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The London Wide Environment Programme

Benzene Diffusion Tube Survey 2002

Report

London Wide Benzene Diffusion Tube Survey Annual Report 2002

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London Borough of Richmond
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London Borough of Wandsworth
City of Westminster

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Executive Summary

This report presents the results of the 2002 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 2002 programme participating boroughs maintained a total of ninety six sites across London of which ninety two have been included in this report due to insufficient data capture. 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 1.8µg m^{-3} to 6.3µg m^{-3} at roadside locations, 1.7µg m^{-3} to 3.3µg m^{-3} at background locations and 2.1µgm^{-3} to 12.5µg m^{-3} at petrol stations. The annual mean benzene concentrations for the three different location types were 3.3µg m^{-3}, 2.2µg m^{-3} and 7.3µg 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 2002 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 2002 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 target concentration of 1ppb (3.24µg m^{-3}) to be met at many roadside locations within the London area.

1 Introduction

This report presents the results of the 2002 London Wide Benzene Monitoring Programme. The report describes results collected from January 2002 to December 2002, which covers the eleventh 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 2002 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 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 2002 programme, participating boroughs maintained a total of ninety-six sites across London of which six are not included in statistics due to data capture. 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 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 60% of total emissions in 1997, with petrol engine exhausts contributing 56% of the total. 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 1: UK Annual Benzene Emissions, 1990 – 1997 (ktonnes)

Source	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**% of 1997 emissions**
Petroleum refining plants	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.0%
Other comb. & trans.	0.31	0.31	0.30	0.30	0.34	0.13	0.14	0.14	0.4%
Comm, public & agri. combustion	0.11	0.12	0.12	0.12	0.12	0.13	0.15	0.14	0.4%
Residential plant	3.43	3.55	3.40	3.40	3.06	2.77	2.92	2.81	7.4%
Iron & steel combustion	0.31	0.32	0.30	0.30	0.31	0.32	0.34	0.35	0.9%
Other comb. In industry	0.56	0.53	0.51	0.49	0.54	0.58	0.61	0.61	1.6%
Processes in industry	9.71	9.36	9.23	8.88	8.50	8.26	7.73	7.26	19.1%
Gasoline distribution	0.57	0.58	0.59	0.57	0.56	0.54	0.56	0.56	1.5%
Road transport –									
petrol combustion	35.61	35.67	34.24	31.85	29.52	26.96	24.33	21.29	56.0%
diesel combustion	2.64	2.59	2.41	2.28	2.21	1.98	1.82	1.69	4.4%
petrol evaporation	2.23	2.21	2.16	2.01	1.87	1.71	1.6	1.46	3.8%
Civil aircraft	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.1%
Military	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.1%
Off-road sources	1.30	1.35	1.38	1.34	1.30	1.23	1.26	1.20	3.2%
Railways	0.03	0.03	0.05	0.04	0.04	0.04	0.04	0.04	0.1%
Shipping	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.2%
Landfill	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.2%
Total	**57**	**57**	**55**	**52**	**49**	**45**	**42**	**38**	

(From The Air Quality Strategy, Jan 2000)

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 also 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 by 2003. 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 2001.

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 EPAQS also recommended a long-term policy target of 1ppb 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)*.

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)].

The Government is confident that measures currently in place will be sufficient to allow current objectives to be met by 2003. Annual mean concentrations recorded at background locations are well below 16µg m^{-3} and forecasts from mapping work suggest the objective of 16µg m^{-3} being achieved at all urban background and roadside locations by the end of 2003[(20)]. The longer-term aim of policy for the Government and devolved administrations is to strengthen and supplement the existing benzene objective of 16µg m^{-3}. It is proposed to set a target value of 3.25µg m^{-3} as a running annual mean, which would be the new UK wide objective to be achieved by the end 2010. By reducing benzene levels as far as practical and achieving the target value, the EU limit value of 5µg m^{-3} will also be reached. Additionally it is proposed to incorporate the new objective into regulations for the purposes of LAQM[(19)].

7 Methodology

7.1 Monitoring Sites

Descriptions of all 96 monitoring sites are given in Appendix A on an individual borough basis in the following pages. 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 57 roadside sites, 30 background sites and 3 petrol station sites as shown in Figure A below.

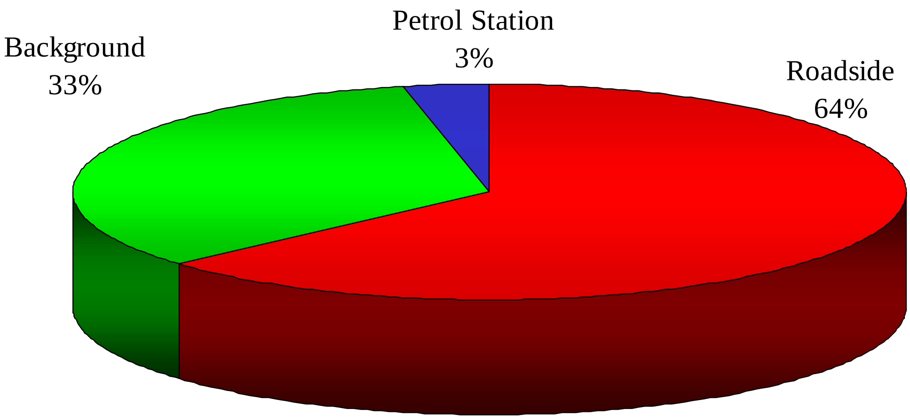


Figure A. Percentage of classified sites which participated in the survey

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 2002 Benzene Monitoring Programme

Benzene, toluene, ethyl benzene, m, p and o-xylene data collected between January 2002 and December 2002 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

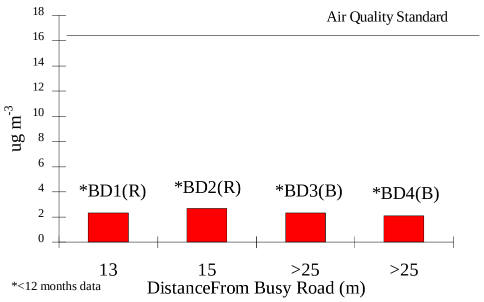


Figure 1A. Annual Mean Benzene Concentrations – 2002

Annual Mean Concentration

Annual mean benzene concentrations of 2.1 and 2.7µg m^{-3} were recorded at the two roadside locations, BD4 and BD2. An annual mean value of 2.3µg m^{-3} was recorded at BD1 and BD3, which are roadside and background locations respectively. The highest mean level of 2.7µg m^{-3} was recorded for roadside location BD2 situated at Maplestead Road, Barking. The AQS was not approached or exceeded at any site.

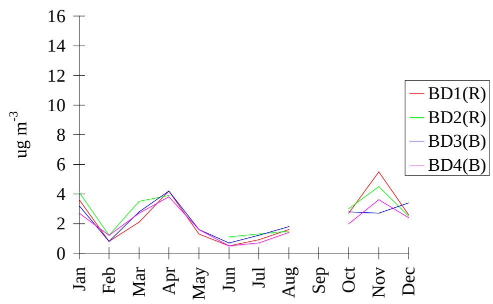


Figure 1B. Temporal Variation 2002

Temporal Variation

As illustrated in Figure 1B, benzene concentration at all four sites followed a similar pattern with some seasonal variation. Benzene levels peaked in January, April and November at sites with a maximum concentration of 5.5µg m^{-3} recorded for site BD1 located at Marsh Green Infants School, White Barn Lane, Barking.

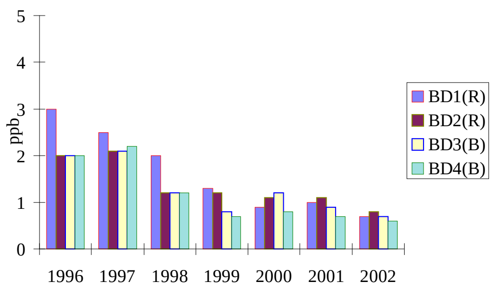


Figure 1C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 1C illustrates annual average benzene concentrations for 1996-2002. 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. Although levels are shown to decline since 1996, there was little variation for 1999-2001. Mean levels for 2002 are now showing some decline.

8.2 London Borough of Bexley

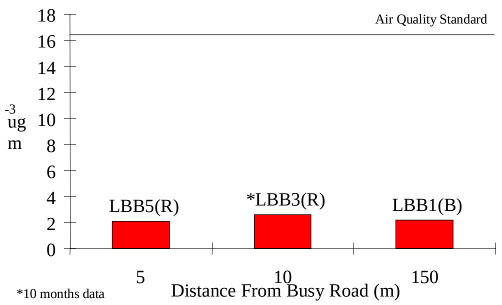


Figure 2A. Annual Mean Benzene Concentrations – 2002

Annual Mean Concentration

Mean concentrations of 2.1 and 2.6µg m^{-3} were recorded at roadside locations LBB1 and LBB3. The highest mean value of 2.6µg m^{-3} was recorded for site LBB3 located at Crayford Library, Crayford Road. A lower mean value of 2.1µg m^{-3} was recorded at the background site LBB1 located at Whitehall lane. The AQS was not exceeded or approached at any of the three sites.

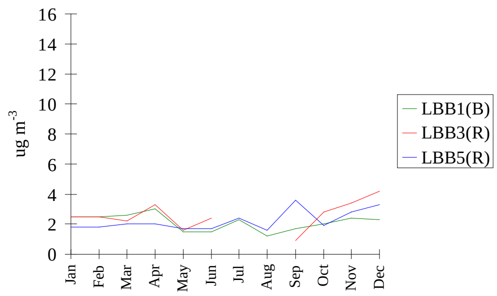


Figure 2B. Temporal Variation 2002

Temporal Variation

Figure 2B illustrates temporal trends for the three site locations. Throughout the year benzene levels followed a similar pattern with some seasonal variation. A maximum peak level of 4.2µg m^{-3} was recorded for December at site LBB3 a roadside site located at Crayford Library, Crayford Road.

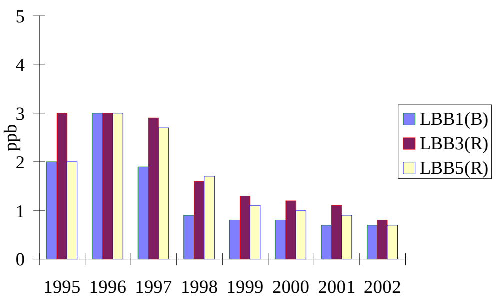


Figure 2C. Trends in Annual Average Benzene Concentrations

Annual Trends

Annual mean benzene concentrations have remained consistently below the AQS since 1995 with levels showing a continued decrease since 1996. Although concentrations recorded for 1999-2001 showed little variation, the levels for 2002 now show some decline.

8.3 London Borough of Brent

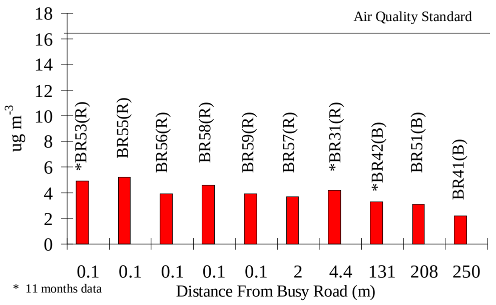


Figure 3A. Annual Mean Benzene Concentrations – 2002

Annual Mean Concentration

Annual mean benzene concentrations ranged from 2.2µg m^{-3} at site BR41, background to 5.2µg m^{-3} recorded at site BR55, roadside. The highest mean level of 5.2µg m^{-3} was recorded at 79 High Street, Harlesden. The AQS was not exceeded or approached at any site.

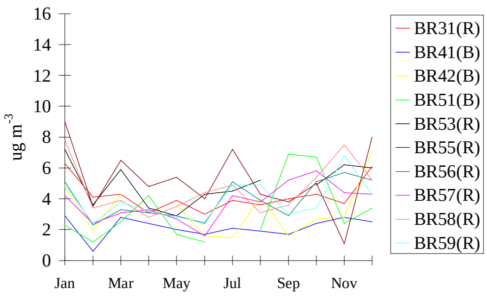


Figure 3B. Temporal Variation 2002

Temporal Variation

Temporal trends for 2002 are illustrated in Figure 3B. Concentrations were variable throughout the monitoring period.

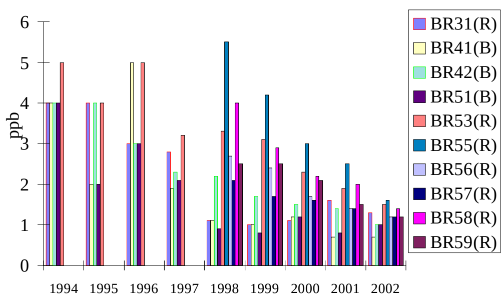


Figure 3C. Trends in Annual Average Benzene Concentrations

Annual Trends

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

8.4 London Borough of Camden

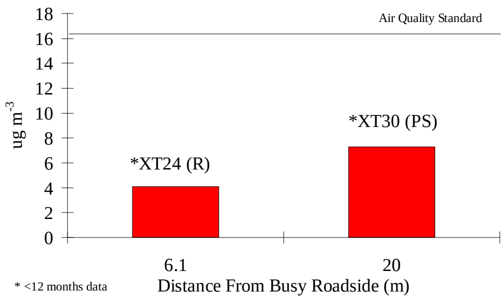


Figure 4A. Annual Mean Benzene Concentrations - 2002

Annual Mean Concentration

Mean concentrations were 4.1µg m^{-3} at roadside site XT24 at the Town Hall on Euston road and 7.3µg m^{-3} at site XT30, a BP petrol station on Finchley road. The annual mean was not included for sites XT21 and XT28 due to insufficient data. The AQS was not exceeded at any of the site locations.

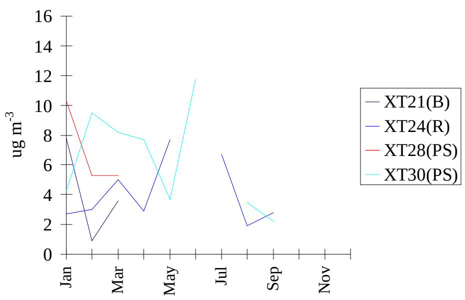


Figure 4B. Temporal Variation 2002

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 14.6µg m^{-3} was recorded for a petrol station location XT30.

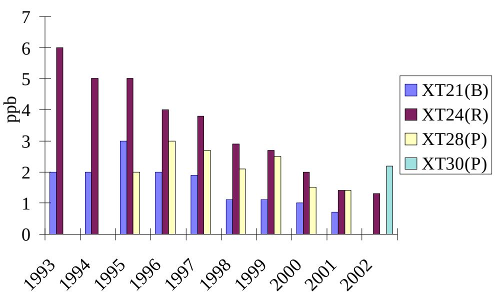


Figure 4C. Trends in Annual Average Benzene Concentrations

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 were higher than the 2001 petrol station location XT28.

8.5 London Borough of Greenwich

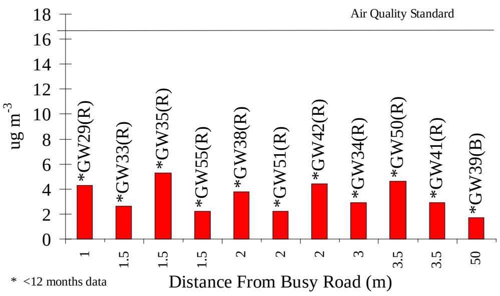


Figure 5A. Annual Mean Benzene Concentrations – 2002

Annual Mean Concentration

Mean concentrations ranged from 1.7µg m^{-3} recorded at site GW39, a background location to 5.3µg m^{-3} recorded at site GW35, a roadside site located at Greenwich Town Hall, SE 10. There was no clear relationship between mean concentration and distance from roadsides. The AQS was not exceeded or approached at any time.

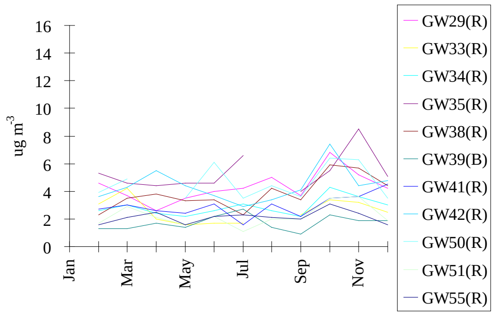


Figure 5B. Temporal Variation 2002

Temporal Variation

Figure 5B illustrates temporal trends for the eleven sites. All sites followed a similar pattern with benzene concentration consistently lower at the background site GW39. A maximum peak level of 8.5µg m^{-3} was recorded for November at roadside location GW35.

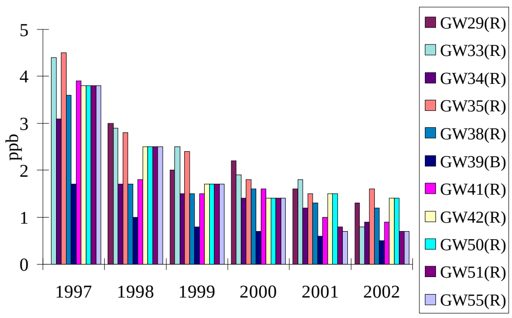


Figure 5C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 5C illustrates the level of benzene declining since 1997. Levels recorded for 2002 were similar to those recorded during 2000-2001.

8.6 London Borough of Hammersmith and Fulham

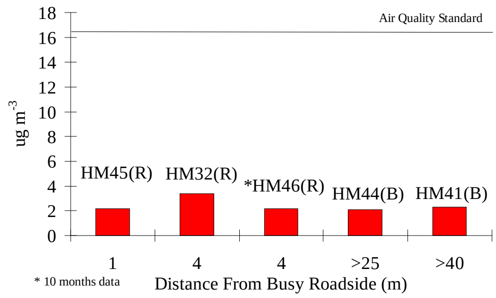


Figure 6A. Annual Mean Benzene Concentrations – 2002

Annual Mean Concentration

Annual mean concentrations ranged from 2.1µg m^{-3} to 3.4µg m^{-3}. The highest annual mean concentration of 3.4µg m^{-3} was recorded at site HM32, a roadside location at Queen Caroline Street. The lowest mean level was recorded at site HM44 background location situated at Eel Brook Common. The AQS was not approached or exceeded at any site.

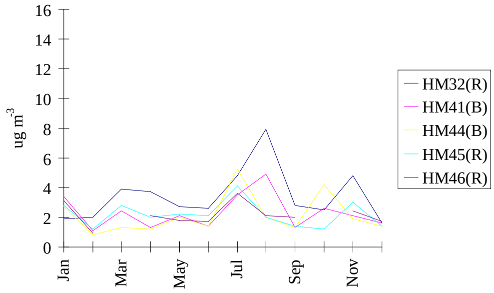


Figure 6B. Temporal Variation 2002

Temporal Variation

Figure 6B shows that benzene concentration followed similar trends with maximum levels occurring in July and August. Roadside location HM32 recorded consistently higher levels throughout the year with a maximum peak level of 7.9µg m^{-3} in August.

Annual Trends

Levels of benzene have been declining since 1995. Figure 6C illustrates this and shows similar levels for the past five years with little fluctuation.

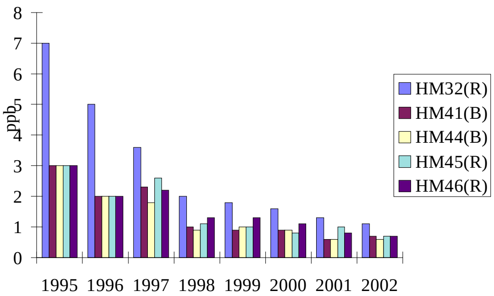


Figure 6C. Trends in Annual Average Benzene Concentrations

8.7 London Borough of Harrow

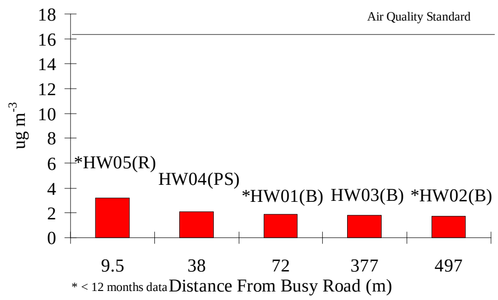


Figure 7A. Annual Mean Benzene Concentrations - 2002

Annual Mean Concentration

Annual mean levels ranged from 1.7µ m^{-3} at site HW02 to 3.2µg m^{-3} at site HW05. The highest mean of 3.2µg m^{-3} was recorded at a roadside location on Station Road, Harrow. The lowest mean of 1.7µg m^{-3} was recorded at Grimsdyke School, a background location at Hatch End. The AQS was not exceeded or approached at any site.

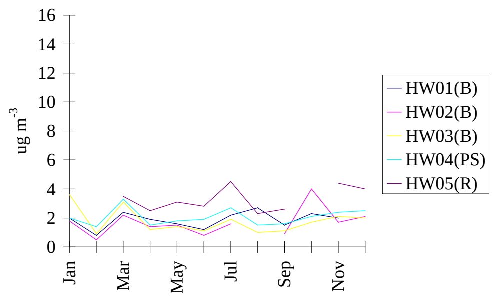


Figure 7B. Temporal Variation 2002

Temporal Variation

Temporal trends shown in Figure 7B were similar at all sites with some seasonal variation. Concentrations peaked during January, March, July and October. Roadside location HW05 remained consistently higher than other sites throughout the year with a maximum concentration of 4.5µg m^{-3} in July.

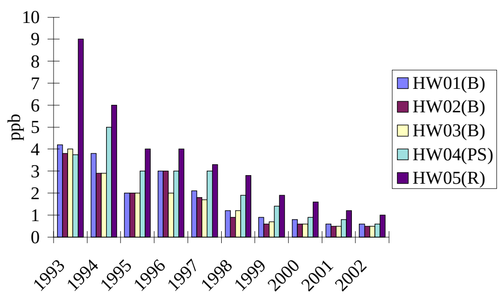


Figure 7C. Trends in Annual Average Benzene Concentrations

Annual Trends

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

8.8 London Borough of Hounslow

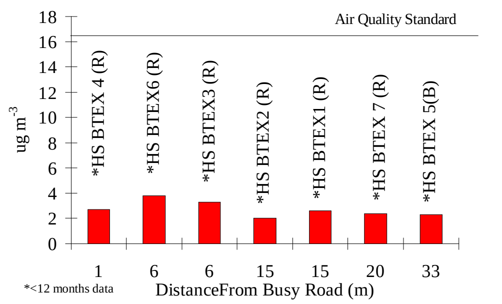


Figure 8A. Annual Mean Benzene Concentrations - 2002

Mean Concentration

Annual mean concentrations ranged from 2.0µg m^{-3} to 3.8µg m^{-3} both at roadside locations. The highest mean value of 3.8µg m^{-3} was recorded for site HS BTEX6 located at 24 Adelaide Terrace, Brentford. The lowest mean value of 2.0µg m^{-3} was recorded for site HS BTEX2 located at Marjory Kinnon School, Hatton Road. The AQS was not exceeded or approached at any time.

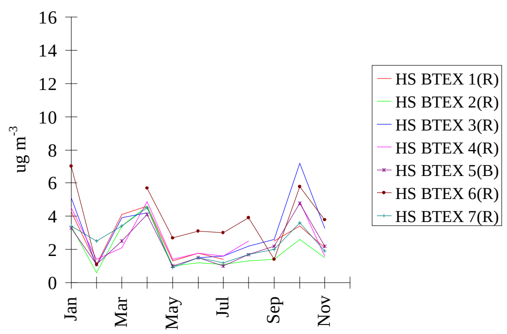


Figure 8B. Temporal Variation 2002

Temporal Variation

Figure 8B shows temporal trends for 2002. Benzene levels followed similar trends throughout the year with peak concentrations for January, May and October. During October a maximum peak value of 7.2µg m^{-3} was recorded for HS BTEX3 a roadside site located at the Cranford Library, A4 Bath Road. In February, a peak concentration of 7.0µg m^{-3} was recorded for roadside site HS BTEX6.

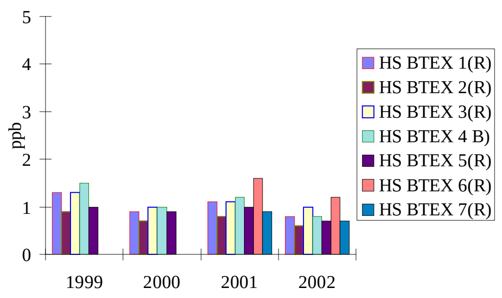


Figure 8C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 8C shows levels of benzene at all sites to be similar to those observed in previous years with little fluctuation.

8.9 Royal Borough of Kensington & Chelsea

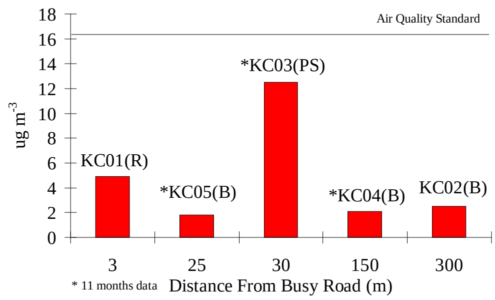


Figure 9A. Annual Mean Benzene Concentrations – 2002

Annual Mean Concentration

Mean concentrations ranged from 1.8µg m^{-3} to 12.5µg 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 but was approached at the service station site.

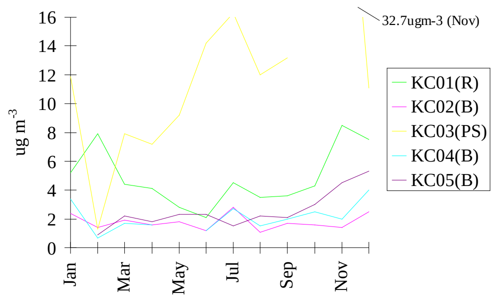


Figure 9B. Temporal Variation 2002

Temporal Variation

Figure 9B illustrates temporal trends for 2002. Levels of benzene were consistently higher at site KC03 than other sites throughout the year, with a maximum peak level of 32.7µg m^{-3} recorded for November. All other sites followed a similar pattern with peak levels during January, July, November and December.

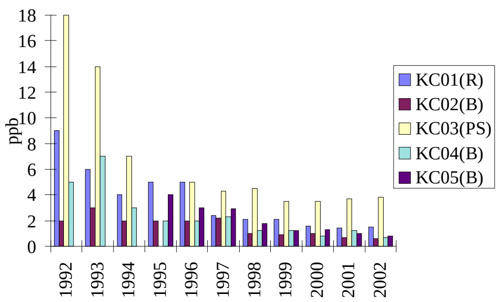


Figure 9C. Trends in Annual Average Benzene Concentrations

Annual Trends

With the exception of the petrol station site KC03, which has shown a slight increase this year, general levels have continued to decline.

8.10 Corporation of London

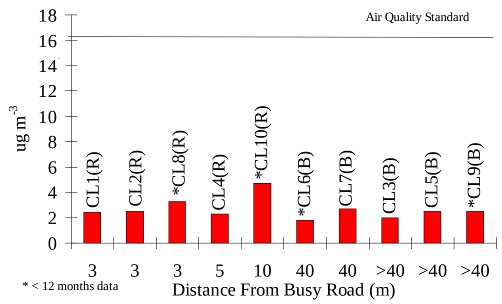


Figure 10A. Annual Mean Benzene Concentrations - 2002

Annual Mean Concentration

Annual mean benzene concentrations ranged from 1.8µg m^{-3} at site CL6 to 4.7µg m^{-3} at site CL10, a roadside location. The lowest mean level of 1.8µg m^{-3} was recorded at St Pauls Cathedral, St Pauls Churchyard. The highest mean level of 4.7µg m^{-3} was recorded at Mansion House, Mansion House Street. Mean levels were low with no exceedences of the AQS at any site.

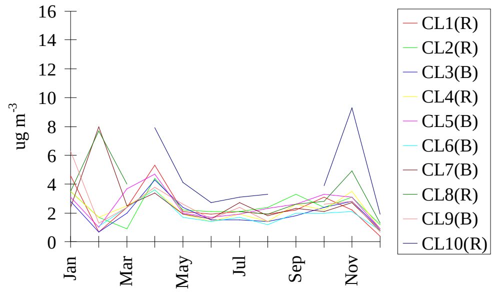


Figure 10B. Temporal Variation 2002

Temporal Variation

Figure 10B shows that although there were predominant concentration increases during January, April and November, sites CL8 and CL10 followed a slightly different trend in February. A maximum peak concentration of 9.3µg m^{-3} was recorded in November for site CL10, a roadside location.

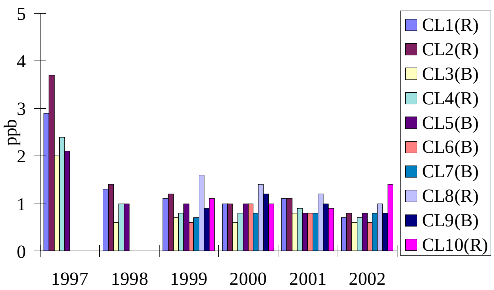


Figure 10C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 10C illustrates annual average benzene concentrations. Following 1997, levels showed a decrease at the five locations monitored at that time. For the past four years the data shows benzene levels at all sites to be similar with little fluctuation.

8.11 London Borough of Newham

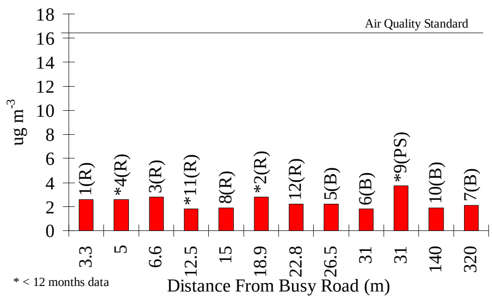


Figure 11A. Annual Mean Benzene Concentrations - 2002

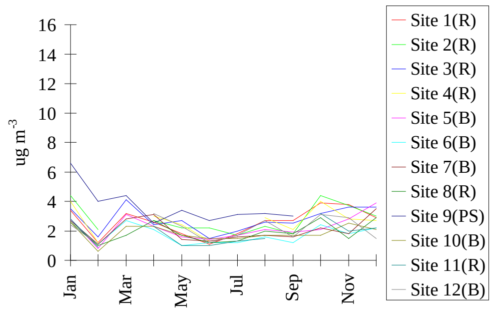


Figure 11B. Temporal Variation 2002

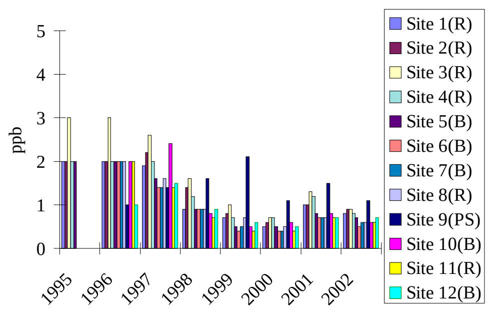


Figure 11C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Mean benzene concentrations ranged from 1.8µg m^{-3} to 3.7µg m^{-3}. The maximum mean concentration of 3.7µg m^{-3} was recorded for site 9, located at a service station on Barking Road. The lowest mean value of 1.8µg m^{-3} was recorded for sites 6 and 11, a background site located at East London Cemetery at Grange Road and a roadside location at London City Airport, Car Park Entrance, E16 respectively. There was no apparent relationship between mean concentrations and distance from busy roadsides. The AQS was not exceeded or approached at any site

Temporal Variation

Figure 11B illustrates temporal trends for 2002. Levels of benzene followed similar trends with peak concentrations during the winter months. A maximum peak concentration of 6.6µg m^{-3} was recorded in January for site 9.

Annual Trends

Since 1995 levels of benzene have shown a downward trend as shown in Figure 11C. However, mean benzene concentrations for 2001 and 2002 were slightly higher than levels obtained for 2000 at all sites. Site 9 located at a service station on Barking Road has continued to produce elevated levels since 1998.

8.12 London Borough of Richmond

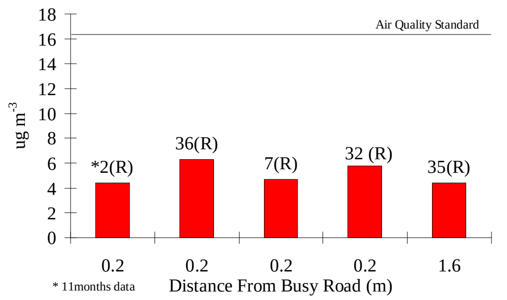


Figure 12A. Annual Mean Benzene Concentrations - 2002

Annual Mean Concentration

Annual mean concentrations ranged from 4.4µg m^{-3} at sites 2 and 35, located at High Street, Hampton Wick and George Street Richmond respectively to 6.3µg m^{-3} at site 36 located at upper Richmond Road West, East Sheen. All were roadside locations.

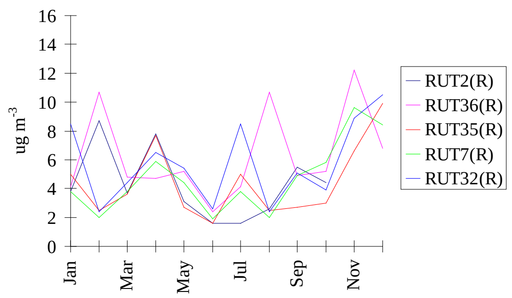


Figure 12B. Temporal Variation 2002

Temporal Variation

Figure 12B shows concentrations at all sites following similar trends throughout the year with a prominent increase in levels during February, July, August and November. A maximum peak concentration of 12.2µg m^{-3} was recorded in November for site 36, a roadside location.

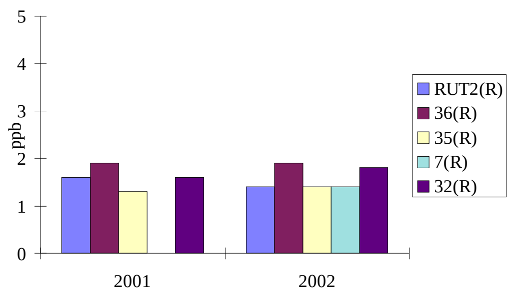


Figure 12C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 12C illustrates annual average benzene concentrations. For 2001-2002 benzene levels at all the sites were similar with little fluctuation.

8.13 London Borough of Sutton

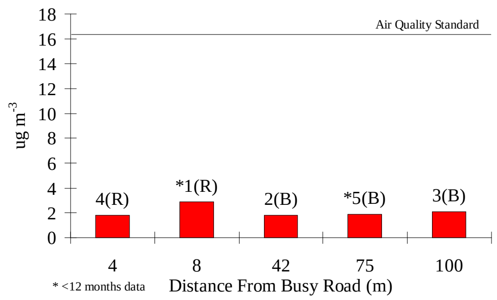


Figure 13A. Annual Mean Benzene Concentrations - 2002

Annual Mean Concentration

Mean benzene concentrations ranged from 1.8µg m^{-3} to 2.9µg m^{-3}. The minimum mean value of 1.8µg m^{-3} was recorded at sites 2 and 4, a background location at Devonshire Primary School, Devonshire Avenue and a roadside location at the Robin Hood Junior School, Thorncroft Road. The highest mean value of 2.9µg m^{-3} was recorded for site 1, a roadside location at Paynes Poppets, Croydon Road. The AQS was not approached or exceeded at any site.

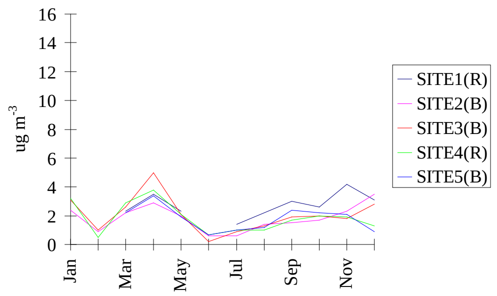


Figure 13B. Temporal Variation 2002

Temporal Variation

Temporal trends, illustrated in Figure 13B, were similar at all five sites with peak concentrations in April and November. The highest peak value of 5.0µg m^{-3} was recorded in April for a background location at site 3.

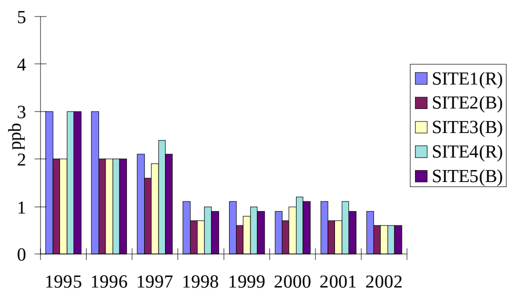


Figure 13C. Trends in Annual Average Benzene Concentrations

Annual Trends

Annual trends are illustrated in Figure 13C. Concentrations decreased significantly from 1997 to 1998 but have since remained fairly constant showing little change.

8.14 London Borough of Wandsworth

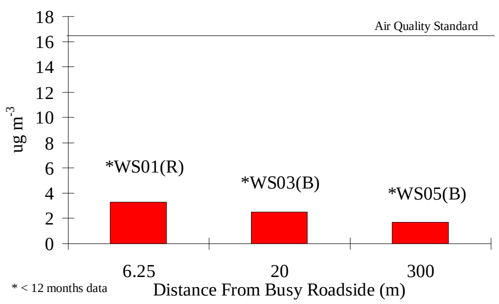


Figure 14A. Annual Mean Benzene Concentrations - 2002

Annual Mean Concentration

Annual mean concentrations ranged from 1.7µg m^{-3} to 3.3µg m^{-3}. A minimum mean value of 1.7µg m^{-3} was recorded at WS05, a background site located at Parkstead House, Holybourne Avenue in Roehampton. A maximum mean value of 3.3µg m^{-3} was recorded at WS01, also a roadside site, located at Tooting Library, Mitcham Road. The AQS was not approached or exceeded at any site.

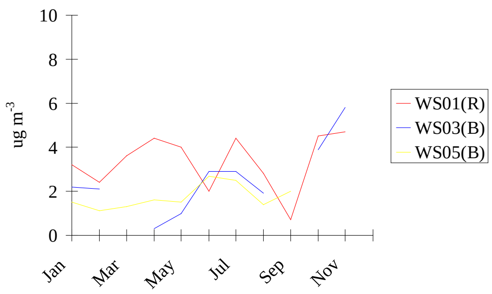


Figure 14B. Temporal Variation 2002

Temporal Variation

Levels showed some variation throughout the year with an increase in concentration during the winter months. A maximum peak level of 5.8µg m^{-3} was recorded in November at background site WS03.

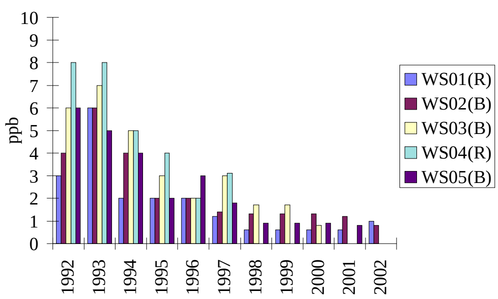


Figure 14C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 14C shows that annual benzene levels have been on the decline since 1993 with some inter-site variation. Annual means decreased at all sites in 1998 with levels now showing little change over recent years.

8.15 London Borough of Westminster

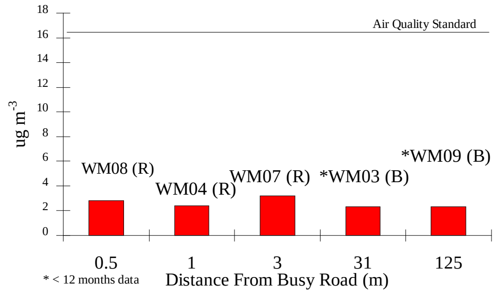


Figure 15A. Annual Mean Benzene Concentrations - 2002

Annual Mean Concentration

Mean benzene concentrations ranged from 2.3µg m^{-3} to 3.2µg m^{-3}. The lowest mean value of 2.3µg m^{-3} was recorded at sites WM03 and WM09, both are background sites, located at Harrow Road, Housing Office and Horseferry Road respectively. The highest value of 3.2µg m^{-3} was recorded for WM07, a roadside site located at Westminster Council House. The AQS was not exceeded at any of the sites.

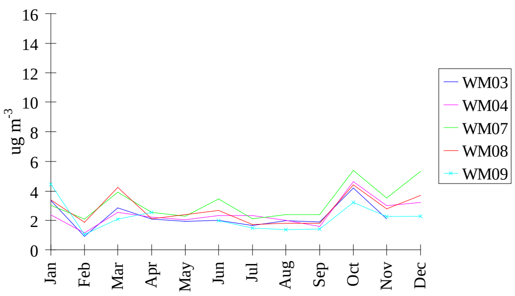


Figure 15B. Temporal Variation 2002

Temporal Variation

Figure 15B illustrates benzene levels following a similar pattern. A maximum peak level of 5.4µg m^{-3} was recorded in October at background site WM07 located at Westminster Council House.

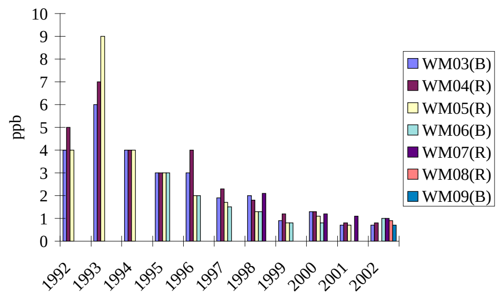


Figure 15C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 15C shows annual mean concentrations declining steadily from 1993 to 1999, with a slight increase in 2000. Mean levels for 2001-2002 are now similar with little fluctuation

8.16 Summary of 2002 Annual Mean Benzene Concentrations

Across all boroughs, mean concentrations recorded at roadside sites ranged from 1.8µg m^{-3} recorded in Newham and Sutton, to 7.1µgm^{-3} in Greenwich. At background sites, mean benzene concentrations varied from 1.7µg m^{-3} at Harrow and Greenwich to 3.3µg m^{-3} at Brent. Mean concentrations recorded at petrol stations varied from 2.1µg m^{-3} at Harrow to 12.5µg m^{-3} at Kensington & Chelsea.

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

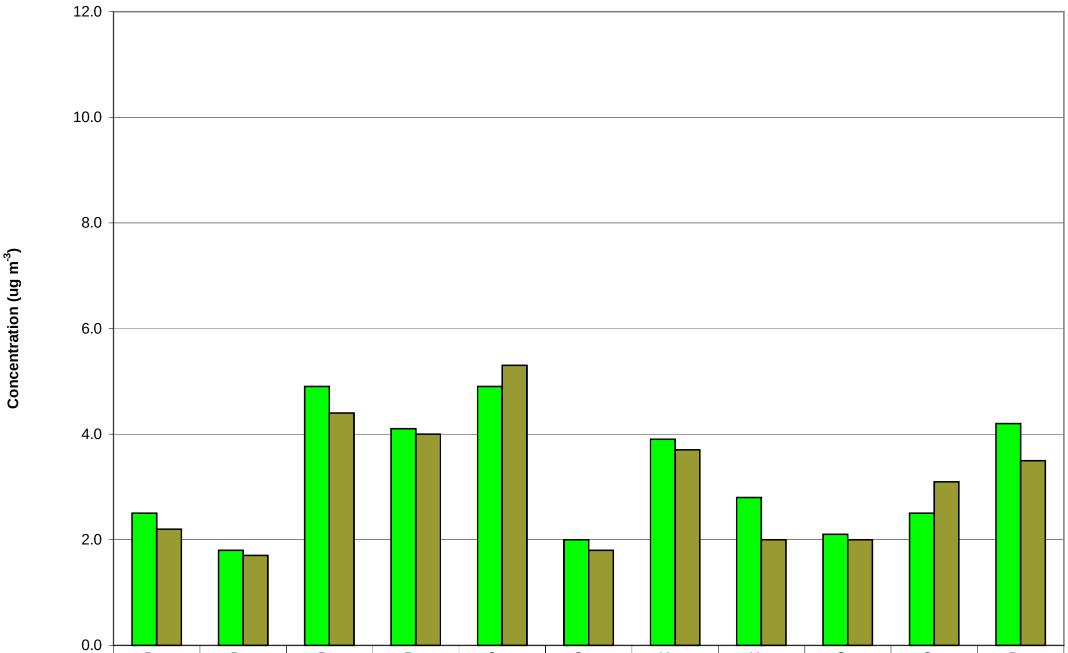
Table 2: Summary of 2002 Annual Mean Concentrations (µg m^{-3})

Site Type	Minimum	Mean	Maximum
Background	1.7	**2.2**	3.3
Roadside	1.8	**3.5**	7.1
Petrol Station	2.1	**7.3**	12.5

9 Quality Assurance and Quality Control

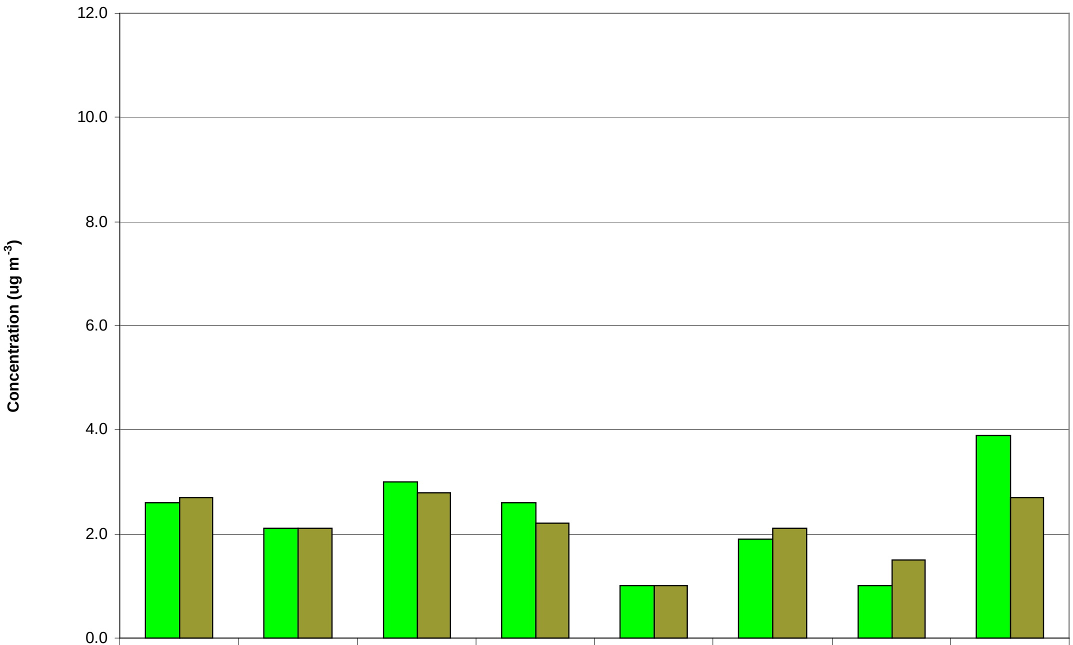
9.1 Duplicate Exposures at Monitoring Sites

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 2002 duplicate exposures were made on nineteen occasions and triplicate exposures on three. The results of these tubes indicate satisfactory agreement between duplicate and triplicate tubes. The maximum difference between duplicates is ± 1.2µg m^{-3} and the maximum difference between triplicates is ± 2.1µg m^{-3}. The results of these duplicate exposures are summarised below in Figure 16a-16d and are also given in appendix I.



	Bex	Bex	Bre	Bre	Cam	Cam	Ham	Har	Gre	Gre	Bar
Sampler	2.5	1.8	4.9	4.1	4.9	2.0	3.9	2.8	2.1	2.5	4.2
Duplicate	2.2	1.7	4.4	4.0	5.3	1.8	3.7	2.0	2.0	3.1	3.5

Figure 16a: Summary of 2002 Duplicate Exposures within London Boroughs



	Wes	Ken	Hou	Sut	Sut	Lon	New	New
Sampler	2.6	2.1	3.0	2.6	1.0	1.9	1.0	3.9
Duplicate	2.7	2.1	2.8	2.2	1.0	2.1	1.5	2.7

Figure 16b: Summary of 2002 Duplicate Exposures within London Boroughs

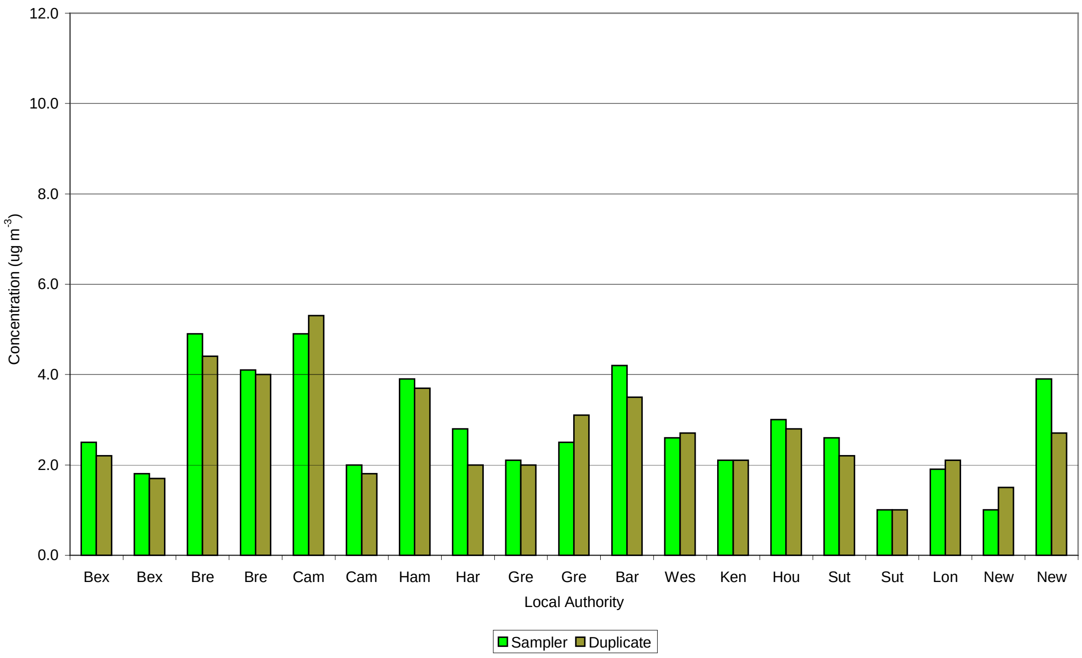


Figure 16c: Summary of 2002 Duplicate Exposures within London Boroughs showing all Nineteen exposures.

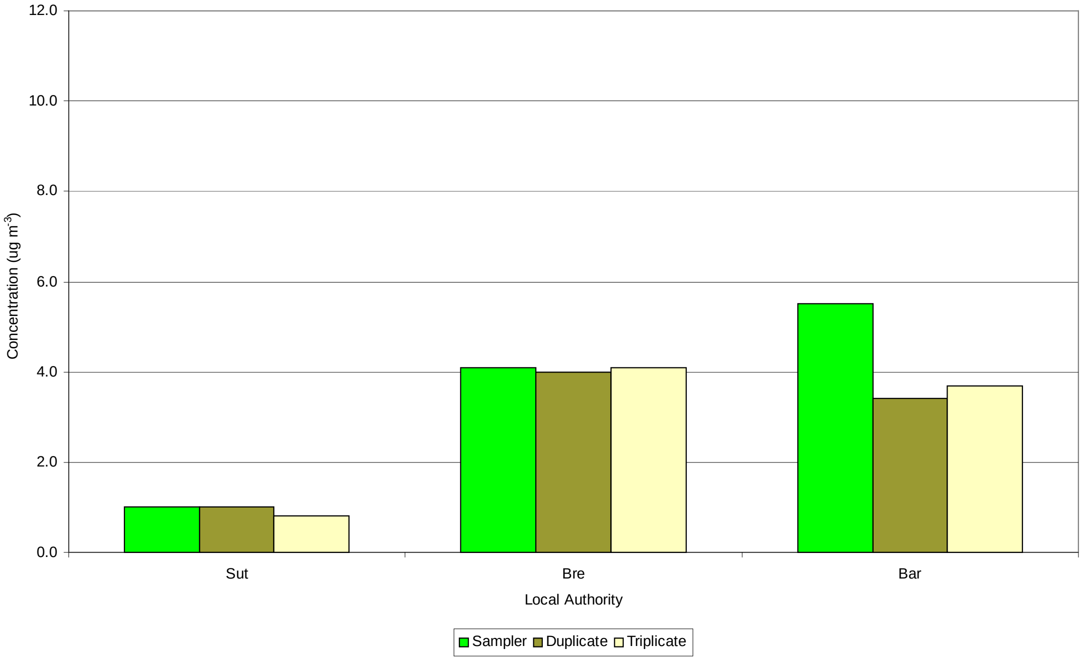


Figure 16d: Summary of 2002 Triplicate Exposures within London Boroughs showing all three exposures.

9.2 Duplicate Exposures at the Hydrocarbon Network

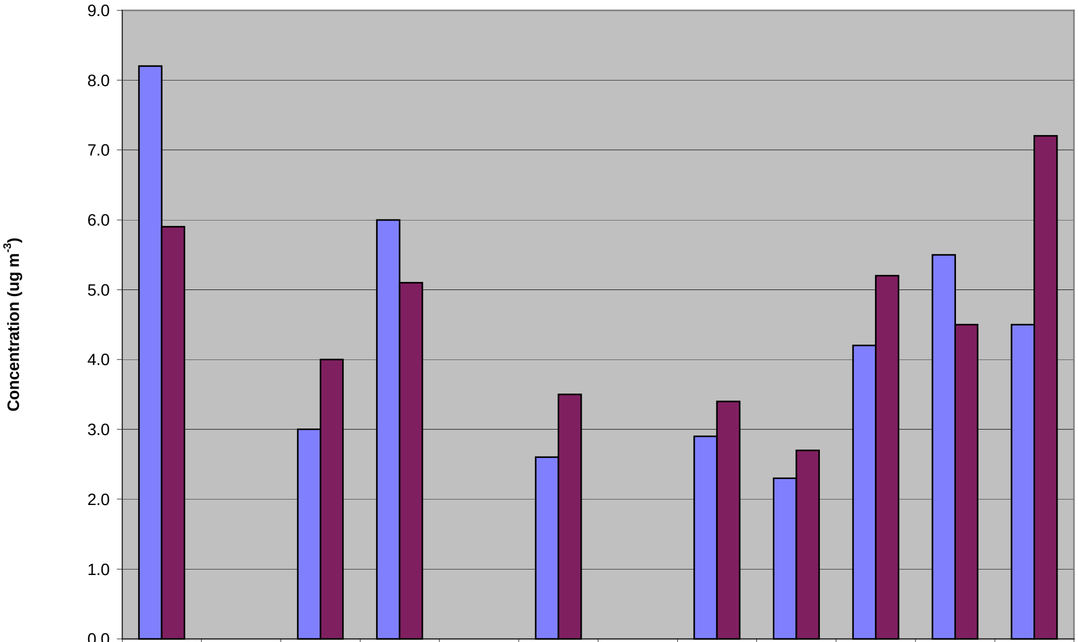
As an additional part of the quality assurance/control procedures, diffusion tubes were also exposed at the Hydrocarbon Network site on Marylebone Road *(Super-Site)*. Tubes exposed at this site were analysed for benzene, toluene, ethyl benzene, m, p-xylene and o-xylene *(btex)* and the data compared 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, May and July. Benzene levels ranged from 2.3µg m^{-3} recorded in September to 8.2µg m^{-3} recorded in January. Using this data the annual mean value was calculated to be 4.5µg m^{-3} and compared against the calculated annual mean value of 3.9µg m^{-3} recorded for the Hydrocarbon Network. Mean values for Toluene ranged from 10.0µg m^{-3} recorded in June to 47.8µg m^{-3} recorded in December. Calculated mean values for ethyl benzene ranged between 1.7µg m^{-3} in December to 6.4µg m^{-3} in January. Results for m, p-xylene ranged from 5.5µg m^{-3} in March to 16.7µg m^{-3} in November. Mean values for o-xylene ranged between 1.9µg m^{-3} in March and December to 6.3µg m^{-3} in January. 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 higher, but 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.

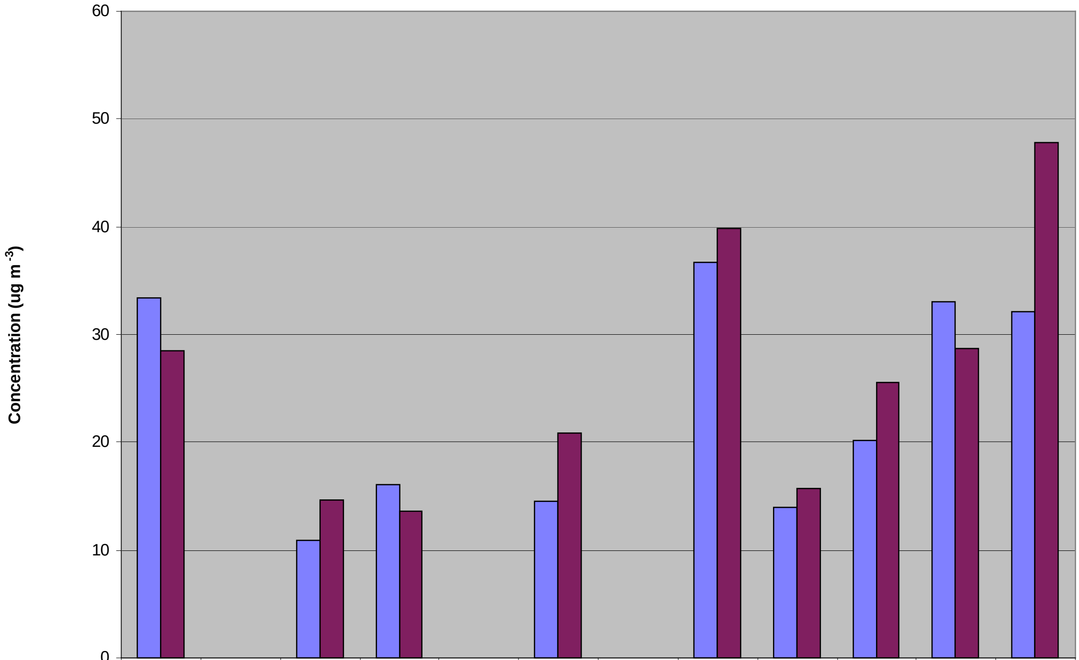
Table 3: Comparison of Annual mean Concentrations at Marylebone Road Hydrocarbon Station

Species (µg m^{-3})	Casella Stanger tubes	Network analyser
Benzene	4.5	3.9
Toluene	24.8	16.9
Ethyl Benzene	3.4	3.2
m, p Xylene	10.1	11.0
o Xylene	6.9	3.9



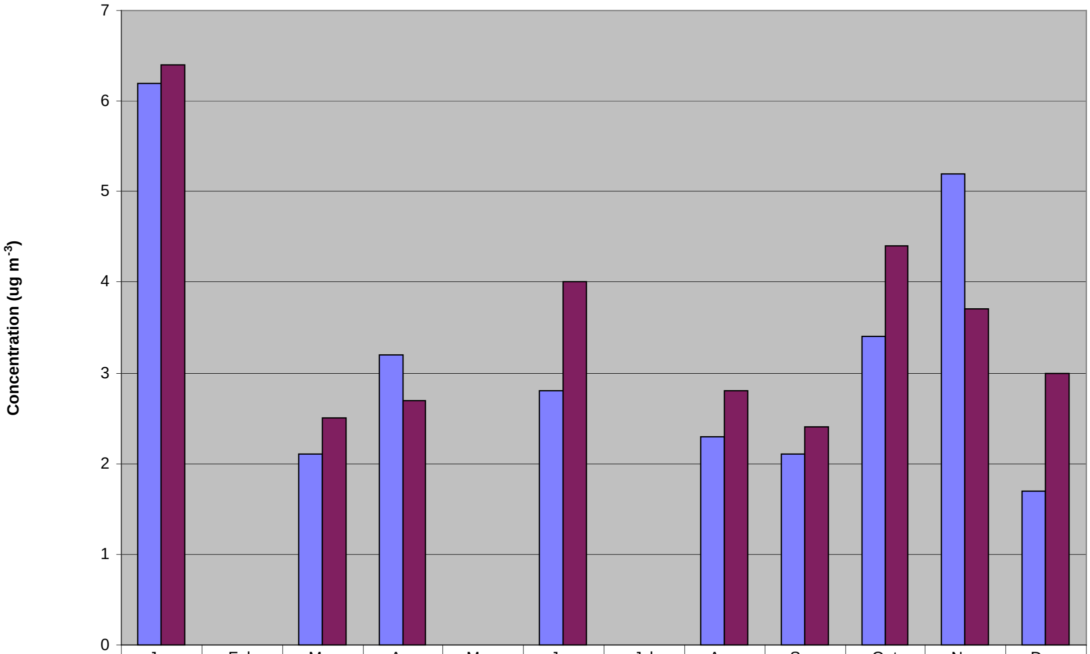
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sampler	8.2		3.0	6.0		2.6		2.9	2.3	4.2	5.5	4.5
Duplicate	5.9		4.0	5.1		3.5		3.4	2.7	5.2	4.5	7.2

Figure 17a: Summary of 2002 Duplicate Benzene Exposures at London Marylebone Road



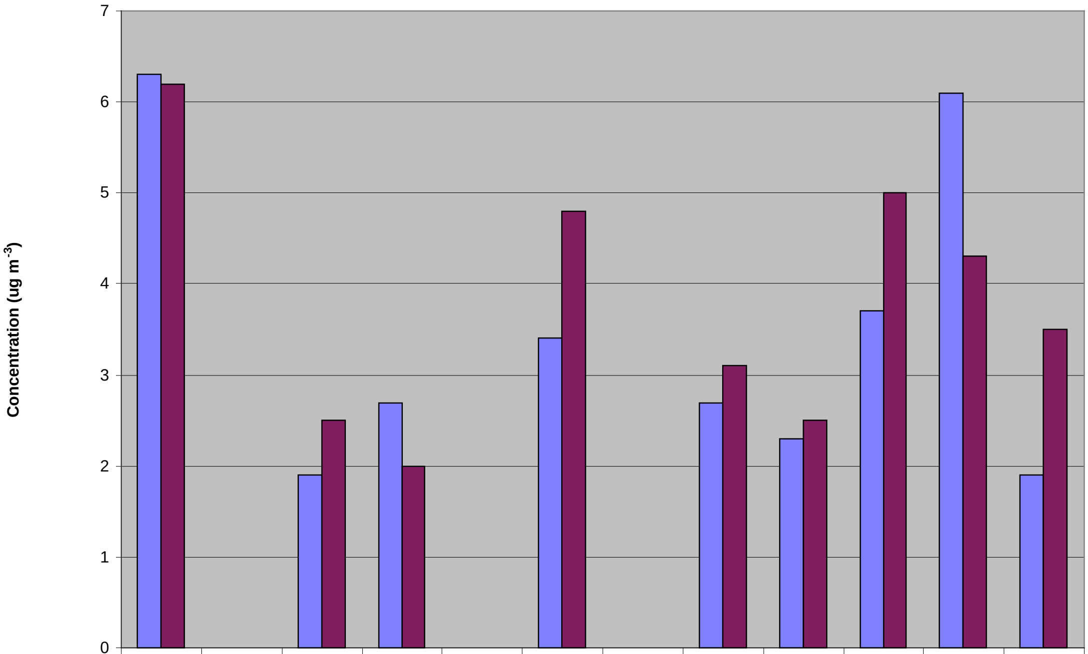
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sampler	33.4		10.9	16.0		14.5		36.7	13.9	20.2	33.0	32.1
Duplicate	28.5		14.6	13.6		20.9		39.9	15.7	25.6	28.7	47.8

Figure 17b: Summary of 2002 Duplicate Toluene Exposures at London Marylebone Road



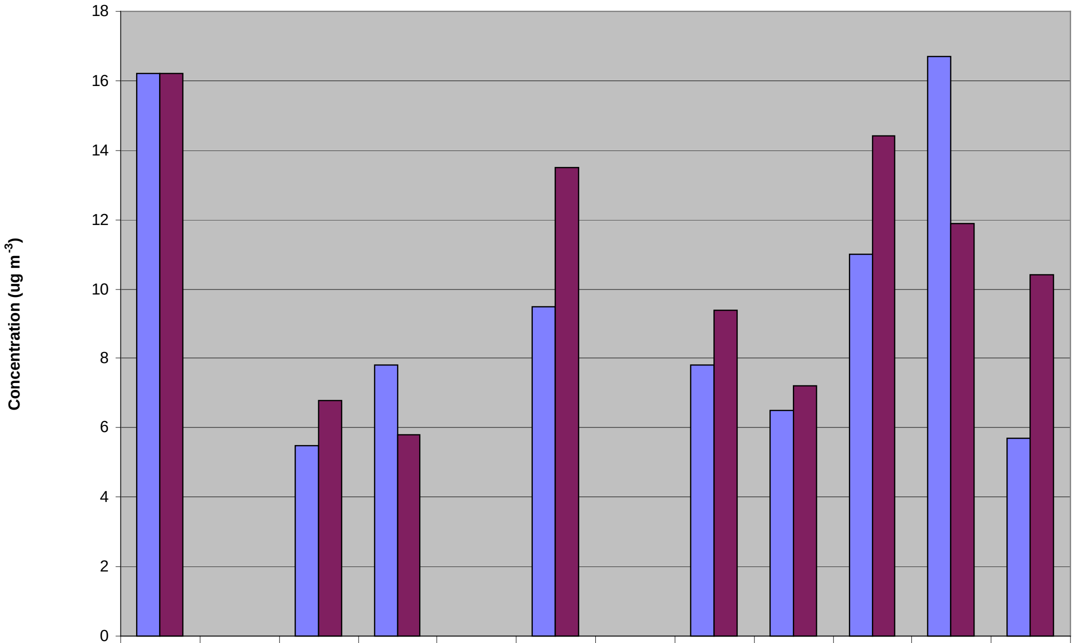
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sampler	6.2		2.1	3.2		2.8		2.3	2.1	3.4	5.2	1.7
Duplicate	6.4		2.5	2.7		4.0		2.8	2.4	4.4	3.7	3.0

Figure 17c: Summary of 2002 Duplicate Ethyl Benzene Exposures at London Marylebone Road



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sampler	6.3		1.9	2.7		3.4		2.7	2.3	3.7	6.1	1.9
Duplicate	6.2		2.5	2		4.8		3.1	2.5	5.0	4.3	3.5

Figure 17d: Summary of 2002 Duplicate m, p Xylene Exposures at London Marylebone Road



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sampler	16.2		5.5	7.8		9.5		7.8	6.5	11.0	16.7	5.7
Duplicate	16.2		6.8	5.8		13.5		9.4	7.2	14.4	11.9	10.4

Figure 17e: Summary of 2002 Duplicate o Xylene Exposures at London Marylebone Road

10 Discussion

10.1 Mean Benzene Concentrations

Maximum concentrations were recorded at roadside locations, which accounted for 64% of the total site classes in the survey. 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 at roadside, although results do show some category overlap when assessing mean values across boroughs. For example, mean levels recorded at background sites ranged from 1.7µg m^{-3} to 3.3µg m^{-3} and at roadside mean values ranged from 1.8µg m^{-3} to 7.1µg 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.

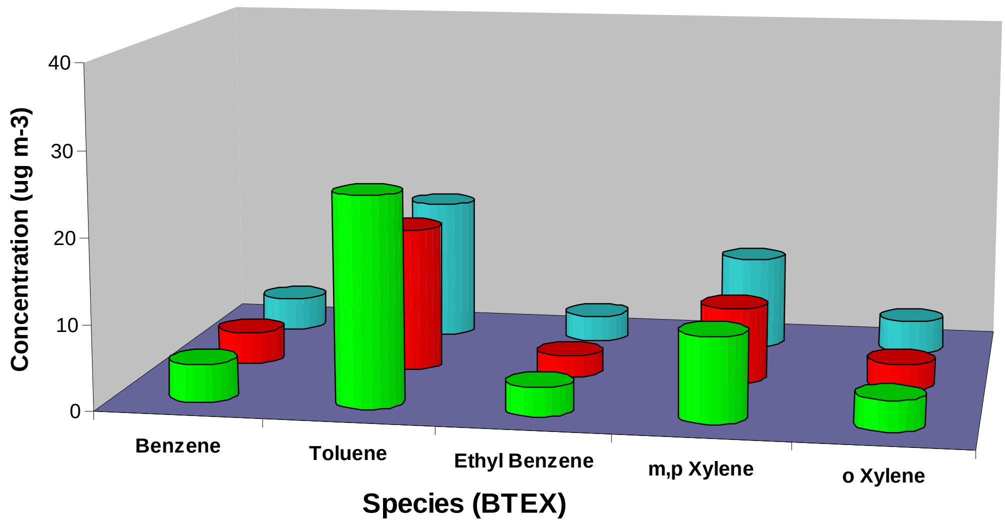
In Camden, Harrow, Newham and Kensington & Chelsea, mean benzene levels recorded at the petrol station sites were similar to levels recorded at the busy roadside sites, although the site located in Kensington & Chelsea produced the highest mean of the survey 12.5µg m^{-3}. This suggests that the influence of evaporative emissions on benzene levels at these sites is similar to the influence of exhaust emissions at roadside sites. Benzene levels at the petrol station site, 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 fairly busy road and thus vehicle emissions would have contributed to levels recorded at this site and also may 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. Indications are that the diffusion tube method may tend to over-estimate concentrations and thus present a worst-case scenario when assessing annual means. This can be seen when assessing the toluene levels in Figure 18, although such levels can be attributed to possible contamination.

The calculated annual mean level for the roadside location type was 3.3µgm^{-3} which compares with 3.9µg m^{-3} calculated for London Marylebone Road. Within the survey, the highest annual mean recorded at roadside was 6.3µg m^{-3}, which was recorded for Richmond. The maximum annual mean recorded at background was 3.3µg m^{-3}, which was also recorded at Brent.

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	4.5	24.8	3.4	10.1	3.6
Hydrocarbon Network mean data for LWEP exposure period	3.9	17.2	2.5	9.0	3.1
Hydrocarbon Network annual mean data.	3.9	16.9	3.2	11.1	3.9

Figure 18: 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 March 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).*

It therefore 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.
To some extent the degree of temporal variation observed in the data for individual boroughs reflects the differences in benzene levels between the site categories, such that greater variation was recorded at the roadside sites as opposed to the background sites. In turn this possibly again reflects the variation in traffic flow, which will only have a marked influence on roadside sites.

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.

Forecasts from mapping work suggest policy measures now in place should achieve the objective of 16.25μg m^{-3} at all urban background and roadside locations by the end of 2003. The EPAQS longer-term target level of 1 ppb should be achieved at urban background locations by the end of 2005 and most roadside locations by 2010.

12.0 Report Statement

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

Unless specifically assigned or transferred within the terms of the agreement, the consultant asserts and retains all copyright, and other Intellectual Property Rights, in and over the report and its contents.

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.

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, Sivitar 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 Police 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, Harlesden, 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

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 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	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 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 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

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 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

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

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 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	20	Background	TQ2562/7442
WS05	Parkstead House, Holybourne Avenue, Roehampton SW15	300	Background	TQ522150/173573
WS06	South Thames College Wandsworth High Street London SW18	4	Roadside	TQ525760/174570

Appendix B

Benzene Calculation

Benzene Calculation and Conversion

Average Benzene Concentration (ppb) = $\frac{M(ng)x1000}{T(mins)x\,Dc}$

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:

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

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 2002

LONDON BOROUGH OF BEXLEY

Month	Site Code LBB1		LBB3		LBB5	
	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	0.8	2.5	0.8	2.5	0.5	1.8
February	0.9	2.9	1.1	3.6	1.0	3.4
March	0.8	2.6	0.7	2.2	0.6	2.0
April	0.9	3.0	1.0	3.3	0.6	2.0
May	0.5	1.5	0.5	1.6	0.5	1.7
June	0.5	1.5	0.7	2.4	0.5	1.7
July	0.7	2.3	-	-	0.8	2.4
August	0.4	1.2	-	-	0.5	1.6
September	0.5	1.7	0.3	0.9	1.1	3.6
October	0.6	2.0	0.9	2.8	0.6	1.9
November	0.7	2.4	1.0	3.4	0.9	2.8
December	0.7	2.3	1.3	4.2	1.0	3.3
Annual Mean	**0.7**	**2.1**	**0.8**	**2.6**	**0.7**	**2.2**

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1		BD2		BD3		BD4	
	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	1.1	3.6	1.3	4.1	1.0	3.2	0.8	2.7
February	0.2	0.8	0.4	1.2	0.2	0.8	0.4	1.2
March	0.6	2.1	1.1	3.5	0.9	2.8	0.8	2.7
April	1.3	4.2	1.2	3.9	1.3	4.2	1.2	3.8
May	0.4	1.3	-	-	0.5	1.6	0.5	1.6
June	0.1	0.5	0.4	1.1	0.2	0.7	0.2	0.5
July	0.3	0.9	0.4	1.3	0.4	1.2	0.2	0.7
August	0.5	1.6	0.5	1.5	0.6	1.8	0.4	1.4
September	-	-	-	-	-	-	-	-
October	0.8	2.7	0.9	3.0	0.8	2.8	0.6	2.0
November	1.7	5.5	1.4	4.5	0.8	2.7	1.1	3.6
December	0.8	2.6	0.8	2.5	1.0	3.4	0.7	2.4
Annual Mean	**0.7**	**2.3**	**0.8**	**2.1**	**0.7**	**1.9**	**0.6**	**2.1**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF BRENT

Month	Site Code BR31		BR41		BR42		BR51		BR53	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	1.9	6.3	0.9	2.9	1.5	4.8	0.7	2.3	2.2	7.2
February	1.3	4.1	0.2	0.6	0.6	1.9	0.4	1.2	1.1	3.6
March	1.3	4.3	0.9	2.8	1.3	4.3	0.8	2.5	1.8	5.9
April	1.0	3.1	0.7	2.4	-	-	1.3	4.2	1.0	3.4
May	1.2	3.9	0.6	2.0	1.1	3.6	0.5	1.7	0.9	2.9
June	0.9	3.0	0.5	1.7	0.5	1.6	0.4	1.2	1.3	4.3
July	1.2	3.9	0.6	2.1	0.5	1.5	-	-	1.4	4.5
August	1.1	3.6	0.6	1.9	1.3	4.1	0.6	2.0	1.6	5.2
September	1.2	4.0	0.5	1.7	0.5	1.6	2.1	6.9	-	-
October	1.3	4.3	0.7	2.4	0.8	2.7	2.1	6.7	1.5	4.9
November	1.1	3.7	0.9	2.8	0.9	2.8	0.8	2.4	1.9	6.2
December	1.9	6.1	0.8	2.5	2.2	7.1	1.0	3.4	1.9	6.0
Annual Mean	**1.3**	**4.2**	**0.7**	**2.2**	**1.0**	**3.3**	**1.0**	**3.1**	**1.5**	**4.9**

Month	Site Code BR55		BR56		BR57		BR58		BR59	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	2.8	9.0	1.6	5.1	1.3	4.2	2.4	7.8	1.5	4.9
February	1.1	3.5	0.7	2.3	0.7	2.4	1.0	3.4	0.7	2.4
March	2.0	6.5	1.0	3.3	1.0	3.1	1.2	3.9	1.2	3.8
April	1.5	4.8	1.0	3.1	1.0	3.3	0.9	2.8	1.0	3.2
May	1.7	5.4	0.9	2.9	0.8	2.7	1.1	3.5	0.9	2.8
June	1.2	4.0	0.7	2.4	0.5	1.6	1.3	4.4	0.8	2.5
July	2.2	7.2	1.6	5.1	1.3	4.2	1.5	4.9	1.5	4.9
August	1.3	4.3	1.2	3.9	1.2	3.8	1.0	3.1	1.5	4.9
September	1.2	3.8	0.9	2.9	1.6	5.2	1.1	3.6	0.9	3.0
October	1.6	5.0	1.6	5.1	1.8	5.8	1.7	5.4	1.1	3.4
November	0.3	1.1	1.8	5.7	1.4	4.4	2.3	7.5	2.1	6.8
December	2.5	8.0	1.6	5.2	1.3	4.3	1.6	5.2	1.3	4.3
Annual Mean	**1.6**	**5.2**	**1.2**	**3.9**	**1.2**	**3.7**	**1.4**	**4.6**	**1.2**	**3.9**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF CAMDEN

Month	Site Code XT21		XT24		XT28		XT30	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	2.4	7.8	0.8	2.7	3.2	10.3	1.3	4.3
February	0.3	0.9	0.9	3.0	1.6	5.3	2.9	9.5
March	1.1	3.6	1.5	5.0	1.6	5.3	2.5	8.2
April	-	-	0.9	2.9	-	-	2.4	7.7
May	-	-	2.4	7.7	-	-	1.1	3.7
June	-	-	-	-	-	-	3.6	11.8
July	-	-	2.0	6.7	-	-	-	-
August	-	-	0.6	1.9	-	-	1.1	3.5
September	-	-	0.9	2.8	-	-	0.7	2.2
October	-	-	-	-	-	-	-	-
November	-	-	1.4	4.5	-	-	4.5	14.6
December	-	-	-	-	-	-	-	-
Annual Mean	**-**	**-**	**1.3**	**4.1**	**-**	**-**	**2.2**	**7.3**

CORPORATION OF LONDON

Month	Site Code CL1		CL2		CL3		CL4		CL5	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	1.4	4.6	1.1	3.5	0.9	2.8	1.1	3.5	1.0	3.1
February	0.2	0.7	0.5	1.7	0.2	0.7	0.5	1.7	0.3	1.0
March	0.7	2.4	0.3	0.9	0.6	2.0	0.8	2.5	1.1	3.7
April	1.6	5.3	1.4	4.4	1.3	4.3	1.1	3.6	1.5	4.7
May	0.7	2.1	0.7	2.2	0.7	2.4	0.6	1.9	0.6	2.0
June	0.6	1.9	0.7	2.1	0.5	1.5	0.4	1.4	0.5	1.7
July	0.7	2.1	0.7	2.1	0.5	1.5	0.6	1.9	0.6	1.9
August	0.6	1.9	0.8	2.4	0.4	1.4	0.4	1.4	0.7	2.3
September	0.7	2.2	1.0	3.3	0.5	1.8	0.8	2.6	0.8	2.6
October	0.9	3.1	0.7	2.4	0.7	2.4	0.7	2.2	1.0	3.3
November	0.7	2.2	1.0	3.1	0.9	2.8	1.1	3.5	1.0	3.1
December	0.1	0.4	0.4	1.2	0.3	0.9	0.3	0.9	0.3	0.9
Annual Mean	**0.7**	**2.4**	**0.8**	**2.5**	**0.6**	**2.0**	**0.7**	**2.3**	**0.8**	**2.5**

BENZENE CONCENTRATIONS 2002

CORPORATION OF LONDON (continued)

Month	Site Code CL6		CL7		CL8		CL9		CL10	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	-	-	0.7	2.4	1.1	3.5	1.9	6.3	1.8	5.9
February	0.3	1.1	2.5	8.0	2.4	7.7	0.4	1.3	-	-
March	0.7	2.4	0.8	2.5	1.2	4.0	0.7	2.4	-	-
April	1.1	3.6	1.0	3.4	-	-	1.2	3.8	2.4	7.9
May	0.5	1.7	0.6	1.9	0.8	2.6	0.8	2.6	1.3	4.1
June	0.4	1.4	0.5	1.6	-	-	0.5	1.6	0.8	2.7
July	0.5	1.7	0.8	2.7	0.7	2.1	0.7	2.4	0.9	3.1
August	0.4	1.2	0.5	1.8	0.6	1.9	0.4	1.4	1.0	3.3
September	0.6	2.0	0.7	2.3	0.8	2.6	-	-	-	-
October	0.6	2.0	0.7	2.1	0.9	2.8	0.8	2.6	1.2	3.9
November	0.6	2.1	0.8	2.7	1.5	4.9	0.9	2.8	2.9	9.3
December	0.2	0.8	0.2	0.8	0.4	1.3	0.2	0.7	0.6	1.9
Annual Mean	**0.6**	**1.8**	**0.8**	**2.7**	**1.0**	**3.3**	**0.8**	**2.5**	**1.4**	**4.7**

LONDON BOROUGH OF GREENWICH

Month	Site Code GW29		GW33		GW34		GW35		GW38	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	-	-	-	-	-	-	-	-	-	-
February	1.4	4.6	1.0	3.1	0.8	2.6	1.6	5.3	0.7	2.3
March	1.1	3.7	1.3	4.2	0.9	3.0	1.4	4.6	1.1	3.5
April	0.8	2.6	0.6	2.0	0.8	2.4	1.4	4.4	1.2	3.8
May	1.1	3.5	0.5	1.6	0.7	2.2	1.4	4.6	1.0	3.3
June	1.2	4.0	0.5	1.7	0.8	2.6	1.4	4.6	1.0	3.4
July	1.3	4.2	0.5	1.7	1.0	3.1	2.0	6.6	0.7	2.3
August	1.5	5.0	-	-	0.8	2.6	-	-	1.3	4.2
September	1.1	3.7	0.7	2.3	0.7	2.2	1.2	4.0	1.0	3.4
October	2.1	6.8	1.0	3.4	1.3	4.3	1.7	5.5	1.8	5.9
November	1.6	5.2	1.0	3.2	1.1	3.6	2.6	8.5	1.8	5.7
December	1.3	4.2	0.8	2.5	0.9	3.0	1.6	5.1	1.4	4.4
Annual Mean	**1.3**	**4.3**	**0.8**	**2.6**	**0.9**	**2.9**	**1.6**	**5.3**	**1.2**	**3.8**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF GREENWICH (continued)

Month	Site Code GW39		GW41		GW42		GW50		GW51	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3	Ppb	µg m3
January	-	-	-	-	-	-	-	-	-	-
February	0.4	1.3	0.8	2.7	1.1	3.6	1.2	3.9	0.5	1.7
March	0.4	1.3	0.9	3.0	1.3	4.3	1.5	4.9	0.9	2.9
April	0.5	1.7	0.8	2.6	1.7	5.5	-	-	0.6	2.1
May	0.4	1.4	0.7	2.4	1.3	4.4	1.1	3.5	0.5	1.6
June	0.7	2.2	1.0	3.1	1.2	3.7	1.9	6.1	0.7	2.2
July	0.8	2.7	0.5	1.6	0.9	2.9	1.1	3.5	0.3	1.1
August	0.4	1.4	1.0	3.1	1.0	3.4	1.4	4.4	0.6	2.0
September	0.3	0.9	0.7	2.2	1.3	4.1	1.1	3.6	0.6	2.0
October	0.7	2.3	1.1	3.5	2.3	7.4	2.0	6.4	1.1	3.5
November	0.6	1.9	1.1	3.6	1.4	4.4	1.9	6.3	1.1	3.6
December	0.6	1.9	1.4	4.5	1.5	4.8	1.1	3.5	0.6	1.9
Annual Mean	**0.5**	**1.7**	**0.9**	**2.9**	**1.4**	**4.4**	**1.4**	**4.6**	**0.7**	**2.2**

Month	Site Code GW55	
	Ppb	µg m3
January	-	-
February	0.5	1.6
March	0.6	2.1
April	0.8	2.5
May	0.5	1.6
June	0.7	2.2
July	0.7	2.3
August	0.6	2.1
September	0.6	2.0
October	1.0	3.1
November	0.8	2.4
December	0.5	1.6
Annual Mean	**0.7**	**2.2**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF HAMMERSMITH AND FULHAM

Month	Site Code HM32		HM41		HM44		HM45		HM46	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	0.6	1.9	1.0	3.4	0.8	2.7	0.9	2.8	1.0	3.1
February	0.6	2.0	0.4	1.1	0.2	0.8	0.4	1.2	0.3	0.9
March	1.2	3.9	0.7	2.4	0.4	1.3	0.9	2.8	-	-
April	1.1	3.7	0.4	1.3	0.4	1.2	0.6	2.0	0.6	2.1
May	0.8	2.7	0.6	2.1	0.6	2.0	0.7	2.2	0.6	1.8
June	0.8	2.6	0.4	1.4	0.4	1.4	0.7	2.1	0.5	1.7
July	1.5	4.8	1.1	3.5	1.6	5.2	1.3	4.1	1.1	3.6
August	2.4	7.9	1.5	4.9	0.6	2.0	0.6	2.0	0.7	2.1
September	0.9	2.8	0.4	1.3	0.4	1.3	0.4	1.4	0.6	2.0
October	0.8	2.5	0.8	2.6	1.3	4.2	0.4	1.2	-	-
November	1.5	4.8	0.6	2.1	0.6	1.9	0.9	3.0	0.8	2.4
December	0.5	1.6	0.5	1.6	0.4	1.4	0.4	1.4	0.5	1.7
Annual Mean	**1.1**	**3.4**	**0.7**	**2.3**	**0.6**	**2.1**	**0.7**	**2.2**	**0.7**	**2.2**

LONDON BOROUGH OF HARROW

Month	Site Code HW01		HW02		HW03		HW04		HW05	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	0.6	2.0	0.6	1.8	1.1	3.6	0.6	2.0	0.7	2.4
February	0.2	0.8	0.2	0.5	0.3	0.9	0.4	1.4	-	-
March	0.7	2.4	0.7	2.2	0.9	3.1	1.0	3.3	1.1	3.5
April	0.6	1.9	0.4	1.4	0.4	1.2	0.5	1.5	0.8	2.5
May	0.5	1.6	0.5	1.5	0.4	1.4	0.6	1.8	1.0	3.1
June	0.4	1.2	0.3	0.8	0.3	1.1	0.6	1.9	0.9	2.8
July	0.7	2.2	0.5	1.6	0.6	1.9	0.8	2.7	1.4	4.5
August	0.8	2.7	-	-	0.3	1.0	0.5	1.5	0.7	2.3
September	0.5	1.5	0.3	0.9	0.3	1.1	0.5	1.6	0.8	2.6
October	0.7	2.3	1.2	4.0	0.5	1.7	0.6	2.1	-	-
November	0.6	2.0	0.5	1.7	0.6	2.1	0.8	2.4	1.3	4.4
December	-	-	0.7	2.1	0.6	2.0	0.8	2.5	1.2	4.0
Annual Mean	**0.6**	**1.9**	**0.5**	**1.7**	**0.5**	**1.8**	**0.6**	**2.1**	**1.0**	**3.2**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF HOUNSLOW

Month	**Site Code HS BTEX1**		**HSBTEX2**		**HS BTEX3**		**HS BTEX4**	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	Ppb	µg m3
January	1.3	4.3	1.0	3.4	1.6	5.1	1.4	4.5
February	0.3	1.1	0.2	0.6	0.3	1.0	0.4	1.4
March	1.3	4.1	1.0	3.4	1.2	3.9	0.7	2.1
April	1.4	4.6	1.4	4.6	1.3	4.2	1.5	4.9
May	0.4	1.3	0.3	1.0	-	-	0.4	1.4
June	0.5	1.8	0.4	1.2	0.5	1.5	0.5	1.8
July	0.4	1.4	0.3	1.1	0.5	1.6	0.5	1.6
August	-	-	0.4	1.3	0.7	2.2	0.8	2.5
September	0.8	2.5	0.4	1.4	0.8	2.6	-	-
October	1.0	3.4	0.8	2.6	2.2	7.2	1.5	4.9
November	0.6	2.1	0.5	1.5	1.0	3.3	0.5	1.6
December	-	-	-	-	-	-	-	-
Annual Mean	**0.8**	**2.6**	**0.6**	**2.0**	**1.0**	**3.3**	**0.8**	**2.7**

Month	**Site Code HS BTEX5**		**HS BTEX6**		**HS BTEX7**	
	Ppb	µg m3	ppb	µg m3	Ppb	µg m3
January	1.0	3.3	2.1	7.0	1.0	3.4
February	0.3	1.1	0.3	1.1	0.8	2.5
March	0.8	2.5	-	-	1.0	3.4
April	1.3	4.1	1.7	5.7	1.4	4.5
May	0.3	1.0	0.8	2.7	0.3	0.9
June	0.5	1.5	1.0	3.1	0.5	1.5
July	0.3	1.0	0.9	3.0	0.4	1.2
August	0.5	1.7	1.2	3.9	0.5	1.7
September	0.7	2.2	0.4	1.4	0.6	2.0
October	1.5	4.8	1.8	5.8	1.1	3.6
November	0.7	2.2	1.2	3.8	0.6	1.9
December	-	-	-	-	-	-
Annual Mean	**0.7**	**2.3**	**1.2**	**3.8**	**0.7**	**2.4**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF NEWHAM

Month	Site Code 1		2		3		4	
	Ppb	μg m3	ppb	μg m3	ppb	μg m3	ppb	μg m3
January	1.0	3.4	1.4	4.4	1.1	3.5	1.2	4.0
February	0.4	1.2	0.6	2.1	0.5	1.6	0.4	1.2
March	1.0	3.2	-	-	1.3	4.1	-	-
April	0.8	2.6	0.8	2.7	0.7	2.4	0.9	3.0
May	0.6	1.8	0.7	2.2	0.8	2.7	0.7	2.4
June	0.4	1.1	07	2.2	0.5	1.5	0.4	1.3
July	0.6	1.8	0.5	1.7	0.6	2.0	-	-
August	0.8	2.7	0.7	2.3	0.8	2.6	0.9	2.9
September	0.8	2.7	0.5	1.8	0.8	2.5	0.7	2.1
October	1.2	3.9	1.3	4.4	1.0	3.2	1.2	4.0
November	1.2	3.8	1.1	3.7	1.1	3.6	0.9	2.8
December	0.9	2.9	0.9	3.0	1.1	3.6	0.8	2.7
Annual Mean	**0.8**	**2.6**	**0.9**	**2.8**	**0.9**	**2.8**	**0.8**	**2.6**

Month	Site Code 5		6		7		8	
	Ppb	μg m3	ppb	μg m3	ppb	μg m3	ppb	μg m3
January	0.9	2.8	0.8	2.7	0.8	2.7	0.8	2.6
February	0.3	0.8	0.3	1.1	0.3	1.1	0.3	1.0
March	1.0	3.1	0.8	2.7	0.9	2.8	0.5	1.7
April	0.7	2.3	0.6	2.1	1.0	3.1	0.8	2.7
May	0.5	1.6	0.3	1.0	0.4	1.4	0.5	1.7
June	0.4	1.4	0.4	1.2	0.4	1.3	0.4	1.2
July	0.5	1.7	0.4	1.2	0.5	1.6	0.4	1.3
August	0.6	2.1	0.5	1.6	0.5	1.7	0.6	2.0
September	0.6	1.9	0.4	1.2	0.5	1.6	0.5	1.8
October	0.7	2.1	0.7	2.4	0.7	2.2	0.9	2.9
November	0.9	2.8	0.6	1.8	0.6	1.8	0.5	1.5
December	1.2	3.9	0.7	2.2	1.1	3.5	0.9	2.9
Annual Mean	**0.7**	**2.2**	**0.5**	**1.8**	**0.6**	**2.1**	**0.6**	**1.9**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF NEWHAM (continued)

Month	Site Code 9		10		11		12	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	2.0	6.6	0.8	2.6	0.9	2.8	0.8	2.4
February	1.2	4.0	0.2	0.6	0.3	0.9	0.3	1.1
March	1.4	4.4	0.7	2.3	-	-	-	-
April	0.8	2.5	0.7	2.3	0.7	2.3	1.0	3.2
May	1.0	3.4	0.5	1.7	0.3	1.0	0.7	2.3
June	0.8	2.7	0.5	1.5	0.3	1.0	0.4	1.2
July	1.0	3.1	0.5	1.5	0.4	1.3	0.5	1.7
August	1.0	3.2	0.5	1.7	0.5	1.5	0.8	2.7
September	0.9	3.0	0.5	1.7	-	-	0.5	1.6
October	-	-	0.5	1.7	1.0	3.2	1.0	3.1
November	-	-	0.8	2.5	0.6	2.0	0.9	2.9
December	-	-	0.6	2.1	0.7	2.2	0.5	1.5
Annual Mean	**1.1**	**3.7**	**0.6**	**1.9**	**0.6**	**1.8**	**0.7**	**2.2**

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01		KC02		KC03		KC04		KC05	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	1.6	5.2	0.8	2.4	3.7	11.9	1.0	3.4	-	-
February	2.4	7.9	0.4	1.4	0.4	1.3	0.2	0.7	0.3	0.9
March	1.4	4.4	0.6	1.9	2.4	7.9	0.5	1.7	0.7	2.2
April	1.3	4.1	0.5	1.6	2.2	7.2	0.5	1.6	0.6	1.8
May	0.9	2.8	0.6	1.8	2.8	9.2	-	-	0.7	2.3
June	0.6	2.1	0.4	1.2	4.4	14.2	0.4	1.2	0.7	2.3
July	1.4	4.5	0.9	2.8	5.0	16.3	0.8	2.7	0.5	1.5
August	1.1	3.5	0.3	1.1	3.7	12.0	0.5	1.5	0.7	2.2
September	1.1	3.6	0.5	1.7	4.1	13.2	0.6	2.0	0.6	2.1
October	1.3	4.3	0.5	1.6	-	-	0.8	2.5	0.9	3.0
November	2.6	8.5	0.4	1.4	10.1	32.7	0.6	2.0	1.4	4.5
December	2.3	7.5	0.8	2.5	3.4	11.1	1.2	4.0	1.6	5.3
Annual Mean	**1.5**	**4.9**	**0.6**	**1.8**	**3.8**	**12.5**	**0.7**	**2.1**	**0.8**	**2.6**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2		Sheen RUT36		Hamp RUT35		Ted RUT7		Twick RUT32	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.2	3.8	1.3	4.1	1.5	5.0	1.2	3.8	2.6	8.5
February	2.7	8.7	3.3	10.7	0.8	2.5	0.6	2.0	0.7	2.4
March	1.1	3.7	1.5	4.8	1.1	3.6	1.2	3.8	1.4	4.4
April	2.4	7.8	1.5	4.7	2.4	7.7	1.8	5.9	2.0	6.5
May	1.0	3.1	1.6	5.2	0.8	2.7	1.4	4.4	1.7	5.4
June	0.5	1.6	0.7	2.4	0.5	1.6	0.6	1.9	0.8	2.6
July	0.6	1.8	1.3	4.1	1.5	5.0	1.2	3.8	2.6	8.5
August	0.8	2.6	3.3	10.7	0.7	2.4	0.6	2.0	0.7	2.4
September	1.7	5.5	1.5	4.9	0.8	2.7	1.5	4.9	1.6	5.1
October	1.3	4.4	1.6	5.2	0.9	3.0	1.8	5.8	1.2	3.9
November	-	-	3.7	12.2	2.0	6.6	3.0	9.6	2.7	8.9
December	1.8	5.7	2.1	6.8	3.0	9.9	2.6	8.4	3.2	10.5
Annual Mean	**1.4**	**4.4**	**1.9**	**6.3**	**1.4**	**4.4**	**1.4**	**4.7**	**1.8**	**5.8**

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1		Site 2		Site 3		Site 4		Site 5	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.4	4.4	0.7	2.4	1.0	3.1	1.0	3.2	0.9	3.0
February	-	-	0.3	0.9	0.3	1.0	0.1	0.5	-	-
March	0.7	2.3	0.7	2.2	0.8	2.6	0.9	2.9	0.7	2.2
April	1.1	3.5	0.9	2.9	1.5	5.0	1.2	3.8	1.0	3.4
May	0.7	2.3	0.6	2.0	0.6	2.1	0.6	2.1	0.6	1.9
June	-	-	0.2	0.6	0.1	0.2	0.2	0.7	0.2	0.7
July	0.4	1.4	0.2	0.6	0.3	0.9	0.3	1.0	0.3	1.0
August	0.7	2.2	0.4	1.4	0.4	1.3	0.3	1.0	0.4	1.2
September	0.9	3.0	0.5	1.5	0.6	1.9	0.5	1.7	0.7	2.4
October	0.8	2.6	0.5	1.7	0.6	2.0	0.6	2.0	0.7	2.2
November	1.3	4.2	0.7	2.3	0.6	1.8	0.6	1.9	0.6	2.1
December	1.0	3.1	1.1	3.5	0.9	2.8	0.4	1.3	0.3	0.9
Annual Mean	**0.9**	**2.9**	**0.6**	**1.8**	**0.6**	**2.1**	**0.6**	**1.8**	**0.6**	**1.9**

BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF WANDSWORTH

Month	Site Code WS01		WS03		WS05		WS06	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.0	3.2	0.7	2.2	0.5	1.5	-	-
February	0.7	2.4	0.6	2.1	0.3	1.1	-	-
March	1.1	3.6	-	-	0.4	1.3	-	-
April	1.4	4.4	0.1	0.3	0.5	1.6	-	-
May	1.2	4.0	0.3	1.0	0.5	1.5	-	-
June	0.6	2.0	0.9	2.9	0.8	2.7	-	-
July	1.4	4.4	0.9	2.9	0.8	2.5	-	-
August	0.9	2.8	0.6	1.9	0.4	1.4	-	-
September	0.2	0.7	-	-	0.6	2.0	-	-
October	1.4	4.5	1.2	3.9	-	-	1.2	3.9
November	1.5	4.7	1.8	5.8	-	-	-	-
December	-	-	-	-	-	-	-	-
Annual mean	**1.0**	**3.3**	**0.8**	**2.5**	**0.5**	**1.7**	**-**	**-**

CITY OF WESTMINSTER

Month	Site Code WM03		WM04		WM07		WM08		WM09	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.0	3.3	0.7	2.4	0.9	3.0	1.0	3.4	1.4	4.5
February	0.3	0.9	0.4	1.2	0.6	2.1	0.6	1.9	0.3	1.0
March	0.9	2.9	0.8	2.5	1.2	3.9	1.3	4.2	0.6	2.1
April	0.6	2.1	0.7	2.2	0.8	2.6	0.7	2.1	0.8	2.5
May	0.6	1.9	0.6	2.0	0.7	2.3	0.7	2.4	-	-
June	0.6	2.0	0.7	2.3	1.1	3.5	0.8	2.7	0.6	2.0
July	0.5	1.6	0.7	2.3	0.7	2.1	0.5	1.7	0.5	1.5
August	0.6	2.0	0.7	2.4	0.8	2.5	0.8	2.5	0.8	2.5
September	0.6	1.9	0.5	1.6	0.8	2.4	0.6	1.8	0.4	1.4
October	1.3	4.2	1.4	4.6	1.7	5.4	1.3	4.4	1.0	3.2
November	0.7	2.1	0.9	3.0	1.1	3.5	0.9	2.8	0.7	2.2
December	-	-	1.0	3.2	1.6	5.3	1.1	3.7	0.7	2.3
Annual Mean	**0.7**	**2.3**	**0.8**	**2.4**	**1.0**	**3.2**	**0.9**	**2.8**	**0.7**	**2.3**

BENZENE CONCENTRATIONS 2002

CITY OF WESTMINSTER (continued)

Month	**Site Code WM10**	
	Ppb	µg m3
January	-	-
February	-	-
March	-	-
April	-	-
May	-	-
June	-	-
July	0.5	1.6
August	0.4	1.4
September	0.5	1.8
October	1.0	3.3
November	0.7	2.3
December	1.1	3.5
Annual Mean	**-**	**-**

Appendix D

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

TOLUENE CONCENTRATIONS 2002

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1		BD2		BD3		BD4	
	Ppb	µg m³	ppb	µg m³	ppb	µg m³	ppb	µg m³
January	3.8	14.7	4.6	17.4	3.2	12.3	2.5	9.7
February	1.2	4.4	1.3	5.2	0.8	2.9	1.0	3.7
March	1.9	7.3	3.2	12.3	2.4	9.0	2.0	7.8
April	2.2	8.5	2.7	10.5	3.0	11.5	2.1	8.2
May	8.7	33.4	-	-	12.4	47.4	9.4	36.1
June	0.5	1.9	1.8	6.7	2.7	10.4	0.7	2.8
July	1.2	4.5	1.7	6.5	3.5	13.3	0.7	2.8
August	7.2	27.4	5.8	22.2	8.0	30.5	1-	38.2
September	-	-	-	-	-	-	-	
October	3.2	12.2	3.5	13.2	5.2	19.7	2.0	7.7
November	7.1	27.3	6.3	24.2	8.1	30.9	10.2	39.3
December	2.3	8.9	1.7	6.5	4.0	15.1	1.8	6.8
Annual Mean	**3.3**	**12.5**	**3.0**	**11.3**	**4.4**	**16.9**	**3.5**	**13.6**

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01		KC02		KC03		KC04		KC05	
	Ppb	µg m³	ppb	µg m³	ppb	µg m³	ppb	µg m³	Ppb	µg m³
January	6.7	25.6	2.9	11.1	15.0	57.6	4.4	16.7	-	-
February	11.4	43.6	1.3	5.1	1.7	6.6	0.8	3.1	1.7	6.5
March	4.6	17.5	1.3	5.1	10.9	41.9	1.2	4.7	1.5	5.7
April	12.1	46.2	8.0	30.5	16.6	63.6	7.5	28.9	9.2	35.4
May	3.4	13.0	2.4	9.1	15.6	59.8	-	-	2.8	10.8
June	2.5	9.5	1.5	5.6	25.3	96.9	1.2	4.7	3.1	12.0
July	5.7	21.8	3.2	12.2	25.6	98.2	3.4	13.0	1.4	5.4
August	11.8	45.1	5.9	22.7	25.4	97.2	9.6	36.7	9.1	37.4
September	12.2	46.6	17.0	65.0	30.4	116.4	11.4	43.7	15.0	57.5
October	5.3	20.5	1.6	6.2	-	-	3.1	12.0	3.5	13.3
November	29.6	113.4	21.4	81.9	67.5	258.6	17.1	65.5	19.5	74.6
December	8.9	34.0	3.5	13.5	14.1	53.9	3.7	14.1	5.6	21.5
Annual Mean	**9.5**	**36.4**	**5.8**	**22.3**	**22.6**	**86.4**	**5.8**	**22.1**	**6.6**	**25.2**

TOLUENE CONCENTRATIONS 2002

CORPORATION OF LONDON

Month	Site Code CL1		CL2		CL3		CL4		CL5	
	ppb	μg m3	ppb	μg m3	ppb	μg m3	ppb	μg m3	ppb	μg m3
January	4.4	16.8	4.5	17.3	3.3	12.5	3.5	13.6	3.7	14.2
February	1.1	4.2	1.9	7.3	3.3	12.8	1.9	7.4	1.2	4.5
March	1.7	6.7	2.1	7.9	1.4	5.4	1.5	5.8	3.5	13.5
April	3.9	14.8	3.9	14.8	2.2	8.4	2.6	1-	3.1	11.9
May	3.5	13.2	3.4	13.1	3.5	13.6	2.7	10.4	3.1	11.9
June	3.5	13.5	2.5	9.7	1.6	6.2	1.5	5.7	2.3	8.6
July	4.2	16.2	2.2	8.4	1.4	5.3	1.6	6.0	2.1	8.0
August	9.2	35.3	7.8	29.8	8.1	30.9	9.5	36.3	12.8	49.0
September	8.6	33.1	7.2	27.7	5.8	22.3	4.9	18.8	5.8	22.4
October	4.9	18.7	2.8	10.8	2.4	9.3	7.3	27.8	3.9	15.1
November	27.3	104.5	35.9	137.5	33.3	127.7	23.5	90.1	31.0	118.6
December	0.7	2.6	1.3	4.9	1.6	6.3	3.1	12.0	0.9	3.6
Annual Mean	**6.1**	**23.3**	**6.3**	**24.1**	**5.7**	**21.7**	**5.3**	**20.3**	**6.1**	**23.4**

Month	Site Code CL6		CL7		CL8		CL9		CL10	
	ppb	μg m3	ppb	μg m3	ppb	μg m3	ppb	μg m3	Ppb	μg m3
January	-	-	3.8	14.4	3.9	15.0	7.5	28.9	7.7	29.4
February	1.5	5.7	1.9	7.1	1.8	6.9	1.4	5.2	-	-
March	1.4	5.3	1.4	5.4	3.1	12.1	3.0	11.6	-	-
April	3.5	13.5	2.8	10.6	-	-	2.9	11.0	7.4	28.4
May	4.8	18.3	3.1	11.9	5.2	20.1	4.1	15.8	6.2	23.8
June	6.0	23.1	1.3	5.0	-	-	2.3	8.6	4.0	15.3
July	3.1	12.1	5.4	20.8	2.3	8.7	3.3	12.7	4.5	17.1
August	8.9	34.2	7.7	29.6	8.9	34.0	5.7	22.0	11.7	44.9
September	11.1	42.5	5.3	20.3	5.1	19.4	-	-	-	-
October	3.2	12.3	2.3	8.9	3.2	12.3	3.0	11.4	5.1	19.7
November	40.6	155.7	26.6	101.9	42.9	164.3	48.3	184.9	42.5	162.6
December	1.2	4.7	0.6	2.1	2.3	8.9	0.9	3.3	2.3	8.9
Annual Mean	**7.8**	**29.8**	**5.2**	**19.9**	**7.9**	**30.2**	**7.5**	**28.7**	**10.2**	**38.9**

TOLUENE CONCENTRATIONS 2002

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HSBTEX2		HS BTEX3		HS BTEX4	
	Ppb	µg m3	Ppb	µg m3	ppb	µg m3	ppb	µg m3
January	5.0	19.2	3.5	13.4	8.2	31.3	5.7	22.0
February	1.4	5.2	0.9	3.6	1.3	4.9	1.3	5.0
March	3.8	14.6	2.6	10.1	2.9	11.0	2.2	8.5
April	2.9	11.2	2.6	10.0	4.2	16.0	3.8	14.6
May	1.6	6.3	1.3	4.9	-	-	1.8	7.1
June	1.4	5.3	1.2	4.5	1.6	6.2	1.9	7.3
July	1.6	6.1	1.0	4.0	2.1	8.2	1.9	7.3
August	-	-	5.6	21.3	7.1	27.1	10.9	41.7
September	3.1	11.8	1.3	4.8	2.5	9.7	-	-
October	3.4	13.1	4.7	18.0	5.7	21.6	3.9	14.8
November	3.4	12.9	3.4	13.1	5.4	20.7	2.9	10.9
December	-	-	-	-	-	-	-	-
Annual Mean	**2.8**	**10.6**	**2.6**	**9.8**	**4.1**	**15.7**	**3.6**	**13.9**

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3
January	3.8	14.4	6.9	26.5	3.9	15.1
February	1.1	4.3	1.0	3.7	3.0	11.5
March	4.2	16.0	-	-	2.0	7.7
April	2.3	9.0	4.2	16.0	2.2	8.4
May	1.2	4.7	4.3	16.6	1.1	4.3
June	0.9	3.6	3.9	14.8	1.3	5.1
July	0.9	3.4	4.5	17.4	1.2	4.5
August	7.2	27.7	14.3	54.7	6.1	23.3
September	2.8	10.7	2.4	9.4	2.6	9.9
October	3.7	14.1	5.7	21.9	4.9	18.7
November	3.6	13.7	7.0	26.9	3.0	11.4
December	-	-	-	-	-	-
Annual Mean	**2.9**	**11.1**	**5.4**	**20.8**	**2.8**	**10.9**

TOLUENE CONCENTRATIONS 2002

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2		Sheen RUT36		Hamp RUT35		Ted RUT7		Twick RUT32	
	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	4.6	17.7	4.7	17.9	6.1	23.5	6.4	24.6	8.8	33.5
February	2.0	7.7	3.5	13.3	2.6	9.9	3.7	14.1	2.7	10.2
March	3.0	11.6	5.8	22.2	3.5	13.6	7.4	28.4	3.9	14.8
April	5.5	21.2	5.5	21.2	7.7	29.4	4.9	18.7	5.6	21.4
May	21.7	83.1	100.5	385.0	13.4	51.5	18.8	71.9	163.9	627.9
June	2.2	8.5	4.1	15.7	2.5	9.5	8.4	32.1	4.1	15.7
July	3.0	11.7	4.1	15.7	-	-	14.7	56.1	3.2	12.3
August	6.8	26.2	15.7	60.1	5.7	21.7	19.5	74.7	9.8	37.4
September	6.6	25.4	6.8	26.0	4.4	16.8	16.8	64.2	6.2	23.6
October	6.0	22.8	7.2	27.6	3.8	14.7	11.7	44.9	5.8	22.1
November	-	-	21.6	82.7	20.5	78.7	47.7	182.7	31.6	121.2
December	15.1	57.7	10.5	40.4	16.7	63.9	10.4	39.9	13.5	51.6
Annual Mean	**7.0**	**26.7**	**15.8**	**60.7**	**7.9**	**30.3**	**14.2**	**54.4**	**26.1**	**82.7**

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1		Site 2		Site 3		Site 4		Site 5	
	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	4.6	17.7	2.6	9.8	4.7	17.8	4.4	17.0	4.5	17.3
February	-	-	0.8	3.0	0.6	2.3	0.6	2.5	-	-
March	1.9	7.3	1.1	4.3	1.5	5.8	1.3	4.8	1.2	4.7
April	2.4	9.1	1.8	6.8	6.4	24.7	2.5	9.6	1.8	6.9
May	13.5	51.8	8.0	30.6	10.2	39.2	11.0	42.2	12.1	46.5
June	-	-	0.7	2.7	0.7	2.6	2.7	10.4	2.3	8.9
July	1.9	7.4	0.7	2.6	1.1	4.2	1.3	4.9	1.2	4.5
August	5.8	22.2	11.4	43.5	3.9	14.9	6.0	23.1	5.0	19.2
September	3.6	13.9	1.9	7.3	2.2	8.5	2.0	7.6	2.6	10.0
October	2.5	9.6	1.2	4.7	1.8	6.7	1.8	7.1	2.1	7.9
November	6.7	25.5	6.0	23.0	4.4	17.0	5.4	20.6	6.2	23.9
December	2.4	9.2	1.3	5.1	1.3	4.8	N.D	N.D	0.5	2.1
Annual Mean	**4.5**	**17.4**	**3.1**	**12.0**	**3.2**	**12.4**	**3.6**	**13.6**	**3.6**	**13.8**

Appendix E

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

ETHYL BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1		BD2		BD3		BD4	
	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.1	4.7	1.1	4.8	0.8	3.4	0.6	2.5
February	0.1	0.5	0.1	0.5	0.2	0.7	0.1	0.6
March	0.3	1.2	0.6	2.6	0.4	1.8	0.3	1.5
April	0.6	2.7	0.5	2.2	0.5	2.1	0.4	1.6
May	0.2	0.9	-	-	0.3	1.2	0.3	1.3
June	0.1	0.4	0.3	1.4	0.3	1.4	0.1	0.6
July	0.2	0.9	0.3	1.2	0.4	1.6	0.1	0.5
August	0.3	1.2	0.2	1.0	0.4	1.9	0.2	0.9
September	-	-	-	-	-	-	-	-
October	0.5	2.2	0.6	2.5	0.7	3.2	0.3	1.4
November	0.6	2.7	0.5	2.1	0.5	2.1	0.4	1.7
December	0.3	1.2	0.2	0.9	0.4	2.0	0.2	0.8
Annual Mean	**0.3**	**1.5**	**0.4**	**1.7**	**0.4**	**1.8**	**0.3**	**1.1**

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01		KC02		KC03		KC04		KC05	
	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	Ppb	µg m^3
January	1.2	5.4	0.4	1.8	2.4	10.7	0.8	3.3	-	-
February	1.4	6.1	0.1	0.5	0.2	0.7	-	0.1	0.1	0.5
March	0.8	3.4	0.3	1.1	1.2	5.5	0.2	1.1	0.3	1.3
April	0.8	3.4	0.2	1.0	1.2	5.4	0.2	1.1	0.3	1.4
May	0.5	2.2	0.3	1.2	2.0	8.8	-	-	0.4	1.8
June	0.4	1.8	0.2	1.0	3.1	13.8	0.2	0.9	0.5	2.3
July	1.0	4.3	0.4	2.0	2.9	13.0	0.5	2.1	0.2	0.9
August	0.7	3.3	0.2	0.9	2.3	10.3	0.3	1.2	0.5	2.1
September	0.5	2.3	0.2	1.1	1.8	8.2	0.3	1.2	0.3	1.5
October	0.7	3.2	0.2	1.1	-	-	0.4	2.0	0.5	2.2
November	1.2	5.1	0.2	1.1	4.2	18.6	0.3	1.3	0.5	2.3
December	1.1	4.8	0.3	1.4	1.2	5.1	0.3	1.4	0.5	2.3
Annual Mean	**0.9**	**3.8**	**0.3**	**1.2**	**2.1**	**9.1**	**0.3**	**1.4**	**0.4**	**1.7**

ETHYL BENZENE CONCENTRATIONS 2002

CORPORATION OF LONDON

Month	Site Code CL1		CL2		CL3		CL4		CL5	
	Ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3
January	0.7	3.2	1.0	4.3	0.6	2.4	0.7	3.2	0.7	3.2
February	-	-	0.2	1.0	0.1	0.5	0.2	0.8	0.1	0.3
March	0.3	1.2	0.4	1.6	0.2	1.1	0.3	1.2	0.6	2.7
April	0.7	2.9	0.5	2.1	0.4	1.8	0.4	1.9	0.6	2.5
May	0.4	1.6	0.4	1.7	0.4	1.7	0.3	1.4	0.3	1.5
June	0.4	1.6	0.4	2.0	0.3	1.2	0.3	1.2	0.4	1.6
July	0.4	1.6	0.3	1.5	0.2	0.9	0.3	1.1	0.3	1.1
August	0.3	1.4	0.5	2.1	0.3	1.1	0.3	1.1	0.5	2.3
September	0.4	1.7	0.5	2.3	0.3	1.1	0.4	1.7	0.3	1.5
October	0.6	2.7	0.4	1.9	0.3	1.5	0.4	1.7	0.6	2.5
November	0.5	2.2	0.5	2.3	0.6	2.4	0.6	2.6	0.5	2.3
December	0.0	0.1	0.1	0.5	0.1	0.4	0.1	0.5	0.1	0.3
Annual Mean	**0.4**	**1.7**	**0.4**	**1.9**	**0.3**	**1.3**	**0.3**	**1.5**	**0.4**	**1.8**

Month	Site Code CL6		CL7		CL8		CL9		CL10	
	Ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3
January	-	-	0.6	2.4	0.6	2.7	1.4	6.0	1.3	5.9
February	0.1	0.4	1.6	7.3	1.5	6.8	0.1	0.3	-	-
March	0.3	1.3	0.3	1.2	0.6	2.6	0.5	2.2	-	-
April	0.4	1.9	0.4	1.9	-	-	0.5	2.2	1.2	5.1
May	0.4	1.6	0.3	1.4	0.5	2.2	0.5	2.2	0.9	4.0
June	0.7	3.0	0.2	1.0	-	-	0.4	1.8	0.6	2.7
July	0.4	1.7	0.6	2.8	0.3	1.4	-	-	0.6	2.6
August	0.7	3.0	0.3	1.4	0.3	1.4	0.2	0.9	0.6	2.8
September	1.3	5.5	0.4	1.7	0.4	1.7	-	-	-	-
October	0.6	2.8	0.3	1.5	0.5	2.1	0.4	2.0	0.7	3.1
November	0.6	2.7	0.5	2.1	0.6	2.8	0.7	2.9	1.1	5.0
December	0.1	0.4	0.1	0.2	0.1	0.4	0.1	0.3	0.2	1.0
Annual Mean	**0.5**	**2.2**	**0.5**	**2.1**	**0.5**	**2.4**	**0.4**	**1.9**	**0.8**	**3.6**

ETHYL BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HSBTEX2		HS BTEX3		HS BTEX4	
	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	0.9	3.8	0.6	2.4	1.4	6.1	0.9	4.0
February	0.1	0.4	-	0.1	0.1	0.4	0.1	0.4
March	0.5	2.4	0.4	1.7	0.5	2.1	0.4	1.6
April	0.5	2.4	0.4	1.8	0.6	2.5	0.5	2.2
May	0.3	1.2	0.2	0.8	-	-	0.3	1.3
June	0.3	1.1	0.2	1.0	0.3	1.3	0.4	1.6
July	0.2	0.9	0.2	0.7	0.3	1.4	0.3	1.3
August	-	-	0.2	0.8	0.4	1.7	0.5	2.3
September	0.4	1.8	0.2	0.7	0.3	1.4	-	-
October	0.3	1.5	0.3	1.4	0.7	3.0	0.4	1.8
November	0.3	1.4	0.2	0.9	0.7	2.9	0.2	0.9
December	-	-	-	-	-	-	-	-
Annual Mean	**0.4**	**1.7**	**0.3**	**1.1**	**0.5**	**2.3**	**0.4**	**1.7**

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	0.6	2.8	1.2	5.5	0.7	3.0
February	0.1	0.4	0.1	0.5	0.4	1.6
March	0.7	3.0	-	-	0.4	1.6
April	0.4	1.7	0.6	2.8	0.4	1.7
May	0.2	0.9	0.7	3.2	0.2	0.8
June	0.2	1.0	0.6	2.7	0.3	1.1
July	0.1	0.6	0.6	2.7	0.2	0.8
August	0.3	1.1	0.8	3.4	0.3	1.2
September	0.3	1.4	0.5	2.0	0.3	1.3
October	0.4	1.8	0.5	2.1	1.7	7.3
November	0.4	1.6	0.7	3.2	0.3	1.3
December	-	-	-	-	-	-
Annual Mean	**0.3**	**1.5**	**0.6**	**2.8**	**0.4**	**2.0**

ETHYL BENZENE CONCENTRATIONS 2002

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2		Sheen RUT36		Hamp RUT35		Ted RUT7		Twick RUT32	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	0.7	3.0	0.7	3.2	1.4	6.0	0.8	3.5	1.7	7.3
February	0.2	1.0	0.4	1.8	0.4	1.8	0.3	1.4	0.4	1.6
March	0.5	2.3	0.9	3.9	0.6	2.8	0.9	3.8	0.7	3.2
April	0.9	4.2	0.7	3.0	1.0	4.6	0.7	3.0	0.9	3.8
May	1.6	6.9	1.2	5.3	0.4	2.0	0.9	4.0	1.9	8.4
June	0.4	1.8	0.6	2.8	0.5	2.4	0.6	2.8	0.9	3.9
July	0.4	1.9	0.5	2.2	-	-	0.7	3.3	0.4	1.9
August	0.4	1.8	0.6	2.7	0.4	1.8	0.6	2.7	1.0	4.3
September	0.9	4.0	0.7	3.3	0.5	2.0	0.8	3.4	0.7	3.3
October	0.9	4.0	0.9	3.9	0.6	2.7	1.2	5.2	0.8	3.5
November	-	-	1.7	7.5	0.6	2.6	0.9	4.1	1.2	5.2
December	0.4	1.7	0.7	3.1	1.1	4.8	1.2	5.5	1.2	5.3
Annual Mean	**0.6**	**3.0**	**0.7**	**3.5**	**0.6**	**3.0**	**0.7**	**3.6**	**0.9**	**4.3**

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1		Site 2		Site 3		Site 4		Site 5	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	0.9	3.8	0.4	1.6	0.6	2.5	0.7	2.9	0.6	2.6
February	-	-	-	-	-	-	-	-	-	-
March	0.2	1.0	0.2	0.9	0.3	1.3	0.3	1.2	0.2	1.0
April	0.4	1.6	0.2	1.0	0.4	1.9	0.4	1.9	0.3	1.3
May	0.3	1.5	0.2	1.1	0.3	1.2	0.3	1.5	0.3	1.2
June	-	-	0.1	0.5	0.1	0.5	0.2	1.1	0.2	0.9
July	0.3	1.3	0.1	0.5	0.2	0.7	0.2	0.9	0.2	0.8
August	0.3	1.3	0.2	1.0	0.2	0.9	0.1	0.6	0.1	0.5
September	0.5	2.1	0.2	0.9	0.2	1.1	0.2	1.0	0.3	1.5
October	0.4	1.7	0.2	0.9	0.3	1.3	0.3	1.3	0.3	1.5
November	0.5	2.1	0.3	1.3	0.2	1.1	0.2	1.1	0.3	1.2
December	0.2	1.0	0.2	0.9	0.2	0.7	N.D	N.D	N.D	N.D
Annual Mean	**0.4**	**1.7**	**0.2**	**0.9**	**0.3**	**1.1**	**0.3**	**1.2**	**0.3**	**1.2**

Appendix F

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

M, P-XYLENE CONCENTRATIONS 2002

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1		BD2		BD3		BD4	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	2.4	10.7	2.6	11.4	1.6	6.9	1.1	5.0
February	0.5	2.3	0.5	2.0	0.5	2.0	0.2	0.9
March	0.8	3.7	2.0	8.7	1.1	5.0	1.1	4.6
April	0.8	3.7	1.1	4.8	1.0	4.4	0.7	3.1
May	0.3	1.2	-	-	0.5	2.3	0.7	3.0
June	0.2	0.9	0.9	4.2	0.9	4.2	0.3	1.5
July	0.5	2.2	0.8	3.6	0.9	4.0	0.3	1.1
August	0.9	4.0	0.7	2.9	1.3	5.8	0.6	2.5
September	-	-	-	-	-	-	-	-
October	1.5	6.6	1.7	7.5	2.0	8.9	0.8	3.7
November	2.0	8.6	1.4	6.4	1.4	6.0	1.1	5.0
December	0.7	3.3	0.6	2.6	1.3	5.6	0.4	2.0
Annual Mean	**0.9**	**3.9**	**1.1**	**4.9**	**1.0**	**4.6**	**0.6**	**2.7**

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01		KC02		KC03		KC04		KC05	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.1	5.0	0.4	1.7	2.4	10.7	0.6	2.8	-	-
February	4.1	18.3	0.5	2.3	0.7	3.2	0.3	1.2	0.6	2.7
March	3.1	13.8	0.7	3.1	5.6	24.9	0.7	3.1	0.8	3.5
April	2.4	10.7	0.4	1.9	4.0	17.4	0.5	2.3	0.9	3.8
May	1.4	6.2	0.6	2.6	6.6	29.2	-	-	1.1	4.9
June	1.2	5.4	0.6	2.6	10.9	47.9	0.5	2.1	1.6	7.2
July	3.1	13.9	1.3	5.7	10.3	45.2	1.4	6.1	0.5	2.3
August	2.3	10.0	0.5	2.2	7.9	34.9	0.6	2.9	1.5	6.5
September	1.6	7.1	0.6	2.6	6.5	28.5	0.8	3.4	0.9	4.1
October	2.3	10.2	0.7	3.2	-	-	1.3	5.7	1.4	6.4
November	3.4	15.0	0.6	2.5	14.4	63.4	0.9	4.1	1.7	7.6
December	3.4	14.9	0.9	3.9	4.0	17.5	1.1	4.7	1.7	7.3
Annual Mean	**2.6**	**11.6**	**0.7**	**3.1**	**7.0**	**30.7**	**0.9**	**3.9**	**1.2**	**5.1**

M, P-XYLENE CONCENTRATIONS 2002

CORPORATION OF LONDON

Month	Site Code CL1		CL2		CL3		CL4		CL5	
	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3
January	1.6	7.0	2.0	8.7	1.3	5.6	1.6	7.3	1.6	7.0
February	0.3	1.5	0.9	3.9	0.5	2.2	0.9	3.9	0.4	1.7
March	0.7	2.9	0.8	3.7	0.5	2.0	0.6	2.6	2.0	8.8
April	1.4	6.2	1.1	5.0	0.9	3.9	1.0	4.3	1.3	5.7
May	0.9	3.9	1.1	4.7	1.1	4.8	0.8	3.4	0.8	3.4
June	1.1	4.9	1.3	5.7	0.7	3.2	0.8	3.7	1.1	4.8
July	1.2	5.3	1.0	4.3	0.5	2.3	0.7	2.9	0.8	3.3
August	0.9	4.1	1.4	6.2	0.8	3.3	0.7	3.2	1.5	6.6
September	1.3	5.9	1.7	7.3	0.7	3.0	1.1	4.9	0.9	4.0
October	1.9	8.4	1.2	5.2	1.0	4.4	1.3	5.6	1.6	7.0
November	1.5	6.8	1.6	7.3	1.7	7.7	2.0	8.8	1.6	7.1
December	0.1	0.4	0.4	1.6	0.3	1.2	0.3	1.4	0.2	0.8
Annual Mean	**1.1**	**4.8**	**1.2**	**5.3**	**0.8**	**3.6**	**1.0**	**4.3**	**1.1**	**5.0**

Month	Site Code CL6		CL7		CL8		CL9		CL10	
	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3
January	-	-	1.3	5.8	1.4	6.2	3.2	14.0	3.3	14.6
February	0.5	2.3	1.5	6.6	1.4	6.3	0.5	2.2	-	-
March	-	-	-	-	1.9	8.6	1.4	6.2	-	-
April	1.1	4.9	1.0	4.2	-	-	1.0	4.3	3.3	14.7
May	1.1	4.6	0.8	3.5	1.4	6.4	1.5	6.5	2.8	12.2
June	2.6	11.5	0.7	2.9	-	-	1.4	6.3	2.0	8.8
July	1.3	5.7	2.1	9.3	0.9	4.0	1.9	8.3	2.0	8.8
August	2.7	12.1	1.0	4.2	0.9	3.9	0.6	2.5	2.0	8.9
September	4.7	20.5	1.1	4.8	1.1	4.9	-	-	-	-
October	1.9	8.2	0.9	4.1	1.4	6.2	1.2	5.4	2.1	9.5
November	2.0	8.6	1.4	6.3	2.0	8.6	2.1	9.3	3.3	14.5
December	0.3	1.5	0.2	0.7	0.3	1.4	0.2	0.8	0.7	3.2
Annual Mean	**1.8**	**8.0**	**1.1**	**4.8**	**1.3**	**5.7**	**1.4**	**6.0**	**2.4**	**10.6**

M, P-XYLENE CONCENTRATIONS 2002

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HSBTEX2		HS BTEX3		HS BTEX4	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	2.3	9.9	1.2	5.4	3.1	13.6	2.3	10.0
February	0.4	1.8	0.2	0.7	0.3	1.5	0.4	1.7
March	0.9	4.1	0.7	3.0	1.2	5.1	0.8	3.5
April	1.0	4.3	0.7	3.2	1.4	6.2	1.3	5.9
May	0.8	3.6	0.5	2.2	-	-	0.9	3.9
June	0.7	3.0	0.5	2.2	0.8	3.4	1.0	4.2
July	0.6	2.8	0.4	1.7	0.9	4.2	0.8	3.7
August	-	-	0.6	2.8	1.3	5.5	1.5	6.8
September	1.2	5.2	0.4	1.7	0.9	4.0	-	-
October	1.1	4.8	0.9	4.0	1.9	8.6	1.2	5.2
November	1.0	4.3	0.6	2.6	2.0	9.0	0.6	2.6
December	-	-	-	-	-	-	-	-
Annual Mean	**1.0**	**4.4**	**0.6**	**2.7**	**1.4**	**6.1**	**1.1**	**4.8**

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.5	6.7	3.2	14.1	1.6	6.9
February	0.3	1.3	0.2	1.0	1.3	5.5
March	1.9	8.6	-	-	0.8	3.5
April	0.8	3.3	1.6	7.3	0.7	3.1
May	0.5	2.4	2.4	10.6	0.5	2.1
June	0.5	2.0	2.0	8.9	0.6	2.8
July	0.3	1.5	2.1	9.1	0.5	2.3
August	0.8	3.4	2.6	11.5	0.9	3.8
September	0.9	4.1	1.3	5.9	0.9	3.8
October	1.2	5.1	1.6	7.1	2.2	9.9
November	1.1	5.0	2.3	10.1	0.9	3.8
December	-	-	-	-	-	-
Annual Mean	**0.9**	**3.9**	**1.9**	**8.6**	**1.0**	**4.3**

M, P-XYLENE CONCENTRATIONS 2002

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2		Sheen RUT36		Hamp RUT35		Ted RUT7		Twick RUT32	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	1.6	7.3	1.7	7.4	2.8	12.3	1.8	7.8	3.9	17.4
February	0.9	3.9	1.3	5.9	1.2	5.3	0.9	4.2	1.2	5.3
March	1.5	6.7	2.5	11.2	1.6	7.3	2.4	10.4	1.9	8.3
April	2.3	10.2	1.7	7.3	2.8	12.2	1.5	6.5	2.3	10.3
May	1.6	6.9	2.6	11.4	1.1	5.0	2.7	11.8	3.8	16.8
June	1.3	5.6	2.0	8.8	1.7	7.5	1.9	8.5	2.7	12.0
July	1.4	6.3	1.6	7.3	-	-	2.4	10.5	1.5	6.5
August	1.3	5.6	2.0	8.9	1.3	5.8	2.0	8.8	3.2	13.9
September	2.9	12.7	2.4	10.4	1.5	6.5	2.4	10.6	2.3	10.3
October	2.7	11.8	2.8	12.5	1.7	7.6	3.7	16.1	2.7	12.0
November	-	-	4.9	21.8	2.0	8.6	2.7	12.0	3.2	14.2
December	1.3	5.7	2.2	9.9	3.5	15.5	3.1	13.6	4.0	17.8
Annual Mean	**1.7**	**7.5**	**2.3**	**10.2**	**1.9**	**8.5**	**2.3**	**10.1**	**2.7**	**12.1**

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1		Site 2		Site 3		Site 4		Site 5	
	Ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3	ppb	µg m^3
January	2.2	9.7	0.8	3.4	1.4	6.0	1.5	6.6	1.4	6.3
February	-	-	0.1	0.5	0.1	0.5	0.2	0.7	-	-
March	0.4	1.6	0.4	1.6	0.6	2.7	-	-	0.4	1.9
April	0.9	3.9	0.3	1.2	0.9	3.9	0.9	4.1	0.4	1.9
May	0.7	3.3	0.5	2.0	0.6	2.6	0.7	3.1	0.5	2.3
June	-	-	0.3	1.1	0.2	1.0	0.5	2.4	0.4	1.9
July	0.9	3.9	0.2	0.8	0.4	1.7	0.5	2.2	0.5	2.4
August	0.9	3.9	0.5	2.3	0.6	2.7	0.4	1.8	0.3	1.5
September	1.4	6.0	0.5	2.3	0.6	2.8	0.6	2.5	0.9	4.1
October	1.1	5.0	0.5	2.2	0.9	3.8	0.8	3.5	0.9	4.1
November	1.5	6.7	0.8	3.6	0.6	2.6	0.6	2.7	0.7	3.2
December	0.7	3.2	0.6	2.6	0.5	2.3	0.1	0.3	N.D	N.D
Annual Mean	**1.1**	**4.7**	**0.4**	**2.0**	**0.6**	**2.7**	**0.6**	**2.7**	**0.7**	**3.0**

Appendix G

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

O-XYLENE CONCENTRATIONS 2002

LONDON BOROUGH OF BARKING AND DAGENHAM

Month	Site Code BD1		BD2		BD3		BD4	
	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3
January	0.9	4.0	1.0	4.3	0.6	2.6	0.4	1.9
February	0.2	0.7	0.2	0.7	0.2	0.7	0.1	0.3
March	0.3	1.1	0.5	2.3	0.3	1.2	0.3	1.1
April	0.3	1.3	0.4	1.6	0.4	1.6	0.2	1.0
May	0.1	0.6	-	-	0.2	0.9	0.3	1.1
June	0.1	0.3	0.3	1.4	0.3	1.5	0.1	0.5
July	0.2	0.8	0.3	1.2	0.3	1.4	0.1	0.4
August	0.3	1.4	0.2	1.0	0.5	2.0	0.2	0.9
September	-	-	-	-	-	-	-	-
October	0.6	2.5	0.6	2.7	0.7	3.2	0.3	1.4
November	0.6	2.8	0.5	2.1	0.5	2.0	0.4	1.7
December	0.3	1.2	0.2	1.0	0.4	1.9	0.2	0.7
Annual Mean	**0.3**	**1.4**	**0.4**	**1.7**	**0.4**	**1.6**	**0.2**	**0.9**

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

Month	Site Code KC01		KC02		KC03		KC04		KC05	
	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	Ppb	μg m^3
January	1.1	5.0	0.4	1.7	2.4	10.7	0.6	2.8	-	-
February	1.7	7.4	0.2	0.7	0.3	1.1	0.1	0.3	0.2	1.0
March	0.8	3.5	0.2	1.0	1.4	6.2	0.3	1.2	0.2	0.9
April	0.8	3.7	0.2	0.8	1.4	6.1	0.2	0.9	0.3	1.4
May	0.5	2.2	0.2	0.9	2.4	10.5	-	-	0.4	1.7
June	0.5	2.0	0.2	1.0	3.9	17.1	0.2	0.7	0.6	2.6
July	1.2	5.3	0.5	2.0	3.7	16.3	0.5	2.1	0.2	0.8
August	0.8	3.6	0.2	0.8	2.7	11.9	0.2	1.1	0.5	2.3
September	0.6	2.6	0.2	1.0	2.3	10.3	0.3	1.3	0.3	1.4
October	0.8	3.6	0.3	1.2	-	-	0.5	2.0	0.5	2.2
November	1.1	5.0	0.2	0.9	4.7	20.7	0.3	1.4	0.6	2.5
December	1.2	5.4	0.3	1.4	1.3	5.7	0.4	1.7	0.5	2.4
Annual Mean	**0.9**	**4.1**	**0.3**	**1.1**	**2.4**	**10.6**	**0.3**	**1.4**	**0.4**	**1.8**

O-XYLENE CONCENTRATIONS 2002

CORPORATION OF LONDON

Month	Site Code CL1		CL2		CL3		CL4		CL5	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	0.6	2.7	0.9	3.9	0.5	2.2	0.7	3.0	0.7	3.0
February	0.1	0.4	0.3	1.3	0.2	0.7	0.3	1.3	0.1	0.4
March	0.2	1.0	0.3	1.3	0.2	0.9	0.2	0.9	0.5	2.3
April	0.5	2.3	-	0.1	0.3	1.1	0.3	1.4	0.4	1.8
May	0.3	1.4	0.4	1.7	0.3	1.5	0.3	1.1	0.3	1.1
June	0.4	1.8	0.5	2.1	0.2	1.1	0.3	1.3	0.4	1.8
July	0.4	1.7	0.3	1.5	0.2	0.8	0.2	0.9	0.3	1.1
August	0.3	1.3	0.5	2.1	0.2	1.0	0.2	1.0	0.5	2.2
September	0.5	2.0	0.6	2.6	0.3	1.1	0.4	1.8	0.3	1.5
October	0.6	2.8	0.4	1.8	0.3	1.5	0.4	1.9	0.6	2.5
November	0.5	2.0	0.5	2.3	0.5	2.3	0.6	2.6	0.5	2.2
December	0.0	0.1	0.1	0.5	0.1	0.4	0.1	0.4	0.1	0.3
Annual Mean	**0.4**	**1.6**	**0.4**	**1.8**	**0.3**	**1.2**	**0.3**	**1.5**	**0.4**	**1.7**

Month	Site Code CL6		CL7		CL8		CL9		CL10	
	Ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3	ppb	µg m3
January	-	-	0.6	2.4	0.6	2.4	1.2	5.3	1.3	5.9
February	0.2	0.7	1.7	7.3	1.6	6.9	0.1	0.6	-	-
March	0.2	1.0	0.2	6.9	0.5	2.2	0.5	2.0	-	-
April	0.4	1.7	0.5	2.0	-	-	0.4	1.6	1.2	5.1
May	0.3	1.5	0.3	1.2	0.5	2.2	0.5	2.2	1.0	4.4
June	0.8	3.7	0.2	1.1	-	-	0.4	1.8	0.7	3.2
July	0.4	1.7	0.7	3.2	0.3	1.4	0.5	2.3	0.7	3.2
August	0.6	2.6	0.3	1.3	0.3	1.3	0.2	0.8	0.7	3.1
September	1.4	6.2	0.4	1.8	0.4	1.8	-	-	-	-
October	0.5	2.1	0.3	1.4	0.5	2.1	0.4	1.9	0.8	3.4
November	0.5	2.2	0.5	2.0	0.7	3.0	0.6	2.7	1.1	4.8
December	0.1	0.4	0.1	0.2	0.1	0.5	0.1	0.3	0.2	1.1
Annual Mean	**0.5**	**2.2**	**0.5**	**2.1**	**0.5**	**2.4**	**0.4**	**1.9**	**0.8**	**3.4**

O-XYLENE CONCENTRATIONS 2002

LONDON BOROUGH OF HOUNSLOW

Month	Site Code HS BTEX1		HSBTEX2		HS BTEX3		HS BTEX4	
	ppb	μg m3	Ppb	μg m3	ppb	μg m3	ppb	μg m3
January	0.8	3.7	0.5	2.0	1.2	5.4	0.8	3.7
February	0.2	0.7	0.1	0.2	0.1	0.6	0.1	0.6
March	0.4	1.7	0.2	1.1	0.4	1.7	1.7	7.6
April	0.4	1.6	0.3	1.1	0.5	2.3	0.5	2.0
May	0.3	1.4	0.2	0.8	-	-	0.3	1.4
June	0.2	1.0	0.2	0.8	0.3	1.3	0.4	1.6
July	0.2	1.0	0.1	0.6	0.3	1.5	0.3	1.3
August	-	-	0.2	0.9	0.4	2.0	0.5	2.4
September	0.4	1.9	0.2	0.7	0.4	1.5	-	-
October	0.4	1.7	0.3	1.4	0.7	2.9	0.4	1.8
November	0.3	1.5	0.2	0.9	0.7	3.2	0.2	1.0
December	-	-	-	-	-	-	-	-
Annual Mean	**0.4**	**1.6**	**0.2**	**1.0**	**0.5**	**2.2**	**0.5**	**2.3**

Month	Site Code HS BTEX5		HS BTEX6		HS BTEX7	
	ppb	μg m3	Ppb	μg m3	ppb	μg m3
January	0.6	2.6	1.3	5.8	0.6	2.8
February	0.1	0.4	0.1	0.4	0.5	2.2
March	0.6	2.6	-	-	0.2	1.0
April	0.3	1.2	0.6	2.4	0.2	1.0
May	0.2	0.9	0.9	3.9	0.2	0.8
June	0.2	0.8	0.7	3.3	0.2	1.0
July	0.1	0.5	0.7	3.3	0.2	0.8
August	0.3	1.3	0.9	4.1	0.3	1.3
September	0.4	1.6	0.5	2.1	0.3	1.4
October	0.4	1.8	0.6	2.4	0.8	3.5
November	0.4	1.8	0.8	3.6	0.3	1.4
December	-	-	-	-	-	-
Annual Mean	**0.3**	**1.4**	**0.7**	**3.1**	**0.4**	**1.6**

O-XYLENE CONCENTRATIONS 2002

LONDON BOROUGH OF RICHMOND

Month	Site Code RUT 2		Sheen RUT36		Hamp RUT35		Ted RUT7		Twick RUT32	
	Ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3
January	0.6	2.8	0.7	3.1	1.1	5.0	0.7	3.1	1.6	7.1
February	0.3	1.4	0.5	2.0	0.5	2.2	0.4	1.6	0.5	2.3
March	0.5	2.1	0.8	3.4	0.5	2.1	0.8	3.3	0.7	2.9
April	0.8	3.6	0.6	2.6	0.9	4.1	0.5	2.3	0.8	3.6
May	0.6	2.4	1.0	4.3	0.4	1.8	1.0	4.4	1.4	6.4
June	0.4	1.7	0.7	2.9	0.5	2.2	0.6	2.6	0.8	3.6
July	0.5	2.2	0.6	2.6	-	-	0.8	3.6	0.5	2.3
August	0.4	1.9	0.7	3.3	0.5	2.1	0.7	3.1	1.1	5.0
September	1.1	4.7	0.9	4.0	0.5	2.3	0.9	4.1	0.9	3.9
October	1.0	4.4	1.0	4.5	0.6	2.8	1.4	6.0	1.0	4.6
November	-	-	1.7	7.4	0.7	2.9	0.9	4.0	1.1	5.0
December	0.4	2.0	0.7	3.3	1.2	5.2	1.0	4.5	1.3	5.9
Annual Mean	**0.6**	**2.7**	**0.8**	**3.6**	**0.7**	**3.0**	**0.8**	**3.5**	**1.0**	**4.4**

LONDON BOROUGH OF SUTTON

Month	Site Code Site 1		Site 2		Site 3		Site 4		Site 5	
	Ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3	ppb	μg m^3
January	0.9	4.0	0.3	1.4	0.6	2.7	0.7	3.0	0.7	2.9
February	-	-	-	-	-	-	-	0.1	-	-
March	0.2	0.7	-	-	0.2	0.8	0.2	0.7	0.2	0.8
April	0.3	1.2	0.1	0.5	0.3	1.3	0.4	1.6	0.2	0.7
May	0.3	1.3	0.2	0.9	0.2	1.0	0.3	1.2	0.2	0.9
June	-	-	0.1	0.4	0.1	0.4	0.2	1.0	0.2	0.8
July	0.3	1.4	0.1	0.3	0.2	0.7	0.2	0.8	0.2	0.9
August	0.3	1.4	0.2	0.8	0.2	0.9	0.2	0.7	0.1	0.6
September	0.5	2.2	0.2	0.9	0.3	1.1	0.2	1.0	0.4	1.6
October	0.4	1.9	0.2	0.9	0.3	1.5	0.3	1.3	0.4	1.6
November	0.5	2.3	0.3	1.3	0.2	0.9	0.2	1.0	0.3	1.1
December	0.3	1.1	0.2	1.0	0.2	0.9	0.1	0.2	0.0	0.1
Annual Mean	**0.4**	**1.8**	**0.2**	**0.8**	**0.2**	**1.0**	**0.2**	**1.0**	**0.2**	**1.1**

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 Ratio
Barking	BD1	Roadside	0.7	3.3	1:5
	BD2	Roadside	0.8	3.0	1:4
	BD3	Background	0.7	4.4	1:6
	BD4	Background	0.6	3.5	1:5
Kensington	KC01	Roadside	1.5	9.5	1:6
	KC02	Background	0.6	5.8	1:10
	KC03	Roadside/PS	3.8	22.6	1:6
	KC04	Background	0.7	5.8	1:8
	KC05	Roadside	0.8	6.6	1:8
Sutton	1	Roadside	0.9	4.5	1:5
	2	Background	0.6	3.1	1:5
	3	Background	0.6	3.2	1:5
	4	Roadside	0.6	3.2	1:5
	5	Background	0.6	3.6	1:6
Hounslow	BTEX 1	Roadside	0.8	2.8	1:4
	BTEX 2	Roadside	0.6	2.6	1:4
	BTEX 3	Roadside	1.0	4.1	1:4
	BTEX 4	Roadside	0.8	3.6	1:5
	BTEX 5	Background	0.7	2.9	1:4
	BTEX 6	Roadside	1.2	5.4	1:5
	BTEX 7	Roadside	0.7	2.8	1:4
Corporation of	CL1	Roadside	0.7	6.1	1:9
London	CL2	Roadside	0.8	6.3	1:8
	CL3	Background	0.6	5.7	1:10
	CL4	Roadside	0.7	5.3	1:8
	CL5	Background	0.8	6.1	1:8
	CL6	Background	0.6	7.8	1:13
	CL7	Background	0.8	5.2	1:7
	CL8	Roadside	1.0	7.9	1:8
	CL9	Background	0.8	7.5	1:9
	CL10	Roadside	1.4	10.2	1:7
Richmond	RUT 2	Roadside	1.4	7.0	1:5
	RUT36	Roadside	1.9	15.8	1:8
	RUT35	Roadside	1.4	7.9	1:6
	RUT7	Roadside	1.4	14.2	1:10
	RUT32	Roadside	1.8	21.6	1:12

Note: Above ratio are approximated values, calculated using available data which may not be representative of a full year. However, these give a good indication of ratio between the two compounds.

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		Ethylbenzene	Ethylbenzene		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-02	BD 443	04/01/2002	12:33	18/01/2002	13:45	71	2.5	8.2	272	8.7	33.4	51	1.4	6.2	143	3.7	16.2	57	1.4	6.3
	BD 444	04/01/2002	12:33	18/01/2002	13:45	51	1.8	5.9	232	7.4	28.5	53	1.5	6.4	143	3.7	16.2	56	1.4	6.2
Mar-02	BD 739	01/03/2002	12:30	14/03/2002	13:20	24	0.9	3.0	82	2.8	10.9	16	0.5	2.1	45	1.2	5.5	16	0.4	1.9
	BD 740	01/03/2002	12:30	14/03/2002	13:20	32	1.2	4.0	110	3.8	14.6	19	0.6	2.5	56	1.5	6.8	21	0.6	2.5
Apr-02	BD 876	04/04/2002	14:15	18/04/2002	14:30	52	1.9	6.0	130	4.2	16.0	24	0.7	3.2	69	1.8	7.8	24	0.6	2.7
	BD 877	04/04/2002	14:15	18/04/2002	14:30	44	1.6	5.1	110	3.5	13.6	22	0.6	2.7	51	1.3	5.8	18	0.5	2.0
Jun-02	BE 369	07/06/2002	13:55	28/06/2002	15:45	34	0.8	2.6	177	3.8	14.5	35	0.6	2.8	126	2.2	9.5	46	0.8	3.4
	BE 370	07/06/2002	13:55	28/06/2002	15:45	46	1.1	3.5	255	5.5	20.9	50	0.9	4.0	179	3.1	13.5	65	1.1	4.8
Aug-02	BE 445	08/08/2002	14:15	22/08/2002	13:00	25	0.9	2.9	296	9.6	36.7	19	0.5	2.3	69	1.8	7.8	24	0.6	2.7
	BE 446	08/08/2002	14:15	22/08/2002	13:00	29	1.0	3.4	322	10.4	39.9	23	0.6	2.8	83	2.1	9.4	28	0.7	3.1
Sep-02	BE 595	05/09/2002	14:40	24/09/2002	16:00	27	0.7	2.3	153	3.6	13.9	24	0.5	2.1	78	1.5	6.5	28	0.5	2.3
	BE 596	05/09/2002	14:40	24/09/2002	16:00	32	0.8	2.7	173	4.1	15.7	27	0.5	2.4	87	1.6	7.2	31	0.6	2.5
Oct-02	BE 725	01/10/2002	13:55	11/10/2002	13:50	26	1.3	4.2	117	5.3	20.2	20	0.8	3.4	69	2.5	11.0	24	0.8	3.7
	BE 726	01/10/2002	13:55	11/10/2002	13:50	32	1.6	5.2	148	6.7	25.6	26	1.0	4.4	91	3.3	14.4	32	1.1	5.0
Nov-02	BE 860	04/11/2002	15:35	06/12/2002	14:30	108	1.7	5.5	610	8.6	33.0	98	1.2	5.2	336	3.8	16.7	125	1.4	6.1
	BE 861	04/11/2002	15:35	06/12/2002	14:30	89	1.4	4.5	531	7.5	28.7	70	0.8	3.7	239	2.7	11.9	88	1.0	4.3
Dec-02	BE 996	06/12/2002	15:00	20/12/2002	13:50	39	1.4	4.5	259	8.4	32.1	34	0.4	1.7	50	1.3	5.7	37	0.4	1.9
	BE 997	06/12/2002	15:00	20/12/2002	13:50	62	2.2	7.2	386	12.5	47.8	25	0.7	3.0	91	2.3	10.4	31	0.8	3.5
Average								4.5			24.8			3.4			10.1			3.6