Lambeth

Annual Air Quality Report

2005

Issue 1.1 Final

Introduction

This report reviews the work that was undertaken in Lambeth during 2005 so far as air quality was concerned. It incorporates some historical monitoring data to show trends where these can be established.

The UK air quality strategy specifies objectives for nine pollutants which are considered to have potential for adversely affecting human health although two of these, Ozone (O3) and PAH, have not been made the subject of regulation at the present time.

As part of its Local Air Quality Management (LAQM) responsibilities, the Council completed the first round review and assessment (R&A) of air quality (see the individual reports prepared between 1999 and 2003). These reports presented a staged approach whereby the seven air pollutants in the Government's Air Quality Strategy related to LAQM, were assessed and screened within the Council's area.

The assessment indicated that some areas (mainly in close proximity to arterial roads) were likely to exceed the objectives for nitrogen dioxide (NO_2) and daily mean PM_{10} (particulate) objectives.

An initial Air Quality Management Area (AQMA) was declared for parts of the borough in 2001. The area was subsequently extended to include all of Lambeth in 2003 when it became clear that predicted improvements in motor vehicle engine emission technology were unlikely to give the benefits originally anticipated and there was thus a likelihood that national air quality objectives would continue to be exceeded.

A second group of pollutants comprising Benzene, 1,3 butadiene, carbon monoxide, lead and sulphur dioxide (SO_2) were also considered but the assessment indicated that it was unlikely that the air quality objectives would be exceeded. Although the Council was not required to take any further action it nevertheless continues to monitor Benzene, Carbon Monoxide and Sulphur Dioxide.

Following declaration of the AQMA, the Council was required to produce a local Air Quality Action Plan. The plan was adopted in 2003 and aims to reduce emissions of air pollutants to meet national air quality objectives within the borough. A number of measures were identified which when implemented would have the effect of reducing road traffic generated pollution. The Council is not legally required to achieve the objectives but continues to make every effort to do so.

The Council has recently undertaken a second round of air quality review and assessment. There was no change in the findings from the 2003 USA[1] and thus it is intended that the AQMA will remain in its current format. The report is available on the Councils website.

[1] USA – Updating and Screening Assessment

In 2005 there were, as in previous years, a number of pollution incidents measured at some (but not all) sites in the borough where air quality levels breached the moderate, high and very high bands that the Government uses to define air quality.

This banding is known as Public Dissemination Banding, which has been designed to provide a readily understandable matrix for people who are sensitive to air pollution. The bands together with the potential ill health effects are set out in the table 1 below:

Banding	Index	Health Descriptor
Low	1	Effects are unlikely to be noticed even by individuals who know they are sensitive to air pollutants
	2	
	3	
Moderate	4	Mild effects, unlikely to require action, may be noticed amongst sensitive individuals.
	5	
	6	
High	7	Significant effects may be noticed by sensitive individuals and action to avoid or reduce these effects may be needed (e.g. reducing exposure by spending less time in polluted areas outdoors). Asthmatics will find that their 'reliever' inhaler is likely to reverse the effects on the lung.
	8	
	9	
Very High	10	The effects on sensitive individuals described for 'High' levels of pollution may worsen.

Table 1. Public Dissemination Banding.

Air Quality Assessment and Review 2005

The aim of this document is to report on results of air quality monitoring that was undertaken by Lambeth Council during 2005. Recorded levels are compared to the national objectives (as set out in table 2 below).

The Pollutants

Road traffic continues to be the primary cause of air pollution in London and in Lambeth over 90% of all air pollution is caused by road vehicles. Vehicle pollutants of greatest concern are Nitrogen Dioxide, Fine Particles (PM_{10}), Carbon Monoxide and Volatile Organic Compounds such as Benzene and 1, 3-Butadiene. Ozone is also a pollutant of some concern.

Nitrogen Dioxide

NO_2 is largely a secondary pollutant formed by the oxidation of NO. In Lambeth, road transport is the dominant source of oxides of Nitrogen (NOx). This is reflected in the general distribution of NO_2, with the greatest annual mean concentrations being measured near roads and in central London locations.

The Air Quality Strategy stipulates two objectives for NO_2:

(i) An annual mean of 21ppb (40 µg/m^3) and

(ii) An "incident based" Objective of 104.6ppb (200 µg/m^3) as an hourly mean not to be exceeded more than 18 times a year.

Fine Particles (PM_{10})

PM_{10} is believed to have a significant impact on public health. Long term exposure to even low levels of particulates have been identified as a potential risk to health.

Particulate levels tend to be higher near busy roads and in urban areas. Nationally annual average urban background PM_{10} levels decreased from 36 µg m^{-3} to 22 µg m^{-3} between 1993 and 2005. Roadside concentrations tend to be higher, because of the emissions from road vehicles, but these also show a similar downward trend

Unlike other air pollutants PM_{10} do not comprise a single defined chemical compound like for example Sulphur Dioxide. The composition of PM_{10} varies with location, time of year and during episodes of poor air quality. PM_{10} can often contain a mixture of primary sources, which tend to be locally emitted from vehicle exhausts, as well as secondary sources (mainly from distant sources) and coarse particles whose origin can be further afield. In addition there is increasing evidence that PM_{10} levels can be significantly elevated by local building and road works.

There are two Air Quality Standards for PM_{10}. These are in line with EC Daughter Directive – Stage Limit Value for PM_{10}:

(i) An annual mean of 40 µg/m^3.
(ii) An incident-based objective of 50 µg/m^3, measured as a daily mean not to be exceeded on more than 35 days a year.

Sulphur Dioxide

The distribution of Sulphur Dioxide (SO^2) concentrations is influenced by both road traffic and industrial point sources. Road traffic is the main factor influencing annual mean concentrations, whereas industrial point sources can produce short-term high values due to plume grounding. The annual mean concentrations of SO^2 do not vary to a large extent over London.

The Air Quality Strategy stipulates three objectives for SO^2:

(i) No more than 24 occurrences of an hourly mean of >150 µg/m^3.
(ii) No more than 3 days where the daily mean >125 µg/m^3.
(iii) No more than 35 occurrences of 15min mean >267 µg/m^3.

Ozone

Ozone is caused by complex reactions in the atmosphere involving a cocktail of combustion generated pollutants. In the presence of sunlight and high temperatures chemical reactions take place in which Ozone gas (O3) is formed. Ozone is often described as a seasonal pollutant with the highest concentrations being recorded during the summer months. It is also a regional pollutant, with episodes of high concentrations often extending over hundreds of miles.

The greatest concentrations of Ozone have, in recent years, been measured at sites in outer London and the Home Counties, with somewhat lower levels being recorded in Lambeth and other inner London Boroughs. Significant local variations in Ozone concentrations have also been reported. In heavily trafficked areas this is believed to be due to the scavenging effect of NO close to NOx emission sources, for example at roadsides, which has the effect of lowering Ozone levels around the immediate area.

The National Air Quality Strategy has a single objective of 100 $\mu g/m^3$(50ppb) measured as a rolling 8 hr mean, which should not be exceeded on more than 10 days a year.

Benzene

The main source of Benzene in the UK is the combustion and distribution of petrol, of which Benzene is a minor constituent. Petrol is the only product marketed to the general public in the UK in which Benzene is present in more than trace amounts. There are no specific industrial processes in Lambeth emitting quantities of Benzene such as oil refineries. Although national policies already in hand should continue to reduce future concentrations of Benzene, Lambeth has been monitoring long term levels of Benzene at 15 sites in the borough since 1997.

The major health risk associated with low-level exposure to Benzene is leukaemia. Based on data from the Institute for Environment and Health, estimated exposure to Benzene for the general population is three times less than the lowest exposures reported to be associated with adverse effects.

The National Air Quality Strategy has a single objective of 16.25 $\mu g/ m^3$ on an Annual Running Mean.

Carbon Monoxide

Carbon Monoxide (CO) is a toxic gas which is emitted into the atmosphere as a result of combustion processes. It is also formed by the oxidation of hydrocarbons and other organic compounds. In Lambeth, CO is produced almost entirely from car and lorry engines although it is eventually oxidised naturally in the air to Carbon Dioxide (CO_2). High levels of CO can prevent the normal transport of oxygen by the blood. This can lead to a significant reduction in the supply of oxygen to the heart, particularly in people suffering from heart disease.

The Air Quality Strategy has a single objective of:

(i) 10 mg/m^3 (8.6 ppm) maximum on a daily running 8 hour Mean

Air Quality Objectives within London

Air Quality Objectives are health based standards which have to be achieved by a given date. These objectives must continue to be met beyond the deadline. Objectives have been set with different time averaging periods for each pollutant. The different averaging periods reflect the way in which some pollutants may be harmful to health over relatively short exposure times. Table 2, identifies the pollutants of concern and the relevant information in relation to each of the objectives.

Pollutant	Concentration	Measured as	Date to be achieved
Benzene	16.25µg/m^3 5.00µg/m^3	running annual mean annual mean	31.12.2003 31.12.2010
1,3-butadiene	2.25µg/m^3	running annual mean	31.12.2003
Carbon Monoxide	10 mg/m^3	max daily running 8hr mean	31.12.2003
Lead	0.5 µg/m^3 0.25 µg/m^3	annual mean annual mean	31.12.2004 31.12.2008
Nitrogen Dioxide	200 µg/m^3 (not to be exceeded more than 18 times per year) 40 µg/m^3	1hr mean annual mean	31.12.2005 31.12.2005
Particles (PM_{10})	50µg/m^3 (not to be exceeded more than 35 times per year) 40µg/m^3	24 hr mean annual mean	31.12.2004 31.12.2004
Sulphur Dioxide	350 µg/m^3 (not to be exceeded more than 24 times per year) 125µg/m^3 (not to be exceeded more than 3 times per year) 266 µg/m^3 (not to be exceeded more than 35 times per year)	1 hr mean 24 hr mean 15 minute mean	31.12.2004 31.12.2004 31.12.2005

Table 2.

For two pollutants –Particles (PM_{10}) and Polycyclic Aromatic Hydrocarbons (PAHs), further objectives have been set. These have not yet been incorporated within the Air Quality Regulations and are shown in table 3 below. Local Authorities are however being encouraged to work towards these objectives.

Pollutant	Concentration	Measured as	Date to be achieved
Particles (PM_{10})	50 µg/m^3 not to be exceeded more than 10 times per year 23 µg/m^3 20 µg/m^3	24 hr mean annual mean annual mean	31.12.2010 31.12.2010 31.12.2015
Polycyclic aromatic hydrocarbons (PAH)	25 µg/m^3	annual mean	31.12.2010

Table 3. Objectives adopted but not yet incorporated within the Air Quality Regulations.

An objective for a further pollutant, Ozone (O3), is shown in table 4. This has not been adopted for the purposes of local air quality management because of the difficulties of dealing with it at a local level. A brief section on the assessment of PAH and Ozone has been included within this document, for information purposes only.

Pollutant	**Concentration**	Measured **as**	**Date to be achieved**
Ozone	100µg/m^3 not to be exceeded by more than 10 times a year	Daily maximum 8 hour mean	31.12.2005

Table 4.

Monitoring Air Quality in Lambeth

This section of the report considers pollution monitoring results and trends in Lambeth. Additional data has been obtained from other monitoring stations located close to the borough boundary and supplemented with further data from other sites in central London where necessary.

Active and Passive Air Quality Monitoring

The Council undertakes monitoring using both automatic high quality continuous monitoring analysers (active monitoring) and diffusion tubes (passive monitoring) across its area. Automatic long-term continuous analysers are located at:

- Christchurch Road (Lambeth 1) - a roadside site in Streatham Hill towards the south of the Borough (this site has been operating since 2000).

- Loughborough Junction (Lambeth 3) – an urban background site installed in late 2001.

- Brixton Road (Lambeth 4) – a kerbside site installed in late 2003.

- Vauxhall Cross (Lambeth 5) - a kerbside site re-sited in the middle of a traffic island that started operating in 2005.

- Crystal Palace – a jointly operated roadside site located on Crystal Palace Parade on the southern edge of the Borough.

All the sites are part of the London Air Quality Network and therefore the standards of quality control are similar to those of the Government's AURN[2] sites. Regular calibrations are carried out, with subsequent data ratification undertaken by the ERG at King's College London.

[2] AURN – Automatic Urban Network

The location of the monitors is shown on the attached map at Appendix 1. The locations have been chosen to provide a useful contribution to the London Wide Air Quality Network, as well as provide valuable real time air quality information covering arterial roads (kerbside) main roads (roadside) and less busy (urban background) sites in the borough. The Lambeth automatic monitors measure levels of Nitrogen Dioxide (NO^2) Particulates (PM_{10}), Sulphur Dioxide (SO^2). In addition Carbon Monoxide (CO) is measured at the Crystal Palace site.

The Council also undertakes an extensive programme of passive (non- continuous) monitoring from an additional 15 sites in the borough. These sites are also shown on the map at Appendix 1. These sites monitor Nitrogen Dioxide, Sulphur Dioxide, and Benzene. Two sites additionally monitor Ozone levels.

The results of the monitoring at the sites are given below.

Commentary on National 2005 Results

Annual average urban background particulate (PM_{10}) levels for 2005 remained unchanged at 22 microgrammes per cubic metre ($\mu g\ m^{-3}$) from 2004 to 2005, generally showing a decreasing trend from 36 $\mu g\ m^{-3}$ in 1993[3].

Rural ozone levels in 2005 (measured as the daily maximum 8-hour running mean) averaged 70 $\mu g\ m^{-3}$ in 2005 compared to 73 $\mu g\ m^{-3}$ in 2004 and 68 $\mu g\ m^{-3}$ in 1993. There is no clear long term trend.

Urban background ozone levels were 57 $\mu g\ m^{-3}$ in 2005, the same as in 2004 and have generally increased from 42 $\mu g\ m^{-3}$ since 1993.

Overall, in urban areas air pollution was recorded as moderate or higher for 22 days on average per site, compared with 23 days in 2004, 50 days in 2003, and 59 days in 1993, also reflecting a general decline in urban pollution.

In rural areas, moderate or higher air pollution was recorded for 40 days on average per site, compared with 44 in 2004, and 64 in 2003. The number of days has fluctuated between 21 days in 1987 and the 2003 figure of 64 days, showing little overall trend.

Lambeth 2005 Results

Table 5 below shows the number of days where air pollution was measured as being moderate or above on the Public Dissemination Banding in Lambeth:

[3] Source Defra Statistical Release 2006

Table 5

Pollutant	Location	Days Moderate	Days High	Days Very High
Nitrogen Dioxide	Christchurch Road (R)	0	0	0
	Vauxhall Cross (R)[4]	0	0	0
	Loughborough Junction (U)	0	0	0
	Brixton Road (K)	238	5	1
	Crystal Palace(R)	0	1	0
Particulate Matter (PM_{10})	Christchurch Road (R)	56	14	0
	Vauxhall Cross (R)	44	46	134
	Loughborough Junction (U)	29	10	10
	Brixton Road (K)	103	54	22
	Crystal Palace (R)	1	0	0
Sulphur Dioxide	Christchurch Road (R)	0	0	0
	Vauxhall Cross (R)	0	0	1
	Loughborough Junction (U)	0	0	0
	Brixton Road (K)	1	0	0
	Crystal Palace (R)	1	0	0

Key: Levels 1 to 3 = Low Levels 4 to 6 = Moderate Levels 7 to 9 = High Level 10 = Very High
R = Roadside Site K = Kerbside Site U = Urban Background Site

The Following tables show the results of each active monitoring station in Lambeth and to what extent the National Air Quality Objectives were met in 2005

Lambeth 1 – Christchurch Road (Roadside)

Pollutant	Objective	Result	Achieved Objective
Nitrogen Dioxide	Annual Mean not exceeding 40 µg/ m^3	59	NO
Nitrogen Dioxide	No more than 18 occurrences of hourly Mean >200 µg/ m^3	0	YES
PM $_{10}$ Particles	Annual Mean less than 40 µg/ m^3 (gravimetric)	25	YES
PM $_{10}$ Particles	No more than 35 days where daily Mean >50 µg/ m^3 (gravimetric)	4	YES
Sulphur Dioxide	No more than 24 occurrences of Hourly Mean > 350 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 3 days where daily Mean > 125 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 35 occurrences of 15 min Mean >267 µg/ m^3	0	YES

Table 6.

[4] Note Vauxhall Cross site switched off during construction of Vauxhall Cross Interchange. Replacement Site back on stream as at February 2005.

Lambeth 3 Loughborough Junction (Urban Background)

Pollutant	Objective	Result	Achieved Objective
Nitrogen Dioxide	Annual Mean not exceeding 40 µg/ m^3	40	NO
Nitrogen Dioxide	No more than 18 occurrences of hourly Mean >200 µg/ m^3	0	YES
PM_{10} Particles	Annual Mean less than 40 µg/ m^3 (gravimetric)	23	YES
PM_{10} Particles	No more than 35 days where daily Mean >50 µg/ m^3 (gravimetric)	16	YES
Sulphur Dioxide	No more than 24 occurrences of Hourly Mean > 350 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 3 days where daily Mean > 125 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 35 occurrences of 15 min Mean >267 µg/ m^3	0	YES

Table 7.

Lambeth 4 – Brixton Road (Kerbside)

Pollutant	Objective	Result	Achieved Objective
Nitrogen Dioxide	Annual Mean not exceeding 40 µg/ m^3	227	NO
Nitrogen Dioxide	No more than 18 occurrences of Hourly Mean >200 µg/ m^3	327	NO
PM_{10} Particles	Annual Mean less than 40 µg/ m^3 (gravimetric)	43	NO
PM_{10} Particles	No more than 35 days where daily Mean >50 µg/ m^3 (gravimetric)	78	NO
Sulphur Dioxide	No more than 24 occurrences of Hourly Mean > 350 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 3 days where daily Mean > 125 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 35 occurrences of 15 min Mean >267 µg/ m^3	1	YES

Table 8.

Crystal Palace (Roadside)

Pollutant	Objective	Result	Achieved Objective
Carbon Monoxide	No occurrences of rolling 8 hr Mean >10 µg/ m^3	0	YES
Nitrogen Dioxide	Annual Mean not exceeding 40 µg/ m^3	51	NO
Nitrogen Dioxide	No more than 18 occurrences of hourly Mean >200 µg/ m^3	0	YES
PM_{10} Particles	Annual Mean less than 40 µg/ m^3 (gravimetric)	28	YES
PM_{10} Particles	No more than 35 days where daily Mean >50 µg/ m^3 (gravimetric)	7	YES
Sulphur Dioxide	No more than 24 occurrences of Hourly Mean > 350 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 3 days where daily Mean > 125 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 35 occurrences of 15 min Mean >267 µg/ m^3	0	YES

Table 9.

Vauxhall Cross (Lambeth 5) *

Pollutant	Objective	Result	Achieved Objective
Nitrogen Dioxide	Annual Mean not exceeding 40 µg/ m^3	82	NO
Nitrogen Dioxide	No more than 18 occurrences of hourly Mean >200 µg/ m^3	14	YES
PM_{10} Particles	Annual Mean less than 40 µg/ m^3 (gravimetric)	70	NO
PM $_{10}$ Particles	No more than 35 days where daily Mean >50 µg/ m^3 (gravimetric)	175	NO
Sulphur Dioxide	No more than 24 occurrences Hourly Mean > 350 µg/ m^3 (gravimetric)		YES
Sulphur Dioxide	No more than 3 days where daily Mean > 125 µg/ m^3 (gravimetric)	0	YES
Sulphur Dioxide	No more than 35 occurrences of 15 min Mean >267 µg/ m^3	1	YES

Table 10.

* Note: Lambeth 5 PM 10 Particulate achieved a capture rate less than 75% for the year (68%). Results should be used for guidance only.
* Note: Lambeth 5 Sulphur Dioxide achieved a capture rate less than 75% for the year (55%) Results should be used for guidance only.

Passive (Non Continuous Monitoring Results) 2005

Passive diffusion tubes have been used to monitor nitrogen dioxide in the borough since 1992. We undertake sampling at fifteen locations using passive diffusion tube samplers. The tubes are exposed for a 4/5 week period approximating to a calendar month.

Diffusion tubes are a cost-effective method for assessing a range of air pollutants. Although this method is less accurate than fully automated techniques, the diffusion tube method tends to under-estimate concentrations. It is however possible to factor the results to account for known differences in the methodologies. For example a factor of 1.11 has been used for NO^2 2005 data.

Nitrogen Dioxide

Table 2 of this report sets out the two different objectives for nitrogen dioxide. (NO_2); a short term objective of 200µg/m^3 not to be exceeded more than 18 times per year as a one hour mean, and a longer term objective of 40µg/m^{-3} as an annual mean, both to be achieved by the end of 2005.

The chart below (Chart 1) shows that the annual mean objective was exceeded at all main road locations in 2005. The results are consistent with those previously discussed from the active monitoring stations located within the borough.

Chart 2 shows that overall NO_2 levels in the borough were again above the target level but continue do show a steady downward trend in mean concentrations.

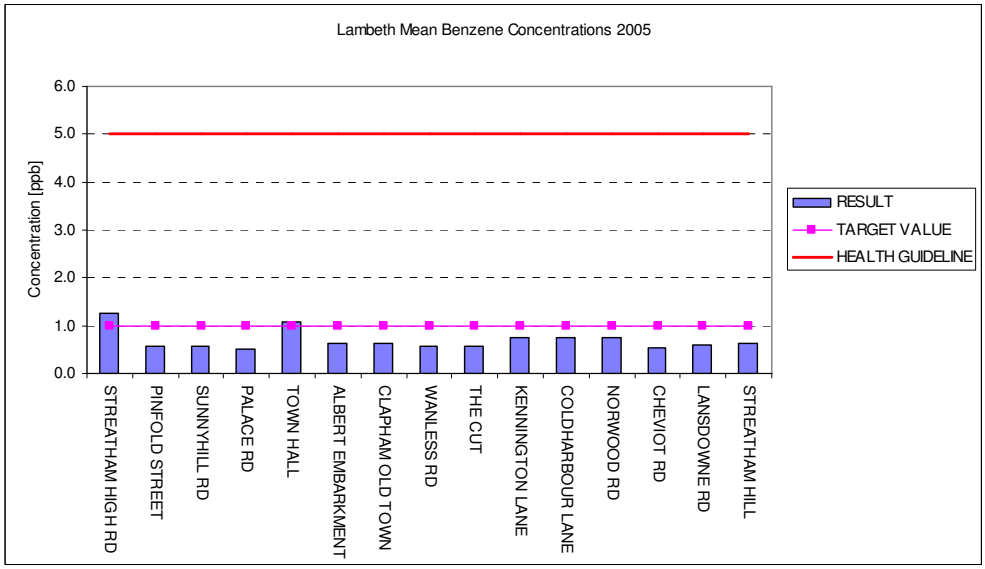


Chart 1. Nitrogen Dioxide – Individual Sites

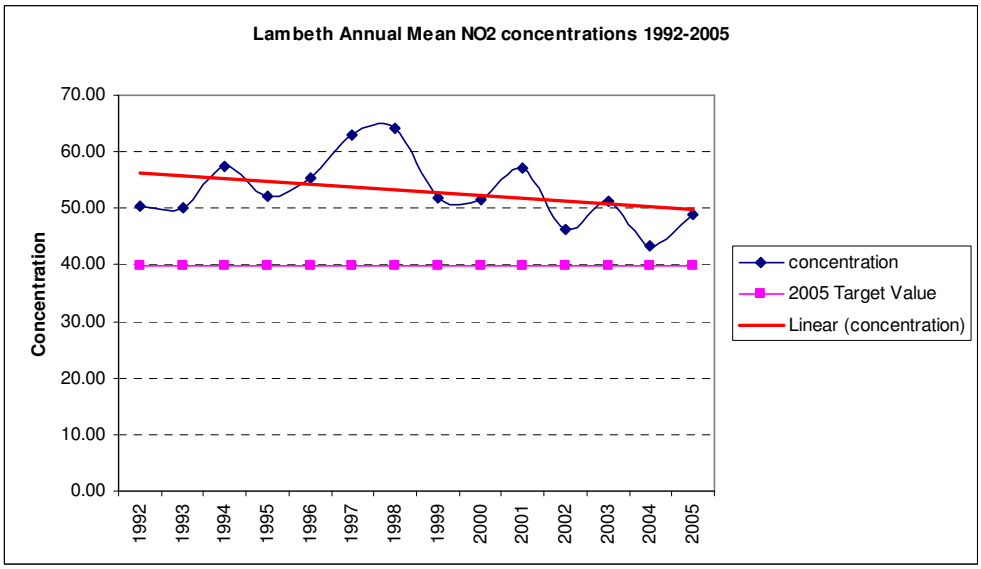


Chart 2. NO_2 Lambeth Annual Averages

Benzene

Two objectives have been set for the assessment of Benzene – a running annual mean of 16.25µg/m^3 to be met by December 2003 and a newer, more stringent annual mean of 5µg/m^3 to be achieved by December 2010.

The results for Benzene Monitoring in Lambeth are shown in the following charts

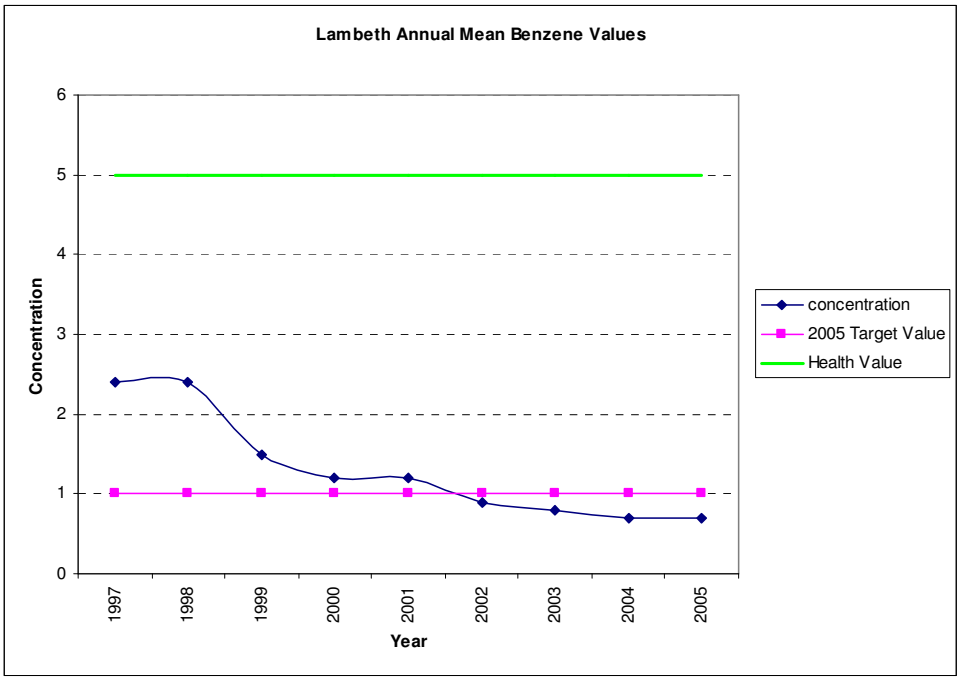
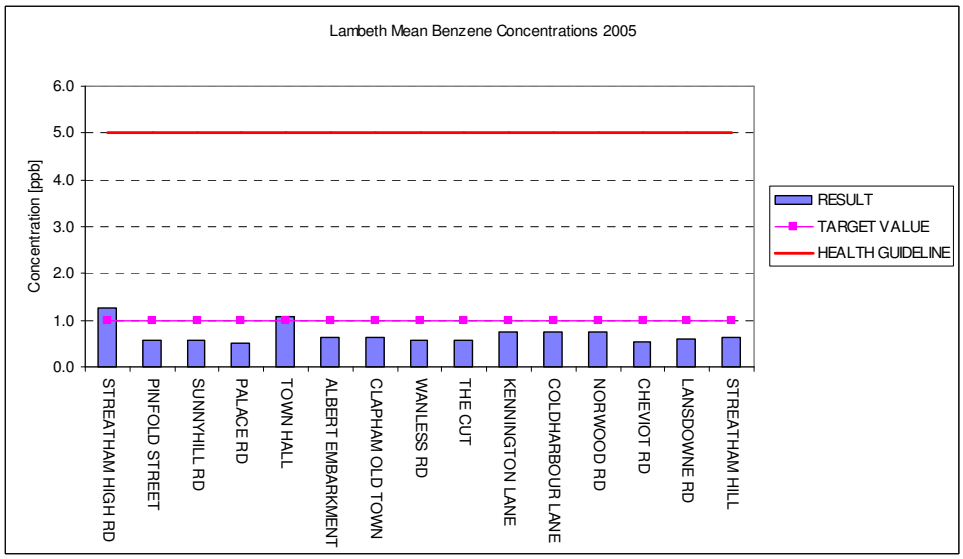


Chart 3. Annual average benzene levels using diffusion samplers



Note: Benzene 1 ppb = 3.25 μg m^{-3} / 1 ppb = 3.19 μg m^{-3}

Chart 4. Benzene Individual Sites

Chart 3 above shows a steady downward trend. The individual results are similar to those recorded for 2004 with all levels well below levels that are regarded as being of concern to human health.

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 267 µg/m^{-3} (not to be exceeded more than 35 times per year).

Monitoring of Sulphur Dioxide has been undertaken since 1992. The monitoring data have shown that annual average and peak levels have declined substantially. This has been largely due to the switch from coal and oil for heating to gas from both domestic and commercial sources. The 2005 results did not continue the trend established in recent years which appeared to be pointing to year on year increases in mean levels of Sulphur Dioxide on a borough wide basis. This is shown in chart 6 below.

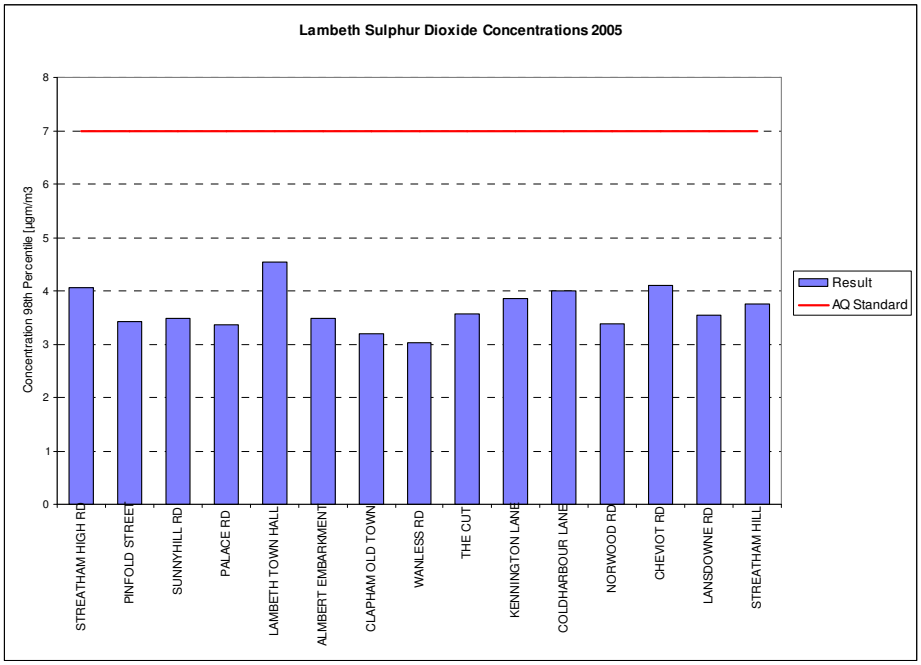


Chart 5 - Sulphur Dioxide Individual Sites

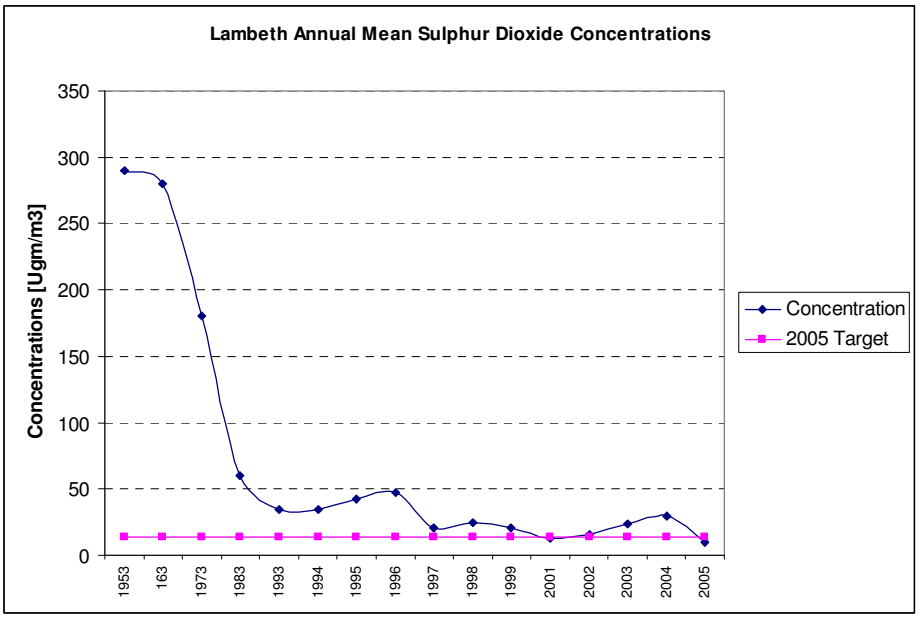


Chart 6 – SO_2 Lambeth Annual Averages

Ozone

Ozone is one of a group of secondary pollutants. It is formed during periods of warm sunny weather in the presence of other necessary "precursor pollutants". In recognition that the precursor pollutants may frequently cross regional and national boundaries efforts to control Ozone are being undertaken at a European level.

From year to year there can be significant variations caused by the weather, particularly for ozone, more of which is created in hot sunny weather. For example, the hot summer of 2003 was a major factor in the high figures for that year.

Monitoring is undertaken at two locations using diffusion tubes. Chart 7 below shows the results for 2005. Unlike most pollutants, Ozone levels tend to be depressed at locations close to busy main roads. This is because oxides of Nitrogen (NOx) emitted from vehicle exhausts will scavenge Oxygen molecules from Ozone and thus reduce its level.

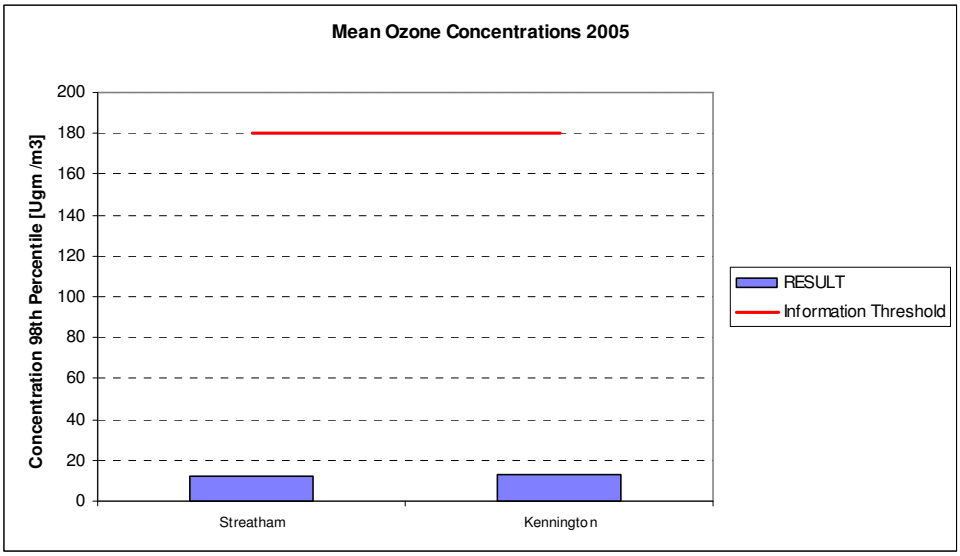


Chart 7 – Lambeth Ozone Individual Sites.

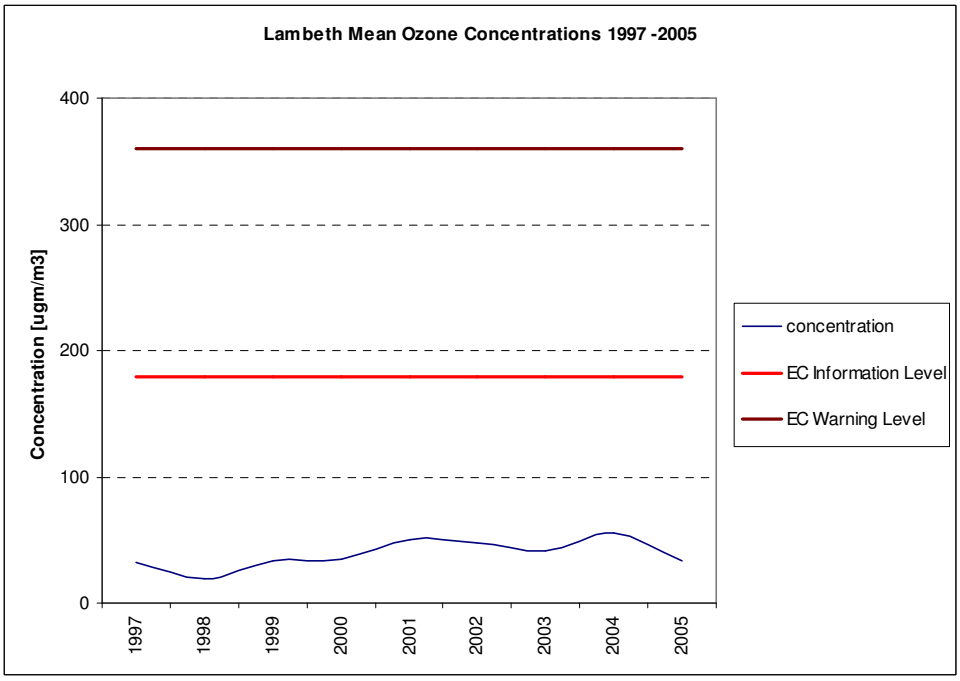


Chart 8. Ozone – Lambeth Annual Averages

Air Pollution Episodes 2005

Over London and the South East five separate episodes of poor air quality were recorded in 2005. These were:

- Calm Weather Smog – Feb 2005
- High Ozone Levels May 2005
- Summer Smog – June 2005
- High levels of particles (PM_{10}) and Sulphur Dioxide – October 2005
- Calm Weather Smog – November 2005

Not all of the above episodes were felt in all parts of the borough.

<u>Calm Weather Smog – February 2005</u>

Still settled conditions led to poor dispersion of transport derived pollutants during Monday 7th February 2005. Elevated concentrations of PM_{10} particulate and nitrogen dioxide were measured at a number of London roadside sites. The episode registered at all of the active Lambeth sites as can been seen in the following graph:

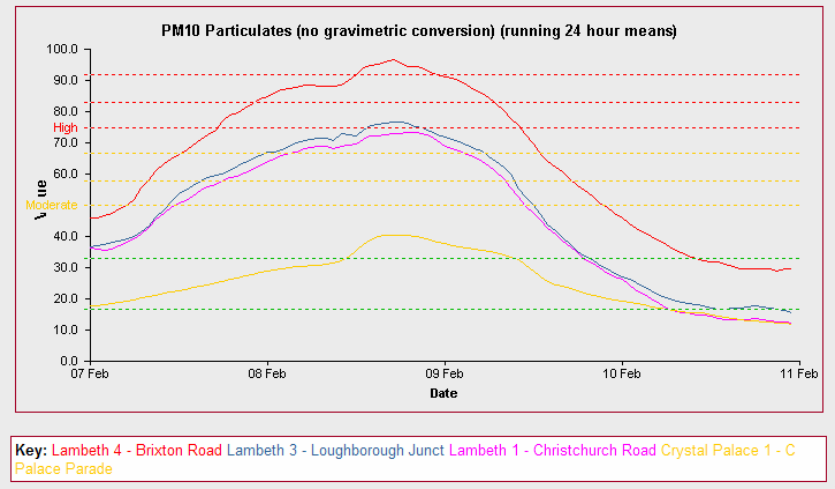


Chart 9. February 7 – 9 Smog PM_{10}

In addition "Moderate" nitrogen dioxide was measured at the Lambeth 4 (Brixton Road) kerbside site. The peaks and troughs of the pollution can be seen graphically in the following chart:

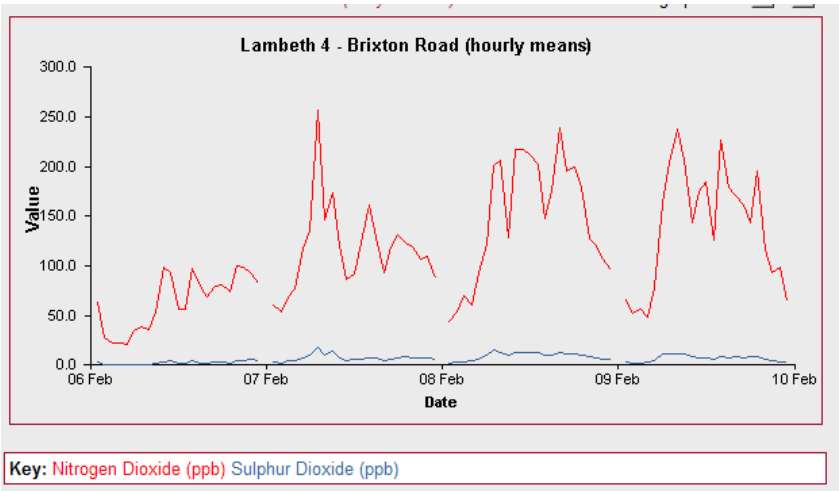
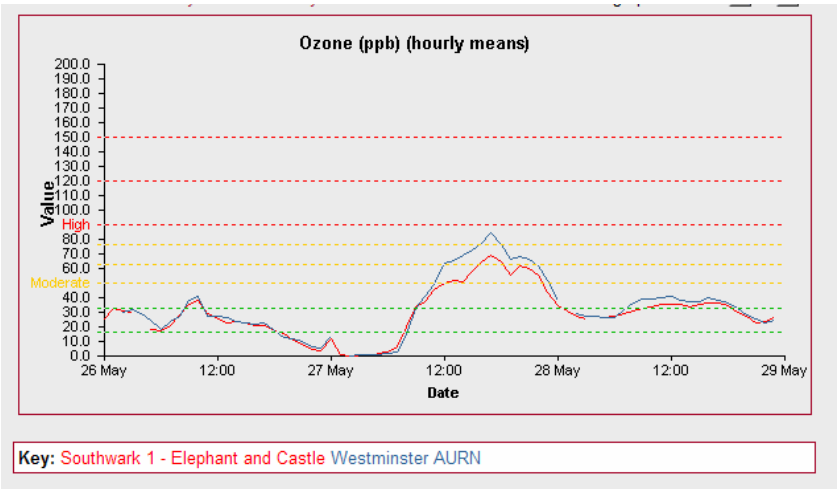


Chart 10. February Smog – Nitrogen Dioxide (NO_2) pollution

<u>High Ozone Levels: May 27- 29</u>

A hot sunny day on Friday 27th May 2005 resulted in substantial photochemistry as expected. "Moderate" levels of ozone were recorded across the region. Raised levels of Ozone were recorded at both of the automatic monitoring sites close to Lambeth. The following charts show how Ozone levels increased during the day at both nearby Westminster and Elephant and Castle sites. This was the first time that ozone levels at or approaching "high" were measured in south east England since summer 2003.



<u>Chart 11. – 27 – 29 May Ozone</u>

Summer Smog 22 – 25th June

On Thursday 23rd June 2005, hot sunny weather combined with precursor pollutants, and resulted in substantial photochemistry as expected. The following chart shows that only the Central (Brixton 4) site detected increased NO_2.

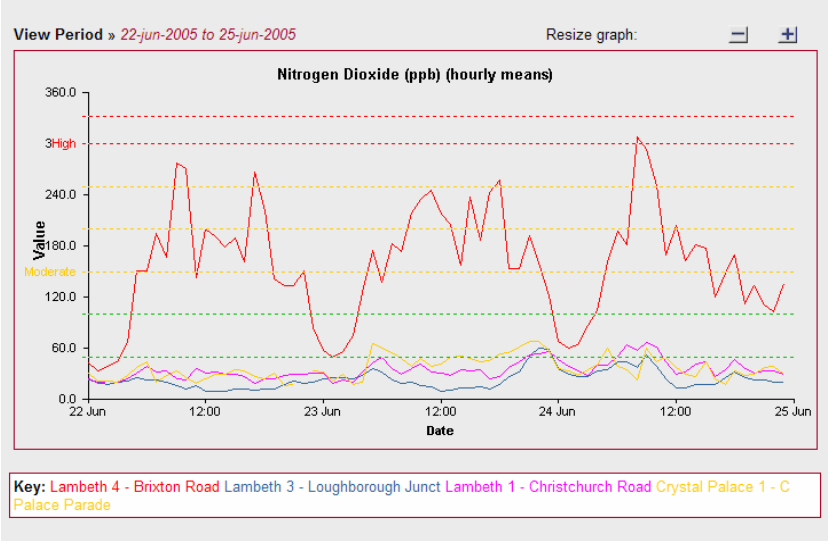


Chart 12. – June 23 – 25 NO_2 Brixton Road

Elevated PM_{10} was measured across S.E. England on Friday 24th June with increased PM_{10} measured at all the Lambeth sites.

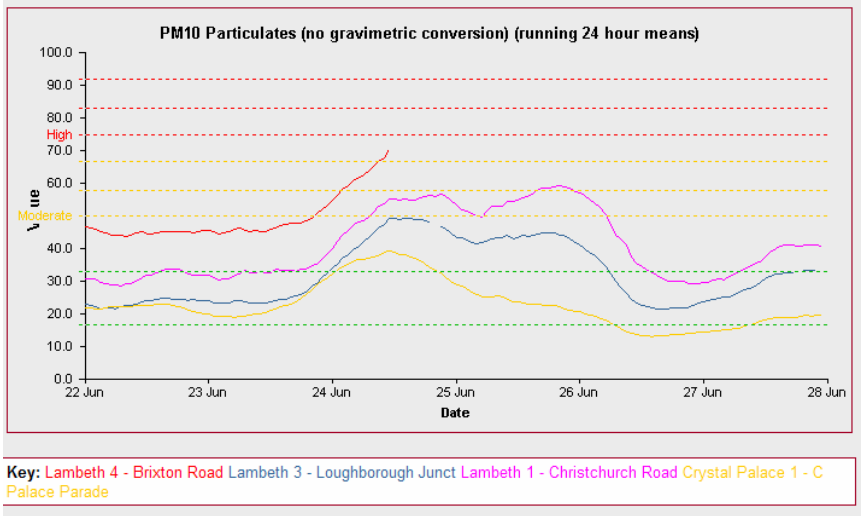


Chart 13. June 23 – 25 PM_{10}

Elevated PM_{10} (particles) – October 7 – 9th

Increased levels of PM_{10} was measured throughout London and surrounding counties from 7 – 9th October. "Moderate" PM_{10} levels were measured at many roadside monitoring sites in London and at roadside sites in the larger towns in the south east. PM_{10} particulate concentrations began to rise on Wednesday 5th October with some roadside sites experiencing "moderate" PM_{10} particulate on Thursday the 6th. Concentrations peaked on Friday 7th and Saturday 8th October before fresher Atlantic winds caused concentrations to fall. By Sunday 9th October, PM_{10} particulate concentrations were "low" at all sites.

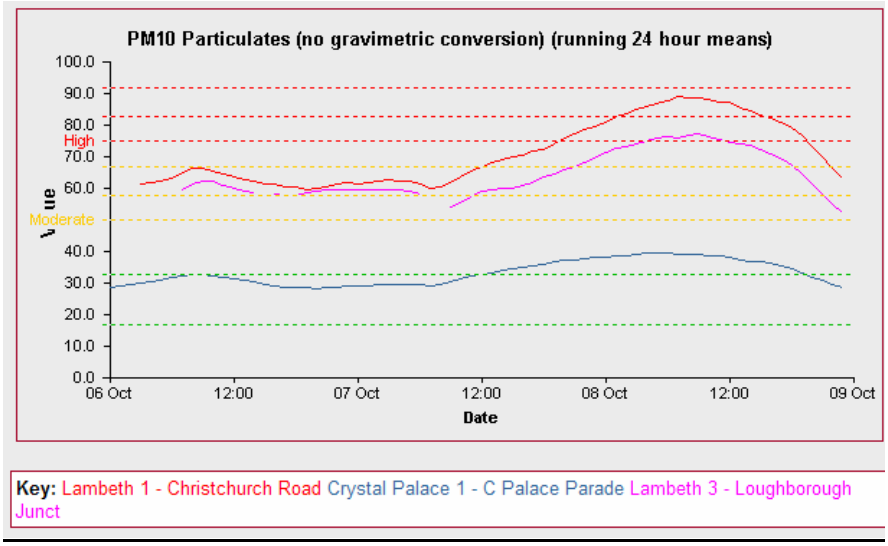


Chart 14. - October PM_{10}

Bonfire Night

During previous years Guy Fawkes Night events, bonfires and fireworks have been associated with elevated levels of PM_{10} with concentrations locally reaching the "very high" pollution threshold.

In previous years Guy Fawkes Night events have often been displaced from the 5th November. However in 2005 most events were on Friday 4th and Saturday 5th.

Concentrations measured are very dependant on the proximity of a monitoring site to local Guy Fawkes Night events. The greatest concentrations of PM_{10} particulate are generally measured in the suburban areas where gardens and parklands are more plentiful. Here, concentrations rise rapidly at dusk.

This year sufficient breeze was present to prevent widespread "moderate" or "high" PM_{10} particulate. Elevated concentrations were measured at many sites on both Friday and Saturday evening. Only 3 sites in London and southeast England exceeded "low" PM_{10} particulate. Lewes 2 measured a peak 15 minute mean concentration of 771 ugm^{-3} and "moderate" concentrations as a consequence.

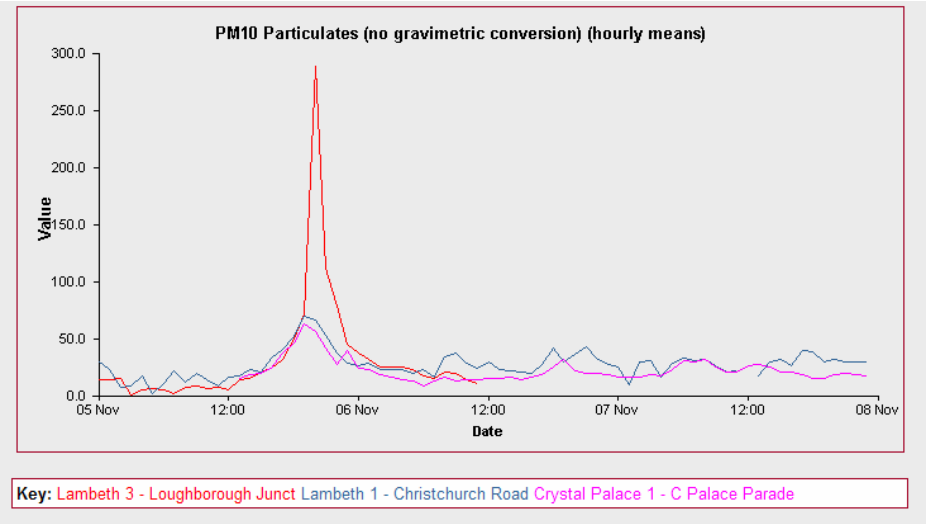


Chart 15. Bonfire Night – Loughborough Junction

Calm Weather Smog – 22nd November

Settled weather conditions and cold overnight conditions led to widespread "moderate" air pollution in inner and west London and at outer London roadside sites. "Moderate" PM_{10} particulate was measured at 32 monitoring sites in the London Air Quality Network. The pollution incident was especially acute in inner and west London with widespread "moderate" PM_{10} at roadside sites.

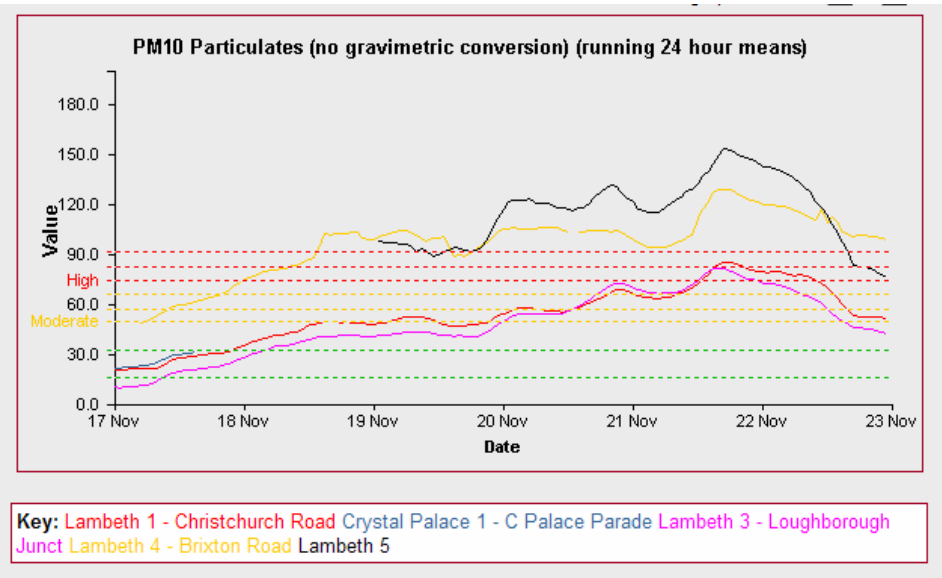
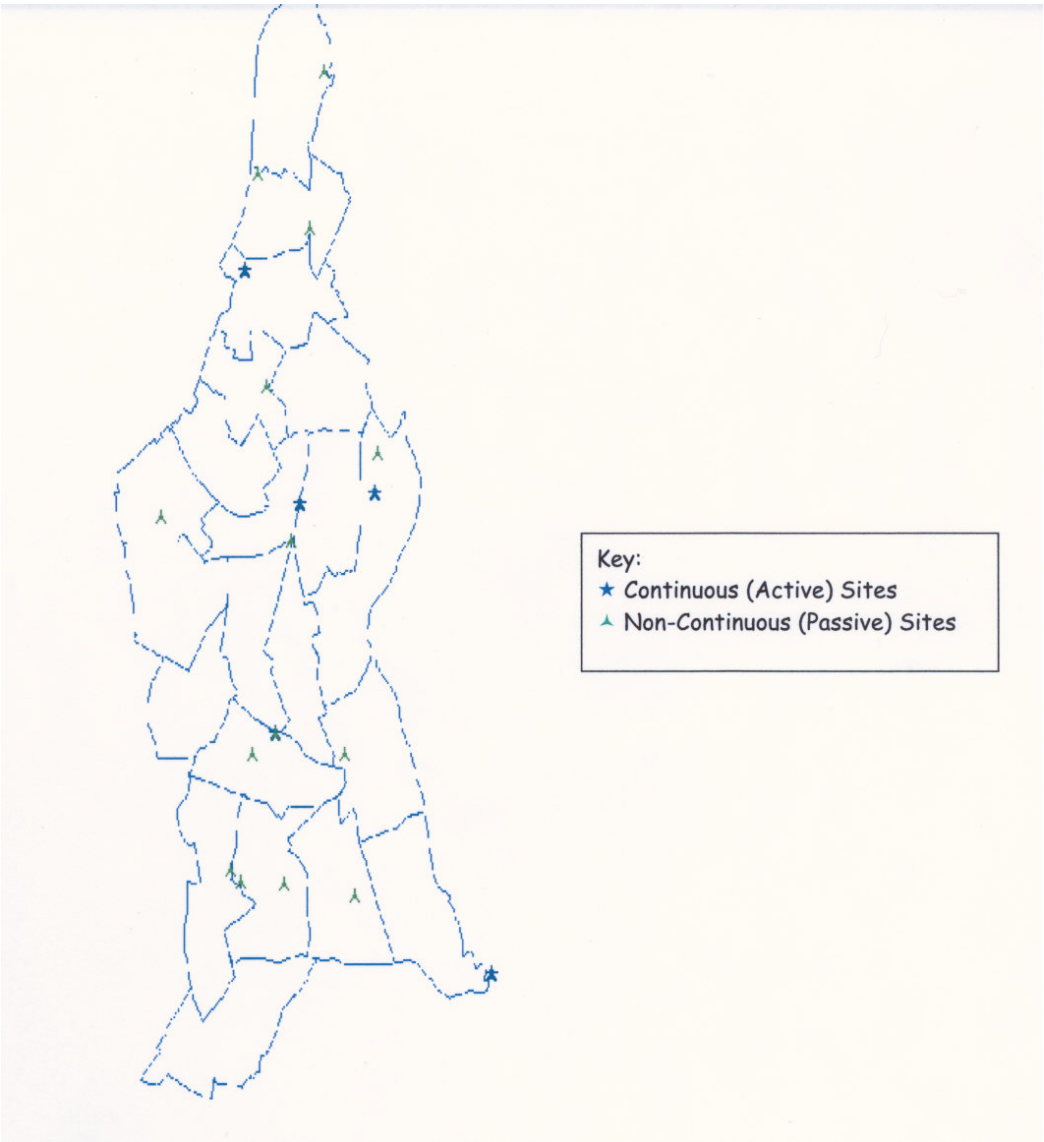


Chart 16. – Late November PM_{10}.

Appendix 1.

Monitoring Location map



Appendix 2 - Technical

Conversion Factors for Pollutants

EC Standards for Pollutants	**World Health Organisation (WHO) Standards**
20^{o} C and 1013mb	**25^{o} C and 1013mb**
Ozone 1 ppb = 2.00 μg m-3 1	ppb = 1.96 μg m-3
Nitrogen dioxide 1 ppb = 1.91 μg m-3	1 ppb = 1.88 μg m-3
Carbon monoxide 1 ppm = 1.16 mg m-3	1 ppm = 1.15 mg m-3
Sulphur dioxide 1 ppb = 2.66 μg m-3	1 ppb = 2.62 μg m-3
1,3-butadiene 1 ppb = 2.25 μg m-3	1 ppb = 2.21 μg m-3