green estate comprises 538 affordable homes to replace those demolished, an additional 30 shared ownership homes and more than 300 new homes for sale with the reinstatement of a traditional street pattern, and approximately 20 new retail units for Portobello Road generating up to 200 new jobs. This was also the subject of the Wornington Green SPD (Adopted 9 November 2009).

### **222 Kensal Road**

A major application that has been approved includes 222 Kensal Road which is in the north of the borough. This involves the demolition of an existing building and industrial sheds and the erection of a seven storey building comprising of flexible workspace, student accommodation and associated facilities. The applicant has completed a dust and emissions risk assessment and categorised the site as 'medium risk' based on the criteria in the London Councils' Best Practice Guidance<sup>6</sup>. This includes considering the size of the site, the vicinity of the site to sensitive receptors and the type of the demolition/construction techniques that will be carried out. The development will be car free and use high efficiency low NO<sub>x</sub> boilers.

Planning applications which have not yet been determined include:

### **Commonwealth Institute**

Refurbishment and alteration of the property (including removal of the administration building and extension of the basement) for D1 (non-residential institution), retail, restaurant and cafe, office, storage and ancillary uses; the erection of two residential buildings and one mixed use building containing 62 residential units, retail and ancillary D1 uses. A section 106 agreement is currently under negotiation.

In all cases the air quality implications of such developments are considered in accordance with the Council's Air Quality SPD in developing measures to reduce emissions. Many of the larger developments are also undertaking PM<sub>10</sub> monitoring as well as using mitigation measures from the London Councils' Best Practice Guidance.

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<sup>6</sup> London Councils (2006) Best Practice Guidance. The Control of Dust and Emissions from Construction and Demolition

## 6 Air Quality Planning Policies

In 2009 the Council updated its Air Quality SPD, replacing the SPD adopted on 25th May 2002. The SPD sets out the Council's requirements for reducing air pollution emissions from new development, conversions and change of use.

The SPD supplements Unitary Development Plan (UDP) Policies PU1 and PU2 and provides detailed guidance on their implementation. The UDP, together with the London Plan, is the current Development Plan for the borough, which is used to determine applications for planning permission. However, the UDP is currently being replaced by the Local Development Framework (LDF), and in particular the Development Plan Documents.

The SPD will be a significant material planning consideration when determining applications for planning permission and form part of the Local Development Framework. With our Planning colleagues we have also introduced an air quality action fund (as part of Section 106 agreements) as a means to counteract adverse effects of new developments, although our first priority will be to steer developers towards technology that reduces emissions.

The primary aim of this SPD is to supplement existing UDP Policies seeking to improve air quality in the borough. However, this SPD will also help implement the objectives in the AQAP relating to land use.

In assessing the potential impacts from the operational phase of developments, the Council is requesting low emission strategies to be submitted rather than considering air pollutant concentrations alone. The developer must submit a strategy for reducing emissions from all areas of the new development including transport, heating and energy use. The extent of the measures will depend on the location, size and traffic generated by the development and will need to be agreed by the Council.

Developers are also expected to assess the impacts that demolition and construction works may have on local air quality by undertaking a risk assessment using the London Councils' Best Practice Guidance and expected to include appropriate measures in their construction management plans.

## 7 Local Transport Plans and Strategies

The Council's Local Implementation Plan (LIP) sets out how we intend to implement the Mayor's Transport Strategy locally. Our first LIP was approved by the then Mayor in August 2007 and covers the period up to April 2011. On 10 May 2010, the Mayor of London published the final version of his Transport Strategy and Transport for London (TfL) and London Councils jointly published draft guidance, to which boroughs must have regard when preparing their second round of LIPs. The Consultation Draft LIP is due to be published by the end of December 2010. In parallel with the development of the LIP is the Strategic Environment Assessment.

The main objectives of the draft LIP for 2010-2014 are;

1. Improve accessibility to places and services, especially for those with special mobility needs
2. Make it easier for residents to choose walking, cycling and public transport over private car ownership and use
3. Improve the quality, accessibility and reliability of public transport
4. Reduce transport - related air and noise pollution
5. Reduce transport - related carbon dioxide emissions
6. Increase the proportion of journeys made on foot and by bicycle
7. Manage on-street parking and loading to achieve a better balance between the competing demands on kerb-side space
8. Improve journey time reliability for all road users
9. Improve the appearance, efficiency and inclusiveness of our streets and places
10. Reduce the number and severity of road accident casualties

Funding through the LIP has been used for a number of air quality projects, including the improvement to air quality monitoring along the Earls Court Road. The equipment will record NO<sub>x</sub> levels on Earl's Court Road (south of the station) to monitor changes in air quality in Earl's Court resulting from the westward extension to the Central London Congestion Charging Scheme.

The Council has also produced a 'Green Driving Guide and Green Fleet Toolkit'. This will be used to encourage fuel-efficient driving practice in the borough, and offer advice and guidance to other organisations in the borough about making their vehicle fleet, driving practices, maintenance and procurement less polluting.

## 8 Climate Change Strategies

The Council adopted a Climate Change Strategy in 2008<sup>7</sup>. Through this strategy, the Council aims to make a difference over seven years from 2008 – 2015, through the operation of its own estate; in delivering services, and in stimulating behavioural change amongst businesses, residents and partner organisations in the community.

The Council is committed to playing an important role in national and regional programmes and has set targets to help in the delivery of this agenda. Four main indicators (Comprehensive Area Assessment) relate to climate change:

- NI 185 – measures the carbon emissions from the Council's own estate, including schools and contractors;
- NI 186 – measures the carbon emissions of the borough's domestic, commercial and transport sectors;
- NI 188 – measures the Council's performance in adapting to climate change,
- NI 194 – measures the reduction in NO<sub>x</sub> and primary PM<sub>10</sub> emissions from the Council's own estate.

The Council recognises the need to lead by example. To do this the Council has joined The Carbon Trust's Local Authority Carbon Management Programme (LACMP). This is a major commitment that commenced in May 2008 and will lead to a detailed 5-year action plan. The Carbon Management Plan was published in 2009<sup>(6)</sup>. The Council was selected to take part in 2008 phase, and have worked with the Carbon Trust in partnership to establish the baseline and the action plan. This Carbon Management Plan commits the Council to a target of reducing CO<sub>2</sub> by 40% by March 2014 from 2007/08 level.

A comprehensive review of the Council's Renewable Energy Options (both on and off site) was commissioned. The review provided a number of options for renewable energy generations but concluded that the onsite generation was not cost effective compared to the offsite. Since offsite energy generation is currently not recognised as carbon savings, in the Government's measures such as National Indicator 185, it was decided that the Council will continue to review other long term solutions including technologies to improve building energy efficiency to minimise the Council's energy use.

The Council is at the early stages of developing a decentralised energy strategy and are involved in the Decentralised Energy Masterplan project. The programme is lead by the LDA, with collaboration from Capital Ambitions, London Councils, GLA and London Energy Partnership and they are offering a comprehensive support package to local authorities that promote the delivery of decentralised energy. This support package forms part of a broader programme designed to put London on track to deliver 25% of its energy from decentralised sources by 2025.

The Council is in the final stages of adopting its Core Strategy, which puts forward several opportunities for Decentralised Energy, more specifically Combined Cooling, Heat and Power systems or similar, through major development opportunities. The first

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<sup>7</sup> RBKC (2008) The Climate Change Strategy 2008-2015  
<http://www.rbkc.gov.uk/environmentandtransport/climatechange.aspx>



phase of the project is to produce a Heat Map of the borough, which will help identify areas of highest heat demand as well as locations of existing CHP plant and DE Networks. Once the Heat Map is finalised, we will be able to identify 'clusters' of buildings and development areas in the boroughs that have the best potential for delivering future district heating networks as well as extensions to existing local heat networks. The air quality impact of the proposals will however need to be examined.

## **9 Implementation of Action Plans**

The Council's second Air Quality Action Plan (AQAP) 2009-2014 outlines the measures that will be taken in order to work towards achieving the national air quality objectives. This section provides an update on the progressions that have been made so far in terms of the measures and targets set out in the AQAP. It should be noted that this is the first progress report for the AQAP 2009-2014, which was only fully implemented towards the end of 2009. Successful delivery of these measures also involves the co-ordination of several different departments within the Council.

An update of each of the 23 measures is provided in the summary table below. Some progress has been made but many of the measures are ongoing and will therefore be developed over the next few years.

**Table 9.1 Action Plan Progress**

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
1	Review scope for PM <sub>2.5</sub> monitoring	Review the scope of the current monitoring network to account for the increasing concerns for health effects of fine particles (PM <sub>2.5</sub> )	LA	2009	2010	At least one road side PM <sub>2.5</sub> monitoring station in the borough by Dec 2010	N/a	• PM <sub>2.5</sub> monitoring equipment was installed at the Council's Cromwell road (roadside) monitoring station.		Complete	The monitoring of PM <sub>2.5</sub> will help the Council in developing emission reduction measures specific to PM <sub>2.5</sub> .
2	Public Health Collaboration	Work to strengthen collaboration with local health organisations and coordinate efforts in tackling pollution related illness and health inequalities by raising awareness of asthma and indoor air quality and the dangers of second-hand smoke.	LA	2009-2010	2009-2014	A number of joint initiatives on asthma and indoor air quality covering issues such as smoking, carbon monoxide and boiler emissions.	N/a	<ul style="list-style-type: none"> <li>•Regular meetings held with representatives from the local Primary Care Trust and Health Protection Agency.</li> <li>•Working together to distribute the Indoor Air Quality leaflet and raise awareness of the project.</li> <li>•Smoke Free Homes Officer appointed in December 2009 who is working closely with local health organisations.</li> </ul>		Ongoing	N/a
3	Raising awareness	Continue to raise awareness of air pollution and its effects on health and promote air	LA	2009	2009-2014 (ongoing)	No. of airTEXT users to reach target of 300.  Provide	N/a	<ul style="list-style-type: none"> <li>•To date, there are a total of 156 airTEXT users who are subscribed to receive alerts in this borough.</li> <li>•Promoted airTEXT at pharmacies and GP</li> </ul>		Target of 300 airTEXT users will be achieved by March 2012.	N/a

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
		quality issues by participation in schemes such as airTEXT and Walkit.com, and working with schools.				presentations and awareness workshops to schools and community groups.  Establish links with all schools in the borough.		surgeries by circulating leaflets and submitting an electronic message for waiting room information screens.  •Utilising opportunities such as the Council's Environment Day and community workshops to raise awareness and promote airTEXT and Walkit.com.  •Working in collaboration with the Healthy Schools Programme to engage schools in the borough.		General promotional opportunities will be ongoing (2009-2014).	
4	Council and contractors' fleet	Improve emissions from Council and contractors' fleet by requiring the latest Euro Standard, where possible, increasing the number of alternatively fuelled "low emission" vehicles, fitting abatement equipment and providing green driver training.	LA	2009	2009-2014 (ongoing)	Achieve the emission reduction target from the NI194 baseline toolkit (2008/09).	8%	Progress relating to low emission vehicles:  • The Council has trialled a bio-methane fuelled Volkswagen Caddy (small commercial van) as well as the re-designed petrol/electric hybrid Honda Insight car. Staff who trialled these vehicles were impressed with the performance. Currently reviewing the associated lease costs.  • In partnership with SITA UK, the Council has trialled a new refuse collection vehicle which runs on is fuelled on a mix of fuel made from landfill gas and diesel.  •The Council is keeping up to date with advances in low emission vehicle technology by attending events held by a range of manufacturers.  Progress relating to green driver training: •The Council has produced a <i>Smarter</i>	2014	An emission reduction target of 8% has been set in relation to the baseline levels (2008/09) in the NI 194 toolkit (relating to percentage reduction in NO <sub>x</sub> and primary PM <sub>10</sub> emissions through local authority's estate and operations).	

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
								<p><i>Driving, Greener Driving</i> leaflet which provides tips on lower emissions, such as removing excessive weight and regularly checking tyre pressure.</p> <p>•No significant progress has been made in the last 12 months in terms of delivering green driver training.</p>			
5.	Council staff travel	Continue to improve emissions from Council staff commuting and business travel and maintain an up to date Council Green Travel Plan.	LA	2009	2009-2014 (ongoing)	<p>Green Travel Plan in place</p> <p>50% increase in number of days staff homework. Figures collected through staff travel surveys.</p>	N/a	<p>•The Council's Travel Plan (2009-2012) has now been produced which reviews current modes of staff travel and sets measures and targets for increasing sustainable transport, e.g. cycling.</p> <p>•A target of 30% by 2012 is set in the Council's Travel Plan in relation to the proportion of staff with some home working days.</p> <p>•In addition, the Council's Space Programme, which is a process of reviewing the utilisation of office space and ensuring future requirements are met and costs are reduced, will enable increased home working and flexible working arrangements. The work to refurbish the Town Hall for this programme will take four years and is due to start in early 2011.</p>	<p>The Council's Travel Plan is now in place-measure is complete.</p> <p>Staff home working target anticipated to be met by March 2014.</p>	N/a	
6.	Council and contractor buildings	Improve emissions from Council owned and/or leased premises by improving energy efficiency and increasing the	LA	2009-2010	2009-2014 (ongoing)	<p>NI194 toolkit</p> <p>Reduction target in emissions from 2008/09 baseline level.</p> <p>On-site renewables</p>	N/a	<p>•Installing Voltage Optimisation Units to the Council's corporate sites; Kensington Town Hall, Chelsea Old Town Hall and Council Offices in July 2010.</p> <p>•Double Glazing and Wall Insulation at Kensington Town Hall will be incorporated</p>	2009-2014 (ongoing)	N/a	

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
		use of renewable technology.				in at least one Council building		within phased Space Programme works (implemented by 2014).  •Implemented Smart electricity metering to 92 electricity supplies for reporting and improved monitoring.  •Undertaken Energy Audits on a selection of the borough's Schools.  •The design of the Council's St Quintin Children's Centre has incorporated energy efficient measures such as, high performance double glazed composite windows and doors, draught lobbies and natural cross ventilation.			
7.	Social and TMO housing stock	The Council will assess its social housing and TMO building stock as part of work on National Indicator NI194 and set targets for reducing emissions	LA	2009-2010	2010	Baseline year data collected and entered into the NI194 toolkit and target set.	N/a	• Currently in discussion with the TMO Energy Officer in order to incorporate TMO building stock into the spreadsheet. The data needs to be converted into a format which is suitable for the NI194 toolkit.		December 2010	Once the data for the baseline year has been collected, a suitable emission reduction target can be established and delivered through measures such as renewing/upgrading boilers.
8.	Air Quality SPD and LES	Adopt a revised Supplementary Planning Document (SPD) which requires large developments to submit a Low Emission Strategy	LA	2009-2010	2009-2014 (ongoing)	Air Quality SPD adopted and requirements being implemented	N/a	•SPD completed and low emission strategies being implemented		Revised SPD has been adopted therefore this aspect of the measure is complete.	N/a

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
		and implement mitigation measures in order to offset impact of the development.								Requests for low emission strategies will be ongoing.	
9.	Air Quality Action Fund	Make use of S106 obligations to require large new developments to make a one-off financial contribution to an air quality action fund.	LA	2009-2010	2009-2014 (Ongoing)	Section 106 Planning Obligations SPD adopted and contributions recorded.	N/a	<ul style="list-style-type: none"> <li>The Council's Section 106 Planning Obligations SPD sets out the approach, policies and procedures in respect of planning obligations. The document outlines the standard contributions for air quality and justifies the approach.</li> <li>To date, contributions have been sought for one major development within the borough.</li> </ul>	<p>The final Section 106 Planning Obligations SPD will be finalised and fully adopted by June 2010.</p> <p>Requests for financial contributions will be ongoing.</p>	N/a	
10.	Green Developers Guide	Produce a Green Developers Guide which will provide guidance to developers on energy efficient building design and use of renewable technology.	LA	2009	2010	Green Developers guide in place. Energy assessment submitted with proposed developments.	N/a	<ul style="list-style-type: none"> <li>The Green Developers guide is unlikely to be produced. The Council's proposed Core Strategy has now been submitted to the Planning Inspectorate, which is the key document for the Local Development Framework (LDF). Once finalised and adopted, the LDF will set out the Council's planning policies for the next ten years and replace the Unitary Development Plan. Restrictive policies on energy efficiency have been set out in the Core</li> </ul>	<p>The Council's Core Strategy is likely to be published by the end of 2010.</p>	N/a	

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
								Strategy (Policy CE1, Chapter 36), asking developers to achieve: <ul style="list-style-type: none"> <li>– Code for Sustainable Homes Level 4 for new residential developments (increasing to Level 5 in 2013);</li> <li>– BREAAAM <i>Excellent</i> for new non-residential developments(increasing to <i>Outstanding</i> in 2016), and;</li> <li>– EcoHomes <i>Very Good</i> for conversions and refurbishments defined as major developments.</li> </ul>			
11.	Construction Emissions	Continue work to minimise emissions from construction sites by requiring all developers to follow the London Council's (2006) <i>Best Practice Guidance – The control of dust and emissions from construction and demolition</i> as a minimum standard.	LA	2009	2009-2014 (Ongoing)	Planning conditions imposed on all large developments, requesting construction risk assessments.	N/a	Construction risk assessments are being requested for all large development proposals.  As stated in the guidance, sites should be evaluated and categorised into low, medium or high risk. The developer must then determine the measures that will be undertaken in order to mitigate any anticipated risks.	2009-2014 (Ongoing)	N/a	
12.	Energy Efficiency	Continue to promote energy-efficiency measures in homes in the borough, within the Council's HECA	LA	2009	2009-2014 (ongoing)	100% RSL and TMO homes in the borough meet "decent homes" thermal efficiency standards.	N/a	<ul style="list-style-type: none"> <li>•90% of Registered Social Landlords total housing stock has achieved the <i>Decent Homes</i> standard. Working towards 100%. It should be noted that RSLs are now referred to as Registered Providers.</li> <li>•TMO achieved 100% <i>Decent Homes</i></li> </ul>	Uncertain exactly when 100% of RSLs will be achieved but will continue to work		



No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
		and Affordable Warmth work.				Year on year increase in the number of qualifying households taking grants.		<p>standard in March 2009. Continuing to improve thermal efficiency by undertaking loft and cavity wall insulation projects as well as communal boiler upgrades.</p> <p>•A number of schemes are now available to help people improve the energy efficiency of their living accommodation:</p> <p><u>Warm Front</u>- a national scheme available to those on certain benefits, providing financial assistance to upgrade heating systems and improve insulation.</p> <p><u>West London- Warm Zone</u>- grants for free heating and insulation is available to homeowners and private tenants in receipt of means tested benefits. It also provides free loft insulation to those over 70 years of age and heavily subsidised loft insulation to all other residents. The Council has however negotiated a concession that allows us to give grants to the over 70's even if they are not on benefits.</p> <p><u>Kensington and Chelsea Keep Warm Grant</u>- Financial assistance is available to homeowners and private tenants on benefits or low income to upgrade or install heating and insulation.</p> <p>•In the past year, the Council have installed 52 new boilers/heating systems this year and additional loft insulation etc.</p>		towards this.  TMO achieved 100% so measure is complete.	

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
								•The Council has also established an Affordable Warmth and Energy Efficiency Working Group. The first formal meeting is scheduled for September 2010.			
13.	Borough-wide Boiler Survey	Research the emissions associated with existing heating plant in Kensington and Chelsea by carrying out a borough- wide boiler survey	LA	2009-2010	2011	Compiling an emissions inventory	N/a	No significant progress. Funding would be necessary to undertake a borough-wide survey.		2011	N/a
14.	Integrating air quality and climate change measures	Aim to identify the most effective emission reduction measures which provide the greatest benefits in terms of CO <sub>2</sub> and air quality emissions.	LA	2009-2010	2011	Produce a NI194 toolkit/ policy changes	N/a	No significant progress has been made on this measure.		2011	N/a
15.	Controlling Emissions from Biomass	Make use of planning conditions and obligations in order to set requirements for controlling pollutant emissions from biomass and biofuel boilers and CHP.	LA	2009	2009-2014 (ongoing)	Planning conditions or obligations.	N/a	•A detailed air quality assessment with dispersion modelling is requested for all developments proposing to use of biomass and biofuel.  •No biomass or biofuel boilers have been granted planning permission in the last 12 months.		2014	As stated in the Air Quality SPD, the Council is unlikely to accept proposals for biomass-fuelled (including biofuels) individual or CHP systems because of the concern about increasing emissions of particulate and

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
											gaseous pollutants within a borough which is an AQMA and Smoke Control Area.
16.	School Travel Plans	Requiring school travel plans in all schools (LEA and independent) in the borough	LA	2009	2010	100% schools in the borough with approved travel plans	N/a	<ul style="list-style-type: none"> <li>•School Travel Plans encourage sustainable transport through initiatives such as free cycle, scooter and pedestrian skills training and the installation of scooter and cycle storage areas.</li> <li>•Progress to date is that 98.6% of all schools and colleges in the borough now have an approved travel plan</li> </ul>		December 2010 completion date in order to achieve 100%.	N/a
17.	Encouraging Cycling	Continue to encourage safe cycling in the borough by improving facilities and providing free cycle training to residents	LA	2009-2010	2009-2014 (ongoing)	Annual increase in cycling numbers	N/a	<ul style="list-style-type: none"> <li>•Delivered 160 free adult cycle training lessons during the last year.</li> <li>•Provided 55 free cycle maintenance sessions (Dr Bike) to the public and workplaces.</li> <li>•Cycle Parking Facility Scheme: <ul style="list-style-type: none"> <li>- Footway Cycle Stands at 26 locations, 100 stands</li> <li>Carriageway Cycle Stands at 17 locations, 69 stands</li> <li>Chelsea &amp; Westminster Hospital now has 12 stands</li> </ul> </li> </ul>		2014	N/a

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
18.	London Cycle Hire Scheme	The Council will support TfL in implementing a Central London Cycle Hire Scheme based on the Paris model.	TfL and LA	2009-2010	2010	50 docking stations installed in the borough	N/a	•48 docking stations will be fully installed in the borough by the end of July 2010 and aims to encourage bicycle use, especially for short journeys.		30 <sup>th</sup> July 2010	N/a
19.	Car club Expansion	Double the number of on-street car club bays available in the borough and increase the number of low emitting vehicles in the car club fleet.	LA	2009-2010	2014	No. of car club members in the borough  200 on-street car club bays in the borough.  33% of the fleet within VED band A-B.	N/a	•187 bays on-street;  •5% of the fleet within VED band A-B;  •6301 members.		2014	New pricing structure for car club parking permits will increase number in VED band A-B. The structure also gives an incentive for vehicles in VED band C. Each car club vehicles takes at least 4 private vehicles off the road and reduces the mileage driven by its members.
20.	Idling Engines	Undertake an awareness raising campaign to inform drivers of the idling engines regulation and	LA	2009-2010	2009-2014 (ongoing)	Number of warnings and complaints	N/a	•The Highways Enforcement Team conducted regular checks at known trouble spots during the year and responded to 12 complaints of vehicles parked with idling engines running. These were generally coaches or construction		Ongoing  Ad-hoc checks will continue throughout	When a vehicle is waiting for longer than 30 seconds then engine should be switched off to stop emissions and

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
		continue to monitor hotspots and use the available enforcement powers to encourage drivers to switch off their engines.						site lorries. This number of complaints is lower than previous years.  •Wrights Lane , Kensington High Street, Courtfield Gardens and Walton Street are checked regularly and drivers warned. 23 warnings were recorded. All were compliant and no Fixed Penalty Notices were issued.  • Flyers were also distributed when drivers were warned.		the year	fuel consumption.
21.	Investigate the effects of a more robust LEZ	Assess the effectiveness of a number of scenarios for an alternative central London Low Emission Zone (LEZ) and lobby the Mayor of London to implement the most cost-effective option.	LA	2010	2011	Investigation completed and results submitted to TfL and GLA.	N/a	•To date, the Council has made no significant progress on this measure but will be responding to <i>Clearing the air- the Mayor's Draft Air Quality Strategy</i> (March 2009). The response will address issues such as the Mayor's decision to suspend the LEZ regulations for large vans and minibuses until 2012.		2011	The existing London LEZ has lead to a reduction in emissions but could be further strengthened by introducing the next stages of the regulations sooner and introducing a similar system to cities such as Berlin.
22.	Parking Charges	Review the surcharge for diesel vehicles  Review the graduated parking permits system to incorporate	LA	2009	2010-2011	Changes implemented to residents parking permit charges	N/a	•Residents parking charges are reviewed on a yearly basis. At the most recent review, a 10% increase to permit charges was introduced across the board.  •The diesel surcharge was not increased. Further support would be required from residents and LALors in order to introduce		The parking charges will continue to be reviewed on an annual basis but it is not known when a	It is hoped that any future changes to residents parking permits will further reward residents who have chosen low emission vehicles such as

No	Measure	Focus	Lead	Planning phase	Implnt phase	Indicator	Target annual emission reduction	Progress to date*	Progress in last 12 months*	Estimated completion date	Comments relating to emission reductions
		discounts for low emission vehicles (electric vehicles)						<p>this measure. This is especially the case because the environmental message has been confusing. Diesel vehicles have been marketed as more fuel efficient and as lower emitters of carbon dioxide compared to petrol equivalents. Unfortunately, they have a greater impact on levels of local air pollutants such as PM<sub>10</sub>.</p> <p>•Electric vehicles continue to be charged at the lowest parking permit rate.</p>		diesel surcharge will be introduced.	electric, and place a surcharge on vehicles which are most polluting.
23.	Encourage the creation of electric recharging infrastructure	Actively encourage the creation of electric recharging infrastructure within the borough by requiring charging points to be incorporated in development and promoting grants to local businesses.	LA	2009	2009-2014 (ongoing)	<p>Electric Charging Points (ECPs) installed by developers and on business premises:</p> <p>50% of on-site parking spaces in new development with ECPs by March 2012</p> <p>100% parking spaces with ECPs by March 2014</p>	N/a	<p>•The Council now require ECPs with all new developments. This is enforced through the use of planning conditions.</p> <p>• The Council is currently requesting that ECPs are installed at around 20% of on-site parking spaces in new developments. This will continue to increase in line with this measure.</p>		On target for completion (50% by 2012 and 100% by 2014)	N/a

\*The *Progress to date* and *Progress in the last 12 months* columns have been combined because the Council's Air Quality Action Plan has been in place for less than 12 months.

## 9.1 Supporting Information

### 9.1.1 Protecting Public Health and the Environment- Public Health Collaboration (Measure 2)

The Council is working alongside local health organisations including the Primary Care Trust (PCT) and the Health Protection Agency (HPA) to raise awareness of issues such as the health effects of air pollution, asthma, indoor air quality and the dangers of second hand smoking. Regular air quality and public health meetings are now held with PCT and HPA in order to discuss opportunities for collaboration.

The Council has now produced an indoor air quality leaflet which outlines some of the factors that can lead to a deterioration of air quality in the home, the associated health effects and improvement measures. This addresses household products, dust mites, mould and smoking. The leaflet also highlights the dangers of carbon monoxide and recommends installing a carbon monoxide alarm. With the support of the PCT and HPA, the Council is distributing this leaflet and targeting the most vulnerable including individuals with existing heart and lung conditions. Several awareness sessions have also been held with community groups, e.g. Sixty Plus and a cardiac rehabilitation support group at Chelsea and Westminster Hospital.



The Council's Smoke Free Homes Officer (SFHO) was appointed in December 2009 and has been working in partnership with local health organisations in order to encourage people to sign the Smoke Free Homes and Cars pledge. The pledge is designed to protect families from the dangers of second-hand smoke by banning smoking at home and in the car. The SFHO has attended a substantial number of events at local hospitals and health centres and to date, 78 pledges have been signed and 52 referrals have been made to the local stop smoking service.



The Council is keen to strengthen partnerships with the local health organisations and explore further opportunities to work together in the future.

### 9.1.2 Reducing Emissions from Council Buildings and Operations- Council and Contractor's Fleet (Measure 4)

The Council has recently trialled a number of alternatively fuelled vehicles, including a new refuse collection vehicle which runs on compressed biomethane. Biomethane is a fuel derived from the gas produced from the decomposition of waste in landfill sites. This trial was carried out in partnership with SITA UK and was the first vehicle of its kind to collect household recycling in the United Kingdom.

The truck has a dual-fuel engine, using a mix of landfill gas and diesel and aims to reduce diesel consumption by around 65 per cent. Nitrogen oxides emissions are anticipated to reduce by between 35-65 per cent.

Following the six month trial, the Council is now in discussion with a company who produces and supplies biomethane fuel from SITA UK landfill sites. Investigations are being made into the feasibility of installing a fuel pump on Council premises to serve specially adapted vehicles.



### 9.1.3 Reducing Emissions from New Development and Construction- Air Quality SPD and LES (Measure 8) and Air Quality Action Fund (Measure 9)

The Council's Air Quality Supplementary Planning Document (SPD) has now been adopted and sets out the Council's requirements for reducing air pollution emissions from new development, conversions and change of use. The objectives of the SPD are:

- to highlight the existing policy framework and emphasise the importance of air quality as a material planning consideration;
- to identify the circumstances where emissions assessments and/or low emission strategies will be required for new developments;
- to offer guidance on measures to mitigate potentially harmful impacts of new developments;
- to offer guidance on the use of planning conditions and Section 106 obligations to improve air quality; and
- to provide guidance on the submission of air quality assessments and where these will be required.

A significant change in terms of assessing the impact of developments on air quality is that the Council is moving away from just considering pollutant concentrations and towards requesting explicit emission reduction strategies.

Due to a greater intensity of use and/or the development of vacant sites, most new development is likely to contribute to the already elevated levels of air pollution in the borough. In this regard, any increase in air pollution, especially from new development, will contradict the requirements of the Council's Air Quality Action Plan. A low emission strategy must address all aspects of the new development, including transport, heating and energy use. The extent of the strategies or measures to be implemented will depend on the location, size (floor space) and traffic generated by the development. Even where developments are a direct replacement of like for like, the opportunity to reduce emissions will be strongly encouraged by the Council.

The Air Quality SPD also aims to offer guidance on the use of Section 106 obligations to improve air quality. A separate Section 106 Planning Obligations SPD



is being finalised and should be fully adopted by June 2010. Financial contributions will be sought through Section 106 obligations, where appropriate. Contributions will be used towards air quality monitoring, action planning, and the monitoring of compliance. To date, contributions have been sought for one major development within the borough and requests will be ongoing.

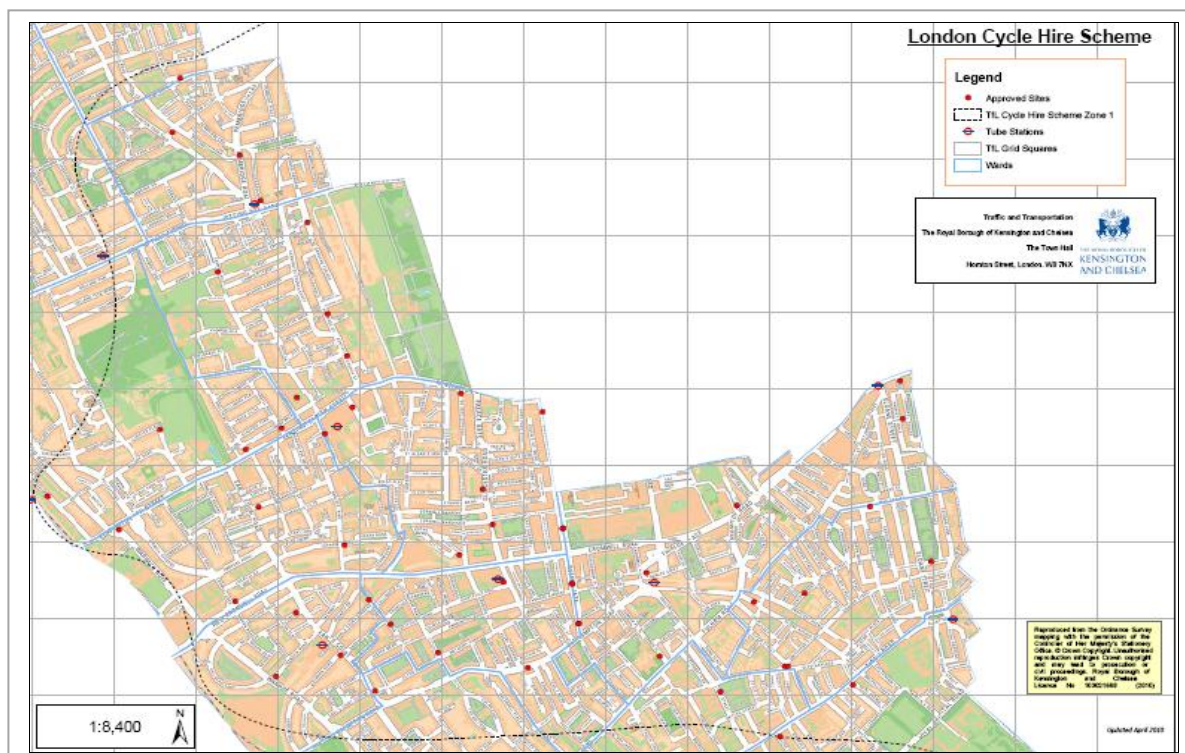
### 9.1.4 Reducing Emissions from Road Traffic- London Cycle Hire scheme (Measure 18)

The Council is working in partnership with Transport for London (TfL) to launch the Cycle Hire Scheme in July 2010. The scheme allows people to easily hire a bike for short trips around central London. Docking stations will be located at convenient locations, allowing easy collection and drop off. Users must pay an access fee to use the scheme and then a usage charge based on the duration of the journey. The first 30 minutes hire will be free of charge.



There will be a total of 49 docking stations in the borough, which are currently under construction. It is hoped that the scheme will reduce congestion on public transport and encourage cycling as an alternative to driving, particularly for short journeys.

**Figure 9:1 Location of TfL Cycle Hire Docking Stations in the Borough**



## **10 Conclusions and Proposed Actions**

### **10.1 Conclusions from New Monitoring Data**

The whole borough is an AQMA. New monitoring data shows that nitrogen dioxide levels continue to breach both annual and hourly mean objective levels over a wide area. Overall there has been little change, other than some indication that levels are declining at urban background locations. Significant reductions up to  $50\mu\text{g}/\text{m}^3$  are required to meet both the annual mean and hourly mean.

Exceedences of the annual mean objective at the Council's monitoring sites for  $\text{PM}_{10}$  are largely met, however the daily mean is exceeded at one location indicating a continued risk.

### **10.2 Conclusions relating to New Local Developments**

Air quality assessments submitted for new developments are always subject to a thorough review; however most indicate only a minor negative impact. Nonetheless mitigation measures, through low levels of parking; installation of electric charging points; the development of travel plans and so on, are negotiated to reduce the impact of pollutant and greenhouse emissions. There are no new local developments that will require a more detailed assessment.

### **10.3 Other Conclusions**

The Council will continue to make progress with the measures set out in the AQAP over the next few years. It will be important to set key deadlines, especially for the ongoing measures to ensure the aims of the actions are achieved. However, given the significant reductions required to meet objective levels, up to  $50\mu\text{g}/\text{m}^3$  in the case of nitrogen dioxide (Section 2.2.1) it is clear that no individual borough in London can achieve objective levels on their own. Whilst the situation for  $\text{PM}_{10}$  appears to be less of a problem in terms of meeting objective levels; the great concern over the health impacts of particulate matter, and especially the finer  $\text{PM}_{2.5}$  fraction, means that efforts should continue to be made to tackle this pollutant.

Difficulties in improving quality are exacerbated by the relatively small geographical area covered by each local authority (especially one such as small as ours) and the lack of direct control over the main pollutant sources. For example the main strategic roads (and therefore the traffic) are under TfL management.

Transport measures such as the encouragement of car clubs, school and business travel plans, improving the accessibility and reliability of public transport, making it easier for residents to walk and cycle can only affect only a small proportion of the transport fleet using the boroughs roads. Other actions that we can take, for example, through planning control over new developments can only hope to reduce the impact of new additional sources. All these measures will make a contribution but significant reductions are only feasible with greater government intervention.

It is therefore important that greater effort is made to understand the unique problems faced in London and that the solutions must be agreed and co-ordinated amongst local authorities, the GLA and the government to ensure that air quality objectives can be met.

## **10.4 Proposed Actions**

The new monitoring data has not identified the need to proceed to a Detailed Assessment for any other pollutants not already covered within the existing AQMA. The next review and assessment report that the council will prepare is the progress report due in April 2011.

## 11 References

Maggs, R., Harrison, D., Carslaw, D. , Stevenson, K. (2009) Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom

Defra (2007) The Air Quality Strategy for England, Scotland, Wales, and Northern Ireland

Defra (2009) Local Air Quality Management Technical Guidance LAQM.TG (09)

London Councils (2006) Best Practice Guidance.The Control of Dust and Emissions from Construction and Demolition

RBKC (2008) The Climate Change Strategy 2008-2015

<http://www.rbkc.gov.uk/environmentandtransport/climatechange.aspx>

Defra's Local Air Quality Management Support Pages

[http://www.laqmsupport.org.uk/Summary\\_of\\_Laboratory\\_Performance\\_in\\_WASP\\_R1\\_03-107.pdf](http://www.laqmsupport.org.uk/Summary_of_Laboratory_Performance_in_WASP_R1_03-107.pdf)

## **Appendices**

Appendix A: QA/QC Data

Appendix B: Monthly Mean Value Results of Nitrogen Dioxide Diffusion Tubes

Appendix C: Glossary

## Appendix A: QA:QC Data

### Diffusion Tube Bias Adjustment Factors

#### NO<sub>2</sub> diffusion tubes

Bureau Veritas manage the data from the London Wide Environmental Programme (LWEP) diffusion tube networks, however the supply and analysis of the tubes is undertaken by Gradko International Ltd. The preparation method is 50% TEA v/v in Acetone and the analytical method is U.V. Spectrophotometry.

#### Factor from Local Co-location Studies

Bureau Veritas conduct an 'in-house' co-location study to establish an LWEP bias adjustment factor based on triplicate NO<sub>2</sub> diffusion tubes sampling concurrently located with continuous analysers for a number of local authorities. They employ the DIFTAB.xls spreadsheet to calculate the factor.

#### NO<sub>2</sub> diffusion tube bias adjustment factors for 2006 to 2009

Year	Mean Adjustment	Mean% Bias
2006	1.06	-4.00
2007	1.01	-1.06
2008	0.98	3.92
2009	1.00	1.14

#### Calculation of Bias adjustment factor for 2009

	Diffusion Tube	Continuous Analyser	Correction Factor (A)	% Bias based on continuous monitor (B)
London N. Kensington	35.6	34.1	0.93	8
London Cromwell Road 2	75.6	70.4	0.95	5
London Brent	32.9	32.6	0.99	1
Croydon, London Road	64.8	64.2	0.99	1
Croydon, George Street	54.9	50.0	0.91	9
Hounslow, Chiswick High Road	65.5	68.0	1.04	-4
Hounslow, Brentford	58.0	58.4	1.01	-1
Hounslow, Cranfield	30.1	34.2	1.13	-11
Hillingdon, AURN	47.5	53.2	1.14	-12
Hillingdon 1, South Ruslip	49.3	49.7	1.01	-1
Hillingdon 2, Hospital	40.6	37.6	0.93	8
Greenwich 5, Trafalgar Road	46.2	47.1	1.01	-1
Lewisham LW2, New Cross Road	73.8	63.3	0.84	19
LWEP Bloomsbury	47.7	50.0	1.05	-5
		<b>Overall % Bias</b>		<b>1.14</b>
		<b>Mean Bias Adjustment Factor</b>	<b>1.00</b>	

Calculations provided by Bureau Veritas

**Choice of Factor**

The LWEP factor has been selected as being the most suitable as it includes sites in the borough and is based on a large number of co-located automated and diffusion tube samplers.

**Benzene diffusion tubes**

Benzene data is also collected as part of the LWEP managed by Bureau Veritas. The tubes are analysed using desorption scanning gas chromatography/mass spectrometry (GC/MS). Comparison of the LWEP data with the calculated mean data for the Automatic Hydrocarbon Monitoring Network (AHMN) indicates that the concentrations recorded were very comparable. However there is no bias adjustment factor for benzene measurements.

**PM Monitoring Adjustment****TEOM**

In the past TEOM data was corrected using a simple multiplication factor of 1.3. Co-located instruments (TEOM and Partisol) at North Kensington in the past enabled us to compare the results, this had shown that adjusting the TEOM data by a factor of 1.3 gave a reasonable approximation of the annual average as less reliable when applied to exceedences of the daily objective. However co-location studies have shown that the instrument was not equivalent to the reference method and the FDMS measurement device was developed to correct the problem and in comparisons was shown to be equivalent to the EU reference method. In 2008/09 Defra began the replacement of TEOM units with FDMS units on the particulate monitoring network. Government guidance LAQM TG(09) states that the Volatile Correction Model (VCM) should be used to correct TEOM measurements for Local Air Quality Management purposes.

Data has been collected from the London Air Quality Network (LAQN) website ([www.londonair.org.uk](http://www.londonair.org.uk)) operated by King's ERG. TEOM measurements on the website are now adjusted by the CVC. The VCM uses FDMS purge measurements to correct TEOM measurements for the loss of volatile material. This method is now recommended in Defra's TG (09) as the preferred method for correcting TEOM measurements for Local Air Quality Management purposes. This correction has been undertaken for data in the Council's two TEOM sites from 2004. Data corrected using both the simple multiplication factor and the VCM method is included in the report.

**QA/QC of Automatic Monitoring****Data collection, screening and validation**

Monitoring data is stored as 15-minute averages within the analysers. Air quality data, including full instrument status information, is collected hourly via modem by the King's ERG on the borough's behalf from the monitoring sites via the data loggers within the analysers. This data is stored within the LAQN database. Data is validated by a combination of automatic and manual checks. The procedures used comply with the validation requirements of the UK Automatic Urban and Rural Network (AURN) Management and Co-ordination Units. Manual validation is carried out daily. Data is ratified in three to six month blocks using service records,

calibration records, and the results of inter-calibration and audit. Data is passed on to the Defra's Quality Assurance and Quality Control Unit for final ratification.

### **Routine calibration and independent checks**

Local site visits are undertaken fortnightly at the urban background site and weekly for the roadside Tapered Element Oscillating Microbalance (TEOM-FDMS) for the purposes of calibration, filter changes and instrument cleaning. Equipment is additionally serviced at regular intervals. Routine calibrations are undertaken by contractors.

Independent calibration and audit is carried out by AEA Technology as part of their AURN responsibilities for the North Kensington site and for the Cromwell Rd site through a separate contract. Calibration certificates are provided by AEAT. The National Physical Laboratory (NPL) undertake the London affiliate inter-calibration exercise. The following checks are performed for the oxides of nitrogen, sulphur dioxide and carbon monoxide analysers:

Analyser response factors: The analyser samples a stable 'inter-calibration standard' which has been validated against a network primary standard. The analyser also samples from a certified zero air source.

Analyser linearity: The analyser response to a series of known concentrations covering the analyser range is noted. A linear regression is then performed on the results.

Analyser 'noise' levels: This is the standard error of ten successive spot readings of analyser readings when fully stabilised on zero.

Nitrogen Oxides analyser converter efficiency: NO<sub>x</sub> analyser converter efficiency is determined using Gas Phase Titration at a range of concentrations, this uses a high concentration of NO and a known amount of O<sub>3</sub> which is subsequently converted to NO<sub>2</sub>.

Estimation of site cylinder concentrations: The concentrations are evaluated by sampling from the site cylinder and comparison to analyser response factors determined from the 'inter-calibration standard'.

For particle analysers the following checks are performed: Mass transducer calibration: The mass transducer is calibrated by placing pre-weighed filters on it and noting the change in the frequency that is induced.

Analyser flow rates: Flow rates are measured by calibrated flow audit measurement systems. Leak checks are also carried out.

### **QA/QC of Gravimetric monitoring-Partisol**

The Partisol operating at the Earls Court Road site since May 2002 is a gravimetric sampler which is equivalent to the EU reference method. Reference to the report has also been made to other Partisols operating in the borough by Defra. However



the co-location trail<sup>8</sup> raised concerns over the filter media used in these instruments and showed that an over estimation in measured concentrations resulted from the use of quartz filters. The filters used at the site are Teflon coated glass fibre (Emfab) filters which are not affected in the same way as quartz filters<sup>7</sup>. No correction factor is required for gravimetric instruments.

Verification of ambient temperature, verification of filter temperature, verification of ambient pressure and humidity, internal leak check, external leak check and flow verification are undertaken for the partisol at the time of audit and service.

### **QA/QC of Diffusion tube data**

#### **Nitrogen dioxide**

The laboratory of Gradko International Ltd follows the Practical Guidance document "Diffusion Tubes for Ambient NO<sub>2</sub> Monitoring: Practical Guidance for users and laboratories (Feb 2008)" (AEA on behalf of Defra). The preparation method: 50% TEA v/v in Acetone and the analytical method is U.V. Spectrophotometry. Analysis is carried out in accordance with documented in-house Laboratory Method GLM6.

Results are blank subtracted.

Uncertainty of measurement - 8.07%+/- Limit of Detection - 0.408mg/m<sup>3</sup>\*  
@1248.05hrs

Gradko International Ltd participates in the Workplace Analysis Scheme for Proficiency (WASP). This is a recognised performance-testing programme for laboratories undertaking NO<sub>2</sub> diffusion tube analysis as part of the UK NO<sub>2</sub> monitoring network. The scheme is designed to help laboratories meet the European Standard EN48213. The laboratory performance for each month between October 2008 and October 2009 was rated 'good' which signifies a high level of accuracy for laboratory measurements.<sup>9</sup>

They also participate in the Network Field Inter-comparison Exercise operated by NETCEN, which complements the WASP scheme in assessing sampling and analytical performance of diffusion tubes under normal operating conditions. This involves the regular exposure of a triplet of tubes at an Automatic Urban Network site (AURN) site. These sites employ continuous chemiluminescent analysers to measure NO<sub>2</sub> concentrations. The results indicate that Gradko International Ltd diffusion tubes are well within the performance targets set by NETCEN.

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<sup>8</sup> Maggs, R., Harrison, D., Carslaw, D., Stevenson, K. (2009) Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom

<sup>9</sup> Defra's Local Air Quality Management Support Pages  
[http://www.laqmsupport.org.uk/Summary\\_of\\_Laboratory\\_Performance\\_in\\_WASP\\_R103-107.pdf](http://www.laqmsupport.org.uk/Summary_of_Laboratory_Performance_in_WASP_R103-107.pdf)

**Summary of NO<sub>2</sub> Network Field Inter-comparison Results, 2008**

<b>Annual Mean Bias</b>		<b>Precision</b>	
NETCEN Performance Target	Gradko Annual Mean Bias	NETCEN Performance Target	Gradko Precision
<b>±25%</b>	<b>- 11%</b>	<b>10%</b>	<b>3%</b>

**Benzene**

All benzene tubes were analysed by a UKAS accredited laboratory using desorption scanning gas chromatography/mass spectrometry (GC/MS). This method of analysis gives unequivocal identification of BTEX peaks. Comparison of the LWEP data with the calculated mean data for the AHMN indicates that the concentrations recorded are comparable.

The measurement method used in the benzene survey was consistent with the sampling, analysis and QA/QC requirements of EN 14662-4: 2005 Ambient air quality – Standard method for measurement of benzene concentrations – Part 4: Diffusive sampling followed by thermal desorption and gas. As part of quality control procedures integral to the London-Wide Benzene Survey, a selection of boroughs are sent one or two extra diffusion tubes for duplicate or triplicate exposure at a monitoring site within their borough. In 2009, duplicate exposures were successful on eleven occasions and triplicate exposures on eight. The results of these tubes indicate satisfactory agreement between duplicate and triplicate tubes. The maximum difference between duplicates is  $\pm 1.0 \mu\text{g}/\text{m}^3$  and the maximum difference between triplicates is  $\pm 1.2 \mu\text{g}/\text{m}^3$ .

## Appendix B: Monthly Mean Value Results of Nitrogen Dioxide Diffusion Tubes

Full dataset (monthly mean values) for the nitrogen dioxide diffusion tubes 2009 (unadjusted)

Site Code	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean
KC31	Ladbroke Grove	67.7	63.6	55.1	59.7	54.9	66.3	43.1	44.7	58.3	68.4	52.0	58.4	57.7
KC32	Holland Park	42.8	42.8	31.2	28.2	27.7	28.3	22.9	22.9	24.2	35.2	32.2	41.7	31.7
KC33	Cromwell Road	66.2	86.6	94.6	79.9	95.0	97.9	100.4	78.4	92.2	101.7	108.5	89.6	90.9
KC34	Dovehouse St	59.2	53.9	45.8	51.2	38.7	50.7	41.4	37.0	36.7	48.6	48.9	54.7	47.2
KC35	Brompton Road/Cottage Place	69.4	64.4	60.1	64.0	74.9	66.1	78.1	65.4	65.0	60.1	83.5	63.3	67.9
KC38	Earls Court (station)	109.8	97.4	100.8	97.0	101.9	111.2	101.4	98.5	99.7	95.7	113.6	87.4	101.2
KC39	Lots Rd/Uperne Rd	57.9	54.0	42.5	43.7	37.7	40.6	30.2	29.2	38.3	38.4	37.3	47.2	41.4
KC40	Brompton Road	69.5	55.2	52.0	50.7	47.5	44.6	51.1	43.5	40.7	50.3	55.3	58.9	51.6
KC41	Ladbroke Crescent	52.7	54.4	36.4	41.5	31.5	36.6	27.6	31.1	36.8	39.7	36.8	50.5	39.6
KC42	Pembroke Square	57.5	53.2	52.7	48.9	45.4	44.3	39.6	37.1	38.0	43.4	45.1	50.0	46.3
KC43	St Marks Gove	51.8	45.4	34.9	44.7	35.2	40.9	24.9	27.1	29.0	42.3	39.9	52.6	39.1
KC44	Donne Place	48.9	55.4	41.8	45.5	35.5	38.9	31.4	33.2	36.4	41.2	46.3	51.0	42.1
KC45	Chatsworth Court	57.7	57.1	53.3	54.9	48.7	51.6	44.5	40.7	42.8	46.6	57.4		50.5
KC47	Sion Manning	48.2	47.3	37.7	37.2	26.7	31.8	25.3	26.7	28.2	36.4	36.1	45.6	35.6
KC48	Sloane Square	84.5	82.6	81.1	87.2	81.1	91.0	75.7	74.5	85.3		76.9	79.9	81.8
KC49	Harrods	79.7	77.5	69.4	94.1	68.0	94.7	76.9	63.3	102.0	65.3	84.6	82.6	79.8
KC50	Chelsea Physic Garden (Gate)	63.2	61.2	55.6	62.5	63.6	55.3	60.4	53.9	54.7	54.5	64.7	58.0	58.9
KC51	Chelsea Physic Garden (Met)	46.5	53.4	40.1	38.6	29.8	33.0	27.5	26.0	33.3	35.2	37.7	43.9	37.1
KC52	Sloane Avenue	69.3	69.5	65.4	62.0	57.0	65.8	51.9	44.4	54.8	57.4	56.0	59.2	59.4
KC53	Walmer House	55.3	50.5	52.4	47.6	49.1	50.6	46.8	44.3	44.8		51.9	51.8	49.6
KC54	Natural History Museum	89.1	75.3	77.8	79.1	71.0	75.2	69.0	68.8	70.1	64.0	88.0	79.3	75.6
KC55	Blantyre St	47.3	62.2	47.1	52.2	30.5	39.7	34.0	31.2	37.4	43.0	43.5	50.8	43.2
KC56	Chelsea Old TH	85.8	62.2	83.5	89.8	75.8	96.7	82.7	78.8	87.0	78.6	86.8	75.0	81.9
KC57	Pavillion St/Sloane Ave	68.4	63.4	60.4	60.6	51.1	60.2	42.2	34.7	56.9	52.9	48.9	60.8	55.0
KC58	Kensington H St/Camden Hill Rd	66.8		71.4	66.8	59.4	75.9	61.4	47.2	64.4	55.8	57.8	64.0	62.8
KC59	Kensington H St/Argyll St	81.1	100.1	100.6	93.0	77.1	91.6	77.0	73.4	89.1	80.8	82.1	86.9	86.1
KC60	Old Brompton Rd	70.7	88.0	77.7	77.2	73.9	78.9	72.3	68.2	65.5	76.3	93.3	74.2	76.4
KC61	Fulham Rd/Limerston St	64.0	81.0	67.8	63.7	52.0	67.9	54.9	43.1	51.0	54.3	54.0	66.5	60.0
KC64	Warwick Road	65.5	66.3	47.2	59.6	42.3	57.3	37.6	40.5	45.1	54.5	49.4	55.3	51.7
KC65	Barbly road					31.4	43.8	28.4		31.9	37.6	38.1	49.6	37.3
KC66	Acklam Road					38.2	48.7	37.1	36.1	36.0	40.9	46.6	49.1	41.6
KC67	Southern Row					34.6	37.4	34.9	37.7	33.5	42.8	44.8	48.2	39.3

Results from sites KC47 and KC54 are the mean results from multiple tube exposures (triplicate tubes).

Note: This data has not been corrected for bias.

## Appendix C: Glossary

**AQMA** - Air Quality Management Area - an area designated by a local authority where it is likely that the air quality objectives in the National Air Quality Strategy will not be achieved by the appropriate future year specified by each pollutants' objective.

**AQAP** - Air Quality Action Plan- a plan of initiatives that is being implemented to improve air quality.

**Automatic monitoring sites**- sites producing high-resolution measurements typically hourly or shorter period averages.

**AURN**- Automatic Urban and Rural Network- A Defra air quality monitoring network.

**AURN affiliate**- a monitoring site owned and operated by a local authority but included in the Defra network of sites.

**AHMN**- Automatic Hydrocarbon Monitoring Network

**Urban background site**- a sampling site in an urban location distanced from sources and broadly representative of city-wide background concentrations e.g. elevated locations, parks and urban residential areas.

**Benzene**- an aromatic hydrocarbon

**1,3-Butadiene**- colourless gaseous hydrocarbon

**Carbon monoxide (CO)**- gas formed by the incomplete combustion of carbon containing fuels

**Defra**- Department for Environment, Food & Rural Affairs

**Diffusion tube**- a small tube used to monitor pollutants by passively absorbing a pollutant over a specific time period, and is then collected and analysed

**Emissions inventory**- a comprehensive data set of pollution emitted from a variety of sources

**FDMS**- Fluid Dynamic Measurement System- an airborne particulate monitor based on TEOM technology measuring the core and volatile fractions of the collected mass

**Fine particles**- see Particles

**Gravimetric method**- a method of sampling particulate matter by collecting it on a filter which is then weighed later under controlled conditions, e.g. Partisol

**HGV**- heavy goods vehicle, a goods carrying vehicle of 3.5T (tons), or more, gross laden weight

**8 hr running mean**- an average taken over an 8-hour period, which progresses hour by hour

**Intermediate site** - a sampling site within 20-40 metres of the source/road

**Kerbside site**- a site sampling within 1 metre of a busy road

**Lead (Pb)** - one of the heavy metals that are a toxic and acts as a cumulative poison

**LWEP-** London Wide Environmental Programme- provision and analysis of diffusion tubes led by Bureau Veritas in a number of London boroughs

**LAQN-** London Air Quality Network - a network run by a consortium including local authorities, the Environmental Research Group- King's College, to co-ordinate air pollution monitoring

**Microgram (µg)** – a unit of mass equivalent to one millionth of a gram or one thousandth of a milligram

**Milligram (mg)** – a unit of mass equivalent to one thousandth of a gram

**µg/m<sup>3</sup>**- a microgram of pollutant in a cubic metre of air

**Nanogram (ng)**- a unit of mass equivalent to one thousandth of one millionth of a gram

**ng/m<sup>3</sup>** nanogram of pollutant in a cubic metre of air

**Oxides of nitrogen (NO<sub>x</sub>)**- a mixture of NO and NO<sub>2</sub>

**Nitric oxide (NO)**- a colourless toxic gas arising from the combination of atmospheric nitrogen with oxygen in high temperature combustion

**Nitrogen dioxide (NO<sub>2</sub>)**- a stable brown gas largely produced by the oxidation of NO. NO<sub>2</sub> is more toxic than NO

**Particles-** or fine particles, these are microscopic particles of varying composition, and for the purposes of this report the term 'particles' refers to a range of particle sizes from 10µ to 0.1µ

**Pollutant specific guidance-** issued by Defra, provides advice on review and assessment for each pollutant identified in the air quality regulations

**Objective-** we have used the word objective throughout this report. This is the term used by the Government to describe standards which have a set timescale (i.e. a target date) for their achievement

**PM<sub>10</sub>**- particulate matter less than 10µ (micrometres) in diameter

**PM<sub>2.5</sub>**- particulate matter less than 2.5µ (micrometres) in diameter

**Roadside site-** a sampling site between 1 metre of the kerbside of a busy road and the back of the pavement, typically within 5 metres of the road

**Screening models-** give a preliminary level of assessment and only require simple input data

**Source apportionment-** the degree to which various sources of pollution contribute to air quality problems

**Sulphur dioxide (SO<sub>2</sub>)** - a colourless toxic and acid forming gas, it is the main product of the combustion of sulphur contained in fuels

**TEOM-** Tampered Element Oscillating Microbalance- a monitor to measure the mass of particles collected on a filter continuously

**VCM-** Volatile Correction Model- a model to correct measurements of PM<sub>10</sub> by the TEOM so that they can be used to compare against the EU Limit Value in the UK.