AIR QUALITY IN LONDON 2002

THE TENTH REPORT OF THE LONDON AIR QUALITY NETWORK

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November 2003

ACKNOWLEDGEMENTS AND CONTACTS

The London Air Quality Network is a unique and valuable resource. Its inception and continued development would not have been possible without the support of the local authorities in London and the Home Counties, the Association of London Government, London's health authorities and the Association of London Environmental Health Managers. The kind support of the Department of the Environment, Food and Rural Affairs, the Greater London Authority and Transport for London is also gratefully acknowledged.

The measurements detailed in this report result from a team effort undertaken by staff who are dedicated and committed to their work. Further information can be gained from the following contacts.

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CONTENTS

FOREWORD

Professor Frank Kelly - Director of the Environmental Research Group

Welcome to the tenth annual report of the London Air Quality Network (LAQN). The report provides an essential strategic overview of air pollution across the London area during 2002 and includes measurements of eight different pollutants. Building upon previous initiatives further steps have been taken to provide more detailed information for each of these pollutants.

The established trend of network expansion continued during 2002, with 6 new monitoring stations being brought on line. Introduction of these new sites and the upgrading of several other monitoring stations have ensured that the LAQN remains the largest and most comprehensive regional monitoring network in Europe commensurate with the air quality management challenges that London faces today.

The quality of the air we breathe continues to be a major concern for many who live and work in London. Such concerns are real given recent figures suggesting that 100,000 EU citizens die prematurely every year as a consequence of particulate air pollution. Although London did not experience any major pollution episodes during 2002, the annual mean Objective for NO_2 was exceeded at many kerb and roadside sites. More worryingly, the objective was also exceeded at several background sites in inner and west London. The annual mean PM_{10} Objective was exceeded at three sites (1 kerbside/2 roadside). Thus meeting the annual mean objectives for NO_2 and PM_{10} continues to cause concern and there is increasing recognition that attaining these objectives will require an innovative air quality management process.

The O_3 Objective was exceeded across wide areas of suburban London and South East England in 2002. O_3 concentrations are important, both from a heath perspective and in the understanding of the behaviour of nitrogen dioxide. This pollutant however tends to be overlooked as councils strive to achieve the Objectives required by the local air quality management process.

With the exception of O3, medium term trends (1996-2002) reveal significant improvements in the concentrations of the majority of pollutants (NOx, NO2, PM10, CO, SO2). However, indications in 2000/1 that these improvements were slowing down are confirmed by the 2002 data which indicate that annual mean PM10 concentration actually increased at a rate of 3%/year from 2000. London clearly still suffers from major air quality problems and attainment of the Air Quality Strategy Objectives will be very challenging for many parts of the City.

The LAQN website www.erg.kcl.ac.uk launched in 2000, continues to play a vital role in data dissemination. It is now the first port of call for the public and our colleagues in the London Boroughs needing current air quality information. A major upgrade of the website is planned during 2004 to further improve this facility.

Air quality is currently under the scrutiny of a number of National, European and WHO committees with NO_2, PM and O_3 particularly in focus. Particular attention has been made of $PM_{2.5}$ and it is likely that measurements of this particle metric will become more important following recent WHO recommendations. The foresight shown by Boroughs that monitor this particle metric will provide London with a lead in the understanding of $PM_{2.5}$ and these measurements have also been vital to our current understanding of the spatial and temporal distribution of PM_{10}.

During 2004 the Environmental Research Group (ERG) will work with Boroughs to install a new type of TEOM analyser, which will further inform our understanding of airborne particulate. Although the health impacts of airborne particulate on city populations are well established the causal mechanisms are not. During the year ahead ERG will continue to work closely with medical researchers to shed further light in this area.

EXECUTIVE SUMMARY

During 2002 the London Air Quality Network continued to expand with additional data from 6 new monitoring sites.

Network annual mean concentrations have been analysed for the period November 1996 to December 2003:

- There was no overall change in annual mean NO_2 during 2002. Provisional measurements for 2003 suggest a rise due to photochemistry during the summer. Overall there has been a reduction of approximately 6% in annual mean NO_2 concentration during the period November 1996 to November 2003. Annual mean concentrations at typical background sites in outer London have been below the Air Quality Strategy (AQS) Objective since 1998, whereas those at typical roadside and background sites in central London have been consistently above the Objective.

- Overall annual mean NO_X concentrations have fallen by 33%.

- The annual mean O_3 rose 43% during the period November 1996 to November 2003. During the summer of 2003 the annual mean increased by 20% due to the frequency and magnitude of photochemical episodes at this time.

- The annual mean CO has continued to decline and has reduced by 53%.

- The SO_2 annual mean reduced by 66% during the period November 1996 to November 2003. However, provisional measurements suggest a 4% increase during 2003.

- Over the period November 1996 to November 2003, the LAQN annual mean for PM_{10} decreased by 19% overall. LAQN annual mean PM_{10} declined steadily to the end of 2000 and then rose at a rate of 3% per year through to spring 2003. The provisional measurements for 2003 show an increase of 23% due a series of pollution episodes.

- The Annual Report contains an analysis of the number of days when mean PM_{10} exceeded 50 μgm^{-3}. By the end of 2003 many road and kerbside sites in London will exceed the year 2005 AQS Objective. There is also a possibility of the Objective being exceeded at background sites in central and inner London.

Each of the pollutants monitored by the LAQN during 2002 has been compared to the AQS Objectives:

- For the first time in the LAQN's 10 year history the CO Objective was not exceeded at any site.

- The annual mean Objective for NO_2 was exceeded at the majority of kerbside and roadside sites. The Objective was also exceeded at many background sites in inner and west London. The incident based Objective for NO_2 was exceeded at the kerbside site Redbridge 2 and the roadside site Kensington & Chelsea 3.

- The O_3 Objective was exceeded at 8 sites.

- The PM_{10} incident based Objective was exceeded at 11 sites and the annual mean Objective for PM_{10} was exceeded at 3 sites.

- All LAQN sites met the Objectives for SO_2.

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1.1 Background

The purpose of this report is to review air quality in London during 2002. Measurements have been analysed with specific reference to the Air Quality Strategy (AQS) Objectives (DETR, 2000a, DETR 2000b). Full details of the sites in the London Air Quality Network (LAQN) in 2002 are presented in Appendix 1 and the detailed monitoring results are presented in Appendix 3. Details of pollution incidents during the year can be found in the quarterly reports for 2002.

The LAQN was formed in 1993 to co-ordinate and improve air pollution monitoring in London. At the end of December 2002, 31 London boroughs were supplying data to the LAQN. These data were supplemented with measurements from local authorities around London, thereby allowing an overall perspective of air pollution in South East England. The LAQN is operated and managed by the Environmental Research Group (ERG) at King's College London, on the basis of each borough funding the monitoring activities in its own area. Further LAQN sites are funded by Transport for London and BAA plc. The ERG is contracted by the Department of the Environment, Food and Rural Affairs (DEFRA) to maintain 16 of the LAQN sites as affiliate sites to the UK Automatic Urban and Rural Network (AURN). This support from DEFRA assists the operation of the overall LAQN.

The combined London, Hertfordshire & Bedfordshire and Kent networks produce a detailed perspective of air pollution in London and the Home Counties. This perspective is unique within the UK. It is also an increasingly important resource to support the boroughs and the Greater London Authority in meeting the challenges of the AQS.

The LAQN is able to report measurements from 6 new monitoring sites installed during 2002. Several sites received equipment enhancements during the year. The principal site changes are listed in Appendix 1.

Analysis of LAQN measurements has been augmented by measurements from the directly funded DEFRA sites in London. These 6 sites provide further information concerning pollution in central and west London. Hourly and 15 minute mean measurements from these sites were obtained from the DEFRA National Air Quality Archive and are included within the LAQN database.

In response to requests from air pollution modellers, this report includes annual mean NO_X measurements for each NO_2 monitoring site in the LAQN. Building upon the precedent of the quarterly reports for 2002, this report chiefly reports gas measurements expressed as mass per unit volume (μgm^{-3} and mgm^{-3}) using conversion factors at 20 ^{O}C and 1.03 KPa as suggested in the Draft Guidance LAQM.TG(02) (DEFRA 2002). NO_X measurements are reported as NO_2 equivalent. For the first time, gravimetric measurements of PM_{10} and $PM_{2.5}$ are reported from DEFRA and local authority monitoring sites.

The latest air pollution measurements for London can be viewed on the LAQN web site. The site has graphical summaries of air pollution across the LAQN, details of the monitoring sites, background information about air pollution and tools to allow the user to analyse and plot measurement data. The Internet site, shown in Figure 1, may be accessed at www.erg.kcl.ac.uk

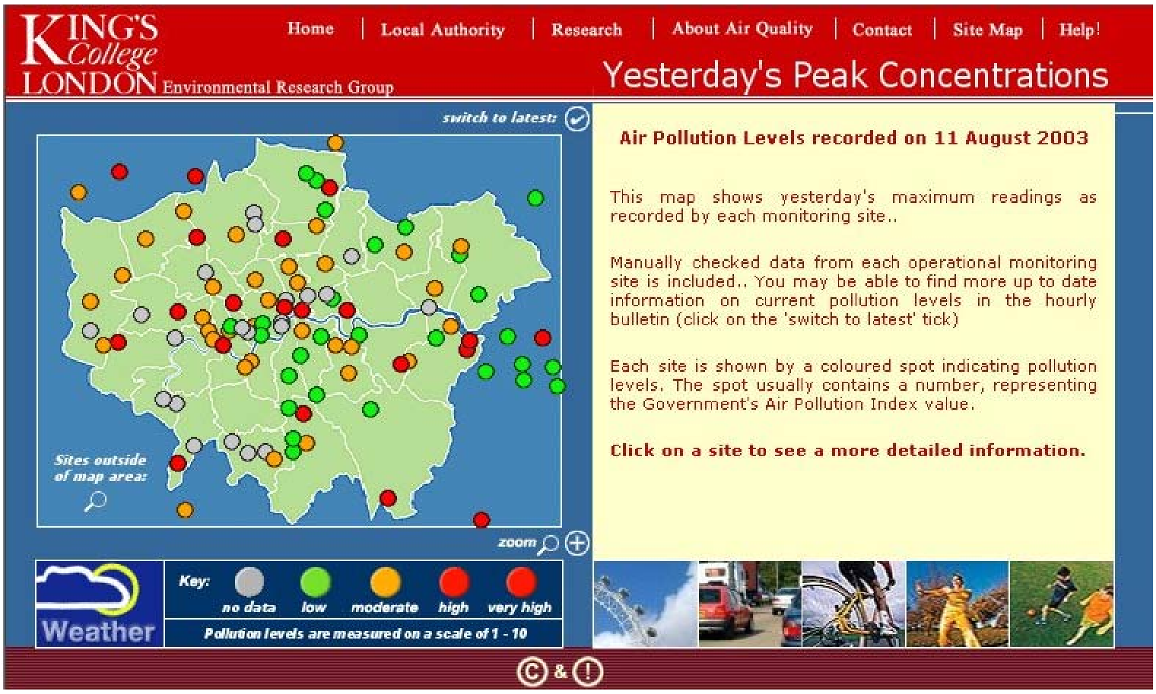

*Figure 1 The LAQN Internet site: **www.erg.kcl.ac.uk***

1.2 Discussion of Results

1.2.1 *Measurement Uncertainty and Presentation*

Comparisons of 2002 results with national and international guidelines and standards are shown in Appendix 3.

When examining pollution measurements it is important to consider the location of the monitoring site, e.g. kerbside, urban background, rural, etc., and the measurement quality. The site type and quality assurance standard for each site are listed in Appendix 1. Data from sites affiliated to the AURN and London Standard sites have traceability to national metrological standards, whereas for the locality standard sites there is insufficient information to demonstrate such traceability.

No scientific measurement is absolutely accurate or absolutely precise. The combination of accuracy and precision is termed the uncertainty. In order to place results in context, the uncertainty associated with each result has to be considered. Estimates of the uncertainty associated with air quality measurement are discussed in previous LAQN annual reports (ERG, 2002 and SEIPH-ERG, 1997). It is reasonable to assume a working uncertainty of around 10% (2σ) when discussing high values and long-term means of CO, NO_2, O_3 and SO_2 measured at London Standard sites. This is justified on the basis of both mathematical modelling and equipment performance tests. However, due to the statistical distribution of the data, a 10% uncertainty in measurements does not imply a 10% uncertainty in the number of exceedences of an Objective. The calculation of uncertainty in the number of exceedences has to be based on an analysis of the dataset for each individual site. Error bars indicate the range of uncertainty in the figures below. The uncertainty associated with the measurement of PM_{10} is more complex due to the nature of the pollutant and the measurement techniques.

The LAQN measurements are subject to two quality assurance processes. Initially, measurements are validated when they are collected using the best calibration and instrument performance information available at the time. Measurements are retrospectively examined during the ratification process using long-term instrument histories and the results of further quality checks, including audit at many sites by the National Physical Laboratory. Hence the final ratified measurements in this Report will differ from those initially published via our fax and Email dissemination services, the Internet and quarterly reports.

The final and definitive data sets for the AURN affiliated sites are published by DEFRA.

Each of the pollutants monitored by the LAQN in 2002 is discussed below in terms of its spatial distribution and in comparison with the AQS Objectives. Many Objectives require data representative of the whole year. If insufficient data are available, then comparison with the Objective is not possible. This, for example, may be the case for sites installed during the year or those that experienced serious and prolonged instrument failure. A data capture Objective of 90% is recommended in LAQM.TG(02) (DEFRA 2002) in line with EU Directive requirements. Additionally, sites with a data capture between 75% and 90% are included in the following comparisons and indicated with an asterisk in each figure.

1.2.2 Relative Results 1995 to 2003

During 2002 there were no major pollution incidents as seen in previous years. For example, during 1991, 1994 and 1997, London experienced important winter pollution incidents. Furthermore, a prolonged secondary particulate episode occurred during 1996 and the hot summer of 1995 produced substantial photochemistry. During 2003 London experienced a series of secondary particulate episodes during spring and summer, whilst the hot weather in August produced the greatest measurements of ground level O_3 measured in the 10 year history of the LAQN.

Data from November 1995 to November 2003 have been analysed to place the results from 2002 in context. Annual means from November 1996 have been calculated at monthly intervals in an attempt to eliminate seasonal effects. The mean value for a particular date represents that for the preceding 12 months, for example, the value calculated for November 1996 represents the mean between November 1995 and November 1996. To provide a perspective across the network as a whole, the mean from each of the long-term sites has been averaged to produce a LAQN network mean. The LAQN network mean has been set to 100 for each pollutant as at November 1996 to illustrate relative change. Measurements from roadside and background sites have been used. However, due to data availability, a different set of sites has been used for each pollutant. Four sites have been used for the PM_{10} calculation, 5 for CO, 6 for O_3 and SO_2, and 12 for NO_X and NO_2. The 3 long-term monitoring sites in Sutton closed during May 2002. These have been replaced in the network mean analysis by sites in similar locations: Bexley 2, Crystal Palace, Greenwich Bexley 6 and Haringey 2. It should be noted that data from 2003 are provisional and subject to ratification. The annual means are shown in Figure 2 and Figure 3.

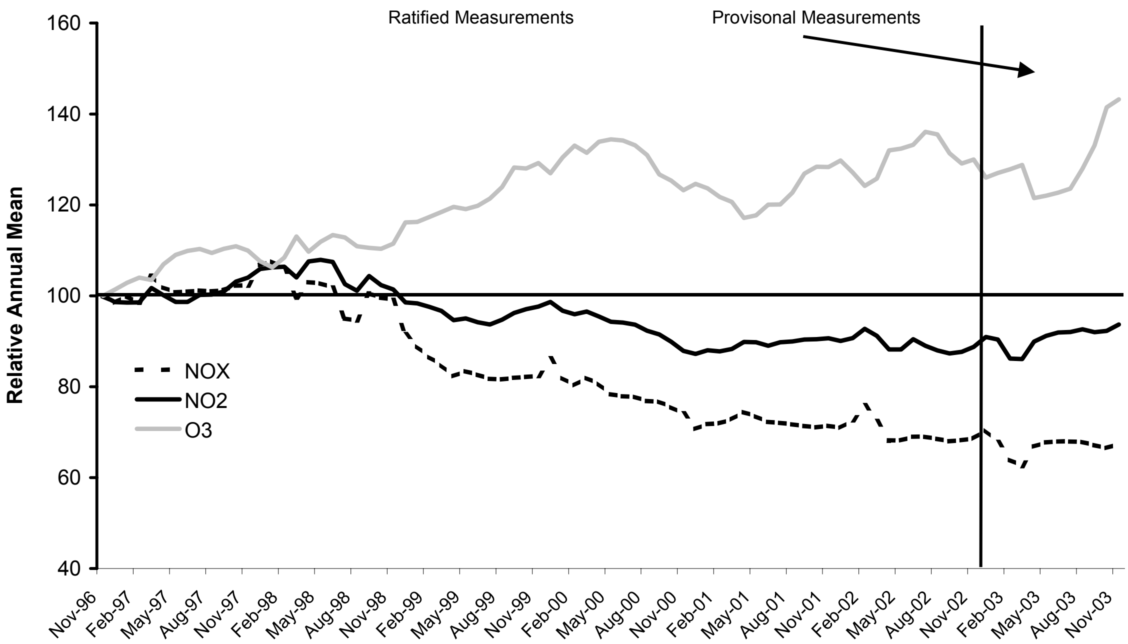

Figure 2 Relative Annual LAQN Mean for O_3, NO_X and NO_2

Figure 2 shows a fall of around 33% in the NO_X concentration over the period November 1996 to November 2003. This is the result of reduced NO_X emissions due to technological changes in the vehicle fleet. The effects of pollution incidents during winter 1997 can be seen in the NO_X concentration; causing a rise in concentration at this time and a consequential fall during winter 1998 as this incident drops from the rolling annual mean. NO_X concentrations during 2002 continued the downward tendency established since mid 1999.

LAQN annual mean NO_2 initially shows a rise due to pollution incidents in winter 1997. The NO_2 mean fell during 1998 only to rise again during 1999. During 2000, NO_2 concentrations showed a substantial decline of around 10% due to the unsettled weather at this time. NO_2 concentrations rose slowly during 2001 and showed no overall change during 2002. Provisional measurements for 2003 suggest a rise due to photochemistry during the summer. Overall, there has been a reduction of approximately 6% in annual mean NO_2 concentration during the period November 1996 to November 2003. This will be disappointing to air quality managers and illustrates the challenges of controlling the concentrations of this secondary pollutant. Although local management of NO_2 focuses on the emissions of NO_X, the concentration of NO_2 is also determined by the capacity of the atmosphere to oxidise NO to NO_2. In this respect, concentrations of NO_2 and O_3 are linked and measurement of O_3 can provide insight into the concentrations of NO_2 (e.g. Clapp and Jenkins, 2001). In addition, O_3 measurement is important in its own right given the important health effects of this pollutant. Other important determinants of NO_2 concentrations include direct emissions of NO_2 and other substances that can oxidise NO to NO_2.

The O_3 concentration in Figure 2 shows an overall rise of 43% during the period November 1996 to November 2003. During summer 2003 the LAQN annual mean increased by 20% due to the frequency and magnitude of photochemical episodes at this time.

Figure 3 shows that LAQN annual means for CO and SO_2 fell relatively rapidly from November 1996 to late 1999. From the start of 2000 the rate of decline for CO and SO_2 has been more modest. Overall there have been declines of 53% and 66% in the LAQN annual means for CO and for SO_2 respectively. During 2003 the provisional SO_2 mean increased by 4% due to pollution from industry to the east of London being brought into the capital by the more frequent easterly winds.

Figure 3 also shows the LAQN annual mean PM_{10}, which declined steadily to the end of 2000 and then rose at a rate of 3% per year through to spring 2003. The provisional measurements for 2003 reflect a series of four episodes, largely caused by PM_{10} from long-range sources. These episodes caused an increase of 23% in the LAQN annual mean for PM_{10}. Over the period November 1996 to November 2003, the LAQN annual mean for PM_{10} decreased by 19% overall.

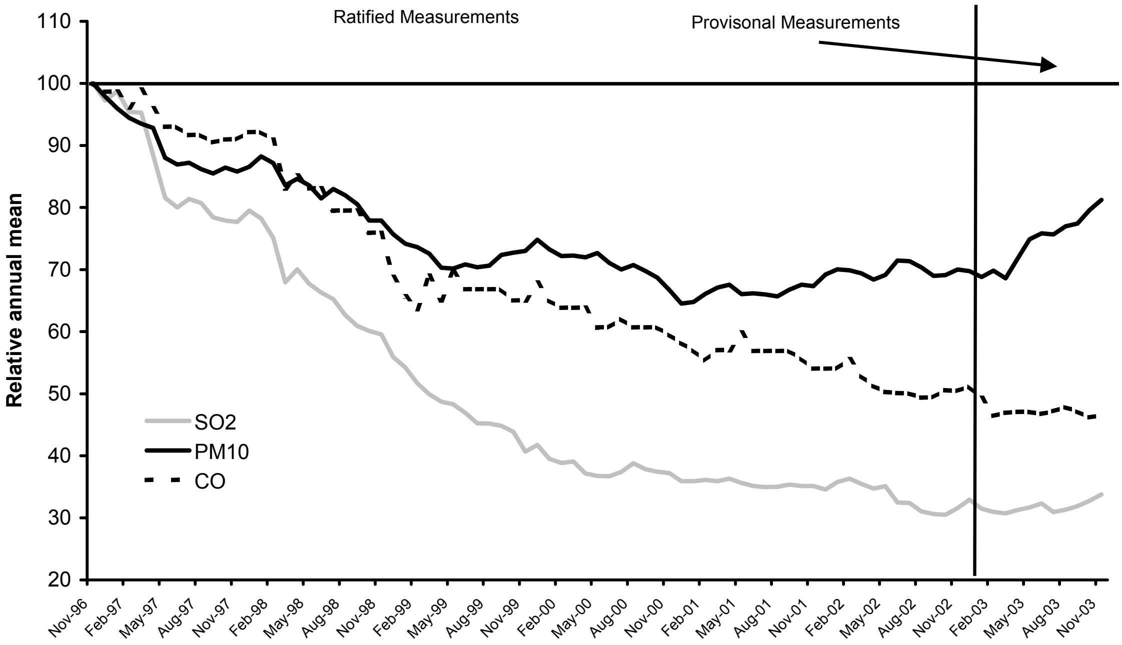

Figure 3 Relative Annual LAQN Mean for CO, PM_{10} and SO_2

The LAQN annual means illustrate the relative change of annual mean concentrations. It is also important to consider the change of absolute concentrations in relation to the AQS Objectives. Figure 4 compares the annual mean NO_2 at 3 different types of location in London. All location types show an overall reduction and exhibit fluctuations due to the same factors; for example the pollution episodes in autumn 1997 and, to a lesser extent, the photochemical episodes during 2003. Annual mean concentrations at typical background sites in outer London have been below the AQS Objective since 1998, whereas those at typical roadside and background sites in central London have been consistently above the Objective. Annual mean concentrations at the Marylebone Road kerbside site are not shown in Figure 4 but have remained in the range 80–100 μgm^{-3} since the site commenced.

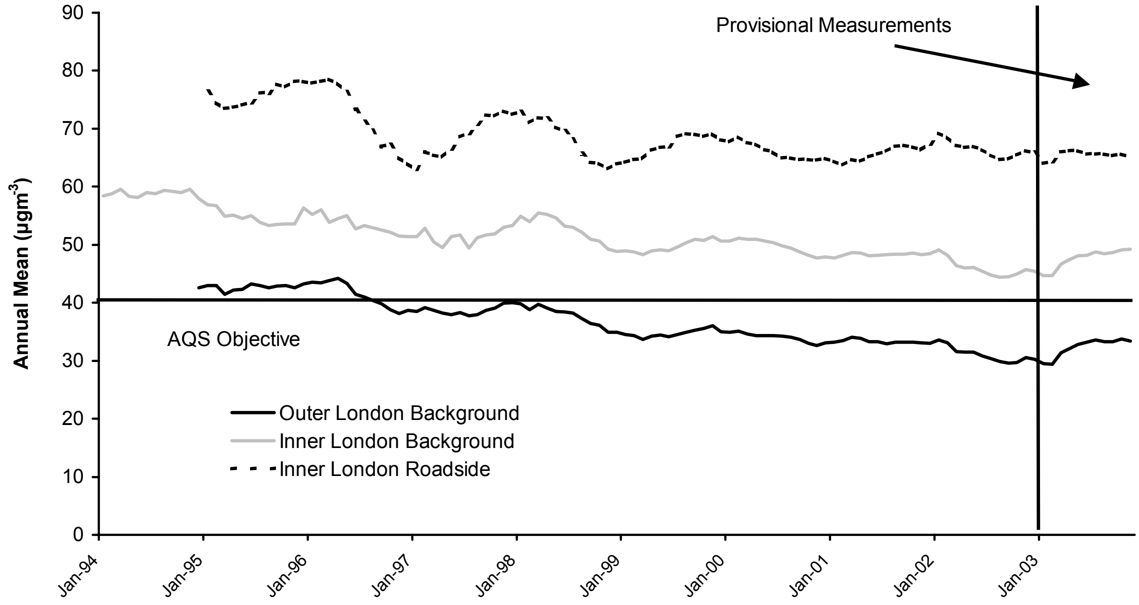

Figure 4 Annual mean NO_2

AQS Objectives vary in their averaging time from annual means to shorter incident-based Objectives of a day or less. The shorter averaging time Objectives are important for local air quality management and this is especially the case with PM_{10}. These incident-based Objectives show more variations between sites, and from year to year, than those exhibited by annual means. It is therefore difficult to summarise the network wide trends with reference to these Objectives.

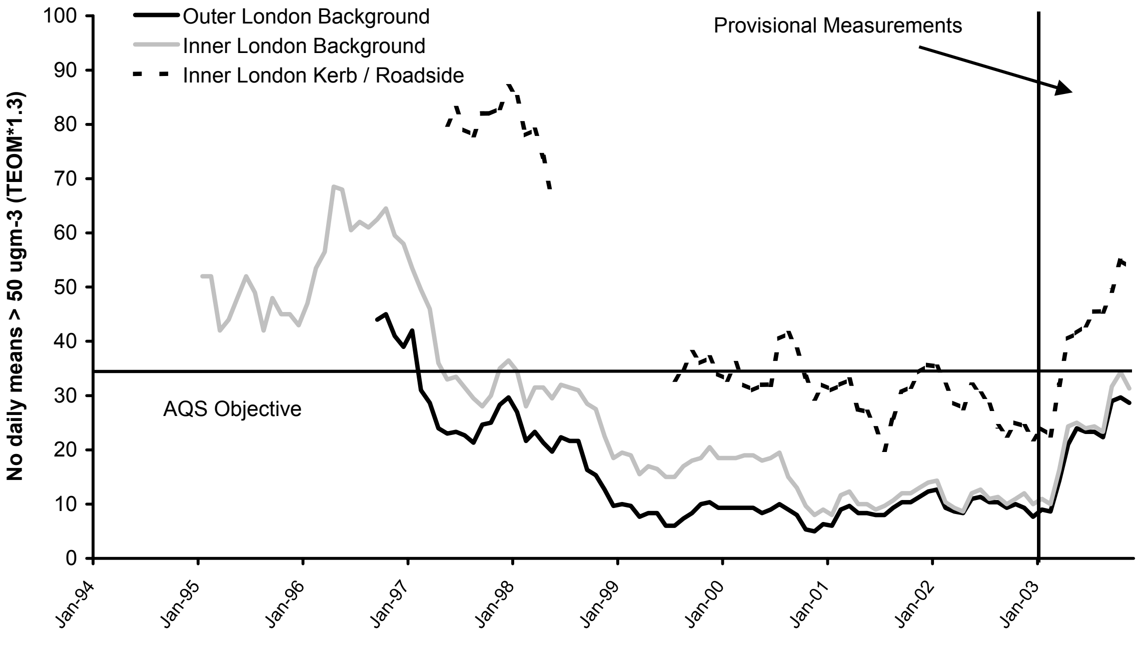

*Figure 5 Annual number of PM_{10} daily means above 50 ugm^{-3} (TEOM*1.3)*

Figure 5 shows the annual number of daily mean PM_{10} measurements above 50 μgm^{-3} (TEOM*1.3) at three different types of location. The long-term measurements at inner London background sites exhibit a downward trend from around 50 days above 50 μgm^{-3} in 1995 to around 10 days in 2002. The similar downward trend of all site types reflects a reduction in secondary and primary PM_{10} emissions, whilst the convergence in the number of daily means above 50 μgm^{-3} (TEOM*1.3) illustrates the reduction in traffic emissions of primary PM_{10}.

During 1995 typical inner London background sites exceeded the Objective, which implied a widespread breach of the Objective throughout London. The situation deteriorated in spring 1996 due to the substantial secondary episode at this time. As a consequence, 76 daily means above 50 μgm^{-3} (TEOM*1.3) were measured in the year ending April 1996; more than double the 2005 objective of 35 days. A repetition of such an episode would clearly provide significant challenges for air quality management. The additional days above 50 μgm^{-3} caused by the spring 1996 episode leave the running count in spring 1997. Other events affecting the number of daily means above 50 μgm^{-3} (TEOM*1.3) include the primary episode of autumn 1997 and the unsettled weather in late 2000. Inner London background sites have consistently achieved the Objective since 1998. The number of daily means above 50 μgm^{-3} (TEOM*1.3) measured at outer London sites is only marginally below those measured in inner London. A larger difference can be seen between the background and kerb/ roadside sites in inner London than between inner and outer London background sites.

The number of daily means above 50 μgm^{-3} (TEOM*1.3) at the kerb/roadside in inner London follows a similar trend to background, with additional days due to local traffic emissions. Inner London roadside sites have generally achieved the Objective since 2000. Measurements at Marylebone Road are not shown in Figure 5 but have been in the range 70–150 days per year and show variations in part due to local events such as building works.

Provisional measurements shown in Figure 5 reflect the impact of the PM_{10} episodes in 2003. Compared to 2002, background sites measured around 20 additional daily means above 50 μgm^{-3} (TEOM*1.3) during the first 10 months of 2003, with kerb/roadside sites in inner London measuring around 30 such additional days. By the end of 2003 many road and kerbside sites in London will exceed the 2005 AQS Objective. There is also a possibility of the Objective being exceeded at background sites in inner London.

1.2.3 Carbon Monoxide

CO emissions within the LAQN area are dominated by road transport sources.

As expected, the highest rolling 8 hour means during 2002 were again measured at kerbside and roadside sites. For the first time in the LAQN's 10 year history, the AQS Objective of 10 mgm^{-3} (8.6 ppm) was not exceeded at any site.

1.2.4 Nitrogen Dioxide

NO_2 is largely a secondary pollutant formed by the oxidation of NO. In the LAQN area road transport is the dominant source of NO_X. This is reflected in the general distribution of NO_2, with the highest concentrations in 2002 being measured at roadside and central London locations. Lower concentrations were observed at background, suburban and rural areas. The AQS stipulates two objectives for NO_2: an annual mean of 40 μgm^{-3} (21 ppb) and an incident based objective of 200 μgm^{-3} (104.6 ppb), as an hourly mean, not to be exceeded more than 18 times per year.

The provisional modelled annual mean NO_2 concentration across London for 2002 is shown in Figure 6. It is likely that the predicted NO_2 concentration is overestimated around Heathrow due to uncertainties in the NO_X emissions at the airport. Elsewhere, there are slight differences between the mapped results and those measured at the individual background monitoring sites. However these are within the variation that would be expected for individual sites and the limits of measurement uncertainty.

Figure 6 shows two main concentration centres focused on central London and the area around Heathrow Airport. The NO_2 Objective is exceeded in almost all areas in inner London and measurements alongside roads in central London are almost twice the Objective. The Objective is also exceeded along trunk roads in outer London, the M25 and main roads in the suburban boroughs. Elevated background concentrations can also be seen around the trunk road network and in suburban 'town' centres such as Kingston, Sutton, Croydon and Romford.

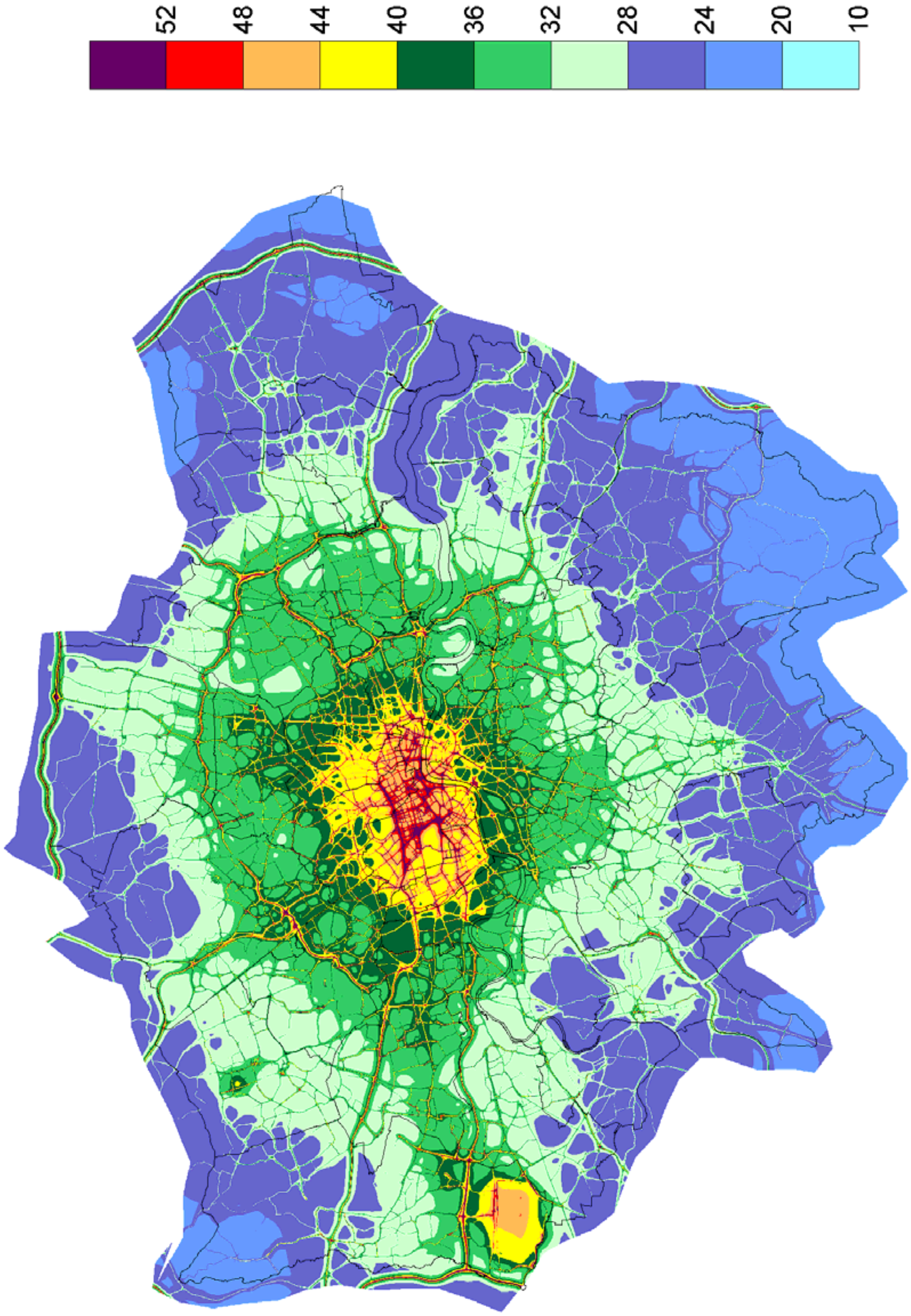

Figure 6 Provisional Annual Mean NO_2 Concentrations 2002 (µgm^{-3}).

Figure 7 and Figure 8 show the annual mean NO_2 at the background sites across the network that have achieved greater than 75% data capture. Sites with a data capture between 75% and 90% have been included in the following comparisons and are indicated with an asterisk in each figure. The distribution of annual means is reflected in Figure 6. The highest annual means were measured at Wandsworth 2 and at Heathrow Airport. Background sites exceeding the Objective are largely in inner and west London.

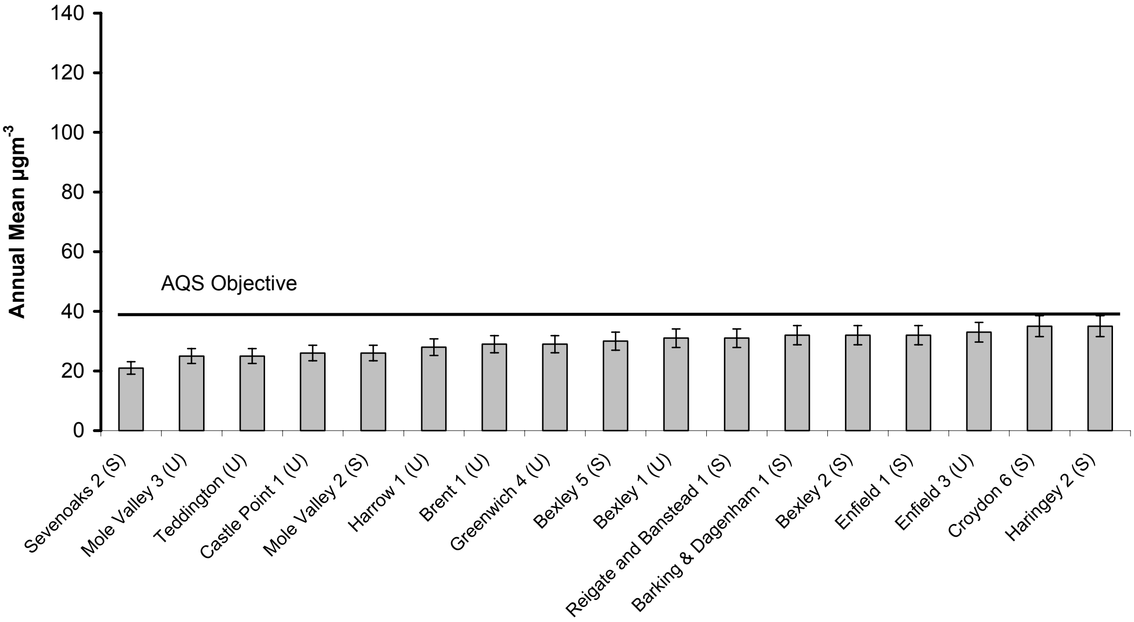

Figure 7 Background Annual Mean NO_2 (2002)

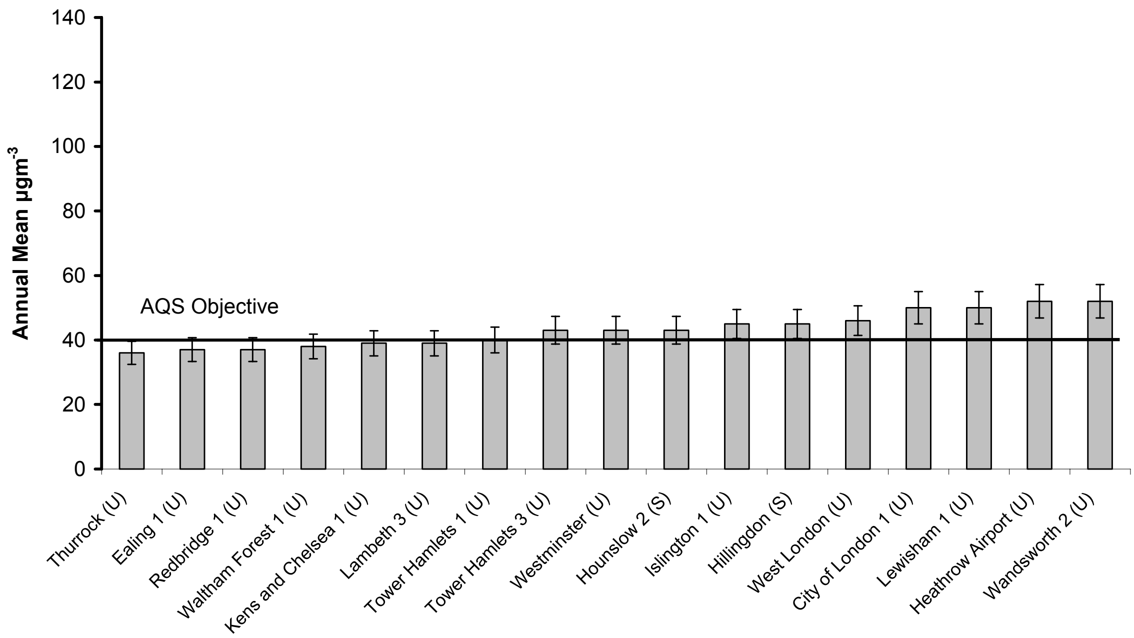

Figure 8 Background Annual Mean NO_2 (2002)

The annual mean NO_2 at kerbside and roadside sites is shown in Figure 9 and Figure 10. The highest annual mean NO_2 was measured at the Redbridge 2 site, which is located on a traffic island in the middle of a busy junction where public exposure is transient. All kerbside and roadside sites exceeded the AQS annual mean Objective.

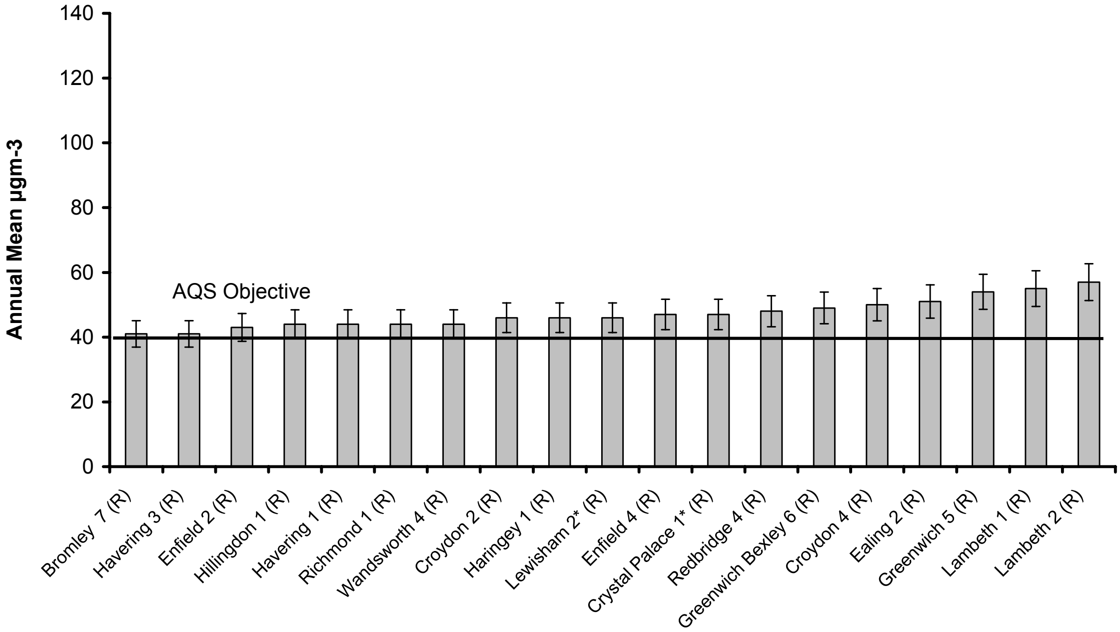

Figure 9 Kerbside and Roadside Annual Mean NO_2 (2002)

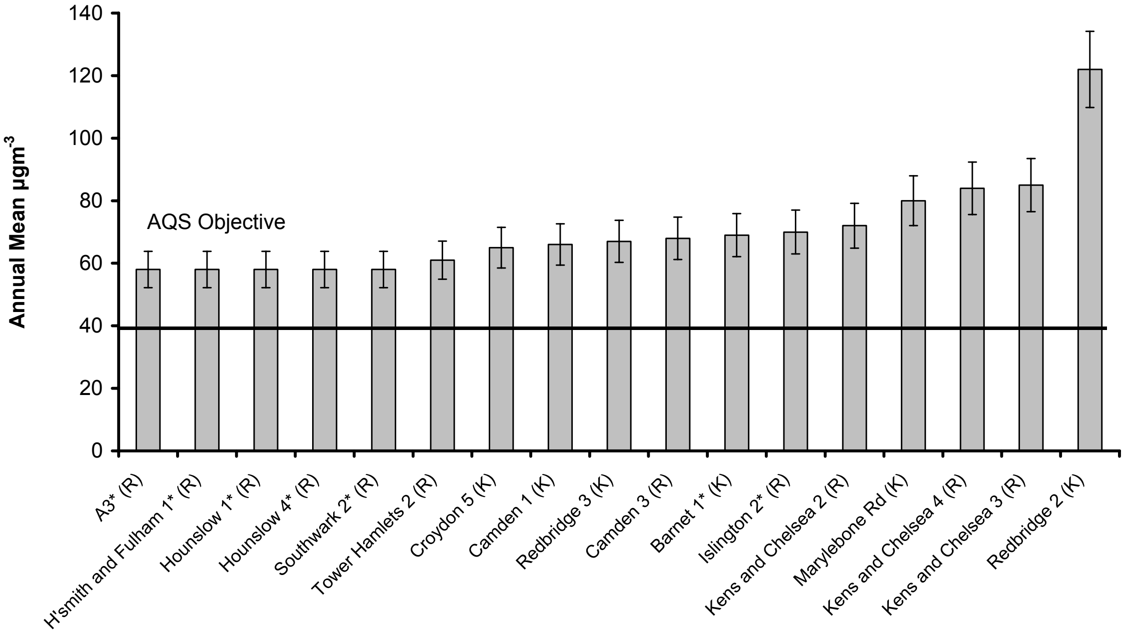

Figure 10 Kerbside and Roadside Annual Mean NO_2 (2002)

The AQS also has an incident-based Objective for NO_2. Measurements during 2002 are compared to this Objective in Figure 11 for the sites that approached the Objective during the year. The kerbside site Redbridge 2 measured 963 hourly means above 200 μgm^{-3} compared to the AQS Objective of 18. This site is located on a traffic island in the middle of a busy junction where public exposure is transient. The Objective was also exceeded at the roadside site Kensington & Chelsea 3. Within the limits of measurement uncertainty, 4 further kerb and roadside sites may have exceeded the Objective; Barnet 1, Redbridge 3, Croydon 5 and Marylebone Road.

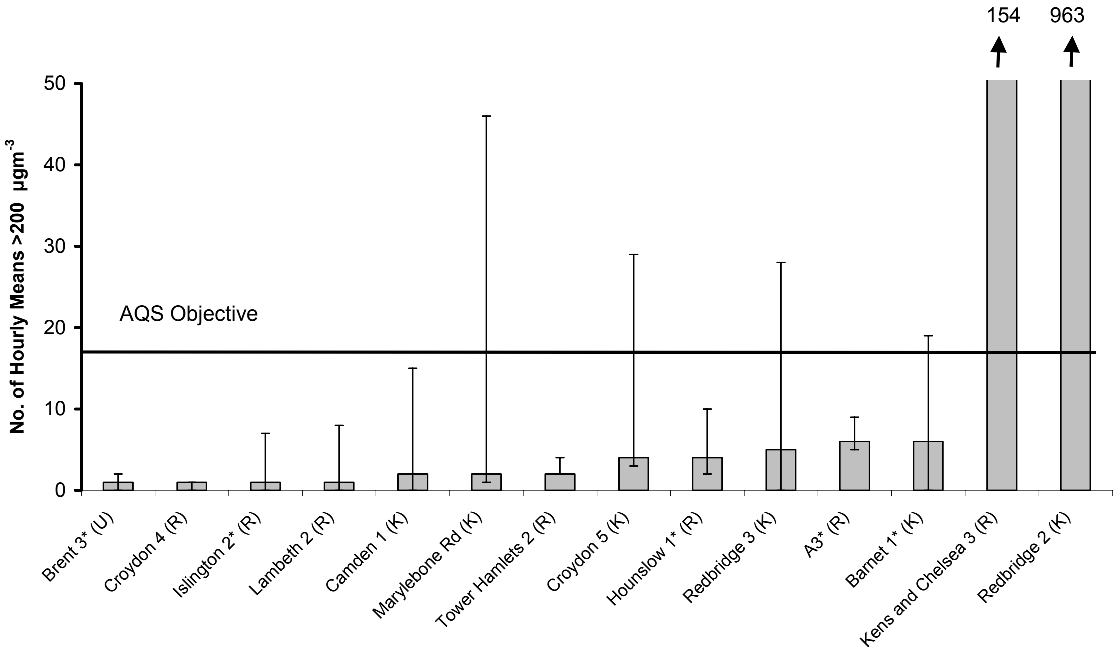

Figure 11 AQS Incident Based Objective for NO_2 (2002)

1.2.5 Ozone

O_3 is a seasonal pollutant with the highest concentrations being measured during the summer months. It is also a regional pollutant, with episodes extending over many hundreds of kilometres. O_3 exhibits significant local variation caused by the scavenging effect of NO close to NO_X emission sources, e.g. at the roadside. Exceedence of the health-based standard is therefore rare at roadside and kerbside sites and O_3 monitoring is not generally undertaken in these locations. Results from the LAQN are shown in Figure *12*.

The AQS Objective is 100 μgm^{-3} (50 ppb), measured as a rolling 8 hour mean, which should not be exceeded on more than 10 days per year. The AQS Objective was exceeded at a total of 9 LAQN background and suburban sites. Eight further sites may have exceeded the Objective, within the limits of uncertainty.

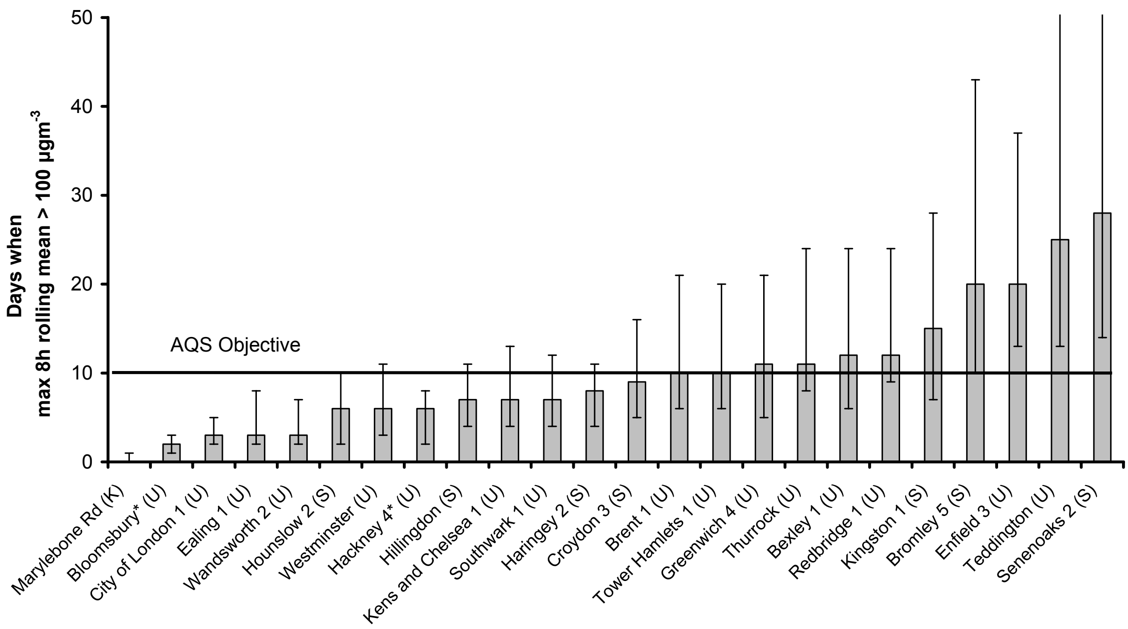

Figure 12 AQS O_3 Objective (2002)

1.2.6 PM_{10}

There are two AQS Objectives for PM_{10}. These are in line with the EU Daughter Directive Stage 1 Limit Value for PM_{10}. The AQS has an incident-based Objective of 50 μgm^{-3}, measured as a daily mean, not to be exceeded on more than 35 days per year, and an annual mean Objective of 40 μgm^{-3}.

PM_{10} poses many measurement challenges. In order to reflect the loss of volatile PM_{10} from TEOM instruments, DETR (1999) recommends that a correction factor of 1.3 be applied to TEOM measurements for comparison to the AQS Objective. The efficacy of 1.3 correction factor was tested by Green *et al* (2000). TEOM results from 2002, calculated on this basis, are shown in grey in Figure 13 to Figure 18.

For the first time, PM_{10} measurements from 'gravimetric' samplers are reported. These are shown in white in Figure 13 to Figure 18.

Beta Attenuation Monitors (BAM) are also used on the LAQN to measure PM_{10}. BAM measurements are shown in black in Figure 13 to Figure 18. Research at Marylebone Road (Green, 1999) sought to compare the results from TEOM, 'gravimetric' and BAM instruments. The BAM instrument tested produced higher results than the 'gravimetric' method at this location during the test period. However, no correction factor has been applied to the BAM measurements. Due to these methodological differences it has not been possible to make an uncertainty estimate for PM_{10} measurements.

Several sites were affected by local PM_{10} sources during 2002, principally the Bexley 4 site. This site was regularly affected by PM_{10} arising from vehicles accessing nearby industrial sites. Measurements at Greenwich 7 were influenced by long-term road works following major subsidence. An investigation of local sources around the Thurrock 1 site is underway.

During 2002 the PM_{10} AQS incident based Objective was exceeded at 11 sites. This is shown in Figure 13 to Figure 15.

The annual mean AQS Objective is shown in Figure 16 to Figure 18. This Objective was exceeded at the kerbside site Marylebone Road and the roadside sites Bexley 4 and Enfield 4.

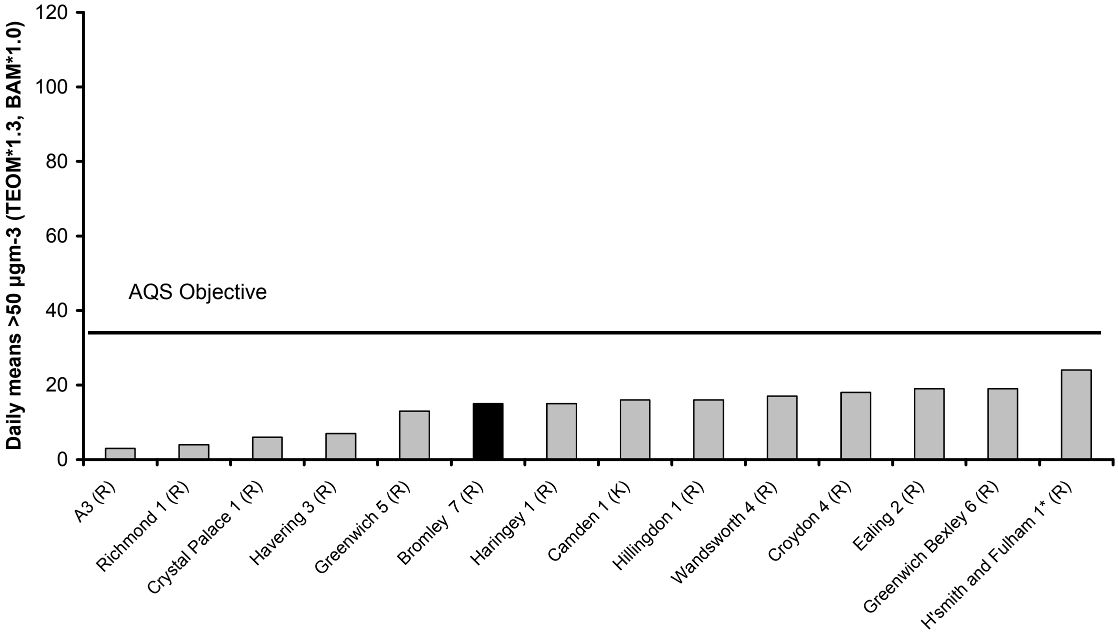

Figure 13 AQS Incident Based Objective for PM_{10} at Road and Kerbside Sites (2002). TEOM measurements are shown in grey and BAM measurements are shown in black.

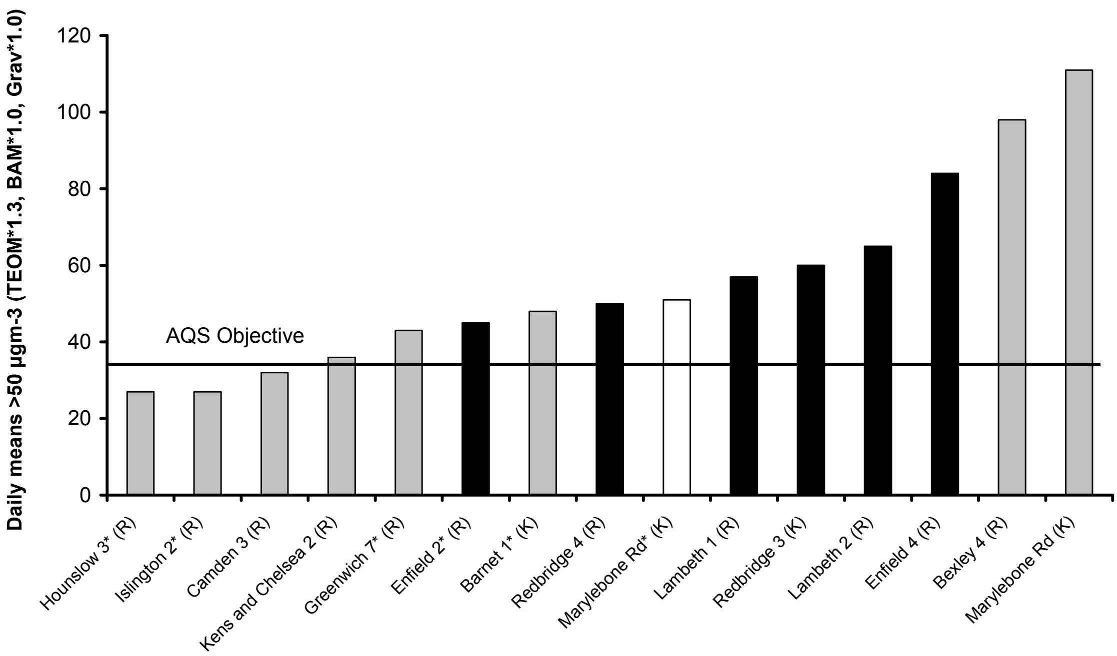

Figure 14 AQS Incident Based Objective for PM_{10} at Road and Kerbside Sites (2002). TEOM measurements are shown in grey, BAM measurements are shown in black and gravimetric measurements are shown in white.

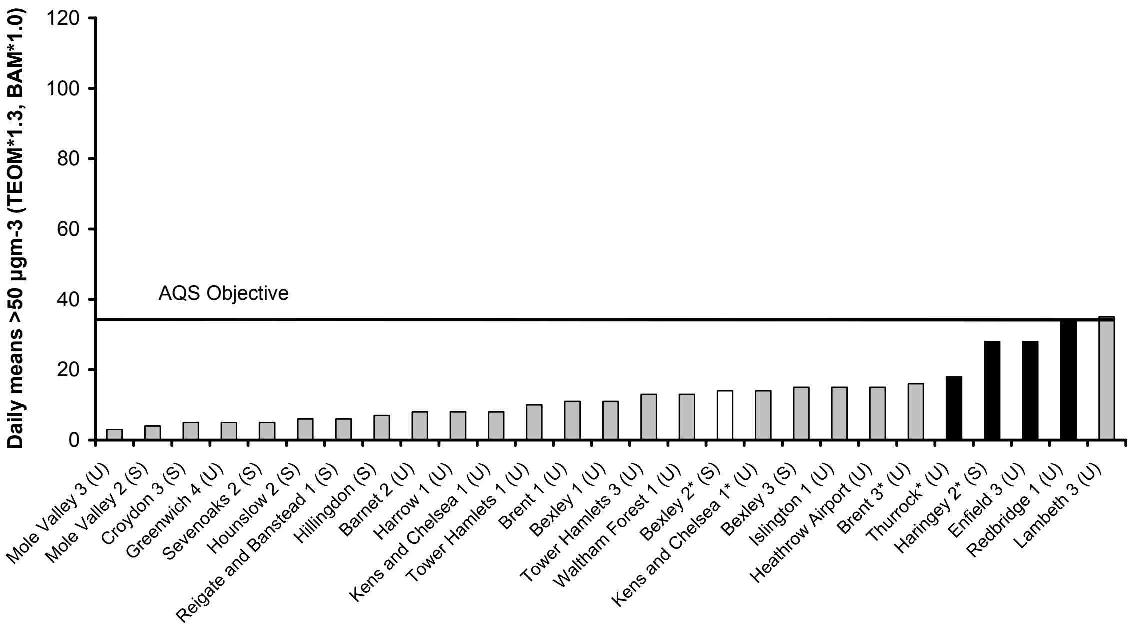

Figure 15 AQS Incident Based Objective for PM_{10} at Background Sites (2002). TEOM measurements are shown in grey, BAM measurements are shown in black and gravimetric measurements are shown in white.

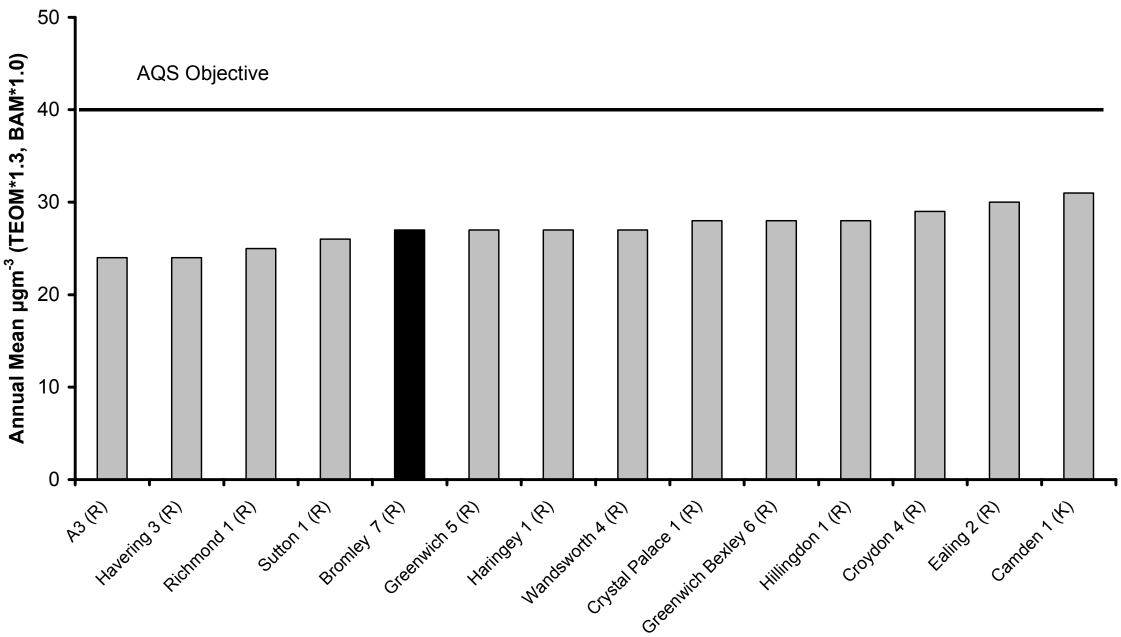

Figure 16 AQS PM_{10} Annual Mean Objective at Kerbside and Roadside Sites (2002). TEOM measurements are shown in grey and BAM measurements are shown in black.

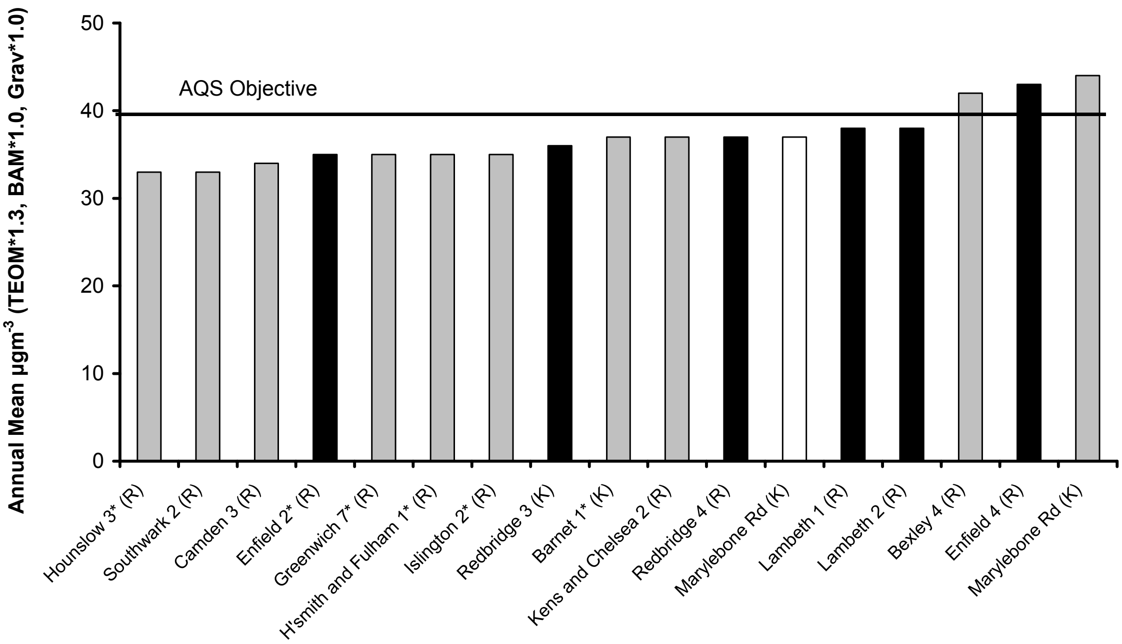

Figure 17 AQS PM_{10} Annual Mean Objective at Kerbside and Roadside Sites (2002). TEOM measurements are shown in grey, BAM measurements are shown in black and gravimetric measurements are shown in white.

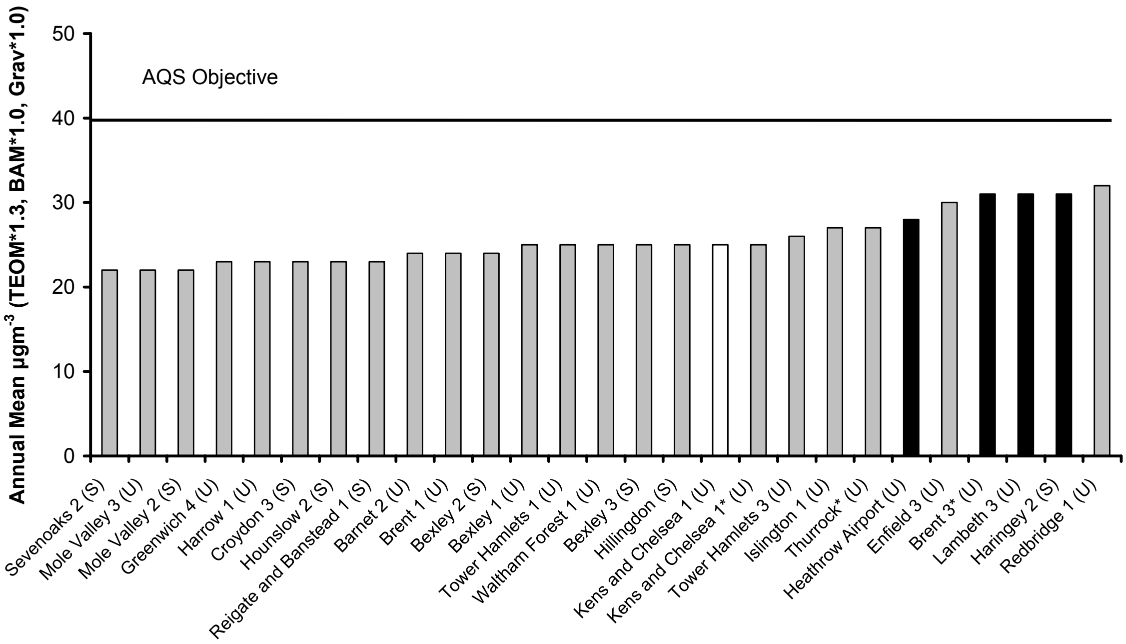

Figure 18 AQS PM_{10} Annual Mean Objective at background sites (2002). TEOM measurements are shown in grey, BAM measurements are shown in black and gravimetric measurements are shown in white.

1.2.7 $PM_{2.5}$

$PM_{2.5}$ is a finer fraction of PM_{10} and is not currently included in the AQS. However, measurements of $PM_{2.5}$ are essential to the understanding of PM_{10}. Co-located measurements of PM_{10} and $PM_{2.5}$ are especially useful, providing valuable data for modelling PM_{10} in London and South East England

(Fuller et al, 2002). The Expert Panel on Air Quality Standards (EPAQS 2000) considered $PM_{2.5}$ and concluded that health evidence did not justify a separate $PM_{2.5}$ standard at the time. More recently, the Clean Air for Europe Working Group on Particulate Matter proposed replacing the 2010 EU Limit Value for PM_{10} with a $PM_{2.5}$ Limit Value between 12 and 20 μgm^{-3} expressed as an annual mean (CAFÉ 2003). $PM_{2.5}$ measurements are shown in Figure 19. The proportion of volatile $PM_{2.5}$ lost from TEOM measurements is assumed to be equal to that lost during the measurement of PM_{10} and a conversion factor of 1.3 has therefore been assumed. Annual mean $PM_{2.5}$ at all sites exceeded the low threshold of the proposed 2010 Limit Value, with the upper threshold being exceeded at the roadside sites Marylebone Road and Ealing 2, and at the urban background site Hackney 4. Measurements of $PM_{2.5}$ will enable this pollutant to be characterised ahead of any changes to the EU Limit Values.

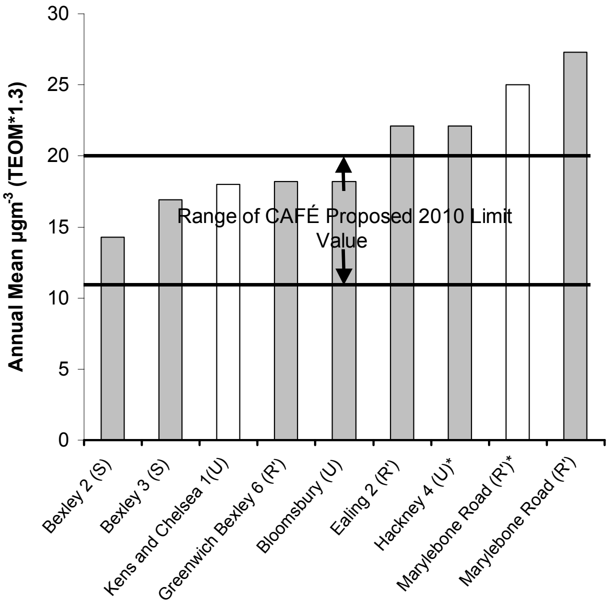

Figure 19 Annual Mean $PM_{2.5}$ (2002). TEOM measurements are shown in grey and gravimetric measurements are shown in white.

1.2.8 Sulphur Dioxide

The distribution of SO_2 concentrations in 2002 provides further evidence of the influence of both road traffic and industrial point sources. Road traffic sources are the main factor influencing annual mean concentrations, whereas industrial point sources produce elevated short-term concentrations during plume grounding. This is discussed in Air Quality in London in 1995. The annual mean concentrations of SO_2 do not vary to any substantial degree over the network.

The AQS Objective for SO_2, based on 35 15-minute mean measurements greater than 266 μgm^{-3} (100 ppb), was not approached at any site in the network. Four sites measured 15 minute means above 350 μgm^{-3}; Brent 2, Castle Point 1, Enfield 3, and Thurrock 1. The hourly and daily mean objectives were not exceeded.

1.2.9 Benzene and 1,3 Butadiene

The main atmospheric source of benzene is the distribution and combustion of petrol, whereas 1,3 butadiene is mainly derived from petrol combustion. Both benzene and 1,3 butadiene are measured at the kerbside at Marylebone Road and at the roadside at Tower Hamlets 2. During 2002 the annual means were below the AQS Objectives for 2003. Both pollutants are also measured by the National Hydrocarbon Network at Haringey 1 where the AQS Objective for benzene was comfortably met.

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LAQN MONITORING SITES 2002

APPENDIX 1: LAQN MONITORING SITES 2002

A.1.0 Details of Monitoring Sites

The following tables detail the pollution monitoring sites in the LAQN at the end of 2002. The start date of each site is shown along with the pollutants monitored and the data quality. In some cases a monitoring site was not operating during the 12 month period. The availability of data from a site is indicated in the data column in the tables below.

Sites are classified according to their location:

- Kerbside sites are those with sampling locations within 1 m of the kerbside and with a sampling height of 3 m or less.
- Roadside sites are those with sampling locations within 1-5 m of the roadside and with a sampling height of 3 m or less.
- Urban background sites are located to represent pollution conditions in the centre of an urban area. Sampling locations are away from the influence of individual pollution sources; 25 m from major roads for example.
- Suburban sites are typical of residential locations on the edge of a built up area. Sampling locations are away from the influence of individual pollution sources; 25 m from major roads for example.

A.1.1 Kerbside Sites

	Start	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$	Data	Quality
Barnet 1	Dec 98		●			**T**		**Yes**	**
Bromley 4	Feb 96	Closed Jul 1998							
Camden 1	Apr 96		●			**T**		**Yes**	** **A1**
Marylebone Road	Jun 97	●	●	●	●	**TG**	●	**Yes**	** **A1**
Redbridge 2	Dec 99	●	●					**Yes**	*
Redbridge 3	Dec 99		●			**B**		**Yes**	*
Richmond 5	Feb 01	Closed Aug 2001							
Richmond 9	Sep 02	●	●	●	●	**T**		**Yes**	**
Richmond 11	Nov 02	●	●	●	●	**T**		**Yes**	**
Sutton 4	Jul 02		●			**T**		**Yes**	**

Key: T =TEOM, B=Beta Attenuation, G= Gravimetric, *Locality Standard, **Traceability to National Standards
A1= Affiliated to UK AURN – ratified data supplied to LAQN by NPL - final data set published by DEFRA
A2= Affiliated to UK AURN – final data set published by DEFRA

A.1.2 Roadside Sites

	Start	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$	Data	Quality
Bexley 4	May 99					**T**		**Yes**	**
Brent 2	Jun 01		●	●		**T**		**Yes**	**
Bromley 7	July 98	●	●			**B**	**B**	**Yes**	*/**A
Camden 3	Apr 00		●			**T**		**Yes**	**
Croydon 2	Sept 94		●					**Yes**	**
Croydon 4	Sept 99		●	●		**T**		**Yes**	**
Croydon 5	Oct 00		●					**Yes**	**
Crystal Palace	Oct 99	●	●	●		**T**		**Yes**	**
Ealing 2	Sept 96	●	●			**T**	**T**	**Yes**	**
Ealing 4	Dec 98	Closed Mar 99							
Ealing 5	Mar 99	Closed Jun 2001							
Enfield 2	Jan 98	●	●			**B**		**Yes**	**
Enfield 4	Mar 00		●	●		**B**		**Yes**	**
Greenwich 5	Sept 97		●			**T**		**Yes**	*
Greenwich 7	Mar 02		●			**T**		**Yes**	*
Greenwich Bexley 6	Oct 00		●			**T**	**T**	**Yes**	**
Hams & Fulham 1	Aug 99		●	●		**T**		**Yes**	**
Hackney 6	Nov 02		●			**T**		**Yes**	**
Haringey 1	Dec 94		●	●		**T**		**Yes**	** A
Haringey 3	Apr 99	Closed Mar 2001							
Havering 1	Dec 95		●					**Yes**	**
Havering 3	Dec 98		●	●		**T**		**Yes**	**
Hillingdon 1	Sept 99		●			**T**		**Yes**	**
Hillingdon 2	Sept 02		●			**T**		**Yes**	**
Hounslow 1	Apr 93	●	●		(●)			**Yes**	** A
Hounslow 3	Mar 99					**T**		**Yes**	**
Hounslow 4	Aug 99		●	●		**T**		**Yes**	**

Key: T =TEOM, B=Beta Attenuation, G= Gravimetric, *Locality Standard, **Traceability to National Standards
A1= Affiliated to UK AURN – ratified data supplied to LAQN by NPL - final data set published by DEFRA
A2= Affiliated to UK AURN – final data set published by DEFRA

A.1.2 Roadside Sites (continued)

	Start	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$	Data	Quality
Islington 2	Jul 00	●	●			**T**		**Yes**	**
Ken & Chelsea 2	May 98					**T**		**Yes**	**
Ken & Chelsea 3	Mar 00		●					**Yes**	**
Ken & Chelsea 4	Sep 00		●					**Yes**	**
Ken & Chelsea 5	May 02					**G**		**Yes**	*
Kingston 2	Apr 96		●			**T**		**No**	
Lambeth 1	Sep 00		●	●		**B**		**Yes**	*
Lambeth 2	Dec 01		●	●		**B**		**Yes**	*
Redbridge 4	Dec 99	●	●	●		**B**		**Yes**	*
Richmond 1	Jun 00		●			**T**		**Yes**	**
Southwark 2	Oct 94	●	●	●		**T**		**Yes**	*/****A**
Sutton 1	May 95	●	●	●		**T**		**Yes**	** **A**
Tower Hamlets 2	Mar 94	●	●					**Yes**	** **A**
Wandsworth 1	Sept 94	Closed Mar 1996							
Wandsworth 4	Feb 98	●	●			**T**		**Yes**	**
Westminster 2	Jun95	Last data 1995							

Key: T =TEOM, B=Beta Attenuation, G= Gravimetric, *Locality Standard, **Traceability to National Standards
A1= Affiliated to UK AURN – ratified data supplied to LAQN by NPL - final data set published by DEFRA
A2= Affiliated to UK AURN – final data set published by DEFRA

A.1.3 Urban Background Sites

	Start	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$	Data	Quality
Barnet 2	Aug 00		●			**T**		**Yes**	**
Barnet 3	Aug 00		●			**T**		**Yes**	**
Brent 1	Aug 95	●	●	●	●	**T**		**Yes**	* **A**
Brent 3	Dec 01		●	●		**T**		**Yes**	**
Bromley 1	Jan 93	Closed Feb 96							
Castle Point	May 96		●	●				**Yes**	**
City of London 1	Oct 01		●	●	●			**Yes**	*
Croydon 3	May 97				●	**T**		**Yes**	**
Ealing 1	Mar 95	(●)	●	●	●			**Yes**	**
Enfield 3	Nov 98	●	●	●	●	**B**		**Yes**	**
Greenwich 4	Sept 93		●	●	●	**T**		**Yes**	** **A**
Hackney 4	Oct 93	●	●		●		**T**	**Yes**	*/****A**
Heathrow Airport	Mar 99	●	●			**T**		**Yes**	*
Hillingdon (O)	Oct 94	Last Data Apr 95							
Ken & Chelsea 1	Mar 95	●	●	●	●	**TG**	**G**	**Yes**	****A**
Islington 1	Sep 94	(●)	●			**T**		**Yes**	**
Lambeth 3	Dec 01		●	●		**B**		**Yes**	*
Lewisham 1	Jan 95		●	●	●			**Yes**	****A**
Mole Valley 3	Oct 01		●			**T**		**Yes**	**
Redbridge 1	Dec 99		●		●	**B**		**Yes**	*
Sevenoaks 2	Feb 98	●	●	●	●	**T**		**Yes**	**
Southwark 1	Mar 93	●	●	●	●	**T**		**Yes**	*/****A**
Thurrock 1	Feb 95	●	●	●	●	**TG**		**Yes**	***A**
Tower Hamlets 1	Jan 94		●	●	●	**T**		**Yes**	**
Tower Hamlets 3	Oct 99		●	●		**T**		**Yes**	**
Waltham Forest 1	Jul 98		●	●		**T**		**Yes**	**
Wandsworth 2	Oct 94	●	●	●	●			**Yes**	****A**
Westminster 1	Jan 93	Last Data 1996							

Key: T =TEOM, B=Beta Attenuation, G= Gravimetric, *Locality Standard, **Traceability to National Standards
A = final data set published by DEFRA

A.1.4 Suburban Sites

	Start	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$	Data	Quality
Bark & Dag 1	Sep 1993		●	●				**Yes**	∗∗
Bark & Dag 2	Oct 99					**T**		**Yes**	∗∗
Bexley 1	Jan 93	●	●	●	●	**T**		**Yes**	∗**A**
Bexley 2	Jan 98		●			**T**	**T**	**Yes**	∗∗
Bexley 3	Jan 98					**T**	**T**	**Yes**	∗∗
Bexley 5	Nov 99	●	●	●				**Yes**	∗∗
Brentwood 1	Aug 95		●					**Yes**	∗∗
Bromley 5	Mar 96				●			**Yes**	∗∗
Croydon 6	Jan 01		●					**Yes**	∗∗
Enfield 1	Jul 95		●					**Yes**	∗∗
Haringey 2	Apr 96		●		●	**B**		**Yes**	∗∗**A**
Havering 2	Apr 98	Closed Nov 2000							
Harrow	Apr 99		●	●		**T**		**Yes**	∗∗
Hounslow 2	Apr 99		●	●	●	**T**		**Yes**	∗∗
Kingston 1	Mar 96				●			**Yes**	∗∗
Mole Valley 2	Apr 97		●			**T**		**Yes**	∗∗
Reigate & Bans 1	Jul 00		●			**T**		**Yes**	∗∗
Richmond 2	Apr 01		●		●	**T**		**Yes**	∗∗
Richmond 7	Apr 02	●	●	●	●	**T**		**Yes**	∗
Sutton 2	May 95		●					**Yes**	∗∗
Sutton 3	May 95		●		●			**Yes**	∗∗**A**
Wandsworth 3	Oct 94	Closed Nov 2000							

A.1.5 Rural Sites

	Start	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$	Data	Quality
Mole Valley 1	Mar 96	Closed Mar 1999							
S'oaks Scudders H	Sept 95	Closed Sept 1997							

Key: T =TEOM, B=Beta Attenuation, G= Gravimetric, ∗Locality Standard, ∗∗Traceability to National Standards
A1= Affiliated to UK AURN – ratified data supplied to LAQN by NPL - final data set published by DEFRA
A2= Affiliated to UK AURN – final data set published by DEFRA

A.1.6 Principal Site Changes During 2002

- The Barnet 3 site was temporarily shut down due to a local construction project.

- The Greenwich 7 monitoring site joined the network during March. The site is located in a roadside position on Blackheath Hill. Blackheath Hill is part of the alternative route for heavy goods vehicles that cannot travel through the centre of Greenwich. The site monitors NO_X and PM_{10} (TEOM).

- The roadside site Hackney 6 site joined the LAQN in November. The site is located at Old Street and monitors NO_X and PM_{10} (TEOM). Being adjacent to the Inner Ring Road, the site will be useful to assess any air quality impacts arising from the Congestion Charging Scheme. The inclusion of this site in the LAQN is supported by Transport for London.

- The Hillingdon 2 site joined the network during September. The site monitors NO_X and PM_{10} (TEOM) at a roadside location close to Hillingdon Hospital. The site was severely affected by data logger problems and did not become fully operational until summer 2003.

- The Kensington and Chelsea 5 roadside site was installed during May. The site is located on Earls Court Road and monitors PM_{10} using a gravimetric sampler. The site is an important expansion to the gravimetric PM_{10} monitoring in London.

- The Lewisham 2 roadside site joined the LAQN at the end of March. The site is located near New Cross on the A2. The site monitors NO_X, SO_2 and PM_{10} (TEOM) and is positioned in line with the building façades along the road. This increases LAQN coverage along the A2 trunk road to 4 monitoring sites.

- An O_3 analyser was added to the Richmond 2 suburban site. Despite the expansion in the LAQN during recent years the extent of O_3 monitoring in London has not increased, despite the health concerns associated with this pollutant. The new O_3 analyser is a welcome addition to the LAQN.

- The Richmond mobile site was deployed in three separate locations during the year.

- A TEOM measuring PM_{10} was added to the Southwark 1 background site at the end of October. This analyser will improve the monitoring of PM_{10} in background locations in south inner London.

- At the start of May the 3 Sutton monitoring sites were closed. These sites had operated since 1995 and their closure will diminish the London wide medium term analysis of air pollution trends. However, the Sutton 4 kerbside site joined the LAQN during July. The site, monitoring NO_X and $PM_{10,}$ (TEOM) is located in Wallington in a busy shopping area

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DEFRA DIRECTLY FUNDED SITES

APPENDIX 2: DEFRA DIRECTLY FUNDED SITES

A.2.0 Roadside Sites

	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$
A3	●	●			T	
Cromwell Rd	●	●	●		#	

A.2.1 Background Sites

	CO	NO_2	SO_2	O_3	PM_{10}	$PM_{2.5}$
Bloomsbury	●	●	●	●	T	T
Hillingdon	●	●	●	●	T	
Teddington		●	●	●		
Westminster	●	●	●	●	G	
West London	●	●				

Key: T =TEOM, B=Beta Attenuation, G= Gravimetric.
 # Reported as LAQN site Kensington & Chelsea 2.

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SUMMARY OF RESULTS

APPENDIX 3: SUMMARY OF MONITORING RESULTS

A.3.0 Carbon Monoxide

Carbon Monoxide	Type	Capture Rate (%)	Days Moderate and Above
A3	R	97	0
Bexley 1	U	90	0
Bexley 5	S	85	0
Bloomsbury	U	88	0
Brent 1	U	99	0
Bromley 7	R	92	0
Crystal Palace 1	R	96	0
Ealing 2	R	98	0
Enfield 2	R	95	0
Enfield 3	U	84	0
Hackney 4	U	86	0
Heathrow Airport	U	97	0
Hillingdon	S	86	0
Hounslow 1	R	84	0
Islington 2	R	77	0
Kens and Chelsea 1	U	96	0
Kens and Chelsea 2	R	93	0
Marylebone Rd	K	97	0
Redbridge 2	K	98	0
Redbridge 4	R	94	0
Richmond 7	S	35	0
Richmond 9	K	17	0
Richmond 11	K	11	0
Sevenoaks 2	S	91	0
Southwark 1	U	95	0
Southwark 2	R	84	0
Sutton 1	R	32	0
Thurrock	U	97	0

Carbon Monoxide	Type	Capture Rate (%)	Days Moderate and Above
Tower Hamlets 2	R	98	0
Wandsworth 2	U	94	0
Wandsworth 4	R	91	0
West London	U	96	0
Westminster	U	94	0

Carbon Monoxide	Type	No occurrences of rolling 8hr mean >=10mgm^{-3} (8.6ppb)	Achieved
A3	R	0	YES
Bexley 1	U	0	YES
Bexley 5	S	0	NA
Bloomsbury	U	0	NA
Brent 1	U	0	YES
Bromley 7	R	0	YES
Crystal Palace 1	R	0	YES
Ealing 2	R	0	YES
Enfield 2	R	0	YES
Enfield 3	U	0	NA
Hackney 4	U	0	NA
Heathrow Airport	U	0	YES
Hillingdon	S	0	NA
Hounslow 1	R	0	NA
Islington 2	R	0	NA
Kens and Chelsea 1	U	0	YES
Kens and Chelsea 2	R	0	YES
Marylebone Rd	K	0	YES
Redbridge 2	K	0	YES
Redbridge 4	R	0	YES
Richmond 11	K	0	NA
Richmond 7	S	0	NA
Richmond 9	K	0	NA
Sevenoaks 2	S	0	YES
Southwark 1	U	0	YES
Southwark 2	R	0	NA
Sutton 1	R	0	NA

Carbon Monoxide	Type	No occurrences of rolling 8hr mean >=10mgm^{-3} (8.6ppb)	Achieved
Thurrock	U	0	YES
Tower Hamlets 2	R	0	YES
Wandsworth 2	U	0	YES
Wandsworth 4	R	0	YES
West London	U	0	YES
Westminster	U	0	YES

A.3.1 Nitrogen Oxides

Nitrogen Oxides	Type	Capture Rate (%)
A3	R	88
Barking & Dagenham 1	S	98
Barnet 1	K	86
Barnet 2	U	72
Barnet 3	U	36
Bexley 1	U	89
Bexley 2	S	98
Bexley 5	S	97
Bloomsbury	U	9
Brent 1	U	98
Brent 2	R	63
Brent 3	U	84
Brentwood 1	U	89
Bromley 7	R	97
Camden 1	K	96
Camden 3	R	98
Castle Point 1	U	99
City of London 1	U	94
Croydon 2	R	98
Croydon 4	R	92
Croydon 5	K	97
Croydon 6	S	99
Crystal Palace 1	R	82
Ealing 1	U	92
Ealing 2	R	95
Enfield 1	S	99
Enfield 2	R	96
Enfield 3	U	94
Enfield 4	R	92
Greenwich 4	U	98
Greenwich 5	R	99
Greenwich 7	R	71
Greenwich Bexley 6	R	98
Hackney 4	U	88

Nitrogen Oxides	Type	Capture Rate (%)
Hackney 6	R	11
Haringey 1	R	98
Haringey 2	S	98
Harrow 1	U	96
Havering 1	R	98
Havering 3	R	96
Heathrow Airport	U	95
Hillingdon	S	96
Hillingdon 1	R	97
Hillingdon 2	R	2
Hounslow 1	R	82
Hounslow 2	S	96
Hounslow 4	R	79
H'smith and Fulham 1	R	80
Islington 1	U	96
Islington 2	R	84
Kens and Chelsea 1	U	98
Kens and Chelsea 2	R	95
Kens and Chelsea 3	R	97
Kens and Chelsea 4	R	99
Lambeth 1	R	99
Lambeth 2	R	99
Lambeth 3	U	99
Lewisham 1	U	93
Lewisham 2	R	75
Marylebone Rd	K	98
Mole Valley 2	S	99
Mole Valley 3	U	99
Redbridge 1	U	96
Redbridge 2	K	97
Redbridge 3	K	95
Redbridge 4	R	94
Reigate and Banstead 1	S	99
Richmond 1	R	98
Richmond 2	S	36

Nitrogen Oxides	Type	Capture Rate (%)
Richmond 7	S	35
Richmond 9	K	17
Richmond 11	K	11
Sevenoaks 2	S	99
Southwark 1	U	84
Southwark 2	R	86
Sutton 1	R	31
Sutton 2	U	30
Sutton 3	S	33
Sutton 4	K	45
Teddington	U	98
Thurrock	U	94
Tower Hamlets 1	U	97
Tower Hamlets 2	R	98
Tower Hamlets 3	U	91
Waltham Forest 1	U	98
Wandsworth 2	U	98
Wandsworth 4	R	97
West London	U	96
Westminster	U	97

Nitrogen Oxides	Type	Annual Mean NO_X ppb	Annual Mean NO_X as NO_2 μgm^{-3}
A3	R	87	167
Barking & Dagenham 1	S	25	48
Barnet 1	K	106	203
Barnet 2	U	32	60
Barnet 3	U	44	85
Bexley 1	U	29	55
Bexley 2	S	29	56
Bexley 5	S	23	45
Bloomsbury	U	51	97
Brent 1	U	27	52
Brent 2	R	150	287
Brent 3	U	65	124
Brentwood 1	U	25	48
Bromley 7	R	42	81
Camden 1	K	82	157
Camden 3	R	85	162
Castle Point 1	U	19	36
City of London 1	U	47	90
Croydon 2	R	78	149
Croydon 4	R	57	109
Croydon 5	K	117	224
Croydon 6	S	35	68
Crystal Palace 1	R	64	123
Ealing 1	U	38	72
Ealing 2	R	78	149
Enfield 1	S	28	54
Enfield 2	R	45	87
Enfield 3	U	29	56
Enfield 4	R	57	109
Greenwich 4	U	25	47
Greenwich 5	R	65	124
Greenwich 7	R	53	101
Greenwich Bexley 6	R	81	155
Hackney 4	U	52	99

Nitrogen Oxides	Type	Annual Mean NO_X ppb	Annual Mean NO_X as NO_2 μgm^{-3}
Hackney 6	R	91	174
Haringey 1	R	57	108
Haringey 2	S	31	59
Harrow 1	U	24	46
Havering 1	R	49	93
Havering 3	R	55	105
Heathrow Airport	U	62	119
Hillingdon	S	59	113
Hillingdon 1	R	69	132
Hillingdon 2	R	86	165
Hounslow 1	R	69	131
Hounslow 2	S	38	73
Hounslow 4	R	81	155
H'smith and Fulham 1	R	94	180
Islington 1	U	39	75
Islington 2	R	108	206
Kens and Chelsea 1	U	34	65
Kens and Chelsea 2	R	100	191
Kens and Chelsea 3	R	120	229
Kens and Chelsea 4	R	131	251
Lambeth 1	R	67	128
Lambeth 2	R	68	130
Lambeth 3	U	34	65
Lewisham 1	U	58	110
Lewisham 2	R	64	121
Marylebone Rd	K	157	299
Mole Valley 2	S	21	40
Mole Valley 3	U	23	44
Redbridge 1	U	34	65
Redbridge 2	K	166	316
Redbridge 3	K	88	168
Redbridge 4	R	63	120
Reigate and Banstead 1	S	25	47
Richmond 1	R	46	88
Richmond 2	S	31	59

Nitrogen Oxides	Type	Annual Mean NO_X ppb	Annual Mean NO_X as NO_2 μgm^{-3}
Richmond 7	S	13	25
Richmond 9	K	117	224
Richmond 11	K	89	170
Sevenoaks 2	S	18	35
Southwark 1	U	47	89
Southwark 2	R	81	154
Sutton 1	R	46	87
Sutton 2	U	32	60
Sutton 3	S	30	57
Sutton 4	K	99	189
Teddington	U	20	39
Thurrock	U	35	66
Tower Hamlets 1	U	34	64
Tower Hamlets 2	R	97	186
Tower Hamlets 3	U	39	74
Waltham Forest 1	U	33	63
Wandsworth 2	U	61	117
Wandsworth 4	R	52	99
West London	U	41	78
Westminster	U	41	79

A.3.2 Nitrogen Dioxide

Nitrogen Dioxide	Type	Capture Rate (%)	Days moderate and above
A3	R	88	1
Barking & Dagenham 1	S	98	0
Barnet 1	K	86	0
Barnet 2	U	72	0
Barnet 3	U	36	0
Bexley 1	U	89	0
Bexley 2	S	98	0
Bexley 5	S	97	0
Bloomsbury	U	9	0
Brent 1	U	98	0
Brent 2	R	63	0
Brent 3	U	84	0
Brentwood 1	U	89	0
Bromley 7	R	97	0
Camden 1	K	96	0
Camden 3	R	98	0
Castle Point 1	U	99	0
City of London 1	U	94	0
Croydon 2	R	98	0
Croydon 4	R	92	0
Croydon 5	K	97	0
Croydon 6	S	99	0
Crystal Palace 1	R	82	0
Ealing 1	U	92	0
Ealing 2	R	95	0
Enfield 1	S	99	0
Enfield 2	R	96	0
Enfield 3	U	94	0
Enfield 4	R	92	0
Greenwich 4	U	98	0
Greenwich 5	R	99	0
Greenwich 7	R	71	0
Greenwich Bexley 6	R	98	0
Hackney 4	U	88	0

Nitrogen Dioxide	Type	Capture Rate (%)	Days moderate and above
Hackney 6	R	11	0
Haringey 1	R	98	0
Haringey 2	S	98	0
Harrow 1	U	96	0
Havering 1	R	98	0
Havering 3	R	96	0
Heathrow Airport	U	95	0
Hillingdon	S	96	0
Hillingdon 1	R	97	0
Hillingdon 2	R	2	0
Hounslow 1	R	82	0
Hounslow 2	S	96	0
Hounslow 4	R	79	0
H'smith and Fulham 1	R	80	0
Islington 1	U	96	0
Islington 2	R	84	0
Kens and Chelsea 1	U	98	0
Kens and Chelsea 2	R	95	0
Kens and Chelsea 3	R	97	4
Kens and Chelsea 4	R	99	0
Lambeth 1	R	99	0
Lambeth 2	R	99	0
Lambeth 3	U	99	0
Lewisham 1	U	93	0
Lewisham 2	R	75	0
Marylebone Rd	K	98	0
Mole Valley 2	S	99	0
Mole Valley 3	U	99	0
Redbridge 1	U	96	0
Redbridge 2	K	97	55
Redbridge 3	K	95	0
Redbridge 4	R	94	0
Reigate and Banstead 1	S	99	0
Richmond 1	R	98	0
Richmond 2	S	36	0

Nitrogen Dioxide	Type	Capture Rate (%)	Days moderate and above
Richmond 7	S	35	0
Richmond 9	K	17	0
Richmond 11	K	11	0
Sevenoaks 2	S	99	0
Southwark 1	U	84	0
Southwark 2	R	86	0
Sutton 1	R	31	0
Sutton 2	U	30	0
Sutton 3	S	33	0
Sutton 4	K	45	0
Teddington	U	98	0
Thurrock	U	94	0
Tower Hamlets 1	U	97	0
Tower Hamlets 2	R	98	0
Tower Hamlets 3	U	91	0
Waltham Forest 1	U	98	0
Wandsworth 2	U	98	0
Wandsworth 4	R	97	0
West London	U	96	0
Westminster	U	97	0

Nitrogen Dioxide	Type	Annual Mean less than 21 ppb	Annual Mean less than 40 μgm^{-3}	Achieved
A3	R	30	58	NA
Barking & Dagenham 1	S	17	32	YES
Barnet 1	K	36	69	NA
Barnet 2	U	18	34	NA
Barnet 3	U	22	43	NA
Bexley 1	U	16	31	NA
Bexley 2	S	17	32	YES
Bexley 5	S	16	30	YES
Bloomsbury	U	23	43	NA
Brent 1	U	15	29	YES
Brent 2	R	36	69	NA
Brent 3	U	27	51	NA
Brentwood 1	U	17	32	NA

Nitrogen Dioxide	Type	Annual Mean less than 21 ppb	Annual Mean less than 40 µgm^{-3}	Achieved
Bromley 7	R	22	41	NO
Camden 1	K	35	66	NO
Camden 3	R	36	68	NO
Castle Point 1	U	14	26	YES
City of London 1	U	26	50	NO
Croydon 2	R	24	46	NO
Croydon 4	R	26	50	NO
Croydon 5	K	34	65	NO
Croydon 6	S	18	35	YES
Crystal Palace 1	R	24	47	NA
Ealing 1	U	19	37	YES
Ealing 2	R	27	51	NO
Enfield 1	S	17	32	YES
Enfield 2	R	23	43	NO
Enfield 3	U	18	33	YES
Enfield 4	R	25	47	NO
Greenwich 4	U	15	29	YES
Greenwich 5	R	28	54	NO
Greenwich 7	R	26	50	NA
Greenwich Bexley 6	R	25	49	NO
Hackney 4	U	24	46	NA
Hackney 6	R	33	62	NA
Haringey 1	R	24	46	NO
Haringey 2	S	18	35	YES
Harrow 1	U	15	28	YES
Havering 1	R	23	44	NO
Havering 3	R	21	41	NO
Heathrow Airport	U	27	52	NO
Hillingdon	S	24	45	NO
Hillingdon 1	R	23	44	NO
Hillingdon 2	R	32	60	NA
Hounslow 1	R	30	58	NA
Hounslow 2	S	23	43	NO
Hounslow 4	R	31	58	NA
H'smith and Fulham 1	R	31	58	NA

Nitrogen Dioxide	Type	Annual Mean less than 21 ppb	Annual Mean less than 40 µgm^{-3}	Achieved
Islington 1	U	23	45	NO
Islington 2	R	37	70	NA
Kens and Chelsea 1	U	21	39	YES
Kens and Chelsea 2	R	38	72	NO
Kens and Chelsea 3	R	44	85	NO
Kens and Chelsea 4	R	44	84	NO
Lambeth 1	R	29	55	NO
Lambeth 2	R	30	57	NO
Lambeth 3	U	20	39	YES
Lewisham 1	U	26	50	NO
Lewisham 2	R	24	46	NA
Marylebone Rd	K	42	80	NO
Mole Valley 2	S	13	26	YES
Mole Valley 3	U	13	25	YES
Redbridge 1	U	19	37	YES
Redbridge 2	K	64	122	NO
Redbridge 3	K	35	67	NO
Redbridge 4	R	25	48	NO
Reigate and Banstead 1	S	16	31	YES
Richmond 1	R	23	44	NO
Richmond 2	S	17	32	NA
Richmond 7	S	11	20	NA
Richmond 9	K	44	84	NA
Richmond 11	K	30	58	NA
Sevenoaks 2	S	11	21	YES
Southwark 1	U	24	46	NA
Southwark 2	R	30	58	NA
Sutton 1	R	20	38	NA
Sutton 2	U	20	38	NA
Sutton 3	S	16	31	NA
Sutton 4	K	34	66	NA
Teddington	U	13	25	YES
Thurrock	U	19	36	YES
Tower Hamlets 1	U	21	40	NO
Tower Hamlets 2	R	32	61	NO

Nitrogen Dioxide	Type	Annual Mean less than 21 ppb	Annual Mean less than 40 µgm^{-3}	Achieved
Tower Hamlets 3	U	23	43	NO
Waltham Forest 1	U	20	38	YES
Wandsworth 2	U	27	52	NO
Wandsworth 4	R	23	44	NO
West London	U	24	46	NO
Westminster	U	23	43	NO

Nitrogen Dioxide	Type	No more than 18 occurrences of hourly mean >=200µgm^{-3} (104.6ppb)	Achieved
A3	R	6	NA
Barking & Dagenham 1	S	0	YES
Barnet 1	K	6	NA
Barnet 2	U	0	NA
Barnet 3	U	0	NA
Bexley 1	U	0	NA
Bexley 2	S	0	YES
Bexley 5	S	0	YES
Bloomsbury	U	0	NA
Brent 1	U	0	YES
Brent 2	R	1	NA
Brent 3	U	1	NA
Brentwood 1	U	0	NA
Bromley 7	R	0	YES
Camden 1	K	2	YES
Camden 3	R	0	YES
Castle Point 1	U	0	YES
City of London 1	U	0	YES
Croydon 2	R	0	YES
Croydon 4	R	1	YES
Croydon 5	K	4	YES
Croydon 6	S	0	YES
Crystal Palace 1	R	0	NA
Ealing 1	U	0	YES
Ealing 2	R	0	YES

Nitrogen Dioxide	Type	No more than 18 occurrences of hourly mean >=200µgm^{-3} (104.6ppb)	Achieved
Enfield 1	S	0	YES
Enfield 2	R	0	YES
Enfield 3	U	0	YES
Enfield 4	R	0	YES
Greenwich 4	U	0	YES
Greenwich 5	R	0	YES
Greenwich 7	R	4	NA
Greenwich Bexley 6	R	0	YES
Hackney 4	U	0	NA
Hackney 6	R	0	NA
Haringey 1	R	0	YES
Haringey 2	S	0	YES
Harrow 1	U	0	YES
Havering 1	R	0	YES
Havering 3	R	0	YES
Heathrow Airport	U	0	YES
Hillingdon	S	0	YES
Hillingdon 1	R	0	YES
Hillingdon 2	R	0	NA
Hounslow 1	R	4	NA
Hounslow 2	S	0	YES
Hounslow 4	R	0	NA
H'smith and Fulham 1	R	0	NA
Islington 1	U	0	YES
Islington 2	R	1	NA
Kens and Chelsea 1	U	0	YES
Kens and Chelsea 2	R	0	YES
Kens and Chelsea 3	R	154	NO
Kens and Chelsea 4	R	0	YES
Lambeth 1	R	0	YES
Lambeth 2	R	1	YES
Lambeth 3	U	0	YES
Lewisham 1	U	0	YES

Nitrogen Dioxide	Type	No more than 18 occurrences of hourly mean >=200µgm^{-3} (104.6ppb)	Achieved
Lewisham 2	R	0	NA
Marylebone Rd	K	2	YES
Mole Valley 2	S	0	YES
Mole Valley 3	U	0	YES
Redbridge 1	U	0	YES
Redbridge 2	K	963	NO
Redbridge 3	K	5	YES
Redbridge 4	R	0	YES
Reigate and Banstead 1	S	0	YES
Richmond 1	R	0	YES
Richmond 2	S	0	NA
Richmond 7	S	0	NA
Richmond 9	K	1	NA
Richmond 11	K	0	NA
Sevenoaks 2	S	0	YES
Southwark 1	U	0	NA
Southwark 2	R	0	NA
Sutton 1	R	0	NA
Sutton 2	U	0	NA
Sutton 3	S	0	NA
Sutton 4	K	2	NA
Teddington	U	0	YES
Thurrock	U	0	YES
Tower Hamlets 1	U	0	YES
Tower Hamlets 2	R	2	YES
Tower Hamlets 3	U	0	YES
Waltham Forest 1	U	0	YES
Wandsworth 2	U	0	YES
Wandsworth 4	R	0	YES
West London	U	0	YES
Westminster	U	0	YES

A.3.3 Ozone

Ozone	Type	Capture Rate (%)	Days moderate and above
Bexley 1	U	96	28
Bloomsbury	U	89	4
Brent 1	U	99	20
Bromley 5	S	97	39
City of London 1	U	92	5
Croydon 3	S	99	15
Ealing 1	U	98	11
Enfield 3	U	95	36
Greenwich 4	U	97	21
Hackney 4	U	89	10
Haringey 2	S	98	13
Hillingdon	S	97	11
Hounslow 2	S	96	10
Kens and Chelsea 1	U	99	14
Kingston 1	S	99	29
Lewisham 1	U	83	8
Marylebone Rd	K	97	1
Redbridge 1	U	98	29
Richmond 2	S	11	0
Richmond 7	S	35	21
Richmond 9	K	17	0
Richmond 11	K	11	0
Sevenoaks 2	S	99	59
Southwark 1	U	94	12
Sutton 3	S	33	3
Teddington	U	98	58
Thurrock	U	96	27
Tower Hamlets 1	U	99	17
Wandsworth 2	U	99	9
Westminster	U	96	13

Ozone	Type	No more than 10 days where maximum rolling 8hr mean >=100µgm^{-3} (50ppb)	Achieved
Bexley 1	U	12	NO
Bloomsbury	U	2	NA
Brent 1	U	10	YES
Bromley 5	S	17	NO
City of London 1	U	3	YES
Croydon 3	S	9	YES
Ealing 1	U	3	YES
Enfield 3	U	20	NO
Greenwich 4	U	11	NO
Hackney 4	U	6	NA
Haringey 2	S	8	YES
Hillingdon	S	7	YES
Hounslow 2	S	6	YES
Kens and Chelsea 1	U	7	YES
Kingston 1	S	15	NO
Lewisham 1	U	3	NA
Marylebone Rd	K	0	YES
Redbridge 1	U	12	NO
Richmond 11	K	0	NA
Richmond 2	S	0	NA
Richmond 7	S	11	NO
Richmond 9	K	0	NA
Sevenoaks 2	S	28	NO
Southwark 1	U	7	YES
Sutton 3	S	1	NA
Teddington	U	25	NO
Thurrock	U	11	NO
Tower Hamlets 1	U	10	YES
Wandsworth 2	U	3	YES
Westminster	U	6	YES

A.3.4 PM_{10}

PM_{10}	Type	Instrument	Capture Rate (%)	Days moderate and above
A3	R	T	96	0
Barking & Dagenham 2	S	T	70	12
Barnet 1	K	T	83	34
Barnet 2	U	T	99	1
Barnet 3	U	T	34	5
Bexley 1	U	T	98	7
Bexley 2	S	T	82	7
Bexley 3	S	T	98	7
Bexley 4	R	T	95	99
Bloomsbury	U	T	35	23
Brent 1	U	T	98	3
Brent 2	R	T	66	16
Brent 3	U	T	88	8
Bromley 7	R	B	92	(33)
Camden 1	K	T	99	1
Camden 3	R	T	98	13
Croydon 3	S	T	95	3
Croydon 4	R	T	98	8
Crystal Palace 1	R	T	99	5
Ealing 2	R	T	96	13
Enfield 2	R	B	89	(68)
Enfield 3	U	B	93	(48)
Enfield 4	R	B	91	(123)
Greenwich 4	U	T	94	1
Greenwich 5	R	T	95	6
Greenwich 7	R	T	81	34
Greenwich Bexley 6	R	T	99	10
Hackney 6	R	T	7	7
Haringey 1	R	T	98	9
Haringey 2	S	B	87	(50)
Harrow 1	U	T	99	6
Havering 3	R	T	96	1
Heathrow Airport	U	T	97	7
Hillingdon	S	T	97	0

PM_{10}	Type	Instrument	Capture Rate (%)	Days moderate and above
Hillingdon 1	R	T	96	10
Hillingdon 2	R	T	2	0
Hounslow 2	S	T	92	3
Hounslow 3	R	T	85	12
Hounslow 4	R	T	70	6
H'smith and Fulham 1	R	T	82	9
Islington 1	U	T	99	8
Islington 2	R	T	84	10
Kens and Chelsea 1	U	T	98	2
Kens and Chelsea 1	U	G - Partisol	87	NA
Kens and Chelsea 2	R	T	95	10
Kens and Chelsea 5	R	G - Partisol	62	NA
Lambeth 1	R	B	96	(87)
Lambeth 2	R	B	94	(103)
Lambeth 3	U	B	97	(60)
Lewisham 2	R	T	54	10
Marylebone Rd	K	T	98	50
Marylebone Rd	K	G -Partisol	68	NA
Marylebone Rd	K	G- KFG	90	NA
Mole Valley 2	S	T	96	0
Mole Valley 3	U	T	99	2
Redbridge 1	U	B	95	(62)
Redbridge 3	K	B	97	(106)
Redbridge 4	R	B	96	(86)
Reigate and Banstead 1	S	T	99	0
Richmond 1	R	T	91	1
Richmond 2	S	T	29	0
Richmond 7	S	T	24	0
Richmond 9	K	T	13	0
Richmond 11	K	T	11	0
Sevenoaks 2	S	T	98	0
Southwark 1	U	T	16	1
Southwark 2	R	T	71	9
Sutton 1	R	T	32	2
Sutton 4	K	T	43	2

PM_{10}	Type	Instrument	Capture Rate (%)	Days moderate and above
Thurrock 1	U	T	82	11
Thurrock 1	U	G - KFG	70	NA
Tower Hamlets 1	U	T	96	3
Tower Hamlets 3	U	T	90	6
Waltham Forest 1	U	T	98	3
Wandsworth 4	R	T	97	6

Instrument type; T = TEOM, B = BAM, G = Gravimetric (and type).

PM_{10}	Type	Instrument	No more than 35 days where daily mean >=50μgm^{-3} (TEOM *1.3, BAM *1)	Achieved
A3	R	T	3	YES
Barking & Dagenham 2	S	T	21	NA
Barnet 1	K	T	48	NO
Barnet 2	U	T	8	YES
Barnet 3	U	T	10	NA
Bexley 1	U	T	11	YES
Bexley 2	S	T	14	NA
Bexley 3	S	T	15	YES
Bexley 4	R	T	98	NO
Bloomsbury	U	T	23	NA
Brent 1	U	T	11	YES
Brent 2	R	T	37	NO
Brent 3	U	T	16	NA
Bromley 7	R	B	15	YES
Camden 1	K	T	16	YES
Camden 3	R	T	32	YES
Croydon 3	S	T	5	YES
Croydon 4	R	T	18	YES
Crystal Palace 1	R	T	6	YES
Ealing 2	R	T	19	YES
Enfield 2	R	B	45	NO
Enfield 3	U	B	28	YES
Enfield 4	R	B	84	NO
Greenwich 4	U	T	5	YES
Greenwich 5	R	T	13	YES

PM_{10}	Type	Instrument	No more than 35 days where daily mean >=50µgm^{-3} (TEOM *1.3, BAM *1)	Achieved
Greenwich 7	R	T	43	NO
Greenwich Bexley 6	R	T	19	YES
Hackney 6	R	T	7	NA
Haringey 1	R	T	15	YES
Haringey 2	S	B	28	NA
Harrow 1	U	T	8	YES
Havering 3	R	T	7	YES
Heathrow Airport	U	T	15	YES
Hillingdon	S	T	7	YES
Hillingdon 1	R	T	16	YES
Hillingdon 2	R	T	1	NA
Hounslow 2	S	T	6	YES
Hounslow 3	R	T	27	NA
Hounslow 4	R	T	18	NA
H'smith and Fulham 1	R	T	24	NA
Islington 1	U	T	15	YES
Islington 2	R	T	27	NA
Kens and Chelsea 1	U	T	8	YES
Kens and Chelsea 1	U	G - Partisol	14	NA
Kens and Chelsea 2	R	T	36	NO
Kens and Chelsea 5	R	G - Partisol	28	NA
Lambeth 1	R	B	57	NO
Lambeth 2	R	B	65	NO
Lambeth 3	U	B	35	YES
Lewisham 2	R	T	17	NA
Marylebone Rd	K	T	111	NO
Marylebone Rd	K	G - Partisol	65	NO
Marylebone Rd	K	G - KFG	51	NO
Mole Valley 2	S	T	4	YES
Mole Valley 3	U	T	3	YES
Redbridge 1	U	B	34	YES
Redbridge 3	K	B	60	NO
Redbridge 4	R	B	50	NO
Reigate and Banstead 1	S	T	6	YES

PM_{10}	Type	Instrument	No more than 35 days where daily mean >=50µgm^{-3} (TEOM *1.3, BAM *1)	Achieved
Richmond 1	R	T	4	YES
Richmond 11	K	T	1	NA
Richmond 2	S	T	1	NA
Richmond 7	S	T	1	NA
Richmond 9	K	T	0	NA
Sevenoaks 2	S	T	5	YES
Southwark 1	U	T	1	NA
Southwark 2	R	T	25	NA
Sutton 1	R	T	4	NA
Sutton 4	K	T	8	NA
Thurrock 1	U	T	18	NA
Thurrock 1	U	G - KFG	25	NA
Tower Hamlets 1	U	T	10	YES
Tower Hamlets 3	U	T	13	YES
Waltham Forest 1	U	T	13	YES
Wandsworth 4	R	T	17	YES

Instrument type; T = TEOM, B = BAM, G = Gravimetric (and type).

PM_{10}	Type	Instrument	Annual Mean less than 40µgm^{-3} (TEOM *1.3, BAM *1)	Achieved
A3	R	T	24	YES
Barking & Dagenham 2	S	T	29	NA
Barnet 1	K	T	37	NA
Barnet 2	U	T	24	YES
Barnet 3	U	T	28	NA
Bexley 1	U	T	25	YES
Bexley 2	S	T	24	NA
Bexley 3	S	T	25	YES
Bexley 4	R	T	42	NO
Bloomsbury	U	T	37	NA
Brent 1	U	T	24	YES
Brent 2	R	T	38	NA
Brent 3	U	T	31	NA
Bromley 7	R	B	27	YES
Camden 1	K	T	31	YES

PM_{10}	Type	Instrument	Annual Mean less than 40µgm^{-3} (TEOM *1.3, BAM *1)	Achieved
Camden 3	R	T	34	YES
Croydon 3	S	T	23	YES
Croydon 4	R	T	29	YES
Crystal Palace 1	R	T	28	YES
Ealing 2	R	T	30	YES
Enfield 2	R	B	35	NA
Enfield 3	U	B	30	YES
Enfield 4	R	B	43	NO
Greenwich 4	U	T	23	YES
Greenwich 5	R	T	27	YES
Greenwich 7	R	T	35	NA
Greenwich Bexley 6	R	T	28	YES
Hackney 6	R	T	40	NA
Haringey 1	R	T	27	YES
Haringey 2	S	B	31	NA
Harrow 1	U	T	23	YES
Havering 3	R	T	24	YES
Heathrow Airport	U	T	28	YES
Hillingdon	S	T	25	YES
Hillingdon 1	R	T	28	YES
Hillingdon 2	R	T	37	NA
Hounslow 2	S	T	23	YES
Hounslow 3	R	T	33	NA
Hounslow 4	R	T	32	NA
H'smith and Fulham 1	R	T	35	NA
Islington 1	U	T	27	YES
Islington 2	R	T	35	NA
Kens and Chelsea 1	U	T	25	YES
Kens and Chelsea 1	U	G - Partisol	25	NA
Kens and Chelsea 2	R	T	37	YES
Kens and Chelsea 5	R	G - Partisol	36	NA
Lambeth 1	R	B	38	YES
Lambeth 2	R	B	38	YES
Lambeth 3	U	B	31	YES

PM_{10}	Type	Instrument	Annual Mean less than 40µgm^{-3} (TEOM *1.3, BAM *1)	Achieved
Lewisham 2	R	T	31	NA
Marylebone Rd	K	T	44	NO
Marylebone Rd	K	G - Partisol	44	NO
Marylebone Rd	K	G - KFG	37	NO
Mole Valley 2	S	T	22	YES
Mole Valley 3	U	T	22	YES
Redbridge 1	U	B	32	YES
Redbridge 3	K	B	36	YES
Redbridge 4	R	B	37	YES
Reigate and Banstead 1	S	T	23	YES
Richmond 1	R	T	25	YES
Richmond 2	S	T	20	NA
Richmond 7	S	T	20	NA
Richmond 9	K	T	29	NA
Richmond 11	K	T	29	NA
Sevenoaks 2	S	T	22	YES
Southwark 1	U	T	26	NA
Southwark 2	R	T	33	NA
Sutton 1	R	T	26	NA
Sutton 4	K	T	32	NA
Thurrock 1	U	T	27	NA
Thurrock 1	U	G - KFG	30	NA
Tower Hamlets 1	U	T	25	YES
Tower Hamlets 3	U	T	26	YES
Waltham Forest 1	U	T	25	YES
Wandsworth 4	R	T	27	YES

Instrument type; T = TEOM, B = BAM, G = Gravimetric (and type).

A.3.5 $PM_{2.5}$

$PM_{2.5}$	Type	Instrument	Capture Rate (%)	Annual Mean μgm^{-3}
Bexley 2	S	T	97	11
Bexley 3	S	T	99	13
Bloomsbury	U	T	87	14
Ealing 2	R	T	97	17
Greenwich Bexley 6	R	T	99	14
Hackney 4	U	T	85	17
Kens and Chelsea 1	U	G - Partisol	90	18
Marylebone Rd	K	T	93	21
Marylebone Rd	K	G - Partisol	78	25

Instrument type; T = TEOM, B = BAM, G = Gravimetric (and type).

A.3.6 Sulphur Dioxide

Sulphur Dioxide	Type	Capture Rate (%)	Days moderate and above
Barking & Dagenham 1	S	86	0
Bexley 1	U	87	0
Bexley 5	S	96	0
Bloomsbury	U	90	0
Brent 1	U	99	0
Brent 2	R	63	1
Brent 3	U	90	0
Castle Point 1	U	99	1
City of London 1	U	95	0
Croydon 4	R	94	0
Crystal Palace 1	R	89	0
Ealing 1	U	88	0
Enfield 3	U	78	1
Enfield 4	R	92	0
Greenwich 4	U	96	0
Haringey 1	R	95	0
Harrow 1	U	97	0
Havering 3	R	96	0
Hillingdon	S	97	0
Hounslow 2	S	96	0
Hounslow 4	R	80	0
H'smith and Fulham 1	R	70	0
Kens and Chelsea 1	U	99	0
Kens and Chelsea 2	R	85	0
Lambeth 1	R	95	0
Lambeth 2	R	93	0
Lambeth 3	U	87	0
Lewisham 1	U	96	0
Lewisham 2	R	75	0
Marylebone Rd	K	96	0
Redbridge 4	R	93	0
Richmond 7	S	35	0
Richmond 9	K	17	0
Richmond 11	K	8	0

Sulphur Dioxide	Type	Capture Rate (%)	Days moderate and above
Sevenoaks 2	T	99	0
Southwark 1	U	93	0
Southwark 2	R	85	0
Sutton 1	R	32	0
Teddington	U	99	0
Thurrock	U	97	1
Tower Hamlets 1	U	99	0
Tower Hamlets 3	U	91	0
Waltham Forest 1	U	96	0
Wandsworth 2	U	95	0
Westminster	U	91	0

Sulphur Dioxide	Type	No more than 35 occurrences of 15min mean >=266μgm^{-3} (100ppb)	Achieved
Barking & Dagenham 1	S	0	NA
Bexley 1	U	0	NA
Bexley 5	S	0	YES
Bloomsbury	U	0	YES
Brent 1	U	0	YES
Brent 2	R	1	NA
Brent 3	U	0	YES
Castle Point 1	U	2	YES
City of London 1	U	0	YES
Croydon 4	R	0	YES
Crystal Palace 1	R	0	NA
Ealing 1	U	0	NA
Enfield 3	U	2	NA
Enfield 4	R	0	YES
Greenwich 4	U	0	YES
Haringey 1	R	0	YES
Harrow 1	U	0	YES
Havering 3	R	0	YES
Hillingdon	S	0	YES
Hounslow 2	S	0	YES

Sulphur Dioxide	Type	No more than 35 occurrences of 15min mean >=266µgm^{-3} (100ppb)	Achieved
Hounslow 4	R	0	NA
H'smith and Fulham 1	R	0	NA
Kens and Chelsea 1	U	0	YES
Kens and Chelsea 2	R	0	NA
Lambeth 1	R	0	YES
Lambeth 2	R	0	YES
Lambeth 3	U	0	NA
Lewisham 1	U	0	YES
Lewisham 2	R	0	NA
Marylebone Rd	K	0	YES
Redbridge 4	R	0	YES
Richmond 7	S	0	NA
Richmond 9	K	0	NA
Richmond 11	K	0	NA
Sevenoaks 2	S	0	YES
Southwark 1	U	0	YES
Southwark 2	R	0	NA
Sutton 1	R	0	NA
Teddington	U	0	YES
Thurrock	U	1	YES
Tower Hamlets 1	U	0	YES
Tower Hamlets 3	U	0	YES
Waltham Forest 1	U	0	YES
Wandsworth 2	U	0	YES
Westminster	U	0	YES

A.3.7 1,3 Butadiene

1,3 Butadiene	Type	Instrument	Capture Rate (%)
Marylebone Road	K	GC	96
Tower Hamlets 2	R	GC	35

1,3 Butadiene	Type	Instrument	Annual Mean less than 2.25 μgm^{-3}	Achieved
Marylebone Road	K	GC	0.9	YES
Tower Hamlets 2	R	GC	0.4	NA

Instrument Type: PS = Pumped sampler GC = Gas Chromatograph.

A.3.8 Benzene

Benzene	Type	Instrument	Capture Rate (%)
Bloomsbury	U	PS	NA
Haringey 1	R	PS	NA
Marylebone Road	K	GC	96
Tower Hamlets 2	R	GC	37

Benzene	Type	Instrument	Annual Mean less than 16.25 μgm^{-3}	Achieved
Bloomsbury	U	PS	1.5	YES
Haringey 1	R	PS	2.7	YES
Marylebone Road	K	GC	3.9	YES
Tower Hamlets 2	R	GC	1.4	NA

Instrument Type: PS = Pumped sampler GC = Gas Chromatograph.

KING'S College LONDON

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AIR QUALITY STRATEGY OBJECTIVES & UK AIR QUALITY INFORMATION SYSTEM

APPENDIX 4: AIR QUALITY STRATEGY OBJECTIVES & UK AIR QUALITY INFORMATION SYSTEM

The following objectives are set out in the Air Quality Regulations for the purposes of Local Air Quality Management.

Pollutant	Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 μgm^{-3} (5 ppb)	Running Annual Mean	31 Dec 2003
1, 3 Butadiene	2.25 μgm^{-3} (1 ppb)	Running Annual Mean	31 Dec 2003
Carbon Monoxide	10 μgm^{-3} (8.6 ppb)	Running 8 hour mean	31 Dec 2003
Lead	0.5 μgm^{-3} 0.25 μgm^{-3}	Annual Mean Annual Mean	31 Dec 2003 31 Dec 2008
Nitrogen Dioxide (provisional)	200 μgm^{-3} (105 ppb) not to be exceeded more than 18 times a year 40 μgm^{-3} (21 ppb)	1 hour mean Annual Mean	31 Dec 2005 31 Dec 2005
Particles (PM_{10})	50 μgm^{-3} not to be exceeded more than 35 times a year 40 μgm^{-3}	24 hour mean Annual Mean	31 Dec 2004 31 Dec 2004
Sulphur Dioxide	350 μgm^{-3} (132 ppb) not to be exceeded more than 24 times a year 125 μgm^{-3} (47 ppb) not to be exceeded more than3 times a year 266 μgm^{-3} (100 ppb) not to be exceeded more than 35 times a year	1 hour mean 24 hour mean 15 minute mean	31 Dec 2004 31 Dec 2004 31 Dec 2005

The following objectives are not included in the Air Quality Regulations for the purposes of Local Air Quality Management.

Pollutant	Objective		Date to be achieved by
	Concentration	Measured as	
Objectives for the protection of human health			
Ozone (provisional)	100 µgm^{-3} (50 ppb) not to be exceeded more than 10 times per year	Daily maximum of running 8 hour mean	31 Dec 2005
Objectives for the protection of vegetation and ecosystems			
Nitrogen Oxides (assuming NO_X is taken as NO_2)	30 µgm^{-3} (16 ppb)	Annual mean	31 Dec 2000
Sulphur Dioxide	20 µgm^{-3} (8 ppb) 20 µgm^{-3} (8 ppb)	Annual Mean Winter Mean (1 Oct- 31 Mar)	31 Dec 2000 31 Dec 2000

The ‘descriptors’ applied to air pollution concentrations are defined by the UK Air Quality Information system.

Pollutant / Band	LOW	MODERATE	HIGH	VERY HIGH
Air Quality Index	**1 -3**	**4-6**	**7-9**	**10**
Sulphur Dioxide	below 100ppb, averaged over 15 minutes	100ppb, averaged over 15 minutes	200ppb, averaged over 15 minutes	400ppb, averaged over 15 minutes
Ozone	below 50ppb, as an 8 hour running average	50ppb, as an 8 hour running average or 50ppb averaged over one hour	90 ppb, averaged over one hour	180 ppb, averaged over one hour
Carbon Monoxide	below 10 ppm, as an 8 hour running average	10 ppm, as an 8 hour running average	15 ppm, as an 8 hour running average	20 ppm, as an 8 hour running average
Nitrogen Dioxide	below 150 ppb, averaged over one hour	150 ppb, averaged over one hour	300 ppb, averaged over one hour	400 ppb, averaged over one hour
PM_{10} Particles (by TEOM)	below 50 ug/m^3, as a 24 hour running average	50 ug/m^3, as a 24 hour running average	75 ug/m^3, as a 24 hour running average	100 ug/m^3, as a 24 hour running average