The South East Institute of Public Health (SEIPH) was originally formed in 1991 by the South East Thames Regional Health Authority, and is now part of King's College London. During 1999 the Environmental Research Group (ERG) at SEIPH joined the School of Health and Life Sciences enabling closer collaboration with other groups engaged in environmental research. SEIPH is a not for profit organisation.

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AIR QUALITY IN LONDON 1998

THE SIXTH REPORT OF THE LONDON AIR QUALITY NETWORK

SEIPH-Environmental Research Group
Kings College London
November 1999

CONTENTS

FOREWORD

The news on London's air quality in 1998 was mixed. The good news was evidence of downward trends for some pollutants and an absence of significant pollution "episodes", mainly due to a favourable run of weather. The bad news was further evidence that nitrogen dioxide concentrations in the Capital's air were limited more by the oxidising capacity of that air than by emissions of nitrogen oxides (NO_X). The clear and disturbing implication for air quality action plans is that reductions in emissions from vehicles and other sources of NO_X may not produce proportionate decreases in nitrogen dioxide.

For a sixth year the London Boroughs, districts around London and DETR have worked with the South East Institute of Public Health - Environmental Research Group (SEIPH-ERG) under the auspices of the Association of London Government and in close cooperation with the Association of London Environmental Health Managers to improve understanding of air quality in the capital and home counties by means of automatic air quality monitoring. Boroughs have added nine more stations to the London Air Quality Network (LAQN) so that the picture of London's air quality, which follows, is based on the most detailed observation and analysis yet. More than sixteen million pollutant, meteorological and traffic observations have been recorded in real time and immediately reported in synopsis on Teletext, the Internet by Email and by fax. As a result Londoners can access an up to the hour picture of their air quality. Hourly data has also been ratified for use in this report and for other public protection, conservation and research purposes.

The LAQN archive has provided a uniquely solid foundation for the reviews and assessments of air quality*, which local authorities have been carrying out during the year. Air quality management areas (AQMAs) will be declared on the basis of these assessments. Boroughs with AQMAs will then refine assessments and start to work with communities, neighbours and, in due course, the Mayor on action plans for attainment of the new air quality objectives. At the same time the Mayor will be producing his or her strategy for London's air quality, which will both guide Boroughs and inform the Mayor's views as consultee on their action plans. Security and appropriate development of LAQN will be a critical factor in delivering the necessary actions against the very tight timetable that has been set by Government.

Inevitably the effectiveness of air quality action plans will be uncertain at their inception. LAQN will therefore continue to play a vital role both in public confidence and the refinement of action plans and strategies through comparison of prediction and experience.

SEIPH-ERG remains committed to quality, innovation and partnership to ensure that LAQN can develop in a way which meets the very great future challenges ever more effectively and economically. Our new location on a Kings College campus at the very heart of London will enable us to strengthen links with our longstanding partners in government, business and research and facilitate new links with colleagues in Kings and the London academic community.

Finally I should record my thanks and appreciation to colleagues at SEIPH -ERG. It has been a privilege to work with an outstandingly able and professional team which has shown enormous dedication and productivity during a period of rapid change. Soon after this Report is published a new Professor of Environmental Sciences in the School will assume the responsibilities which I have discharged part-time for the past year and three quarters. This further change will anchor the Group more firmly in good science whilst protecting, I am sure, our traditional, collaborative, approach.

Tom Crossett

Acting Director, December 1999

ACKNOWLEDGEMENTS AND CONTACTS

The London Air Quality Network is a unique and valuable resource whose 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, Transport and Regions and the Government Office for London is also gratefully acknowledged.

The production of this report has truly been a team effort, which has been undertaken by staff who are both dedicated and committed to their work. Further information relating to this report (or related issues) can be gained through the following contacts.

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EXECUTIVE SUMMARY

This report summarises the results of the air pollution monitoring carried out by the London Air Quality Network (LAQN) during 1998.

During 1998 the LAQN expanded rapidly with the addition of a further nine monitoring sites.

Rolling annual averages for carbon monoxide (CO), oxides of nitrogen (NO_X), nitrogen dioxide (NO_2) and particulate matter (PM10) have been analysed for the period November 1996 to November 1999. This analysis shows reductions in the rolling annual average concentrations of CO, NO_X and PM10 across the LAQN. However, the NO_2 rolling annual averages show little overall change.

In contrast with previous years, no significant pollution episodes occurred during 1998.

Each of the pollutants monitored by the LAQN in 1998 has been analysed in terms of their spatial distribution, and compared to the current and proposed Air Quality Strategy (AQS) objectives (DETR, 1999).

- The annual average objective for NO_2 was exceeded at all roadside sites and inner London background sites.
- The current annual maximum hour objective for NO_2 was exceeded at Marylebone Road and Sutton 2 only. The proposed incident based NO_2 was exceeded at Marylebone Road only.
- Analyses of past data show that the current and proposed 'incident based' objectives were exceeded at a similar number of sites in three of the previous four years.
- The CO objective was exceeded at the Bromley kerbside site only.
- All London sites met the objective for sulphur dioxide. However, the objective was exceeded at Sevenoaks.
- The current PM10 objective was exceeded at all sites except Greenwich and St. Albans.
- The proposed PM10 objective was exceeded at Marylebone Road only.
- The objectives for benzene and 1,3 butadiene were met at all continuous monitoring sites.

AIR QUALITY IN 1998

AIR QUALITY IN 1998

1.1 Introduction

The purpose of this report is to review air quality in London during 1998. Measurements have been analysed with specific reference to the current National Air Quality Strategy (NAQS) objectives, and the proposed Air Quality Strategy objectives (AQS) likely to come into force during early 2000 (DETR, 1999). Full details of the sites in the London Air Quality Network (LAQN) in 1998 are presented in Appendix 2 and the detailed monitoring results are presented in Appendix 3.

The LAQN was formed in 1993 to co-ordinate and improve air pollution monitoring in London. At the end of November 1999, twenty-nine London Boroughs were supplying data to the LAQN. Increasingly, these data are being supplemented by data from local authorities around London allowing an overall perspective of air pollution in South East England. The LAQN is facilitated by the Association of London Government on behalf of the thirty-three London Boroughs and is operated and managed by SEIPH. The core LAQN activities are mainly funded by SEIPH itself, supplemented by funding from several of London's Health Authorities. SEIPH are funded by the DETR to maintain sixteen of the LAQN sites as affiliate sites to the UK Automatic Urban and Rural Network. This DETR support assists the operation of the overall LAQN.

1.2 Network Changes

During 1998 the following sites joined the network:

- Barnet 1: a kerbside site measuring PM10 and NO_2 located on the busy Tally-Ho corner.
- Bexley 2: A suburban site located in a school in Belvedere. The site monitors NO_2, PM10 and PM2.5.
- Bexley 3: A suburban site located on the edge of Thamesmead. The site monitors PM10 and PM2.5. The PM10 and PM2.5 measurements from Bexley 2 and Bexley 3, coupled with similar measurements at the roadside in Ealing, at Marylebone Road and Hackney, are essential to the understanding of the complex nature of particulate pollution across the capital.
- Bromley 7: During 1998 the Bromley kerbside site (Bromley 4) was closed and a new roadside site was opened around 200m to the south. The site monitors CO, NO_2, PM10 and PM2.5.
- Ealing Mobile: In the latter half of the year London Borough of Ealing commissioned a mobile monitoring site measuring NO_2, PM10 and SO_2. During 1998 the site was deployed at two locations within the London Borough of Ealing.
- East Hertfordshire 2: An urban site measuring PM10 and NO_2. The site is located in Sawbridgeworth and measures pollution in residential area near the M1.
- Enfield 3: An urban background site located in Edmonton in the east of the Borough monitoring CO, NO_2, O_3, PM10 and SO_2.
- Havering 3: A roadside site in the grounds of a hospital in central Romford. The site monitors NO_2, PM10 and SO_2. In addition, the site will supply valuable outer London roadside data and will inform the understanding of the sulphur dioxide pollution incidents affecting East London.
- Waltham Forest 1: An urban background site in Walthamstow monitoring NO_2, PM10 and SO_2. The site improves the distribution of non-roadside monitoring sites in London, providing valuable information about the background concentrations in the northeast suburbs.

- Wandsworth 4: The site monitors CO, NO_2 and PM10 and is located at the roadside opposite the Wandsworth 2 site. In addition to measuring the concentration of pollutants at a busy town centre gyratory, the combined data from Wandsworth 2 and Wandsworth 4 may assist the wider understanding of roadside pollution behaviour.

The majority of the these sites were funded by the Supplementary Credit Approval process, a DETR initiative allowing local authorities to borrow funds to finance capital equipment.

This year also saw expansion in the neighbouring Kent Air Quality Monitoring Network. Together, the results from the LAQN and Kent networks allow a perspective on air quality from Hertfordshire, through London to the Channel ports. Results from Kent Air Quality Monitoring Network sites can be found in The Kent Air Quality Monitoring Network Annual Reports (Barratt, 1998 and 1999).

1.3 Discussion of Results

Comparisons of 1998 results with national and international guidelines and standards are shown in Appendix 3.

When examining data it is important to consider the location of the monitoring site e.g. kerbside, urban background, rural, etc., and the data quality. The site type and quality assurance standard for each site is listed in Appendix 2. Sites are divided into three quality standards. Data from sites affiliated to the Automatic Urban and Rural Network (AURN) and London standard sites have traceabilty 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 the 1996 LAQN Annual Report (SEIPH, 1996). This suggests that a working uncertainty of around 10 % (2σ) should be considered when discussing high values and long term averages of CO, NO_2 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 a standard. 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 have been used to indicate the range of uncertainty in the figures below. There is some justification for a lower uncertainty of around 5% for O_3 measurements. The uncertainty associated with the measurement of PM10 is more complex and is discussed below.

Data are subject to two quality assurance processes. Initially data is validated as it is collected using the best calibration and instrument performance information available at the time. Data is retrospectively examined during the ratification process, using long term instrument histories and the results of further quality checks. Hence the final ratified data in this report for 1998 will differ from that initially published.

The final and definitive data sets for the AURN affiliated sites will be published by the DETR.

Each of the pollutants monitored by the LAQN in 1998 is discussed below in terms of their spatial distribution, and in comparison with the current and proposed Air Quality Strategy (AQS) objectives, (DETR, 1999). Many objectives require data representative of the whole year. If insufficient data were available (i.e. a data capture of less than 75% for the whole year), then comparison with the objective was not possible. This, for example, is the case for new sites.

1.3.1 Relative Results 1995 to 1999

During 1998 the weather conditions were such that there was an absence of prolonged periods of anticyclonic conditions during either winter or summer. As a result, no significant pollution incidents occurred during 1998. This is in contrast to the previous four years. For example during 1994 and 1997 London experienced significant winter pollution incidents, a prolonged secondary particulate episode occurred during 1996 and the hot summer of 1995 produced substantial photochemistry.

Data from November 1995 to November 1999 have been analysed to place the results from 1998 in context and rolling annual averages from November 1996 have been calculated in an attempt to eliminate seasonal effects. Further, to provide a perspective across the network as a whole, the rolling averages from each of the long term sites have been averaged to produce a LAQN rolling average. The results have been normalised 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. Five sites have been used for the rolling PM10 calculation, eight for CO and twelve for NO_X and NO_2. It should be noted that data from 1999 are still subject to ratification. The rolling annual averages are shown in Figure 1.1.

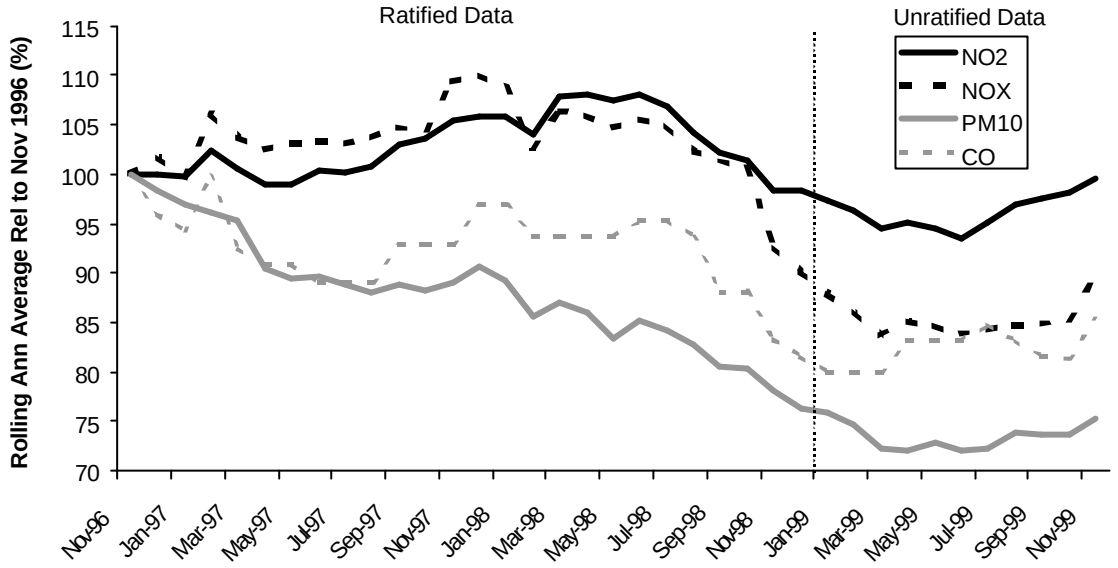

Figure 1.1 Relative Rolling Annual Averages.

The results shown in Figure 1.1 for CO, NO_X and PM10 show a decline up to Spring 1999 with a gradual increase during the later part of 1999. The effect of individual pollution incidents can be clearly seen. PM10 data up to Spring 1997 shows the influence of the large secondary pollutant episode during spring 1996. (SEIPH 1997). All pollutants show an increase around autumn 1997 due to the two very significant pollution episodes at this time. The smaller episodes during early 1997 can be seen to a lesser extent (SEIPH 1999). During 1998 the rolling averages for each pollutant decline with a large reduction occurring in the Autumn as the Autumn 1997 episodes are removed from the rolling average.

The overall downward trend of CO, PM10 and NO_X is in marked contrast to that of NO_2. The rolling NO_2 annual average at the end of the period is almost exactly the same as that at the beginning, despite a 11% relative reduction of NO_X concentrations. This may be due to the largely secondary nature of NO_2, with concentrations of NO_2 being dependent on both NO_X emissions and the oxidising capacity of the atmosphere.

1.3.2 Nitrogen Dioxide

NO_2 is largely a secondary pollutant formed by the oxidation of NO. The sum of NO and NO_2 is termed NO_X. 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 1998 being measured at roadside and central London locations. Lower concentrations were observed at background, suburban and rural areas. Generally, concentrations decrease with distance from central London.

The current NAQS stipulates two objectives for NO_2: an annual mean of 21 ppb and an annual maximum hourly average of 150 ppb. It is proposed to replace the maximum hour objective with an objective of 104.6 ppb (hourly average) not to be exceeded on more than 18 days per year.

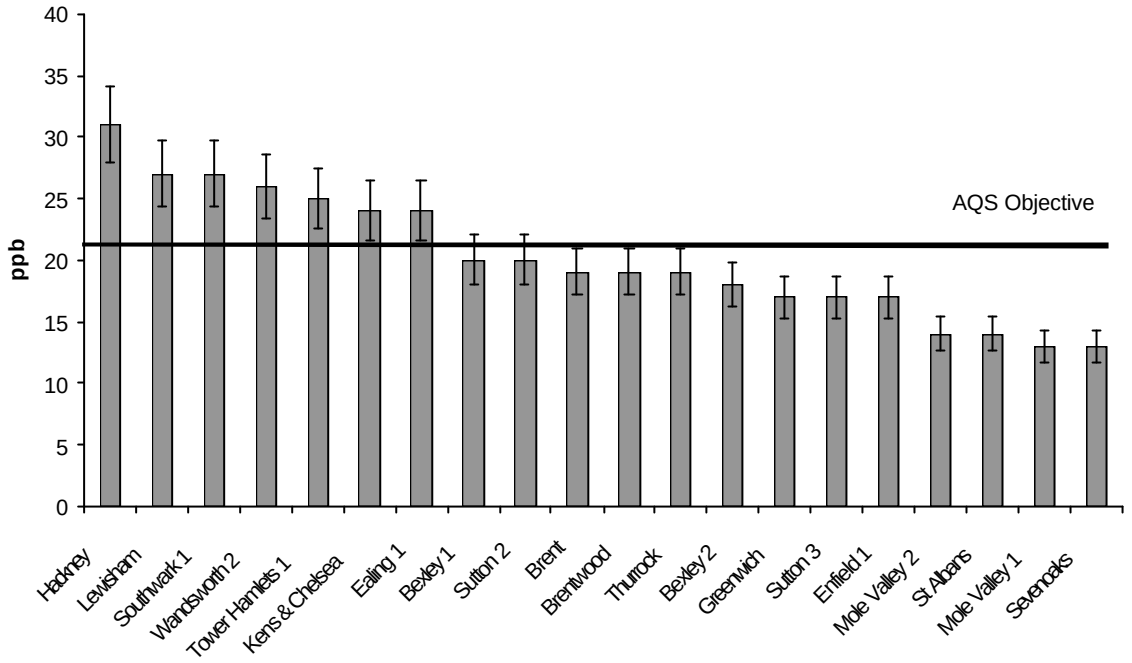

Figure 1.2 Background Annual Average NO_2 (1998)

Figure 1.2 shows the annual average NO_2 at the background sites across the network. Annual averages are highest in central and inner London and lower in suburban and rural areas. All inner and central sites exceed the objective. The outer west London site in Ealing comfortably exceeds the objective. Elsewhere Brent, Sutton 2 and Bexley 1 equal or exceed the objective within the boundaries of uncertainty. Outside London, the Essex sites at Brentwood and Thurrock measured annual averages similar to those in suburban London whereas the sites in Mole Valley, Sevenoaks and St Albans reported lower annual averages.

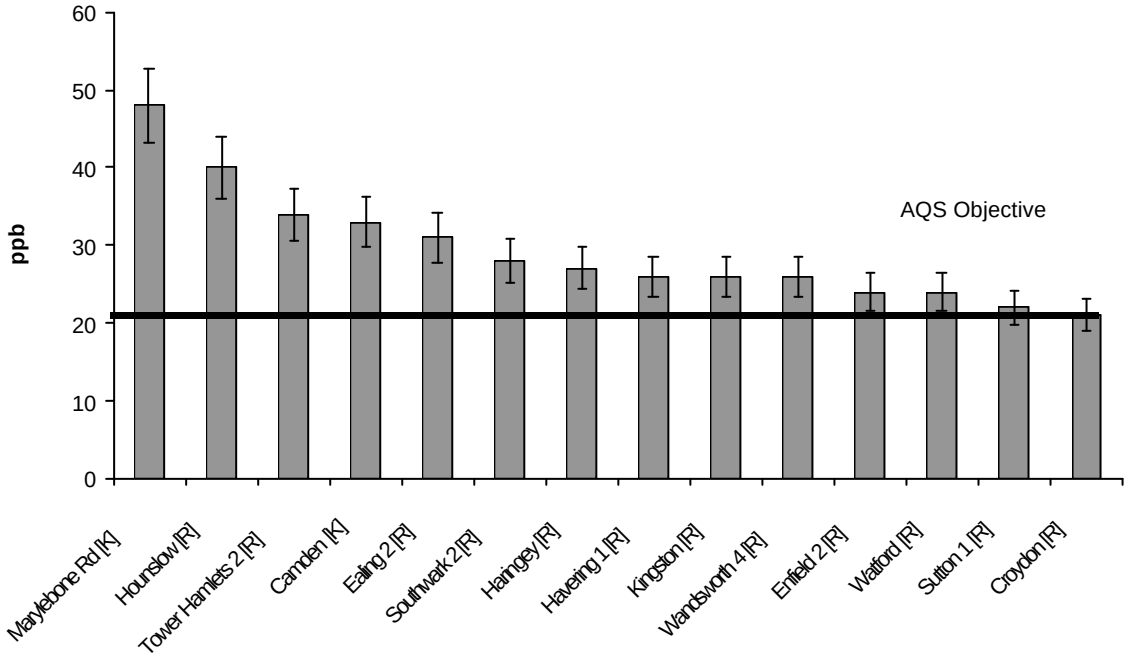

Figure 1.3 Kerbside and Roadside Annual Mean NO_2 (1998)

Figure 1.3 shows the annual average for the kerbside and roadside sites in the network, all of which equalled or exceeded the annual average objective. The relative concentrations show a similar pattern to the background sites. The highest annual averages were measured in central and inner London; at Marylebone Road, Camden and Tower Hamlets, and beside the M4/A4 at the Hounslow site in west London.

Network relative rolling annual averages for NO_2 and NO_X for long term sites are shown in Figure 1.1. The rolling annual average for NO_2 shows little overall change during the period November 1996 to November 1999 despite significant reductions in NO_X concentrations. The relative rolling annual average NO_2 is shown in more detail in Figure 1.4. The range of sites about the network mean is exhibited by the results from Greenwich and Sutton 3. The results from the Hounslow roadside site (not shown) lies outside this pattern and merits further investigation. In addition to Hounslow and Greenwich, Bexley, Croydon and Tower Hamlets sites also show overall increases. It should be noted that data from 1999 are still subject to ratification.

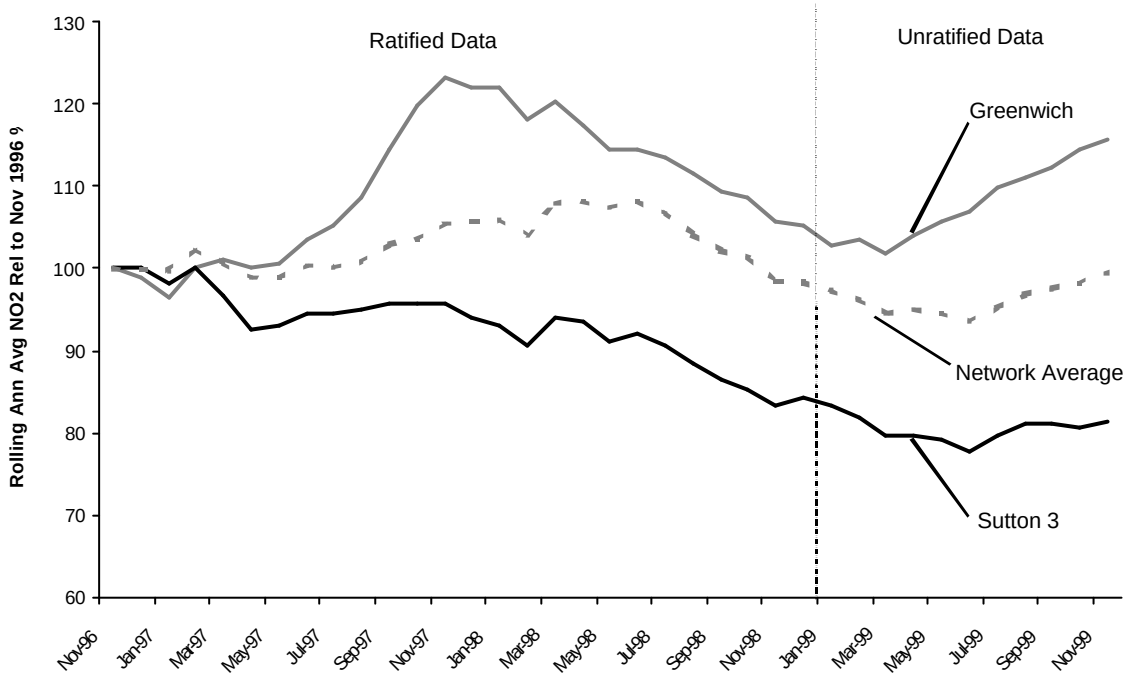

Figure 1.4 Relative Rolling Annual Average NO_2, 1 Nov 1996 to 1Nov 1999.

The maximum hourly objective (Figures 1.5 and 1.6) was at Marylebone Road and Sutton 2 although results from Camden, Ealing 3 (mobile), and Tower Hamlets Roadside are within the boundaries of uncertainty. The distribution of the maximum hourly values is often determined by the most significant pollution episode of the year. Since 1998 did not feature a significant episode, the distribution is broadly similar to that for the annual average. The distribution can also affected by local incidents and the operational availability of each site.

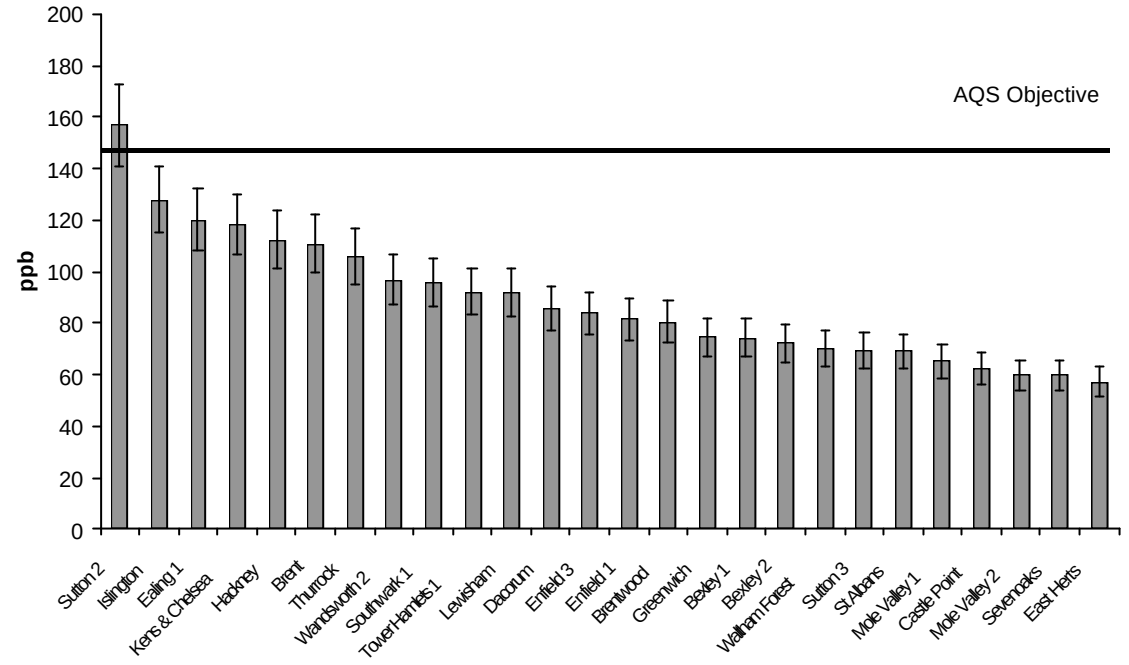

Figure 1.5 Background Maximum Hourly NO_2 (1998).

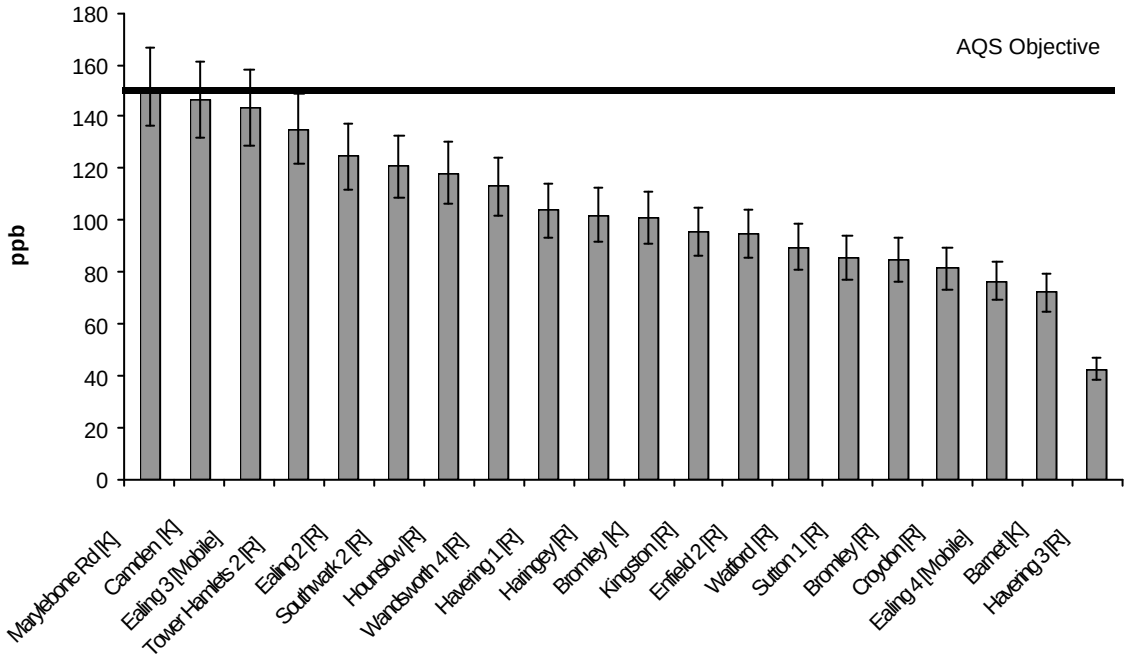

Figure 1.6 Kerbside and Roadside Maximum Hourly NO_2 (1998).

It is proposed to replace the current maximum hour objective of 150 ppb with an objective of 104.6 ppb not to be exceeded on more than 18 days per year. The number of days greater than 104.6 ppb is shown in Figure 1.7 for all sites that approached 100 ppb during 1998. As with the current maximum hour objective, the proposed objective was exceeded at Marylebone Road only. Results from the Hounslow roadside site and Sutton 2 show a possible exceedence, within the boundaries of uncertainty.

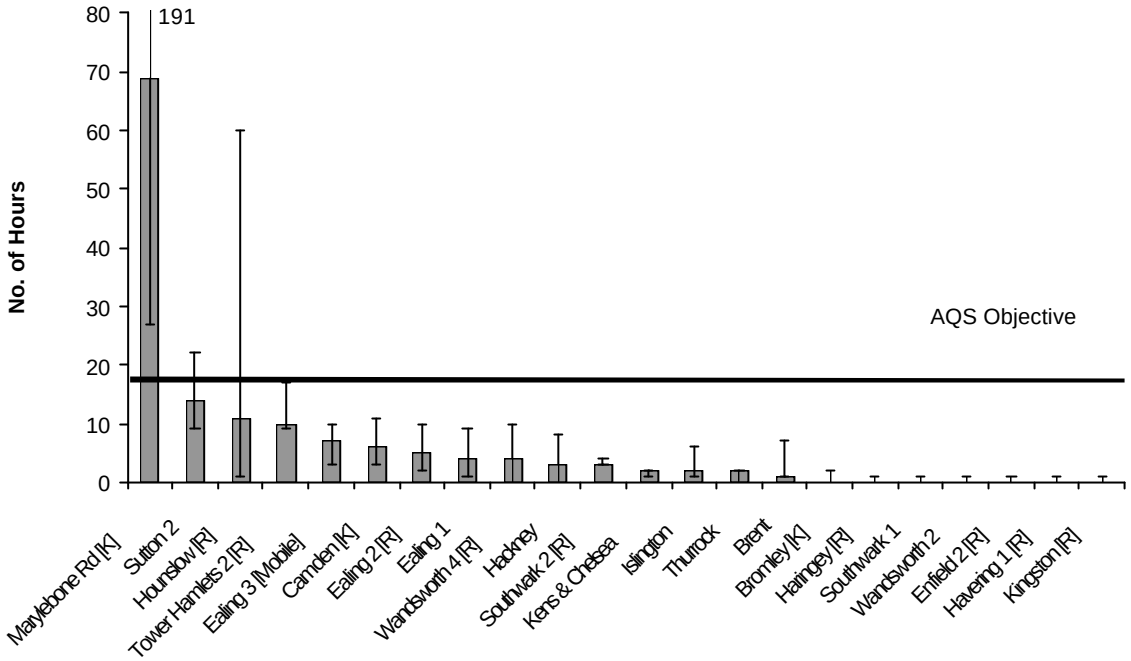

Figure 1.7 Proposed NO_2 AQS Objective (1998).

The proposed 'incident based' objective brings the UK into line with the EU Daughter Directive for NO_2. The objective has a lower concentration (104.6 ppb compared to 150 ppb) although the number of permitted excursions above this is far greater (18 compared to none). Hourly averages above 150 ppb only occur during significant winter time pollution incidents and a single significant episode may cause the objective to be exceeded. Hourly averages over 104.6 ppb occur more frequently during less significant episodes. Importantly, hourly averages of greater than 104.6 ppb have been measured during both winter and summer incidents. During summer incidents, NO_2 concentrations above 104.6ppb result from photochemical reactions and these may not be responsive to NO_X reduction measures. Table 1.1 shows a comparison of the two objectives at all sites in the LAQN during the period 1995 to 1998. This shows the total number of LAQN sites exceeding the proposed objective to be comparable during 1995, 1997 and 1998, although the exceedences were measured at different sites. During 1996 the proposed objective was exceeded at fewer sites.

Year	Current NAQS	Proposed AQS
1995	4	4
1996	9	3
1997	14	13
1998	1	2

Table 1.1 Comparison of the number of exceedences of the current and proposed 'incident based' NO_2 AQS Objectives.

1.3.3 Carbon Monoxide

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

Figure 1.8 shows the maximum rolling 8 hour average carbon monoxide measured at each site during the year. An exceedence of the NAQS objective was measured at the Bromley Kerbside site, which was closed during 1998. Generally, the highest rolling 8 hour averages were measured at near road sites.

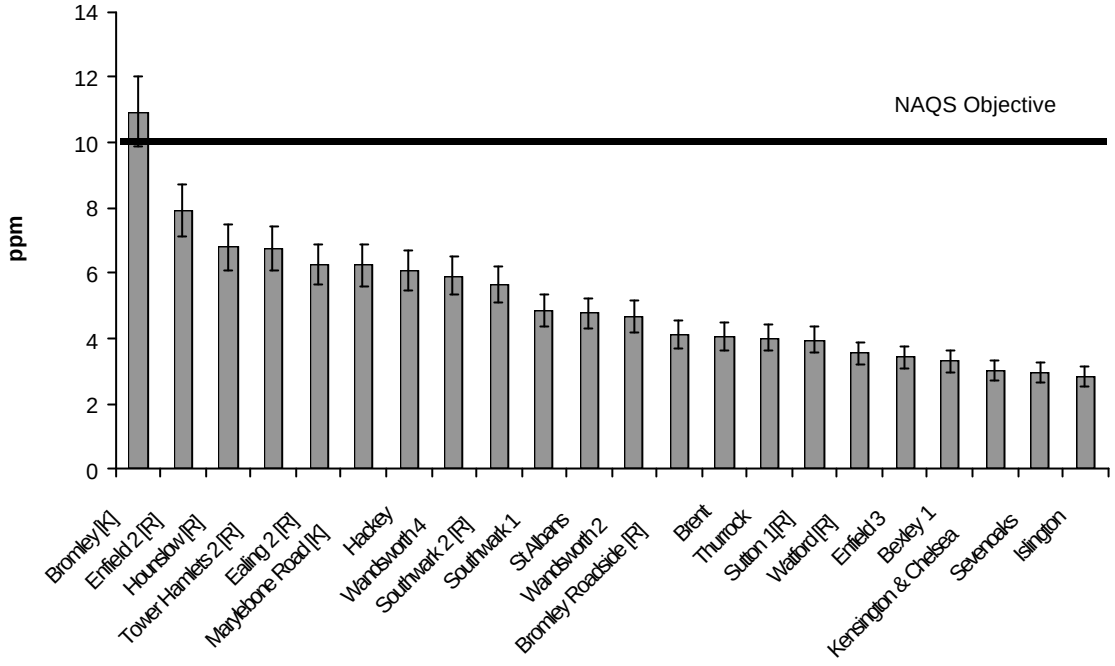

Figure 1.8 Maximum Rolling 8 Hour Average CO (1998)

The maximum rolling 8 hour average CO for the period 1995 – 1998 has shown a steady decline at the longest established sites on the LAQN. The network relative rolling annual average for CO long term sites is shown in Figure 1.1. The network rolling annual average for CO shows a 15% reduction during the period November 1996 to November 1999. The relative rolling annual average CO is shown in more detail in Figure 1.9. The range of sites about the network mean is exhibited by the results from Hounslow and Wandsworth 2. Results from Bexley (not shown) lie outside this pattern and merit further investigation. It should be noted that data from 1999 are still subject to ratification.

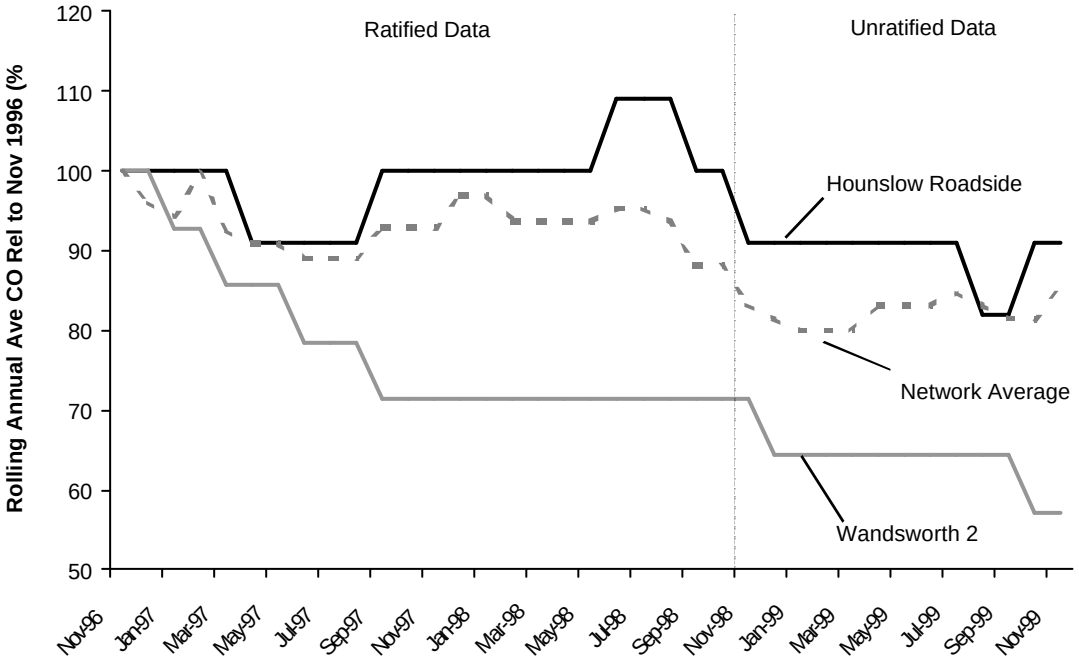

Figure 1.9 Rolling Annual Average CO November 1996 to November 1999

1.3.4 Sulphur Dioxide

The distribution of SO_2 concentrations in 1998 provides further evidence of the influence of both road traffic (affecting annual average concentrations) and industrial point sources (causing episodic high values due to plume grounding). This is discussed in Air Quality in London in 1995, The Third Report of the London Air Quality Network (SEIPH, 1996).

The annual average concentrations of SO_2 do not vary to any significant degree over the network. The proposed AQS Objective for SO_2, based on 35 exceedences of a 15 minute mean of 100 ppb, is shown in Figure 1.10 for all sites measuring 15 minute averages greater than 90 ppb during the year. Although no site in Greater London exceeded the objective, an exceedence was measured at the Kent Network site at Sevenoaks, due to a succession of incidents during Spring 1998. The distribution of the results of this 'incident based' objective across London is based on two factors; the proximity of monitoring sites to industrial sources and a succession of SO_2 plumes originating in the Thames Estuary which crossed south London on north easterly winds.

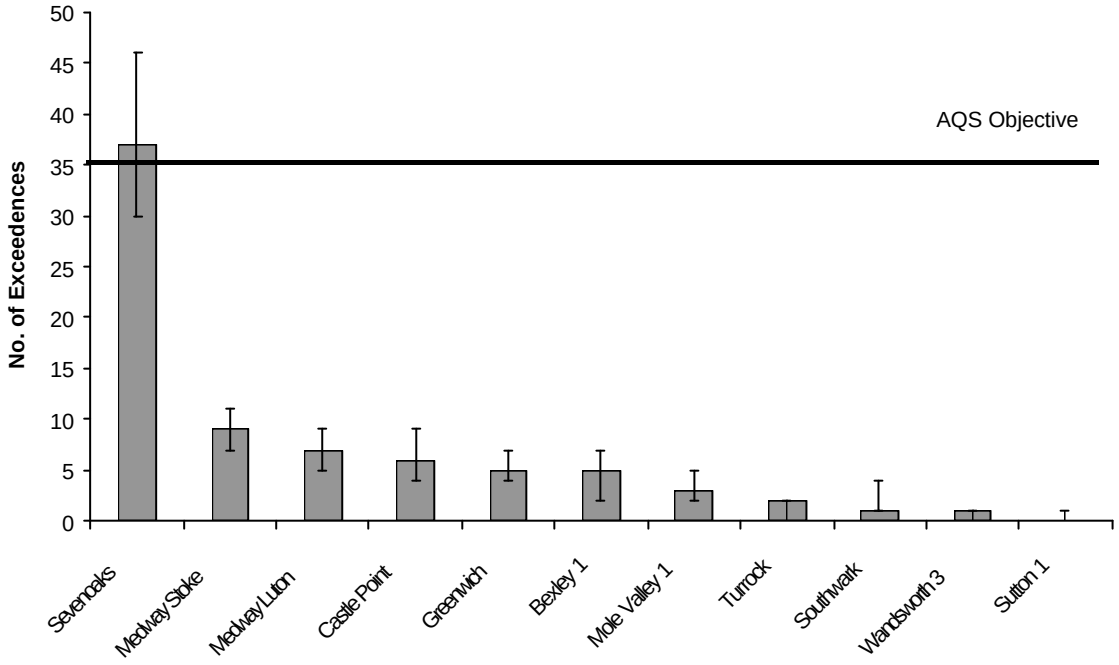

Figure 1.10 Proposed AQS Sulphur Dioxide Objective (1998)

The proposed AQS Objective for SO_2 is based on 35 exceedences of 100 ppb. This proposed objective represents a slight modification, and is less stringent than the current objective of 100ppb as a 99.9^{th} percentile, dependent on the annual data capture. Analysis of exceedences of the proposed objective over the years 1996 – 1998 is shown in Figure 1.11. The number of exceedences in 1998 is lower than in previous years at all of the long term sites in London. Results from sites around the Thames estuary show a similar pattern.

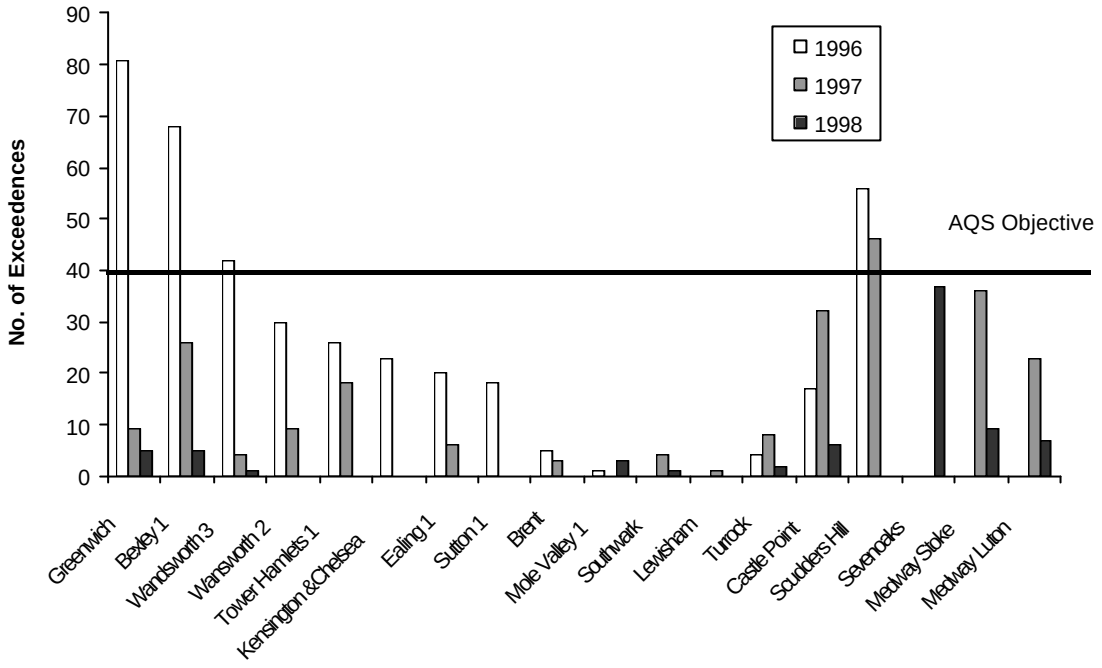

Figure 1.11 Proposed AQS Sulphur Dioxide Objective (15 minute) (1996-1998)

1.3.5 Ozone

Ozone is a seasonal pollutant with the highest concentrations being measured during the summer months. It is also a regional pollutant, which varies locally due to the scavenging effect of NO close to NO_X emission sources, e.g. at roadside. Exceedences of health based standards are therefore not expected at roadside and kerbside sites and ozone monitoring is not generally undertaken in these locations. Results from the LAQN are shown in Figure 1.12 along with selected sites from the KAQMN. The objective was exceeded at many of the outer suburban sites and at sites in Kent. Several suburban sites, including those in Hertfordshire and Surrey and all roadside sites were below the objective.

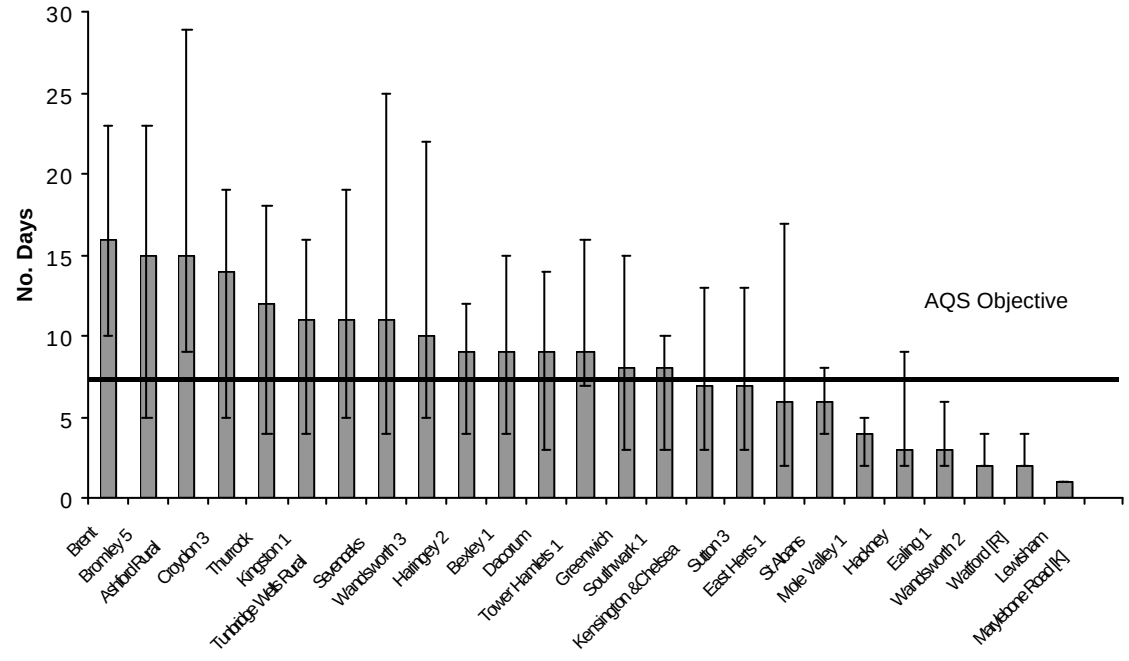

Figure 1.12 Proposed AQS for O_3 (1998)

The proposed AQS Objective for O_3 is based on 10 days where the maximum rolling 8 hourly average exceeds 50 ppb. This represents a slight modification from the current objective of 50ppb as a 97th percentile of rolling 8 hourly means. Analysis of exceedences of the proposed objective over the years 1996 – 1999 is shown in Figure 1.13. The number of exceedences in 1998 is lower than in previous years at all long term sites in London. Further, provisional data for the summer of 1999 indicates a higher level of exceedences than during 1998. This suggests that the low number of ozone exceedences for 1998 is due to relatively poor summer weather rather than any trend.

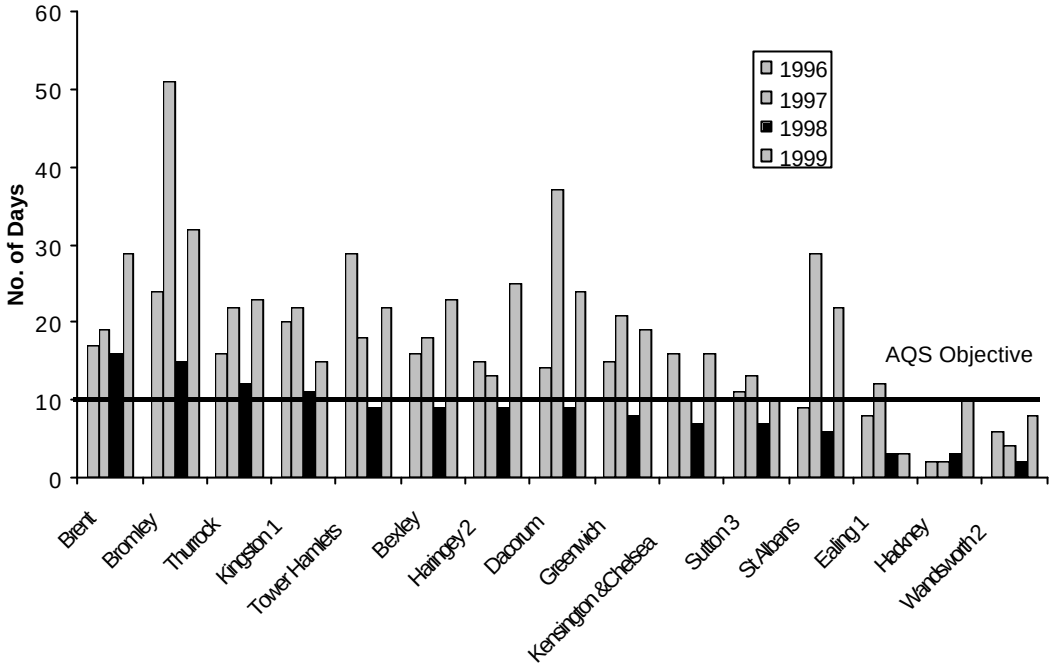

Figure 1.13 Proposed AQS for O_3 (1996-1999)

1.3.6 PM10

PM10 is a fraction of the particulate matter suspended in air. It represents the fraction that is considered to enter the respiratory system, and is that part of suspended particulate matter that has passed through a size selector with a 50% cut off efficiency at 10 μm (hence the term PM10) and has an absolute cut off at 30 μm.

The current NAQS objective for PM10 is 50 μgm^{-3} as the 99th percentile of the maximum daily rolling 24 hour averages. In previous years this has been generously exceeded at all sites in London and most of those in the UK. In the absence of significant pollution episodes, the data for 1998 show a large reduction on previous years. The objective was met at Greenwich and St Albans. The current objective, however, is thought to be largely unachievable (DETR 1999) and is to be replaced. The proposed new objective is 50 μgm^{-3}, measured as a daily average, not to be exceeded on more than 35 days per year. This brings the AQS into line with the EU Daughter Directive Stage 1 Limit Value for PM10.

PM10 also poses many measurement challenges. Rather than comprising of a single defined chemical compound, like CO or SO_2 for example, the composition of PM10 varies with location, time of year and during episodes. PM10 can be considered to comprise; primary particulates, mainly emitted from local sources; secondary particulates, mainly from distant sources; and coarse particulates whose origin can be local or further afield. The variation in composition affects each measurement technique differently and therefore each measurement technique produces systematically different results. The EU Daughter Directive is based on a so called 'gravimetric' method where PM10 is collected on a filter that is then weighed in a laboratory (CEN 1998). There is growing evidence to suggest that the most common measurement methodology employed in the UK, the Tapered Element Oscillating Microbalance (TEOM) produces a result lower than the 'gravimetric' method (APEG 1999, Green 1999 and others). It has been suggested that a corrective

factor of 1.3 be applied to TEOM results for comparison to the proposed AQS Objective (DETR 1999). Results from 1998, calculated on this basis, are shown in Figure 1.14.

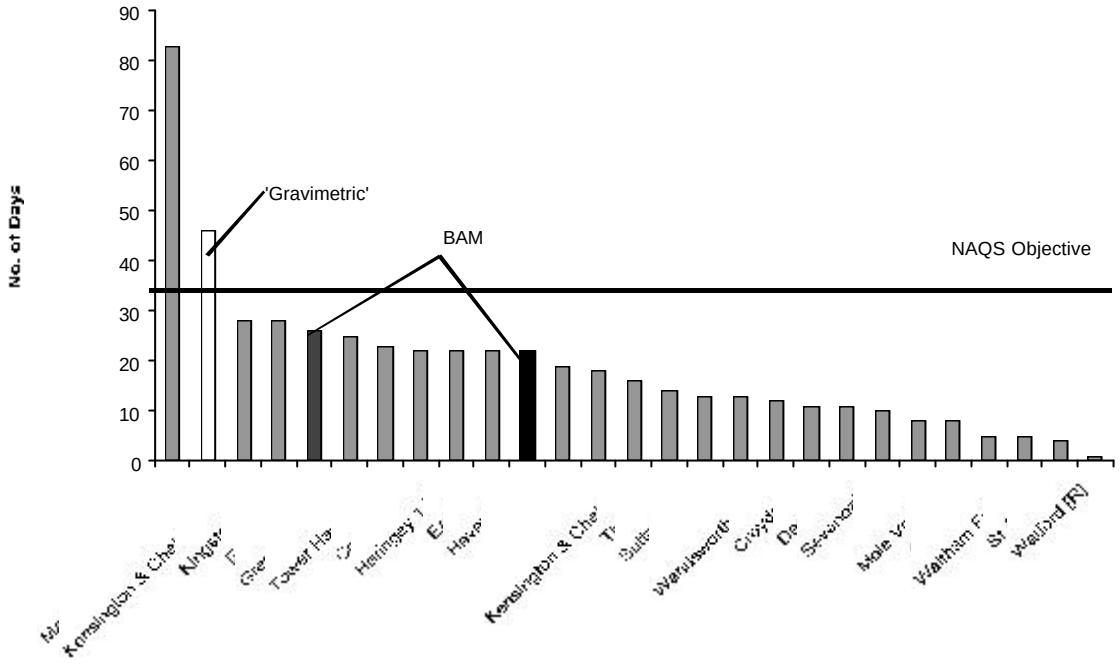

Figure 1.14 Proposed AQS Objective for PM10 (1998)

Figure 1.14 shows a significant difference, between the results from the TEOM * 1.3 and the 'gravimetric' measurements at Marylebone Road. This suggests that the TEOM * 1.3 relationship leads to a considerable overestimate in the exceedence of the proposed objective at this site for 1998. These results have been analysed further by Green (1999 SEIPH) and a polynomial conversion factor of

'Gravimetric'= 0.01 $(TEOM)^2$ + 0.68 (TEOM) +4.78,

has been found to be highly accurate for comparison of data against this objective. This conversion factor, however, is likely to be specific to the unique characteristics of the Marylebone Road site and to the 1998 pollution year.

Beta attenuation monitors (BAM) are also employed on the LAQN to measure PM10. BAMs operate by collecting PM10 on a filter. The collected PM10 is then exposed to beta radiation. The extent to which the beta radiation is attenuated by the PM10 sample is used to infer the mass collected. BAM instruments are specifically marked in Figure 1.14. It should be noted that data from the BAM instruments was not available for the first 2 months of 1998. Further work at Marylebone Road (Green 1999 SEIPH) sought to compare the results from TEOM, 'gravimetric' and BAM instruments. It was found that the BAM instrument tested produced higher results than the 'gravimetric' method at this location during the test period. Due to these methodological differences it has not been possible to subscribe an uncertainty estimate to the measurements for PM10.

Results from the period 1996 –1998 are shown in Figure 1.15. Although these show an apparent trend this is almost certainly an artefact of meteorological conditions; results from 1996 were influenced by a prolonged secondary particulate episode and in 1998 there was absence of significant episodes. This is further highlighted in Figure 1.1 and Figure 1.17.

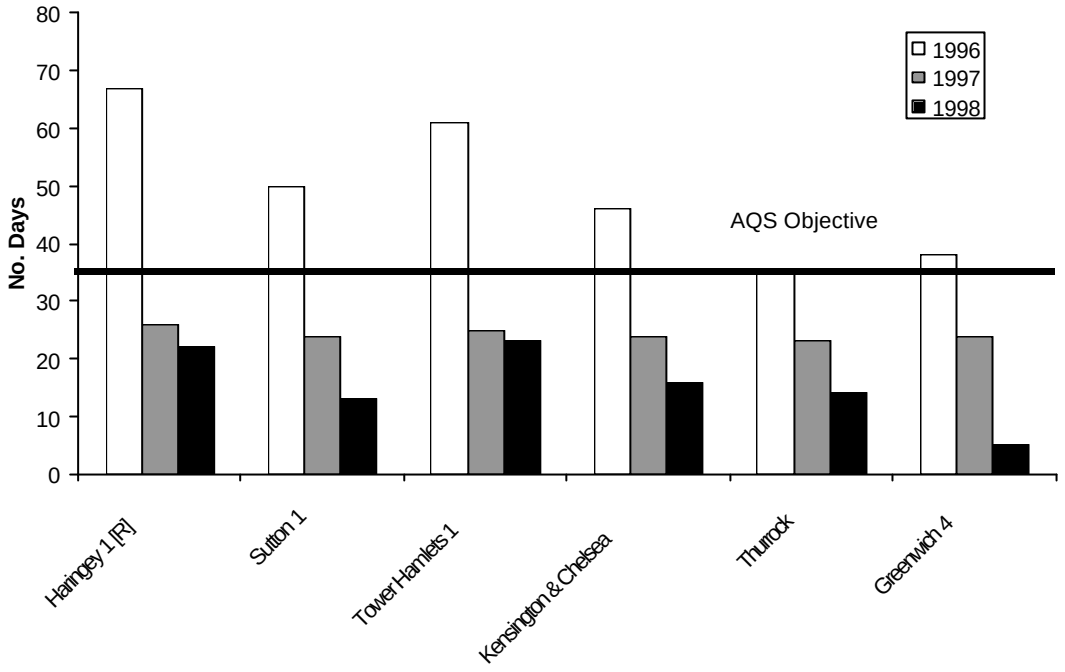

Figure 1.15 Proposed AQS Daily Objective 1996-1998.

It is also proposed to introduce an annual average objective of 40 ugm^{-3} for PM10 into the AQS (DETR 1999). This brings the UK into line with the EU Daughter Directive Stage 1 and again applies to 'gravimetric' measurements. It is suggested that the 1.3 conversion factor is also used for assessments against this objective (DETR 1999). Results for 1998 measured against this objective are shown in Figure 1.16. The objective was exceeded at Marylebone Road for the TEOM*1.3 measurement only. On the whole little variation can be seen in the annual averages across London and the South East due to the influence of background secondary particulates.

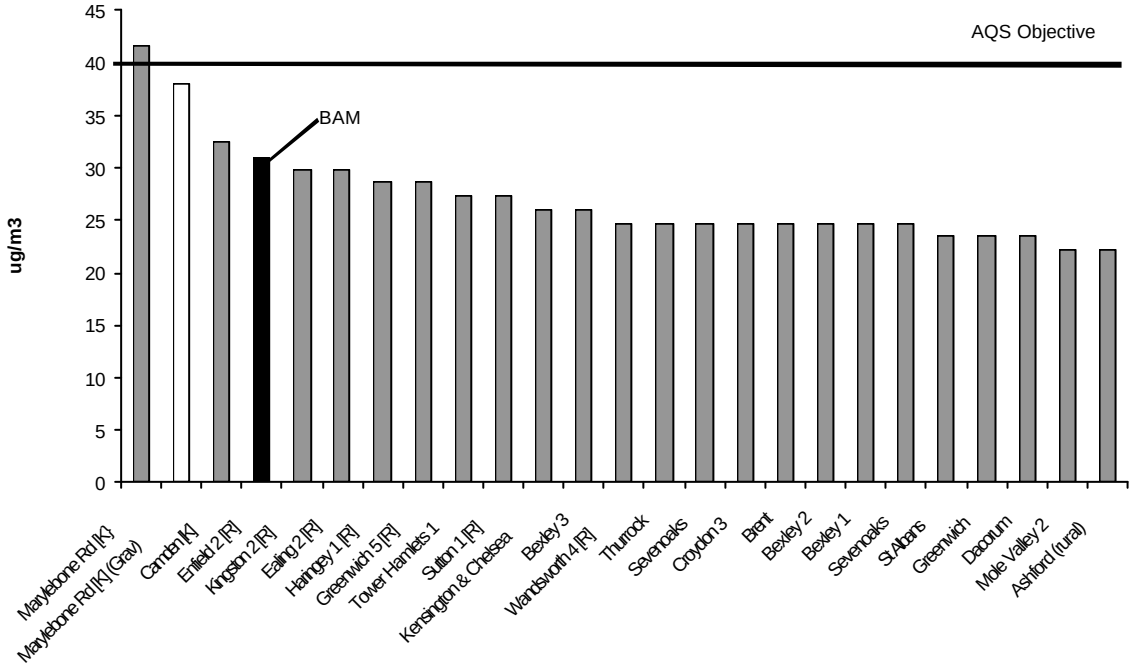

Figure 1.16 Proposed Annual Average AQS Objective for PM10 (1998).

The network relative rolling annual averages for PM10 for long term sites are shown in Figure 1.1. The network rolling annual average for PM10 shows a 25% reduction over the period November 1996 to November 1999. The relative rolling annual average PM10 is shown in more detail in Figure 1.17. The range of sites about the network mean is exhibited by the results from Kensington and Chelsea and Greenwich. It should be noted that data from 1999 are still subject to ratification.

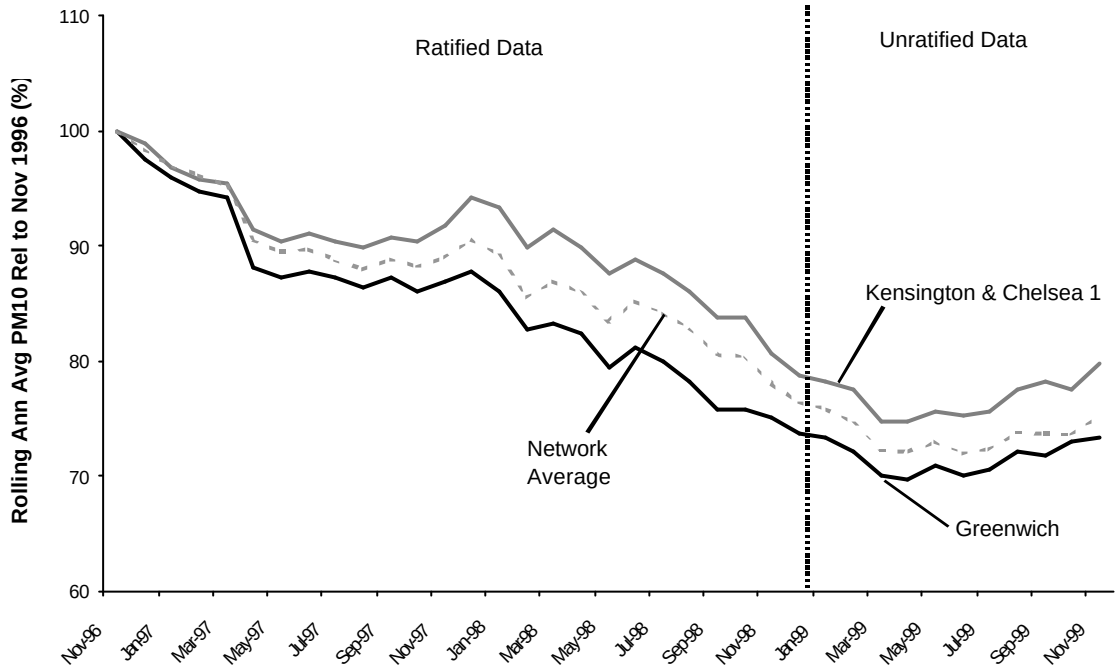

Figure 1.17 Rolling Annual Average PM10 1 November 1996 to 1 November 1999

1.3.6 PM2.5

PM2.5 is a finer fraction of PM10. PM2.5 is not currently included in the AQS, although this is under consideration (DETR 1999). Measurements of PM2.5 are essential to the understanding of PM10. Co-located measurements of PM10 and PM2.5 are undertaken at several sites in the LAQN including the roadside sites in Ealing and at Marylebone Road, and at the suburban sites at Bexley 2 and Bexley 3. The ratio of PM2.5 to PM10 at each of these sites is shown in Figure 1.18. Additionally, PM2.5 and PM10 were measured at the Bromley 7 site during the latter part of the year, and PM2.5 is measured at Hackney.

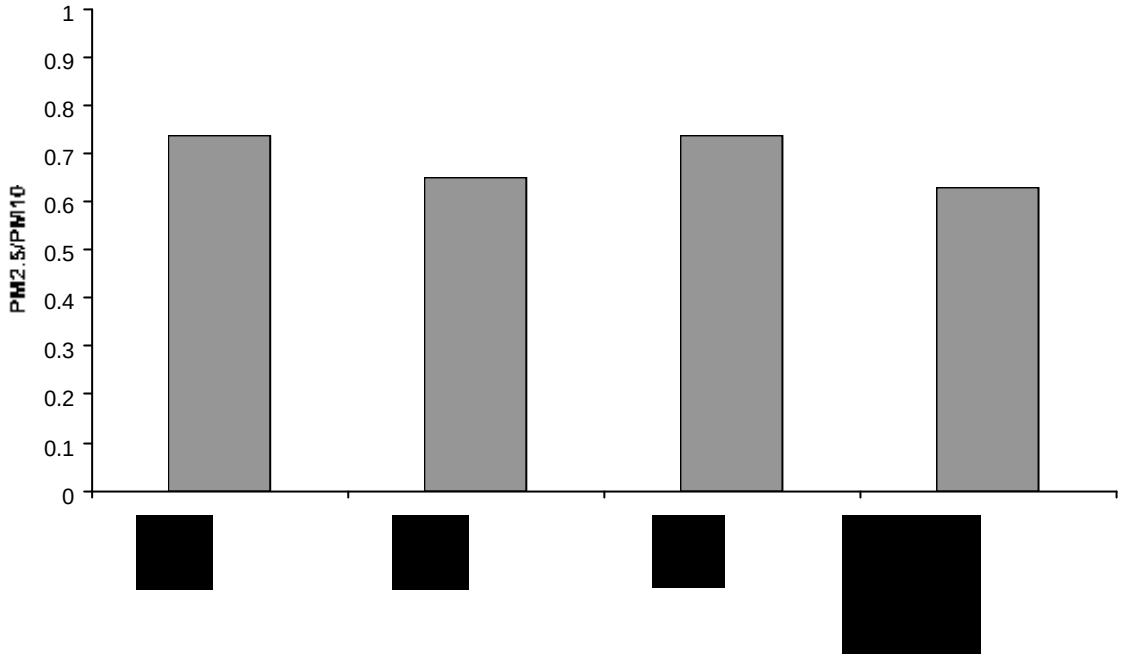

Figure 1.17 Ratio of PM2.5 to PM10 (1998).

1.4.7 Benzene and 1,3 Butadiene

Both benzene and 1,3 butadiene are carcinogenic. Reflecting this the AQS contains objectives for the annual average concentration of these substances. The main atmospheric source of benzene is the distribution and combustion of petrol, and 1,3 butadiene in the atmosphere is mainly derived from the combustion of petrol. Both benzene and 1,3 butadiene are measured at the kerbside at Marylebone Road and at the roadside at Tower Hamlets 2. During 1998 the annual average for benzene was below the proposed AQS objectives for 2003. The AQS objective for 1,3 butadiene was marginally exceeded at Marylebone Road. Both pollutants are also measured at the National Hydrocarbon Network monitoring sites in central London and at Eltham (Greenwich). The AQS objectives for benzene and 1,3 butadiene were comfortably met at both sites for 1998.

References

Barratt, B (1998) (SEIPH) ***The Kent Air Quality Monitoring Network Annual Report 1997***

Barratt, B (1999) (SEIPH) ***The Kent Air Quality Monitoring Network Annual Report 1998***

Green, D (1999) (SEIPH) ***Kerbside Air Quality Monitoring Site ('Supersite') 1st Janaury 1998 – 31st December 1998***

(CEN 1998) ***EN12341 Air Quality – Determination of the PM10 Fraction of Suspended Particulate Matter – Reference Method and Field Test Procedure to Demonstrate Reference Equivalence of Measurement Methods***.

DETR (1999) ***The Air Quality Strategy for England, Wales and Northern Ireland – A Consultation Document.***

DETR (1999) ***Consultation on the Air Quality (England) Regulations 2000***.

DETR (1999) ***Assistance with the Review and Assessment of PM10 Concentration in Relation to the Proposed EU Stage 1 limit values***.

SEIPH (1995) ***Air Quality in London 1994***

SEIPH (1996) ***Air Quality in London 1995***

SEIPH (1997) ***The AIM Project and Air Quality in London 1996***

SEIPH (1999) ***Air Quality in London 1997***

Appendix 1

RECENT PUBLICATIONS

APPENDIX 1: RECENT PUBLICATIONS

SEIPH – ERG carries out extensive research in the field of air pollution. The following recent reports will be available either from the SEIPH – ERG WWW site (www.seiph.umds.ac.uk), or from our clients.

Barratt, B (1999) ***The Kent Air Quality Monitoring Network Annual Report 1998.***

The second annual report of the Kent Air Quality Monitoring Network summarises air pollution in Kent during 1998 including a statistical analysis of data. The report focuses on local air quality management and the continuous monitoring network in Kent. Copies are available from the Kent Air Quality Network home page; www.seiph.umds.ac.uk/kaqmn.htm

Beevers S, Carslaw D (1999) ***Estimating the Uncertainty of Model Predictions Using a Monte Carlo Simulation.***

Outlines the use of Monte Carlo simulation applied to the predictions of NO_X and NO_2 in London. The report considers the likely errors of predictions and their distributions. Consideration is also given to the sensitivity of predictions to key input parameters. Work on behalf of the DETR.

Beevers S, Carslaw D (1998) ***Evaluation of Local transport Measures in Tackling National Air Quality Strategy Objectives.***

Work on behalf of the DETR's review of the air quality strategy in London. Features predictions of NO_X, NO_2 and PM10 for a range of transport scenarios.

Carslaw D and Beevers S (1999) ***NO_X and NO_2 Predictions at Roadside and Background Locations in London.***

Summarises the development of techniques to make predictions at different locations across London, based on the use of air pollution measurements and dispersion modelling. Work on behalf of the DETR.

Carslaw D and Beevers S(1999) ***Estimating the NO_2 Concentration at Building Facades in London***.

Makes use of National Remote Censing Data to estimate the likely NO_X and NO_2 concentrations for a small region of central London. Work on behalf of the DETR.

Carslaw D, Beevers S, Hedley S (1999) ***Meeting Air Quality Targets in London: Understanding the Contribution From the Management of Road Traffic.***

Development of base case air pollution predictions for London. Contribution made by road traffic and road traffic management scenarios. Work on behalf of the Government Office For London.

Green, D; Fuller G; Barratt B (1999) (SEIPH) ***Kerbside Air Quality Monitoring Site ('Supersite') 1st Janaury 1998 – 31st December 1998***

Sponsored by DETR, the report is part of an ongoing series describing the work carried out at the Marylebone Road 'Supersite'. The report details results for 1998 and describes the traffic monitoring carried out at the site. Important comparisons are made between continuous and non-continuous monitoring techniques and between the results from 'gravimetric' and TEOM PM10 measurement methods.

Green, D (1999) (SEIPH) ***Particulate Monitor Comparison***.

A SEIPH funded project compared the results from co-located PM10 monitoring techniques at the DETR funded Marylebone Road site. The measurements from three continuous PM10 monitoring instruments employing beta attenuation, light scattering and tapered element oscillating microbalance were compared to the results from a Partisol 'gravimetric' technique. The report describes the behaviour of each of the instruments during different pollution conditions and suggests conversion factors between each of the continuous methods and the Partisol 'gravimetric'.

Appendix 2

LAQN MONITORING SITES 1998

APPENDIX 2: LAQN MONITORING SITES 1998

A.2.1 Kerbside Sites

Site	Start	CO	NO2	SO2	O3	PM10	PM2.5	1998 Data	Quality
Barnet	Dec 98		●			T		●	*
Bromley 4	Feb 96	●	●						** A
Camden	Apr 96		●			T		●	** A
Marylebone Road	Jun 97	●	●	●	●	TG	●	●	** A

A.2.2 Roadside Sites

	Start	CO	NO2	SO2	O3	PM10	PM2.5	1998 Data	Quality
Bromley 7	July 98	●	●			(B)	(B)	●	*/** A1
Croydon 2	Sept 94		●					●	**
Ealing 2	Sept 96	●	●			T		●	**
Enfield 2	Jan 98	●	●	●		B		●	**
Greenwich 5	Sept 97					T		●	*
Haringey 1	Dec 94		●			T		●	** A1
Havering 1	Dec 95		●					●	**
Havering 3	Dec 98		●	●		T		●	**
Hounslow 1	Apr 93	●	●		●			●	** A1
K'ton&Chelsea 2	May 98					T		●	**
Kingston 2	Apr 96		●			T		●	**
Southwark 2	Oct 94	●	●	●				●	** A1
Sutton 1	May 95	●	●	●		T		●	** A1
Tower Hams 2	Mar 94	●	●					●	** A1
Wandsworth 1	Sept 94	Closed Mar 1996							
Wandsworth 4	Feb 98	●	●			T		●	**
Watford	May 96	●	●	●		T		●	**
Westminster 2	Jun95	Last data 1995							

Key: T =TEOM, B=Beta Attentuation, G= Gravimetric.
A1= Affiliated to UKAURN – Ratified Data supplied to LAQN by NPL - final data set published by DETR
A2= Affiliated to UKAURN – final data set published by DETR

A.2.3 Urban Background Sites

	Start	CO	NO2	SO2	O3	PM10	PM2.5	1998 Data	Quality
Bark & Dag	Sep 1993		●		●				
Brent	Aug 95	●	●	●	●	T		●	* A2
Bromley 1	Jan 93	Closed Feb 96							
Castlepoint	May 96		●	●				●	**
Croydon 3	May 96				●	T		●	**
Dacorum	May 96		●		●	T		●	**
Ealing 1	Mar 95	●	●	●	●			●	**
East Herts 2	Jul 98		●					●	*
Enfield 3	Nov 98	●	●	●	●	B		●	*
Greenwich 4	Sept 93		●	●	●	T		●	** A1
Hackney	Oct 93	●	●		●		●	●	**/* A1
Hillingdon	Oct 94	Last Data Apr 95							
K'ton&Chelsea 1	Mar 95	●	●	●	●	T		●	** A1
Islington	Sep 94	●	●						
Lewesham	Jan 95		●	●	●			●	** A1
Sevenoaks 2	Feb 98	●	●	●	●	T		●	**
Southwark 1	Mar 93	●	●	●	●			●	** A1
St Albans	May 96	●	●	●	●	T		●	**
Thurrock	Feb 95	●	●	●	●	T		●	* A2
Tower Hams 1	Jan 94		●	●	●	T		●	**
Waltham Forest	Jul 98		●		●	T		●	*
Wandsworth 2	Oct 94	●	●	●	●			●	** A1
Westminster 1	Jan 93	Last Data 1996							

Key: T =TEOM, B=Beta Attentuation, G= Gravimetric.
A1= Affiliated to UKAURN – Ratified Data supplied to LAQN by NPL - final data set published by DETR
A2= Affiliated to UKAURN – final data set published by DETR

A.2.4 Suburban Sites

	Start	CO	NO2	SO2	O3	PM10	PM2.5	1998 Data	Quality
Bexley 1	Jan 93	●	●	●	●	T		●	* A2
Bexley 2	Jan 98		●			T	T	●	**
Bexley 3	Jan 98					T	T	●	**
Brentwood 1	Aug 95		●					●	**
Bromley 5	Mar 96				●			●	**
Enfield 1	Jul 95		●					●	**
Haringey 2	Apr 96				●			●	** A1
Havering 2	Apr 98		●					●	*
Kingston 1	Mar 96				●			●	**
Mole Valley 2	Apr 97		●			T		●	**
Sutton 2	May 95		●					●	**
Sutton 3	May 95		●		●			●	** A1
Wandsworth 3	Oct 94			●	●			●	**

A.2.4 Rural Sites

	Start	CO	NO2	SO2	O3	PM10	PM2.5	1998 Data	Quality
East Herts 1	Jun 97				●			●	*
Mole Valley 1	Mar 96		●	●	●			●	**/*
S'oaks Scudders H	Sept 95		●	●	●			●	**

Key: T =TEOM, B=Beta Attentuation, G= Gravimetric.
A1= Affiliated to UKAURN – Ratified Data supplied to LAQN by NPL - final data set published by DETR
A2= Affiliated to UKAURN – final data set published by DETR

Appendix 3

SUMMARY OF RESULTS

APPENDIX 3: SUMMARY OF MONITORING RESULTS

Where data capture for an analyser is less than 75% statistical comparisons are shown in parenthesis. Where comparison with the objective cannot be made these results are marked not applicable (N.A.).

A.3.1 Carbon Monoxide

Carbon Monoxide	Data Capture %	Annual Mean (ppm)	Annual Max (ppm)
Kerbside			
Bromley 4	47	2.2	18.4
Marylebone Rd	98	2.0	10.2
Roadside			
Bromley 7	17	1.0	7.1
Ealing 2	98	1.2	9.3
Enfield 2	95	0.9	12.2
Hounslow 1	75	1.0	9.4
Southwark 2	92	0.6	7.4
Sutton 1	99	0.8	7.4
Tower Hams 2	96	1.2	7.5
Wandsworth 4	84	1.0	8.6
Watford	90	0.6	5.7
Background			
Brent	94	0.3	8.1
Enfield 3	13	0.8	6.2
Hackney	93	0.6	8.0
Islington	18	0.5	4.6
Kens & Chelsea 1	93	0.4	4.6
Sevenoaks 2	80	0.2	5.7
Southwark 1	92	0.6	7.4
St Albans	90	0.3	8.0
Thurrock	92	0.4	11.3
Wandsworth 2	94	0.9	6.5
Suburban			
Bexley 1	95	0.4	5.8

Carbon Monoxide	Low Pollution		Moderate Pollution		High Pollution		Very High Pollution	
DETR Bands	Hours	Days	Hours	Days	Hours	Days	Hours	Days
Kerbside								
Bromley 4	4093	169	24	4	0	0	0	0
Marylebone Rd	8577	360	0	0	0	0	0	0
Roadside								
Bromley 7	1478	61	0	0	0	0	0	0
Ealing 2	8619	361	0	0	0	0	0	0
Enfield 2	8304	363	0	0	0	0	0	0
Hounslow 1	6560	277	0	0	0	0	0	0
Southwark 2	5583	233	0	0	0	0	0	0
Sutton 1	8636	365	0	0	0	0	0	0
Tower Hams 2	8335	352	0	0	0	0	0	0
Wandsworth 4	7426	311	0	0	0	0	0	0
Watford	7868	329	0	0	0	0	0	0
Background								
Brent	8229	342	0	0	0	0	0	0
Enfield 3	1171	51	0	0	0	0	0	0
Hackney	8161	344	0	0	0	0	0	0
Islington	1619	69	0	0	0	0	0	0
Kens & Chelsea 1	8150	342	0	0	0	0	0	0
Sevenoaks 2	8356	294	0	0	0	0	0	0
Southwark 1	8009	334	0	0	0	0	0	0
St Albans	7803	322	0	0	0	0	0	0
Thurrock	8019	336	0	0	0	0	0	0
Wandsworth 2	8292	363	0	0	0	0	0	0
Suburban								
Bexley 1	8287	350	0	0	0	0	0	0

Carbon Monoxide	Exceedence of NAQS Objective (Max Rolling 8h Mean >10ppm)
Kerbside	
Bromley 4	Yes / (11.0)
Marylebone Rd	No / 6.2
Roadside	
Bromley 7	NA / (4.1)
Ealing 2	No / 6.3
Enfield 2	No / 7.9
Hounslow 1	No / 6.8
Southwark 2	No / 5.6
Sutton 1	No / 3.9
Tower Hams 2	No / 6.7
Wandsworth 4	No / 5.9
Watford	No / 3.5
Background	
Brent	No / 4.1
Enfield 3	NA / (3.4)
Hackney	No / 6.1
Islington	NA / (2.8)
Kens & Chelsea 1	No / 3.0
Sevenoaks 2	No / 3.0
Southwark 1	No / 4.8
St Albans	No / 4.8
Thurrock	No / 4.0
Wandsworth 2	No / 4.7
Suburban	
Bexley 1	No / 3.3

A.3.2 Nitrogen Dioxide

Where data capture for an analyser is less than 75% statistical comparisons are shown in brackets. Where comparison with the objective cannot be made these results are marked not applicable (N.A.).

Nitrogen Dioxide	Data Capture %	Annual Mean (ppb)	Annual Max (ppb)
Kerbside			
Barnet	2	34	72
Bromley 4	37	22	101
Camden	97	33	146
Marylebone Road	97	48	152
Roadside			
Bromley 7	24	32	85
Croydon 2	99	21	82
Ealing 2	99	31	125
Enfield 2	99	24	95
Haringey 1	98	27	102
Havering 1	84	26	104
Hounslow 1	85	38	118
Kingston 2	99	26	96
Southwark 2	74	28	121
Sutton 1	98	22	86
Tower Hamlets 2	96	34	135
Wandsworth 4	76	26	113
Watford	90	24	90

Nitrogen Dioxide	Data Capture %	Annual Mean (ppb)	Annual Max (ppb)
Background			
Brent	94	19	111
Castle Point	45	16	62
Dacorum	58	12	85
Ealing 1	99	24	120
East Herts 2	47	15	57
Enfield 3	11	26	84
Greenwich 4	86	18	74
Hackney	97	31	112
Islington	26	33	128
Ken & Chelsea 1	98	24	118
Lewisham	93	27	92
Sevenoaks 2	84	13	60
Southwark 1	94	27	96
St Albans	77	14	69
Thurrock	95	19	106
Tower Hamlets 1	96	25	92
Waltham Forest	35	21	70
Wandsworth 2	99	26	97
Suburban			
Bexley 1	94	20	74
Bexley 2	87	18	72
Brentwood	98	19	81
Enfield 1	95	17	82
Mole Valley 2	84	14	60
Sutton 2	99	20	157
Sutton 3	99	17	69
Rural			
Mole Valley 1	80	13	65

Nitrogen Dioxide	Low Pollution		Moderate Pollution		High Pollution		Very High Pollution	
	Hours	Days	Hours	Days	Hours	Days	Hours	Days
Kerbside								
Barnet	236	9	0	0	0	0	0	0
Bromley 4	3299	134	0	0	0	0	0	0
Camden	8522	359	0	0	0	0	0	0
Marylebone Road	8540	355	1	1	0	0	0	0
Roadside								
Bromley 7	2134	86	0	0	0	0	0	0
Croydon 2	8732	365	0	0	0	0	0	0
Ealing 2	8721	365	0	0	0	0	0	0
Enfield 2	8292	361	0	0	0	0	0	0
Haringey 1	8653	360	0	0	0	0	0	0
Havering 1	7433	300	0	0	0	0	0	0
Hounslow 1	7485	314	0	0	0	0	0	0
Kingston 2	8722	365	0	0	0	0	0	0
Southwark 2	6560	272	0	0	0	0	0	0
Sutton 1	8616	359	0	0	0	0	0	0
Tower Hamlets 2	8410	350	0	0	0	0	0	0
Wandsworth 4	6724	282	0	0	0	0	0	0
Watford	7949	332	0	0	0	0	0	0

Nitrogen Dioxide	Low Pollution		Moderate Pollution		High Pollution		Very High Pollution	
DETR Bands	Hours	Days	Hours	Days	Hours	Days	Hours	Days
Background								
Brent	8315	343	0	0	0	0	0	0
Castle Point	4029	168	0	0	0	0	0	0
Dacorum	5120	216	0	0	0	0	0	0
Ealing 1	8717	365	0	0	0	0	0	0
East Herts 2	4200	178	0	0	0	0	0	0
Enfield 3	982	42	0	0	0	0	0	0
Greenwich 4	7553	315	0	0	0	0	0	0
Hackney	8573	358	0	0	0	0	0	0
Islington	2290	95	0	0	0	0	0	0
Ken & Chelsea 1	8631	361	0	0	0	0	0	0
Lewisham	8203	340	0	0	0	0	0	0
Sevenoaks 2	7395	306	0	0	0	0	0	0
Southwark 1	8255	341	0	0	0	0	0	0
St Albans	6786	284	0	0	0	0	0	0
Thurrock	8337	346	0	0	0	0	0	0
Tower Hamlets 1	7933	329	0	0	0	0	0	0
Waltham Forest	3095	127	0	0	0	0	0	0
Wandsworth 2	8689	364	0	0	0	0	0	0
Suburban								
Bexley 1	8303	344	0	0	0	0	0	0
Bexley 2	7689	318	0	0	0	0	0	0
Brentwood	8618	358	0	0	0	0	0	0
Enfield 1	8343	349	0	0	0	0	0	0
Mole Valley 2	7389	308	0	0	0	0	0	0
Sutton 2	8707	362	1	1	0	0	0	0
Sutton 3	8675	362	0	0	0	0	0	0
Rural								
Mole Valley 1	8611	291	0	0	0	0	0	0

Nitrogen Dioxide	Exceedence of National Air Quality Strategy Objectives / Proposed Objectives		
DETR Bands	**Annual Mean >21ppb**	**Max Hour > 150ppb**	**104.6ppb not to be exceeded on more than 18 hours**
Kerbside			
Barnet	NA / (34)	No / (72)	No / (0)
Bromley 4	NA / (22)	No / (101)	No / (0)
Camden	Yes (33)	No / (146)	No / (6)
Marylebone Road	Yes (48)	Yes / (152)	Yes / (69)
Roadside			
Bromley 7	NA / (32)	No / (85)	No / (0)
Croydon 2	Yes / (21)	No / (82)	No / (0)
Ealing 2	Yes / (31)	No / (125)	No / (5)
Enfield 2	Yes / (24)	No / (95)	No / (0)
Haringey 1	Yes / (27)	No / (102)	No / (0)
Havering 1	Yes / (26)	No / (104)	No / (0)
Hounslow 1	Yes / (38)	No / (118)	No / (11)
Kingston 2	Yes / (26)	No / (96)	No / (0)
Southwark 2	Yes / (28)	No / (121)	No / (3)
Sutton 1	Yes / (22)	No / (86)	No / (0)
Tower Hamlets 2	Yes / (34)	No / (135)	No / (10)
Wandsworth 4	Yes / (26)	No / (113)	No / (4)
Watford	Yes / (24)	No / (90)	No / (0)

Nitrogen Dioxide	Exceedence of National Air Quality Strategy Objectives / Proposed Objectives		
	Annual Mean >21ppb	Max Hour > 150ppb	104.6ppb not to be exceeded on more than 18 hours
Background			
Brent	No / (19)	111	No / (1)
Castle Point	NA / (16)	62	No / (0)
Dacorum	NA / (12)	85	No / (0)
Ealing 1	Yes / (24)	120	No / (4)
East Herts 2	NA / (15)	57	No / (0)
Enfield 3	NA / (26)	84	No / (0)
Greenwich 4	No / (18	74	No / (0)
Hackney	Yes / (31)	112	No / (3)
Islington	NA / (33)	128	No / (2)
Ken & Chelsea 1	Yes / (24)	118	No / (2)
Lewisham	Yes / (27)	92	No / (0)
Sevenoaks 2	No / (13)	60	No / (0)
Southwark 1	Yes / (27)	96	No / (0)
St Albans	No / (14)	69	No / (0)
Thurrock	No / (19)	106	No / (2)
Tower Hamlets 1	Yes / (25)	92	No / (0)
Waltham Forest	NA / (21)	70	No / (0)
Wandsworth 2	Yes / (26)	97	No / (0)
Suburban			
Bexley 1	No / (20)	74	No / (0)
Bexley 2	No / (18)	72	No / (0)
Brentwood	No / (19)	81	No / (0)
Enfield 1	No / (17)	82	No / (0)
Mole Valley 2	No / (14)	60	No / (0)
Sutton 2	No / (20)	157	No / (14)
Sutton 3	No / (17)	69	No / (0)
Rural			
Mole Valley 1	No / (13)	65	No / (0)

A.3.3 Ozone

Where data capture for an analyser is less than 75% statistical comparisons are shown in brackets. Where comparison with the objective cannot be made these results are marked not applicable (N.A.).

Ozone	Data Capture %	Annual Mean (ppb)	Annual Max (ppb)
Kerbside			
Marylebone Road	86	6	38
Roadside			
Hounslow	38	9	45
Watford	91	14	81
Background			
Brent	95	19	101
Croydon 3	94	19	96
Dacorum	95	19	75
Ealing 1	99	13	78
Enfield 3	11	8	38
Greenwich 4	86	18	103
Hackney	98	15	79
Kens & Chelsea 1	98	15	95
Lewisham	92	10	74
St Albans	92	17	88
Sevenoaks 2	85	21	95
Southwark 1	90	14	74
Thurrock	96	17	88
Tower Hamlets 1	97	16	96
Wandsworth 2	98	11	72
Suburban			
Bexley 1	94	18	100
Bromley 5	92	23	102
Haringey 2	98	15	85
Kingston 1	99	18	86
Sutton 3	96	17	98
Wandsworth 3	95	20	94
Rural			
East Herts. 1	79	23	81
Mole Valley 1	93	15	83

Ozone	Low Pollution		Moderate Pollution		High Pollution		Very High Pollution	
DETR Bands	**Hours**	**Days**	**Hours**	**Days**	**Hours**	**Days**	**Hours**	**Days**
Kerbside								
Marylebone Road	7555	317	0	0	0	0	0	0
Roadside								
Hounslow	3335	142	0	0	0	0	0	0
Watford	7930	328	27	6	0	0	0	0
Background								
Brent	8056	313	183	30	1	1	0	0
Croydon 3	8105	324	133	21	3	1	0	0
Dacorum	8272	349	86	15	0	0	0	0
Ealing 1	8687	358	37	7	0	0	0	0
Enfield 3	1019	44	0	0	0	0	0	0
Greenwich 4	7459	295	94	18	5	1	0	0
Hackney	6280	255	43	9	0	0	0	0
Kens & Chelsea 1	8486	341	85	18	2	1	0	0
Lewisham	7985	332	10	2	0	0	0	0
St Albans	7957	320	64	11	0	0	0	0
Sevenoaks 2	7287	282	125	26	5	2	0	0
Southwark 1	7757	318	75	11	0	0	0	0
Thurrock	8195	327	125	22	0	0	0	0
Tower Hamlets 1	8364	333	117	20	2	1	0	0
Wandsworth 2	8538	354	25	5	0	0	0	0
Suburban								
Bexley 1	8108	327	95	16	3	1	0	0
Bromley 5	7956	313	167	25	3	1	0	0
Haringey 2	8528	347	84	13	0	0	0	0
Kingston 1	8486	348	109	16	0	0	0	0
Sutton 3	8337	336	81	16	4	1	0	0
Wandsworth 3	8187	328	132	21	3	2	0	0
Rural								
East Herts. 1	6867	274	77	16	0	0	0	0
Mole Valley 1	8130	345	42	8	0	0	0	0

Ozone	Exceedence of AQS Objective 10 days Max Rolling 8h Mean >50ppb
Kerbside	
Marylebone Road	No / 0
Roadside	
Hounslow	NA / (0)
Watford	No / 2
Background	
Brent	Yes / 16
Croydon 3	Yes / 14
Dacorum	No / 9
Ealing 1	No / 3
Enfield 3	NA / (0)
Greenwich 4	No / 8
Hackney	No / 3
Kens & Chelsea 1	No / 7
Lewisham	No / 1
St Albans	No / 6
Sevenoaks 2	Yes / 11
Southwark 1	No / 8
Thurrock	Yes / 12
Tower Hamlets 1	No / 9
Wandsworth 2	No / 2
Suburban	
Bexley 1	No / 9
Bromley 5	Yes / 15
Haringey 2	No / 9
Kingston 1	Yes / 11
Sutton 3	No / 7
Wandsworth 3	No / 10
Rural	
East Herts. 1	No / 6
Mole Valley 1	No / 4

A.3.4 PM10

PM10	Instrument Type*	Data Capture %	Annual Mean (μg/m3)	Annual Max (μg/m3)
Kerbside				
Barnet	**T**	2	19	66
Camden	**T**	81	25	108
Marylebone Road	**T**	98	32	153
Roadside				
Bromley 7	**B**	25	32	129
Ealing 2	**T**	78	23	101
Enfield 2	**B**	71	31	170
Greenwich 5	**T**	77	22	106
Haringey 1	**T**	93	22	288
Havering 3	**T**	1	16	48
Kens and Chelsea 2	**T**	60	28	161
Kingston 2	**T**	96	23	153
Sutton 1	**T**	98	21	94
Wandsworth 4	**T**	81	19	102
Watford	**T**	7	20	85

*T= TEOM, B=BAM

PM10	Instrument Type*	Data Capture %	Annual Mean (μg/m3)	Annual Max (μg/m3)
Background				
Brent	**T**	95	18	83
Croydon 3	**T**	95	19	148
Dacorum	**T**	95	18	110
East Herts. 2	**T**	48	17	87
Enfield 3	**B**	12	29	121
Greenwich 4	**T**	85	18	109
Kens and Chelsea 1	**T**	98	20	159
St Albans	**T**	93	18	114
Sevenoaks 2	**T**	89	19	169
Tower Hamlets 1	**T**	99	21	112
Thurrock	**T**	89	19	155
Waltham Forest	**T**	7	20	85
Suburban				
Bexley 1	**T**	96	19	184
Bexley 2	**T**	91	19	144
Bexley 3	**T**	83	20	90
Havering 2	**B**	69	28	127
Mole Valley 2	**T**	98	17	101

*T= TEOM, B=BAM

PM10	Low Pollution		Moderate Pollution		High Pollution		Very High Pollution	
DETR Bands	**Hours**	**Days**	**Hours**	**Days**	**Hours**	**Days**	**Hours**	**Days**
Kerbside								
Barnet	219	9	0	0	0	0	0	0
Camden	7054	294	41	4	0	0	0	0
Marylebone Road	8204	329	371	32	8	1	0	0
Roadside								
Bromley 7	(1877)	(75)	(149)	(8)	(36)	(2)	(4)	(1)
Ealing 2	6721	273	155	16	0	0	0	0
Enfield 2	(5538)	(221)	(447)	(25)	(124)	(11)	(22)	(1)
Greenwich 5	6628	276	90	8	0	0	0	0
Haringey 1	7943	325	121	12	0	0	0	0
Havering 3	74	4	0	0	0	0	0	0
Kens & Chelsea 2	5126	353	122	11	0	0	0	0
Kingston 2	8177	340	146	11	0	0	0	0
Sutton 1	8529	356	59	5	0	0	0	0
Wandsworth 4	6993	290	72	7	0	0	0	0
Watford	597	25	0	0	0	0	0	0

DETR bands are for PM10 as measured by TEOM. Results using other instruments cannot be compared directly and are shown in parenthesis.

PM10	Low Pollution		Moderate Pollution		High Pollution		Very High Pollution	
DETR Bands	**Hours**	**Days**	**Hours**	**Days**	**Hours**	**Days**	**Hours**	**Days**
Background								
Brent	8170	342	39	4	0	0	0	0
Croydon 3	8166	343	54	6	0	0	0	0
Dacorum	8225	355	42	6	0	0	0	0
East Herts. 2	4188	176	0	0	0	0	0	0
Enfield 3	(999)	(39)	(59)	(4)	(1)	(1)	(0)	(0)
Greenwich 4	7423	310	33	3	0	0	0	0
Kens & Chelsea 1	8493	352	70	8	0	0	0	0
St Albans	8059	338	0	0	0	0	0	0
Sevenoaks 2	7676	317	95	8	0	0	0	0
Tower Hamlets 1	8600	356	81	9	0	0	0	0
Thurrock	7514	316	65	6	0	0	0	0
Waltham Forest	4003	168	10	2	0	0	0	0
Suburban								
Bexley 1	8313	349	38	3	0	0	0	0
Bexley 2	7920	330	52	6	0	0	0	0
Bexley 3	7134	300	39	3	0	0	0	0
Havering 2	(5372)	(213)	(442)	(28)	(75)	(8)	(11)	(1)
Mole Valley 2	8520	354	62	6	0	0	0	0

DETR bands are for PM10 as measured by TEOM. Results using other instruments cannot be compared directly and are shown in parenthesis.

PM10	NAQS Objectives / Proposed AQS Objectives		
	99th %ile Max daily rolling 24 h Average>50µg/m3	35 Days Daily Average >50µg/m3	Annual Mean >40µg/m3
		(TEOM *1.3, BAM *1)	(TEOM *1.3, BAM *1)
Kerbside			
Barnet	NA/ (50)	NA/ (0)	NA/ (24.7)
Camden	Yes / 50	No / 22	No / 33
Marylebone Road	Yes / 65	Yes / 83	Yes / 42
Roadside			
Bromley 7	NA/ (98)	NA/ (14)	NA/ (32)
Ealing 2	Yes / 61	No / 22	No / 30
Enfield 2	NA/ (96)	NA/ (26)	NA/ (40)
Greenwich 5	Yes / 57	No / 25	No / 29
Haringey 1	Yes / 54	No / 22	No / 29
Havering 3	NA/ (28)	NA/ (0)	NA/ (21)
Kens and Chelsea 2	Yes / 57	No / 28	No / 36
Kingston 2	Yes / 59	No / 28	No / 30
Sutton 1	Yes / 57	No / 13	No / 27
Wandsworth 4	Yes / 52	No / 12	No / 25
Watford	NA/ (40)	NA/ (1)	NA/ (26)

PM10	NAQS Objectives / Proposed AQS Objectives		
	99th %ile Max daily rolling 24 h Average>50µg/m3	35 Days Daily Average >50µg/m3	Annual Mean >40µg/m3
		(TEOM *1.3, BAM *1)	(TEOM *1.3, BAM *1)
Background			
Brent	Yes / 51	No / 8	No / 24
Croydon 3	Yes / 54	No / 11	No / 25
Dacorum	Yes / 50	No / 11	No / 24
East Herts. 2	NA / (37)	NA / (0)	NA / (22)
Enfield 3	NA / (74)	NA / (3)	NA / (29)
Greenwich 4	No / 47	No / 5	No / 23
Kens & Chelsea 1	Yes / 54	No / 16	No / 26
St Albans	No / 42	No / 4	No / 24
Sevenoaks 2	Yes / 56	No / 10	No / 25
Tower Hamlets 1	Yes / 55	No / 23	No / 27
Thurrock	Yes / 58	No / 14	No / 25
Waltham Forest	NA / (48)	NA / (5)	NA / (25)
Background			
Bexley 1	Yes / 50	No / 18	No / 25
Bexley 2	Yes / 54	No / 19	No / 25
Bexley 3	No / 49	No / 13	No / 26
Havering 2	NA / (86)	NA / (22)	NA / (28)
Mole Valley 2	Yes / 53	No / 8	No / 22

A.3.5 PM2.5

PM10	Instrument Type*	Data Capture %	Annual Mean (μg/m3)	Annual Max (μg/m3)
Roadside				
Bromley 7	**B**	24	29	>500
Ealing 2	**T**	95	17	82
Background				
Hackney	**T**	97	15	82
Suburban				
Bexley 2	**T**	89	14	100
Bexley 3	**T**	87	13	70

*T= TEOM, B=BAM

A3.6 Sulphur Dioxide

Sulphur Dioxide	Data Capture %	Annual Mean (ppb)	Annual Max (ppb)
Kerbside			
Marylebone Road	94	7	63
Roadside			
Havering 3	1	3	10
Southwark 2	82	5	50
Sutton 1	88	4	67
Background			
Brent	92	3	38
Castle Point	37	4	124
Ealing 1	93	4	43
Enfield 3	14	5	35
Greenwich 4	86	3	107
Kens & Chelsea 1	98	3	44
Lewisham	97	3	56
St. Albans	44	2	37
Sevenoaks 2	80	4	149
Southwark 1	96	3	95
Tower Hamlets 1	97	4	56
Thurrock	93	4	62
Waltham Forest	46	3	63
Wandsworth 2	99	4	88
Suburban			
Bexley 1	94	3	101
Wandsworth 3	99	3	74
Rural			
Mole Valley 1	70	4	93

Sulphur Dioxide	Low Pollution		Moderate Pollution		High Pollution		Very High Pollution	
	15 mins	Days	15 mins	Days	15 mins	Days	15 mins	Days
Kerbside								
Marylebone Road	32428	342	0	0	0	0	0	0
Roadside								
Havering 3	509	4	0	0	0	0	0	0
Southwark 2	28394	296	0	0	0	0	0	0
Sutton 1	30468	326	0	0	0	0	0	0
Background								
Brent	31923	335	0	0	0	0	0	0
Castle Point	12689	134	6	1	0	0	0	0
Ealing 1	31963	341	0	0	0	0	0	0
Enfield 3	5251	56	0	0	0	0	0	0
Greenwich 4	29752	316	0	0	0	0	0	0
Kens & Chelsea 1	33961	363	0	0	0	0	0	0
Lewisham	33631	358	0	0	0	0	0	0
St. Albans	15619	160	0	0	0	0	0	0
Sevenoaks 2	28208	286	37	5	3	2	0	0
Southwark 1	33185	349	1	1	0	0	0	0
Tower Hamlets 1	33385	358	0	0	0	0	0	0
Thurrock	32609	336	2	2	0	0	0	0
Waltham Forest	15941	166	0	0	0	0	0	0
Wandsworth 2	34508	364	0	0	0	0	0	0
Suburban								
Bexley 1	32586	342	5	2	0	0	0	0
Wandsworth 3	34907	364	1	1	0	0	0	0
Rural								
Mole Valley 1	24270	253	3	1	0	0	0	0

Sulphur Dioxide	Proposed AQS Objective
	100ppb (15min ave) not to be exceeded more than 35 ocassions
Kerbside	
Marylebone Road	No / 0
Roadside	
Havering 3	(0)
Southwark 2	(0)
Sutton 1	No / 0
Background	
Brent	No / 0
Castle Point	(6)
Ealing 1	No / 0
Enfield 3	(0)
Greenwich 4	5
Kens & Chelsea 1	No / 0
Lewisham	No / 0
St. Albans	(0)
Sevenoaks 2	Yes / 37
Southwark 1	1
Tower Hamlets 1	No / 0
Thurrock	2
Waltham Forest	(0)
Wandsworth 2	1
Suburban	
Bexley 1	5
Wandsworth 3	No / 0
Rural	
Mole Valley 1	No / 3

The proposed AQS objective of 132ppb as an hourly average not to be exceeded on greater than 24 times a year was not exceeded at any LAQN site. Sevenoaks measured 4 hourly averages above 132ppb. No other LAQN site measured hourly averages above 132ppb.

The proposed AQS objective of 47ppb as a daily average, not to be exceeded on more than 3 occasions was not exceeded at any LAQN site. No LAQN site measured daily averages above 47ppb.

Appendix 4

PROPOSED AIR QUALITY STRAEGY OBJECTIVES

APPENDIX 4: PROPOSED AIR QUALITY STRATGEY OBJECTIVES

The following objectives are proposed in the draft Air Quality Regulations 2000 for the purposes of Local Air Quality Management.

Pollutant	Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 μg/m^3 (5 ppb)	Running Annual Mean	31 Dec 2003
1, 3 Butadiene	2.25 μg/m^3 (1 ppb)	Running Annual Mean	31 Dec 2003
Carbon Monoxide	11.6 μg/m^3 (10 ppb)	Running 8 hour mean	31 Dec 2003
Lead	0.5 μg/m^3 0.25 μg/m^3	Annual Mean Annual Mean	31 Dec 2003 31 Dec 2008
Nitrogen Dioxide (provisional)	200 μg/m^3 (105 ppb) not to be exceeded more than 18 times a year 40 μg/m^3 (21 ppb)	1 hour mean Annual Mean	31 Dec 2005 31 Dec 2005
Particles (PM10)	50 μg/m^3 not to be exceeded more than 35 times a year 40 μg/m^3	24 hour mean Annual Mean	31 Dec 2004 31 Dec 2004
Sulphur Dioxide	350 μg/m^3 (132 ppb) not to be exceeded more than 24 times a year 125 μg/m^3 (47 ppb) not to be exceeded more than3 times a year 266 μg/m^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 proposed Air Quality Strategy objectives are not included in the Air Quality Regulations 2000 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 μg/m^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 NOX is taken as NO2)	30 μg/m^3 (16 ppb)	Annual mean	31 Dec 2000
Sulphur Dioxide	20 μg/m^3 (8 ppb) 20 μg/m^3 (8 ppb)	Annual Mean Winter Mean (1 Oct- 31 Mar)	31 Dec 2000 31 Dec 2000

DETR 1999, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – A consultation Document.

DETR 1999 Draft Air Quality Regulations 2000.