1 June 2009

2009 Air Quality Updating and Screening Assessment for *The Royal Borough of Kensington and Chelsea*

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

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 quality objectives. Early in 2009 the Council completed an extensive consultation with residents on a revised action plan to develop new ideas.

This latest Updating and Screening Assessment (USA) provides information on the review and assessment of air quality in the borough. The USA has reviewed the sources of key pollutants identified in the national Air Quality Strategy within the borough using guidance checklists to identify any significant changes since previous assessments. An examination of monitoring data collected during 2008 has also been undertaken for the strategy pollutants; These are nitrogen dioxide (NO_2), particulate matter (PM_{10}) carbon monoxide, benzene, 1,3- butadiene, lead, sulphur dioxide and. Information on benzo(α)pyrene which is used as a marker for a complex group of hydrocarbons (PAH), ozone and $PM_{2.5}$ is also included, though there is no requirement to do so.

The review of the monitoring data shows that most pollutants remain well within their respective objective levels, **except for NO_2 and PM_{10}, which continue to exceed objective levels.** However, some of the background monitoring locations have shown for the second consecutive year a slight downward trend for NO_2. For PM_{10}, levels are just below the annual mean objective but continue to exceed the daily mean objective at one site. The borough has already been declared an Air Quality Management Area on the basis of these exceedences so therefore no changes are required to the air quality management order. However the review of sources has determined that a detailed assessment of nitrogen dioxide in the vicinity of the Paddington to Swansea rail line is required.

Table of contents

Appendices

1 Introduction

1.1 Description of Local Authority Area

The Royal Borough of Kensington and Chelsea is a busy urban environment located on the west side of central London. Geographically, the Borough extends from Chelsea Embankment in the south, through Kensington, Notting Hill and Ladbroke Grove up to Kensal Green in 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 Royal Borough is primarily a residential area with a varied mix of housing encompassing 79,146 households (unshared accommodation) in 88,111 dwellings (shared and unshared occupation).

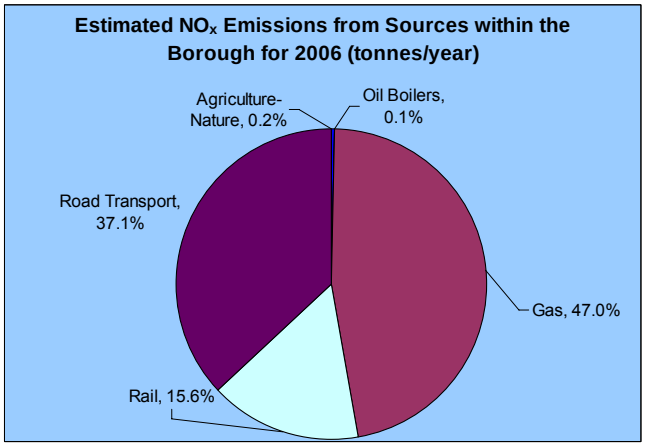
The Royal Borough has a large volume of commuter traffic, both people travelling into the area and local residents travelling within and outside the borough. The area is relatively well served by the London Underground network with the Circle, District, Central, Piccadilly and Hammersmith and City Lines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

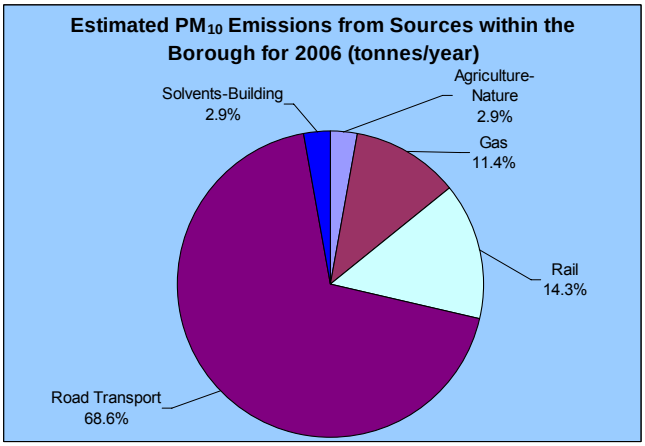
There are 207 km (127.6 miles) of roads in the Royal Borough; 28 km (17 miles) (13.5 per cent) are A roads, ten km (six miles) (4.8 percent) are B roads and the remaining 169 km (105 miles) (81.6 per cent) are C roads or unclassified. Six per cent (12.5 km (7.8 miles)) of the roads in the borough are 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, resulting in competition for road space. 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.

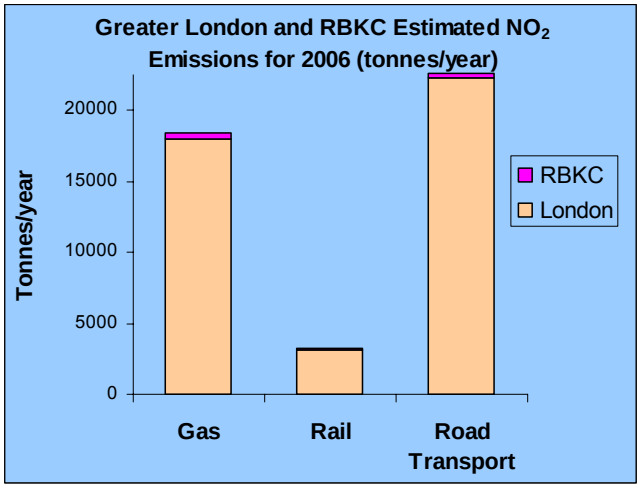
The emission sources from within the borough are therefore mainly from transport, residential and commercial activities. A large proportion of the pollution however arises from beyond the borough's immediate area including neighbouring boroughs, the city as a whole and further afield from national and European sources.

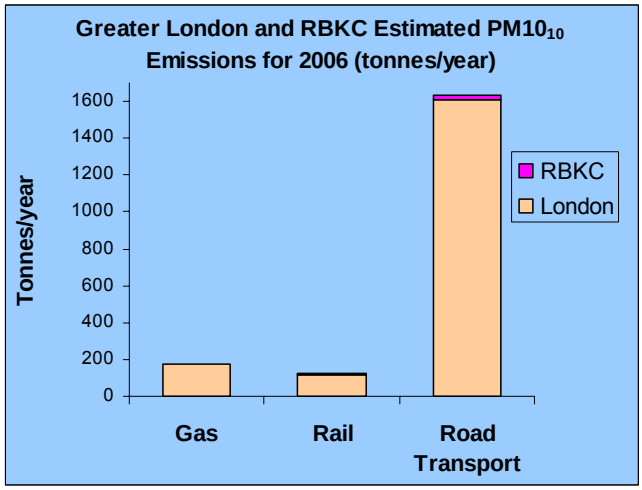
The London Atmospheric Emissions Inventory (LAEI) is one of the most comprehensive inventories and contains detailed information on emission sources in the borough and for London. The LAEI has been prepared by the Greater London Authority (GLA) and is updated annually for use by local authorities and other users. It uses the most up-to-date activity datasets and emission factors to provide a database of geographically referenced information on emissions sources including the location, rates of emissions and estimates of the quantity of specific pollutants emitted into the air for a total of fourteen pollutants. The 2006 LAEI was released April 2009.





The contribution of NO_x and PM_{10} from the borough is compared to emissions from Greater London; this shows the small relative contribution the borough makes compared to the total emissions in London.





1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area and prepare an Air Quality Action Plan setting out the measures it intends to put in place in pursuit of the objectives.

1.3 Air Quality Objectives

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

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu g/m^3$	Running annual mean	31.12.2003
	5.00 $\mu g/m^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu g/m^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu g/m^3$	Annual mean	31.12.2004
	0.25 $\mu g/m^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particulate matter (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, 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 Royal Borough of Kensington and Chelsea completed the first round of Review and Assessment in 2003; it consisted of three stages which involved examining the sources, identifying the contribution of each and 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

Pollutant	Assessment
NO_2	High likelihood the Borough would exceed the annual mean, and hourly mean objective along many of the major roads in the borough.
PM_{10}	High likelihood that the Borough would exceed the 24 hour mean objective at a few locations.
SO_2	Virtually no likelihood that the Borough would exceed the objectives for sulphur dioxide.
CO	No likelihood that the Borough would exceed the objectives for carbon monoxide.

Consequently an Air Quality Management Area was declared in December 2000 based on exceedences of nitrogen dioxide (NO_2) and particulate matter (PM_{10}). This covers the whole of the Royal Borough of Kensington and Chelsea.

Stage Four

Stage four was carried out to check the results of the previous reports in the 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_2 and PM_{10}. In addition the further work eliminated any concerns regarding carbon monoxide and sulphur dioxide. Alongside this, an 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 Updating and Screening Assessment 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 updating and screening assessments are not required.

1.4.4 Fourth Round of Review and Assessment

This Updating and Screening Assessment forms part of the fourth round of assessment. New monitoring data is reported for each pollutant individually. This is followed by an examination of sources using the checklists provided in Defra's LAQM (TG09) to identify any significant changes since the previous rounds of review and assessment.

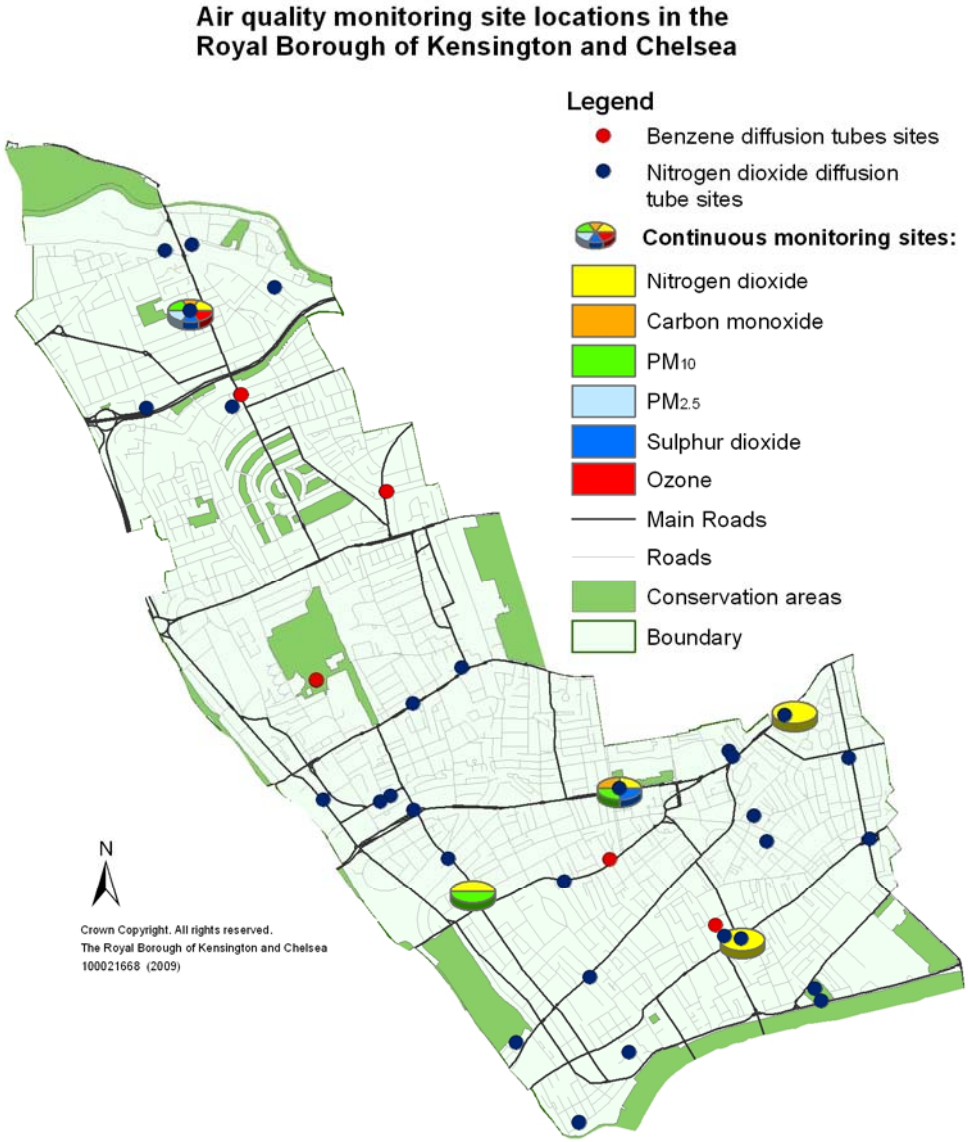
2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

We have automated continuous monitoring at five sites in the borough; Table 2.1 provides details about each. The West London site operated by Defra (Department of Environment, Food and Rural Affairs) was recently closed following a review of their monitoring networks. Monitoring for nitrogen dioxide at the Earls Court site commenced in early 2008, following an expansion of Council's existing site to improve its monitoring network.

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) as the filters must be weighed manually. Air quality data for 2008 has been included in the report where it is available but is largely provisional. The map below shows sites operating between 2006 and 2008.



Quality Control and Assurance

Automated data that we collect is subject to quality control and audit procedures by Kings Environmental Research Group (Kings ERG) that operate the London Air Quality Network (LAQN). In addition independent consultants carry out audits annually. 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.

Table 2.1 Details of 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?
KC1	North Kensington	LAQN & AURN affiliate, Urban background	X 524045 Y 181752	Nitrogen oxides PM_{10} Carbon monoxide Sulphur dioxide Other monitoring undertaken: Gravimetric monitoring PM_{10} & $PM_{2.5}$	Y	Y	N/A	No
AURN	Cromwell Rd/ Cromwell Rd 2	AURN, Roadside	X 526524 Y 178965	Nitrogen oxides Carbon monoxide Sulphur dioxide Other monitoring undertaken: Lead and heavy metals	Y	Y	3.5m from Cromwell Road	No
KC2	Cromwell Rd 2	LAQN, Roadside	X 526524 Y 178965	PM_{10}	Y	Y	Approx within 8m of Cromwell Rd and 5m of Queens Gate.	No
AURN	West London	AURN, Urban background	X 525026 Y 178741	Nitrogen oxides Carbon monoxide	Y	Y	50m from Warwick Rd	No
KC3	Knightsbridge	LAQN, Kerbside	X 527518 Y 179395	Nitrogen oxides	Y	Y	Located on the kerb of Hans Road and 4m from Brompton Rd	Yes
KC4	Chelsea Town Hall	LAQN, Roadside	X 527268 Y 178089	Nitrogen oxides	Y	Y	Approx 8m from Kings Rd	No
KC5	Earls Court	LAQN, Kerbside	X 525695 Y 178363	PM_{10} gravimetric Nitrogen oxides	Y	Y	Sited on the kerb of Earls Court Rd	Yes

*LAQN- London Air Quality Network, AURN- Automatic Urban and Rural Network
Kerbside: within 1m of a busy road; Roadside: located between 1-5m from the kerbside of a busy road, but could be up to 15m; Intermediate: 20-30m from the kerb of a busy road; Urban background: A location distanced from sources such as busy roads and therefore representative of background conditions, e.g. residential areas.

All sites are representative of some relevant exposure to one or more of the objective levels. If not at the site itself they are representative of many other locations in which residential buildings are present or exposure to the public over the shorter-term is likely (for example to hourly nitrogen dioxide levels in busy high street and shopping areas).

2.1.2 Non-Automatic Monitoring

Non-Automatic Networks

Monitoring data for benzene and nitrogen dioxide (in addition to continuous monitoring) is collected using passive diffusion techniques. The borough subscribes to the London Wide Environmental Programme offered by Bureau Veritas for the provision and analysis of diffusion tubes.

The Warwick Road monitoring site commenced in early 2008, following an expansion of Council's existing sites to improve its monitoring network. Table 2.2 provides details of thirty nitrogen dioxide and five benzene diffusion tube sites operating in the Borough between 2006 and 2008. Details of a sixth benzene site, which closed in 2006, have also been included as data for this site is included in this report.

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_2	Y	Y	3.5m	No
KC32	Holland Park	Urban Background	X 524784 Y 179599	NO_2	Y	Y	380m	No
KC33	Cromwell Rd/ Earls Court Rd	Roadside	X 525355 Y 178841	NO_2	Y	Y	1.1m	Yes
KC34	Dovehouse Street	Urban Centre	X 527164 Y 178103	NO_2	Y	Y	26m	No
KC35	Brompton Road/ Cottage Place	Roadside	X 527192 Y 179185	NO_2	Y	Y	8m	No
KC38	Earls Court Station	Roadside	X 525548 Y 178556	NO_2	Y	Y	1.7m	Yes
KC39	Lots Road/ Upcerne Road	Roadside	X 526317 Y 177022	NO_2	Y	Y	8.1m	No
KC40	Brompton Road	Urban Centre	X 527214 Y 179153	NO_2	Y	Y	65m	No
KC41	Ladbroke Crescent	Urban Background	X 524294 Y 181200	NO_2	Y	Y	70m	No
KC42	Pembridge Square Library	Roadside	X 525191 Y 180705	NO_2	Y	Y	6m	No
KC43	St Marks Grove	Urban Background	X 525950 Y 177487	NO_2	Y	Y	38m	No
KC44	Donne Place	Urban Background	X 527335 Y 178810	NO_2	Y	Y	55m	No
KC45	Chatsworth Court	Roadside	X 525263 Y 178936	NO_2	Y	Y	13m	No
KC46	Marlborough Court	Roadside	X 525157 Y 178892	NO_2	Y	Y	8m	No
KC47	Sion Manning School	Urban Background	X 524046 Y 181758	NO_2	Y	Y	8.5m	No
KC48	Sloane Square	Roadside	X 528011 Y 178675	NO_2	Y	Y	7m	No
KC49	Harrods	Urban Centre	X 527516 Y 179395	NO_2	Y	Y	4m	Yes
KC50	Chelsea Physic Garden (Gate)	Roadside	X 527726 Y 177727	NO_2	Y	Y	4m	No
KC51	Chelsea Physic Garden (Met Station)	Urban Background	X 527690 Y 177800	NO_2	Y	Y	92m	No
KC52	Sloane Avenue	Roadside	X 527411 Y 178659	NO_2	Y	Y	2.6m	No

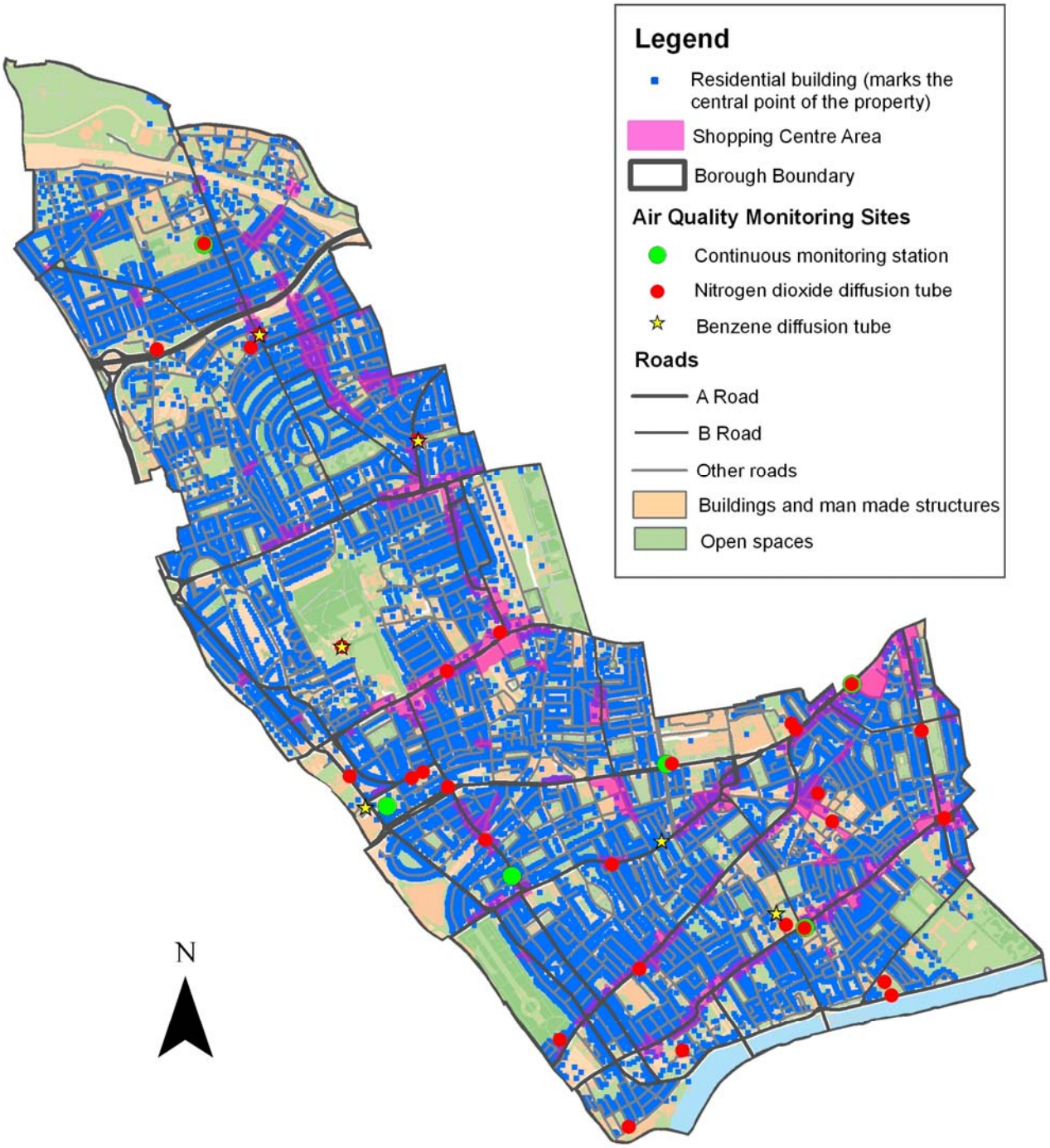
Table 2.2 cont

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?
KC53	Walmer House	Urban Background	X 523792 Y 181189	NO_2	Y	Y	12.5m	No
KC54	Cromwell Rd/ Natural History Museum	Roadside	X 526550 Y 178968	NO_2	Y	Y	3.1m	No
KC55	Blantyre St	Urban Background	X 526608 Y 177429	NO_2	Y	Y	100m	No
KC56	Chelsea Old Town Hall	Roadside	X 527268 Y 178089	NO_2	Y	Y	9m	No
KC57	Pavillion St/ Sloane Ave	Roadside	X 527889 Y 179145	NO_2	Y	Y	3m	No
KC58	Kensington H St/Kensington Church St	Roadside	X 525630 Y 179674	NO_2	Y	Y	13m	No
KC59	Kensington High St/Argyll St	Kerbside	X 525342 Y 179464	NO_2	Y	Y	0.7m	No
KC60	Old Brompton Rd/ Draycott Ave	Kerbside	X 526231 Y 178425	NO_2	Y	Y	0.7m	No
KC61	Fulham Rd/ Limerston St	Roadside	X 526377 Y 177867	NO_2	Y	Y	10m	No
KC64	Warwick Road	Roadside	X 524825 Y 178902	NO_2	Y	Y	3.5m	No
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)	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

*Kerbside: within 1m of a busy road; Roadside: located between 1-5m from the kerbside of a busy road, but could be up to 15m; Intermediate: 20-30m from the kerb of a busy road; Urban Centre: Representative of typical population exposure in towns and city centres; Urban background: A location distanced from sources such as busy roads and therefore representative of background conditions, e.g. residential areas.

The map overleaf shows the position of the borough's monitoring sites in relation to residential buildings and main shopping areas. The residential properties (indicated by blue squares) extend to most of the built environment. Only a relatively small proportion of the buildings (indicated in beige) are entirely non residential i.e. commercial buildings such large shops, offices, exhibition halls, museums, schools, colleges etc.

Map showing the location of residential properties and main shopping areas in the borough



2.2 Comparison of Monitoring Results with AQ Objectives

2.2.1 Nitrogen Dioxide

There are two objectives for nitrogen dioxide (NO_2); a short term objective of 200µg/m^3 not to be exceeded more than 18 times as a one hour mean, and a longer term objective of 40µg/m^3 as an annual mean. The deadline for achieving these objectives was the end of 2005. The whole of the Royal Borough was declared an Air Quality Management Area in 2000. It was declared on the basis that NO_2 (and PM_{10} to a lesser extent) would fail to meet its objectives.

Monitoring Data

Automatic chemiluminescent analysers and passive diffusion tubes are used to monitor NO_2 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 2.1. The West London monitoring site was closed in 2007 following a review by Defra of its monitoring network. The Earls Court monitoring site in 2008 was replaced with a new site to allow the monitoring of nitrogen dioxide.

The automatic monitoring results are shown in Tables 2.3a and 2.3b. 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. Caution must be applied to the 2008 data as it is provisional. However, any subsequent adjustments are unlikely to affect the overall conclusions.

Preliminary monitoring results for 2008 at continuous sites show exceedences of the average NO_2 annual mean objective level have occurred at all sites in the borough apart from the North Kensington background site. All monitoring sites showed a slight decrease in the annual mean level compared to 2007, except the Chelsea Town Hall site, which showed a minor increase. All sites also saw reductions in the number of hours above the hourly mean objective, except for the Chelsea Town Hall site.

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

Site ID	Location	Within AQMA?	Proportion of year with valid data 2008 %	Annual mean concentrations (µg/m^3)		
				2006	2007	2008
KC1	North Kensington	Y	*90*	38	39	*33*
AURN	West London*	Y	-	**51**	**46**	-
KC5	Earls Court*	Y	*73*	-	-	***107***
AURN	Cromwell Rd 2	Y	*84*	**84**	**72**	***67***
KC3	Knightsbridge	Y	*99*	**95**	**94**	***93***
KC4	Chelsea Town Hall	Y	*98*	**96**	**91**	***92***
AURN	Marylebone Rd	Y	*99*	**112**	**102**	***115***

* These sites have operated for part of a year. Data capture for West London site for 2007 was 82%; Data capture for Earls Court site in 2008 is 73% (as seen in table). 2008 data (in italics) is provisional and should be treated with caution. Source LAQN ratified to Sep 08.

All sites are above the annual mean objective level for nitrogen dioxide apart from the urban background site in North Kensington. Data from the Marylebone Road is included for comparative purposes and is not in the borough. All sites are located at distances which are representative of residential building facades with the exception of Earls Court. The nitrogen dioxide analyser is new to the site. The replacement site was installed in March 2008 and was primarily to investigate the effects of the western extension of the congestion charge zone but is also representative of locations where the public may be exposed to the short term objective.

The chart below shows the longer term trend; only North Kensington and Cromwell Road have shown an overall downward trend. However over the same period the sites at Chelsea and Knightsbridge have shown an increase in annual mean levels.

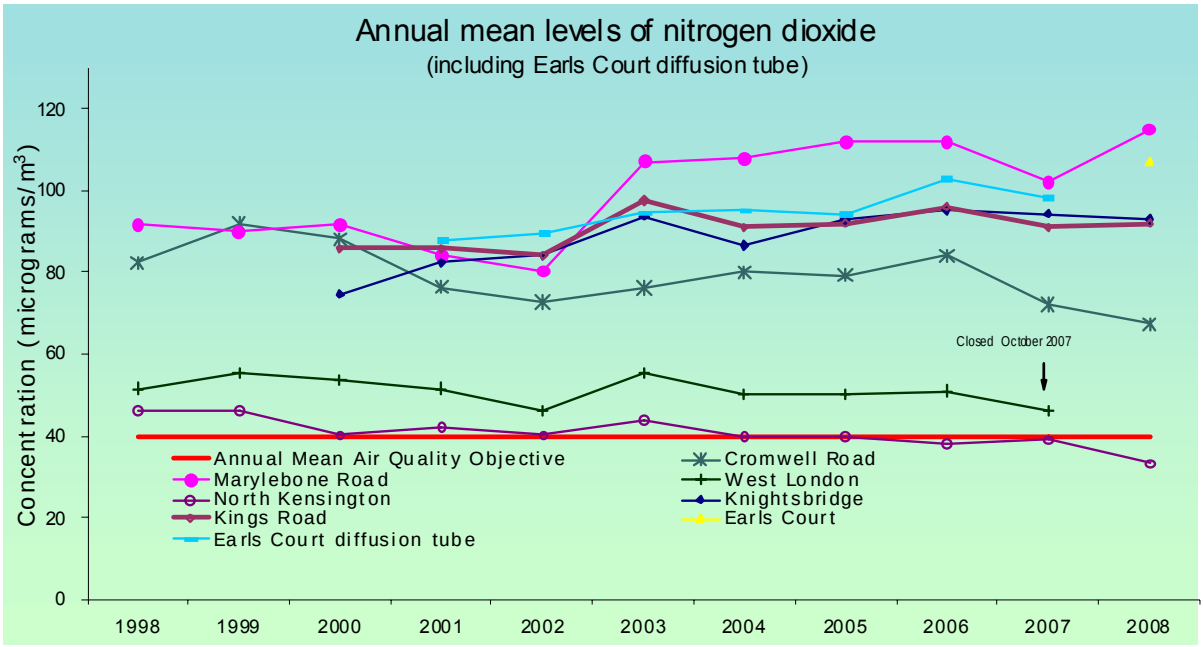


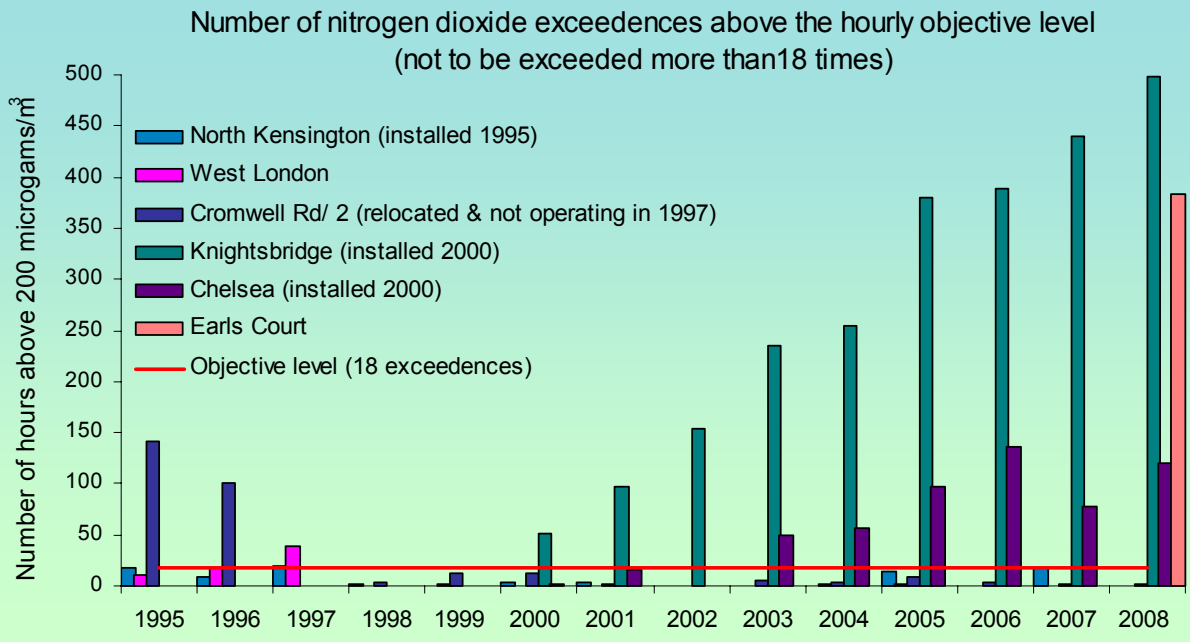
Table 2.3b Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Site ID	Location	Within AQMA?	Data Capture 2008 %	Number of exceedences of hourly mean (200 μg/m^3) *Where valid data is less than 90% the 99.8th %ile is shown in brackets.*		
				2006	2007	2008
KC1	North Kensington	Y	90	0	17 (201)	*0 (122)*
AURN	West London*	Y	0	0	0	-
KC5	Earls Court*	Y	*73*	-	-	***383 (242)***
AURN	Cromwell Rd 2	Y	84	4	2	*1 (147)*
KC3	Knightsbridge	Y	*99*	**389**	**440**	***499***
KC4	Chelsea Town Hall	Y	*98*	**136**	**77**	***121***
AURN	Marylebone Rd	Y	99	**676**	**452**	***822***

* These sites have operated for part of a year. Data capture for West London site for 2007 was 82%; Data capture for Earls Court site in 2008 is 73% (as seen in table) for West London in 2007 was 73% as the site was closed. 2008 data (in italics) is provisional and should be treated with caution.

The chart on the next page shows the number of hourly exceedences at sites in the borough. The hourly objective has been breached at three sites, namely Knightsbridge, Chelsea Town Hall and the Earls Court site, which was installed in 2008. The number of exceedences at the Chelsea site increased compared to 2007, however the number remains below the number reached at the site in 2006. The Knightsbridge site has shown a steady increase in

hourly exceedences since monitoring began at this site. The site though 'a worst case' location is nonetheless relevant in terms of exposure as it is a busy shopping area.



Diffusion Tube Monitoring Data

Diffusion tube data for nitrogen dioxide is collected at 29 locations in the Borough. The details of these sites can be found in Table 2.2. Tables 2.4a and 2.4b present the annual mean concentrations measured from these locations.

The Warwick Road monitoring site (site ID KC64) started in 2008, following an expansion of the Council's existing sites. This was in order to improve its monitoring network in an area where a large number of new developments are being built in the near vicinity. The Marlborough Court site (site ID KC46) closed at the end of 2007; changes to sites meant there were two sites at very similar distance to the same road.

The data is adjusted to take into account the difference between the continuous monitoring and the diffusion tube method. The adjustment factor is calculated by Bureau Veritas using data collected through the London Wide Environmental Programme (LWEP) co-location study. Details of the analytical laboratory and bias adjustment methodology are described in Appendix A. The factor for 2008 has been calculated as 0.98 which is based on all co-located data included in the LWEP.

Table 2.4a presents data for 29 sites (this does not include Marlborough Court which was not operating in 2008 but does include Warwick Road). The results indicate that four out of 29 sites were below the objective level. These sites, located at Holland Park, Chelsea Physic Garden and Sion Manning School, have maintained their levels below the objective for the past three years. Ladbroke Crescent (a residential 'no-through' road) also fell below the objective level for the first time.

Table 2.4a Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA?	Data Capture 2008 %	Annual mean concentrations 2008 ($\mu g/m^3$) Adjusted for bias[#]
KC31	Ladbroke Grove/Nth Ken Library	Y	100	**58.2**
KC32	Holland Park	Y	100	32.3
KC33	Cromwell Road/Earls Court Rd	Y	100	**85.3**
KC34	Dovehouse Street	Y	100	**45.6**
KC35	Brompton Road/Cottage Place	Y	100	**64.0**
KC38	Earls Court Station	Y	92	**98.2**
KC39	Lots Road/Upcerne Road	Y	100	**43.5**
KC40	Brompton Road	Y	100	**49.5**
KC41	Ladbroke Crescent	Y	100	38.8
KC42	Pembridge Square Library	Y	100	**47.2**
KC43	St Marks Grove	Y	100	**40.2**
KC44	Donne Place	Y	92	**42.8**
KC45	Chatsworth Court	Y	100	**50.7**
KC47	Sion Manning School	Y	100	36.0
KC48	Sloane Square	Y	100	**80.1**
KC49	Harrods	Y	92	**76.1**
KC50	Chelsea Physic Garden (Gate)	Y	100	**52.7**
KC51	Chelsea Physic Garden; Met Stat	Y	92	36.1
KC52	Sloane Avenue nr Marlborough school	Y	100	**60.2**
KC53	Walmer House	Y	100	**47.0**
KC54	Cromwell Rd/Natural History Museum	Y	100	**72.8**
KC55	Blantyre St	Y	*83*	***46.9***
KC56	Chelsea Old Town Hall	Y	100	**87.6**
KC57	Pavillion St/Sloane Ave	Y	100	**55.5**
KC58	Kensington H St/Kens. Church St	Y	100	**62.5**
KC59	Kensington H St/Argyll St	Y	100	**86.9**
KC60	Old Brompton Rd/Draycott Ave	Y	100	**72.2**
KC61	Fulham Rd/Limerston St	Y	100	**61.0**
KC64	Warwick Rd	Y	100	**51.2**

#2008 Results corrected for bias using 2008 LWEP factor 0.98. Data in italics indicates the period of valid data is less than 90% of a full year (site KC55- Blantyre St). Results from sites KC47- Sion Manning School, and KC54- Cromwell Rd/Natural History Museum, are the mean results from multiple tube exposures (triplicate tubes).

The graph below shows the diffusion tube data for 2008 and includes the measurements from continuous sites where these are co-located. The results at these sites show a reasonable correlation. Almost all sites apart from those described above exceed the annual mean objective level.

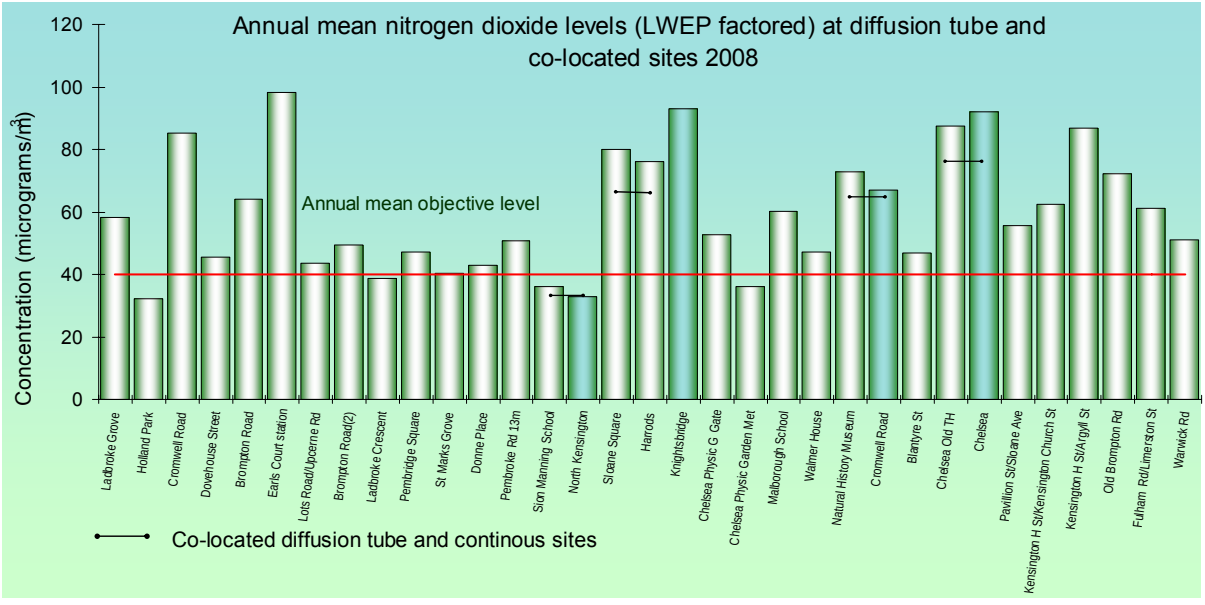


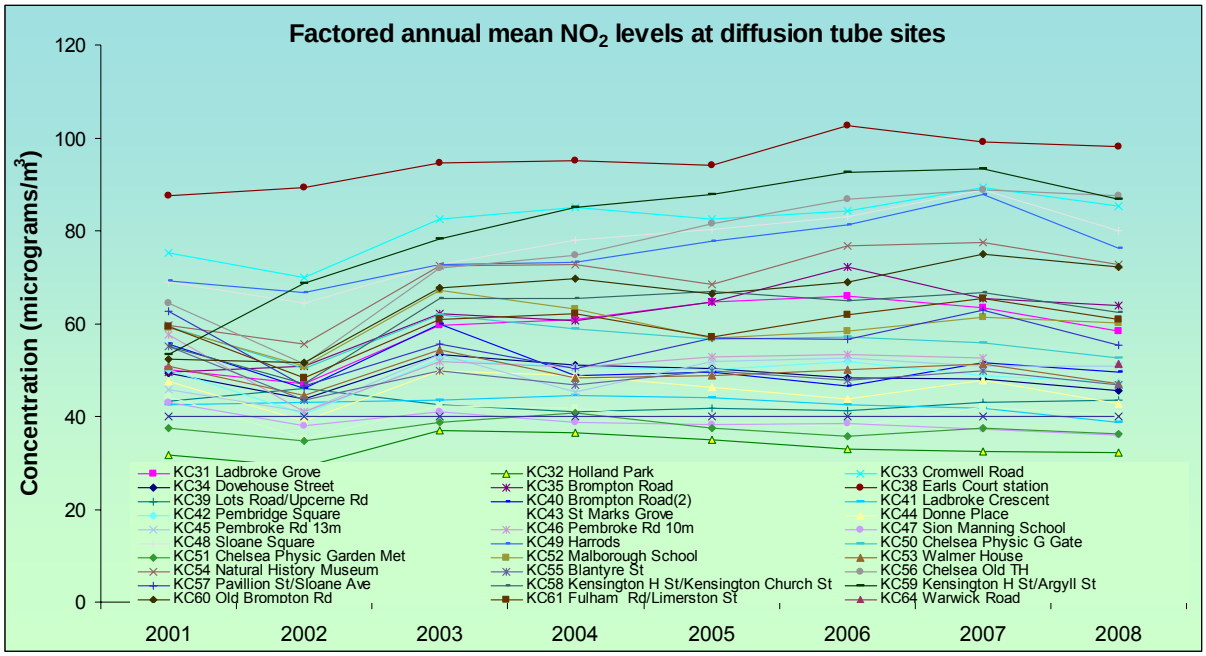
Table 2.4b Results of Nitrogen Dioxide Diffusion Tubes (bias adjusted)

Site ID	Location	Within AQMA ?	Annual mean concentrations (μg/m^3) Adjusted for bias		
			2006	2007	2008[#]
KC31	Ladbroke Grove/Nth Ken Library	Y	**65.8**	**63.4**	**58.2**
KC32	Holland Park	Y	32.9	32.5	32.3
KC33	Cromwell Road/Earls Court Rd	Y	**84.2**	**89.3**	**85.3**
KC34	Dovehouse Street	Y	***48.2***	**48.1**	**45.6**
KC35	Brompton Road/Cottage Place	Y	**72.1**	**65.4**	**64.0**
KC38	Earls Court Station	Y	**102.7**	**99.2**	**98.2**
KC39	Lots Road/Upcerne Road	Y	**41.2**	**43.0**	**43.5**
KC40	Brompton Road	Y	**46.6**	**51.6**	**49.5**
KC41	Ladbroke Crescent	Y	**42.5**	**41.8**	38.8
KC42	Pembridge Square Library	Y	***51.9***	**48.9**	**47.2**
KC43	St Marks Grove	Y	37.8	**42.1**	**40.2**
KC44	Donne Place	Y	**43.7**	**47.7**	**42.8**
KC45	Chatsworth Court	Y	**52.5**	**50.8**	**50.7**
KC46	Marlborough Court	Y	**53.4**	**52.6**	closed
KC47	Sion Manning School	Y	36.7	37.2	36.0
KC48	Sloane Square	Y	**83.0**	**88.9**	**80.1**
KC49	Harrods	Y	**81.3**	**87.8**	**76.1**
KC50	Chelsea Physic Garden (Gate)	Y	**57.0**	**55.9**	**52.7**
KC51	Chelsea Physic Garden (Met Station)	Y	35.6	37.5	36.1
KC52	Sloane Ave. nr Marlborough school	Y	**58.4**	**61.3**	**60.2**
KC53	Walmer House	Y	**50.1**	**51.3**	**47.0**
KC54	Cromwell Rd/Natural History Museum	Y	**76.8**	**77.6**	**72.8**
KC55	Blantyre St	Y	**47.8**	**49.9**	**46.9**
KC56	Chelsea Old Town Hall	Y	**86.9**	**88.8**	**87.6**
KC57	Pavillion St/Sloane Ave	Y	**56.6**	**62.8**	**55.5**
KC58	Kensington H St/Kensington Church St	Y	**64.9**	**66.7**	**62.5**
KC59	Kensington H St/Argyll St	Y	**92.7**	**93.4**	**86.9**
KC60	Old Brompton Rd/Draycott Ave	Y	**68.9**	**75.0**	**72.2**
KC61	Fulham Rd/Limerston St	Y	***62.0***	**65.4**	**61.0**
KC64	Warwick Rd	Y	**-**	**-**	**51.2**

[#]2008 LWEP factor 0.98 Data in italics indicates the period of valid data is less than 90% of a full year (2006: site KC34- Dovehouse Street, site KC42- Pembridge Square Library, site KC47- Sion Manning School, site KC61- Fulham Rd/Limerston St; 2007: site KC60- Old Brompton Rd/Draycott Ave; 2008: site KC55- Blantyre St).
Results from sites KC47- Sion Manning School, and KC54- Cromwell Rd/Natural History Museum, are the mean results from multiple tube exposures (triplicate tubes).

Table 2.4b shows the number of sites that recorded levels below the objective annual mean concentration has varied between 3 to 4 sites (out of 29 sites) for each year between 2006 and 2008. There appears to have been a slight decline between 2007 and 2008.

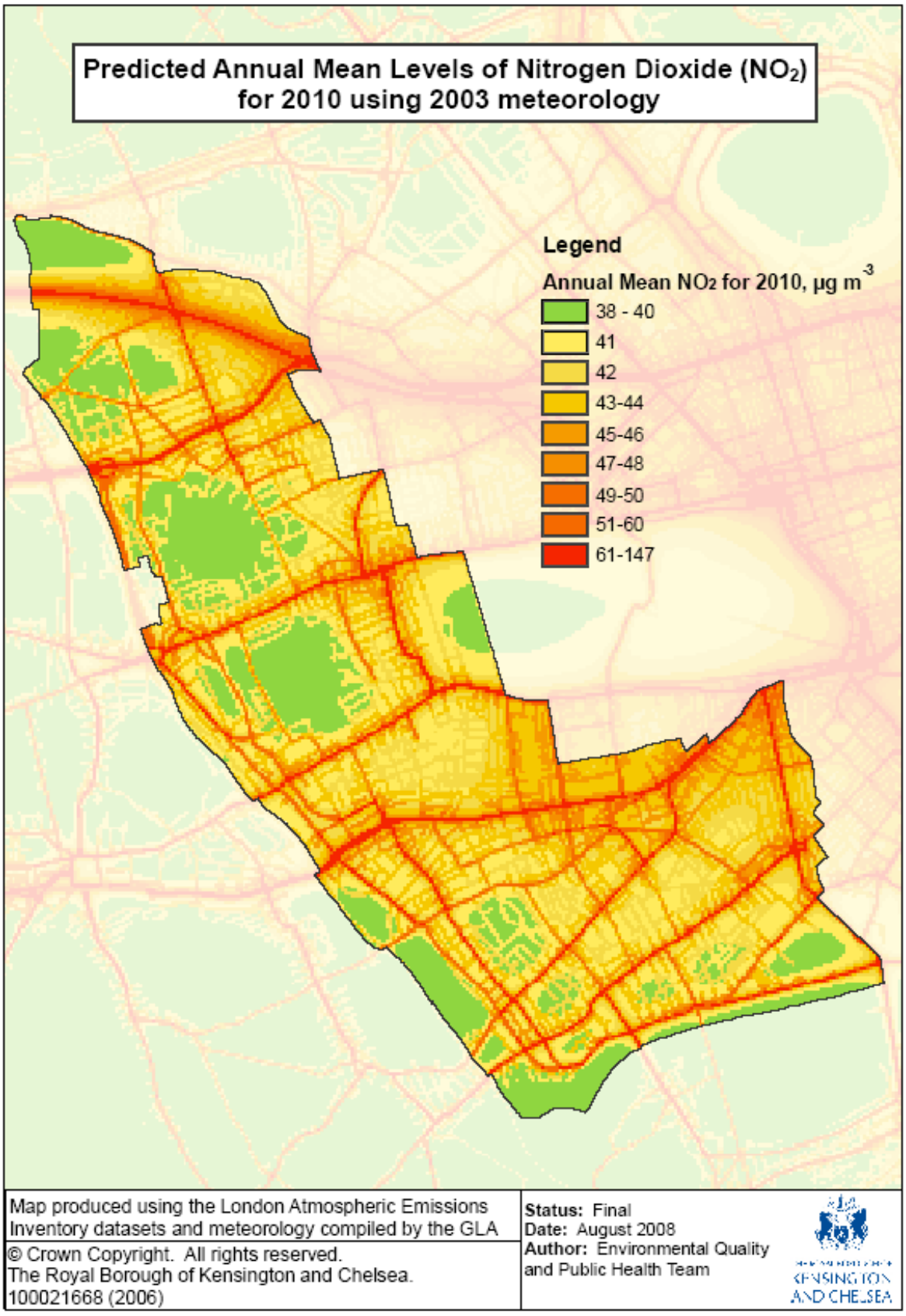
However in terms of the longer timescale (chart overleaf) there has been little significant change in the annual mean concentrators and the majority of sites are well above the objective level.



There have been a number of major interventions including the introduction of the Low Emission Zone (LEZ) which targeted heavy goods vehicles over 12 tonnes for particulate matter in February 2008, extending to vehicles between 3.5 and 12 tonnes in July 2008. Whilst this would have mainly affected PM_{10} emissions there has been concern that emissions of direct NO_2 may have increased as an unexpected consequence. The introduction of the congestion charge in central London in February 2003, followed by the western extension to cover the borough in February 2007, has also affected traffic flows and composition. These interventions have complicated trends and may have affected different parts of the borough in different ways, with some roads being affected by increased flows whilst others by decreased flows. Another consequence is the change in fleet characteristics with increases in buses and taxis.

In conclusion there has been slight improvement in the annual mean nitrogen dioxide concentrations, mainly at background sites, between 2007 and 2008. However, some sites, mainly those which are near busy congested roads, have experienced increased levels and the majority of all sites continue to exceed the annual mean objective by a very large margin.

In any case, modelling undertaken by the GLA using the 2004 inventory (maps based on the 2006 inventory were not available at the time of this reports preparation) shows that exceedences of nitrogen dioxide are still predicted for 2010. The map opposite indicates that approximately 80% of the borough is likely to remain above the annual mean objective. Areas below the objective level are mainly green spaces or areas with quiet residential roads. This is comparable to the concentrations currently measured in the borough.


Predicted Annual Mean Levels of Nitrogen Dioxide (NO_2) for 2010 using 2003 meteorology
Legend
Annual Mean NO_2 for 2010, µg m^{-3}
38 - 40
41
42
43-44
45-46
47-48
49-50
51-60
61-147
Map produced using the London Atmospheric Emissions Inventory datasets and meteorology compiled by the GLA
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The Royal Borough of Kensington and Chelsea.
100021668 (2006)
Status: Final
Date: August 2008
Author: Environmental Quality and Public Health Team
KENSINGTON AND CHELSEA

2.2.2 Particulate Matter (PM_{10})

Two objectives for particulate matter (PM_{10}), to be achieved by the end of 2004, are incorporated in the Air Quality Regulations (see Table 1.1)– a short term 24 hour mean objective and a long term annual average objective. Following the review of the Air Quality Strategy the three more stringent objectives for 2010 and 2015 will not now be adopted. The whole of the Royal Borough was declared an Air Quality Management Area in 2000 partially based on exceedences of the 2004 PM_{10} objectives at some locations.

Monitoring Data

Automatic monitoring of PM_{10} (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 are now not considered to be equivalent to gravimetric methods, the data from these sites is still relevant for local air quality management purposes. Gravimetric data is also available at the North Kensington site up until 2007 when monitoring using partisol instruments stopped, following a review of the Defra monitoring networks and concerns over the quartz filters used[1]. This data was collected by Defra for research purposes comparing different particle monitoring techniques.

A gravimetric sampler (equivalent to the EU reference method) installed by the Council has been operating on the Earls Court Road since May 2002 using Teflon coated glass fibre (Emfab) filters which are not affected in the same way as quartz filters[1].

In 2008, Defra replaced TEOM units with FDMS units for the particulate monitoring network and stopped operating partisols using quartz filters, consequently data for 2007 and 2008 are affected by low data capture. FDMS instruments are adapted TEOM instruments and have been found to be equivalent to the EU reference method. 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. TEOM data from North Kensington and Cromwell Road has also been corrected using the VCM website[2].

Table 2.5a shows particulate data collected in the borough and at other central London locations using various methods and adjustments. Data capture for some sites are especially low due to changes at sites and is included for indicative purposes only.

Table 2.5a Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective

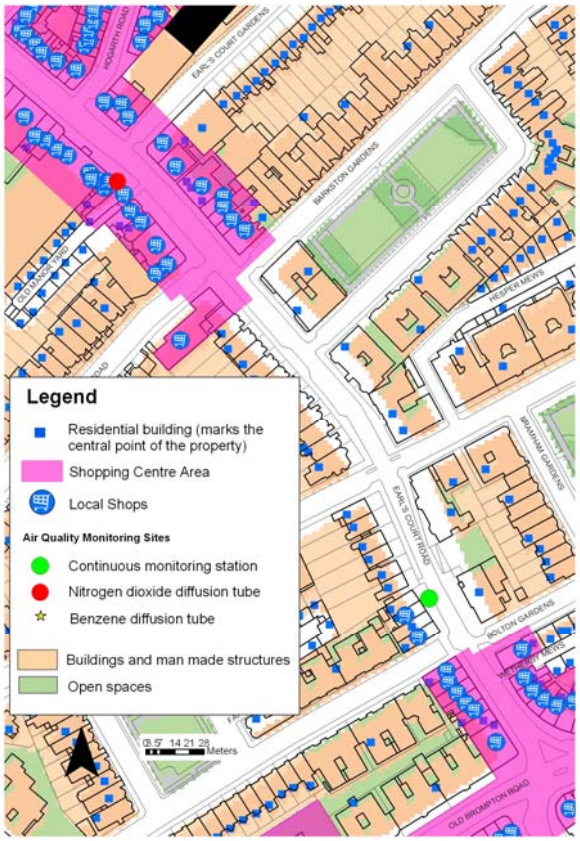
Site ID	Location	Correction	Within AQMA?	Data Capture 2008 %	Annual mean concentrations (µg/m^3)		
					2006	2007	2008
KC1	North Kensington TEOM	1.3	Y	*98*	26	25	*23*
KC1	North Kensington TEOM	VCM	Y	*98*	23	22	*22*
AURN	N Kensington Partisol	None	Y	91, 73, 45	32	28	*19*
KC2	Cromwell Rd 2 TEOM	1.3	Y	*98*	40	35	*33*
KC2	Cromwell Rd 2 TEOM	VCM	Y	*98*	34	30	*29*
KC5	Earls Court Partisol	None	Y	86	40	40	*37*
AURN	Bloomsbury TEOM	1.3	Y	*98*	30	29	*26*
AURN	Marylebone Rd TEOM	1.3	Y	*96*	47	45	*47*
AURN	Marylebone Rd Partisol	none	Y	76, 66, 58	46	47	*37*

Partisols are gravimetric instruments. TEOM data has been factored by 1.3. Data shown in italics is provisional.

[1] Monitoring Networks Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom Dr Richard Maggs, Dr David Harrison, Dr David Carslaw and Ken Stevenson
[2] http://www.volatile-correction-model.info/Default.aspx

Map of area surrounding the Earls Court monitoring site showing residential buildings and shopping centre areas.

In 2008 there were no exceedences of the annual mean level of 40µg/m^3 at the borough's monitoring sites. However caution should be applied to the 2008 data at the Earls Court site which had a low data capture rate because of an upgrade to the site. In the past the site has been on or above the objective level. Whilst this is a kerbside location there are residential properties and shops located within a few metres of the site and the area is heavily used by pedestrians. It is also similar in character to many other busy congested routes and is therefore representative of other worst case locations.



The chart below shows long term data from TEOM sites (adjusted using the simple adjustment factor of 1.3 as long time series data is available for this) and gravimetric sites. This shows that overall levels have declined since monitoring first began at North Kensington and Cromwell Road but no clear trend can be seen for Earl's Court which has a shorter time series. The site at Marylebone Rd is above the objective level but it is not clear if this is representative of roads in the borough.

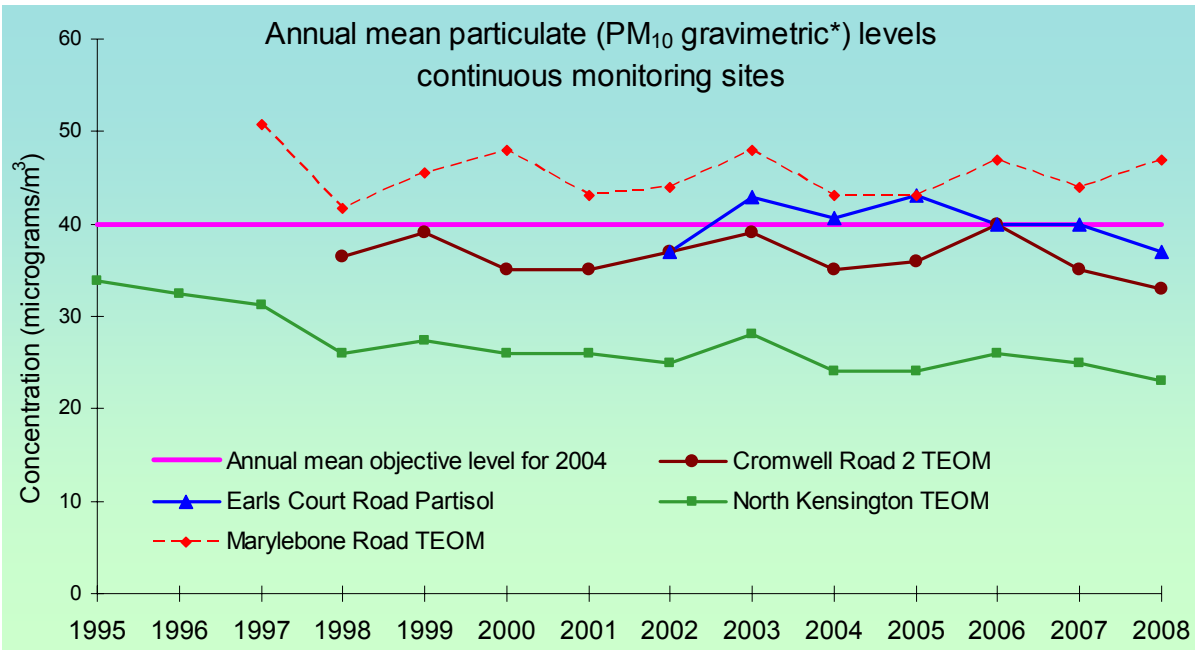


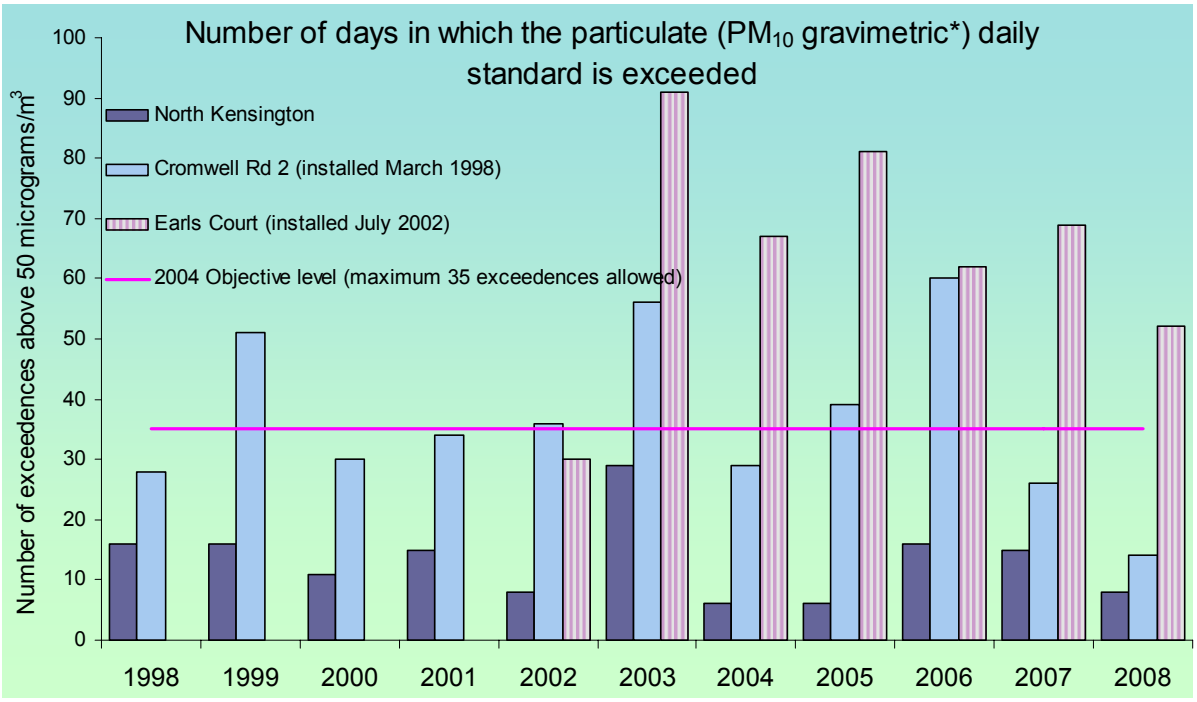
Table 2.5b summarises data in relation to the daily mean objective level. Exceedences have occurred at Cromwell Road in 2006 and all years at Earls Court.

Table 2.5b Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective (maximum of 35 exceedences above 50 $\mu g/m^3$)

Site ID	Location	Correction	Within AQMA?	Data Capture 2008 %	Number of Exceedences of 24 hourly mean (50 µg/m³) *90th %tile shown in brackets where data capture less than 90 %*		
					2006	2007	2008
KC1	North Kensington TEOM	1.3	Y	*98*	16	15	*8*
KC1	North Kensington TEOM	VCM	Y	*98*	13	18	*11*
AURN	N Kensington Partisol	None	Y	91, 73, 45	*22*	*19*	N/A
KC2	Cromwell Rd2 TEOM	1.3	Y	*98*	**60**	26	*14*
KC2	Cromwell Rd2 TEOM	VCM	Y	*98*	**35**	27	*15*
KC5	Earls Court Partisol	None	Y	86	**62**	**69**	**52 (74.4)**
AURN	Bloomsbury TEOM	1.3	Y	*81*	*21*	*13*	*9 (48.5)*
AURN	Marylebone Rd TEOM	1.3	Y	*96*	149	119	*151*
AURN	Marylebone Rd Partisol*	none	Y	76, 66, 58	*69*	*62*	N/A

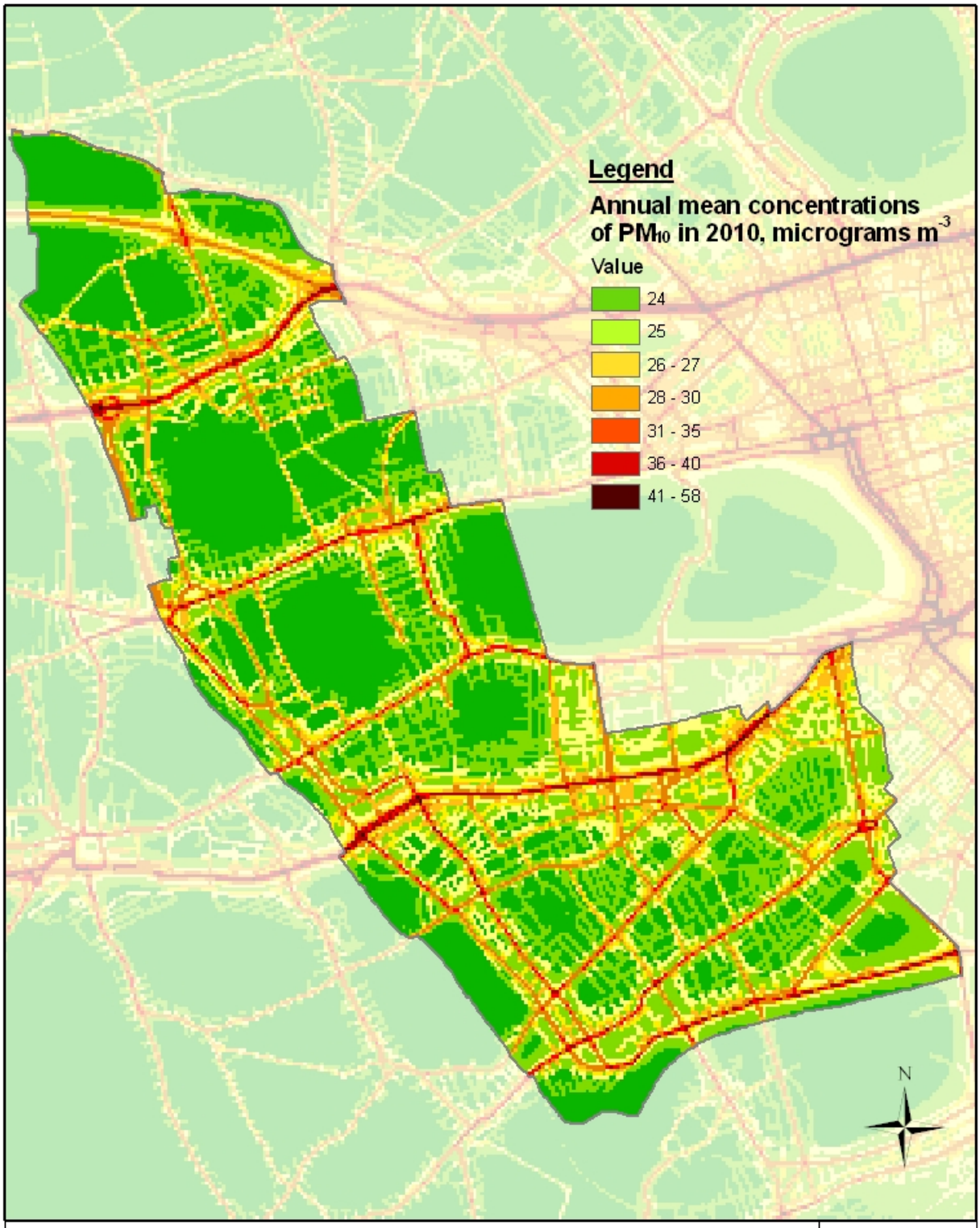
Indicates that these sites were not operating for a full year or low data capture. Partisol indicates gravimetric collection method. Data shown in italics is provisional.

The data in Table 2.5b shows the number of exceedences above 50 $\mu g/m^3$ recorded by the Partisol at the Earls Court site since its installation in 2008 and at other sites using TEOM instruments.



*TEOM data has correction factor applied (x 1.3)

Modelling data provided by the GLA using the 2004 LAEI inventory shows that the annual mean objective is predicted to be exceeded at some locations near busy roads. The results predicted for 2010 indicate that exceedences of the 2004 annual mean objective level are likely to continue along small sections along heavily trafficked roads along the Westway, West Cromwell Road and the Brompton Road. A similar pattern is also predicated for daily exceedences of particulate matter for 2010.



Predicted Annual Mean Levels of Particulate Matter (PM_{10}) for 2010 using 2004 Emissions Datasets and 2003 Meteorology

Map produced using the London Atmospheric Emissions Inventory datasets and meteorology compiled by the GLA

THE ROYAL BOROUGH OF KENSINGTON AND CHELSEA

2.2.3 Particulate Matter $PM_{2.5}$

The latest air quality strategy[3] set a cap of 25µg/m^3 for $PM_{2.5}$ and a 15 per cent reduction in annual mean concentrations at urban background locations by 2020. There is no requirement for local authorities currently to report against these exposure reduction targets. However some information on current levels has been included below.

Monitoring data

Monitoring of $PM_{2.5}$ is only undertaken at a relatively small number of locations in the London area. $PM_{2.5}$ was monitored in the borough at the North Kensington by Defra using a gravimetric instrument. This came to an end in October 2007 and has just recently been replaced with a TEOM FDMS instrument which is a continuous monitoring method.

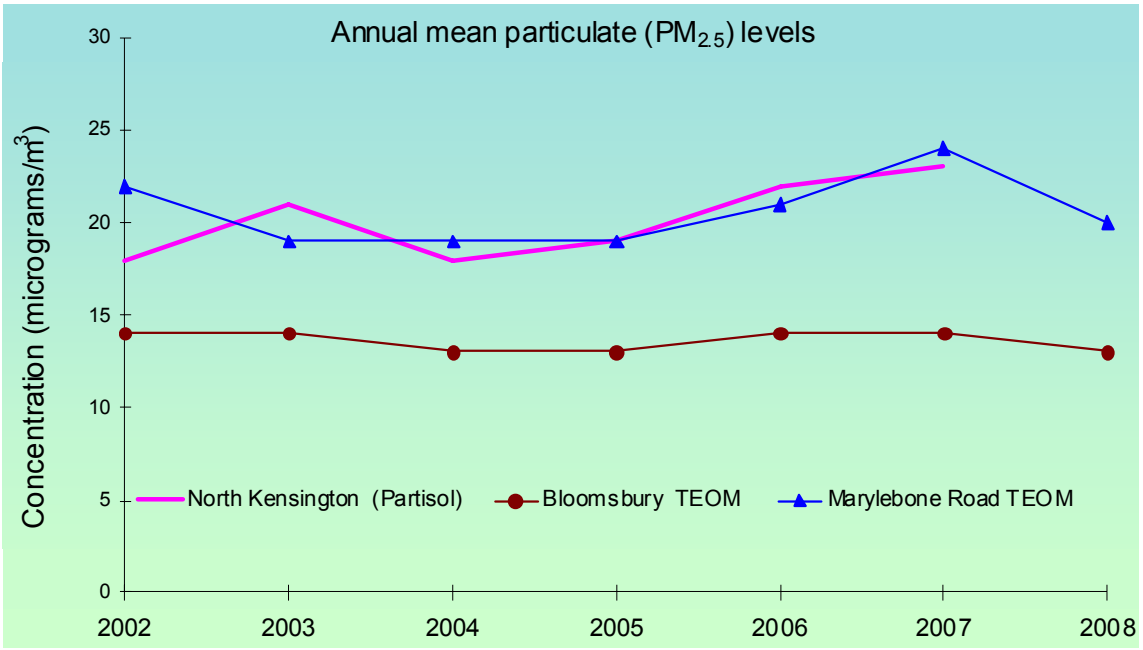
Table 2.6 Concentrations of $PM_{2.5}$ monitoring sites in central London

Year	Site	Annual mean µg/m^3 (TEOM unadjusted)	Annual mean µg/m^3 (GRAV)	% Data Capture
2002	North Kensington (Partisol)	-	18	91
	Bloomsbury TEOM	14	-	87
	Marylebone Road (Partisol)	-	**26**	79
	Marylebone Road TEOM	22	-	96
2003	North Kensington (Partisol)	21	21	87
	Bloomsbury TEOM	14	-	96
	Marylebone Rd (Partisol)	-	**30**	83
	Marylebone Rd TEOM	19	-	93
2004	North Kensington (Partisol)	-	18	89
	Bloomsbury TEOM	13	-	98
	Marylebone Road Partisol)	-	**27**	88
	Marylebone Road TEOM	19	-	96
2005	North Kensington (Partisol)	-	19	93
	Bloomsbury TEOM	13	-	94
	Marylebone Rd (Partisol)	-	**28**	83
	Marylebone Rd TEOM	19	-	97
2006	North Kensington (Partisol)	-	22	94
	Bloomsbury TEOM	14	-	98
	Marylebone Road (Partisol)	-	**31**	87
	Marylebone Road TEOM	21	-	98
2007	North Kensington (Partisol)	-	22	75
	Bloomsbury TEOM	14	-	88
	Marylebone Rd (Partisol)	-	**30**	76
	Marylebone Rd TEOM	22	-	96
2008	North Kensington (Partisol)	*No data due to changes to network*		
	Bloomsbury TEOM	*13*		*77*
	Marylebone Rd (Partisol)	*No data due to changes to network*		
	Marylebone Rd TEOM	*20*		*94*

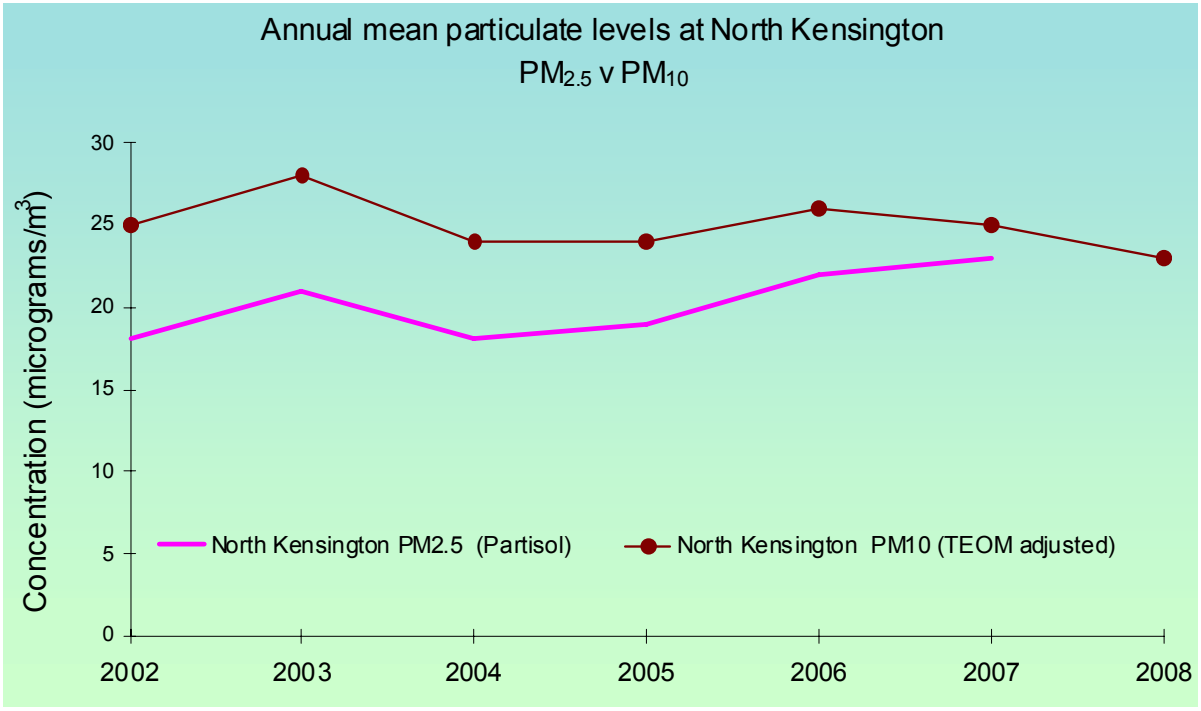
Data in italics may contain data which is unratified.

No data is available for 2008 for $PM_{2.5}$ within the borough due to network changes. Some data is available for central London which shows a slight decline in concentrations of between1 and 2µg/m^3. However overall there has been little change in the long term concentrations.

[3] The Air Quality Strategy for England, Scotland, Wales, and Northern Ireland 17 July 2007



The graph below compares measurements of PM_{10} and $PM_{2.5}$. Whilst it appears that PM_{10} levels are declining, it is of some concern that $PM_{2.5}$ measurements made at the same location have shown an increase over the same period. In 2007 the results show there is a difference of only 2µg/m^3 between the two size fractions.



2.2.4 Sulphur Dioxide

Three objectives have been set for this pollutant; a one hour mean of 350 µg/m^3 (not to be exceeded more than 24 times per year), a 24 hour mean of 125µg/m^3 (not to be exceeded more than 3 times per year) and a 15 minute mean of 266 µg/m^3 (not to be exceeded more than 35 times per year).

Monitoring Data

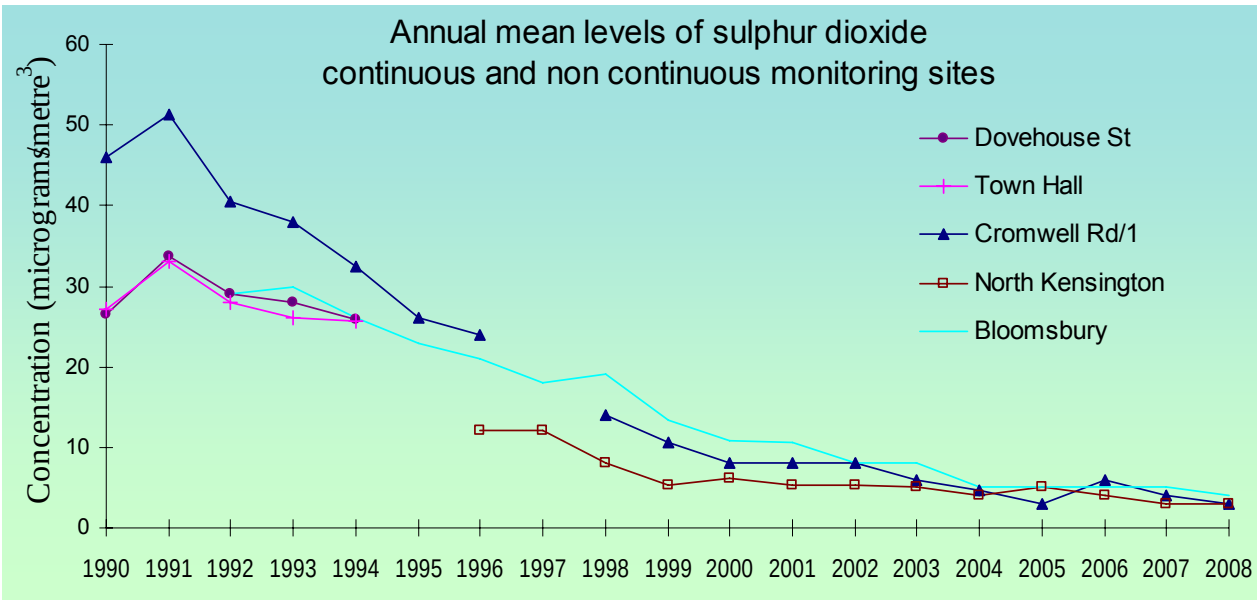
Monitoring data is currently collected at two sites in the borough and is shown in the table below. Historical data based on non continuous '8 port bubbler' method is also available from the Dovehouse Street and Town Hall sites.

Table 2.7 Results of Sulphur Dioxide Monitoring

Year	Location	Annual average (µg/m^3)	No. of 1 hour means > 350µg/m^3	No. of 24 hour means > 125µg/m^3	No. of 15min means > 266µg/m^3	Data capture %
2001	North Kensington	5	0	0	0	97
	Cromwell Rd	8	0	0	0	95
2002	North Kensington	5	0	0	0	99
	Cromwell Rd	8	0	0	0	85
2003	North Kensington	5	0	0	0	99
	Cromwell Rd	6	0	0	0	88
2004	North Kensington	4	0	0	0	97
	Cromwell Rd	5	0	0	0	99
2005	North Kensington	3	0	0	0	99
	Cromwell Rd	5	0	0	0	95
2006	North Kensington	4	0	0	0	99
	Cromwell Rd	6	0	0	0	87
2007	North Kensington	3	0	0	0	96
	Cromwell Rd	4	0	0	0	94
2008	North Kensington	*3*	*0*	*0*	*0*	*98*
	Cromwell Rd	*3*	*0 (43)*	*0 (20)*	*0 (51)*	*88*

Data (in italics) may contain data which is provisional and should be treated with caution.

No exceedences of any of the objectives have been observed in the past ten years at monitoring locations in the Borough. These monitoring sites are representative of residential areas away from busy roads and levels at the façade of residential buildings near busy roads. Elevated sulphur dioxide is most likely to be the result of a plume grounding episode 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 sulphur dioxide continue to be met in the borough.



The graph on the previous page illustrates the long term decline in annual mean sulphur dioxide levels over the past 19 years. However, annual mean levels in the recent years have now largely stabilised. Other data from another central London monitoring location (Bloomsbury) is included to show comparability.

2.2.5 Benzene

Two objectives have been set for the assessment of benzene, as can be seen in Table 1.1; a running annual mean of 16.25μg/m^3 to be met by 31.12.2003, and a more stringent annual mean of 5μg/m^3 to be achieved by 31.12.2010.

Monitoring Data

We undertake sampling at five locations using diffusion tubes, two roadside, two background and one in close proximity to a petrol station forecourt. This site has been operating since mid 2006 and replaced the previous petrol station site which closed permanently in 2006 following re-development of the site. Monitoring at the new petrol station site started in May 2006 but was closed between December 2006 and May 2007 for refurbishment. The site now operates stage two (in addition to stage one) vapour recovery.

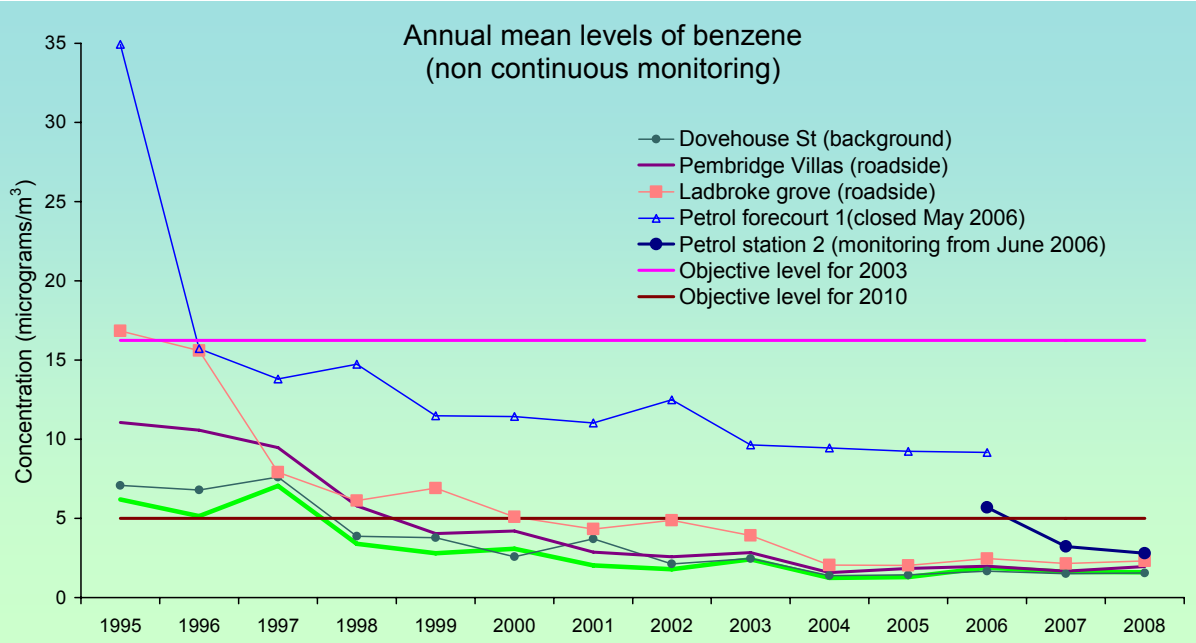
The highest levels of benzene have generally been recorded at the petrol station site. The table below demonstrates that the 2003 (16.25μg/m^3) objective has been met at all sites since 1996 (the measured annual mean is assumed to be the equivalent of the running annual mean). Monitoring results from 2008 show that all sites (including the petrol station site) are below the 2010 objective level of 5μg/m^3.

Table 2.8 Annual average Benzene Levels Using Diffusion Samplers (μg/m^3)

Year	KC01 Ladbroke Grove/Nth Ken Library	KC02 Holland Park	KC03 Warwick Road-Petrol Station (forecourt)	KC04 Dovehouse St	KC05 Pembridge Square Library	KC0X Old Brompton Rd/ Clareville Grove Petrol station
1993	**20.6**	**10.5**	**44.0**	**22.8**	-	-
1994	**14.8**	**9.0**	**27.3**	**13.1**	**10.2**	-
1995	**16.8**	**6.2**	**34.9**	**7.1**	**11.1**	-
1996	**15.6**	**5.1**	**15.7**	**6.8**	**10.6**	-
1997	**7.9**	**7.1**	**13.8**	**7.6**	**9.5**	-
1998	**6.1**	3.4	**14.7**	3.9	**5.8**	-
1999	**6.9**	2.8	**11.5**	3.8	4.0	-
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	3.92	2.43	**9.63**	2.47	2.85	-
2004	2.07	1.24	**9.46**	1.38	1.59	-
2005	2.03	1.28	**9.24**	1.43	1.83	-
2006	2.26	1.88	**9.17**	1.66	1.99	**5.7**
2007	2.16	1.63	Closed	1.5	1.67	3.24
2008	2.32	1.61	Closed	1.55	1.96	2.81

Figures in bold indicate an exceedence of the objective of annual means greater than 5μg/m^3 (the concentration to be achieved by 2010)

The graph overleaf demonstrates the long term trend; generally there has been a significant overall decline though this has slowed down in recent years with levels stabilising at most sites at around 1-2 µg/m^3 with only the petrol station site around 3 µg/m^3.



Whilst continuous monitoring is more accurate than diffusive samplers, the equipment is very costly and complicated to operate; consequently there are few continuous monitors within London. The London-Wide Benzene survey is subject to quality control procedures including exposing additional diffusion tubes for duplicate or triplicate exposure at a monitoring site within each borough. In addition, diffusion tubes are also exposed at the Hydrocarbon Network site on Marylebone Road. Tubes exposed at this site are compared against benzene data from the automatic Hydrocarbon Network data. Generally this has shown a reasonable correlation.

2.2.6 Other pollutants monitored

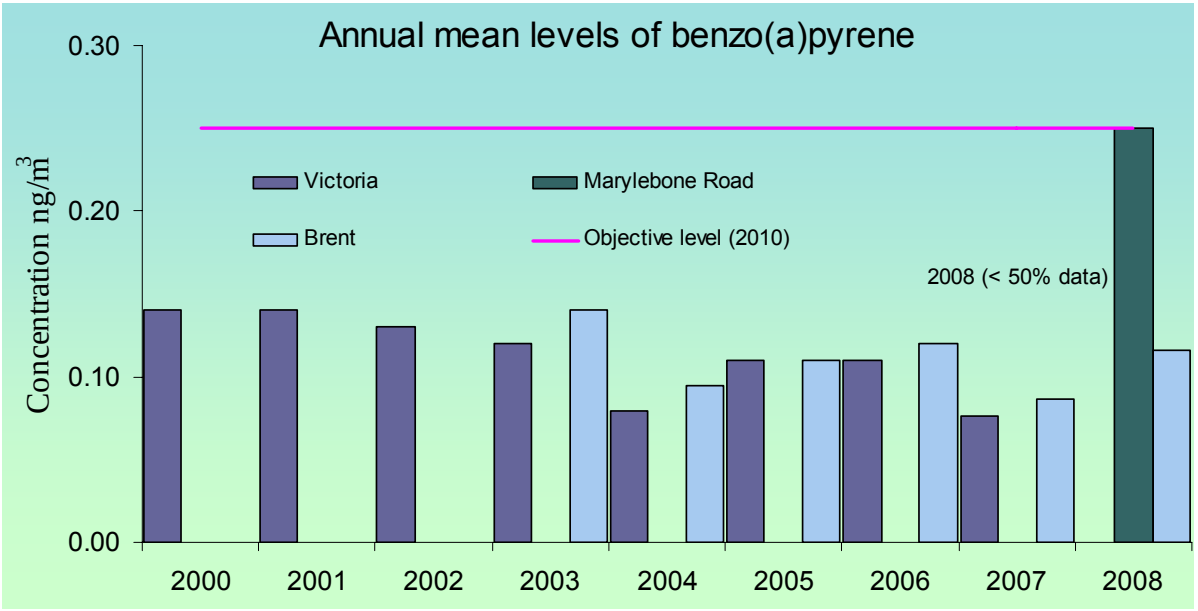
Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons 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(α)pyrene (b(a)p) as a marker for PAH and set an objective based on this pollutant: 0.25ng/m^3 [4] (4 see footnote) 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, without significant industrial activity, such as London have shown reductions in concentrations. This may be of increasing concern in the future if the use of biomass becomes more widespread.

[4] ng stands for nanogram. A nanogram is one millionth of a milligram or one thousandth of one millionth of a gram

The most recent data available from monitoring at sites in Victoria and Brent indicates that at these locations concentrations have generally been declining and are within the objective level. Data for 2008 is only available until June 2008 (data source Air Quality Archive). The level at Marylebone Road (based on a five month average) is at the objective level though this should be treated with caution as it may not be representative of a full year.



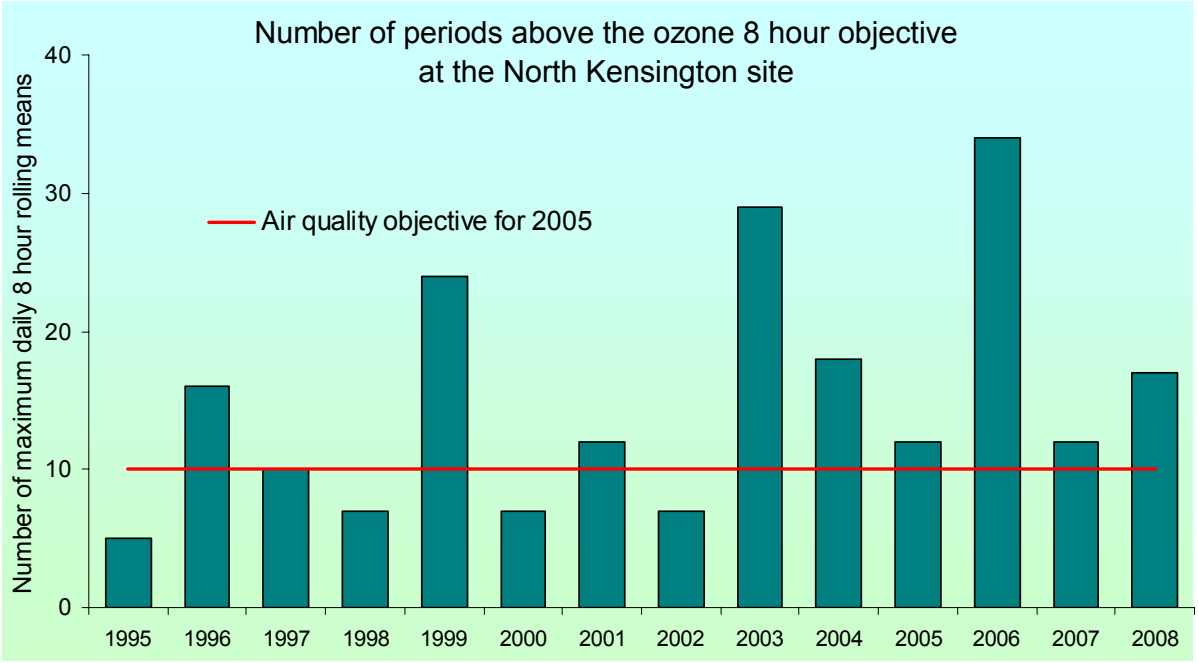
As the borough has no industrial processes and very little coal and wood burning, concentrations of b(a)p would be expected to be similar to the levels indicated by the above monitoring results and are therefore more likely to be well within the 2010 objective.

Ozone

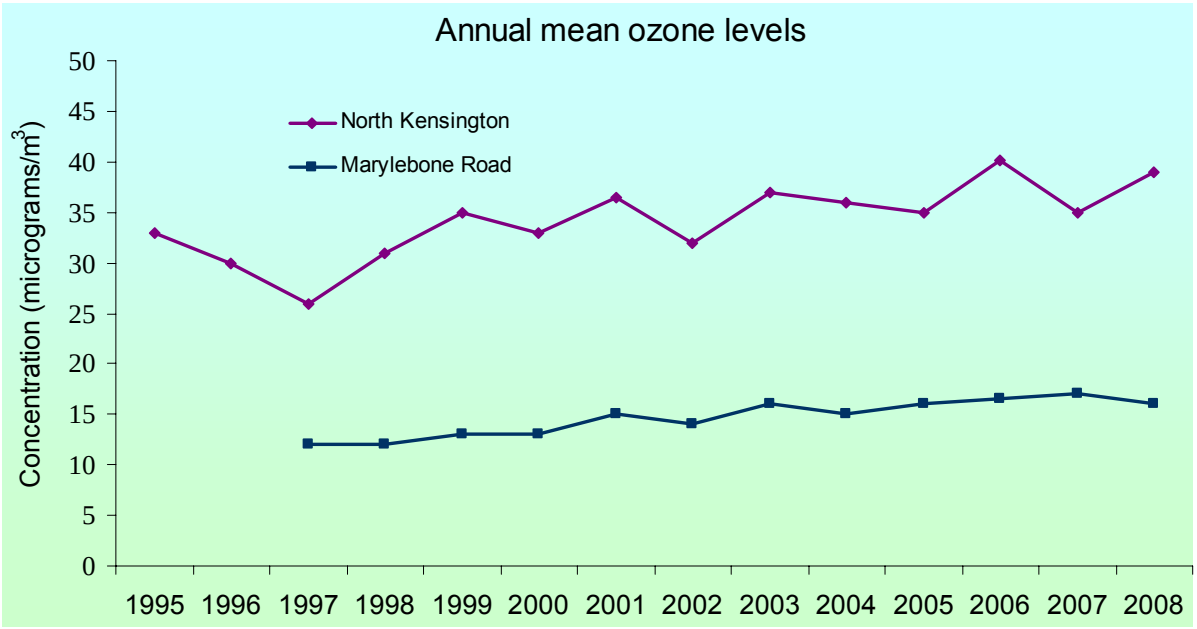
The objective for ozone is 100µg/m^3 not to be exceeded more than 10 times a year (calculated as the daily maximum 8 hour mean) by 2005. The Borough is not required to work towards the achievement of this as it is not included in the LAQM process; this is because ozone reduction requires action at a regional and European level. However, due to its health effects, monitoring is undertaken at the North Kensington background site.

Ozone formation is dependant on high temperatures and sunny weather as well as the necessary precursor pollutants such as oxides of nitrogen (NO_x) and volatile organic compounds. Some of these pollutants may not come from local sources and consequently attempts to control ozone are being undertaken at a European level. 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_x emitted from vehicle exhaust and building flues will react with ozone resulting in a reduction of its level.

The chart overleaf 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. There has been an exceedence of the objective in nine out of the fourteen years that monitoring has been undertaken. These have been in 1996, 1999, 2001, and for the past six years. These are likely to be years which experience high temperatures and a lot of sunshine.



The chart below 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.



Overall, the results of the monitoring show that ozone currently exceeds the objective level in the Borough at background locations.

Lead

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

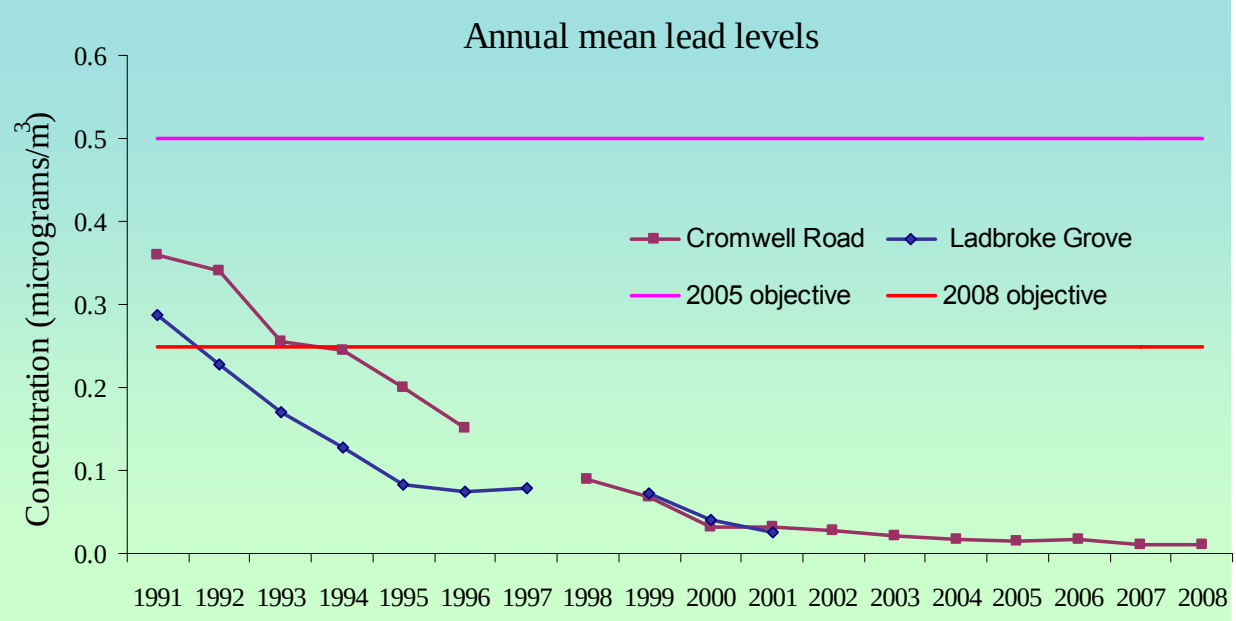
Lead monitoring in the Borough is undertaken by Defra at the Cromwell Road monitoring site. Previously monitoring was also undertaken by the Council in Ladbroke Grove. When

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 2.9 Annual mean lead levels within the Borough

Year	Ladbroke Grove (μg/m^3)	Cromwell Rd (μg/m^3)
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

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**.**



There is sufficient evidence from monitoring to suggest that lead levels within the Borough remain significantly below the 2004 and 2008 objectives and have done so since the mid 1990's.

Carbon monoxide

The objective for carbon monoxide (CO) is 10 mg/m^3 [5] as a maximum daily 8 hour running mean. We have looked at data from 2008 to check this objective continues to be met. All available carbon monoxide monitoring data (since 1999) recorded in the Borough has been collated Table 2.10, along with data from one other busy kerbside location from central London (Marylebone Road).

[5] mg (milligram) = one thousand of a gram

Table 2.10 Concentrations of CO measured in the Borough and at one central London site

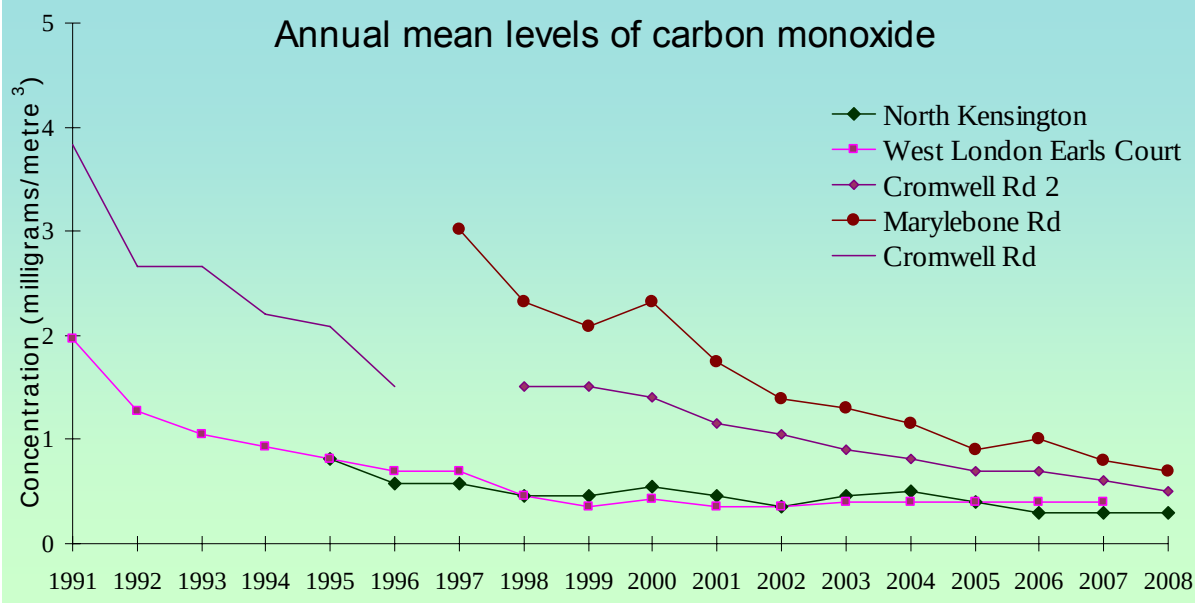
Year	Site	Annual mean (mg/m^3)	Max daily 8-hour running mean (mg/m^3)	No. of hours above $10mg/m^3$	% Data capture
1999	North Kensington	0.4	3.9	0	96
	West London	0.4	4.3	0	97
	Cromwell Rd 2	1.5	5.1	0	98
	Marylebone Rd	2.1	8.5	0	92
2000	North Kensington	0.4	5.8	0	95
	West London	0.3	5.3	0	97
	Cromwell Rd 2	1.3	6.0	0	98
	Marylebone Rd	2.4	9.9	0	96
2001	North Kensington	0.5	3.4	0	92
	West London	0.4	3.8	0	98
	Cromwell Rd 2	1.2	4.1	0	98
	Marylebone Rd	1.7	6.5	0	96
2002	North Kensington	0.4	5	0	96
	West London	0.4	3	0	97
	Cromwell Rd 2	1.0	4	0	93
	Marylebone Rd	1.4	5	0	98
2003	North Kensington	0.4	2.5	0	92
	West London	0.4	2.1	0	95
	Cromwell Rd 2	0.9	2.9	0	89
	Marylebone Rd	1.3	3.7	0	98
2004	North Kensington	0.5	2.3	0	99
	West London	0.4	1.6	0	99
	Cromwell Rd 2	0.8	2.3	0	98
	Marylebone Rd	1.1	3.0	0	96
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*

2007 and 2008 data (in italics) is provisional and must be treated with caution
Low data capture at Marylebone Road

The West London monitoring site was closed in 2007 following a review by Defra of the AURN monitoring network.

There were no exceedences of the objective in 2008 at any of the monitoring locations in the Royal Borough. Generally though, annual mean levels at roadside locations are twice as high as concentrations at background locations. The highest maximum daily 8 hour running mean value measured at any of the sites in the borough during 2008 was 2.5 mg/m^3; this is well below that 10 mg/m^3 objective level. The Marylebone Road site in Westminster, though not located within the Borough, is included because it is indicative of levels at busy kerbside locations.

The chart below indicates that the overall trend shows a reduction in annual mean levels. At background sites levels have largely stabilised in recent years while at roadside locations there continues to be some slight reduction in levels.



In conclusion, levels of carbon monoxide measured remain well within the 10 mg/m^3 (as a maximum 8 hour running mean) objective.

1,3-butadiene

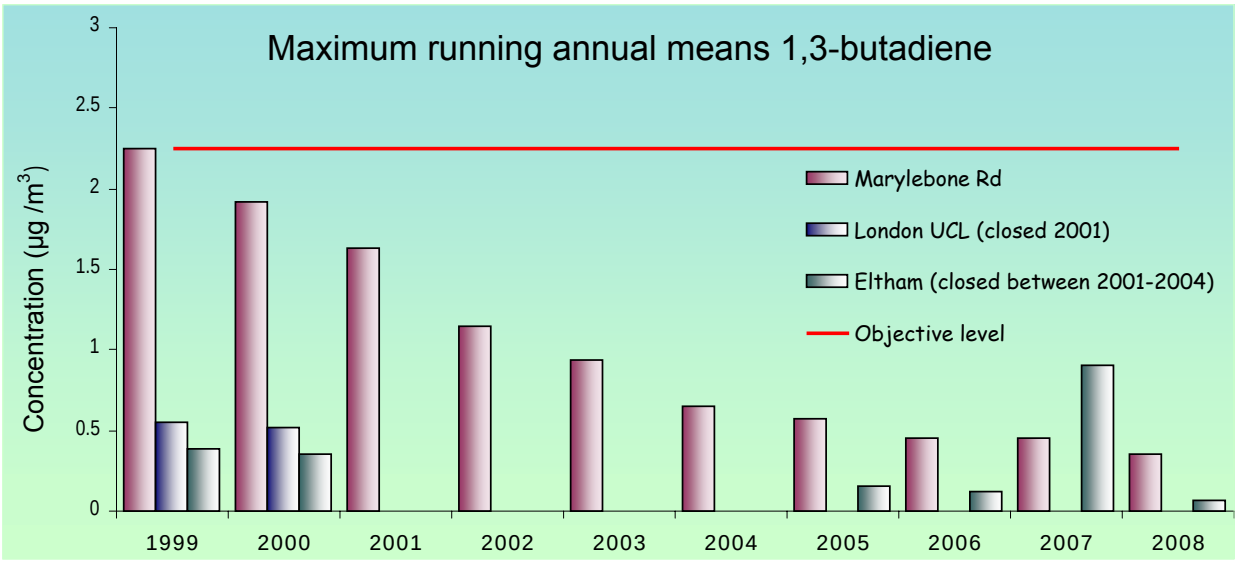
For this pollutant, measurements should meet the 2003 objective as a running annual mean of 2.25 µg/m^3. 1,3-butadiene is not monitored in Kensington and Chelsea. Data are collected by Defra, unfortunately this is limited to a few sites within London. Continuous data is shown in the table below; data from Marylebone Road and Eltham can be used to indicate likely conditions in the borough.

Table 2.11 Levels of 1,3-butadiene (maximum annual running means) in London

Year	Site	Annual Mean (µg/m^3)	% 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*

*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 2.25µg/m^3 to 0.35µg/m^3 in 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.



3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Previous assessments already included narrow congested streets. No new roads have been identified.

The Royal Borough of Kensington and Chelsea confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

Previous assessments already included streets where people may spend one hour or more near to busy traffic. No new roads have been identified.

The Royal Borough of Kensington and Chelsea confirms that there are no new/newly identified busy streets where people may spend one hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or Heavy Goods Vehicles (HGVs).

The Royal Borough of Kensington and Chelsea confirms that there are no new/newly identified roads with high flows of buses/HGVs.

3.4 Junctions

The Royal Borough of Kensington and Chelsea confirms that there are no new/newly identified busy junctions/busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

The Royal Borough of Kensington and Chelsea confirms that there are no new/proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

A road with a significant change in traffic flow (greater than 25%) was measured at one location shortly after the western extension of the congestion charge zone. Although traffic

decreased by 38% in the period immediately following the extension, concentrations of NO_2 measured at a nearby location remain above the objective level. As this has made no substantial difference to monitored levels a detailed assessment is not required.

The Royal Borough of Kensington and Chelsea has assessed new/newly identified roads with significantly changed traffic flows, and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.7 Bus and Coach Stations

There are no relevant bus or coach stations in the borough.

The Royal Borough of Kensington and Chelsea confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

The Royal Borough of Kensington and Chelsea confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

There are two railways that run through the borough, the West London line and the Paddington main line. Rail contributes approximately 16% (137 tonnes/yr) to nitrogen oxide emissions and to 70% (10 tonnes/yr) of sulphur dioxide emissions within the borough.

4.2.1 Stationary Trains

The Royal Borough of Kensington and Chelsea confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

There are no signals, goods loops, depots or stations within 15 metres where members of the public are likely to experience trains idling with engines running for 15 minutes or more. Therefore, a detailed assessment of stationary trains in the borough is not required.

4.2.2 Moving Trains

The Royal Borough of Kensington and Chelsea has identified locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m, and **will need to proceed to a Detailed Assessment for nitrogen dioxide.**

The guidance (TG 09) identifies the Paddington to Swansea line as having high level of diesel passenger trains. This rail line crosses the northern end of the borough; the background annual mean nitrogen dioxide level in the area is expected to be above 25µg/m^3. In addition a number of residential blocks have been identified within 30m of the track.

4.3 Ports (Shipping)

There are no ports within the borough or shipping movements which meet the criteria specified in LAQM (TG09)

The Royal Borough of Kensington and Chelsea confirm that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been carried out

Since the last USA only dry cleaners have come within the control of the local authority. There are twenty eight drycleaners. These premises are inspected on an annual basis. These are not relevant in terms of the Air Quality Strategy pollutants.

The Royal Borough of Kensington and Chelsea confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

The borough has one paint re-sprayer and emissions are unlikely to be relevant to Air Quality Strategy pollutants.

The Royal Borough of Kensington and Chelsea confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

The Royal Borough of Kensington and Chelsea confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

There are no major fuel (petrol) storage depots within the Royal Borough of Kensington and Chelsea.

5.3 Petrol Stations

The borough has a total of six petrol stations. Monitoring is undertaken in the vicinity of one petrol forecourt location within 5 metres of a petrol pump. Currently levels are within objective limits for benzene at all sites including this site. See Section 2.2.4 for further information on this monitoring and the results.

The remaining petrol stations do not have an annual throughput of more than 2000 m^3 of petrol, or do not have exposure within 10m of the pumps. Therefore, a detailed assessment is not required of any of the petrol stations in the borough.

The Royal Borough of Kensington and Chelsea confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

The Royal Borough of Kensington and Chelsea confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

At present there are no biomass boilers likely to be operating in the borough in the range of 50kW-20MW. Further work is planned in our action plan to identify such boilers. The council's planning section has been contacted to provide information. When planning applications are received our advice to the planning department is to discourage biomass because the borough is an AQMA and to draw developer's attention to our new air quality supplementary planning document which promotes low emission strategies for new developments. Where applications include biomass boilers they must demonstrate the likely impact on the surrounding area.

The Royal Borough of Kensington and Chelsea confirms that there are no biomass combustion plant in the Local Authority area.

6.2 Biomass Combustion – Combined Impacts

There is little evidence that a large number of small biomass boilers are operating in the borough.

The Royal Borough of Kensington and Chelsea confirms that there are no biomass combustion plant in the Local Authority area.

6.3 Domestic Solid-Fuel Burning

There is little evidence that large scale solid fuel burning is being carried out in the borough. A small number of fireplaces may be using coal but this is unlikely to be the main source of heating. Few complaints are received by the Environmental Health department about smoke from residential premises.

The Royal Borough of Kensington and Chelsea confirms that there are no areas of significant domestic fuel use in the Local Authority area. This includes the significant burning of coal and smokeless fuel.

7 Fugitive or Uncontrolled Sources

The Royal Borough of Kensington and Chelsea confirms that there are no potential sources of fugitive particulate matter emissions in the Local Authority area which have not been covered by previous rounds of review and assessment.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

The monitoring results from 2008 have not identified any potential or new exceedences of objectives. The Updating and Screening Assessment has not identified any significant changes to the air quality in the borough, with the exception of some improvement in monitored levels at a limited number of locations, sufficient to require changes to the borough's Air Quality Management Area (AQMA).

The results for nitrogen dioxide and particulate matter continue to exceed one of more Government's air quality objectives within the borough, therefore it is necessary to continue to maintain the AQMA.

As no significant changes have been identified, no changes are proposed to the AQMA are required as a result of new monitoring data.

8.2 Conclusions from Assessment of Sources

A review of sources using the recently updated Defra guidance has identified few changes as a result of local developments: road transport, other transport, industrial, commercial, domestic or fugitive emissions.

However the review has determined that a detailed assessment is required for nitrogen dioxide at residential locations adjacent to the Paddington to Swansea rail line.

8.3 Proposed Actions

A review of sources using the recently updated Defra guidance has determined that a detailed assessment is required for nitrogen dioxide at residential locations adjacent to the Paddington to Swansea rail line.

The next progress report will be completed and submitted in 2010, which will include a review of new monitoring data collected for the key pollutants. It will also include a detailed assessment of the Paddington rail line to see if any new exceedences of the Government air quality objectives, or any new sources of pollution, are detected. The council is also due to publish its revised Action Plan in summer 2009 to enable it to continue to work towards delivering cleaner air.

9 References

The Air Quality Strategy for England, Scotland, Wales, and Northern Ireland 17 July 2007

DEFRA Local Air Quality Management Technical guidance LAQM. (TG09)

Monitoring Networks Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom Dr Richard Maggs, Dr David Harrison, Dr David Carslaw and Ken Stevenson 31 January 2009

VCM portal http://www.volatile-correction-model.info/Default.aspx

Kings College London, The London Air Quality Network http://www.londonair.org.uk

UK Air Quality Archive http://www.airquality.co.uk

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_2 diffusion tubes

Whilst Bureau Veritas manage the data from the London Wide Environmental Programme (LWEP) including the diffusion tube networks, the supply and analysis of the tubes is undertaken by Gradko International Ltd. Gradko International Ltd participates in the Workplace Analysis Scheme for Proficiency (WASP). This is a recognised performance-testing programme for laboratories undertaking NO_2 diffusion tube analysis as part of the UK NO_2 monitoring network. The scheme is designed to help laboratories meet the European Standard EN48213. The laboratory performance for each month of 2006 and 2007 was rated 'good' which signifies a high level of accuracy for laboratory measurements.

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 (AUN) site. These sites employ continuous chemiluminescent analysers to measure NO2 concentrations. The results indicate that Gradko International Ltd diffusion tubes are well within the performance targets set by NETCEN.

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_2 diffusion tubes sampling concurrently located with a continuous analysers for a number of local authorities, they employ the DIFTAB.xls spreadsheet to calculate the factor.

Table 12.12 Adjustment factors for the last three years

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

Discussion of Choice of Factor to Use

The factor chosen is based on the London wide programme as this is based on tubes supplied by a single laboratory and a reasonably large number of co-located sites all of which are AUN and LAQN sites; in 2007 the factor was based on 13 co-located sites. A London wide factor is likely to be more relevant because of the range of concentrations measured in London rather than the default factor reported on the R&A spreadsheet for Gradko for diffusion tubes prepared with 50% TEA with acetone method.

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 was 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 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 should be used to correct TEOM measurements for Local Air Quality Management purposes. TEOM data from North Kensington and Cromwell Road has also been corrected using the VCM website[6].

King's ERG have opened a new web portal that allows local authorities and other users of TEOM measurements to correct their data using the Volatile Correction Model (VCM). The VCM uses FDMS purge measurements to correct TEOM measurements for their loss of volatile material. This method is now recommended in Defra's technical guidance as the preferred method for correcting TEOM measurements for Local Air Quality Management purposes. This correction has been undertaken for data at the boroughs two TEOM sites for the past three years.

Data corrected using both the simple multiplication factor and the VCM method is included in the report.

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[7] 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[7]. No correction factor is required for gravimetric instruments.

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 London Air Quality Network 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 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) for the purposes of calibration, filter changes and instrument cleaning. Equipment is additionally serviced at regular intervals.

Independent calibration and audit is carried out by AEA Technology as part of their Automatic Urban and Rural Network (AURN) responsibilities for the North Kensington site and for the Cromwell Rd 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.

[6] http://www.volatile-correction-model.info/Default.aspx

[7] Monitoring Networks Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom Dr Richard Maggs, Dr David Harrison, Dr David Carslaw and Ken Stevenson

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_x 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_3 which is subsequently converted to NO_2.

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

For the partisol the following are done at audit and service: Verification of ambient temperature, verification of filter temperature, verification of ambient pressure and humidity, internal leak check, external leak check and flow verification.

QA/QC of diffusion tube monitoring

Nitrogen dioxide

The laboratory undertaking the preparation and analysis of the tubes are Gradko International Ltd. Quality assurance and control procedures are an integral feature of the LWEP ensuring that uncertainties in the data are minimised and allowing the best estimate of true concentrations to be determined. Gradko International Ltd conducts rigorous quality control and assurance procedures in order to maintain the highest degree of confidence in their laboratory measurements. These are discussed in more detail below.

Gradko International Ltd participates in the Health and Safety Laboratory WASP12 NO2 diffusion tube scheme on a monthly basis. This is a recognised performance-testing programme for laboratories undertaking NO2 diffusion tube analysis as part of the UK NO2 monitoring network. The scheme is designed to help laboratories meet the European Standard EN48213. The laboratory performance for 2008 was rated 'good' which signifies a high level of accuracy for laboratory measurements.[8]

Network Field Inter-comparison Exercise

Gradko International Ltd also takes part in the NO_2 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 (AUN) site. These sites employ continuous chemiluminescent analysers to measure NO_2 concentrations. Of particular interest is the bias of the diffusion tube measurement relative to the automatic analyser that gives an indication of accuracy. NETCEN have established performance criterion for participating laboratories in line with the EU 1st Daughter Directive requirement for indicative monitoring techniques, as the 95% confidence interval of the annual mean bias which should not exceed + 25%.

In conjunction with this, a measure of precision is determined by comparing the triplet co-located tube measurements commonly referred to as the coefficient of variation (CoV). This value is useful for assessing the uncertainty of results due to sampling and analytical techniques. The NETCEN performance criterion for precision is that the mean coefficient of variation for the full year should not exceed 10%.

[8] http://www.laqmsupport.org.uk/Summary_of_Laboratory_Performance_in_WASP_R97-101.pdf

The Field Inter-comparison Exercise has historically generated the bias and precision results for each laboratory on an annual basis. This changed in 2004 to results being reported on a monthly basis. This enables a full year's inter-comparison against the NETCEN performance criteria to be carried, as shown in Table 3. The results below indicate that Gradko International Ltd diffusion tubes are well within the performance targets set by NETCEN.

Summary of NO2 Network Field Inter-comparison Results, 2007

Annual Mean Bias		Precision	
NETCEN Performance Target	Gradko Annual Mean Bias	NETCEN Performance Target	Gradko Precision
±25%	**- 5.3%**	**10%**	**6%**

Gradko International Ltd perform blank exposures that serve as a quality control check on the tube preparation procedure. All results are blank subtracted before they are issued to the Borough. Bureau Veritas conduct an 'in-house' co-location study to establish an LWEP bias adjustment factor based on triplicate NO2 diffusion tubes sampling concurrently located with a continuous analysers for a number of local authorities.

Benzene

The benzene data is collected as part of the LWEP managed by Bureau Veritas. All 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 Automatic Hydrocarbon Monitoring Network (AHMN) indicates that the concentrations recorded were very 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 chromatography.

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 2008, duplicate exposures were successful on nine occasions and triplicate exposures on ten. The results of these tubes indicate satisfactory agreement between duplicate and triplicate tubes. The maximum difference between duplicates is $\pm$ 1.8μg/m^{-3} and the maximum difference between triplicates is $\pm$ 0.9μg/m^{-3}.

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

Table C: Full dataset (monthly mean values) for the nitrogen dioxide diffusion tubes 2008 (unadjusted)

Location	Monthly mean concentrations (μg/m^3)												Annual mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ladbroke Grove/Nth Ken Library	49.29	65.14	45.54	62.99	91.94	57.65	49.80	39.39	74.09	53.19	59.14	64.99	59.43
Holland Park	35.54	44.98	28.59	31.31	35.99	24.00	25.84	23.94	31.64	31.32	38.42	44.06	32.97
Cromwell Road/Earls Court Rd	87.56	90.43	81.85	97.71	110.30	52.92	87.53	86.13	99.93	71.66	87.59	90.35	87.00
Dovehouse Street	50.96	57.16	37.19	44.29	55.46	33.09	41.13	37.27	50.08	43.98	52.35	55.59	46.55
Brompton Road/Cottage Place	76.86	77.27	49.68	60.66	68.08	60.30	71.99	70.24	53.60	64.38	63.54	66.65	65.27
Earls Court Station	118.41	106.96	83.92	100.92	104.86	99.65	-	109.26	83.70	92.82	103.98	98.18	100.24
Lots Road/Upcerne Road	38.58	50.11	38.17	45.06	49.59	34.44	35.96	34.44	53.17	43.12	52.10	58.35	44.42
Brompton Road	50.84	62.43	42.23	52.37	59.79	40.33	45.25	49.84	45.33	53.11	52.40	52.82	50.56
Ladbroke Crescent	37.211	53.16	34.67	36.35	50.47	32.52	29.67	28.45	45.91	33.33	45.44	48.48	39.64
Pembridge Square Library	47.57	57.56	44.91	47.59	51.53	41.29	44.17	42.58	45.35	43.59	59.35	52.55	48.17
St Marks Grove	45.95	57.84	31.89	38.08	63.18	28.12	30.57	26.89	43.79	32.20	46.37	47.13	41.00
Donne Place	52.63	51.92	38.07	52.14	46.14	35.43	38.46	32.22	-	36.04	47.38	50.42	43.71
Chatsworth Court	49.99	59.14	41.38	54.80	77.11	42.88	49.54	46.17	47.24	48.02	51.80	52.79	51.74
Sion Manning School	37.78	48.51	28.92	47.57	45.95	27.26	28.77	26.97	35.36	28.57	43.21	42.35	52.08
Sloane Square	85.02	97.14	68.13	92.06	106.97	71.27	79.48	66.76	71.73	77.75	82.71	81.97	81.75
Harrods	77.76	84.71	63.45	55.82	121.20	63.48	68.39	68.33	77.96	-	88.95	84.26	77.66
Chelsea Physic Garden (Gate)	57.84	65.32	48.43	35.41	78.93	51.16	61.66	13.73	59.55	54.57	58.26	60.48	53.78
Chelsea Physic Garden (Met Station)	35.21	41.81	30.80	44.05	41.32	27.52	-	27.30	29.58	37.47	44.06	46.12	36.84
Marlborough Primary School	65.29	61.70	48.76	64.19	82.59	55.42	58.21	50.26	65.91	55.21	64.33	64.90	61.40
Walmer House	47.62	59.32	41.71	48.72	57.79	37.16	46.05	45.53	49.69	41.06	48.39	52.47	47.96
Cromwell Rd/Natural History Mu	84.36	88.40	63.96	77.83	91.06	62.64	70.75	68.30	64.94	64.98	76.96	76.86	65.55
Blantyre St	45.33	60.15	41.584	48.51	57.73	38.12	41.15	36.01	-	-	54.78	54.95	47.83
Chelsea Old Town Hall	127.38	83.07	62.27	84.01	107.71	79.63	131.85	80.11	79.63	72.66	82.27	81.85	89.37
Pavillion St/Sloane Ave	50.07	63.14	53.43	56.61	77.57	47.72	55.07	44.64	59.63	48.08	62.56	60.56	56.59
Kensington H St/Kensington Chu	61.38	74.38	57.78	66.24	69.04	65.53	71.05	53.78	61.15	50.95	68.37	65.53	63.76
Kensington H St/Argyll St	87.17	88.69	88.71	92.54	91.89	97.97	94.18	74.68	87.87	70.06	94.52	95.24	88.63
Old Brompton Rd/Draycott Ave	77.86	90.44	60.08	73.85	84.17	59.75	79.68	71.66	72.81	61.44	77.97	74.51	73.68
Fulham Rd/Limerston St	57.65	74.63	54.12	62.58	69.83	67.77	56.07	43.54	63.22	50.27	78.55	68.82	62.25
Warwick Rd	40.91	59.48	44.57	53.73	71.12	50.71	46.47	38.29	56.91	38.92	64.02	61.99	52.26

Results from sites KC47- Sion Manning School, and KC54- Cromwell Rd/Natural History Museum, 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.

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- Automated Urban Rural Network- A Defra (previously DETR) air quality monitoring network.

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

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

Benzene- an aromatic hydrocarbon

1,3-Butadiene- colourless gaseous hydrocarbon

Carbon monoxide- 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

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 3.5 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- one of the heavy metals that are a toxic and acts as a cumulative poison

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 – a unit of mass equivalent to one millionth of a gram or one thousand of a milligram

Milligram – a unit of mass equivalent to one thousand of a gram

µg/m^3- a microgram of pollutant in a cubic metre of air

Nanogram- a unit of mass equivalent to one thousandth of one millionth of a gram

ng/m^3 nanogram of pollutant in a cubic metre of air

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

Nitrogen dioxide (NO_2)- a stable brown gas largely produced by the oxidation of NO. NO_2 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 1997

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

PM10- particulate matter less than 10µ (micrometres) in diameter

PM2.5- 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 (SO2) - 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 device for continuously measuring fine particles