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The London Wide Environment Programme

Benzene Diffusion Tube Survey 2003

Report

London Wide Benzene Diffusion Tube Survey Annual Report 2003

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London Borough of Barking and Dagenham
London Borough of Bexley
London Borough of Brent
London Borough of Camden
London Borough of Greenwich
London Borough of Hammersmith and Fulham
London Borough of Harrow
London Borough of Hillingdon
London Borough of Hounslow
Royal Borough of Kensington and Chelsea
Corporation of London
London Borough of Newham
London Borough of Richmond
London Borough of Sutton
London Borough of Wandsworth
City of Westminster

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Executive Summary

This report presents the results of the 2003 London Wide Benzene Monitoring Programme. The main objective of the programme is to determine the ambient concentration of benzene to which people are exposed in urban areas, since benzene is a genotoxic carcinogen and as such is strongly linked to the formation of cancer.

During the 2003 programme participating boroughs maintained one hundred sites across London. These sites included urban background locations, thus allowing the levels of benzene to which the general public are exposed for significant periods of time to be quantified. Monitoring sites also included roadside and petrol station locations, as motor vehicles are the major source of atmospheric benzene, with significant evaporative emissions resulting from the handling, distribution and storage of petrol. Toluene, ethyl benzene, m, p-xylene and o-xylene were also monitored at thirty-six sites in six boroughs across London. Such measurements can be of use in determining possible emission sources. Benzene, toluene, ethyl benzene, m, p-xylene and o-xylene levels were determined using passive diffusion tubes. These provide long term measurements, which give a good indication of personal exposure.

As would be expected, maximum benzene concentrations were recorded at petrol station locations. Annual mean benzene concentrations ranged from 1.4µg m^{-3} to 4.4µg m^{-3} at roadside locations, 1.4µg m^{-3} to 3.2µg m^{-3} at background locations and 2.3µgm^{-3} to 9.6µg m^{-3} at petrol stations. The annual mean benzene concentrations for the three different location types were 2.9µg m^{-3}, 2.3µg m^{-3} and 5.0µg m^{-3} at roadside, background and petrol station locations respectively.

These results are consistent with road traffic and petrol being significant sources of atmospheric benzene. This is shown in the results where a reduction in benzene has occurred with increasing distance from the road. Ambient benzene levels are influenced by several factors; for example traffic flow, meteorological conditions and height of sampler. This partially explains why there appeared to be little influence of road traffic on benzene levels in some boroughs.

During 2003, benzene levels exhibited some seasonal variation similar to that of previous years with mean concentrations at many sites showing little variation. In most boroughs, concentrations followed the pattern documented for other primary pollutants, with much greater variation in ground level concentrations occurring in winter months.

Benzene levels recorded in this study were compared against the Air Quality Objective and the Air Quality Standard *(AQS)* for benzene set by the Expert Panel on Air Quality Standards. The Objective and AQS are set at 16.25µg m^{-3} as a running annual mean and is the level 'at which the risks are exceedingly small and unlikely to be detectable'. Although such comparisons give a good indication of likely exceedences of such criteria, direct comparisons cannot be made, due to the different averaging periods used. However, as a guide the annual mean can be converted into a running mean by using a multiplication factor of 1.1[18].

In 2003 annual mean concentrations at all sites were below the Standard and Objective of 16.25µg m^{-3}. Results were similar to that of the previous year and support the assertion made by the Expert Panel on Air Quality Standards that annual average benzene concentrations rarely exceed the AQS. Current policies already in place have helped greatly to reduce benzene although further measures would be necessary for the EPAQS long-term target concentration of 5µg m^{-3}.

1 Introduction

This report presents the results of the 2003 London Wide Benzene Monitoring Programme. The report describes results collected from January 2003 to December 2003, which covers the twelfth year during which the programme was in operation. The Benzene Monitoring Programme forms part of the London Wide Environmental Programme *(LWEP),* an integrated programme dealing with environmental issues for London Boroughs.

The following London Boroughs sponsored the 2003 Benzene Monitoring Programme:

London Borough of Barking and Dagenham
London Borough of Bexley
London Borough of Brent
London Borough of Camden
London Borough of Greenwich
London Borough of Hammersmith and Fulham
London Borough of Harrow
London Borough of Hillingdon
London Borough of Hounslow
Royal Borough of Kensington and Chelsea
Corporation of London
London Borough of Newham
London Borough of Richmond
London Borough of Sutton
London Borough of Wandsworth
City of Westminster

The main objective of the Benzene Monitoring Programme is to determine the ambient concentrations of benzene to which people are exposed in urban areas. The programme was initiated in response to continuing concern that people living within urban areas are often exposed to elevated concentrations of benzene, which may be harmful to human health. Monitoring conducted as part of the Programme also allows compliance with relevant guidelines to be assessed.

During the 2003 programme, a total of one hundred sites across London were maintained by participating boroughs. Benzene levels were surveyed using the passive diffusion sampler technique incorporating procedures developed by Casella Stanger specifically for monitoring ambient levels. Diffusion samplers were despatched to participating boroughs at regular intervals, exposed by local council staff and returned to Casella Stanger following a standard exposure period.

Toluene, ethyl benzene, m, p-xylene and o-xylene were also monitored at a total of thirty-six sites within six boroughs across London. This additional analysis was carried out on the same diffusion samplers used for benzene monitoring. There are currently no ambient air quality guidelines or standards regarding these volatile organic compounds, however monitoring can be useful in determining possible emission sources in order to aid the understanding of the pollutant occurrence. The ratio between benzene and toluene varies depending on the emission source and so can be used to determine whether road traffic or industrial sources are the main contributors to VOC levels at certain locations. A benzene/toluene ratio of approximately 1:2-1:4 is indicative of road traffic as a main contributor to VOC concentration at a particular location. Benzene/toluene ratios for this study can be found in Appendix H, Table 4. Given the lack of published data regarding these VOC's this report concentrates primarily on sources and effects of benzene.

As road traffic and petrol stations are major sources of atmospheric benzene, at least one site in each borough was located near one of these emission sources. However, as the overall objective of the study was to determine long term concentrations to which the general public are exposed for significant periods of time, samplers were also located at background sites away from direct sources, such as residential areas. Sites were located at varying distances from busy roads, which enabled the importance of road traffic as a source of benzene to be assessed.

2 Sources of Benzene

Benzene is an aromatic hydrocarbon occurring as a colourless, clear liquid. Benzene is one of a group of substances known as volatile organic compounds *(VOC's)*; this group of compounds also includes toluene, ethyl benzene and xylenes.

There are no well-defined natural sources of benzene although it is known to occur naturally as a constituent of natural gas and of light oil recovered from coal carbonisation gases. Other industrial processes including the pyrolysis of petrol also synthetically produce benzene. In Western Europe in the early 1980s, production of benzene was estimated to be 6.9 million tonnes, with the UK, Federal Republic of Germany and Netherlands being the major producers.

Benzene is added to petrol as an anti-knock agent. Since 1 July 1989 the content of benzene in petrol in the UK had been limited to 5% by volume in leaded or unleaded petrol by the EC Directive *COM (84) 226*. In practice this amount varied since refineries often used a variety of other compounds to obtain the same effect depending upon the availability and cost. Since January 2000, EU legislation implemented through the Auto-Oil Programme requires that the amount of benzene in petrol be below 1% in volume and is presently about 0.6% by volume on average for fuel sold in the UK[19].

Benzene in ambient air arises mainly from anthropogenic sources, in particular through the combustion of petrol and oil, although natural benzene emissions occur from plant and animal matter and seepage from petroleum reservoirs. Table 1 shows the benzene emission inventory for the UK, which illustrates motor vehicles being the major source of benzene emissions. On a national basis, this accounted for about 71% of total emissions in 1999. These sources are also significant contributors to ambient concentrations of other VOC's such as toluene, ethyl benzene and xylenes.

An additional significant source of ambient benzene is petrol evaporation from vehicles and evaporative emissions from the handling, distribution and storage of petrol. A study undertaken in Leeds identified motor vehicles, as the single largest source of VOC's, responsible for almost half of all releases. A high proportion of VOC emissions were also attributed to solvent use, particularly in the city centre were there was a large number of industrial point sources *(Clarke et al 1996)*.
Tobacco smoke has also been shown to contain high concentrations of benzene *(up to 200-mg m^{-3})* and is a further source of environmental benzene especially in the indoor environment, as is diet; benzene is found

in drinking water and some foods and therefore enters the body via normal ingestion processes.

Table I: UK Annual Benzene emissions, 1990-1999 (Ktonnes)

Source	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	% in 1999
Industrial Combustion	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	**3%**
Industrial Processes	3.7	3.8	3.9	3.9	4.0	4.0	3.4	2.9	2.0	1.8	**6%**
Domestic	3.5	3.6	3.4	3.4	3.1	2.8	3.0	2.8	2.9	3.0	**10%**
Road Transport Combustion	42.4	41.5	39.8	36.8	34.1	31.3	29.0	26.1	23.4	21.0	**71%**
Other	4.0	4.1	4.2	4.2	4.3	4.0	3.9	3.8	3.5	3.1	**10%**
Total	**54**	**54**	**52**	**49**	**46**	**43**	**40**	**37**	**33**	**30**	**100%**

(From The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: *A consultation document on proposals for air quality objectives for particles, benzene, carbon monoxide and polycyclic aromatic hydrocarbons: September 2001)*

3 Human Exposure to Benzene

Since benzene is a primary pollutant, concentrations are generally higher close to the emission source. However, the sources of personal exposure to benzene may be very different from those contributing to outside air due to time activity and behavioural patterns. Smoking, in particular, is linked to benzene exposure, as tobacco smoke contains significant benzene concentrations. Smoking will undoubtedly be the major source of exposure to benzene for smokers, but passive smoking may also be a significant factor.

Personal exposure to benzene in the home may also result from evaporative emissions from consumer products, such as paints, adhesives and marker pens, while in homes with attached garages, evaporative emissions from petrol tanks of cars could be significant. However, the importance of these sources for personal exposure in the UK is unknown and yet to be established.

Benzene in motor vehicles is likely to be a significant source of exposure. These exposures can result from exhaust and evaporative emissions arising from the vehicle itself or from the higher concentrations of this primary pollutant in the road. The actual concentrations may be influenced by the age and model of the vehicle, by traffic and weather conditions, and by whether the vehicle is being driven with window open or with fans or heaters on. Again, there is very little data on actual UK exposures in vehicles, but data from elsewhere suggest these exposures could be 2-10 times those at urban monitoring sites. Finally, exposure while refilling vehicles with petrol may be high, although the time spent by most individuals at such locations is generally small.

These complex sources of benzene mean that contributions from different sources to total outdoor emissions give a poor indication of the importance of different sources to personal exposure. For example, in the US it has been estimated that direct outdoor exposure only contributes 15% of the total population exposure, whereas 60% is due to direct and indirect exposure to tobacco smoke.

Since the health consequences of ambient benzene exposure are not respiratory effects, and the pollutant tends to accumulate in fatty tissue within the body, exposure in food and drink may be important, as well as that in air. However, most calculations suggest that exposure through food and drink is likely to be small relative to that through the lungs, on a population basis. Deposition to local gardens and allotments could additionally contribute to the total benzene dose of

some individuals in urban areas, although little is known about actual rates of benzene deposition to, and accumulation in, vegetation.

Benzene exposure is especially high in certain groups of industrial workers, in the chemical and petrochemical sectors, and among certain groups with a high exposure to adhesive. These exposures are much greater than those due to ambient benzene and it is studies of these occupational groups, which have provided the clearest evidence of adverse health effects of this pollutant.

4 Health Effects of Benzene

At extremely high concentrations, relatively short-term exposure to benzene can cause anaesthesia or fatal damage to the bone marrow. However, such concentrations can only build up as a result of accidental release into poorly ventilated indoor environments, and are several orders of magnitude higher than ambient concentrations *(10 to 100mg m^{-3})*. Consequently, these toxicological effects are of little relevance when considering the health effects of ambient concentrations of benzene, which are orders of magnitude lower.

The concern relating to normal ambient exposure is linked to the fact that it is a proven genotoxic carcinogen and as such no absolutely safe level can be specified for ambient levels of benzene. Benzene has the effect of modifying the genetic makeup of living cells, which has been deduced from laboratory studies with animals. There is also evidence from several studies of occupational groups that long-term exposure to high concentrations of benzene is associated with a small increase in the probability of developing certain types of leukaemia.

Since leukaemia is a relatively rare disease, and since lifetime exposures as a result of ambient exposure are relatively low, it is effectively impossible to carry out epidemiological studies of the association between benzene exposure and the risk of contracting leukaemia in the general population. Thus, any assessment of the health risks associated with ambient benzene exposure is usually based on extrapolation from the occupational studies.

These occupational investigations are primarily cohort studies, in which defined groups of workers are followed forward over many years, and the number of deaths due to leukaemia recorded. In most of these studies, the number of subjects was no more than 3000, and since the chances of contracting leukaemia overall are only 1 in 6000, the results are generally based on a very small number of deaths. This fact, together with the relatively crude estimates of benzene exposure, which were made in some cases, makes it very difficult to establish exposure-response relationships for benzene.

The data from these studies provide good evidence of an effect after exposure at 32,440µg m^{-3}over 20 years, and some evidence of an effect at exposures between 3,244µg m^{-3} and 32,440µg m^{-3}. However, any assessment of the risk of adverse health effects from long-term exposures to ambient benzene, which are likely to range from 3.24µg m^{-3} to 32.44µg m^{-3} in non-smokers, must rely on extrapolation downward over several orders of magnitude assuming a particular shape to the exposure-

response relationship. Assuming a linear exposure-response relationship, it would be possible to calculate the benzene exposure corresponding to any particular level of risk, but there is no means of verifying the actual shape of the exposure-response relationship.

Some research *(Yu, R et al, 1996)* has suggested that the health risk from exposure to low levels of benzene, such as ambient levels, may be greater than that predicted by extrapolation of occupational research. Muconic acid, a harmful metabolite of benzene, is produced in much higher quantities at lower concentrations than high concentrations. A 2% increase in muconic acid levels was typical at high ppm exposures whereas at exposures 2 to 3 orders of magnitude 25% was produced. This is consistent with enzymes involved in the metabolic pathway processing much more efficiently at low concentrations. This effect was measured in humans exposed to tobacco smoke but is likely to be relevant to other petrochemical exposures.

Clearly, the understanding of the health effects of benzene is increasing all the time through studies of the type quoted here. However, until further evidence is gathered, it shall be assumed that there is no acceptable level of benzene that should be set against which health risks become acceptable.

5 The Air Quality Strategy

In March 1997, the Government published *The United Kingdom Air Quality Strategy*. This fulfilled the requirement for a National Air Quality Strategy under the Environment Act 1995, by setting out policies for the management of ambient air quality. The aim of this strategy was to map out, as far as possible, the future of ambient air quality policy in the United Kingdom for at least the next ten years. A particular purpose was to ensure that all those who contribute to air pollution, or are affected by it, or have a part to play in its abatement, can identify both what is statutorily required from them and what further contribution they could voluntarily make in as efficient manner as possible.[17]

The revised *Air Quality Strategy* was published in January 2000 and addresses remaining problems on air quality issues. Standards are set in the Strategy, which are concentrations below which effects are unlikely, even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely on the effects of a particular pollutant.

The Government has established air quality objectives for pollutants, which are based on recommendations of the Expert Panel on Air Quality Standards *(EPAQS)*. These set out the extent to which the standards are to be achieved for this year and future years. They take account of the costs, benefits, feasibility and practicality of achieving the standards.

The European Parliament and Council of Ministers concluded a conciliation agreement on three Auto-Oil vehicle emissions and fuel quality directives in 1998, which were introduced from January 2000.

This agreement includes stringent emission standards for new vans and cars sold from January 2001 *(Euro III standards)* and January 2006 *(Euro IV standards)*. These are complemented by tighter fuel quality specifications applying to all petrol and diesel sold from 2000 and 2005. These alone should result in a reduction in benzene emissions from road transport by 2005.

The Strategy is currently under review following the published consultation document of September 2002.

6 Air Quality Standards and Objectives for Benzene

The UK Expert Panel on Air Quality Standards *(EPAQS)* set an Air Quality Standard *(AQS)* for benzene in 1994. A running annual mean concentration of 5ppb was recommended which was based on a study of occupational data and the consideration of medical evidence for carcinogenic effects. In the report, the EPAQS also recommended a long-term policy target of 1ppb (*3.25µg m^{-3})* as a running annual mean in order to keep exposure to benzene as low as practicable. As recommended by EPAQS, the objective for benzene has been set at 5 ppb *(16.25µg m^{-3})* as a running annual mean, to be achieved in all areas by the end of 2003.

The provisions of the Air Quality Regulations 1997 in relation to England have been replaced by the Air Quality *(England)* Regulations 2000, which were authorised by the Secretary of State for the Environment, Transport and the Regions. Such regulations incorporate an objective of 16.25µg m^{-3} for benzene. The Governments intention is that this objective will be used for the purposes of Local Air Quality Management *(LAQM)*. Annual mean concentrations recorded at background and roadside locations were well below the AQS 16.25µg m^{-3} to be achieved by the end of 2003.

6.1 Future Air Quality for Benzene

In November 2000, the Second Air Quality Daughter Directive was adopted, which sets limit values for benzene and carbon monoxide *(Council Directive 2000/69/EC).* This European Directive sets a limit value for benzene in ambient air of 5µg m^{-3} as an annual mean to be achieved by Member States by 1 January 2010[19].

Since the latest Air Quality Strategy was published in 2000, an addendum to the Air Quality Strategy was subsequently published in January 2003, which adopted new objectives for benzene. The addendum explains that the objectives are to be kept under review on a pollutant by pollutant basis to take account of scientific and technical developments and developments in European legislation. Thus, as the EU Directive's limit value for benzene (5µg m^{-3}) differs from the previously proposed long-term objective of 3.25µg m^{-3}, the UK Government decided to set an objective of 5µg m^{-3} as an annual mean to be met by the end of 2010 throughout England. This is because the measurable health benefits of achieving a target of 3.25µg m^{-3} rather than 5µg m^{-3} are likely to be extremely small [21].

7 Methodology

7.1 Monitoring Sites

Descriptions of all 100 monitoring sites are given in Appendix A on an individual borough basis. As motor vehicle emissions are a major source of benzene, sites have been categorised according to distance from the nearest busy road. Over time site classifications tend to change within air quality surveys due to assessment of new data and opinion. Theoretically, this could mean the relocation of a site to meet new criteria, which could result in the loss of a valuable data source. Individual borough data thus includes sites that have been moved, ceased to exist, or new sites established.

For the purpose of this survey, sites are defined using roadside, petrol station and background locations only. The term kerbside location is no longer used but instead classified as roadside if within 20m from the kerb edge. A background site is one which is beyond 20 m of any road, usually situated in a residential area. A petrol station site can be located within roadside or background locations. Monitoring was conducted at 61 roadside sites, 34 background sites and 5 petrol station sites as shown in Figure A below.

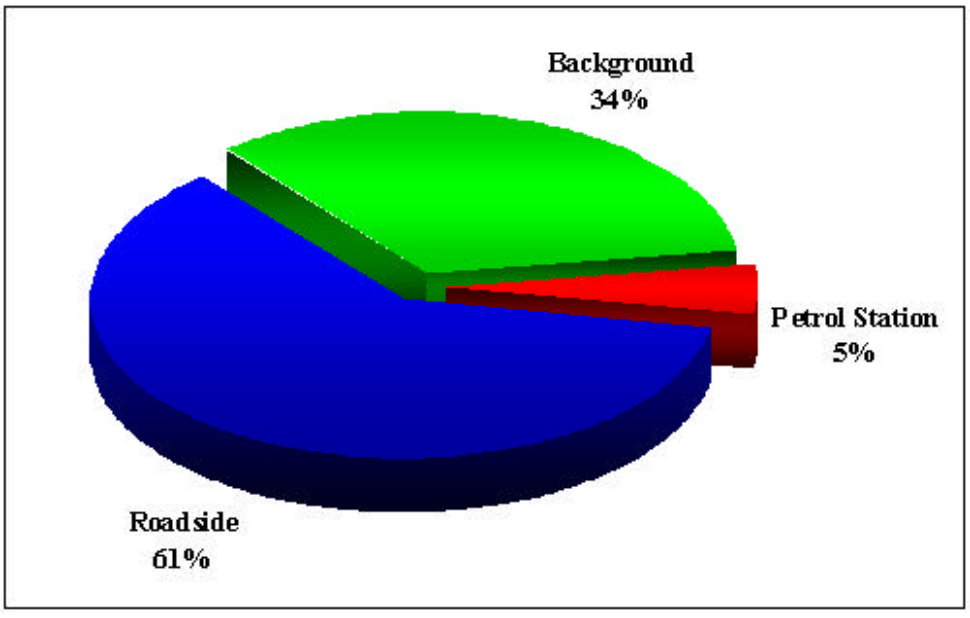


Figure A. Percentage of classified sites, which participated in the survey

7.2 Measurement Technique

Benzene, toluene, ethyl benzene, m, p and o-xylene *(BTEX)* measurements were made using Perkin-Elmer type diffusive samplers[20]. These are 9 cm long stainless steel tubes packed with Chromosorb 106 polymer, an adsorbent material with an excellent affinity for benzene, and sealed at both ends with protective caps. One end is sealed with a brass fitting containing a teflon ferrule, the other end a white teflon cap. On exposure, the white teflon cap is removed and replaced with a diffusion cap, which allows air to diffuse at a constant rate into the tube.

The samplers operate on the principle of molecular diffusion, whereby during exposure benzene in air will migrate to the adsorbent at a rate dependent on several quantifiable variables defined by Fick's First Law of Diffusion:

(a) The pathlength between the top surface of the monitor and the adsorbent bed

(b) The cross sectional area of the sampler

(c) The exposure time

(d) The diffusion coefficient of benzene through air

(e) The ambient concentration of benzene

Casella Stanger prepared all tubes in accordance with in-house technical procedure note: TP44 AIR(C). The tubes were despatched by special post to each borough and exposed for periods of approximately 2-weeks, following which the diffuser head was replaced with the original protective cap. Upon receipt the tubes were stored in a refrigerator prior to analysis.

Although tubes are exposed for 2-week periods previous work has shown that the uptake rate for benzene on to Chromosorb 106 differs by less than 1% for exposure periods of one, two and four weeks[20]. For most adsorbents their uptake rates decline rapidly over the first 16-24 hours of sampling, after which rates tend to stabilise.

7.3 Sample Analysis

All tubes were analysed by a UKAS accreditated laboratory using desorption scanning gas chromatography/mass spectrometry *(GC/MS)*. This method of analysis gives unequivocal identification of the BTEX peaks.

7.3.1 QC Checks

Quantitation was performed and determined by the internal standard technique with formal native compound calibration. A QC standard solution was spiked on to a blank tube together with the internal standard. The validity of the internal calibration was then verified by the analysis of the sample. A blank tube was also spiked with internal standard and analysed. A variation of +/– 20% was considered acceptable for the analysis of samples to continue.

7.3.2 Detection Limits

These were also assessed from the low standards sample i.e. 1ng on the tube and this was determined to be better than 1ng for the benzene based on the minimum detectable peak on the mass chromatogram.

7.3.3 Cleaning of Tubes

After analysis all tubes are heated to 230°C for 60 minutes with a desorption flow of 100ml/min. 10% of tubes are then spiked with internal standard and analysed. These tubes are then re-cleaned.

The mass of BTEX collected in the tube is then expressed as an average airborne concentration *(μgm^{-3})* measured over the monitoring period. This calculation is shown in Appendix B. The diffusion coefficient for benzene has been empirically calculated at Casella Stanger as described in Section 7.4.

As identified above quality control procedures integral to the analytical procedure involve verification of the benzene peak and calibration against internal spiking solutions. All cleaned tubes are analysed prior to exposure to ensure the Chromosorb retains no benzene. Duplicate and triplicate tubes are also exposed at a selection of boroughs each month thus allowing the coefficient of variation between tubes to be assessed.

7.4 Empirical Determination of the Benzene Diffusion Coefficient

Benzene tubes were exposed to a known benzene concentration in air generated using a permeation vial held at 50^{o}C in a glass oven, in turn held in a thermostatic water bath. A purge flow of pure air from an Aadco Model 737 Pure Air Generator was passed through a glass ball filled heat exchanger at a rate of 1 litre/minute to flush the benzene from the oven.

The generated benzene/air mix was further diluted with pure air at a rate of 5 l/m and fed to a 30-cm diameter spherical glass reaction vessel. Diffusion tubes were mounted on a carousel turning at approximately 1.2 revs per minute.

Tubes were exposed over a period of two weeks and benzene uptake was determined by thermal desorption and detection with flame ionisation detection *(FID)* using internal standards. The diffusion coefficient was calculated according to the equation shown in Appendix B. A Photovac, photo ionisation detector with gas chromatography *(PID GC)* was used to determine any losses of benzene in the diffusion coefficient test rig.

8 Results of the 2003 Benzene Monitoring Programme

Benzene, toluene, ethyl benzene, m, p and o-xylene data collected between January 2003 and December 2003 are given on an individual borough basis in Appendices C, D, E, F and G respectively.

Annual mean benzene concentrations have been calculated for each monitoring site in order to allow comparison with the published Air Quality Standard *(AQS)* and Objective. Making such comparisons gives a good indication of likely exceedences of such criteria. Due to different averaging periods, direct comparisons cannot be made however, as a guide, the annual mean can be converted to a running mean by using a multiplication factor of 1.1 *(LAQM.TE4 (00)*. For the purposes of Local Air Quality Management *(LAQM)* results have been expressed in micrograms per cubic metre.

The following section provides results for individual boroughs, given in alphabetical order. In order to maintain validity of results, annual means have not been reported for site locations with data capture of less than 75% or where blocks of seasonal data are missing.

8.1 London Borough of Barking and Dagenham

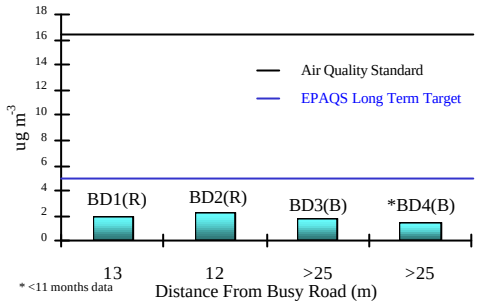


Figure 1A. Annual Mean Benzene Concentrations – 2003

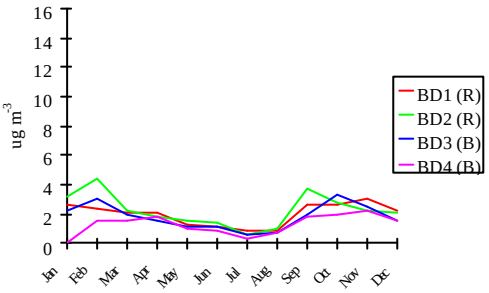


Figure 1B. Temporal Variation 2003

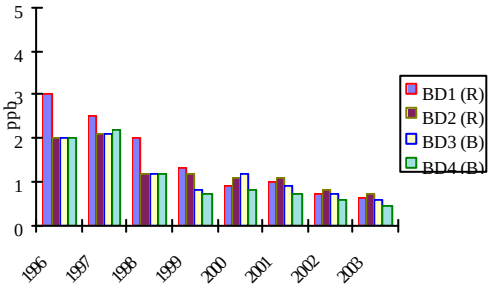


Figure 1C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Annual mean benzene concentrations of 2.0 and 2.3µg m^{-3} were recorded at the two roadside locations, BD1 and BD2. Annual mean values of 1.8 and 1.4µg m^{-3} were recorded at background locations BD3 and BD4 respectively. The highest mean level of 2.3µg m^{-3} was recorded for roadside location BD2 situated at Maplestead Road, Barking. The AQS and EPAQS long-term target were not exceeded or approached at any site.

Temporal Variation

As illustrated in Figure 1B, benzene concentration at all four sites followed a similar profile with some seasonal variation. Benzene levels peaked in February, September, October, November and December at all sites. A maximum concentration of 4.4µg m^{-3} was recorded for February at site BD2.

Annual Trends

Figure 1C illustrates annual average benzene concentrations for 1996-2003. The 1999 trunk road installation that diverts traffic away from the area of site BD1 has continued to have a visible impact on benzene levels at this location. Levels at all sites declined from 1996 to 1999, then stabilised from 1999-2001. From 2001, onwards levels have again started to decline.

8.2 London Borough of Bexley

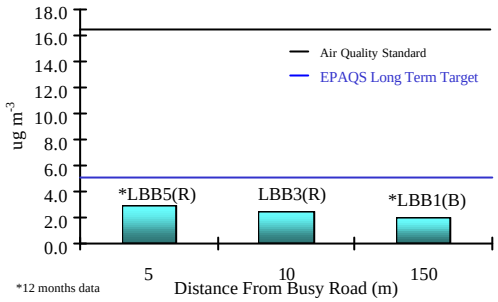


Figure 2A. Annual Mean Benzene Concentrations – 2003

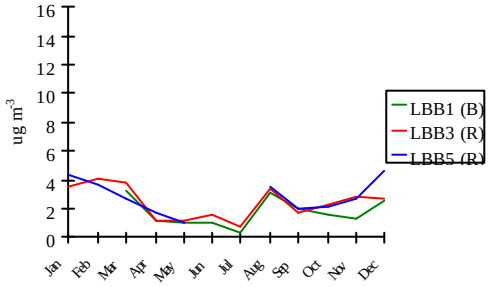


Figure 2B. Temporal Variation 2003

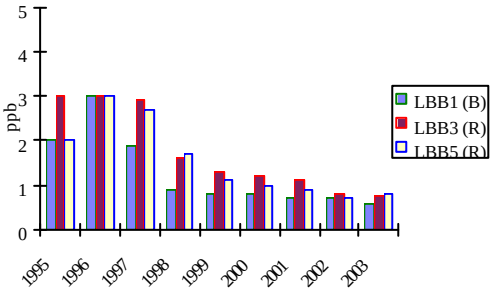


Figure 2C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Mean concentrations of 2.4 and 2.8µg m^{-3} were recorded at roadside locations LBB3 and LBB5 respectively. The highest mean value of 2.8µg m^{-3} was recorded for site LBB5 located at Watling Street, Bexleyheath. A lower mean value of 1.9µg m^{-3} was recorded at the background site LBB1 located at Whitehall lane. A clear relationship between concentration and the distance from a busy road can be seen. Neither the AQS nor the EPAQS long-term target was exceeded or approached at any of the three sites.

Temporal Variation

Figure 2B illustrates temporal trends for the three site locations. Benzene levels followed a similar profile throughout the year with some seasonal variation. A maximum peak level of 4.6µg m^{-3} was recorded for December at roadside site LBB5.

Annual Trends

The initial sharp decrease from 1996-1999 has been followed by a slight but steady decline from 1999-2003. Annual mean benzene concentrations have remained consistently below the AQS since 1995 with levels showing a continued decrease since 1996.

8.3 London Borough of Brent

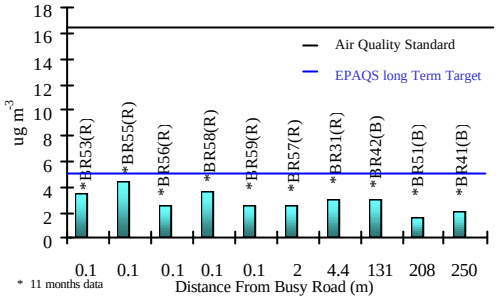


Figure 3A. Annual Mean Benzene Concentrations – 2003

Annual Mean Concentration

Annual mean benzene concentrations ranged from 1.5µg m^{-3} at site BR51, background to 4.4µg m^{-3} recorded at site BR55, roadside. The highest mean level of 4.4µg m^{-3} was recorded at 79 High Street, Harlesden. The AQS and EPAQS target were not exceeded or approached at any site.

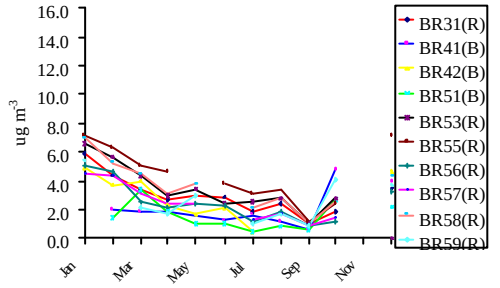


Figure 3B. Temporal Variation 2003

Temporal Variation

Temporal trends for 2003 are illustrated in Figure 3B. Concentrations followed a similar pattern throughout the year with a major increase in levels during winter months. A maximum peak level of 7.2µg m^{-3} was recorded for January and December at BR55 a roadside site, located at 79 High Street Harlesden.

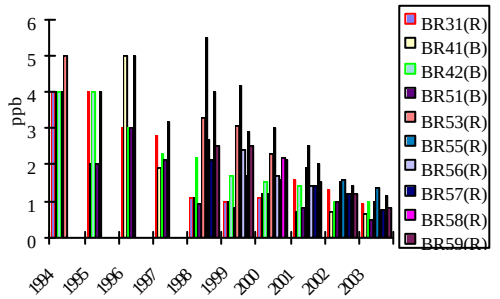


Figure 3C. Trends in Annual Average Benzene Concentrations

Annual Trends

Since 1998, levels recorded have continued to show a decline in benzene concentration at all sites, with the highest mean level being recorded for site BR55.

8.4 London Borough of Camden

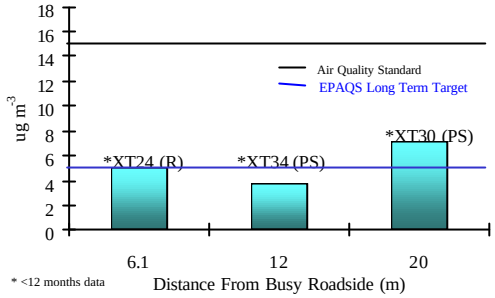


Figure 4A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

Mean concentrations ranged between Mean concentrations ranged between 3.7µg m^{-3} at site XT34 a BP petrol station on Finchley road, Haverstock hill and 7.2µg m^{-3} at site XT30, another BP petrol station on Finchley Road, Swiss Cottage. The AQS was not exceeded at any of the site locations. However, the EPAQS long-term target was exceeded by sites XT24 and XT30.

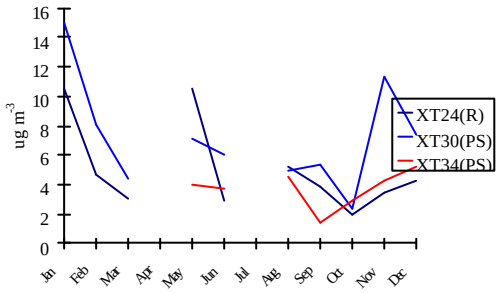


Figure 4B. Temporal Variation 2003

Temporal Variation

Figure 4B illustrates the temporal variation throughout the year, but due to insufficient data, few comments can be made. However, a maximum concentration of 15µgm^{-3} was recorded for a petrol station location XT30.

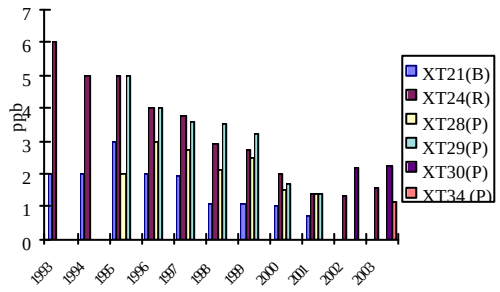


Figure 4C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 4C illustrates the continued decline in annual average benzene concentrations since 1996. Annual average benzene concentrations for the new petrol station site XT30 have remained the same as 2002. Following a decline in levels from 1993 to 2000, site XT24 showed little fluctuation from 2001-2002. Subsequently a slight increase has been observed from 2002-2003.

8.5 London Borough of Greenwich

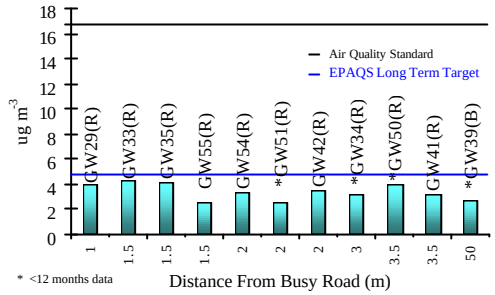


Figure 5A. Annual Mean Benzene Concentrations – 2003

Annual Mean Concentration

Mean concentrations ranged from 2.5µg m^{-3} recorded at site GW55, a roadside location to 4.3µg m^{-3} recorded at site GW33, a roadside site at Blackheath Hill, Blackheath SE3. No relationship was found between mean concentration and the distance from a busy road. Neither the AQS nor the EPAQS long-term target was exceeded or approached by any site.

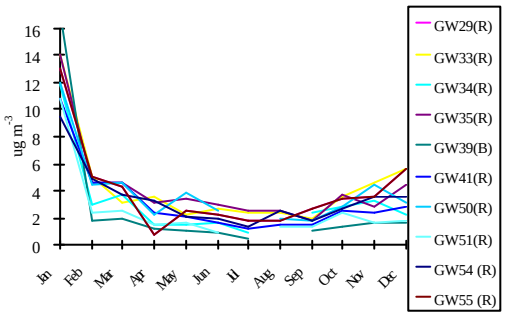


Figure 5B. Temporal Variation 2003

Temporal Variation

Figure 5B illustrates that temporal trends were similar at all eleven sites. High peak levels were observed at all sites during January with a maximum peak level of 17.2µg m^{-3} recorded at background location GW39.

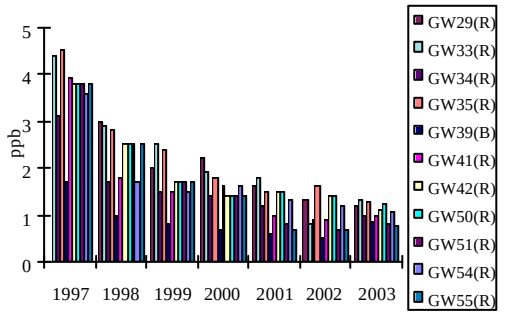


Figure 5C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 5C shows that at all sites levels have declined since 1997. Following a sharp decrease in levels from 1997-2000, concentrations have levelled out showing only a slight decline from 2001-2003.

8.6 London Borough of Hammersmith and Fulham

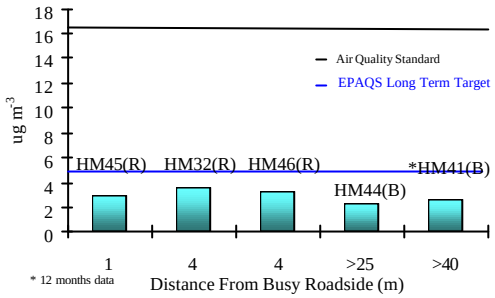


Figure 6A. Annual Mean Benzene Concentrations – 2003

Annual Mean Concentration

Annual mean concentrations ranged from 2.3µg m^{-3} to 3.6µg m^{-3}. The highest annual mean concentration of 3.6µg m^{-3} was recorded at site HM32, a roadside location in the vicinity of Hammersmith Broadway. The lowest mean level was recorded at site HM44 background location situated at Eel Brook Common. Neither the AQS nor the EPAQS long-term target was exceeded or approached at any site.

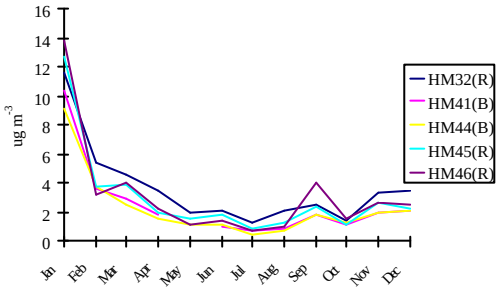


Figure 6B. Temporal Variation 2003

Temporal Variation

Figure 6B illustrates that temporal trends were similar at all sites. Maximum levels were recorded at all sites in January with a peak of 13.9µg m^{-3} at roadside site, HM46.

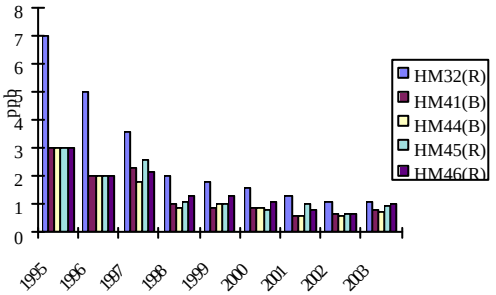


Figure 6C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 6C shows a decline in levels since 1995 with concentrations stabilising over the past six years. Levels at roadside site HM32 have been consistently higher than those at all other sites.

8.7 London Borough of Harrow

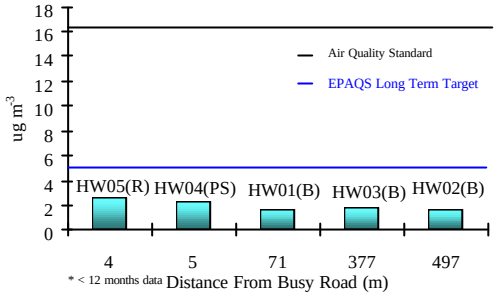


Figure 7A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

Annual mean levels ranged from 1.6µ m^{-3} at site HW02 to 2.6µg m^{-3} at site HW05. The highest mean of 2.6µg m^{-3} was recorded at a roadside location on Station Road, Harrow. The lowest mean of 1.6µg m^{-3} was recorded at a background location at Grimsdyke School, Hatch End. The AQS and EPAQS long-term target were not exceeded at any site.

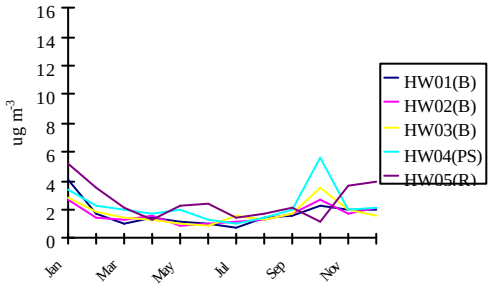


Figure 7B. Temporal Variation 2003

Temporal Variation

Temporal trends shown in Figure 7B were similar at all sites with some seasonal variation. Concentrations peaked during January and October. Petrol station location HW04 recorded a maximum concentration of 5.7µg m^{-3} in October.

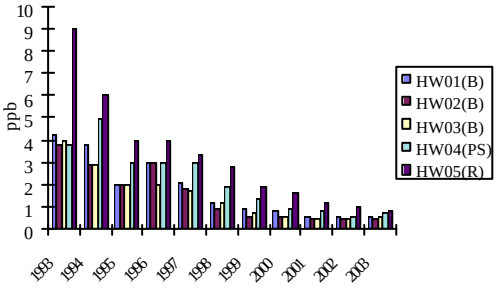


Figure 7C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 7C shows annual mean concentrations have continued to decline at all sites since 1993.

8.8 London Borough of Hillingdon

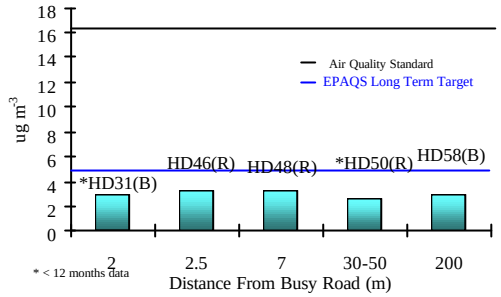


Figure 8A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

Annual mean concentrations ranged from 2.6µg m^{-3} at background site HD31 to 3.3µg m^{-3} at roadside sites HD46, located at South Ruislip Monitoring Station, West End Road, and site HD48, located at Citizens Advice Bureau, Eastcote Road. The AQS and the EPAQS long-term target were not exceeded or approached by any site.

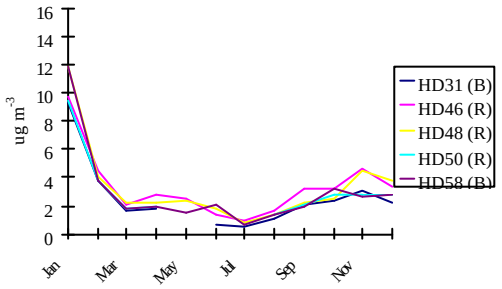


Figure 8B. Temporal Variation 2003

Temporal Variation

Figure 8B shows elevated levels of benzene were recorded during winter, with the highest concentrations for all locations being recorded in January and the lowest in July and September. All the sites followed a similar trend.

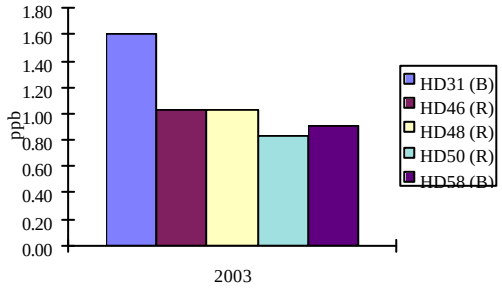


Figure 8C. Trends in Annual Average Benzene Concentrations

Annual Trends

No observations can be made regarding the annual trends since this is the first year that Hillingdon have participated in the monitoring programme.

8.9 London Borough of Hounslow

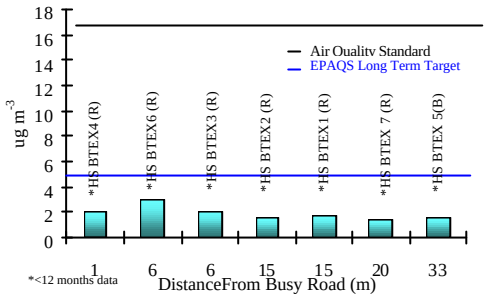


Figure 9A. Annual Mean Benzene Concentrations - 2003

Mean Concentration

Annual mean concentrations ranged from 1.4µg m^{-3} to 3.0µg m^{-3} both recorded at roadside locations. The highest mean value of 3.0µg m^{-3} was seen at site HS BTEX6 located at 24 Adelaide Terrace, Brentford. The lowest mean value of 1.4µg m^{-3} was recorded for site HS BTEX7 located at Chiswick Community School. The AQS and EPAQS long-term target were not exceeded or approached at any time.

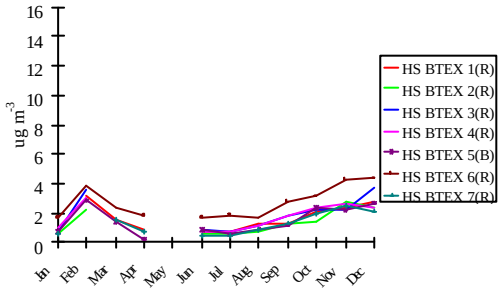


Figure 9B. Temporal Variation 2003

Temporal Variation

Figure 9B shows temporal trends for 2003. Benzene levels followed similar trends throughout the year with peak concentrations in February, November and December. During December a maximum peak value of 4.3µg m^{-3} was recorded for roadside site HS BTEX6.

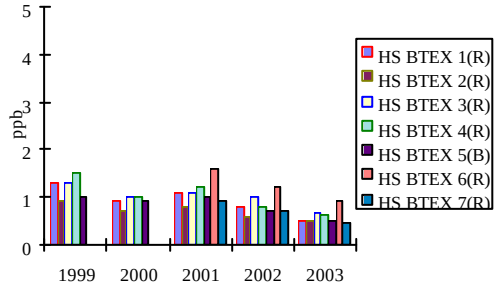


Figure 9C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 9C shows that following a reasonably stable period from 1999-2001 there has been a slight decline at all sites from 2001-2003.

8.10 Royal Borough of Kensington & Chelsea

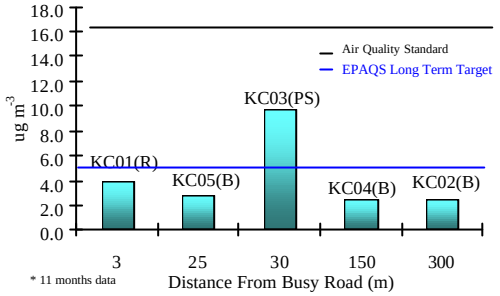


Figure 10A. Annual Mean Benzene Concentrations – 2003

Annual Mean Concentration

Mean concentrations ranged from 2.4µg m^{-3} to 9.6µg m^{-3}. The lowest mean value was recorded for background site KC02, located at Holland Park Offices. The highest mean value was recorded for site KC03, located at Warwick Road, a petrol service station. The AQS was not exceeded or approached at any site. However, the EPAQS long-term target was exceeded at Petrol station site KC03.

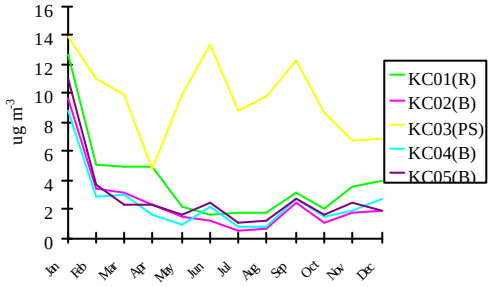


Figure 10B. Temporal Variation 2003

Temporal Variation

Figure 10B illustrates temporal trends for 2003. As expected benzene levels were consistently higher at petrol station location KC03, with a maximum peak level of 13.8µg m^{-3} for January. Unusually high levels were recorded at all sites during January and all sites except KC03 followed a similar trend throughout the year with peak levels during June, September, November and December.

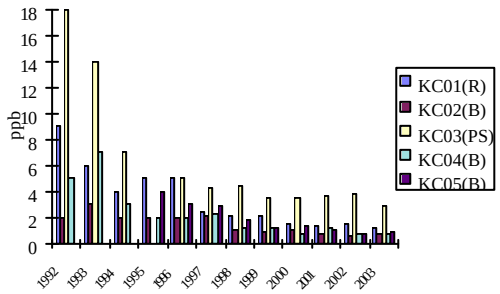


Figure 10C. Trends in Annual Average Benzene Concentrations

Annual Trends

A small decrease in levels has been observed at KC03 and KC04 although levels have shown little fluctuation over the past 3 years.

8.11 Corporation of London

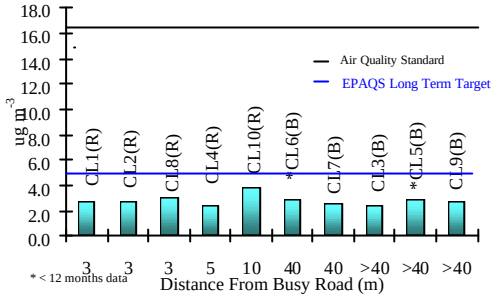


Figure 11A. Annual Mean Benzene Concentrations - 2003

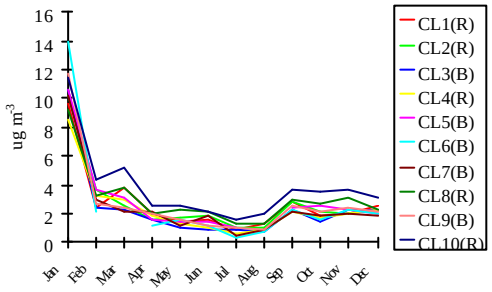


Figure 11B. Temporal Variation 2003

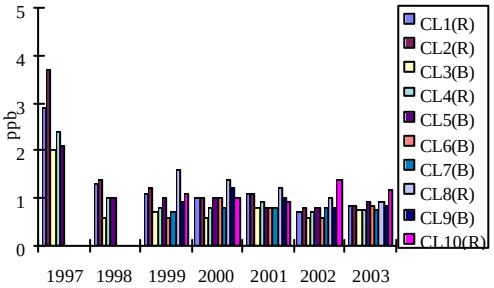


Figure 11C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Annual mean benzene concentrations ranged from 2.4µg m^{-3} to 3.8µg m^{-3}. The lowest mean level of 2.4µg m^{-3} was recorded at background site CL3 Pleach Walk, Barbican, Moorgate and roadside site CL4 Crescent House Goswell Road. The highest mean level of 3.8µg m^{-3} was recorded at roadside site CL10 Mansion House, Mansion House Street. Mean levels have remained low with no exceedences of the AQS or of the EPAQS long-term target.

Temporal Variation

Figure 11B illustrates that high concentrations were recorded at all sites in January with a maximum peak concentration of 13.9µg m^{-3} recorded for site CL6, a background location. From February to December all sites followed a similar trend with a peak in March and elevated levels observed from September to December

Annual Trends

Figure 11C illustrates annual average benzene concentrations. Following a decrease in levels from 1997 to 1998, concentrations from 1999 to 2003 have shown little fluctuation at all sites.

8.12 London Borough of Newham

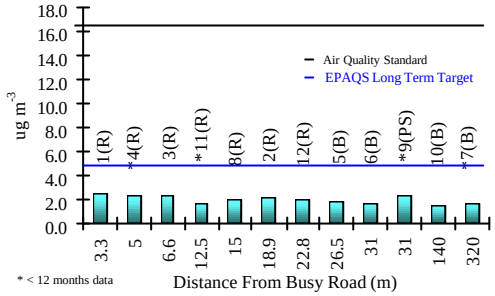


Figure 12A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

Mean benzene concentrations ranged from 1.5µg m^{-3} to 2.4µg m^{-3}. The maximum mean concentration of 2.4µg m^{-3} was recorded at roadside site 1, located at a London International Freight Terminal, Temple Mill Lane. The lowest mean value of 1.5µg m^{-3} was recorded at site 10, a background site located at Mayflower Nursery School, Taut Avenue. The AQS and EPAQS long-term target were not exceeded or approached at any site.

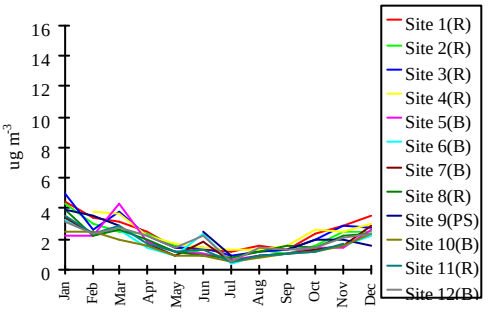


Figure 12B. Temporal Variation 2003

Temporal Variation

Figure 12B illustrates temporal trends for 2003. Benzene levels followed a similar profile with low levels during the summer months and peak concentrations occurring in winter. A maximum peak concentration of 5.0µg m^{-3} was recorded in January at roadside site 3.

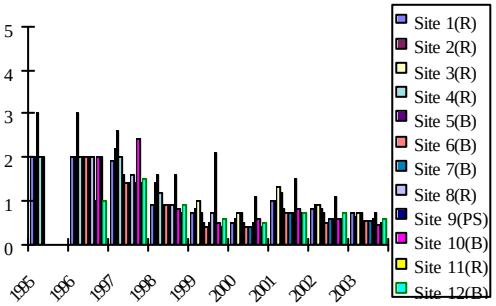


Figure 12C. Trends in Annual Average Benzene Concentrations

Annual Trends

After a steady decline in levels from 1995 to 2000, Figure 12C shows a slight increase in levels during 2001. Subsequent levels declined at all sites. Compared to previous years, low levels were recorded at petrol station site 9 during 2003.

8.13 London Borough of Richmond

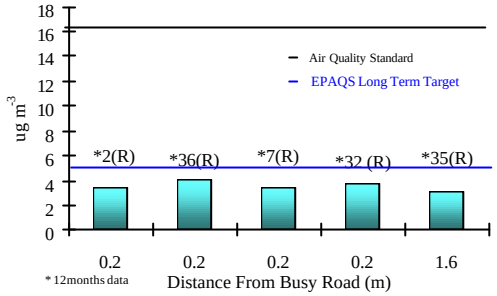


Figure 13A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

The lowest annual mean concentration 3.1µg m^{-3} was recorded at site 35 located at High Street, Hampton Wick. The highest mean concentration of 4.1µg m^{-3} was recorded for site 36 located at upper Richmond Road West, East Sheen. All sites were roadside locations and the sites with the highest and lowest annual mean concentrations were consistent with those of the previous year. Neither the AQS nor the EPAQS long-term target was exceeded or approached at any site.

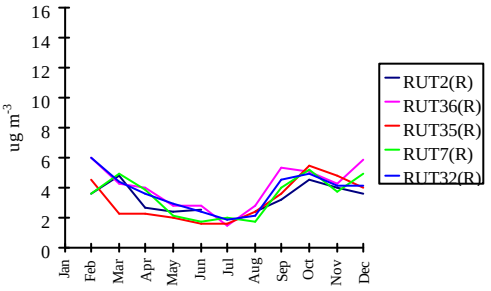


Figure 13B. Temporal Variation 2003

Temporal Variation

Figure 13B shows concentrations at all sites following similar trends throughout the year with a predominant increase in levels during February, September, October, November and December. A maximum peak concentration of 6.0µg m^{-3} was recorded in February for site RUT32, a roadside location.

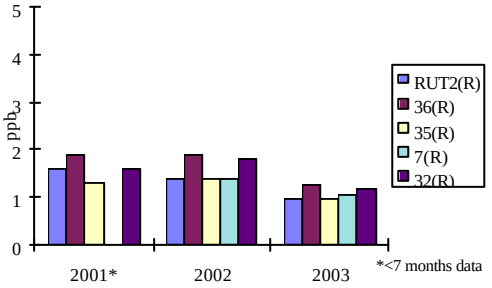


Figure 13C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 13C shows little change in annual average benzene concentrations from 2001 to 2002, while a slight decrease was observed for all sites in 2003.

8.14 London Borough of Sutton

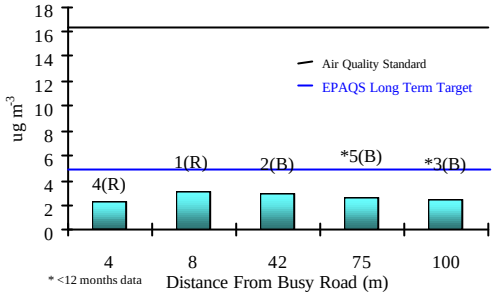


Figure 14A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

Mean benzene concentrations ranged from 2.3µg m^{-3} to 3.1µg m^{-3}. The minimum mean value of 2.3µg m^{-3} was recorded at site 4, a roadside location at Robin Hood Junior School, Thorncroft Road. The highest mean value of 3.1µg m^{-3} was recorded for site 1, a roadside location at Paynes Poppets, Croydon Road. The AQS and EPAQS long-term target were not exceeded at any site.

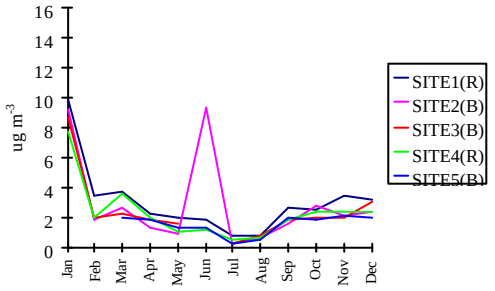


Figure 14B. Temporal Variation 2003

Temporal Variation

Temporal trends, illustrated in Figure 14B, were similar at all five sites with peak concentrations in January, October, November and December. The highest peak value of 9.3µg m^{-3} was recorded in June for site 2, a background location. However this peak is not consistent with the profile of other sites, and hence may not be truly representative of the ambient levels of benzene in the area. It may have been due to a localised benzene source.

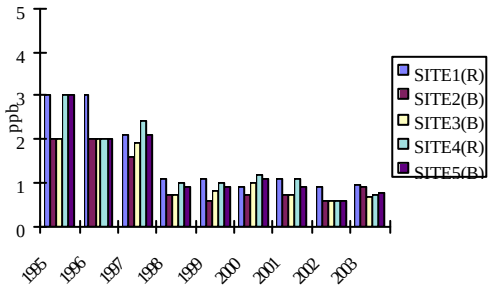


Figure 14C. Trends in Annual Average Benzene Concentrations

Annual Trends

Annual trends are illustrated in Figure 14C. This year concentrations have increased slightly, however since 1998 levels have remained relatively constant showing little change.

8.15 London Borough of Wandsworth

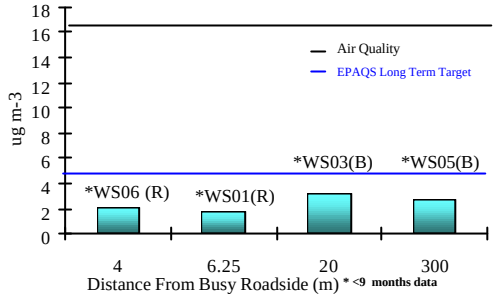


Figure 15A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

Annual mean concentrations ranged from 1.8µg m^{-3}, recorded at WS01, a roadside site, located at Tooting Library, Mitcham Road, to 3.2µg m^{-3} recorded at WS03, a background site, located at the Environmental Services, 78 Garret Lane. Although the AQS and EPAQS long-term target were not approached or exceeded at any site, these values are based on 66% data capture and therefore unlikely to be representative of the true annual means.

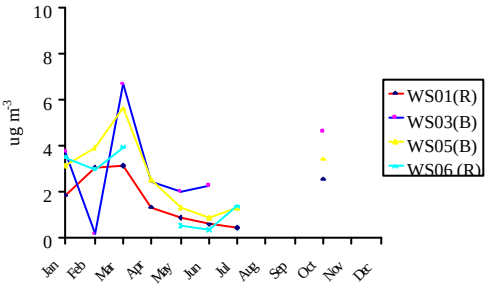


Figure 15B. Temporal Variation 2003

Temporal Variation

Figure 15B illustrates the temporal variation, but due to insufficient data few comments can be made. However, a maximum concentration of 6.7µg m^{-3} was recorded for a background location WS03.

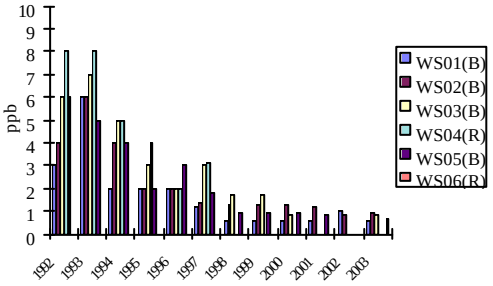


Figure 15C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 15C shows that annual benzene levels have been on the decline since 1993 with some inter-site variation. Levels rapidly decreased from 1992 to 1998 following which levels have declined more slowly.

8.16 London Borough of Westminster

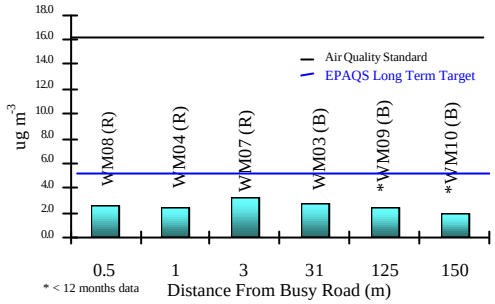


Figure 16A. Annual Mean Benzene Concentrations - 2003

Annual Mean Concentration

Mean benzene concentrations ranged from 1.9µg m^{-3} to 3.2µg m^{-3}. The lowest mean value of 1.9µg m^{-3} was recorded at site WM10, a background site located at Covent Garden London Transport Museum. The highest value of 3.2µg m^{-3} was recorded at WM07, a roadside site located at Westminster Council House in Marylebone Road. The AQS and EPAQS long-term target were not exceeded at any of the sites.

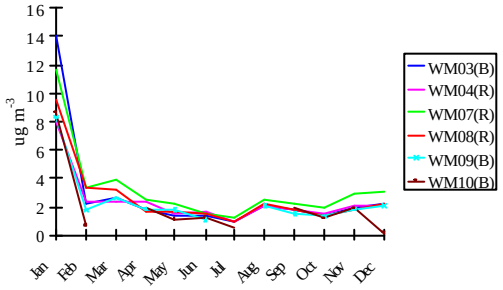


Figure 16B. Temporal Variation 2003

Temporal Variation

Figure 16B illustrates benzene levels following a similar pattern. Peak levels were recorded at all sites during January. A maximum peak level of 14.0µg m^{-3} was recorded in January at background site WM03 located at Harrow Road, Housing Office.

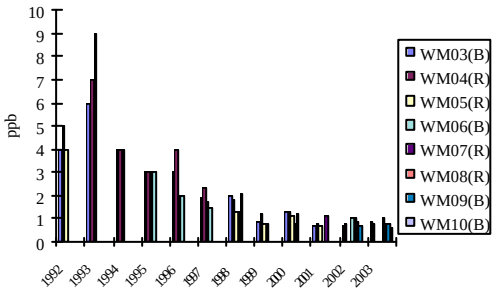


Figure 16C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 16C shows annual mean concentrations sharply declining from 1993 to 1999. A slight increase followed in 2000. During 2001-2003 levels have shown little fluctuation.

8.17 Summary of 2003 Annual Mean Benzene Concentrations

Across all boroughs, mean concentrations recorded at roadside sites ranged from 1.4µg m^{-3} recorded in Hounslow, to 4.4µgm^{-3} in Brent. At background sites, mean benzene concentrations varied from 1.4µg m^{-3} at Barking to 3.2µg m^{-3} at Wandsworth. Mean concentrations recorded at petrol stations varied from 2.3µg m^{-3} at Harrow and Newham to 9.6µg m^{-3} at Kensington & Chelsea.

The annual mean benzene concentrations for the three different location types are summarised in Table 2 below:

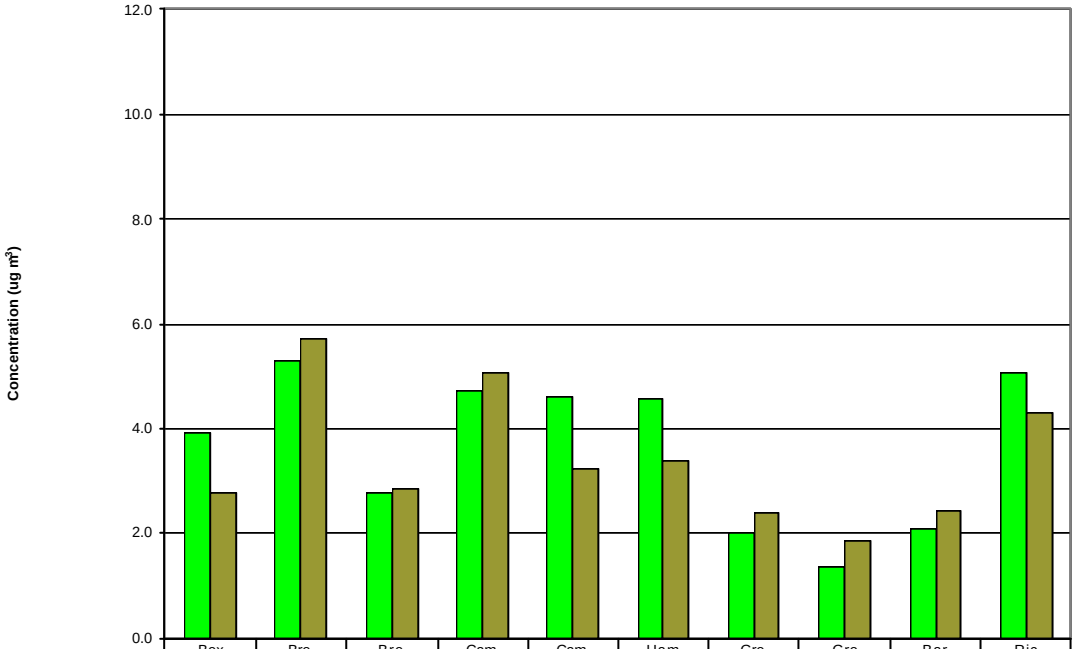
Table 2: Summary of 2003 Annual Mean Concentrations (µg m^{-3})

Site Type	Minimum	Mean	Maximum
Background	1.4	**2.3**	3.2
Roadside	1.4	**2.9**	4.4
Petrol Station	2.3	**5.0**	9.6

9 Quality Assurance and Quality Control

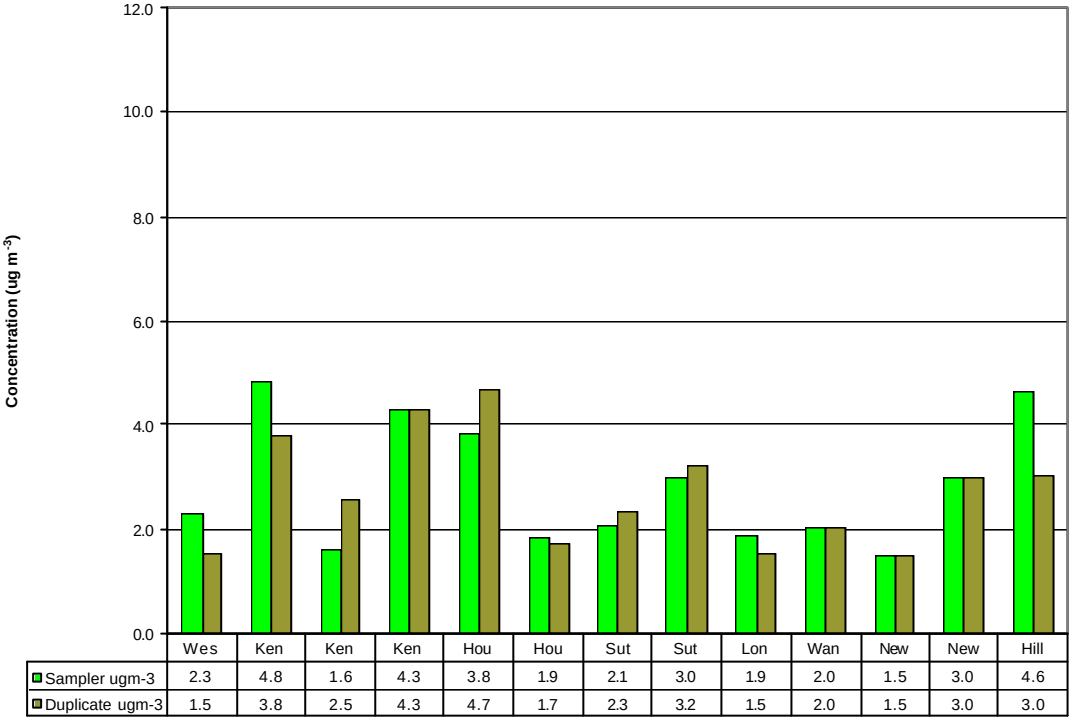
9.1 Duplicate Exposures at Monitoring Sites

As part of the quality assurance/control procedures integral to the London-wide Benzene Survey, a selection of boroughs are sent one extra diffusion tube for duplicate exposure at a monitoring site within the borough. In 2003, duplicate exposures were made on twenty three occasions and triplicate exposures on nine. The results of these tubes indicate satisfactory agreement between duplicate and triplicate tubes. The maximum difference between duplicates is ± 1.6µg m^{-3} and the maximum difference between triplicates is ± 1.6µg m^{-3}. The results of these duplicate exposures are summarised below in Figure 17a-17d and are given in Appendix I.



	Bex	Bre	Bre	Cam	Cam	Ham	Gre	Gre	Bar	Ric
Sampler ugm-3	3.9	5.3	2.8	4.7	4.6	4.6	2.0	1.4	2.1	5.1
Duplicate ugm-3	2.8	5.7	2.8	5.1	3.2	3.4	2.4	1.9	2.4	4.3

Figure 17a: 2003 Duplicate Exposures Within London Boroughs



	Wes	Ken	Ken	Ken	Hou	Hou	Sut	Sut	Lon	Wan	New	New	Hill
Sampler ugm-3	2.3	4.8	1.6	4.3	3.8	1.9	2.1	3.0	1.9	2.0	1.5	3.0	4.6
Duplicate ugm-3	1.5	3.8	2.5	4.3	4.7	1.7	2.3	3.2	1.5	2.0	1.5	3.0	3.0

Figure 17b: 2003 Duplicate Exposures Within London Boroughs

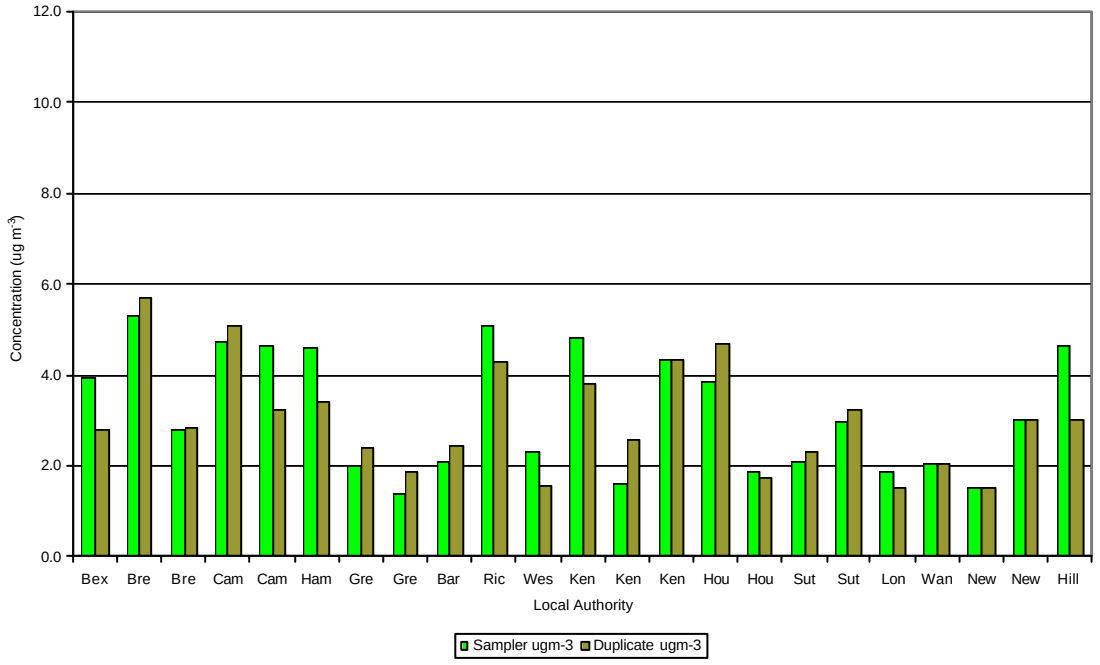


Figure 17c: Summary of 2003 Duplicate Exposures Within London Boroughs Showing All Nineteen Exposures.

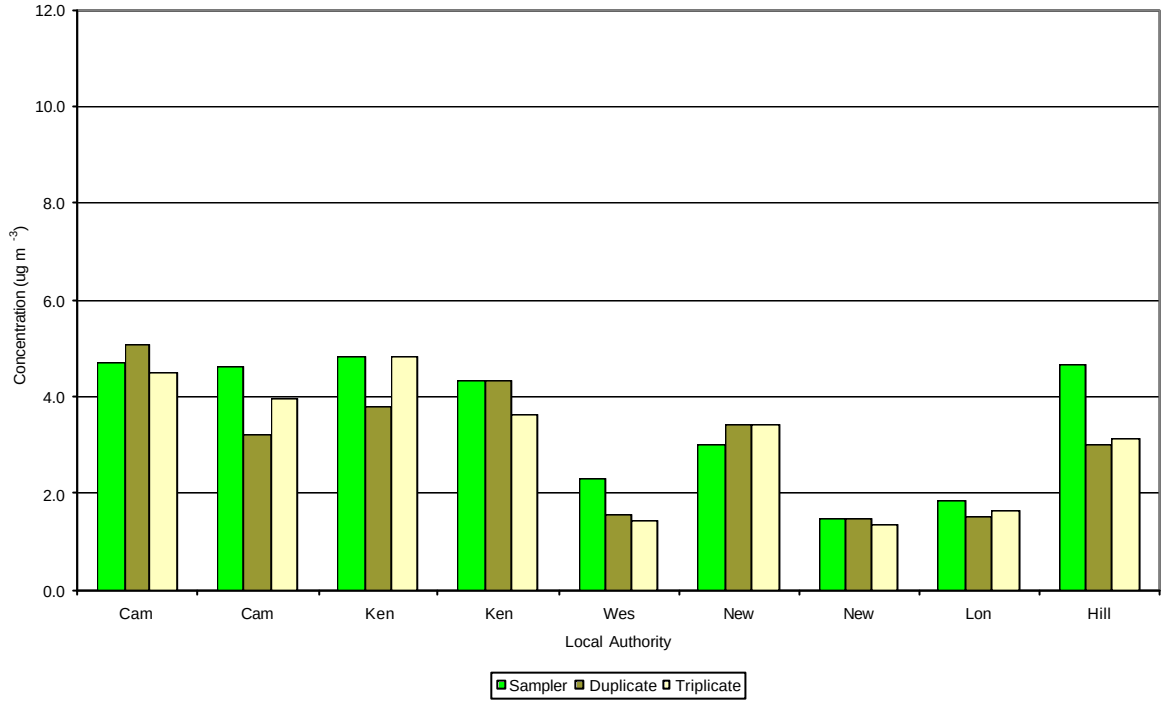


Figure 17d: Summary of 2003 Triplicate Exposures Within London Boroughs Showing All Three Exposures.

9.2 Duplicate Exposures at the Hydrocarbon Network

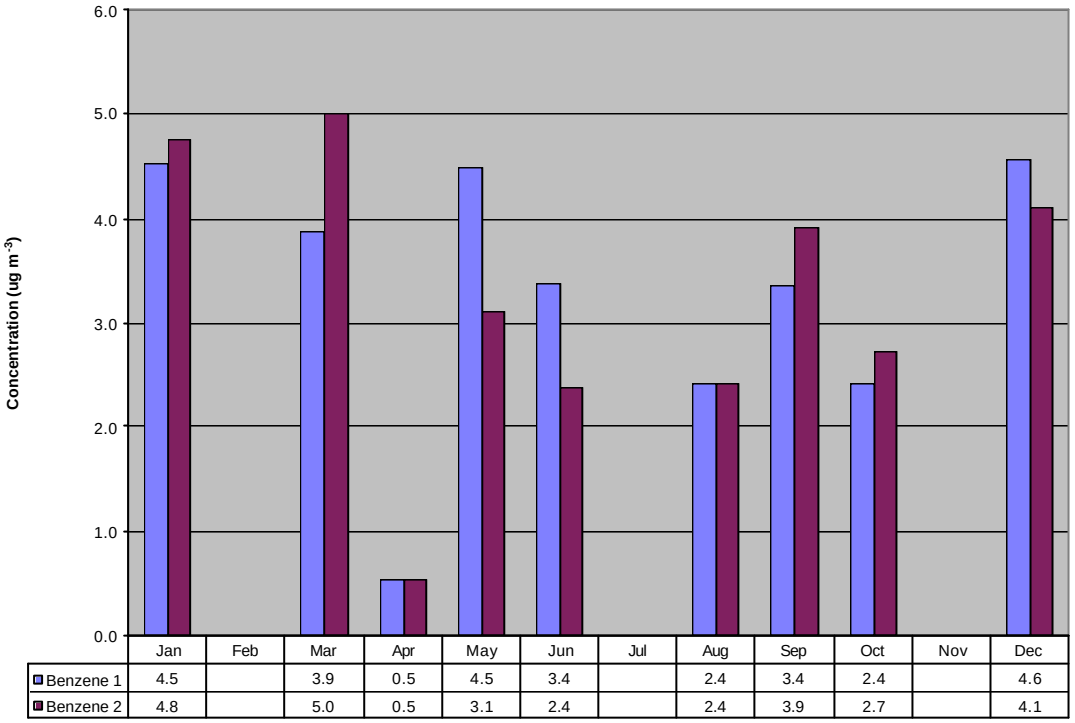
As an additional part of the quality assurance/control procedures, diffusion tubes were also exposed at the Hydrocarbon Network site on Marylebone Road *(Super-Site)*. Tubes exposed at this site were analysed for benzene, toluene, ethyl benzene, m, p-xylene and o-xylene *(BTEX)* and the data compared against data from the automatic Hydrocarbon Network data for comparable periods.

Diffusion tube results for the year included nine-months of validated data excluding February, July and November. Benzene levels ranged from 0.5µg m^{-3} recorded in April to 5.0µg m^{-3} recorded in March. Using this data the annual mean value was calculated to be 3.3µg m^{-3} which can be compared with the calculated annual mean value of 3.3µg m^{-3} recorded for the Hydrocarbon Network. Mean values for Toluene ranged from 17.4µg m^{-3} recorded in June to 64.6µg m^{-3} recorded in September. Calculated mean values for ethyl benzene ranged between 0.6µg m^{-3} in April to 12.6µg m^{-3} in March. Results for m, p-xylene ranged from 0.9µg m^{-3} in April to 13.3µg m^{-3} in May and June. Mean values for o-xylene ranged between 0.2µg m^{-3} in April to 5.0µg m^{-3} in May. Figures 17a–17e illustrate the comparison between duplicate tubes for BTEX. Data is also provided in Appendix I.

Table 3 below shows a comparison between the Hydrocarbon Network and the diffusive sampling at that location. Data has been calculated and compared for the same exposure periods. Results for the network are considered to show satisfactory correlation between the data sources considering the different averaging periods. The Hydrocarbon Network data was based on hourly data and the diffusive sampling was based on one exposure period within a calendar month.

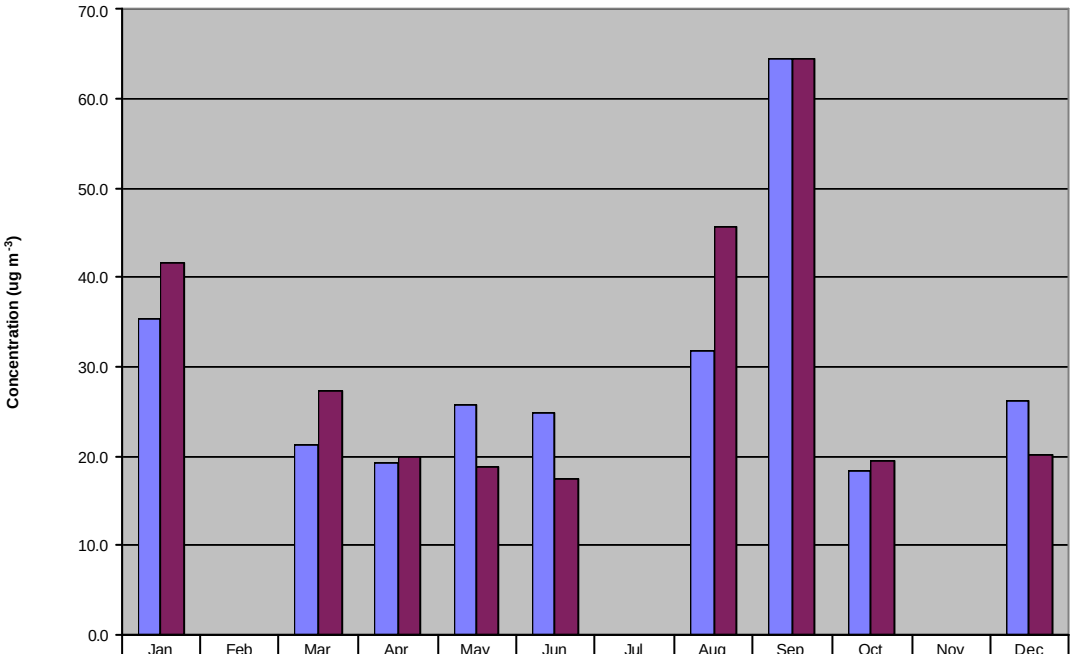
Table 3: Comparison of Annual mean Concentrations at Marylebone Road Hydrocarbon Station

Species (µg m^{-3})	Casella Stanger tubes	Network analyser
Benzene	3.3	3.3
Toluene	30.1	13.6
Ethyl Benzene	3.4	2.6
m, p Xylene	6.7	9.3
o Xylene	2.7	3.2



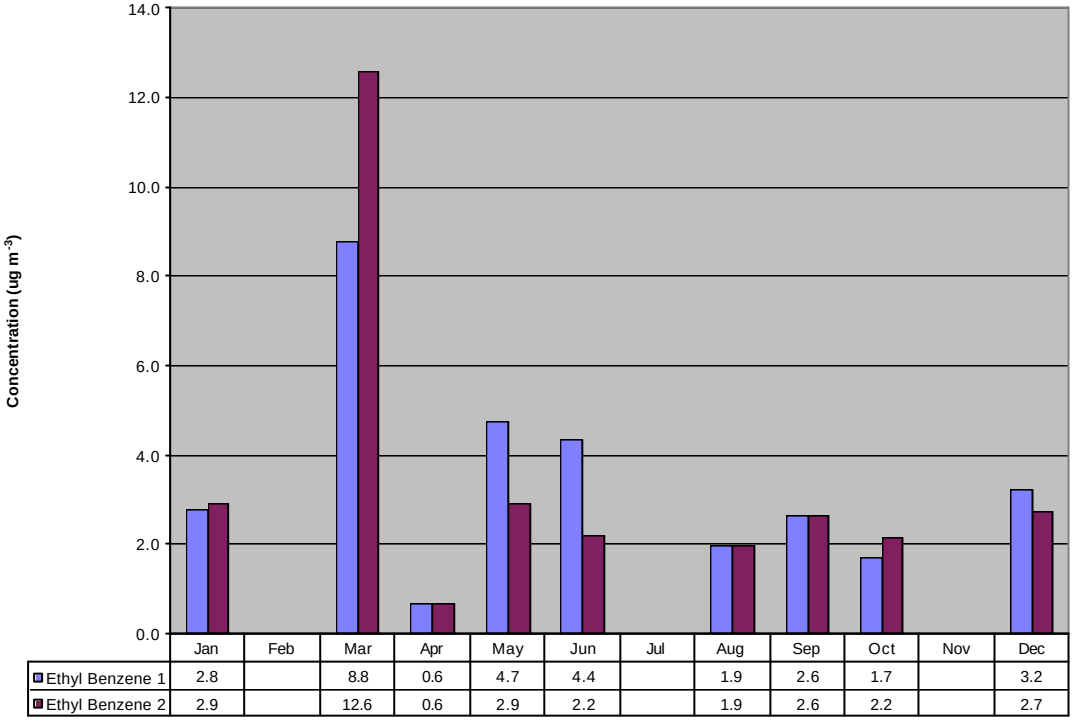
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benzene 1	4.5		3.9	0.5	4.5	3.4		2.4	3.4	2.4		4.6
Benzene 2	4.8		5.0	0.5	3.1	2.4		2.4	3.9	2.7		4.1

Figure 18a: Summary of 2003 Duplicate Benzene Exposures at London Marylebone Road



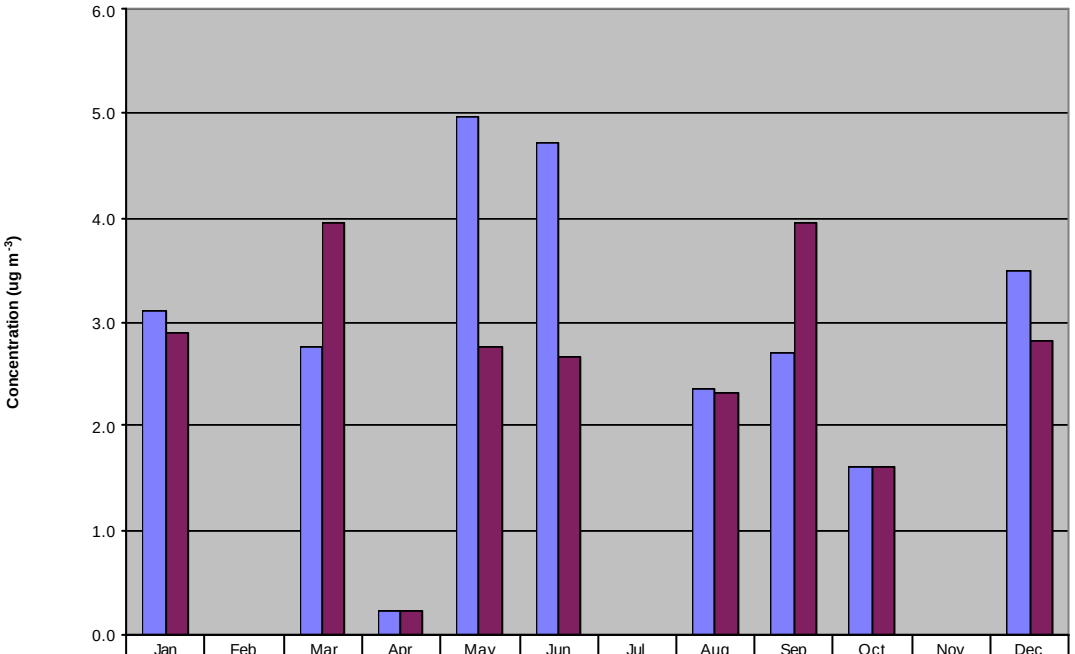
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Toluene 1	35.2		21.3	19.2	25.7	24.7		31.7	64.6	18.3		26.1
Toluene 2	41.5		27.3	20.0	18.8	17.4		45.6	64.6	19.4		20.1

Figure 18b: Summary of 2003 Duplicate Toluene Exposures at London Marylebone Road



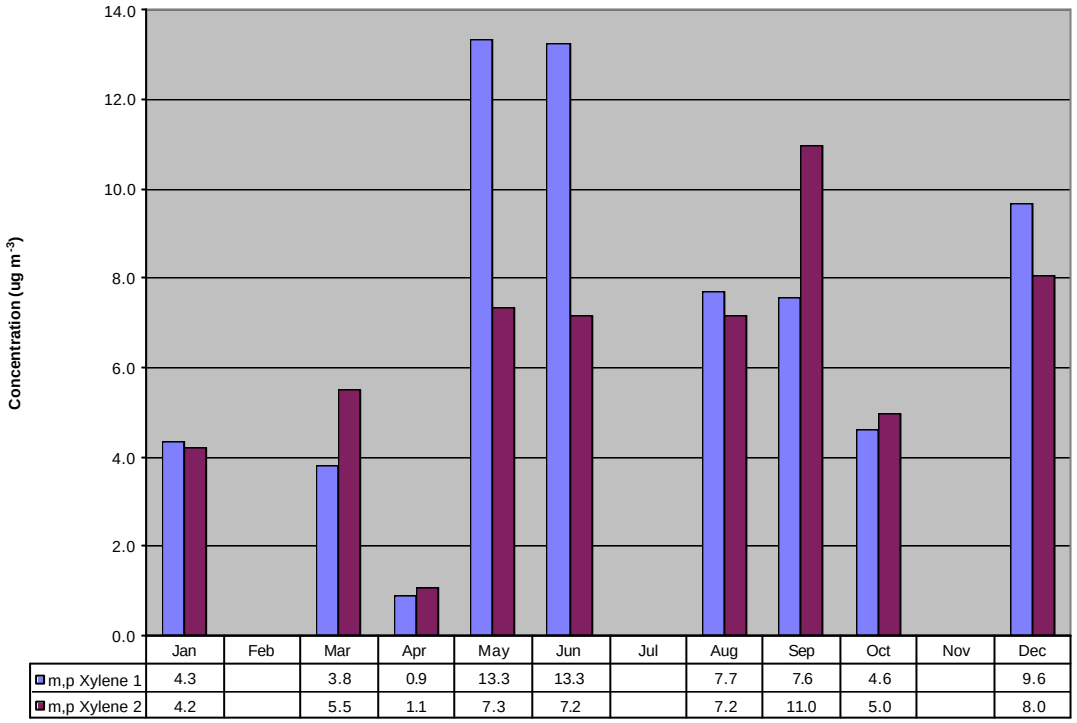
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ethyl Benzene 1	2.8		8.8	0.6	4.7	4.4		1.9	2.6	1.7		3.2
Ethyl Benzene 2	2.9		12.6	0.6	2.9	2.2		1.9	2.6	2.2		2.7

Figure 18c: Summary of 2003 Duplicate Ethyl Benzene Exposures at London Marylebone Road



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
o Xylene 1	3.1		2.8	0.2	5.0	4.7		2.4	2.7	1.6		3.5
o Xylene 2	2.9		4.0	0.2	2.8	2.7		2.3	4.0	1.6		2.8

Figure 18d: Summary of 2003 Duplicate m, p Xylene Exposures at London Marylebone Road



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
m,p Xylene 1	4.3		3.8	0.9	13.3	13.3		7.7	7.6	4.6		9.6
m,p Xylene 2	4.2		5.5	1.1	7.3	7.2		7.2	11.0	5.0		8.0

Figure 18e: Summary of 2003 Duplicate o Xylene Exposures at London Marylebone Road

10 Discussion

10.1 Mean Benzene Concentrations

Maximum concentrations were recorded at roadside and petrol station locations, which accounted for 61% and 5% of the total site classes respectively. These recordings are consistent with motor vehicle emissions and evaporative emissions from petrol being significant sources of atmospheric benzene. Within some boroughs, there was a clear relationship between distance from a busy road and mean concentration, with benzene levels decreasing with increasing distance from the roadside. This emphasises the significance of traffic as a source of benzene and the strong influence of this emission source on urban benzene levels.

Concentrations at background sites across London were generally lower than those recorded at roadside, although concentrations for each category do overlap when assessing mean values across boroughs. For example, mean levels recorded at background sites ranged from 1.4µg m^{-3} to 3.2µg m^{-3} and at roadside mean values ranged from 1.4µg m^{-3} to 4.4µg m^{-3}. Although this overlap exists, maximum mean values are consistent across the three categories. Such variability mainly reflects spatial variation in intensity of traffic flow, which in turn is attributable to heterogeneity in London's road network. Benzene concentrations are also influenced by factors such as meteorological conditions and height of sampler. Factors, which influence ambient benzene concentrations, will obviously vary from site to site and from borough to borough. This may explain why in some boroughs there was no clear relationship between distance from roadside and benzene concentrations.

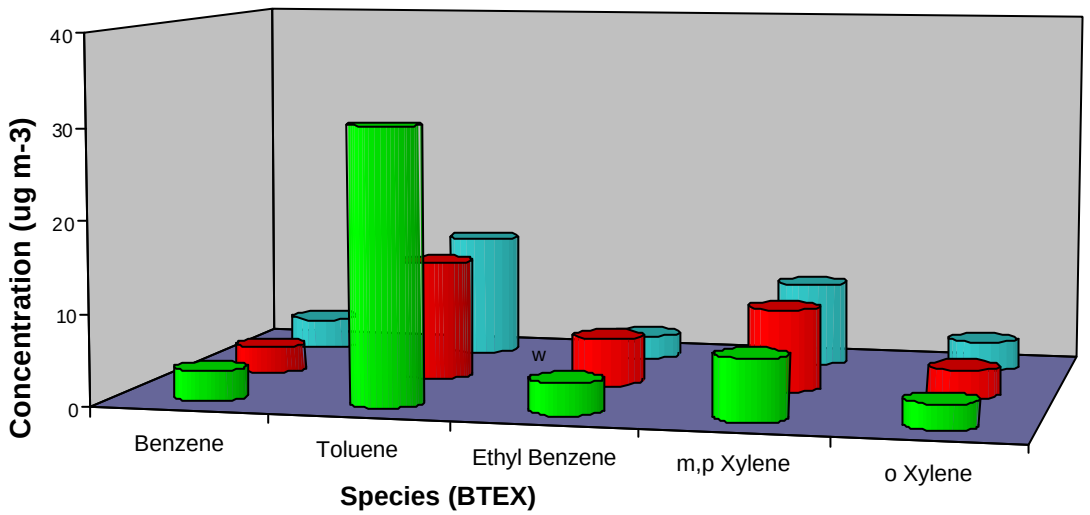
In Camden, Harrow, Newham and Kensington & Chelsea, mean benzene levels recorded at the petrol station sites were similar to levels recorded at the busy roadside sites, although the site located in Kensington & Chelsea produced the highest mean of the survey 9.6µg m^{-3}. This suggests that the influence of evaporative emissions on benzene levels at these sites is similar to the influence of exhaust emissions at roadside sites. Benzene levels at petrol station site (KC03), located in Kensington & Chelsea, were consistently higher than typical roadside levels within the borough and were also higher than petrol station levels recorded in other boroughs. Thus, at this site, it would appear that evaporative emissions of benzene from petrol have a very significant effect on benzene levels. It is likely that this petrol station site is located near a relatively busy road and thus vehicle emissions would have contributed to levels recorded at this site. This may also reflect the number of transactions taking place and/or size of the station.

10.2 Comparison with other Data

Comparison of the LWEP data with calculated mean data for the Automatic Hydrocarbon Monitoring Network *(AHMN)* indicates that levels of benzene recorded in this survey are broadly comparable with such data considering the different averaging periods used for each method. Historically the diffusion tube method has tended to over-estimate concentrations and thus present a worst-case scenario when assessing annual means.

The calculated annual mean level for the roadside location type was 2.9µgm^{-3} which compares with 3.3µg m^{-3} and 2.9µg m^{-3} calculated for Marylebone Road diffusion tube and Hydrocarbon Network (LWEP exposure period) data respectively. Within the survey, the highest annual mean recorded at roadside was 4.4µg m^{-3}, which was recorded for Brent. The maximum annual mean recorded at a background site was 3.0µg m^{-3}, which was recorded at Hillingdon.

Hydrocarbon species *(BTEX)* measured at London Marylebone Road were comparable with diffusion tube data recorded at that location. Figure 18 illustrates the comparison in mean levels between species measured.



	Benzene	Toluene	Ethyl Benzene	m,p Xylene	o Xylene
Mean data for LWEP diffusion tubes	3.3	30.1	3.4	6.7	2.7
Hydrocarbon Network mean data for LWEP exposure period	2.9	13.1	5.2	9.0	3.1
Hydrocarbon Network annual mean data.	3.3	13.6	2.6	9.3	3.2

Figure 19: Comparison of Species Measured at London Marylebone Road

10.3 Seasonal Trends

All site locations showed some degree of inter-site variation with elevated benzene levels recorded for January and October. At these times levels were elevated across site categories. Such peaks are consistent with previous reports that suggest benzene concentrations may increase sharply during pollution episodes typical of winter months. Measurements of benzene made by Imperial College during the London 1991 pollution episode showed a substantial episodic increase in benzene levels, with a concentration of 58.3µg m^{-3} *(2 day mean)* prior to the episode, increasing to a mean of 382.7µg m^{-3} (4 day mean) during the episode *(QUARG, 1993)*. Therefore, it seems that benzene concentrations follow the pattern described for other primary pollutants, with high ground levels occurring in winter as a result of cold temperatures and low wind speeds trapping the pollution in a stable air mass near to the ground.

During January 2003 sharp increases in benzene levels were observed at Kensington and Chelsea, Greenwich, Hammersmith, Hillingdon, Corporation of London, Sutton and Westminster. For example, concentrations at Greenwich roadside site GW39 were typically below 2.0µg m^{-3} during 2003, however during January levels increased to 17.2µg m^{-3}. As shown in Figure 19, the high concentrations recorded during January were also confirmed by the continuous hydrocarbon monitoring network at Marylebone Road.

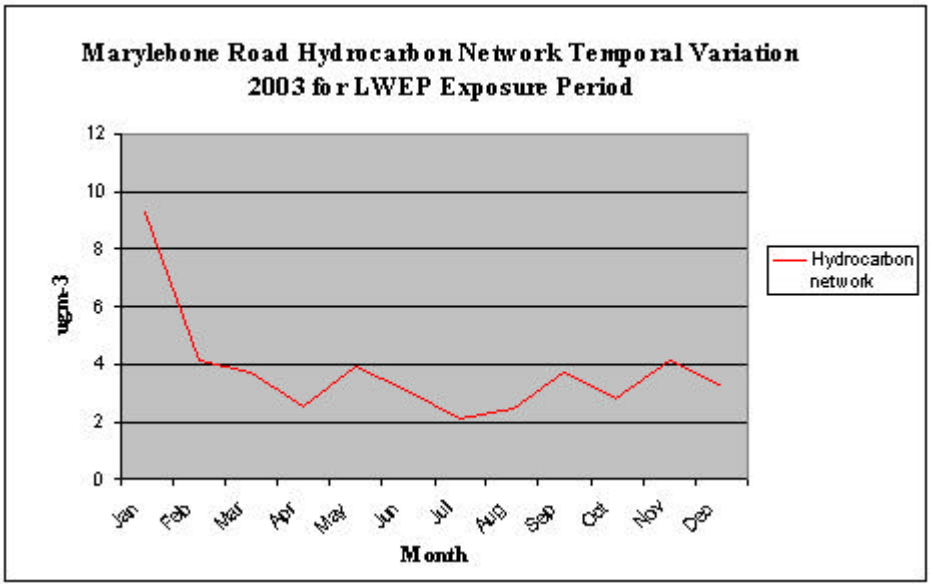


Figure 19: Marylebone Road Temporal Variation

11.0 Predictions for Future Urban Benzene Concentrations

Several measures have been introduced over the past few years to reduce the emissions of pollutants from the transport sector. The current trend of decreasing annual benzene emissions has primarily been caused by the introduction of catalytic converters for cars *(Directive 91/441/EEC)* and a further Directive implemented in 1996 *(94/12/EEC).* Policy developments such as the *Auto-oil Programme (Euro Standards)* implemented in January 2000 are expected to further reduce benzene levels in future years.

As predicted the policy measures in place have helped all urban background and roadside locations achieve the objective of 16.25µg m^{-3} for 2003. However, further measures would be necessary for the EPAQS long term target 5µg m^{-3} annual mean to be achieved by 2010.

12.0 Report Statement

We confirm that in preparing this report we have exercised all reasonable skill and care.

13.0 References

(1) AEA Technology, *(1995)*. Air Pollution in the UK: 1993/4. AEA Technology Report AEA/CSR/033/C.

(2) AEA Technology, *(1995)*. Air Pollution in the UK: 1994. AEA Technology Report AEA/RAMP/200015001/1.

(3) Clarke, A. and Ko, Y-H, *(1996*). The Relative Significance of Vehicular Emissions of Volatile Organic Compounds in the Urban Area of Leeds. The Science of the Total Environment, October 1996 189/190, 401.

(4) Department of the Environment *(1994)*. Expert Panel on Air Quality Standards - Benzene. HMSO, London, UK.

(5) Department of the Environment *(1995)*. Air Quality: Meeting the Challenge HMSO. London, UK.

(6) Department of the Environment *(1997)*. The United Kingdom National Air Quality Strategy. The Stationary Office, London, UK.

(7) Derwent, R.G., *(1995)*. Improving Air Quality in the United Kingdom. NSCA, Volume 25, No. 2.

(8) Eggleston, M.S., *(1992)*. Pollution in the Atmosphere. Future Emissions from the UK. Report LR 888(AP); Warren Spring Laboratory, Stevenage.

(9) Rinsky et al., *(1981)*. Leukaemia in Benzene Workers. American Journal of Industrial Medicine, 2, 217 - 245.

(10) Quality of Urban Air Review Group *(1993)*. Urban Air Quality in the UK. HMSO, London, UK.

(11) Stanger Science and Environment *(1997)*. A Pilot Study to Assess Benzene Concentrations in the Vicinity of Petrol Station. SSE/AQ/1085.

(12) Stanger Science and Environment *(1999)*. London Wide Diffusion Tube Survey, Annual Report 1999. SSE/AQ/1577.

(13) UK Photochemical Oxidants Review Group *(PORG) (1994)*. Third Report of the United Kingdom Photochemical Oxidants Review Group.

(14) Department of Health. Committee on the Medical Effects of Air Pollution, Handbook on Air Pollution and Health 1997.

(15) Weisel, C.P., Yu, R. *(1996)*. Measurement of the Urinary Benzene Metabolite Trans, Trans-Muconic acid From Benzene Exposure in Humans. J Toxicol & Env Health. 48 (5) 453.

(16) WHO, 1987. World Health Organisation. Air Quality Guidelines for Europe. WHO regional publication, European series No. 23. Copenhagen: WHO Regional Office for Europe.

(17) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland *(January 2000)*.

(18) Department of the Environment *(2000), LAQM. TEG 4 (00)* Pollutant Specific Guidance.

(19) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. A consultation document on proposals for Air Quality objectives for particles, benzene, carbon monoxide and polycyclic aromatic hydrocarbons *(September 2001)*

(20) Health and Safety Laboratory Environment Measurement Group. Diffusive sampling of VOCs as an aid to monitoring urban air quality.

(21) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum (February 2003).

Appendix A

Site Descriptions

London Borough of Barking and Dagenham

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
BD1	Marsh Green Infants School, White Barn Lane, Dagenham	13	Roadside	TQ549414/183468
BD2	Car park, Maplestead Road, Barking	12	Roadside	TQ546698/183680
BD3	Pavilion Tower, Old Dagenham Park, Siuitar Way, Dagenham	>25	Background	TQ549722/184267
BD4	Eastbrook End Cemetery Chapel, The Chase, Rush Green, Dagenham	>25	Background	TQ551343/186273

London Borough of Bexley

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
LBB1	Whitehall Day Centre Whitehall Lane, Slade Green	150	Background	TQ551813/176394
LBB3	Crayford Library Crayford Road, Crayford	10	Roadside	TQ551660/174607
LBB5	Watling Street, Bexleyheath	5	Roadside	TQ550269/174941

London Borough of Brent

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
BR31	IKEA (car park) 2 Dury Way, London NW10	4.4	Roadside	TQ520756/185142
BR41	Alperton Community School, Stanley Avenue, Wembley HA0	250	Background	TQ518451/184111
BR42	Harlesden Polic Station, Craven Park, Harlesden, London NW10 8RJ	131	Background	TQ521152/184002
BR51	Kingsbury High School, Princes Ave, Kingsbury, London NW9	208	Background	TQ519562/189276
BR53	High Road (435-431), Wembley, Middx, HA	0.1	Roadside	TQ518303/185181
BR55	79 High Street, Harlesdon, London	0.1	Roadside	TQ521743/183361
BR56	Opposite 73 Chamberloyne Road, Willesden, London, NW10	0.1	Roadside	TQ523635/183153
BR57	1 Kilburn Bridge, High Road, Kilburn, London NW6	2	Roadside	TQ525461/183558
BR58	51 High Road, Willesden, London NW10	0.1	Roadside	TQ522031/184655
BR59	1 Cricklewood Broadway Cricklewood, London	0.1	Roadside	TQ524167/185251

London Borough of Camden

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
XT21	St Andrews Church Finchley Road	27	Background	TQ525662/185365
XT24	Town Hall, Euston Road	6.1	Roadside	TQ530109/182798
XT28	Coram Street, Petrol Station	4.5	Petrol station	TQ53007/18222
XT30	BP Petrol Filling Station Finchley Road, Swiss Cottage	20	Petrol station	TQ526461/184562
XT34	BP Finchley Road 215 Haverstock Hill London, NW5 4QE	12	Petrol station	TQ2527181/185229

London Borough of Greenwich

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
GW29	Antigallican PH, Woolwich Road	1.0	Roadside	TQ541166/178511
GW33	9 Blackheath Hill, Blackheath SE3	1.5	Roadside	TQ537978/176770
GW34	Bannockburn School, Plumstead High Street SE18	3	Roadside	TQ545490/178543
GW35	Greenwich mini Town Hall, SE 10	1.5	Roadside	TQ539527/178282
GW36	Blackwall Lane Lorry Park	30	Background	TQ539307/179263
GW38 now **GW54**	O/S 581/583 Westhorne Avenue, Eltham SE 9	2	Roadside	TQ541914/175038
GW39	Environmental Curriculum Centre, Bexley Road, Eltham SE9	50	Background	TQ543975/174647
GW41	699 Sidcup Road, New Eltham	3.5	Roadside	TQ543390/172764
GW42	Near 10 Greenwich Church Street, SE10	2	Roadside	TQ541915/175042
GW43	McMillan Street, Creek Road	6	Roadside	TQ537358/177635
GW50	O/S Rear of 26 Fearon Street, Peartree Way	3.5	Roadside	TQ540176/178394
GW51	Bugsbys Way	2	Roadside	TQ539638/179024
GW55	GRE/BEX 6 Monitoring Station, Crown Woods Way	1.5	Roadside	TQ545001.7/175098.4

London Borough of Hammersmith and Fulham

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
HM32	Queen Caroline Street	4	Roadside	TQ523303/178408
HM41	Bishops Park	>40	Background	TQ523809/176209
HM44	Eel Brook Common	>25	Background	TQ525309/176803
HM45	Byrony Road	1	Roadside	TQ522406/180604
HM46	Cobbold Road	4	Roadside	TQ521606/179609

London Borough of Harrow

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
HW01	Roxeth Manor School, Eastcote Lane	71	Background	TQ513131/136233
HW02	Grimsdyke School, Hatch End	497	Background	TQ512522/191623
HW03	Aylward School, Pangbourne Drive, Stanmore	377	Background	TQ518013/192250
HW04	Esso Station, Pinner Road, North Harrow	5	Petrol station	TQ514200/188400
HW05	Psychology Service, Station Road, Harrow	4	Roadside	TQ51375/188990

London Borough of Hillingdon

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
HIL31	Aurn London Hillingdon Sipson Road / Keats Way, West Drayton, Moddlesex	30-50	Suburban/ Background	TQ506926/178614
HD46	South Ruislip Monitoring Station, West End Road, South Ruislip, Middlesex	2.5	Roadside	TQ510821/184923
HD48	Citizens Advice Bureau, Eastcote Road, Ruislip, Middlesex	7	Roadside	TQ509094/187645
HD50	Hillingdon Hospital Monitoring Site, Colham Road / Pield Health Road, Hillingdon, Middlesex	2	Roadside	TQ506989/181920
HD58	Brendon Close, Harlington, Middlesex	200	Background	TQ508415/177125

London of Hounslow

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
BTEX 1	West View, Bedfont, A30, Gt S-West Rd	15	Roadside	TQ508142/173665
BTEX 2	Marjory Kinnon School, Hatton Road	15	Roadside	TQ509127/174568
BTEX 3	Cranford Library, A4 Bath Road	6	Roadside	TQ510747/176687
BTEX 4	The Avenue, Cranford	1	Roadside	TQ510491/177160
BTEX 5	Church of the Good Shepherd, Gt South West Road	33	Background	TQ510986/176032
BTEX 6	24 Adelaide Terrace, Brentford	6	Roadside	TQ517592/178212
BTEX 7	Chiswick Community School	20	Roadside	TQ521028/077321

Royal Borough of Kensington and Chelsea

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
KC01	North Kensington Library	3	Roadside	TQ524401/181160
KC02	Holland Park Offices	300	Background	TQ524773/179641
KC03	Petrol Station Warwick Road	30	Petrol station	TQ525029/178570
KC04	Dovehouse Street	150	Background	TQ526958/178187
KC05	Notting Hill Library, Pembridge Square	25	Background	TQ525202/180664

Corporation of London

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
CL1	St Andrews Church Queen Victoria St	3	Roadside	TQ53189/18096
CL2	St Dustins Church Fleet Street	3	Roadside	TQ53123/18115
CL3	Pleach Walk, Barbican, Moorgate	>40	Background	TQ53249/18174
CL4	Crescent House, Goswell Road	5	Roadside	TQ53211/18205
CL5	Petticoat Square Estate, Harrow Place	>40	Background	TQ53353/18147
CL6	St Pauls Cathedral St Pauls Churchyard	>40	Background	TQ53203/18119
CL7	St Bartholomews Hospital	40	Background	TQ53191/18158
CL8	London Bridge Lower Thames Street	3	Roadside	TQ53285/18073
CL9	Finsbury Park	>40	Background	TQ53284/18159
CL10	Mansion House Mansion House Street	10	Roadside	TQ53269/18108

London Borough of Newham

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
Site 1	London International Freight Terminal, Temple Mill Lane, E15	3.3	Roadside (kerbside)	TQ538280/185359
Site 2	Fire Station, Romford Road, Stratford, E15	17.2	Roadside	TQ539572/184659
Site 3	Salisbury School, Romford Road, E12	6.5	Roadside (kerbside)	TQ541954/185430
Site 4	Town Hall Annex,, Barking Road, E15	4.5	Roadside (kerbside)	TQ542832/183617
Site 5	Courtyard, West Ham Town Hall, Romford Road, E15	26.5	Background	TQ538899/184283
Site 6	East London Cemetery, Grange Road, E13	31	Background	TQ539859/182655
Site 7	Newham General Hospital, Glen Road, E13	330	Background	TQ541492/182332
Site 8	Mortuary High Street South, E6	14.8	Roadside	TQ542688/183202
Site 9	Save Petrol Station, 99 Barking Road, E16	30.8	Petrol Station (intermediate)	TQ539585/181720
Site 10	Mayflower Nursery School, Taut Avenue, E16	140	Background	TQ539747/181477
Site 11	London City Airport, Car Park Entrance, E16	12.5	Roadside	TQ542583/180201
Site 12	Pumping Station, Gallions Roundabout, E16	22	Roadside	TQ543762/180784

London Borough of Richmond

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
RUT2	George Street, Richmond	0.2	Roadside	TQ517916/174926
RUT7	Broad Street, Teddington, Middlesex	0.2	Roadside	TQ515690/170983
RUT32	Kings Street, Twickenham, Middlesex	0.2	Roadside	TQ516246/173217
RUT35	High Street, Hampton Wick, Middlesex	1.6	Roadside	TQ517628/169795
RUT36	Upper Richmond Road West, East Sheen, SW14	0.2	Roadside	TQ520533/175399

London Borough of Sutton

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
Site 1	Paynes Poppets, Croydon Road, Croydon CRO 4QE	8	Roadside	TQ530687/164837
Site 2	Devonshire Primary School, Devonshire Avenue, Sutton SM2 5JL	42	Background	TQ526158/163221
Site 3	Sutton Cemetery, Alcorn Close, Sutton SM3 9PX	100	Background	TQ525128/165823
Site 4	Robin Hood Junior School, Thorncroft Road, Sutton SM1 1RL	4	Roadside	TQ525713/164498
Site 5	The Lodge, Honeywood Walk, Carshalton SM5 3PB	75	Background	TQ527775/164606

London Borough of Wandsworth

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
WS01	Tooting Library, Mitcham Road, Tooting SW17	6.25	Roadside	TQ2761/7132
WS03	Environmental Services, 78 Garrett Lane, Wandsworth SW18 4DJ	44	Background	TQ2562/7442
WS05	Parkstead House, Holybourne Avenue, Roehampton SW15	300	Background	TQ522150/173573
WS06	Wandsworth High Street	5	Roadside	TQ257746

City of Westminster

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
WM03	Harrow Road, Housing Office	31	Background	TQ525493/181763
WM04	Lancaster Gate Hotel	1	Roadside	TQ526684/182015
WM05	Victoria Street	12	Roadside	TQ2939/7925
WM06	Drury Lane	50	Background	TQ3040/8109
WM07	Westminster Council House	3	Roadside	TQ527727/181881
WM08	Oxford Street	0.5	Roadside	TQ528275/181064
WM09	Horseferry Road	125	Background	TQ529777/178960
WM10	Covent Garden London Transport museum, The Piazza Covent Garden	150	Background	TQ30444/80903

Appendix B

Benzene Calculation

Benzene Calculation and Conversion

$$\text{Average Benzene Concentration (ppb)} = \frac{M(ng) \times 1000}{T(mins) \times Dc}$$

Where:

M = the amount of benzene adsorbed by each tube
T = the period during which the tube was exposed
Dc = is the diffusion coefficient

Where:

$$\text{Diffusion coefficient} = \frac{D(v) \times F \times 1000}{T \times C}$$

Where:

D(v) = uptake of benzene (ng)
F = 3.244 = ppm to µg m^{-3} conversion factor at 20°C
T = Time in mins
C = Concentration (µg m^{-3})

1 ppb = 3.244 µg m^{-3}

To convert from ppb to µg m^{-3} = multiply by 3.244

To convert from µg m^{-3} to ppb = multiply by 0.31

Appendix C

Benzene Concentrations (ppb & µg m^{-3})

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF BEXLEY

Month	**Site Code** LBB1 ppb	ug m3	LBB3 ppb	ug m3	LBB5 ppb	ug m3
January	1.2	3.9	1.1	3.6	1.4	4.4
February	-	-	1.3	4.2	1.1	3.6
March	1.0	3.2	1.2	3.9	0.8	2.7
April	0.4	1.2	0.4	1.2	0.5	1.7
May	0.3	1.0	0.4	1.1	0.3	1.1
June	0.3	1.0	0.5	1.6	-	-
July	0.1	0.4	0.2	0.7	-	-
August	1.0	3.1	1.0	3.4	1.1	3.5
September	0.6	2.0	0.5	1.7	0.6	1.9
October	0.5	1.6	0.7	2.3	0.6	2.1
November	0.4	1.3	0.9	2.9	0.8	2.7
December	0.8	2.5	0.8	2.7	1.4	4.6
Annual Mean	0.6	1.9	0.8	2.4	0.9	2.8

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	**Site Code** BD1 ppb	ug m3	BD2 ppb	ug m3	BD3 ppb	ug m3	BD4 ppb	ug m3
January	0.8	2.6	1.0	3.2	0.7	2.2	-	-
February	0.7	2.3	1.4	4.4	0.9	3.1	0.5	1.6
March	0.6	2.1	0.7	2.3	0.6	2.0	0.5	1.6
April	0.6	2.1	0.6	1.9	0.5	1.6	0.6	1.9
May	0.4	1.3	0.5	1.6	0.4	1.2	0.3	1.0
June	0.4	1.2	0.4	1.4	0.4	1.2	0.3	0.9
July	0.3	0.8	0.2	0.6	0.2	0.6	0.1	0.3
August	0.3	0.8	0.3	1.0	0.2	0.7	0.2	0.7
September	0.8	2.7	1.1	3.7	0.6	2.0	0.6	1.8
October	0.8	2.7	0.9	2.8	1.0	3.4	0.6	2.0
November	1.0	3.1	0.7	2.3	0.8	2.5	0.7	2.2
December	0.7	2.2	0.6	2.1	0.5	1.5	0.5	1.5
Annual Mean	0.6	2.0	0.7	2.3	0.6	1.8	0.4	1.4

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF BRENT

Month	**Site Code** BR31 ppb	ug m3	BR41 ppb	ug m3	BR42 ppb	ug m3	BR51 ppb	ug m3	BR53 ppb	ug m3
January	1.8	5.9	-	-	1.5	4.9	-	-	2.0	6.6
February	1.4	4.4	0.6	2.0	1.1	3.7	0.4	1.4	1.7	5.7
March	1.0	3.4	0.6	1.8	1.2	4.0	1.0	3.3	1.3	4.3
April	0.8	2.7	0.6	1.8	0.7	2.3	0.6	1.9	0.9	3.0
May	0.9	2.9	0.5	1.5	0.5	1.7	0.3	1.1	1.1	3.4
June	0.9	2.9	0.4	1.3	0.6	2.1	0.3	1.0	0.7	2.4
July	0.6	1.9	0.5	1.6	0.1	0.5	0.1	0.5	0.8	2.5
August	0.8	2.5	0.4	1.2	-	-	0.3	0.8	0.9	2.8
September	0.3	1.0	0.2	0.6	-	-	0.2	0.6	0.3	1.0
October	0.6	1.9	1.5	4.8	1.3	4.1	0.8	2.7	0.9	2.8
November	-	-	-	-	-	-	-	-	-	-
December	1.1	3.5	1.2	3.9	1.4	4.6	0.7	2.2	-	-
Annual Mean	0.9	3.0	0.6	2.1	1.0	3.1	0.5	1.5	1.1	3.5

Month	**Site Code** BR55 ppb	ug m3	BR56 ppb	ug m3	BR57 ppb	ug m3	BR58 ppb	ug m3	BR59 ppb	ug m3
January	2.2	7.2	1.6	5.1	1.4	4.4	2.1	6.9	1.7	5.4
February	1.9	6.3	1.4	4.6	1.3	4.3	1.6	5.2	-	-
March	1.6	5.1	0.8	2.5	1.0	3.1	1.4	4.4	0.7	2.2
April	1.4	4.6	0.7	2.2	0.7	2.4	1.0	3.1	0.5	1.7
May	-	-	0.7	2.4	0.7	2.4	1.2	3.7	0.9	2.9
June	1.2	3.8	0.7	2.3	-	-	-	-	-	-
July	1.0	3.1	0.4	1.2	0.4	1.3	0.6	2.1	0.3	1.0
August	1.1	3.4	0.6	1.9	0.5	1.6	0.9	2.8	0.5	1.6
September	0.4	1.2	0.3	0.8	0.3	0.9	0.3	1.0	0.3	0.9
October	0.8	2.4	0.4	1.2	0.4	1.4	0.8	2.6	1.3	4.1
November	-	-	-	-	-	-	-	-	-	-
December	2.2	7.2	1.0	3.2	1.0	3.4	1.3	4.3	1.1	3.7
Annual Mean	1.4	4.4	0.8	2.5	0.8	2.5	1.1	3.6	0.8	2.6

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF CAMDEN

Month	Site Code XT24 ppb	ug m3	XT30 ppb	ug m3	XT34 ppb	ug m3
January	3.3	10.6	4.6	15.0	-	-
February	1.5	4.7	2.5	8.1	-	-
March	0.9	3.0	1.4	4.4	-	-
April	-	-	-	-	-	-
May	3.3	10.6	2.2	7.2	1.2	4.0
June	0.9	2.9	1.9	6.0	1.2	3.8
July	-	-	-	-	-	-
August	1.6	5.2	1.5	4.9	1.4	4.5
September	1.2	3.9	1.6	5.3	0.4	1.4
October	0.6	2.0	0.7	2.3	0.9	2.9
November	1.1	3.5	3.5	11.3	1.3	4.3
December	1.3	4.3	2.3	7.3	1.6	5.2
Annual Mean	1.6	5.1	2.2	7.2	1.1	3.7

CORPORATION OF LONDON

Month	Site Code CL1 ppb	ug m3	CL2 ppb	ug m3	CL3 ppb	ug m3	CL4 ppb	ug m3	CL5 ppb	ug m3
January	3.0	9.6	3.2	10.2	3.3	10.6	2.6	8.6	3.3	10.6
February	0.8	2.4	1.1	3.7	0.8	2.4	1.0	3.3	1.1	3.6
March	1.2	3.8	0.8	2.6	0.7	2.2	0.9	2.9	1.0	3.2
April	0.6	2.0	0.5	1.6	0.5	1.6	0.6	1.8	0.5	1.6
May	0.4	1.4	0.5	1.7	0.3	1.0	0.4	1.3	0.4	1.4
June	0.5	1.6	0.6	1.9	0.3	0.9	0.3	1.0	0.4	1.4
July	0.3	0.9	0.3	1.0	0.3	0.9	0.2	0.7	0.3	1.0
August	0.4	1.3	0.3	1.0	0.2	0.8	0.3	0.9	-	-
September	0.9	2.9	0.9	2.8	0.7	2.3	0.7	2.2	0.7	2.4
October	0.6	1.9	0.6	2.1	0.4	1.4	0.5	1.7	0.8	2.5
November	0.6	2.1	0.6	2.1	0.7	2.2	0.6	2.0	0.7	2.3
December	0.8	2.6	0.7	2.3	0.7	2.2	0.7	2.3	0.6	2.0
Annual Mean	0.8	2.7	0.8	2.8	0.7	2.4	0.7	2.4	0.9	2.9

BENZENE CONCENTRATIONS 2003

CORPORATION OF LONDON (continued)

Month	Site Code CL6 ppb	ug m3	CL7 ppb	ug m3	CL8 ppb	ug m3	CL9 ppb	ug m3	CL10 ppb	ug m3
January	4.3	13.9	3.2	10.2	2.8	9.2	3.6	11.6	3.5	11.4
February	0.6	2.1	0.9	2.9	1.0	3.3	0.8	2.7	1.3	4.3
March	-	-	0.7	2.1	1.2	3.7	0.8	2.5	1.6	5.2
April	0.4	1.2	0.6	2.1	0.6	2.0	0.6	2.1	0.8	2.5
May	0.5	1.6	0.4	1.2	0.7	2.3	0.5	1.5	0.8	2.5
June	0.4	1.2	0.6	1.9	0.7	2.2	0.4	1.2	0.6	2.1
July	0.1	0.3	0.2	0.5	0.4	1.3	0.3	1.0	0.5	1.5
August	0.2	0.8	0.3	0.9	0.4	1.3	0.3	0.9	0.6	2.0
September	0.7	2.3	0.7	2.2	0.9	3.0	0.8	2.5	1.1	3.7
October	0.5	1.6	0.6	1.9	0.8	2.7	0.7	2.2	1.1	3.6
November	0.7	2.3	0.6	2.1	1.0	3.1	0.7	2.4	1.1	3.7
December	0.6	2.0	0.6	1.9	0.7	2.3	0.6	2.1	1.0	3.2
Annual Mean	0.8	2.7	0.8	2.5	0.9	3.0	0.8	2.7	1.2	3.8

LONDON BOROUGH OF GREENWICH

Month	Site Code GW29 ppb	ug m3	GW33 ppb	ug m3	GW34 ppb	ug m3	GW35 ppb	ug m3	GW39 ppb	ug m3
January	4.0	13.0	4.3	14.0	3.7	11.9	4.3	14.1	5.3	17.2
February	1.5	5.0	1.5	5.0	0.9	3.0	1.4	4.5	0.5	1.8
March	1.3	4.3	1.0	3.1	1.2	3.8	1.4	4.5	0.6	2.0
April	0.3	0.8	1.1	3.5	0.5	1.5	1.0	3.1	0.4	1.2
May	0.8	2.5	0.7	2.2	0.5	1.5	1.0	3.4	0.3	1.0
June	0.7	2.3	0.8	2.7	0.5	1.7	0.9	3.0	0.3	0.9
July	0.5	1.8	0.8	2.5	0.3	0.9	0.8	2.5	0.1	0.5
August	0.5	1.7	0.8	2.4	-	-	0.8	2.5	-	-
September	0.8	2.6	0.6	1.9	0.7	2.4	0.6	1.8	0.3	1.1
October	1.1	3.5	1.1	3.5	0.9	2.9	1.1	3.7	0.4	1.4
November	1.1	3.6	1.4	4.6	1.0	3.2	0.9	2.8	0.5	1.6
December	1.8	5.7	1.7	5.6	0.7	2.2	1.4	4.5	0.5	1.6
Annual Mean	1.2	3.9	1.3	4.3	1.0	3.2	1.3	4.2	0.8	2.7

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF GREENWICH (continued)

Month	**Site Code** GW41 ppb	ug m3	GW42 ppb	ug m3	GW50 ppb	ug m3	GW51 ppb	ug m3	GW54 ppb	ug m3
January	3.3	10.8	3.3	10.8	3.7	11.9	3.3	10.9	2.9	9.4
February	1.4	4.6	1.4	4.4	1.4	4.4	0.8	2.5	1.5	5.0
March	1.4	4.7	1.1	3.6	1.4	4.5	0.8	2.5	1.1	3.7
April	0.7	2.3	1.0	3.4	0.7	2.2	0.5	1.5	1.0	3.3
May	0.6	2.1	0.7	2.2	1.2	3.9	0.5	1.6	0.6	2.1
June	0.5	1.6	0.6	2.0	0.8	2.6	0.3	0.9	0.6	2.0
July	0.4	1.2	0.6	2.0	-	-	-	-	0.4	1.4
August	0.5	1.5	0.6	2.0	0.6	2.0	0.4	1.3	0.8	2.6
September	0.5	1.5	0.7	2.3	0.6	1.8	0.4	1.3	0.6	1.9
October	0.8	2.5	1.1	3.7	0.9	2.9	0.7	2.4	0.8	2.7
November	0.7	2.4	1.0	3.1	1.4	4.4	0.5	1.6	1.1	3.6
December	0.9	2.8	1.1	3.7	1.0	3.2	0.6	1.9	1.1	3.5
Annual Mean	1.0	3.2	1.1	3.6	1.2	4.0	0.8	2.6	1.1	3.4

Month	**Site Code** GW55 ppb	ug m3
January	3.1	10.0
February	1.1	3.6
March	0.9	2.8
April	0.6	2.0
May	0.4	1.2
June	0.4	1.3
July	0.3	0.9
August	0.3	0.9
September	0.4	1.2
October	0.6	2.0
November	0.6	2.0
December	0.6	2.1
Annual Mean	0.8	2.5

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF HAMMERSMITH AND FULHAM

Month	Site Code HM32 ppb	ug m3	HM41 ppb	ug m3	HM44 ppb	ug m3	HM45 ppb	ug m3	HM46 ppb	ug m3
January	3.6	11.6	3.2	10.4	2.8	9.2	3.9	12.7	4.3	13.9
February	1.7	5.4	1.1	3.6	1.2	3.7	1.1	3.7	1.0	3.3
March	1.4	4.6	0.9	2.9	0.8	2.5	1.2	3.9	1.3	4.1
April	1.1	3.5	0.6	1.9	0.5	1.5	0.6	2.0	0.7	2.2
May	0.6	2.0	-	-	0.3	1.1	0.5	1.5	0.4	1.2
June	0.6	2.1	0.3	1.0	0.4	1.2	0.6	1.9	0.5	1.5
July	0.4	1.3	0.2	0.7	0.1	0.5	0.3	0.8	0.2	0.7
August	0.7	2.1	0.3	0.8	0.2	0.7	0.4	1.3	0.3	1.1
September	0.8	2.6	0.6	1.9	0.6	1.9	0.7	2.4	1.3	4.1
October	0.4	1.4	0.4	1.2	0.4	1.3	0.4	1.2	0.5	1.6
November	1.0	3.3	0.6	2.0	0.6	1.9	0.8	2.6	0.8	2.7
December	1.1	3.5	0.7	2.2	0.7	2.2	0.7	2.2	0.8	2.6
Annual Mean	1.1	3.6	0.8	2.6	0.7	2.3	0.9	3.0	1.0	3.2

LONDON BOROUGH OF HARROW

Month	Site Code HW01 ppb	ug m3	HW02 ppb	ug m3	HW03 ppb	ug m3	HW04 ppb	ug m3	HW05 ppb	ug m3
January	1.3	4.1	0.8	2.7	0.9	2.8	1.1	3.4	1.6	5.1
February	0.5	1.6	0.4	1.4	0.6	1.9	0.7	2.3	1.1	3.5
March	0.3	1.0	0.4	1.3	0.4	1.4	0.6	2.0	0.6	2.1
April	0.5	1.5	0.5	1.5	0.4	1.4	0.5	1.7	0.4	1.4
May	0.4	1.2	0.3	0.8	0.3	1.0	0.6	2.0	0.7	2.3
June	0.3	1.1	0.3	1.0	0.3	0.9	0.4	1.3	0.7	2.4
July	0.2	0.8	0.4	1.2	0.5	1.5	0.3	1.0	0.4	1.4
August	0.4	1.4	0.4	1.3	0.4	1.4	0.4	1.4	0.5	1.7
September	0.5	1.6	0.5	1.7	0.5	1.7	0.6	2.0	0.7	2.2
October	0.7	2.3	0.8	2.7	1.1	3.5	1.7	5.7	0.4	1.2
November	0.6	2.1	0.5	1.7	0.6	2.0	0.6	2.1	1.1	3.6
December	0.6	2.0	0.7	2.2	0.5	1.6	0.7	2.2	1.2	3.9
Annual Mean	0.5	1.7	0.5	1.6	0.5	1.8	0.7	2.3	0.8	2.6

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HS BTEX2		HS BTEX3		HS BTEX4	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	-	-	0.6	2.1	0.8	2.6	1.0	3.2
February	1.0	3.2	0.7	2.2	1.1	3.5	0.9	3.0
March	0.5	1.5	-	-	-	-	-	-
April	0.3	0.8	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-
June	0.2	0.7	0.2	0.6	0.3	0.9	0.2	0.7
July	0.2	0.7	0.2	0.6	0.2	0.7	0.2	0.7
August	0.4	1.3	0.2	0.7	0.4	1.2	0.4	1.2
September	0.4	1.3	0.4	1.3	0.6	1.8	0.6	1.9
October	0.7	2.1	0.5	1.5	0.7	2.2	0.7	2.4
November	0.7	2.4	0.8	2.7	0.7	2.3	0.8	2.6
December	0.9	2.8	0.8	2.4	1.2	3.7	0.8	2.5
Annual Mean	0.5	1.7	0.5	1.6	0.6	2.1	0.6	2.0

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	0.7	2.4	1.7	5.4	0.6	2.1
February	0.9	2.8	1.2	3.8	-	-
March	0.4	1.5	0.7	2.3	0.5	1.5
April	0.1	0.2	0.6	1.9	0.2	0.8
May	-	-	-	-	-	-
June	0.3	0.9	0.5	1.7	0.2	0.5
July	0.2	0.6	0.6	1.9	0.1	0.5
August	0.3	0.9	0.5	1.6	0.3	0.9
September	0.4	1.2	0.9	2.8	0.4	1.3
October	0.7	2.4	1.0	3.1	0.6	2.0
November	0.7	2.2	1.3	4.2	0.8	2.5
December	0.8	2.7	1.3	4.3	0.7	2.2
Annual Mean	0.5	1.6	0.9	3.0	0.4	1.4

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF NEWHAM

Month	Site Code 1		2		3		4	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	1.4	4.4	1.4	4.4	1.5	5.0	-	-
February	1.0	3.4	0.9	3.0	0.8	2.7	1.2	3.8
March	1.0	3.2	0.8	2.5	1.2	3.8	1.1	3.7
April	0.8	2.5	0.7	2.3	0.7	2.3	0.7	2.3
May	0.4	1.4	0.5	1.6	0.5	1.5	0.5	1.7
June	0.4	1.4	0.3	1.1	0.5	1.5	0.5	1.5
July	0.4	1.3	0.2	0.8	0.3	0.9	0.4	1.4
August	0.5	1.5	0.4	1.3	0.4	1.2	0.4	1.3
September	0.4	1.3	0.3	1.1	0.4	1.3	0.5	1.5
October	0.7	2.3	0.5	1.6	0.6	2.0	0.8	2.6
November	0.9	2.9	0.8	2.5	0.9	2.9	0.8	2.4
December	1.1	3.5	0.8	2.5	0.8	2.7	0.9	3.0
Annual Mean	0.7	2.4	0.6	2.1	0.7	2.3	0.7	2.3

Month	Site Code 5		6		7		8	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	0.7	2.2	1.0	3.3	1.0	3.4	1.2	3.9
February	0.7	2.2	0.7	2.3	0.7	2.3	0.7	2.2
March	1.3	4.4	0.8	2.6	-	-	0.8	2.7
April	0.6	1.8	0.4	1.4	0.5	1.7	0.6	2.1
May	0.4	1.2	0.3	0.9	0.3	0.9	0.4	1.2
June	0.3	1.1	0.7	2.3	0.6	1.9	0.3	1.0
July	0.2	0.7	0.1	0.4	0.2	0.5	0.3	0.8
August	0.3	0.9	0.3	0.9	0.3	1.0	0.4	1.2
September	0.3	1.0	0.3	1.1	0.3	1.1	0.5	1.5
October	0.5	1.5	0.4	1.4	0.4	1.4	0.5	1.5
November	0.4	1.4	0.5	1.6	0.5	1.5	0.7	2.2
December	0.8	2.6	0.7	2.2	0.9	2.9	0.7	2.3
Annual Mean	0.5	1.7	0.5	1.7	0.5	1.7	0.6	1.9

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF NEWHAM (continued)

Month	Site Code 9		10		11		12	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	1.2	4.0	0.8	2.6	1.1	3.6	1.0	3.2
February	1.1	3.6	0.8	2.4	0.7	2.3	0.7	2.3
March	0.9	3.0	0.6	1.9	0.9	2.9	0.8	2.7
April	-	-	0.5	1.6	0.5	1.7	0.7	2.2
May	-	-	0.3	0.9	0.4	1.2	0.4	1.4
June	0.8	2.5	0.3	0.9	0.4	1.3	0.7	2.2
July	0.3	1.0	0.2	0.5	0.1	0.5	0.2	0.6
August	-	-	0.3	0.8	0.3	0.9	0.4	1.4
September	0.4	1.3	0.3	1.1	0.3	1.1	0.4	1.3
October	0.6	2.0	0.4	1.3	0.4	1.2	0.4	1.4
November	0.6	2.0	0.5	1.6	0.5	1.7	0.6	2.1
December	0.5	1.6	0.7	2.3	-	-	0.7	2.3
Annual Mean	0.7	2.3	0.5	1.5	0.5	1.7	0.6	1.9

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01		KC02		KC03		KC04		KC05	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	3.9	12.6	3.0	9.6	4.3	13.8	2.7	8.8	3.4	10.9
February	1.5	5.0	1.0	3.3	3.4	11.0	0.9	2.9	1.1	3.7
March	1.5	4.8	0.9	3.0	3.0	9.9	0.9	3.0	0.7	2.3
April	1.5	4.8	0.7	2.3	1.5	4.8	0.5	1.6	0.7	2.3
May	0.6	2.1	0.4	1.4	3.0	9.9	0.3	0.9	0.5	1.6
June	0.5	1.6	0.4	1.2	4.1	13.3	0.7	2.2	0.7	2.4
July	0.5	1.8	0.1	0.5	2.7	8.7	0.2	0.8	0.3	1.1
August	0.5	1.7	0.2	0.7	3.0	9.7	0.3	0.8	0.4	1.2
September	1.0	3.1	0.7	2.4	3.8	12.2	0.8	2.7	0.9	2.8
October	0.6	2.0	0.3	1.0	2.7	8.7	0.4	1.4	0.5	1.6
November	1.1	3.5	0.5	1.7	2.1	6.7	0.6	1.8	0.8	2.4
December	1.2	4.0	0.6	1.9	2.1	6.9	0.8	2.7	0.6	1.9
Annual Mean	1.2	3.9	0.7	2.4	3.0	9.6	0.8	2.5	0.9	2.9

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2 ppb	ug m3	RUT 38 ppb	ug m3	RUT 35 ppb	ug m3	RUT 7 ppb	ug m3	Rut 32 ppb	ug m3
January	-	-	-	-	-	-	-	-	-	-
February	1.1	3.6	1.8	5.9	1.4	4.6	1.1	3.6	1.8	6.0
March	1.5	4.8	1.3	4.3	0.7	2.3	1.5	5.0	1.4	4.4
April	0.8	2.7	1.2	3.9	0.7	2.3	1.2	3.8	1.1	3.6
May	0.7	2.4	0.9	2.8	0.6	2.0	0.6	2.1	0.9	2.9
June	0.8	2.5	0.9	2.8	0.5	1.6	0.5	1.7	0.7	2.4
July	-	-	0.5	1.5	0.5	1.6	0.6	2.0	0.6	1.9
August	0.8	2.5	0.9	2.8	0.7	2.4	0.6	1.8	0.7	2.2
September	1.0	3.2	1.6	5.3	1.1	3.6	1.3	4.1	1.4	4.5
October	1.4	4.5	1.6	5.1	1.7	5.4	1.6	5.2	1.5	4.9
November	1.2	3.9	1.3	4.3	1.5	4.8	1.1	3.7	1.3	4.2
December	1.1	3.6	1.8	5.9	1.2	3.9	1.5	4.9	1.3	4.2
Annual Mean	1.0	3.4	1.3	4.1	1.0	3.1	1.1	3.4	1.2	3.7

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1 ppb	ug m3	Site 2 ppb	ug m3	Site 3 ppb	ug m3	Site 4 ppb	ug m3	Site 5 ppb	ug m3
January	3.1	9.9	2.8	9.2	2.7	8.6	2.4	7.8	3.9	12.7
February	1.1	3.5	0.6	1.8	0.6	2.0	0.6	2.0	-	-
March	1.1	3.7	0.8	2.7	0.7	2.3	1.1	3.6	0.6	2.1
April	0.7	2.3	0.4	1.3	0.6	1.8	0.6	2.0	0.6	1.9
May	0.6	2.0	0.3	0.9	0.5	1.6	0.3	1.0	0.4	1.3
June	0.6	1.8	2.9	9.3	-	-	0.4	1.2	0.4	1.4
July	0.3	0.8	0.1	0.3	0.1	0.3	0.2	0.6	0.1	0.3
August	0.3	0.8	0.2	0.7	0.2	0.8	0.2	0.7	0.2	0.6
September	0.8	2.7	0.5	1.6	0.6	1.9	0.6	1.9	0.6	2.1
October	0.8	2.6	0.9	2.8	0.6	2.0	0.8	2.4	0.6	1.9
November	1.1	3.5	0.7	2.2	0.6	2.1	0.7	2.4	0.7	2.2
December	1.0	3.2	0.7	2.4	0.9	3.0	0.7	2.4	0.6	2.0
Annual Mean	0.9	3.1	0.9	2.9	0.7	2.4	0.7	2.3	0.8	2.6

BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF WANDSWORTH

Month	Site Code WS01 ppb	ug m3	WS03 ppb	ug m3	WS05 ppb	ug m3	WS06 ppb	ug m3
January	0.6	1.9	1.2	3.8	1.0	3.1	1.1	3.5
February	0.9	3.1	0.1	0.2	1.2	3.9	0.9	3.0
March	1.0	3.2	2.1	6.7	1.7	5.6	1.2	4.0
April	0.4	1.4	0.8	2.5	0.8	2.5	-	-
May	0.3	0.9	0.6	2.0	0.4	1.3	0.2	0.6
June	0.2	0.6	0.7	2.3	0.3	0.9	0.1	0.4
July	0.1	0.5	-	-	0.4	1.3	0.4	1.4
August	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-
October	0.8	2.6	1.4	4.6	1.1	3.5	-	-
November	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-
Annual Mean	0.5	1.8	1.0	3.2	0.9	2.8	0.7	2.1

CITY OF WESTMINSTER

Month	Site Code WS03 ppb	ug m3	WS04 ppb	ug m3	WS07 ppb	ug m3	WS08 ppb	ug m3
January	4.3	14.0	2.5	8.0	3.6	11.6	2.9	9.5
February	0.7	2.2	0.7	2.4	1.0	3.3	1.0	3.3
March	0.8	2.7	0.7	2.3	1.2	3.9	1.0	3.2
April	0.5	1.7	0.7	2.3	0.8	2.5	0.5	1.6
May	0.4	1.4	0.5	1.5	0.7	2.2	0.5	1.6
June	0.4	1.4	0.5	1.7	0.5	1.5	0.5	1.5
July	0.3	1.0	0.3	0.9	0.4	1.3	0.3	0.9
August	0.6	2.1	0.6	2.1	0.8	2.5	0.7	2.2
September	0.5	1.7	0.5	1.7	0.7	2.2	0.6	1.8
October	0.4	1.4	0.5	1.5	0.6	2.0	0.4	1.4
November	0.6	1.9	0.6	2.0	0.9	2.9	0.6	1.8
December	0.7	2.2	0.6	2.1	0.9	3.0	0.7	2.2
Annual Mean	0.9	2.8	0.7	2.4	1.0	3.2	0.8	2.6

BENZENE CONCENTRATIONS 2003

CITY OF WESTMINSTER (continued)

Month	Site Code WS09 ppb	ug m3	WS10 ppb	ug m3
January	2.6	8.3	2.6	8.6
February	0.5	1.7	0.2	0.6
March	0.8	2.6	-	-
April	0.6	1.8	0.6	1.9
May	0.5	1.8	0.3	1.1
June	0.3	1.0	0.4	1.2
July	-	-	0.2	0.5
August	0.6	2.1	-	-
September	0.5	1.5	0.6	1.9
October	0.4	1.3	0.4	1.1
November	0.6	1.9	0.6	1.9
December	0.6	2.1	0.0	0.1
Annual Mean	0.7	2.4	0.6	1.9

LONDON BOROUGH OF HILLINGDON

Month	Site Code HD31 ppb	ug m3	HD46 ppb	ug m3	HD48 ppb	ug m3	HD50 ppb	ug m3	HD58 ppb	ug m3
January	2.9	9.3	3.0	9.7	3.7	11.9	2.9	9.4	3.7	11.9
February	1.1	3.7	1.4	4.5	1.3	4.1	1.1	3.7	1.2	3.8
March	0.5	1.6	0.6	2.1	0.7	2.2	0.6	1.9	0.5	1.7
April	0.6	1.9	0.8	2.8	0.7	2.3	0.6	1.9	0.6	2.0
May	-	-	0.7	2.4	0.7	2.3	-	-	0.5	1.5
June	0.2	0.7	0.4	1.4	0.6	1.8	0.3	0.9	0.6	2.1
July	0.1	0.5	0.3	0.9	0.2	0.8	-	-	0.2	0.6
August	0.3	1.1	0.5	1.7	0.4	1.4	0.4	1.4	0.4	1.4
September	0.6	2.0	1.0	3.1	0.7	2.2	0.6	2.0	0.6	1.9
October	0.7	2.3	1.0	3.1	0.8	2.6	0.9	2.8	1.0	3.2
November	0.9	3.0	1.4	4.6	1.4	4.5	0.9	2.8	0.8	2.7
December	0.7	2.2	1.0	3.4	1.2	3.8	0.9	2.8	0.9	2.8
Annual Mean	0.8	2.6	1.0	3.3	1.0	3.3	0.9	3.0	0.9	3.0

Appendix D

Toluene Concentrations (ppb & µg m^{-3})

TOLUENE CONCENTRATIONS 2003

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1 ppb	ug m3	BD2 ppb	ug m3	BD3 ppb	ug m3	BD4 ppb	ug m3
January	4.4	16.7	5.7	21.9	5.0	19.0	-	-
February	3.9	15.0	7.8	29.7	4.2	16.1	2.3	8.8
March	4.2	16.1	4.7	17.9	4.8	18.5	3.9	14.9
April	13.7	52.4	3.4	13.1	2.9	11.0	22.5	86.0
May	1.9	7.3	2.7	10.5	3.2	12.1	1.6	6.2
June	3.4	12.9	4.1	15.8	4.2	16.2	2.6	10.1
July	4.0	15.2	3.6	13.6	4.8	18.4	4.0	15.3
August	3.9	14.9	5.3	20.4	4.8	18.3	4.5	17.2
September	21.1	80.7	20.2	77.5	6.6	25.3	5.3	20.4
October	6.2	23.8	6.5	24.8	10.3	39.5	5.0	19.3
November	10.7	41.0	5.6	21.3	14.5	55.4	11.0	41.9
December	5.6	21.5	4.6	17.6	4.6	17.6	2.2	8.4
Annual Mean	6.9	26.5	6.2	23.7	5.8	22.3	5.9	22.6

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01 ppb	ug m3	KC02 ppb	ug m3	KC03 ppb	ug m3	KC04 ppb	ug m3	KC05 ppb	ug m3
January	12.1	46.5	8.3	31.7	14.8	56.6	7.8	29.9	9.6	36.7
February	5.4	20.6	3.4	13.1	15.5	59.5	2.4	9.2	3.4	13.2
March	7.4	28.5	5.6	21.4	15.9	61.1	5.2	19.9	3.7	14.0
April	56.9	218.1	42.5	162.8	7.0	26.7	1.8	6.7	3.1	11.9
May	2.8	10.6	1.3	5.1	15.6	59.6	1.6	6.1	2.6	10.0
June	0.3	1.2	2.9	11.3	20.1	76.9	19.9	76.1	15.7	60.0
July	5.0	19.3	2.7	10.3	13.9	53.2	3.9	15.0	3.7	14.3
August	4.7	18.2	3.4	13.2	21.3	81.5	3.5	13.2	4.2	15.9
September	18.0	68.9	24.9	95.4	24.8	94.9	21.7	83.0	32.8	125.8
October	14.6	56.1	4.2	16.0	17.0	64.9	4.1	15.7	14.0	53.8
November	6.5	24.8	8.6	32.9	20.8	79.6	8.0	30.6	7.1	27.3
December	7.2	27.4	5.2	19.7	10.8	41.4	8.5	32.7	6.7	25.8
Annual Mean	11.8	45.0	9.4	36.1	16.4	63.0	7.4	28.2	8.9	34.1

TOLUENE CONCENTRATIONS 2003

CORPORATION OF LONDON

Month	**Site Code** CL1 ppb	ug m3	CL2 ppb	ug m3	CL3 ppb	ug m3	CL4 ppb	ug m3	CL5 ppb	ug m3
January	9.0	34.7	10.7	40.8	11.0	42.1	8.7	33.4	10.3	39.6
February	2.6	9.9	3.1	11.9	2.4	9.2	3.2	12.3	3.8	14.4
March	9.7	37.2	4.1	15.7	3.9	15.0	8.6	32.9	5.5	21.2
April	3.9	14.8	2.7	10.5	2.2	8.6	2.4	9.2	2.1	8.0
May	2.3	8.6	2.7	10.2	2.1	8.0	1.5	5.8	2.6	10.0
June	5.2	20.0	9.6	36.8	3.6	13.6	4.0	15.2	3.7	14.2
July	3.3	12.7	3.2	12.4	4.8	18.3	3.9	15.1	3.4	12.8
August	10.2	39.0	10.9	41.9	15.5	59.2	14.6	55.8	-	-
September	17.4	66.5	22.5	86.2	26.9	103.0	13.7	52.4	24.3	93.2
October	3.3	12.7	3.8	14.7	4.5	17.1	4.0	15.2	4.9	18.7
November	7.2	27.7	6.4	24.3	8.5	32.5	6.5	24.7	6.5	24.7
December	6.0	23.1	4.3	16.5	5.5	20.9	4.8	18.5	4.5	17.2
Annual Mean	6.7	25.6	7.0	26.8	7.6	29.0	6.3	24.2	6.5	24.9

Month	**Site Code** CL6 ppb	ug m3	CL7 ppb	ug m3	CL8 ppb	ug m3	CL9 ppb	ug m3	CL10 ppb	ug m3
January	14.2	54.5	10.0	38.4	8.1	31.0	11.3	43.3	13.6	52.0
February	2.8	10.9	2.7	10.3	3.1	12.0	2.9	11.3	4.6	17.5
March	-	-	3.5	13.3	9.6	36.9	3.8	14.5	9.1	35.0
April	2.7	10.5	3.6	13.8	2.5	9.7	3.1	11.9	3.3	12.7
May	2.7	10.4	1.4	5.3	3.4	12.9	3.0	11.5	3.3	12.5
June	4.1	15.8	13.0	49.8	12.5	48.0	5.3	20.4	6.7	25.5
July	4.1	15.5	2.5	9.5	5.1	19.4	3.6	13.9	6.2	23.6
August	17.5	67.1	11.8	45.4	9.3	35.7	14.9	57.1	15.6	59.9
September	20.8	79.8	14.3	54.8	30.0	114.9	15.6	59.6	14.9	57.2
October	3.8	14.7	9.7	37.1	6.0	22.9	3.9	14.8	5.7	21.9
November	10.7	40.8	8.9	34.1	10.5	40.2	7.7	29.3	14.1	54.1
December	5.9	22.5	5.6	21.3	5.1	19.4	4.6	17.4	6.2	23.6
Annual Mean	8.1	31.1	7.2	27.7	8.8	33.6	6.6	25.4	8.6	33.0

TOLUENE CONCENTRATIONS 2003

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HS BTEX2		HS BTEX3		HS BTEX4	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	-	-	5.3	20.1	7.3	28.0	6.1	23.5
February	2.7	10.5	1.7	6.7	3.7	14.1	2.2	8.5
March	2.2	8.2	-	-	-	-	-	-
April	1.2	4.7	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-
June	5.1	19.4	6.2	23.6	9.3	35.7	5.0	19.3
July	3.8	14.7	3.4	12.9	4.8	18.3	2.7	10.5
August	22.6	86.5	11.9	45.5	11.8	45.2	14.5	55.7
September	5.0	19.1	4.5	17.1	5.4	20.8	10.1	38.5
October	3.1	11.8	3.3	12.7	3.5	13.5	8.4	32.3
November	4.3	16.5	4.6	17.6	6.0	23.1	4.6	17.8
December	5.5	21.2	4.4	17.0	4.7	18.0	3.2	12.2
Annual Mean	5.6	21.3	5.0	19.2	6.3	24.1	6.3	24.3

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	7.0	26.8	8.6	33.0	4.0	15.3
February	2.1	8.1	4.0	15.5	-	-
March	2.2	8.3	3.7	14.0	2.4	9.4
April	2.3	8.9	3.1	11.9	1.5	5.7
May	-	-	-	-	-	-
June	9.6	36.9	8.8	33.8	4.6	17.6
July	7.5	28.8	6.4	24.5	5.0	19.1
August	15.1	57.6	11.8	45.1	12.3	46.9
September	10.5	40.2	9.5	36.5	8.2	31.3
October	3.9	15.1	6.8	26.0	3.9	14.9
November	5.3	20.2	7.9	30.4	6.3	24.3
December	4.1	15.6	6.1	23.5	4.2	16.0
Annual Mean	6.3	24.2	7.0	26.7	5.2	20.0

TOLUENE CONCENTRATIONS 2003

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2 ppb	ug m3	RUT 38 ppb	ug m3	RUT 35 ppb	ug m3	RUT 7 ppb	ug m3	Rut 32 ppb	ug m3
January	-	-	-	-	-	-	-	-	-	-
February	4.4	16.8	5.9	22.5	5.0	19.1	4.8	18.3	5.6	21.5
March	7.5	28.6	6.3	24.3	3.3	12.6	11.0	42.3	6.7	25.8
April	7.8	30.0	9.7	37.1	5.6	21.4	10.3	39.3	7.6	29.3
May	3.4	12.9	4.3	16.4	2.5	9.5	6.7	25.6	4.1	15.7
June	10.2	39.0	6.2	23.8	3.4	13.2	9.2	35.0	3.8	14.7
July	-	-	6.3	24.3	8.6	32.9	14.5	55.5	5.4	20.6
August	8.1	31.0	9.1	34.9	10.1	38.8	10.6	40.5	7.4	28.4
September	22.5	86.2	23.8	91.0	37.8	144.8	32.5	124.5	37.3	142.8
October	9.4	35.9	12.4	47.5	8.8	33.6	19.4	74.4	8.4	32.2
November	9.0	34.4	8.5	32.5	6.9	26.4	4.3	16.4	3.7	14.3
December	4.5	17.1	6.3	24.0	8.2	31.3	6.6	25.2	4.0	15.3
Annual Mean	8.7	33.2	9.0	34.4	9.1	34.9	11.8	45.2	8.6	32.8

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1 ppb	ug m3	Site 2 ppb	ug m3	Site 3 ppb	ug m3	Site 4 ppb	ug m3	Site 5 ppb	ug m3
January	9.3	35.6	8.1	30.9	7.1	27.3	6.4	24.7	11.6	44.3
February	3.2	12.1	1.3	5.2	1.7	6.5	1.7	6.6	-	-
March	5.6	21.3	3.9	14.9	4.4	16.8	5.9	22.5	3.5	13.4
April	3.8	14.4	2.4	9.3	3.5	13.5	2.6	10.0	3.4	13.1
May	3.4	13.0	1.4	5.2	2.3	8.9	2.1	8.2	2.3	8.8
June	8.4	32.3	7.4	28.5	-	-	3.7	14.1	9.8	37.7
July	2.7	10.4	3.5	13.4	2.7	10.2	4.0	15.2	3.3	12.6
August	15.8	60.5	9.0	34.3	20.2	77.2	13.8	52.8	9.4	36.1
September	28.0	107.3	8.3	31.9	6.7	25.7	9.0	34.5	11.5	44.0
October	11.6	44.4	5.0	19.3	4.5	17.1	8.0	30.6	3.4	12.9
November	10.5	40.1	8.6	32.8	6.6	25.3	7.1	27.1	8.4	32.0
December	5.4	20.8	2.7	10.2	7.0	26.9	3.0	11.3	3.0	11.4
Annual Mean	9.0	34.3	5.1	19.6	6.1	23.2	5.6	21.5	6.3	24.2

Appendix E

Ethyl Benzene Concentrations (ppb & µg m^{-3})

ETHYL BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1 ppb	ug m3	BD2 ppb	ug m3	BD3 ppb	ug m3	BD4 ppb	ug m3
January	0.4	1.8	0.6	2.5	0.4	1.6	-	-
February	0.2	1.1	0.5	2.1	0.3	1.5	0.1	0.6
March	0.3	1.2	0.3	1.5	0.3	1.2	0.2	0.8
April	0.5	2.1	0.3	1.2	0.2	1.1	0.4	1.7
May	0.2	0.7	0.3	1.2	0.2	1.0	0.1	0.5
June	0.3	1.4	0.4	1.9	0.5	2.1	0.2	0.9
July	0.2	1.1	0.2	1.0	0.3	1.3	0.2	0.7
August	0.2	0.9	0.3	1.2	0.2	1.1	0.2	0.7
September	0.5	2.2	0.4	1.9	0.4	1.6	0.3	1.2
October	0.5	2.3	0.5	2.3	0.7	3.3	0.4	1.7
November	0.5	2.3	0.4	1.6	0.5	2.3	0.4	1.7
December	0.4	2.0	0.4	2.0	0.4	1.6	0.3	1.2
Annual Mean	0.4	1.6	0.4	1.7	0.4	1.6	0.2	1.1

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01 ppb	ug m3	KC02 ppb	ug m3	KC03 ppb	ug m3	KC04 ppb	ug m3	KC05 ppb	ug m3
January	2.0	8.7	1.5	6.6	2.3	9.9	1.3	5.6	1.7	7.4
February	0.7	3.2	0.4	1.6	1.7	7.3	0.3	1.2	0.4	1.9
March	0.7	2.9	0.3	1.5	1.5	6.5	0.3	1.5	0.2	1.1
April	0.9	4.0	0.5	2.3	0.8	3.4	0.2	1.1	0.4	1.7
May	0.3	1.4	0.1	0.6	1.6	7.1	0.1	0.4	0.2	1.0
June	3.2	14.1	0.4	1.6	2.4	10.7	1.1	4.7	0.8	3.6
July	0.4	1.8	0.1	0.5	1.3	5.7	0.2	0.8	0.3	1.1
August	0.4	1.7	0.2	0.7	2.4	10.5	0.2	0.9	0.3	1.2
September	0.5	2.1	0.4	1.7	1.9	8.5	0.6	2.5	0.4	1.9
October	0.4	1.6	0.2	0.7	1.8	7.9	0.2	1.1	0.6	2.7
November	0.5	2.3	0.3	1.5	2.2	9.6	0.3	1.4	0.4	1.8
December	0.7	3.0	0.4	1.7	0.9	3.9	0.6	2.5	0.4	1.7
Annual Mean	0.9	3.9	0.4	1.7	1.7	7.6	0.4	2.0	0.5	2.3

ETHYL BENZENE CONCENTRATIONS 2003

CORPORATION OF LONDON

Month	**Site Code** CL1 ppb	ug m3	CL2 ppb	ug m3	CL3 ppb	ug m3	CL4 ppb	ug m3	CL5 ppb	ug m3
January	1.4	6.3	1.6	6.9	1.6	7.2	1.3	5.7	1.6	7.2
February	0.3	1.3	0.4	1.8	0.2	1.1	0.4	1.7	0.4	2.0
March	0.4	2.0	0.3	1.4	0.3	1.1	0.3	1.5	0.4	1.6
April	0.4	1.7	0.3	1.5	0.3	1.3	0.3	1.5	0.3	1.2
May	0.2	0.9	0.3	1.2	0.1	0.6	0.3	1.2	0.2	1.1
June	0.4	1.6	5.6	24.6	0.2	0.7	0.2	1.0	0.3	1.2
July	0.2	0.9	0.4	1.7	0.3	1.4	0.2	0.8	0.2	1.0
August	0.3	1.3	0.2	1.1	0.2	0.8	0.2	0.8	-	-
September	0.5	2.3	0.5	2.2	0.4	1.7	0.3	1.3	0.4	1.8
October	0.3	1.2	0.4	1.6	0.3	1.2	0.3	1.3	0.4	1.7
November	0.3	1.5	0.4	1.6	0.4	1.7	0.3	1.4	0.3	1.5
December	0.5	2.1	0.4	2.0	0.4	1.8	0.4	2.0	0.4	1.7
Annual Mean	0.4	1.9	0.9	4.0	0.4	1.7	0.4	1.7	0.5	2.0

Month	**Site Code** CL6 ppb	ug m3	CL7 ppb	ug m3	CL8 ppb	ug m3	CL9 ppb	ug m3	CL10 ppb	ug m3
January	2.4	10.5	1.6	6.9	1.4	6.3	1.8	7.8	1.9	8.2
February	0.4	2.0	0.3	1.3	0.4	1.7	0.3	1.5	0.7	2.9
March	-	-	0.2	1.0	1.6	6.9	0.3	1.4	2.1	9.4
April	0.3	1.5	0.4	1.9	0.4	1.6	0.4	1.8	0.4	1.9
May	0.3	1.2	0.2	0.9	0.4	1.8	0.2	1.1	0.4	1.9
June	0.3	1.5	0.7	2.9	0.7	3.1	0.3	1.2	0.4	2.0
July	0.2	1.0	0.1	0.6	0.4	1.6	0.2	1.0	0.4	2.0
August	0.2	1.1	0.2	1.0	0.3	1.2	0.2	0.8	0.6	2.5
September	0.5	2.1	0.3	1.5	0.6	2.4	0.5	2.1	0.7	3.0
October	0.2	1.1	0.5	2.3	0.4	1.9	0.3	1.5	0.6	2.4
November	0.5	2.2	0.4	1.6	0.6	2.5	0.3	1.5	0.8	3.4
December	0.4	1.8	0.4	1.7	0.4	2.0	3.9	17.2	0.6	2.5
Annual Mean	0.5	2.4	0.4	2.0	0.6	2.8	0.7	3.2	0.8	3.5

ETHYL BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HS BTEX2		HS BTEX3		HS BTEX4	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	-	-	0.2	1.0	0.4	1.9	0.5	2.1
February	0.3	1.5	0.1	0.6	0.4	1.9	0.3	1.2
March	0.2	0.9	-	-	-	-	-	-
April	0.2	0.8	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-
June	0.3	1.4	0.3	1.2	0.5	2.1	0.3	1.4
July	0.1	0.6	0.1	0.4	0.1	0.6	0.1	0.5
August	0.3	1.5	0.1	0.6	0.3	1.2	0.2	1.0
September	0.3	1.2	0.3	1.2	0.4	1.7	0.4	1.8
October	0.2	0.9	0.2	0.8	0.2	1.0	0.4	1.8
November	0.3	1.4	0.3	1.4	0.3	1.4	0.4	1.6
December	0.4	1.8	0.4	1.7	0.5	2.2	0.4	1.6
Annual Mean	0.3	1.2	0.2	1.0	0.4	1.6	0.3	1.4

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	0.4	1.6	0.9	3.8	0.2	1.0
February	0.2	1.0	0.5	2.4	-	-
March	0.2	0.8	0.4	1.8	0.2	0.9
April	0.1	0.3	0.5	2.2	0.2	0.9
May	-	-	-	-	-	-
June	3.9	17.1	0.7	3.0	0.2	0.9
July	0.2	1.0	0.4	1.8	0.1	0.6
August	0.2	1.0	0.4	1.6	0.2	0.9
September	0.7	2.9	0.3	1.2	0.3	1.4
October	0.2	1.0	0.5	2.2	0.2	1.0
November	0.3	1.4	0.7	3.0	0.4	1.7
December	0.4	1.8	0.6	2.9	0.4	1.6
Annual Mean	0.6	2.7	0.5	2.4	0.2	1.1

ETHYL BENZENE CONCENTRATIONS 2003

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2 ppb	ug m3	RUT 38 ppb	ug m3	RUT 35 ppb	ug m3	RUT 7 ppb	ug m3	Rut 32 ppb	ug m3
January	-	-	-	-	-	-	-	-	-	-
February	0.5	2.2	0.8	3.4	0.6	2.7	0.5	2.1	0.8	3.4
March	0.5	2.4	0.5	2.3	0.3	1.3	0.6	2.4	1.9	8.5
April	0.4	1.7	0.6	2.7	0.3	1.2	0.6	2.7	0.6	2.6
May	0.5	2.1	0.5	2.1	0.4	1.6	0.4	1.6	0.4	1.9
June	5.1	22.6	0.8	3.5	0.6	2.4	0.5	2.2	0.5	2.3
July	-	-	0.3	1.5	0.5	2.1	0.6	2.4	0.4	1.7
August	0.6	2.8	0.5	2.1	0.4	1.8	0.4	1.6	0.4	1.9
September	0.5	2.1	0.9	3.8	0.6	2.8	0.7	2.9	0.7	3.3
October	0.5	2.2	0.7	3.1	0.6	2.9	0.9	4.0	0.6	2.9
November	0.7	2.9	0.8	3.7	0.7	3.2	0.6	2.7	0.6	2.6
December	0.5	2.3	0.9	4.1	1.0	4.5	0.7	2.9	0.6	2.4
Annual Mean	1.0	4.3	0.7	2.9	0.5	2.4	0.6	2.5	0.7	3.0

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1 ppb	ug m3	Site 2 ppb	ug m3	Site 3 ppb	ug m3	Site 4 ppb	ug m3	Site 5 ppb	ug m3
January	1.6	6.9	1.4	6.0	1.3	5.6	1.1	5.0	2.0	9.0
February	0.4	1.6	0.1	0.2	0.1	0.5	0.1	0.6	-	-
March	0.4	1.8	0.2	1.1	0.2	1.1	0.4	1.6	0.2	0.9
April	0.5	2.2	0.3	1.2	0.5	2.3	0.3	1.5	0.4	1.7
May	0.4	1.6	0.1	0.4	0.2	1.0	0.2	0.7	0.2	0.7
June	5.6	24.8	0.4	2.0	-	-	0.5	2.3	5.9	25.8
July	0.2	0.9	0.1	0.5	0.1	0.4	0.2	0.7	0.1	0.5
August	0.2	0.7	0.1	0.6	0.2	0.9	0.2	0.7	0.1	0.5
September	0.5	2.1	0.4	1.7	0.3	1.2	0.3	1.3	0.3	1.5
October	0.6	2.4	0.3	1.5	0.2	1.1	0.4	1.7	0.2	1.0
November	0.5	2.2	0.4	1.6	0.3	1.5	0.4	1.7	0.4	1.6
December	0.5	2.2	0.3	1.5	0.5	2.1	0.4	1.6	0.3	1.3
Annual Mean	0.9	4.1	0.3	1.5	0.4	1.6	0.4	1.6	0.9	4.0

Appendix F

m, p-Xylene Concentrations (ppb & µg m^{-3})

M, P-XYLENE CONCENTRATIONS 2003

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1 ppb	ug m3	BD2 ppb	ug m3	BD3 ppb	ug m3	BD4 ppb	ug m3
January	0.6	2.8	0.8	3.6	0.5	2.4	-	-
February	0.4	1.8	0.7	3.2	0.5	2.4	0.3	1.1
March	0.3	1.5	0.4	1.9	0.3	1.5	0.2	0.9
April	0.5	2.3	0.3	1.5	0.3	1.4	0.3	1.5
May	0.4	1.8	0.8	3.4	0.6	2.5	0.2	0.7
June	0.6	2.7	0.8	3.7	1.0	4.4	0.3	1.2
July	0.7	3.1	0.7	3.1	0.9	4.0	0.4	1.9
August	0.6	2.6	0.9	4.1	0.8	3.7	0.4	1.7
September	1.2	5.4	1.1	5.0	1.0	4.2	0.6	2.7
October	1.0	4.6	1.1	4.9	1.5	6.7	0.6	2.8
November	1.1	5.0	0.7	3.3	1.1	4.9	0.7	2.9
December	1.0	4.5	1.1	4.8	0.9	3.9	0.5	2.2
Annual Mean	0.7	3.2	0.8	3.5	0.8	3.5	0.4	1.8

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01 ppb	ug m3	KC02 ppb	ug m3	KC03 ppb	ug m3	KC04 ppb	ug m3	KC05 ppb	ug m3
January	4.3	19.1	3.1	13.5	5.6	24.9	2.6	11.3	3.3	14.6
February	1.0	4.3	0.4	1.9	2.8	12.1	0.4	1.6	0.6	2.7
March	0.9	4.2	0.4	1.6	2.3	10.4	0.4	1.7	0.3	1.4
April	1.2	5.1	0.5	2.1	1.2	5.1	0.3	1.3	0.5	2.1
May	0.7	3.0	0.2	0.7	5.3	23.2	0.2	0.8	0.6	2.7
June	0.5	2.2	0.6	2.8	6.8	30.1	2.6	11.5	2.1	9.4
July	1.4	6.1	0.3	1.5	4.5	19.8	0.6	2.5	0.7	3.2
August	1.3	5.6	0.4	1.9	7.7	34.1	0.6	2.5	0.9	4.0
September	1.4	6.0	0.8	3.4	7.9	35.0	1.7	7.4	1.0	4.5
October	1.0	4.6	0.4	1.9	5.9	26.0	0.6	2.6	1.9	8.2
November	1.3	5.7	0.7	3.1	7.3	32.1	0.7	2.9	1.1	4.7
December	1.9	8.3	0.8	3.3	2.7	12.0	1.4	6.4	0.9	3.8
Annual Mean	1.4	6.2	0.7	3.1	5.0	22.1	1.0	4.4	1.2	5.1

M, P-XYLENE CONCENTRATIONS 2003

CORPORATION OF LONDON

Month	Site Code CL1 ppb	ug m3	CL2 ppb	ug m3	CL3 ppb	ug m3	CL4 ppb	ug m3	CL5 ppb	ug m3
January	2.8	12.5	3.4	14.8	3.1	13.6	2.6	11.4	3.4	14.8
February	0.4	1.8	0.6	2.5	0.3	1.4	0.5	2.3	0.5	2.4
March	0.5	2.4	0.4	1.7	0.3	1.3	0.4	1.7	0.4	1.7
April	0.5	2.0	0.4	1.7	0.3	1.4	0.4	1.6	0.3	1.2
May	0.5	2.3	0.6	2.8	0.3	1.4	0.3	1.5	0.4	1.7
June	0.9	4.0	8.0	35.4	0.3	1.5	0.5	2.4	0.6	2.5
July	0.7	3.0	0.9	4.0	0.9	3.9	0.5	2.0	0.5	2.4
August	0.9	4.0	0.8	3.6	0.5	2.3	0.6	2.5	-	-
September	1.3	5.7	1.4	6.0	0.9	3.9	0.8	3.4	1.0	4.2
October	0.8	3.7	1.0	4.3	0.7	3.3	0.8	3.7	1.1	4.6
November	0.9	3.9	0.9	4.0	1.0	4.3	0.8	3.6	0.8	3.5
December	1.2	5.3	1.1	4.9	0.9	3.9	1.0	4.6	0.8	3.7
Annual Mean	1.0	4.2	1.6	7.1	0.8	3.5	0.8	3.4	0.9	3.9

Month	Site Code CL6 ppb	ug m3	CL7 ppb	ug m3	CL8 ppb	ug m3	CL9 ppb	ug m3	CL10 ppb	ug m3
January	4.6	20.5	3.1	13.6	2.8	12.5	3.6	15.9	3.9	17.1
February	0.6	2.6	0.4	1.8	0.5	2.3	0.4	1.9	0.9	4.1
March	-	-	0.3	1.3	0.7	3.1	0.4	1.7	0.9	4.1
April	0.4	1.8	0.5	2.0	0.4	1.7	0.5	2.0	0.6	2.5
May	0.7	3.1	0.3	1.5	1.1	5.0	0.8	3.4	1.2	5.1
June	0.9	4.1	1.6	6.8	1.7	7.5	0.7	3.0	1.2	5.4
July	0.6	2.7	0.4	1.6	1.0	4.5	0.7	3.0	1.3	5.8
August	0.7	3.2	0.6	2.7	0.9	3.8	0.6	2.6	1.8	7.9
September	1.2	5.2	0.8	3.5	1.4	6.1	1.2	5.4	2.1	9.1
October	0.7	3.2	1.6	6.9	1.4	6.1	0.9	4.1	1.7	7.5
November	1.3	5.8	0.9	4.0	1.6	7.0	0.9	3.8	2.3	10.3
December	0.9	3.9	0.9	3.8	1.1	4.8	1.0	4.6	1.5	6.5
Annual Mean	1.2	5.1	0.9	4.1	1.2	5.4	1.0	4.3	1.6	7.1

M, P-XYLENE CONCENTRATIONS 2003

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HS BTEX2		HS BTEX3		HS BTEX4	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	-	-	0.4	1.6	0.6	2.8	0.7	3.1
February	0.5	2.1	0.2	0.9	0.6	2.7	0.3	1.5
March	0.3	1.2	-	-	-	-	-	-
April	0.5	2.1	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-
June	0.7	3.2	0.5	2.4	1.0	4.5	0.8	3.4
July	0.5	2.0	0.3	1.2	0.5	2.2	0.4	1.6
August	0.9	3.8	0.4	1.9	0.9	3.8	0.6	2.5
September	0.7	3.3	0.7	3.3	1.1	5.0	1.2	5.2
October	0.6	2.4	0.4	1.9	0.7	3.2	1.2	5.1
November	0.8	3.7	0.6	2.7	0.8	3.6	1.0	4.3
December	1.1	4.8	0.9	4.0	1.4	6.1	0.9	3.8
Annual Mean	0.6	2.9	0.5	2.2	0.9	3.8	0.8	3.4

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	0.5	2.4	1.3	5.6	0.3	1.5
February	0.3	1.4	0.8	3.4	-	-
March	0.3	1.2	0.7	2.9	0.3	1.2
April	0.1	0.5	1.5	6.5	0.5	2.4
May	-	-	-	-	-	-
June	5.7	25.1	2.0	8.6	0.5	2.2
July	0.5	2.2	1.4	6.2	0.4	1.8
August	0.6	2.6	1.1	5.0	0.6	2.4
September	0.7	2.9	1.9	8.4	0.8	3.4
October	0.6	2.7	1.5	6.8	0.6	2.8
November	0.8	3.4	2.1	9.5	1.0	4.6
December	1.0	4.6	1.8	7.9	0.7	3.3
Annual Mean	1.0	4.5	1.5	6.4	0.6	2.6

M, P-XYLENE CONCENTRATIONS 2003

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2 ppb	ug m3	RUT 38 ppb	ug m3	RUT 35 ppb	ug m3	RUT 7 ppb	ug m3	Rut 32 ppb	ug m3
January	-	-	-	-	-	-	-	-	-	-
February	0.7	3.2	1.2	5.3	0.9	3.9	0.7	3.1	1.1	5.0
March	0.7	3.0	0.7	3.3	0.4	1.8	0.7	3.1	0.9	3.8
April	0.6	2.6	0.9	3.8	0.4	1.6	0.9	4.0	0.8	3.7
May	1.1	5.0	1.3	5.9	0.8	3.6	1.2	5.2	1.3	5.9
June	7.6	33.3	1.8	8.0	1.1	5.0	1.1	4.7	1.3	5.5
July	-	-	1.1	4.6	1.4	6.0	1.7	7.4	1.3	5.8
August	2.0	8.9	1.8	7.8	1.5	6.4	1.2	5.3	1.6	7.0
September	1.2	5.4	2.7	11.8	1.5	6.7	1.7	7.6	1.9	8.5
October	1.5	6.5	2.1	9.3	1.9	8.3	2.6	11.4	1.9	8.5
November	3.1	13.8	1.6	7.2	1.9	8.5	1.4	6.2	1.7	7.3
December	1.5	6.7	3.0	13.0	3.3	14.7	2.0	8.8	1.6	7.2
Annual Mean	2.0	8.8	1.6	7.3	1.4	6.1	1.4	6.1	1.4	6.2

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1 ppb	ug m3	Site 2 ppb	ug m3	Site 3 ppb	ug m3	Site 4 ppb	ug m3	Site 5 ppb	ug m3
January	3.1	13.5	2.6	11.4	2.5	10.8	2.3	10.0	3.8	17.0
February	0.5	2.3	0.1	0.3	0.2	0.7	0.2	0.9	-	-
March	0.5	2.2	0.3	1.2	0.3	1.1	0.4	1.8	0.2	0.9
April	0.6	2.8	0.3	1.4	0.5	2.4	0.3	1.5	0.4	1.9
May	0.7	3.1	0.1	0.5	0.4	1.6	0.4	1.6	0.4	1.7
June	7.8	34.3	1.2	5.1	-	-	0.9	3.7	8.0	35.1
July	0.5	2.3	0.3	1.1	0.3	1.1	0.5	2.0	0.3	1.5
August	0.5	2.0	0.3	1.2	0.5	2.2	0.5	2.0	0.3	1.1
September	1.2	5.3	1.1	4.9	0.6	2.8	0.8	3.5	0.8	3.4
October	1.7	7.6	0.7	3.0	0.6	2.8	1.0	4.5	0.6	2.6
November	1.2	5.2	0.5	2.3	0.6	2.6	0.8	3.4	0.7	3.1
December	1.4	6.1	0.6	2.7	1.2	5.2	0.8	3.6	0.6	2.7
Annual Mean	1.6	7.2	0.7	2.9	0.7	3.0	0.7	3.2	1.5	6.5

Appendix G

o-Xylene Concentrations (ppb & µg m^{-3})

O-XYLENE CONCENTRATIONS 2003

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1 ppb	ug m3	BD2 ppb	ug m3	BD3 ppb	ug m3	BD4 ppb	ug m3
January	0.4	1.8	0.5	2.4	0.3	1.5	-	-
February	0.3	1.2	0.5	2.1	0.4	1.8	0.2	0.7
March	0.2	1.1	0.3	1.4	0.2	0.9	0.2	0.7
April	0.4	1.7	0.3	1.1	0.2	1.0	0.2	1.0
May	0.1	0.6	0.3	1.1	0.2	0.8	0.1	0.2
June	0.2	0.8	0.3	1.1	0.3	1.5	0.1	0.3
July	0.2	1.0	0.2	1.0	0.3	1.2	0.2	0.7
August	0.2	0.9	0.3	1.3	0.3	1.2	0.2	0.7
September	0.5	2.1	0.4	1.9	0.4	1.7	0.2	1.0
October	0.4	1.6	0.4	1.7	0.5	2.3	0.2	1.0
November	0.4	1.7	0.3	1.1	0.4	1.7	0.2	1.0
December	0.3	1.4	0.4	1.6	0.3	1.2	0.1	0.6
Annual Mean	0.3	1.3	0.3	1.5	0.3	1.4	0.2	0.7

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01 ppb	ug m3	KC02 ppb	ug m3	KC03 ppb	ug m3	KC04 ppb	ug m3	KC05 ppb	ug m3
January	1.5	6.5	1.0	4.4	1.8	8.1	0.8	3.7	1.1	4.7
February	0.7	3.2	0.3	1.3	1.9	8.4	0.3	1.1	0.4	1.8
March	0.7	2.9	0.3	1.1	1.6	7.1	0.3	1.2	0.2	1.0
April	0.8	3.6	0.4	1.5	0.8	3.6	0.2	0.9	0.4	1.5
May	0.2	0.9	0.0	0.1	1.8	7.9	0.1	0.2	0.2	0.8
June	0.5	2.3	0.2	0.9	2.5	11.1	0.8	3.7	0.7	3.1
July	0.5	2.1	0.1	0.6	1.5	6.8	0.2	0.8	0.3	1.1
August	0.4	1.9	0.2	0.7	2.8	12.2	0.2	1.0	0.3	1.4
September	0.5	2.3	0.3	1.3	3.0	13.2	0.6	2.7	0.4	1.7
October	0.4	1.6	0.2	0.7	2.1	9.4	0.2	0.9	0.6	2.6
November	0.4	1.9	0.2	1.0	2.8	12.2	0.2	1.0	0.4	1.6
December	0.7	3.0	0.2	1.0	1.0	4.4	0.5	2.2	0.3	1.2
Annual Mean	0.6	2.7	0.3	1.2	2.0	8.7	0.4	1.6	0.4	1.9

O-XYLENE CONCENTRATIONS 2003

CORPORATION OF LONDON

Month	**Site Code** CL1 ppb	ug m3	CL2 ppb	ug m3	CL3 ppb	ug m3	CL4 ppb	ug m3	CL5 ppb	ug m3
January	0.9	4.1	1.0	4.6	1.0	4.2	0.8	3.7	1.1	4.7
February	0.3	1.1	0.4	1.7	0.2	0.9	0.4	1.6	0.4	1.6
March	0.4	1.7	0.3	1.2	0.2	0.9	0.3	1.2	0.3	1.2
April	0.3	1.4	0.3	1.2	0.2	1.0	0.3	1.1	0.2	0.9
May	0.2	0.7	0.2	0.9	0.1	0.3	0.1	0.4	0.1	0.6
June	0.3	1.5	1.7	7.6	0.1	0.4	0.2	0.8	0.2	0.8
July	0.2	1.1	0.3	1.5	0.3	1.3	0.2	0.7	0.2	0.8
August	0.3	1.4	0.3	1.3	0.2	0.9	0.2	0.9	-	-
September	0.5	2.3	0.5	2.3	0.4	1.6	0.3	1.3	0.4	1.6
October	0.3	1.1	-	-	0.3	1.1	0.2	1.0	0.3	1.4
November	0.3	1.3	0.3	1.3	0.3	1.4	0.3	1.2	0.3	1.2
December	0.4	1.7	0.4	1.6	0.3	1.2	0.3	1.5	0.3	1.2
Annual Mean	0.4	1.6	0.5	2.3	0.3	1.3	0.3	1.3	0.3	1.5

Month	**Site Code** CL6 ppb	ug m3	CL7 ppb	ug m3	CL8 ppb	ug m3	CL9 ppb	ug m3	CL10 ppb	ug m3
January	1.4	6.4	1.0	4.2	1.0	4.2	1.1	4.8	1.3	5.7
February	0.3	1.3	0.3	1.1	0.4	1.6	0.3	1.2	0.7	2.9
March	-	-	0.2	0.9	0.5	2.1	0.3	1.2	0.7	2.9
April	0.2	1.0	0.3	1.3	0.3	1.2	0.3	1.4	0.4	1.8
May	0.2	0.7	0.1	0.3	0.4	1.7	0.2	1.0	0.4	1.8
June	0.3	1.2	0.5	2.0	0.6	2.5	0.2	0.9	0.4	1.9
July	0.2	0.7	0.1	0.5	0.4	1.6	0.2	1.1	0.5	2.0
August	0.2	1.0	0.2	0.9	0.3	1.4	0.2	1.0	0.7	3.0
September	0.4	1.9	0.3	1.3	0.6	2.4	0.5	2.1	0.8	3.6
October	0.2	0.8	0.5	2.0	0.5	2.0	0.3	1.2	0.6	2.6
November	0.4	2.0	0.3	1.3	0.6	2.5	0.3	1.3	0.8	3.5
December	0.3	1.1	0.3	1.1	0.4	1.6	0.3	1.5	0.5	2.2
Annual Mean	0.4	1.6	0.3	1.4	0.5	2.1	0.4	1.6	0.6	2.8

O-XYLENE CONCENTRATIONS 2003

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HS BTEX2		HS BTEX3		HS BTEX4	
	ppb	ug m3	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	-	-	0.2	1.0	0.4	1.9	0.5	2.2
February	0.3	1.4	0.1	0.6	0.4	1.8	0.2	1.1
March	0.2	0.9	-	-	-	-	-	-
April	0.2	0.7	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-
June	0.2	0.9	0.2	0.9	0.3	1.4	0.2	1.1
July	0.2	0.7	0.1	0.4	0.2	0.8	0.1	0.6
August	0.3	1.4	0.2	0.7	0.3	1.3	0.2	1.0
September	0.3	1.1	0.3	1.1	0.4	1.8	0.4	1.8
October	0.2	0.7	0.1	0.5	0.2	1.0	0.4	1.7
November	0.3	1.2	0.2	1.0	0.3	1.2	0.3	1.5
December	0.4	1.6	0.3	1.3	0.5	2.1	0.3	1.3
Annual Mean	0.2	1.1	0.2	0.8	0.3	1.5	0.3	1.4

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	ppb	ug m3	ppb	ug m3	ppb	ug m3
January	0.4	1.6	0.9	4.0	0.2	1.0
February	0.2	0.9	0.5	2.4	-	-
March	0.2	0.8	0.4	2.0	0.2	0.8
April	0.0	0.1	0.6	2.4	0.2	0.8
May	-	-	-	-	-	-
June	1.2	5.1	0.6	2.8	0.1	0.7
July	0.2	0.7	0.5	2.0	0.1	0.6
August	0.2	1.0	0.4	1.8	0.2	0.9
September	0.2	1.0	0.7	3.1	0.3	1.2
October	0.2	0.7	0.6	2.5	0.2	0.9
November	0.3	1.1	0.7	3.3	0.4	1.6
December	0.4	1.6	0.6	2.7	0.3	1.2
Annual Mean	0.3	1.3	0.6	2.6	0.2	1.0

O-XYLENE CONCENTRATIONS 2003

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2 ppb	ug m3	RUT 38 ppb	ug m3	RUT 35 ppb	ug m3	RUT 7 ppb	ug m3	Rut 32 ppb	ug m3
January	-	-	-	-	-	-	-	-	-	-
February	0.5	2.3	0.9	3.8	0.7	2.9	0.5	2.2	0.8	3.6
March	0.5	2.1	0.6	2.4	0.3	1.5	0.5	2.1	0.6	2.7
April	0.3	1.4	0.6	2.7	0.3	1.2	0.6	2.8	0.6	2.4
May	0.4	1.8	0.5	2.1	0.3	1.3	0.3	1.3	0.5	2.1
June	1.7	7.6	0.6	2.5	0.3	1.4	0.4	1.5	0.4	1.8
July	-	-	0.4	1.7	0.5	2.1	0.6	2.6	0.5	2.0
August	0.8	3.5	0.7	2.9	0.5	2.2	0.4	1.8	0.5	2.3
September	0.5	2.2	1.0	4.3	0.6	2.8	0.7	3.0	0.8	3.5
October	0.5	2.1	0.6	2.9	0.6	2.6	0.9	3.9	0.6	2.6
November	1.4	6.0	0.6	2.8	0.8	3.6	0.5	2.3	0.7	2.9
December	0.5	2.3	1.1	4.7	1.2	5.1	0.7	3.1	0.6	2.4
Annual Mean	0.7	3.1	0.7	3.0	0.6	2.4	0.5	2.4	0.6	2.6

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1 ppb	ug m3	Site 2 ppb	ug m3	Site 3 ppb	ug m3	Site 4 ppb	ug m3	Site 5 ppb	ug m3
January	1.1	4.8	0.8	3.7	0.8	3.6	0.8	3.3	1.3	5.7
February	0.4	1.6	0.0	0.1	0.1	0.3	0.1	0.6	-	-
March	0.4	1.6	0.2	0.9	0.2	0.8	0.3	1.2	0.2	0.7
April	0.4	1.9	0.2	0.9	0.4	1.5	0.3	1.1	0.3	1.1
May	0.2	1.0	0.0	0.1	0.1	0.4	0.1	0.4	0.1	0.6
June	1.6	7.2	0.6	2.7	-	-	0.2	0.9	1.7	7.4
July	0.2	1.0	0.1	0.4	0.1	0.4	0.2	0.7	0.1	0.6
August	0.2	0.8	0.1	0.4	0.2	0.8	0.2	0.8	0.1	0.4
September	0.5	2.1	0.4	1.9	0.3	1.1	0.4	1.6	0.3	1.4
October	0.5	2.3	0.0	0.0	0.2	0.8	0.0	0.0	0.2	0.8
November	0.4	1.8	0.2	0.8	0.2	0.9	0.3	1.1	0.3	1.1
December	0.5	2.0	0.2	0.9	0.4	1.8	0.3	1.2	0.2	0.9
Annual Mea	0.5	2.3	0.2	1.1	0.3	1.1	0.2	1.1	0.4	1.9

Appendix H

Benzene/Toluene Ratios

Table 4: Benzene/Toluene Ratios

Borough	Site Code	Site Classification	Annual Benzene Concentration (ppb)	Annual Toluene Concentration (ppb)	Benzene: Toluene
Barking	BD1	Roadside	0.6	6.9	1: 11
	BD2	Roadside	0.7	6.2	1: 9
	BD3	Background	0.6	5.8	1: 10
	BD4	Background	0.4	5.9	1: 13
Kensington	KC01	Roadside	1.2	11.8	1: 10
	KC02	Background	0.7	9.4	1: 13
	KC03	Roadside/PS	3.0	16.4	1: 6
	KC04	Background	0.8	7.4	1: 10
	KC05	Roadside	0.9	8.9	1: 10
Sutton	1	Roadside	0.9	9.0	1: 9
	2	Background	0.9	5.1	1: 6
	3	Background	0.7	6.1	1: 8
	4	Roadside	0.7	5.6	1: 8
	5	Background	0.8	6.3	1: 8
Hounslow	BTEX 1	Roadside	0.5	5.6	1: 11
	BTEX 2	Roadside	0.5	5.0	1: 10
	BTEX 3	Roadside	0.6	6.3	1: 10
	BTEX 4	Roadside	0.6	6.3	1: 10
	BTEX 5	Background	0.5	6.3	1: 13
	BTEX 6	Roadside	0.9	7.0	1: 8
	BTEX 7	Roadside	0.4	5.2	1: 12
Corporation of	CL1	Roadside	0.8	6.7	1: 8
London	CL2	Roadside	0.8	7.0	1: 8
	CL3	Background	0.7	7.6	1: 10
	CL4	Roadside	0.7	6.3	1: 9
	CL5	Background	0.9	6.5	1: 7
	CL6	Background	0.8	8.1	1: 10
	CL7	Background	0.8	7.2	1: 9
	CL8	Roadside	0.9	8.8	1: 9
	CL9	Background	0.8	6.6	1: 8
	CL10	Roadside	1.2	8.6	1: 7
Richmond	RUT 2	Roadside	1.0	8.7	1: 8
	RUT36	Roadside	1.3	9.0	1: 7
	RUT35	Roadside	1.0	9.1	1: 9
	RUT7	Roadside	1.1	11.8	1: 11
	RUT32	Roadside	1.2	8.6	1: 7

Note: Above ratio are approximated values, calculated using available data which may not be representative of a full year.

Appendix I

Marylebone Road Duplicate BTEX Data

Hydrocarbon Network Comparison, Marylebone Road Duplicate Exposure

Benzene Diffusion Tube Results

Site Code	Tube Code		Date On	Time On	Date Off	Time Off	Conc Tube (ng)	Benzene	Benzene		Toluene	Toluene		Ethyl-benzene	Ethyl-benzene		M+p-Xylene	M+p-Xylene		o-Xylene	o-Xylene
								ppb	ug/m3		ppb	ug/m3		ppb	ug/m3		ppb	ug/m3		ppb	ug/m3
Jan-03	BF	132	03/01/2003	14:25	17/01/2003	13:45	39	1.4	4.5	285	9.2	35.2	23	0.6	2.8	38	1.0	4.3	28	0.7	3.1
	BF	133	03/01/2003	14:25	17/01/2003	13:45	41	1.5	4.8	336	10.8	41.5	24	0.7	2.9	37	1.0	4.2	26	0.7	2.9
Feb-03																					
Mar-03	BF	404	14/03/2003	14:45	27/03/2003	14:00	31	1.2	3.9	160	5.6	21.3	67	2.0	8.8	31	0.9	3.8	23	0.6	2.8
	BF	405	14/03/2003	14:45	27/03/2003	14:00	40	1.5	5.0	205	7.1	27.3	96	2.9	12.6	45	1.2	5.5	33	0.9	4.0
Apr-03	BF	541	22/04/2003	14:45	13/05/2003	15:20	7	0.2	0.5	234	5.0	19.2	8	0.1	0.6	12	0.2	0.9	3	0.1	0.2
	BF	542	22/04/2003	14:45	13/05/2003	15:20	7	0.2	0.5	243	5.2	20.0	8	0.1	0.6	14	0.2	1.1	3	0.1	0.2
May-03	BF	686	16/05/2003	14:30	30/05/2003	15:35	39	1.4	4.5	209	6.7	25.7	39	1.1	4.7	118	3.0	13.3	45	1.1	5.0
	BF	687	16/05/2003	14:30	30/05/2003	15:35	27	1.0	3.1	153	4.9	18.8	24	0.7	2.9	65	1.7	7.3	25	0.6	2.8
Jun-03	BF	833	07/06/2003	13:55	28/06/2003	15:45	44	1.0	3.4	302	6.5	24.7	54	1.0	4.4	176	3.0	13.3	64	1.1	4.7
	BF	834	07/06/2003	13:55	28/06/2003	15:45	31	0.7	2.4	212	4.5	17.4	27	0.5	2.2	95	1.6	7.2	36	0.6	2.7
Jul-03																					
Aug-03	BG	126	14/08/2003	12:00	17/09/2003	15:20	51	0.7	2.4	626	8.3	31.7	39	0.4	1.9	166	1.7	7.7	52	0.5	2.4
	BG	127	14/08/2003	12:00	17/09/2003	15:20	51	0.7	2.4	902	11.9	45.6	39	0.4	1.9	154	1.6	7.2	51	0.5	2.3
Sep-03	BG	272	17/09/2003	15:25	02/10/2003	13:30	31	1.0	3.4	558	16.9	64.6	23	0.6	2.6	71	1.7	7.6	26	0.6	2.7
	BG	273	17/09/2003	15:25	02/10/2003	13:30	36	1.2	3.9	558	16.9	64.6	33	0.9	3.8	103	2.5	11.0	38	0.9	4.0
Oct-03	BG	419	02/10/2003	13:30	24/10/2003	14:15	33	0.7	2.4	233	4.8	18.3	22	0.4	1.7	64	1.0	4.6	23	0.4	1.6
	BG	420	02/10/2003	13:30	24/10/2003	14:15	37	0.8	2.7	248	5.1	19.4	28	0.5	2.2	69	1.1	5.0	23	0.4	1.6
Nov-03																					
Dec-03	BG	708	05/12/2003	15:00	19/12/2003	10:40	39	1.4	4.6	209	6.8	26.1	26	0.7	3.2	84	2.2	9.6	31	0.8	3.5
	BG	709	05/12/2003	15:00	19/12/2003	10:40	35	1.3	4.1	161	5.3	20.1	22	0.6	2.7	70	1.8	8.0	25	0.6	2.8