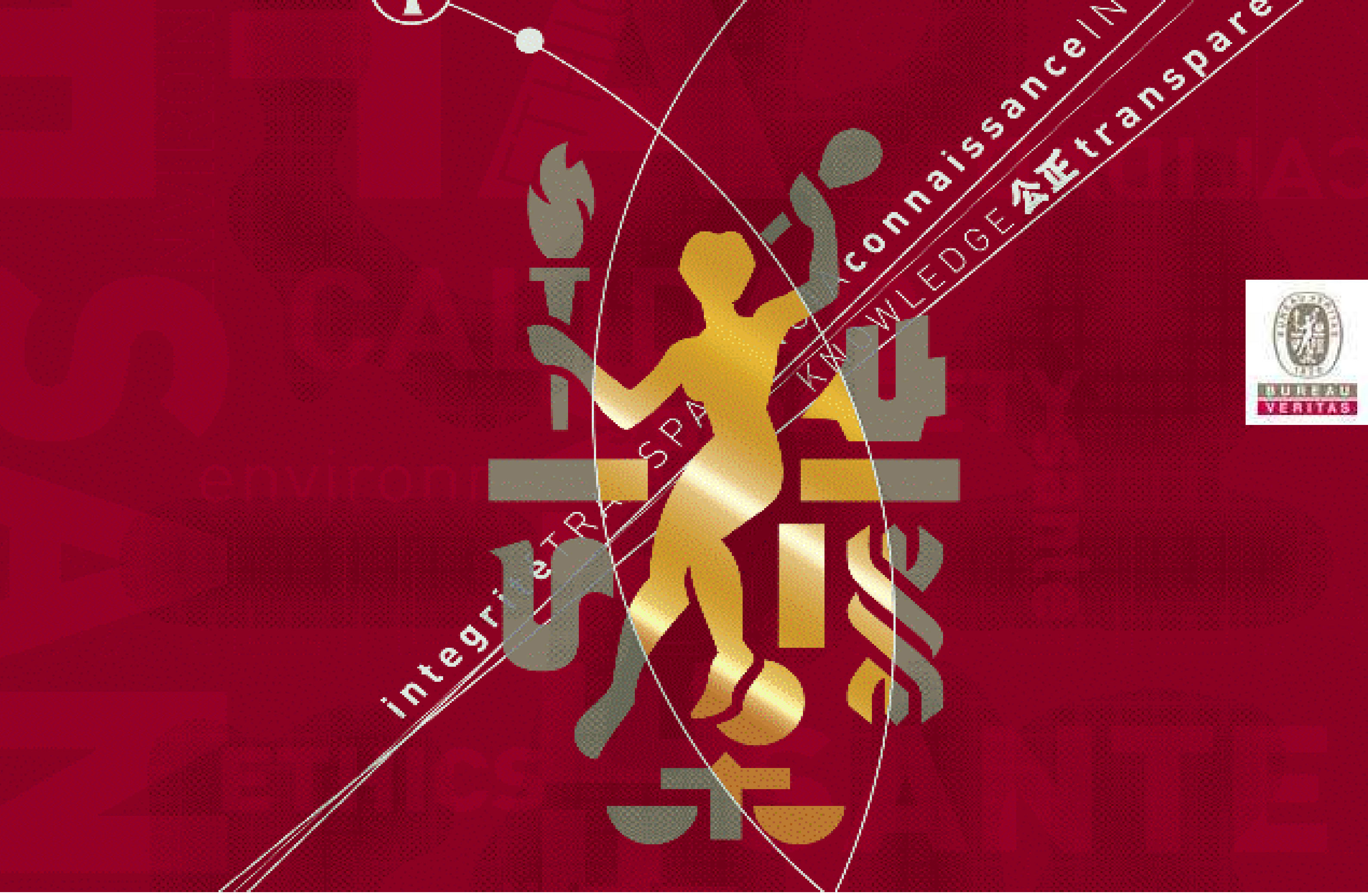

The London Wide Environment Programme

Benzene Diffusion Tube Survey Annual Report 2007

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For the benefit of business and people

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Benzene Diffusion Tube Survey 2007

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Report

London Wide Benzene Diffusion Tube Survey Annual Report 2007

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Prepared for

London Borough of Bexley
London Borough of Brent
London Borough of Greenwich
London Borough of Hackney
London Borough of Harrow
London Borough of Hillingdon
London Borough of Hounslow
Royal Borough of Kensington and Chelsea
City of London
London Borough of Newham
London Borough of Richmond
London Borough of Sutton

16th March 2009

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Executive Summary

This report presents the results of the 2007 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 2007 programme participating boroughs maintained eighty three sites across London. These sites included urban background locations, thus allowing the levels of benzene to which the general public are exposed for significant periods of time to be quantified. Monitoring sites also included roadside and petrol station locations, as motor vehicles are the major source of atmospheric benzene, with significant evaporative emissions resulting from the handling, distribution and storage of petrol. Toluene, ethyl benzene, m, p-xylene and o-xylene were also monitored at thirty-eight 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 a petrol station location. Annual mean benzene concentrations ranged from 1.2μg m^{-3} to 3.3μg m^{-3} at roadside locations, 1.3μg m^{-3} to 2.2μg m^{-3} at background locations and 1.7μg m^{-3} to 3.2μg m^{-3} at petrol stations. The annual mean benzene concentrations for the three different location types were 2.1μg m^{-3}, 1.6μg m^{-3} and 2.5μg 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 the sampler (SSE, 1997). This partially explains why there appeared to be little influence of road traffic benzene levels in some boroughs.

Benzene levels recorded in this study were compared against the National Air Quality Objective and the Air Quality Standard *(AQS)* for benzene set by the Expert Panel on Air Quality Standards. The objective and the 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 comparisons with such criteria give a good indication of likely exceedences, 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[1].

In 2007 annual mean concentrations at all sites were below the Standard and Objective of 16.25µg m^{-3} and the future long term objective of 5µg m^{-3} to be met by the end of 2010. This supports 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 considerably to reduce benzene concentrations and keep levels below the AQS long-term objective concentration of 5µg/m^{-3}.

[1] Department of the Environment (2000), LAQM.TEG 4 (00) Pollutant Specific Guidance

1 Introduction

This report presents the results of the 2007 London Wide Benzene Monitoring Programme. The report describes results collected from January 2007 to December 2007 and covers the fifthteenth year during which the programme has been 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 2007 Benzene Monitoring Programme:

London Borough of Bexley
London Borough of Brent
London Borough of Greenwich
London Borough of Hackney
London Borough of Hammersmith and Fulham
London Borough of Harrow
London Borough of Hillingdon
London Borough of Hounslow
Royal Borough of Kensington and Chelsea
City of London
London Borough of Newham
London Borough of Richmond
London Borough of Sutton

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 2007 programme, a total of eighty five sites across London were maintained by participating boroughs. Benzene levels were surveyed using the passive diffusion sampler technique incorporating procedures developed by Bureau Veritas specifically for monitoring ambient levels. Diffusion samplers were despatched to participating boroughs at regular intervals, exposed by local council staff and returned to Bureau Veritas following a standard exposure period.

Toluene, ethyl benzene, m, p-xylene and o-xylene were also monitored at a total of thirty-seven 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 assess 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 indicates that road traffic is likely to be the major source of VOC's measured at a particular location.

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 the direct sources, such as residential areas. Sites were located at varying distances from busy roads, which enabled the importance of vehicle emissions as a source to be assessed.

2 Sources of Benzene

Benzene in the environment is from both human activities and natural processes. Benzene was first discovered and isolated from coal tar in the 19th century. Today, benzene is emitted mostly from petroleum sources. It is an aromatic hydrocarbon occurring as a colourless, clear liquid. Benzene is one of a group of substances known as volatile organic compounds; 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 gases. Other industrial processes including the pyrolysis of petrol also synthetically produce benzene. In Western Europe at the beginning of the 21st century, production of benzene was estimated to be 7.5 million tonnes[2], accounting for 20% of global production with the UK, Federal Republic of Germany and Netherlands being the major producers.

Benzene is an intermediate in the production of many important chemicals used in the manufacture of plastics, drugs, dyes, detergents and insecticides[2]. Industrial process contributions of benzene in ambient air are to be expected in the vicinity of petrochemical manufacturing plants and locally this can be a more significant source than traffic related emissions. In the UK, ambient benzene concentrations are monitored close to industrial sources at Redcar and Stockton on Tees. Whilst the industrial contribution at these locations is greater than that of London, benzene concentrations at these industrial locations continue to be below national air quality objectives. The Environment Agency expects further reduction in benzene emissions form the chemical industry in the Tees valley between now and 2010[3].

Benzene is also 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% by volume and is presently about 0.6% by volume on average for fuel sold in the UK (AQS, 2001).

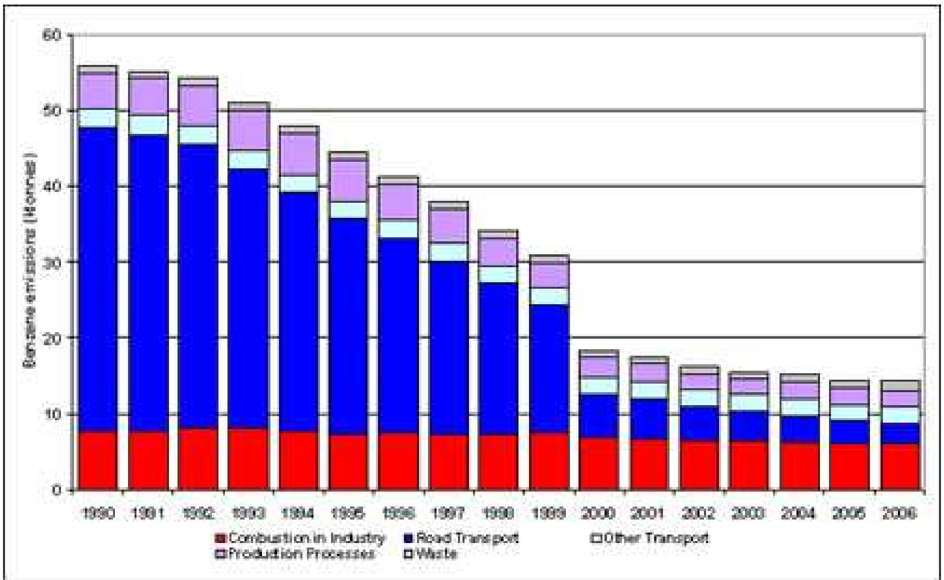
Benzene in ambient air arises mainly from anthropogenic sources, in particular through the combustion of petrol and oil, though benzene emissions from natural sources such as plant and animal matter also occur. Table 1 shows the benzene emission inventory for the UK, which illustrates motor vehicles being the major source of benzene emissions until 1999, prior to the reduction in benzene content in petrol. Benzene contributions from the transport sector

2 http://www.greener-industry.org/pages/benzene/1BenzeneAPQ.htm#top
3 http://www.stockton.gov.uk/resources/environment/airquality/raairquality2006/raairquality06.pdf

accounted for 34% of the total benzene emissions in 2000 with a considerable reduction observed in 2006 to 18%.[4] 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 where there was a large number of industrial point sources *(Clarke et al 1996)*.

Table 1: UK Annual Benzene Emissions, 1990-2006 (Ktonnes)



National Atmospheric Emissions Inventory (NAEI), http://www.naei.org.uk/pollutantdetail.php

While the previously mentioned sources of benzene contribute significantly to ambient benzene levels, it is important to realise that there are other benzene sources that can contribute significantly to an individual's total intake of the chemical. Cigarette smoke contains benzene, and may be the main source of exposure for a heavy smoker; passive smoking may also contribute to benzene intake. It is also present at low concentrations in food and drinking water, and diet may be the main source of benzene for non-smokers living in unpolluted rural areas.

[4] National Atmospheric Emissions Inventory (NAEI) - http://www.naei.org.uk/pollutantdetail.php

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.

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 the window open or with the fans or heaters on. Again, there is very little data on the actual UK exposures in vehicles, but the 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 the 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 direct outdoor exposure only contributes 15% of the total population exposure, where as 60% is due to direct and indirect exposure to tobacco smoke.

Since the health concerns 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 the 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 on, and accumulation in, vegetation.

Benzene exposure is especially high in certain groups of industrial workers, in the chemical and petrochemical sectors, and among certain groups with a high exposure to adhesives. 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 (Rinsky et at, 1981).

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 concentration *(10 to 100mg/m^{-3})*. Consequently, these toxicological effects are of little relevance when considering the health effects of ambient concentrations.

The concern relating to normal ambient exposure is linked to the fact that benzene is a proven genotoxic carcinogen and as such no absolutely safe level can be specified for ambient levels. 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 (Rinsky et al, 1981).

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 etal, 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 for which health risks become acceptable.

5 The Air Quality Strategy for England Scotland, Wales and Northern Ireland

5.1 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 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 ten years. The 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[5].

A revision of *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland* was published in January 2000 and introduced a policy framework further improve on air quality issues. Standards were set in the Strategy for each pollutant, at concentrations below which effects are unlikely, even in sensitive population groups, or below which risks to public health would be exceedingly small. They were based purely on the health effects of a particular pollutant. From these standards, air quality objectives were derived. These set out the extent to which the standards were to be achieved in 2000 and future years. They take account of the costs, benefits, feasibility and practicality of achieving the standards. An addendum to the Strategy in February 2003 introduced a new objective and tightened several existing objectives[6].

The latest revision of the Strategy was published in July 2007 and focuses on progress towards meeting the objectives with proposed policy measures to achieve this. An analytical approach toward quantification and valuation of costs and benefits of existing and proposed policy measures is also a key focus.

5.2 Benzene Targets and Objectives

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 (16.25$\mu g/m^{-3}$) was recommended which was based on a study of occupational data and the consideration of medical evidence for carcinogenic effects. In the report, the EPAQS also recommended a long-term policy objective of 1ppb (3.25$\mu g/m^{-3}$) as a running annual mean.

[5] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (January 2000).

The provisions of the Air Quality Regulations 1997 in relation to England were replaced by the Air Quality (England) Regulations 2000, which were authorised by the Secretary of State for the Environment, Transport and Regions. These regulations include an objective of 16.25$\mu g/m^{-3}$ for benzene. The Governments intention was that this objective would be used for the purpose of Local Air Quality Management (LAQM).

An addendum to the Air Quality Strategy (2000) was subsequently published in January 2003, which adopted new objectives for benzene. The addendum explains that the objectives are to be kept under review on a pollutant by pollutant basis to take account of scientific and technical developments and developments in European legislation. Thus, as the EU Directive's limit value for benzene (5$\mu g/m^{-3}$) differs from the previously proposed long-term objective of 3.25$\mu g/m^{-3}$, the UK Government decided to set an objective of 5$\mu g/m^{-3}$ as an annual mean to be met by the end of 2010 throughout England. This is because the measurable health benefits of achieving a objective of 3.25$\mu g/m^{-3}$ rather than 5$\mu g/m^{-3}$ are likely to be extremely small.[6] This long-term objective was maintained in the 2007 revision of the Air Quality Strategy.

6 European Directive Limit/Target Values and other Relevant Legislation

6.1 EU Daughter Directives

The Council Directive 96/62/EC, also known as the Air Quality Framework Directive, describes how member states should assess, manage and report ambient air quality. It also listed the air quality pollutants for which air quality standards and objectives were to be developed and legislated.[6]

A series of Daughter Directives (1-4) were then developed that specified limit values for those pollutants listed under Air Quality Framework Directive. The second of these adopted in November 2000 *(Council Directive 2000/69/EC)* also known as the 2nd Daughter Directive, established the numerical criteria relating to the assessment and management of benzene and carbon monoxide in air. 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 1st January 2010.[7]

6.2 Euro Emissions Standards

Several measures have been introduced in past years, via the Euro Emissions Standards to reduce the emissions of pollutants from the transport sector. Benzene concentrations at both background and roadside sites have fallen sharply due to reductions in the benzene content of petrol and the introduction of cars equipped with catalytic converters as stipulated in Euro Standards 1 and 2 *(Directive 91/441/EEC - Euro 1 Standards and 94/12/EEC – Euro 2 Standards).* Policy developments such as the *Auto-oil Programme* implemented in January 2000, were the basis for Euro 3 Standards and provided sound scientific knowledge, technology capability, environmental need and economic feasibility for the development of emissions limits for new vans and cars sold from 2001. Euro 4 Standards came into effect in 2005 and halved the allowable hydrocarbon emissions limit from that set previously. These limits have been maintained in Euro 5 and 6 Standards to be achieved by 2009 and 2014 respectively.

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[6] UK Air Quality Archive, http://www.airquality.co.uk/archive/what_are_we_doing.php
[7] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (January 2000).

7 London Specific Air Quality Initiatives

7.1 London Congestion Zone

London suffers the worst traffic congestion in the UK and was one of the most congested cites in Europe. An estimated £2 - £4 million was lost each week due to lost time as motorists spent approximately 50% of their travel time in queues. In addition to the negative economic impact of severe congestion, negative impacts on air quality and human health are also incurred. In honouring his pledge to tackle the congestion issue, the Mayor of London announced the Congestion Charging Zone Scheme in February 2002. From February 2003 charges were applied to all vehicles entering the central London zone. All fees collected are reinvested in the improvement of London's transport system.[8]

7.2 Low Emission Zone

In February 2008 the Low Emission Zone (LEZ) came into effect in a bid to reduce air pollution in London and meet EU air quality objectives. This scheme requires the most polluting diesel engined trucks, buses, coaches and large vans to meet strict Euro emission standards. Vehicles in the above categories, operating in the Greater London area and not complying with the Euro Standards incur a charge. The objective of the scheme is to reduce air pollution in London by deterring the use of heavily polluting vehicles within the Greater London area and provide an incentive for operators to upgrade to less polluting models.[9]

[8] Transport for London, http://www.tfl.gov.uk/roadusers/congestioncharging/6725.aspx
[9] Mayor of London, http://www.london.gov.uk/mayor/environment/air_quality/lez.jsp

8 Methodology

8.1 Monitoring Sites

Descriptions of all ninety six monitoring sites are given in Appendix A on an individual borough basis. As motor vehicle emissions are a major source of benzene, sites have been categorised according to distance from the nearest busy road. Over time site classifications tend to change within air quality surveys due to assessment of new data and opinion. Theoretically, this could mean the relocation of a site to meet new criteria, which could mean 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 20m 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 60 roadside sites, 32 background sites and 4 petrol stations as shown in Figure A.

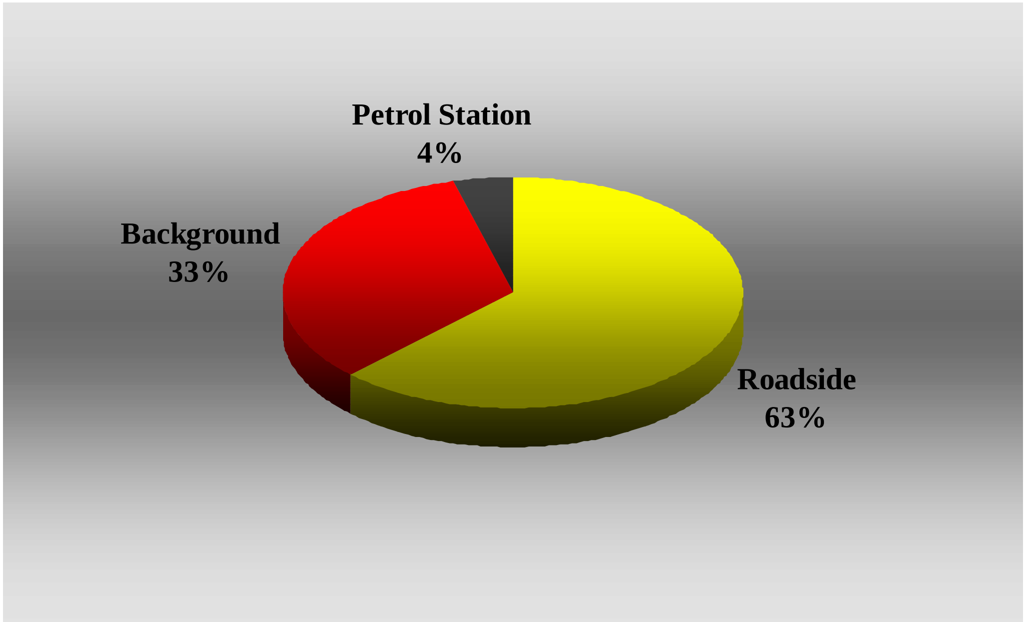


Figure A. Percentage of classified sites, which participated in the survey

8.2 Measurement Technique

In 2005/2006, five European Standard methods for the measurement of benzene in air were approved by the European Committee for Standardization (CEN), all of which are in accordance with the generic methodology selected as the basis of the reference method (EN14662) for the purpose of assessing compliance with limit values with one year reference period.

The measurement method used in this survey was consistent with the sampling, analysis and QA/QC requirements of ***EN 14662-4: 2005 Ambient air quality – Standard method for measurement of benzene concentrations – Part 4: Diffusive sampling followed by thermal desorption and gas chromatography***.

Benzene, toluene, ethyl benzene, m, p and o-xylene *(BTEX)* measurements were made using Perkin-Elmer type diffusive samplers[10]. These are 9cm 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 with a white Teflon cap. On exposure, the white Teflon cap is removed and replaced with a diffusive 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 Law of Diffusion:

(a) The path length between the top surface of the monitor and the absorbent bed.

(b) The cross sectional area of the sampler

(c) The exposure time

(d) The diffusive coefficient of benzene through air

(e) The ambient concentration of benzene

Bureau Veritas 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.

[11] Health and Safety Laboratory Environment Measurement Group. Diffusive sampling of VOC's as an aid to monitoring urban air quality.

Although tubes are exposed for 2-week periods, previous work has shown that the uptake for benzene onto Chromosorb 106 differs by less than 1% for exposure periods of one, two and 4 weeks. For most adsorbents their uptake rates decline rapidly over the first 16-24 hours of sampling, after which rates tend to stabilise.

8.3 Sample Analysis

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

8.3.1 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.

8.3.2 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.

8.3.3 Cleaning of Tubes

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

The mass of BTEX collected in the tube was then expressed as an average airborne concentration ($\mu g/m^{-3}$) measured over the monitoring period. This calculation is shown in Appendix B. The diffusion coefficient for benzene has been empirically calculated at Bureau Veritas 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 were analysed prior to exposure to ensure the Chromosorb retains no benzene. Duplicate and Triplicate tubes were also exposed in a selection of boroughs each month thus allowing the coefficient of variation between tubes to be assessed.

8.4 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°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.

9 Results of the 2007 Benzene Monitoring Programme

Benzene, toluene, ethyl benzene, m, p and o-xylene data collected between January 2007 and December 2007 are given on an individual bases 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 the 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 meter.

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. Site removals occurring in March resulted in insufficient data capture to calculate annual means for sites CL3-CL10 in the City of London Borough and all five sites in Hammersmith and Fulham Borough. Hammersmith and Fulham Borough results have therefore not been included in this report. A new site, HS BTEX 8 was installed in April in the Borough of Hounslow. While this site achieved 75% valid data capture, the annual mean was not reported due to a missing seasonal data block, January – March.

9.1 London Borough of Bexley

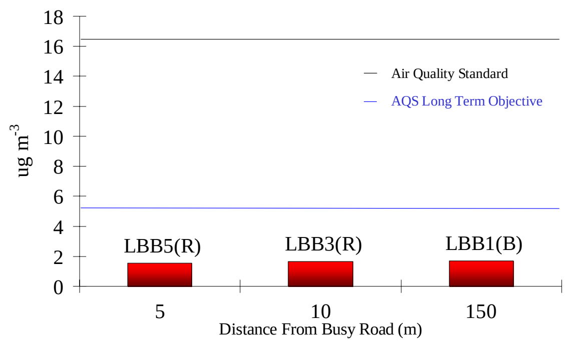


Figure 1A. Annual Mean Benzene Concentrations – 2007

Annual Mean Concentration

Annual mean concentrations recorded at Bexley ranged from 1.5 to 1.7µg/m^{-3}, with the lowest annual mean recorded at site LBB5 a roadside location at Watling Street, Bexleyheath and the highest at site LBB1, a background site at Whitehall Day Centre in Slade Green. Neither the AQS nor the AQS long-term objective was exceeded or approached at any of the three sites.

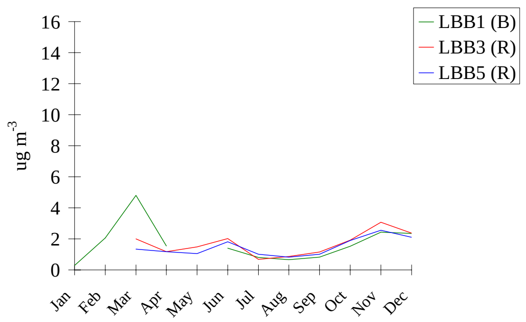


Figure 1B. Temporal Variation - 2007

Temporal Variation

During 2007, some seasonal variation was observed at all the Bexley sites, with a small increase in concentrations observed throughout winter months. A maximum peak level of 4.8µg/m^{-3} was recorded for March at the background site LBB1 while a minimum of 0.3µg/m^{-3} was recorded at the same site in June.

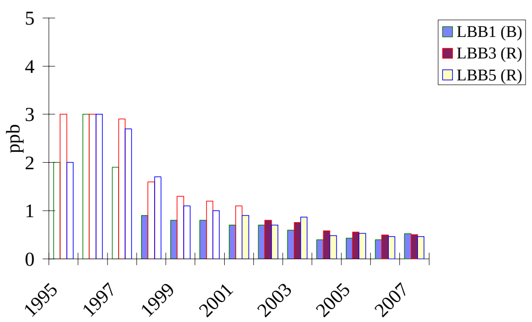


Figure 1C. Trends in Annual Average Benzene Concentrations

Annual Trends

The initial sharp decrease in concentrations from 1996-1999 has been followed by a more gradual decline in subsequent years. From 2004-2007, concentrations have levelled out with annual mean benzene concentrations consistently below 2.0ppb. At no point during the monitoring period 1995-2007, were concentrations in breach of the AQS and AQS long-term objective.

9.2 London Borough of Brent

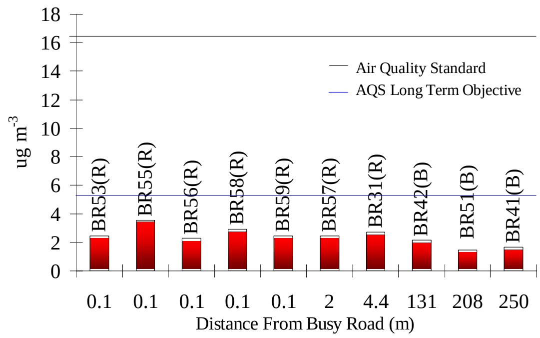


Figure 2B.Annual Mean Benzene Concentrations – 2007

Annual Mean Concentration

Annual mean benzene concentrations ranged from 1.5µg/m^{-3} at background site BR51 located at Kingsbury High School, Princes Avenue, Kingsbury to 3.5µg/m^{-3} recorded at roadside site BR55, located at 79 High Street, Harlesden. The AQS and AQS objective were not exceeded or approached at any site.

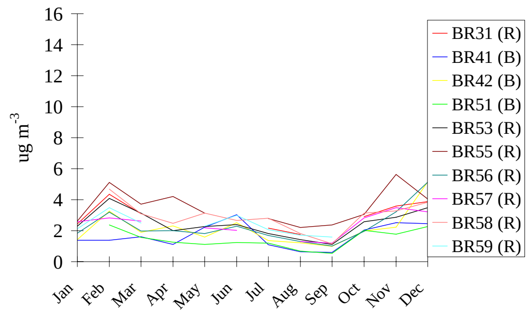


Figure 2B.Temporal Variation – 2007

Temporal Variation

Temporal trends for 2007 are illustrated in Figure 2B. Concentrations throughout the year displayed some seasonal variation with a consistent rise in concentrations exhibited by all sites during winter months. A maximum concentration of 5.6µg/m^{-3} was recorded during November at roadside site BR55.

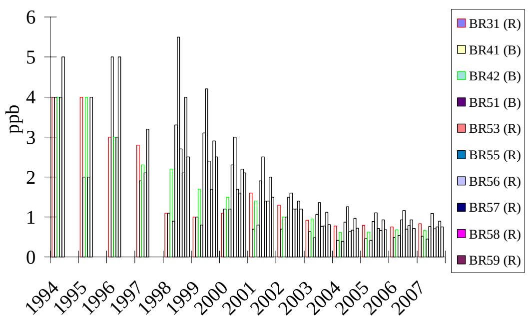


Figure 2C. Trends in Annual Average benzene Concentrations

Annual Trends

A substantial drop in concentrations was observed from 1998-2003. During the period 2004-2007 concentrations appear to have stabilised with little or no change observed. As with the previous 3 years, the highest annual average recorded for 2007 was at site BR55.

9.3 London Borough of Greenwich

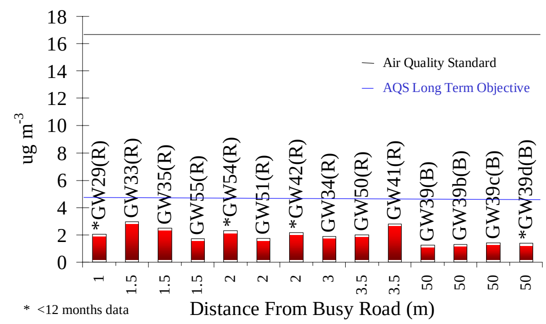


Figure 3A. Annual Mean Benzene Concentrations – 2007

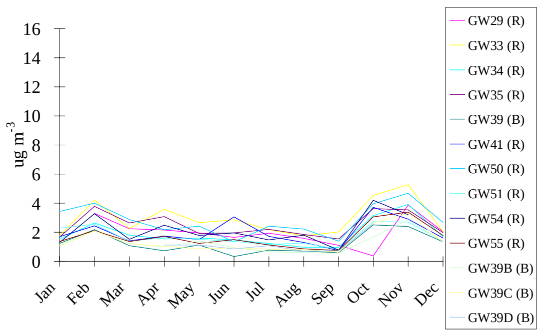


Figure 3B. Temporal Variation 2007

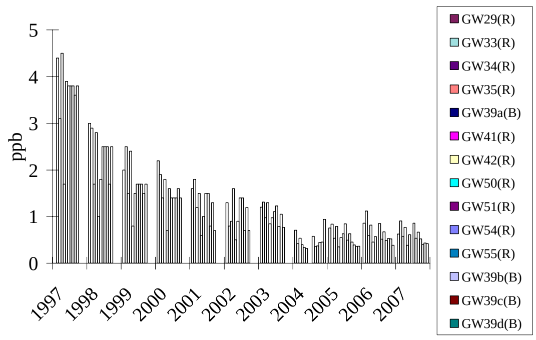


Figure 3C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

The annual mean concentrations recorded at Greenwich, ranged from 1.3µg/m^{-3} recorded at the background site GW39b, to 2.9µg/m^{-3} recorded at the roadside sites GW33, Blackheath Hill. Background sites consistently showed lower concentrations than the roadside sites. Neither the AQS nor the AQS long-term objective were exceeded or approached by any site.

Temporal Variation

Similar temporal trends were observed at all fourteen sites, with the exception of a low monthly mean for October recorded at GW29, a roadside site located at Antigallican PH, Woolwich Road, which is suspected to be invalid. A maximum concentration of 5.3µg/m^{-3} was recorded for site GW33. The majority of sites show higher than average benzene during October and November.

Annual Trends

Figure 3C shows that concentrations significantly declined at all sites from 1997 to 2003. During 2004 concentrations dropped substantially again before stabilising during 2005-2007.

9.4 London Borough of Hackney

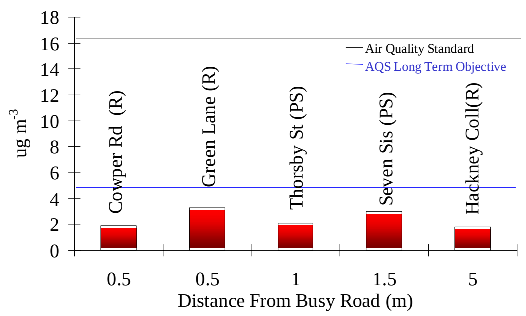


Figure 5A. Annual Mean Benzene Concentrations – 2007

Annual Mean Concentration

Annual mean concentrations ranged from 1.8µg/m^{-3} at the roadside site located at Hackney College to 3.3µg/m^{-3} at the roadside site on Green Lane. Neither the AQS nor the AQS long-term objectives were exceeded.

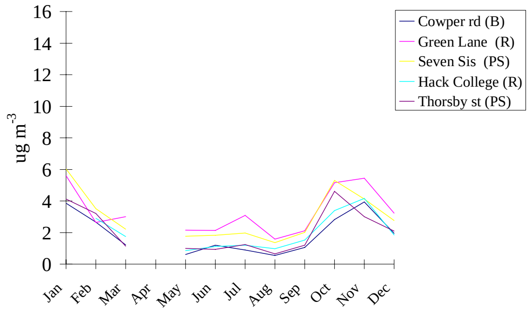


Figure 5B. Temporal Variation – 2007

Temporal Variation

Figure 5B shows that a similar temporal trend was observed at all sites throughout the year, with concentrations peaking during October and November. A maximum peak concentration of 5.4µg/m^{-3} was observed during November at the Green Lane roadside site. Results are not available for any site during April as tubes were not sealed post sample collection.

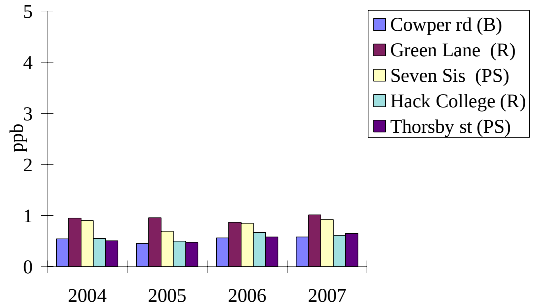


Figure 5C. Trends in Annual Average Benzene Concentrations

Annual Trends

Figure 5C shows that benzene concentrations have varied little during the period of monitoring 2004-07.

9.5 London Borough of Harrow

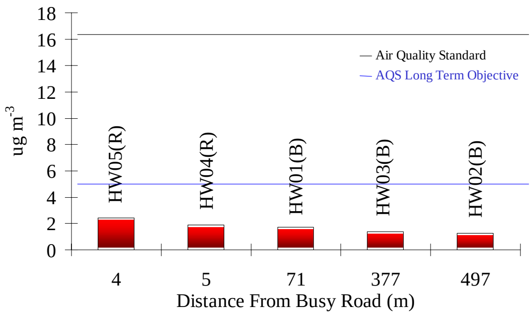


Figure 6A. Annual Mean Benzene Concentrations – 2007

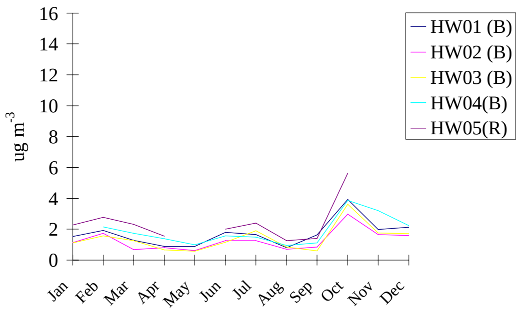


Figure 6B. Temporal Variation – 2007

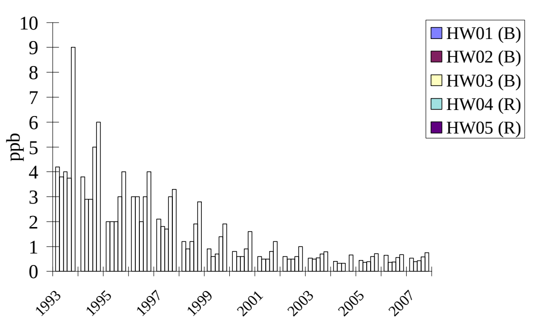


Figure 6C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Annual mean concentrations varied from 2.4 μg/m^{-3} at site HW05 to 1.3μg/m^{-3} at site HW02. The highest concentration of 2.4μg/m^{-3} was recorded at the roadside site on Station Road, Harrow. The lowest mean of 1.3μg/m^{-3} was recorded at a background location at Grimsdyke School, Hatch End. A clear relationship between concentration and the distance from a busy road can be seen. The AQS and AQS long-term objective were not exceeded at any site.

Temporal Variation

Temporal trends shown in Figure 6B showed that concentrations were stable throughout the year with slightly elevated concentrations recorded for October. The highest concentration, 5.6μg/m^{-3}, was recorded at HW05 for the month of October.

Annual Trends

After the substantial drop in concentrations from 1993-98, a more gradual decline in annual mean concentrations was observed at all sites. Concentrations in more recent years have levelled out with little variation observed.

9.6 London Borough of Hillingdon

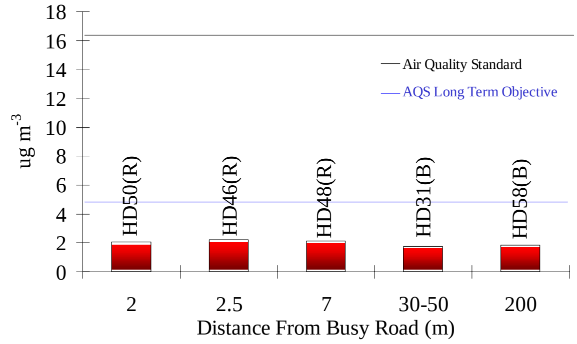


Figure 7A. Annual Mean Benzene concentrations – 2007

Annual Mean Concentration

Annual mean concentrations varied between 1.8µg/m^{-3} at site HD31 to 2.2µg/m^{-3} at site HD46. The lowest mean was recorded at a background "suburban" site located at Sipson Road, West Drayton. The highest mean was recorded at a roadside site at South Ruislip monitoring station, West End Road. The AQS and the AQS long-term objective were not exceeded or approached by any site.

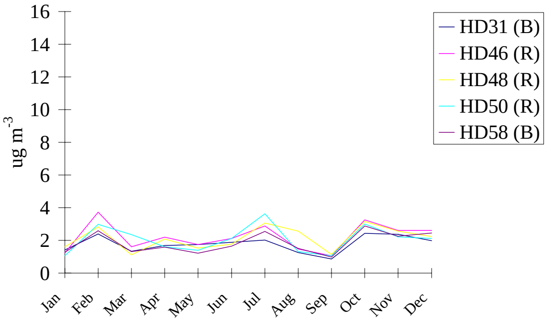


Figure 7B. Temporal Variation – 2007

Temporal Variation

Temporal trends shown by Figure 7B illustrated that benzene levels remained relatively stable throughout the year with minor peaks to 3.7µg/m^{-3} in February at roadside site HD46 and 3.6µg/m^{-3} during November at roadside site HD50.

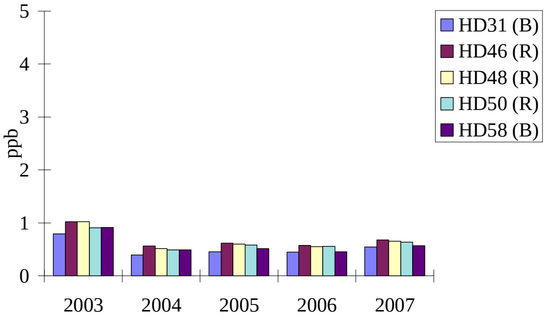


Figure 7C. Trends in Annual Average Benzene concentrations

Annual Trends

Following 2003, mean concentrations at all Hillingdon sites declined. During the period 2004 – 2007 ambient concentrations of benzene have been relatively stable.

9.7 London borough of Hounslow

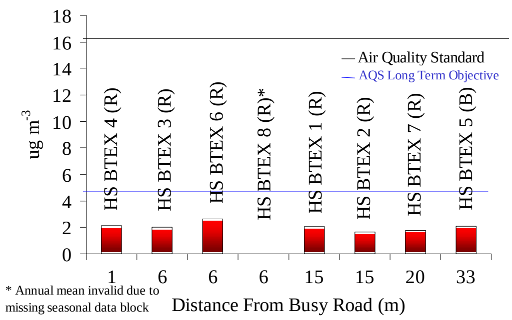


Figure 8A. Annual Mean Benzene concentration – 2007

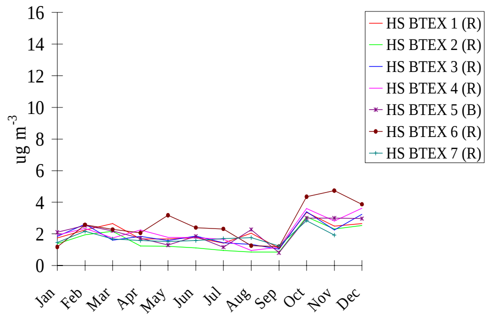


Figure 8B. Temporal Variation – 2007

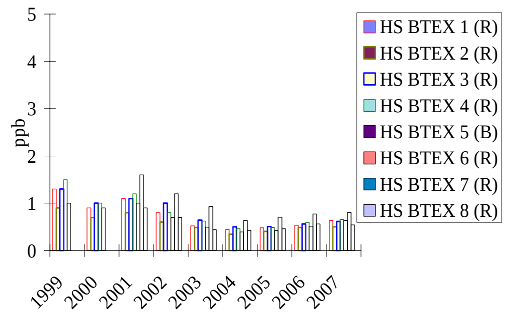


Figure 8C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Annual mean concentrations recorded for Hounslow varied between 1.6µg/m^{-3} and 2.6µg/m^{-3} similar to the previous year. The highest mean value of 2.6µg/m^{-3} was recorded at roadside site HS BTEX6 located at 24 Adelaide Terrace, Brentford. The lowest mean value of 1.6µg/m^{-3} was recorded at roadside site HS BTEX2 located at Marjory Kinnon School, Hatton Road. The AQS and AQS long-term objective were not exceeded or approached at any time.

Temporal Variation

Figure 8B shows that all sites have followed a similar trend with a downward trend from January to September followed by a notable rise in concentrations from October to December. During November, a maximum peak value of 4.7µg/m^{-3} was recorded at roadside site HS BTEX6. HS BTEX6 also experienced higher concentrations during the late spring and early summer months of May – July.

Annual Trends

Figure 8C shows that concentrations have stabilised in recent years with little variation at all sites.

9.8 Royal Borough of Kensington and Chelsea

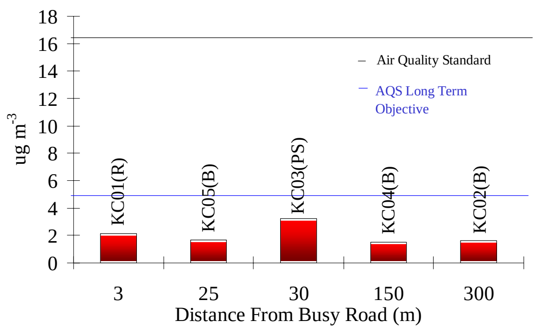


Figure 9A. Annual Mean Benzene Concentrations – 2007

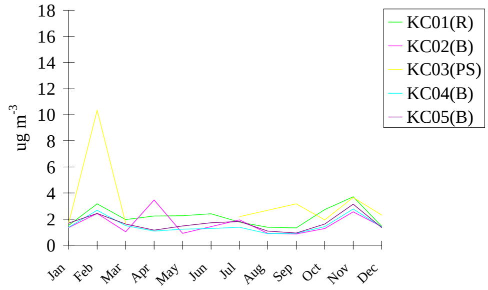


Figure 9B. Temporal Variation – 2007

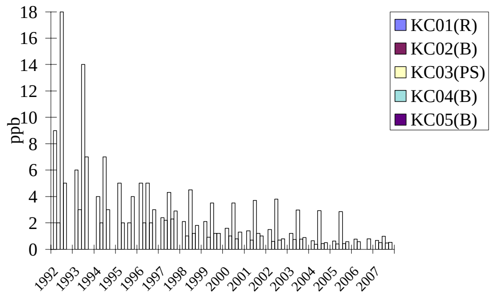


Figure 9C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Annual mean concentrations varied from 1.5µg/m^{-3} to 3.2µg/m^{-3}. The lowest mean value was recorded for background site KC04, located on Dove House Street. The highest mean value was recorded for site KC03, located 1m from the forecourt boundary of a Petrol Station on Warwick Road. The AQS was not exceeded or approached at any site.

Temporal Variation

Figure 9B illustrates temporal trends for 2007. All sites followed a similar trend throughout the year with roadside site KC01 and Petrol Station site KC3 exhibiting consistently higher concentrations as expected. A large episodic spike of 10.4µg/m^{-3} was recorded during February at site KC3 and a small spike, also inconsistent with the group trend, was observed at background site KC02 of 3.5µg/m^{-3}.

Annual Trends

Figure 9C shows that after a substantial decline in concentrations from 1992-1998, a more gradual decline was observed until 2003. During 2004, average mean concentrations for background and roadside sites dropped again and have been relatively stable since. The petrol station location, KC03, continued to show relatively high concentrations until 2005. A considerable drop in concentrations was observed during 2007, and is likely due to a change in site location occurring during 2006.

9.9 City of London

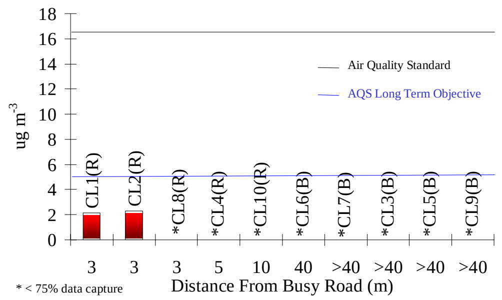


Figure 10A. Annual Mean Benzene Concentration – 2007

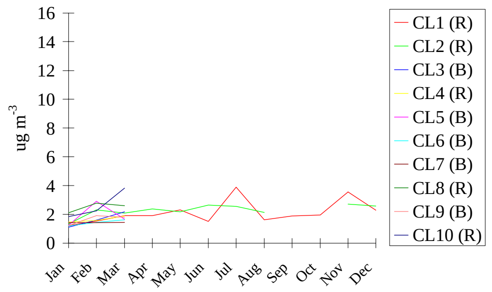


Figure 10B Temporal Variation – 2007

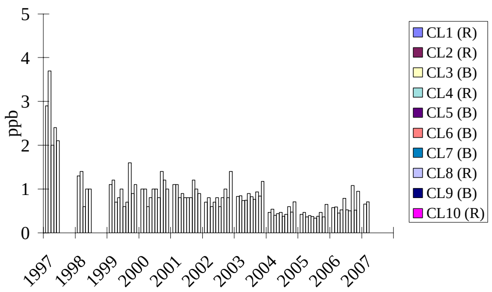


Figure 10C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Annual mean benzene concentrations were 2.1µg/m^{-3} at CL1 and 2.3µg/m^{-3} at CL2 for the two remaining roadside sites, St Andrews Church on Victoria Street and St Dustins Church, on Fleet Street respectively. Sites CL3-CL10 were decommissioned in March 2007 and as a result insufficient data (<75% data capture) is available to calculate annual means for these sites. Mean concentrations have remained low with no exceedences of the AQS or of the AQS long-term objective.

Temporal Variation

Figure 10B shows temporal trends for 2007. Insufficient data is available to comment on trends in the City of London, except to note that recorded concentrations are relatively low with a minimum concentration of 1.2µg/m^{-3} recorded at three sites during January and a maximum concentration of 3.9µg/m^{-3} recorded at roadside site CL1.

Annual Trends

The annual average benzene concentrations illustrated in Figure 10C show a substantial decrease in concentrations from 1997 to 1998 followed by a period of relative stability until 2003. Concentrations dropped further by approximately 40% in 2004 and were maintained at this level in 2005. An increase in concentrations was observed at all sites during 2006 and this trend continued into 2007.

9.10 London Borough of Newham

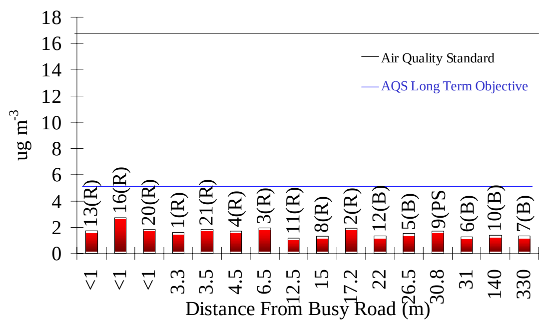


Figure 11A, Annual Mean Benzene Concentrations – 2007

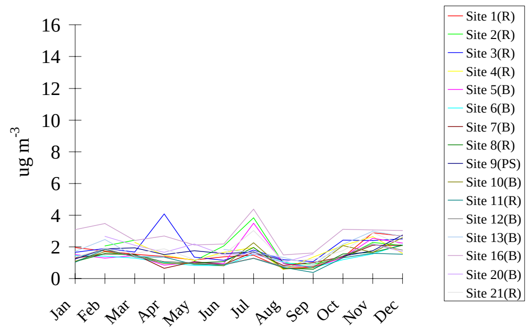


Figure 11B. Temporal Variation – 2007

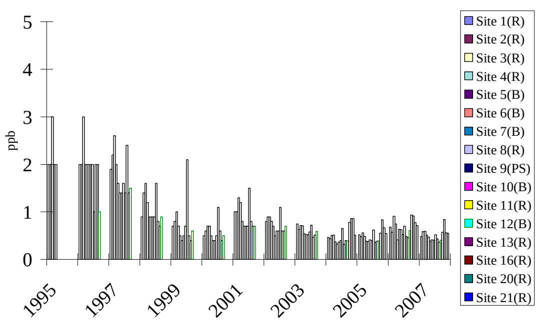


Figure 11C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

Mean benzene concentrations ranged from 1.2µg/m^{-3} to 2.7µg/m^{-3}. The maximum mean concentration of 2.7µg/m^{-3} recorded at roadside site 16, located at Leytonstone Road, Stratford. The lowest mean value of 1.2µg/m^{-3} was recorded at a roadside site, 11, located at the Petrol Station, Gallions Roundabout. The AQS and AQS long-term objective were not exceeded or approached at any site.

Temporal Variation

Figure 11B illustrated temporal trends for 2007. All sites in the Borough showed slightly higher Benzene concentrations during months October-December with several sites showing elevated concentrations during July. A maximum concentration of 4.4µg/m^{3} was recorded at roadside site 16 during this month.

Annual Trends

Annual mean concentrations of Benzene in this Borough have exhibited more trend variation over its 13 year monitoring period than most other Boroughs. After an initial decline in concentrations from 1995 to 2000, concentrations increased in 2001 and subsequently declined steadily until 2004. From this point, annual means show some variation from year to year while maintaining concentrations below 1ppb.

9.11 London Borough of Richmond

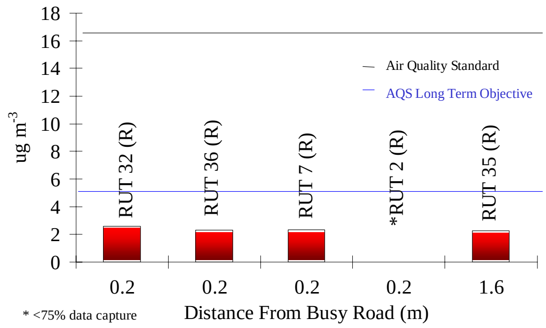


Figure 12A. Annual Mean Benzene Concentrations – 2007

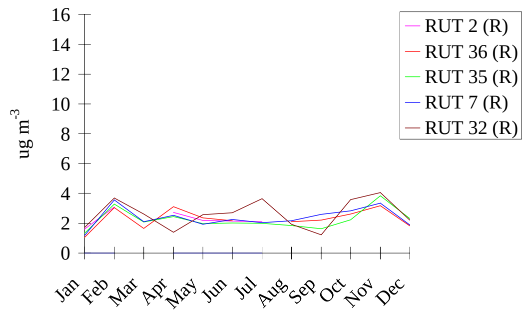


Figure 12B. Temporal Variation 2007

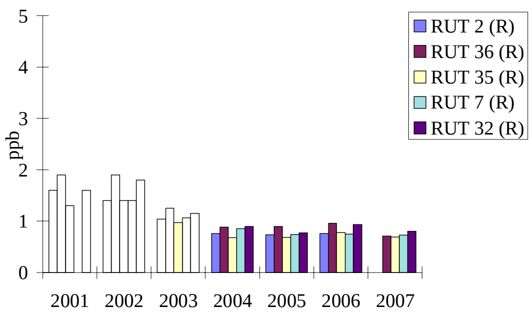


Figure 12C. Trends in Annual Average Benzene Concentrations

Annual Mean Concentration

The lowest annual mean concentration of 2.2µg/m^{-3} was recorded at site RUT35 located on High Street, Hampton Wick. The highest mean concentration of 2.6µg/m^{-3} was recorded at roadside site RUT32 located on Kings Street, Twickenham. The annual mean for RUT2 was omitted due to insufficient valid data capture. Results for March, August, October and November were missing. Neither the AQS or the AQS long-term objective were exceeded or approached at any site.

Temporal Variation

Figure 12B shows concentrations in Richmond during 2007. With the exception of RUT32, all sites showed some seasonal variation with slightly higher concentrations occurring during the winter months. Site RUT32 exhibited more variation with higher concentrations in both summer and winter months. The maximum peak concentration of 4.7µg/m^{-3} was recorded during November at roadside site RUT32.

Annual Trends

Figure 12C shows concentrations of benzene declining from 2002 to 2004 when concentrations levelled off in subsequent years below 1ppb.

9.12 London Borough of Sutton

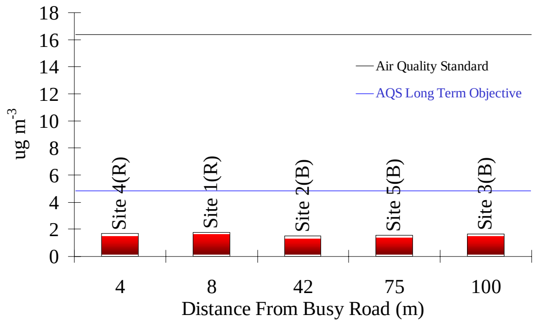


Figure 13A. Annual Mean Benzene Concentrations – 2007

Annual Mean Concentration

Mean benzene concentrations in Sutton were very similar to last year, ranging from 1.5$\mu g/m^{-3}$ to 1.8$\mu g/m^{-3}$. The minimum mean value of 1.5$\mu g/m^{-3}$ was recorded at site 2, a background location at Devonshire School, Devonshire Avenue. The highest mean value of 1.8$\mu g/m^{-3}$ was recorded for site 1, a roadside location at Paynes Poppets, Corydon Road. The AQS and AQS long-term objective were not exceeded at any site.

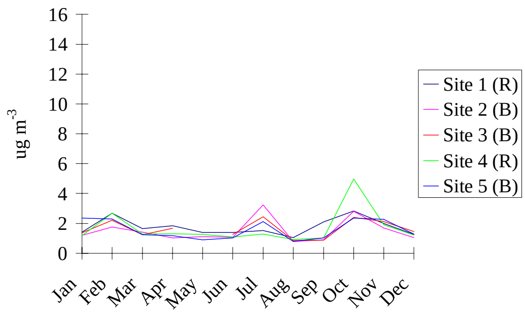


Figure 13B. Temporal Variation – 2007

Temporal Trends

Temporal trends, illustrated in Figure 13B, were similar at all five sites with some peak concentrations seen in July and October. The highest peak value of 5.0$\mu g/m^{-3}$ was recorded in October for site 4, a roadside location.

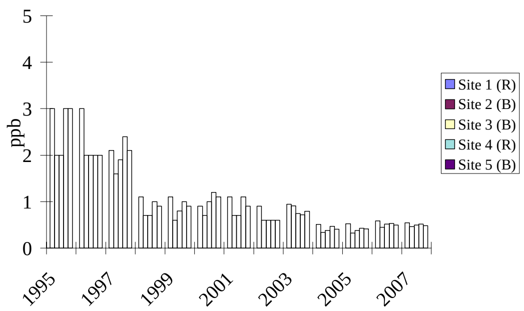


Figure 13C. Trends in Annual Average Benzene Concentrations

Annual Trends

Annual trends are illustrated in Figure 13C. A significant step change occurred between 1997 and 1998 when concentrations on average halved. A period of relative stability followed before another lesser step change occurring between 2003 and 2004, reduced concentrations further.

9.13 Summary of 2007 Annual Mean Benzene Concentrations

Across all boroughs, annual mean concentrations recorded at roadside sites ranged from 1.2μg/m^{-3} recorded in Newham, to 3.3μg/m^{-3} in Hackney. At background sites, mean benzene concentrations varied from 1.3μg/m^{-3} in Greenwich, Harrow and Newham to 2.2μg/m^{-3} at Brent. Mean concentrations recorded at petrol stations varied from 1.7μg/m^{-3} at Kensington and Chelsea to 3.2μg/m^{-3} at Newham. The annual mean benzene concentrations for the three different location types are summarised in Table 2 below:

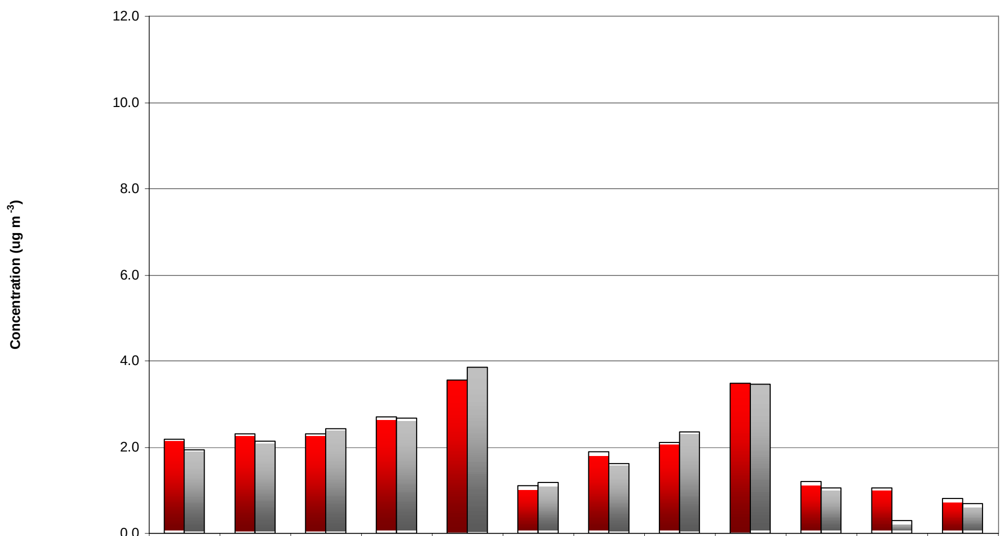
Table 2: Summary of 2007 Annual Mean Concentration (μg/m^{-3})

Site Type	Minimum	Mean	Maximum
Background	1.3	1.6	2.2
Roadside	1.2	2.1	3.3
Petrol Station	1.7	2.5	3.2

10 Quality Assurance and Quality Control

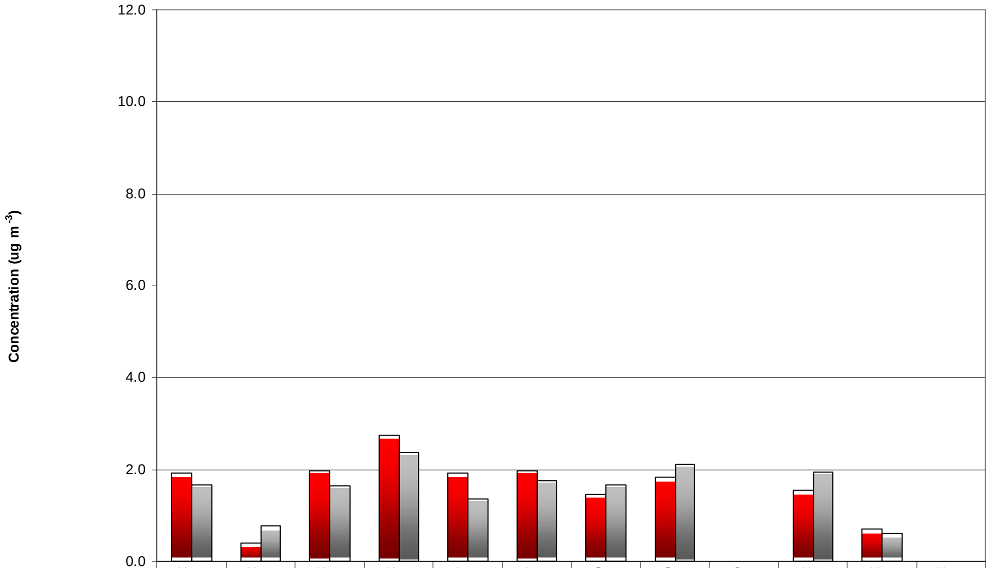
10.1 Duplicate Exposures at Monitoring Sites

As part of quality control procedures integral to the London-Wide Benzene Survey, a selection of boroughs are sent one or two extra diffusion tubes for duplicate or triplicate exposure at a monitoring site within their borough. In 2007, duplicate exposures were successful on eleven occasions and triplicate exposures on seven. The results of these tubes indicate satisfactory agreement between duplicate and triplicate tubes. The maximum difference between duplicates is ± 0.8μg/m^{-3} and the maximum difference between triplicates is ± 0.4μg/m^{-3}. The results of these duplicate exposures are summarised below in Figures 17a-17c.



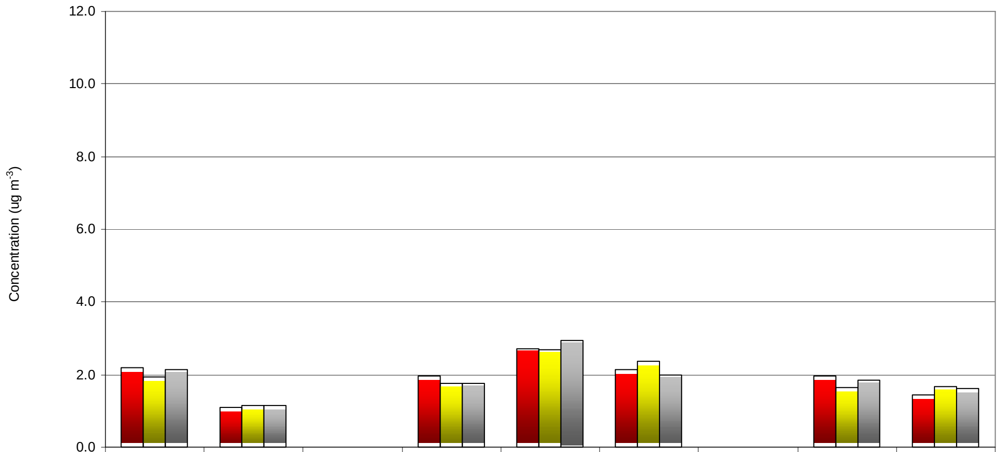
	Rich	Rich	Hou	Hou	Hak	Hak	Hil	Hil	Bre	Bre	Bex	Bex
□ Sampler ugm-3	2.2	2.3	2.3	2.7	3.6	1.1	1.9	2.1	3.5	1.2	1.0	0.8
□ Duplicate ugm-3	1.9	2.1	2.4	2.7	3.9	1.2	1.6	2.4	3.5	1.1	0.3	0.7

Figure 15A. Summary of 2007 Duplicate Exposure within London Boroughs showing concentrations recorded.



	New	New	Ken	Ken	Lon	Lon	Sut	Sut	Gre	Har	Har	Ham
Sampler ugm-3	1.9	0.4	2.0	2.7	1.9	2.0	1.5	1.8		1.6	0.7	
Duplicate ugm-3	1.7	0.8	1.6	2.4	1.4	1.7	1.7	2.1		2.0	0.6	

Figure 15B. Summary of 2007 Duplicate Exposures within London Boroughs shown without recorded data.



	Rich	Hac	New	Lon	Hou	Hil	Bex	Ken	Sut
Sampler	2.2	1.1		2.0	2.7	2.1		2.0	1.5
Duplicate	1.9	1.2		1.7	2.7	2.4		1.6	1.7
Triplicate	2.1	1.1		1.8	2.9	2.0		1.8	1.6

Local Authority

Sampler Duplicate Triplicate

Figure 15C. Summary of 2007 Triplicate Exposures within London Boroughs showing concentrations recorded.

10.2 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.

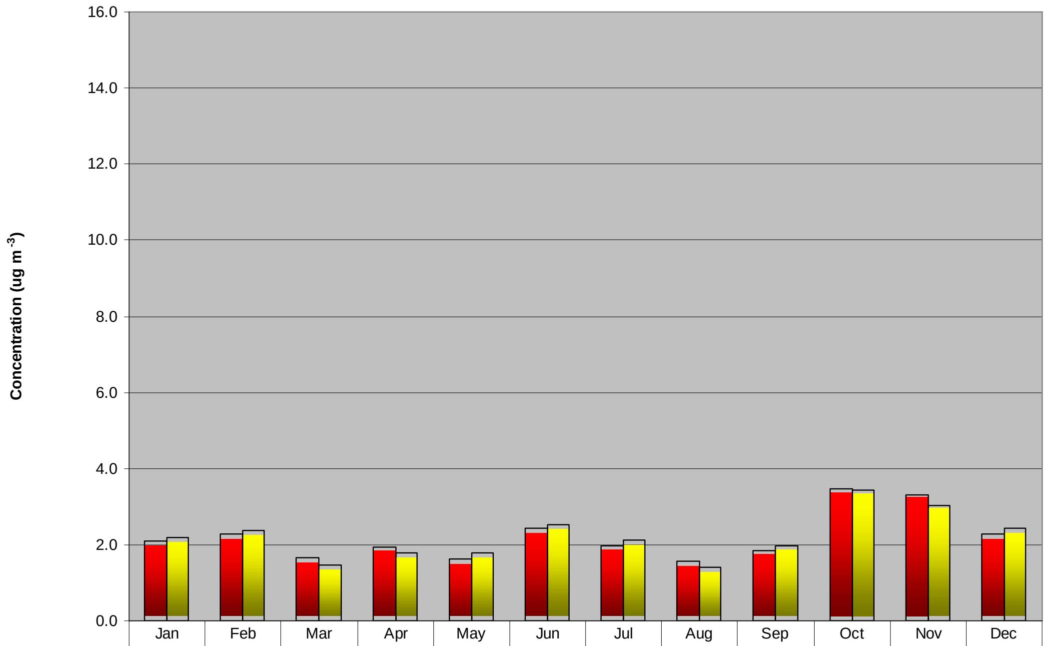
QA Duplicate Hydrocarbon results for toluene for the months of March and July 2007 and ethyl benzene, m, p-xylene and o-xylene results for the month of February 2007 have been invalidated. Benzene concentrations ranged from 1.4 $\mu g/m^{-3}$ recorded in August to 3.4 $\mu g/m^{-3}$ recorded in October. This is a similar range to many roadside sites in London. These results show slightly higher concentrations for Benzene and Toluene and slightly lower concentrations for ethyl benzene, m, p-xylene and o-xylene when compared with 2006 data. From this data, an annual mean value of 2.2 $\mu g/m^{-3}$ was calculated, higher than the benzene annual mean value of 1.4 $\mu g/m^{-3}$ recorded by the Hydrocarbon Network at Marylebone Road. Toluene concentrations ranged from 9.5$\mu g/m^{-3}$ recorded in September to 42.9 $\mu g/m^{-3}$ recorded in April. Ethyl benzene levels ranged between 1.4 $\mu g/m^{-3}$ recorded in January to 16.7 $\mu g/m^{-3}$ also in October. Results for m, p-xylene ranged from 3.7 $\mu g/m^{-3}$ in January to 19.5 $\mu g/m^{-3}$ in October. Monthly mean values for o-xylene ranged between 0.9 $\mu g/m^{-3}$ in January and April to 4.7 $\mu g/m^{-3}$ in October.

Table 3 below shows a comparison between the Hydrocarbon Network benzene and the Bureau Veritas diffusive sampling at the Marylebone Road site. Data has been calculated and compared for the same exposure periods for both 2006 and 2007.

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

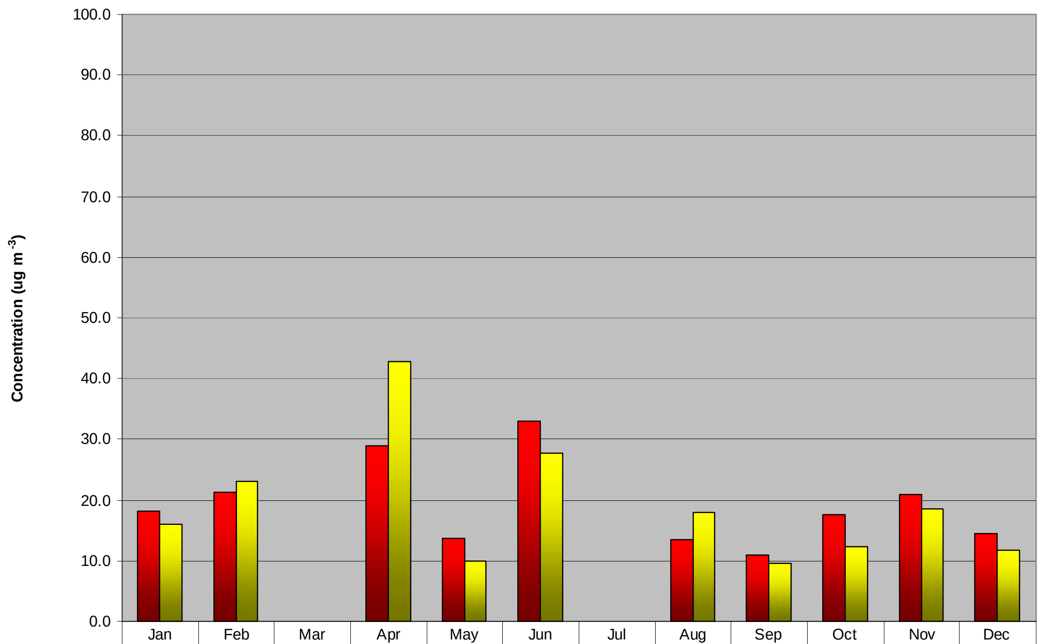
Species ($\mu g/m^{-3}$)	*Bureau Veritas Tubes		Hydrocarbon network	
	2006	**2007**	**2006**	**2007**
Benzene	2.5	**2.2**	1.7	**1.4***
Toluene	23.9	**19.1**	7.8	**6.1***
Ethyl Benzene	2.5	**6.2**	1.2	**0.9***
M, p Xylene	6.1	**9.3**	4.5	**6.4***
o-Xylene	2.0	**3.0**	1.6	**1.3***

* <75% valid data capture



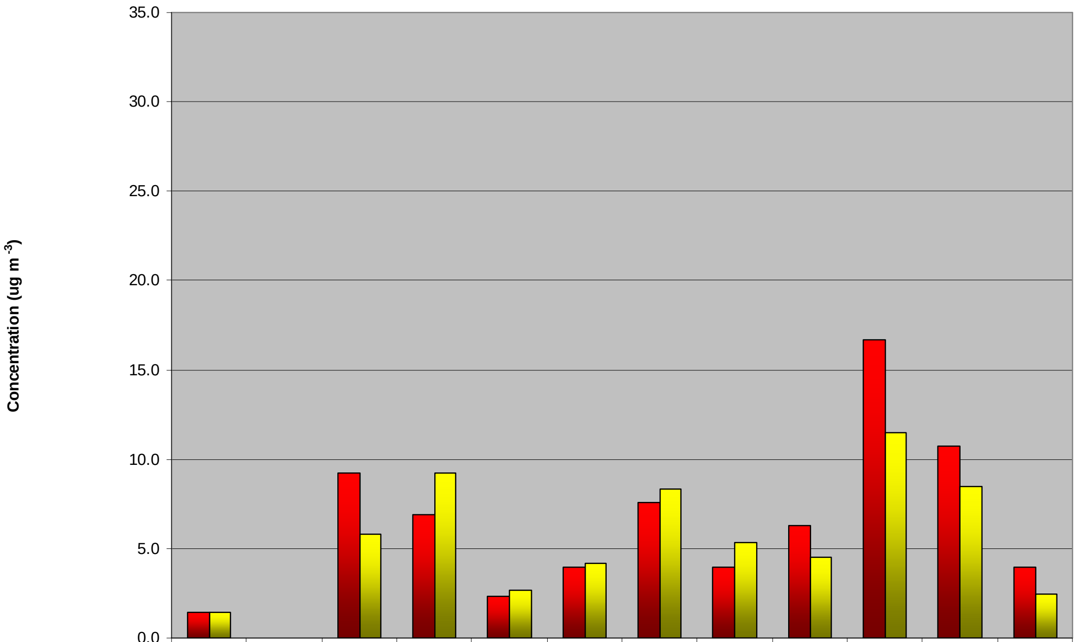
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benzene 1	2.1	2.3	1.7	1.9	1.6	2.4	2.0	1.6	1.8	3.4	3.3	2.3
Benzene 2	2.2	2.4	1.5	1.8	1.8	2.5	2.1	1.4	2.0	3.4	3.0	2.4

Figure 16A. Summary of 2007 Duplicate Benzene Exposures at London Marylebone Road.



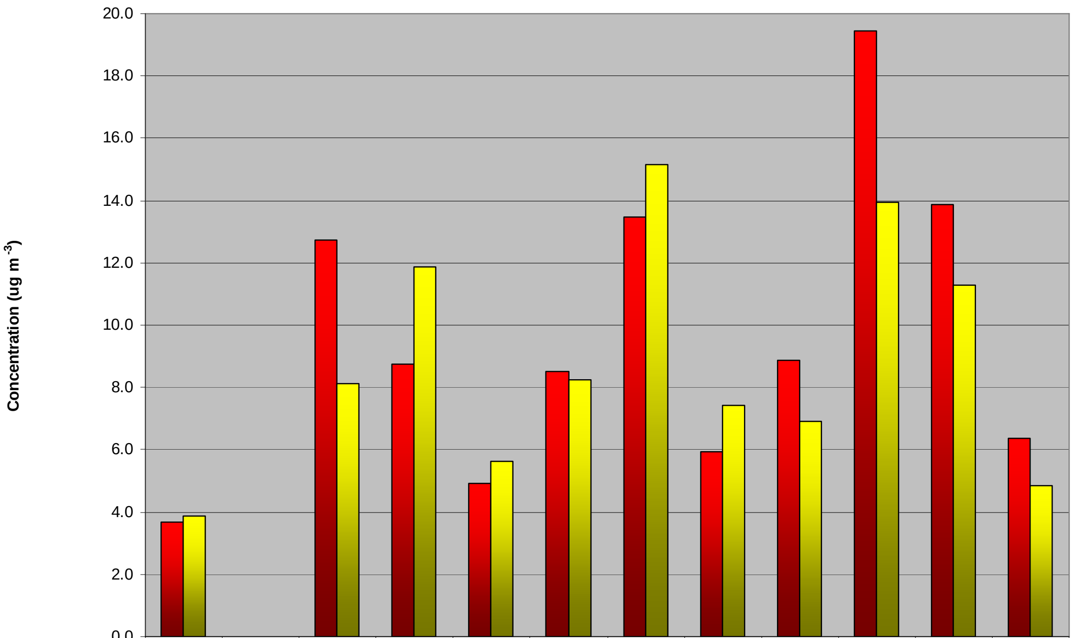
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Toluene 1	18.1	21.2		28.8	13.6	32.9		13.4	10.9	17.6	20.9	14.5
Toluene 2	16.1	23.0		42.9	9.9	27.7		18.1	9.5	12.3	18.5	11.7

Figure 16B. Summary of 2007 Duplicate Toluene Exposures at London Marylebone Road



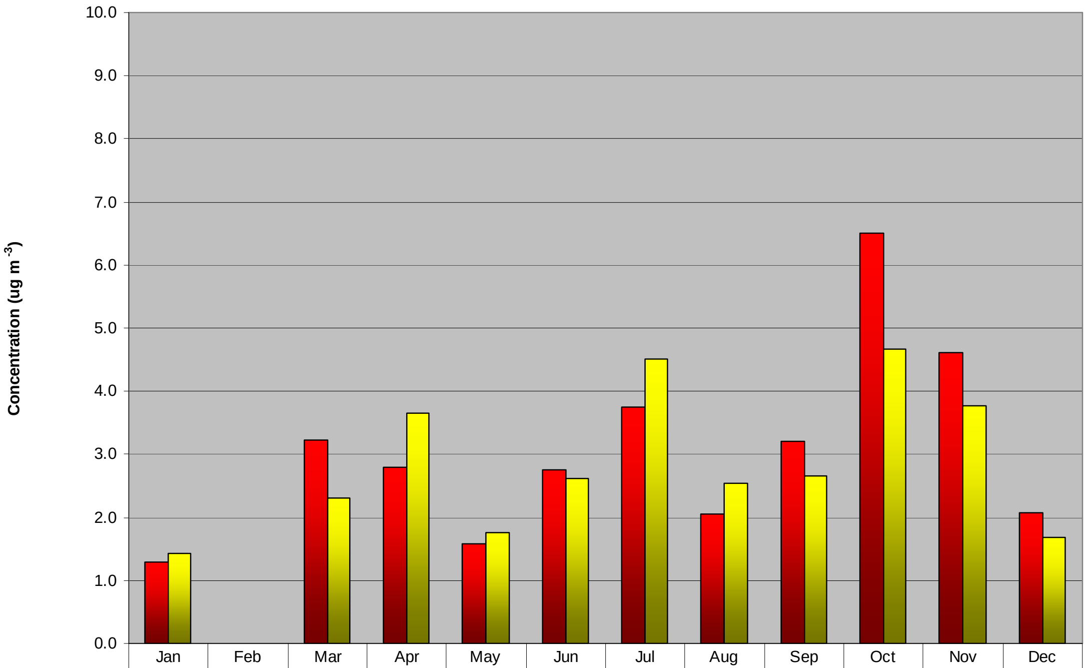
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ethyl Benzene 1	1.4		9.2	6.9	2.3	3.9	7.6	4.0	6.3	16.7	10.7	4.0
Ethyl Benzene 2	1.4		5.8	9.2	2.7	4.2	8.3	5.3	4.5	11.5	8.5	2.5

Figure 17C. Summary of 2007 Duplicate Ethyl Benzene Exposures at London Marylebone Road



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
m,p Xylene 1	3.7		12.7	8.7	4.9	8.5	13.5	5.9	8.9	19.5	13.9	6.4
m,p Xylene 2	3.9		8.1	11.9	5.6	8.2	15.2	7.4	6.9	13.9	11.3	4.9

Figure 17D. Summary of 2007 Duplicate m, p Xylene Exposures at London Marylebone Road



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
o Xylene 1	1.3		3.2	2.8	1.6	2.8	3.8	2.0	3.2	6.5	4.6	2.1
o Xylene 2	1.4		2.3	3.6	1.8	2.6	4.5	2.5	2.7	4.7	3.8	1.7

Figure 16E. Summary of 2007 Duplicate o-Xylene Exposures at London Marylebone Road

11 Discussion

11.1 Mean Benzene Concentrations

As expected, maximum concentrations were recorded at roadside and petrol station locations, which accounted for 63% and 4% of sites respectively. These findings are consistent with motor vehicle emissions and evaporative emissions from petrol being significant sources of atmospheric benzene in Greater London. Within some boroughs, there continues to be a 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 emission source on urban benzene concentrations.

Compared to roadside sites, background concentrations were generally lower. However, there was some concentration overlaps between site classifications, for example mean levels recorded at background sites ranged from 1.1μg/m^{-3} to 2.9μg/m^{-3} and at roadside mean values ranged from 1.5μg/m^{-3} to 3.8μg/m^{-3}. Although this overlap exists, maximum mean values were 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, height of sampler and episodic peaks in benzene which can happen at background and roadside sites. 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 the roadside and benzene concentrations.

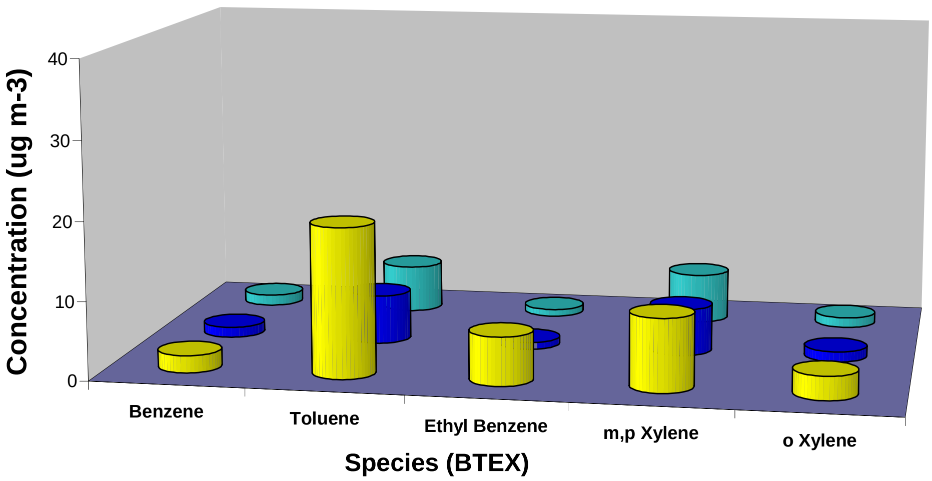
In Hackney and Newham, mean benzene levels recorded at the petrol station sites were similar to levels recorded at the busy roadside sites. This suggests that the influence of evaporative exhaust emissions on benzene levels at these sites is similar to the influence of exhaust emissions at roadside sites. However, benzene levels at the Kensington and Chelsea petrol station continue to be higher than typical roadside levels within this borough, with concentrations recorded in the range of 1.7 $\mu g/m^{-3}$ to 10.4 $\mu g/m^{-3}$. These concentrations were also higher than petrol station concentrations recorded at other boroughs. Thus, at this site, it would appear that evaporative emissions of benzene from petrol have a significant effect on benzene levels. It is likely that this petrol station site is located near a relatively busy road and thus vehicle emissions would have contributed to levels recorded at this site. This may also reflect the number of transactions taking place and/or size of the station.

11.2 Comparison with other Data

Comparison of the LWEP data with the calculated mean data for the Automatic Hydrocarbon Monitoring Network *(AHMN)* indicates that the concentrations recorded in this survey were very comparable for all BTEX species except toluene and ethyl benzene. Historically the diffusion tube method has tended to over-estimate toluene concentrations and thus present a worst-case scenario when assessing annual means. Ethyl benzene has not historically been over-estimated by the diffusive method used in this survey and caution should therefore be taken when including this year's ethyl benzene data in any long term trend analysis. An investigation into this over-estimation is underway and QA/QC procedures are being reviewed.

The calculated annual mean level for the roadside location type was 2.1µg/m^{-3}, which compares with 2.2µg/m^{-3} and 1.3µg/m^{-3} calculated for Marylebone Road diffusion tube and Hydrocarbon Network (LWEP exposure period) data respectively. Within the survey, the highest annual mean recorded at a roadside location was 3.5µg/m^{-3}, which was recorded at a site in Brent. The maximum annual mean recorded at a background site was 2.2µg/m^{-3}, also recorded at a site in Brent.

Three out of five 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	2.2	19.1	6.2	9.3	3.0
Hydrocarbon Network mean data for LWEP exposure period	1.3	6.3	0.9	6.0	1.3
Hydrocarbon Network annual mean data.	1.4	6.1	0.9	6.4	1.3

Figure 17. Comparison of Species Measured at London Marylebone Road.

11.3 Seasonal Trends

Higher benzene concentrations were monitored at most locations during October and November, consistent with inclement meteorological conditions expected with the onset of winter. Conversely, benzene concentrations measured during the winter months of January – March largely did not reflect the effects of winter temperature inversions with little seasonal trend observed. Meteorological measurements made for the same period showed that mean monthly ambient temperatures ranged from 1.7 to 3.2°C higher than average. In fact January of 2007 was the warmest January since 1916 according to the Met Office. Slightly elevated benzene concentrations were also recorded during July in most boroughs. This may be explained by particularly unfavourable meteorological conditions during summer 2007 with twice the average rainfall and ambient temperatures approximately 2°C colder than the average recorded for the month of July. Some episodic peaks did not coincide with the common trend and may be due to localised meteorological and environmental conditions.

Figure 18 below, shows a stability in concentrations observed at the continuous hydrocarbon monitoring network site at Marylebone Road, with winter rises in February and December and a small rise in the summer month of June.

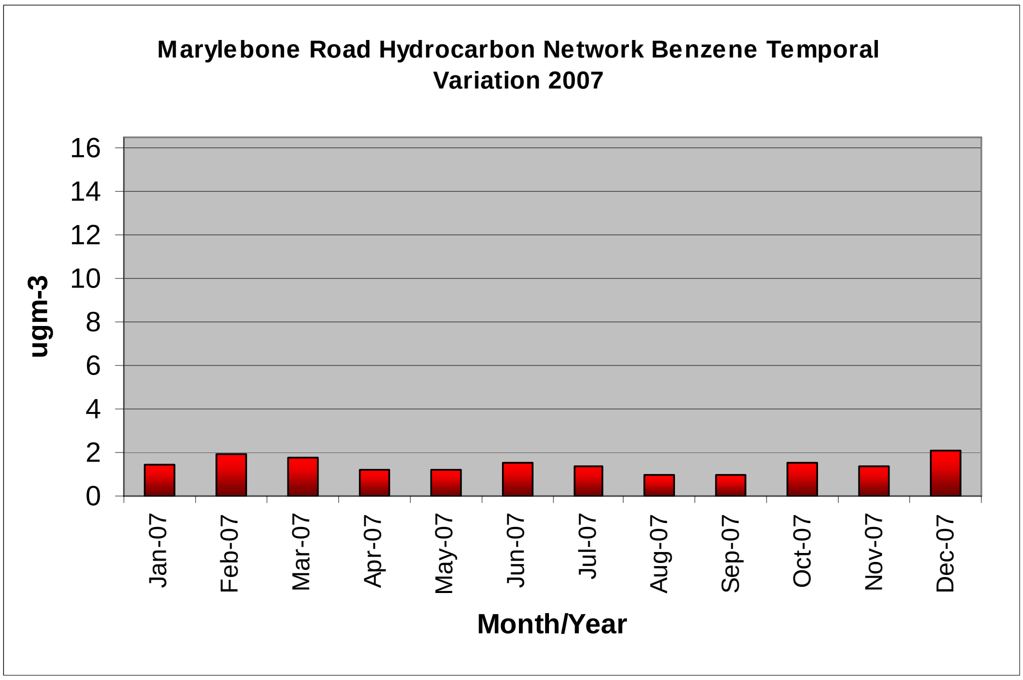


Figure 18. Marylebone Road Temporal Variation

12 Predictions for Future Urban Benzene Concentrations

Several measures have been introduced in past years to reduce the emissions of pollutants from the transport sector. Ambient benzene concentrations have fallen sharply due to reductions in the benzene content of petrol and the introduction of cars equipped with catalytic converters. As predicted the policy measures in place have helped all urban background and roadside locations achieve the objective of 16.25$\mu g/m^{-3}$ (2003) and the AQS long-term objective of 5$\mu g/m^{-3}$ annual mean (2010).

Favourable meteorological conditions during 2005 helped prevent winter episodes caused by temperature inversions. The winter of 2005 was uncharacteristically mild and in combination with 2006 summer peaks may go some way to explaining slightly higher concentrations at many sites during 2006 as compared with 2005. This was the first time benzene concentrations had not declined since the LWEP started. Annual mean benzene concentrations for 2007 show that benzene levels have in most cases been maintained at approximately 2006 levels. Though benzene concentrations are relatively low, the variability in meteorological conditions observed in recent years and the subsequent impact these conditions can have on pollution concentrations, highlights the importance of continued monitoring of benzene to ensure that the AQS long-term objective of 5$\mu g/m^{-3}$ as an annual mean is met by 2010. Benzene emissions are expected to continue to decline until around 2015, but are likely to be emitted through the use of coal and wood for domestic fuel, as well as natural gas, to satisfy demand after 2010.

13 Report Statement

Bureau Veritas completed this report on the basis of a defined program of works and within the terms and conditions agreed with the client.

This report was compiled with all reasonable skill and care, bearing in mind the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project as agreed.

Bureau Veritas cannot accept responsibility to any parties whatsoever, following issue of this report, for any matters arising which may be considered outside the agreed scope of works.

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Appendix A

Site Descriptions

London Borough of Bexley

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

London Borough of Brent

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

London Borough of Hillingdon

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

London 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	North Harrow, Social Services, Council owned Bin Area.	<5	Roadside	TQ513667/188630
HW05	Psychology Service, Station Road, Harrow	4	Roadside	TQ51375/188990

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
GW38	O/S 581/583 Westhorne Avenue, Eltham SE 9	2	Roadside	TQ541914/175038
GW39a,b, c,d	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
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 Hackney

Site Code	Location	Distance from Busy Road (m)	Classification	Grid Reference
Cowper Rd	Cowper Road, Stoke Newington Road.	0.5	Roadside	TQ533224/185606
Green Lane	Green Lane, Seven Sisters	0.5	Roadside	TQ532051/187466
7Sister Rd	Seven Sister Road	1.5	Petrol Station	TQ531591/186898
Hackney College	Six Form College, Brooke House, Kenninghall Road, E5	5	Roadside	TQ534802/186229
Thoresby St	Thoresby Street	1	Petrol Station	TQ532262/182871

London Borough 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
BTEX 8	George IV Public House, Chiswick High Road	6	Roadside	TQ517411/178051

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	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	TQ541954/185430
Site 4	Town Hall Annex,, Barking Road, E15	4.5	Roadside	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	Background	TQ543762/180784
Site 13	290-292 Green Street, Upton park. E7	<1	Roadside	TQ541134/184098
Site 16	Leytonstone Road, Lamp Post Opposite 107, Stratford, E15	<1	Roadside	TQ541134/184098
Site 20	Corner of Canning Town Roundabout, Silvertown Way, Canning Town, E13	<1	Roadside	TQ539556/181499
Site 21	Monitoring Station Cam Road, Stratford, E15	3.5	Roadside	TQ538657/183973

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 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

Benzene Calculation and Conversion

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

Where:

M = the amount of benzene adsorbed by each tube

T = the period during which the tube was exposed

Dc = 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})

Diffusion coefficient used = 1.39 ng ppm^{-1} min^{-1}

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 & $\mu g/m^{-3}$)

Benzene Concentrations 2007

London Borough of Bexley

Month	**Site Code** LBB1 ppb	$\mu g/m^{-3}$	LBB3 ppb	$\mu g/m^{-3}$	LBB5 ppb	$\mu g/m^{-3}$
January	0.1	0.3	0.4	1.3	0.6	1.8
February	0.6	2.1	-	-	-	-
March	1.5	4.8	0.6	2.0	0.4	1.3
April	0.5	1.6	0.4	1.2	0.4	1.2
May	-	-	0.5	1.5	0.3	1.1
June	0.4	1.4	0.6	2.0	0.6	1.8
July	0.2	0.8	0.2	0.7	0.3	1.0
August	0.2	0.6	0.3	0.9	0.3	0.8
September	0.3	0.8	0.4	1.2	0.3	1.0
October	0.5	1.5	0.6	1.9	0.6	1.9
November	0.8	2.4	0.9	3.1	0.8	2.6
December	0.7	2.3	0.7	2.4	0.6	2.1
Annual Mean	0.5	1.6	0.5	1.5	0.4	1.4

Benzene Concentrations 2007

London Borough of Brent

Month	Site Code BR31 ppb	µg/m-3	BR41 ppb	µg/m-3	BR42 ppb	µg/m-3	BR51 ppb	µg/m-3	BR53 ppb	µg/m-3
January	0.8	2.4	0.4	1.4	0.4	1.4	-	-	0.7	2.3
February	1.3	4.4	0.4	1.4	1.0	3.3	0.7	2.4	1.3	4.1
March	1.0	3.1	0.5	1.6	0.6	1.9	0.5	1.6	1.0	3.1
April	0.8	2.5	0.3	1.1	0.7	2.3	0.4	1.3	0.6	2.0
May	0.8	2.7	0.7	2.2	0.5	1.6	0.3	1.1	0.7	2.3
June	0.6	1.8	0.9	3.0	0.8	2.5	0.4	1.2	0.7	2.4
July	0.7	2.2	0.3	1.1	0.4	1.4	0.4	1.2	0.6	1.8
August	0.5	1.8	0.2	0.6	0.4	1.2	0.2	0.7	0.4	1.4
September	0.4	1.3	0.2	0.6	0.3	1.0	0.2	0.5	0.3	1.1
October	0.9	2.9	0.6	2.0	0.6	2.0	0.6	2.0	0.8	2.6
November	1.1	3.6	0.8	2.5	0.7	2.2	0.5	1.8	0.9	2.9
December	1.2	3.9	0.8	2.5	1.6	5.2	0.7	2.3	1.1	3.5
Annual Mean	0.8	2.7	0.5	1.7	0.7	2.2	0.4	1.3	0.8	2.5

Month	Site Code BR55 ppb	µg/m-3	BR56 ppb	µg/m-3	BR57 ppb	µg/m-3	BR58 ppb	µg/m-3	BR59 ppb	µg/m-3
January	0.8	2.6	0.6	1.8	0.8	2.6	-	-	0.7	2.1
February	1.6	5.1	1.0	3.2	0.9	2.8	1.4	4.7	1.1	3.5
March	1.1	3.7	0.6	2.0	0.8	2.6	1.0	3.1	0.8	2.5
April	1.3	4.2	0.6	2.0	-	-	0.8	2.5	-	-
May	1.0	3.1	0.6	1.8	0.7	2.2	1.0	3.1	0.7	2.3
June	-	-	0.7	2.3	0.6	2.0	0.8	2.7	0.9	3.0
July	0.9	2.8	0.5	1.7	-	-	0.9	2.8	0.6	2.1
August	0.7	2.2	0.4	1.3	0.4	1.4	0.6	1.8	0.5	1.7
September	0.7	2.4	0.3	1.0	0.4	1.2	0.4	1.2	0.5	1.6
October	0.9	3.1	0.6	2.0	0.9	2.8	1.0	3.1	-	-
November	1.7	5.6	1.0	3.2	1.1	3.5	1.0	3.3	-	-
December	1.2	4.0	1.6	5.1	1.0	3.2	1.2	3.8	1.0	3.3
Annual Mean	1.0	3.2	0.7	2.3	0.6	2.0	0.8	2.7	0.6	1.8

Benzene Concentrations 2007

City of London

Month	Site Code CL1 ppb	µg/m-3	CL2 ppb	µg/m-3	CL3 ppb	µg/m-3	CL4 ppb	µg/m-3	CL5 ppb	µg/m-3
January	0.4	1.2	0.4	1.3	0.3	1.1	0.5	1.5	0.4	1.2
February	0.5	1.5	0.7	2.3	0.5	1.6	0.5	1.6	0.9	2.9
March	0.6	1.9	0.6	2.1	0.7	2.2	0.6	1.9	0.5	1.7
April	0.6	1.9	0.7	2.4	-	-	-	-	-	-
May	0.7	2.3	0.7	2.2	-	-	-	-	-	-
June	0.5	1.5	0.8	2.7	-	-	-	-	-	-
July	1.2	3.9	0.8	2.6	-	-	-	-	-	-
August	0.5	1.6	0.7	2.1	-	-	-	-	-	-
September	0.6	1.9	-	-	-	-	-	-	-	-
October	0.6	2.0	-	-	-	-	-	-	-	-
November	1.1	3.6	0.8	2.7	-	-	-	-	-	-
December	0.7	2.3	0.8	2.6	-	-	-	-	-	-
Annual Mean	0.7	2.1	0.6	1.9	0.1	0.4	0.1	0.4	0.1	0.5
Month	**Site Code CL6 ppb**	**µg/m-3**	**CL7 ppb**	**µg/m-3**	**CL8 ppb**	**µg/m-3**	**CL9 ppb**	**µg/m-3**	**CL10 ppb**	**µg/m-3**
January	0.4	1.2	0.4	1.4	0.7	2.1	0.4	1.2	0.6	1.8
February	0.4	1.4	0.4	1.4	0.9	2.8	0.6	1.9	0.7	2.3
March	0.5	1.6	0.4	1.4	0.8	2.6	0.6	1.8	1.2	3.8
April	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-
Annual Mean	0.1	0.4	0.1	0.4	0.2	0.6	0.1	0.4	0.2	0.7

Benzene Concentrations 2007

London Borough of Greenwich

Month	Site Code GW29 ppb	µg/m-3	GW33 ppb	µg/m-3	GW34 ppb	µg/m-3	GW35 ppb	µg/m-3	GW38 ppb	µg/m-3
January	0.0	0.0	0.5	1.8	0.5	1.5	0.5	1.7	0.4	1.3
February	1.0	3.3	1.3	4.2	0.8	2.7	1.2	3.8	1.0	3.3
March	0.7	2.3	0.7	2.3	0.6	1.8	0.8	2.7	0.5	1.5
April	0.7	2.2	1.1	3.6	0.5	1.6	1.0	3.1	0.8	2.5
May	0.6	2.0	0.8	2.7	0.5	1.6	0.6	1.9	0.5	1.8
June	0.5	1.7	0.9	2.9	0.5	1.5	0.6	2.0	0.6	2.0
July	0.6	1.9	0.7	2.2	0.4	1.2	0.7	2.2	0.5	1.5
August	0.5	1.6	0.5	1.8	0.3	1.0	0.6	1.9	0.6	1.8
September	0.3	1.1	0.6	2.0	0.3	1.0	0.5	1.5	0.2	0.8
October	0.1	0.4	1.4	4.5	1.0	3.1	1.1	3.6	1.3	4.2
November	1.2	3.9	1.6	5.3	1.2	3.9	1.1	3.5	1.0	3.2
December	0.6	2.0	0.6	2.0	0.5	1.7	0.6	2.0	0.0	0.0
Annual Mean	0.6	1.9	0.9	2.9	0.6	1.9	0.8	2.5	0.6	2.0
Month	Site Code GW39 ppb	µg/m-3	GW41 ppb	µg/m-3	GW42 ppb	µg/m-3	GW50 ppb	µg/m-3	GW51 ppb	µg/m-3
January	0.4	1.2	0.5	1.7	0.5	1.5	1.1	3.4	0.7	2.3
February	0.7	2.2	0.8	2.5	1.0	3.3	1.2	4.0	0.8	2.6
March	0.3	1.1	0.4	1.4	0.5	1.7	0.9	2.9	0.4	1.4
April	0.2	0.7	0.5	1.7	0.9	2.9	0.7	2.2	0.5	1.6
May	0.3	1.1	0.5	1.5	0.6	2.1	0.7	2.4	0.5	1.5
June	0.1	0.3	0.9	3.0	0.0	0.0	0.4	1.4	0.4	1.4
July	0.2	0.8	0.5	1.7	0.0	0.0	0.7	2.4	0.4	1.2
August	0.2	0.7	0.4	1.3	0.4	1.2	0.7	2.2	0.4	1.3
September	0.2	0.6	0.2	0.8	0.4	1.4	0.4	1.4	0.3	0.8
October	0.8	2.5	1.1	3.7	0.9	3.0	1.2	4.0	0.8	2.7
November	0.7	2.4	0.9	2.9	1.2	3.9	1.4	4.7	0.8	2.7
December	0.4	1.4	0.5	1.6	0.5	1.7	0.8	2.7	0.4	1.4
Annual Mean	0.4	1.3	0.6	2.0	0.6	1.9	0.9	2.8	0.5	1.7

Benzene Concentrations 2007

London Borough of Greenwich (continued)

Month	Site Code GW55 ppb	µg/m-3	GW39b ppb	µg/m-3	GW39c ppb	µg/m-3	GW39d ppb	µg/m-3
January	0.4	1.4	0.3	1.1	0.3	1.1	0.3	1.1
February	0.7	2.1	0.6	2.1	0.6	2.1	0.0	0.0
March	0.4	1.4	0.4	1.2	0.4	1.2	0.0	0.0
April	0.5	1.7	0.3	1.0	0.3	1.0	0.3	1.1
May	0.4	1.2	0.4	1.4	0.3	0.9	0.3	1.1
June	0.5	1.5	0.3	1.0	0.3	0.9	0.3	0.9
July	0.3	1.1	0.2	0.7	0.3	0.8	0.3	1.1
August	0.3	0.9	0.2	0.6	0.3	0.8	0.2	0.7
September	0.2	0.8	0.2	0.6	0.2	0.6	0.2	0.7
October	0.9	3.1	0.5	1.7	0.8	2.6	0.8	2.6
November	1.0	3.4	0.9	2.9	1.0	3.3	1.0	3.1
December	0.6	1.8	0.4	1.4	0.4	1.3	0.4	1.1
Annual Mean	0.5	1.7	0.4	1.3	0.4	1.4	0.3	1.1

Benzene Concentrations 2007

London Borough of Harrow

Month	Site Code HW01 ppb	$\mu g/m^{-3}$	HW02 ppb	$\mu g/m^{-3}$	HW03 ppb	$\mu g/m^{-3}$	HW04 ppb	$\mu g/m^{-3}$	HW05 ppb	$\mu g/m^{-3}$
January	0.5	1.5	0.3	1.1	0.3	1.1	-	-	0.7	2.3
February	0.6	1.9	0.5	1.7	0.5	1.6	0.7	2.2	0.9	2.8
March	0.4	1.3	0.2	0.7	0.4	1.3	0.5	1.7	0.7	2.3
April	0.3	0.9	0.3	0.8	0.2	0.7	0.4	1.4	0.5	1.5
May	0.3	0.9	0.2	0.6	0.2	0.6	0.3	1.0	-	-
June	0.6	1.8	0.4	1.2	0.4	1.2	0.5	1.6	0.6	2.0
July	0.5	1.7	0.4	1.3	0.6	1.9	0.5	1.5	0.7	2.4
August	0.3	0.8	0.2	0.7	0.3	0.9	0.3	1.0	0.4	1.3
September	0.5	1.6	0.3	0.8	0.2	0.6	0.3	1.1	0.4	1.4
October	1.2	3.9	0.9	3.0	1.1	3.6	1.2	3.9	1.7	5.6
November	0.6	2.0	0.5	1.7	0.5	1.7	1.0	3.2	-	-
December	0.7	2.1	0.5	1.6	0.5	1.7	0.7	2.2	0.8	2.6
Annual Mean	0.5	1.7	0.4	1.3	0.4	1.4	0.5	1.7	0.6	2.0

Benzene Concentrations 2007

London Borough of Hounslow

Month	Site Code HS BTEX1 ppb	µg/m-3	HS BTEX2 ppb	µg/m-3	HS BTEX3 ppb	µg/m-3	HS BTEX4 ppb	µg/m-3
January	0.5	1.7	0.4	1.4	0.6	1.8	0.6	1.9
February	0.7	2.2	0.6	1.9	0.8	2.6	0.7	2.3
March	0.8	2.7	0.7	2.2	0.5	1.6	0.5	1.7
April	0.5	1.7	0.4	1.2	0.6	1.9	0.7	2.3
May	0.5	1.7	0.4	1.2	0.5	1.6	0.6	1.8
June	0.5	1.8	0.3	1.1	0.6	1.9	0.5	1.8
July	0.4	1.4	0.3	0.9	0.4	1.4	0.5	1.7
August	0.6	2.0	0.3	0.8	0.4	1.3	0.3	1.0
September	0.3	1.1	0.3	0.8	0.3	1.0	0.4	1.2
October	1.0	3.4	0.9	3.1	1.0	3.4	1.1	3.6
November	0.8	2.5	0.7	2.3	0.7	2.2	0.9	2.8
December	0.8	2.7	0.8	2.5	1.0	3.2	1.1	3.6
Annual Mean	0.6	2.1	0.5	1.6	0.6	2.0	0.7	2.1
Month	HS BTEX5 ppb	µg/m-3	HS BTEX6 ppb	µg/m-3	HS BTEX7 ppb	µg/m-3	HS BTEX8 ppb	µg/m-3
January	0.6	2.1	0.4	1.2	0.5	1.5	-	-
February	0.8	2.5	0.8	2.6	0.7	2.2	-	-
March	0.7	2.2	0.7	2.3	0.5	1.7	-	-
April	0.5	1.7	0.6	2.1	0.5	1.6	0.5	1.6
May	0.4	1.3	1.0	3.2	0.5	1.5	0.7	2.3
June	0.6	1.9	0.7	2.4	0.5	1.6	1.1	3.6
July	0.4	1.2	0.7	2.3	0.5	1.7	0.6	2.1
August	0.7	2.3	0.4	1.3	0.5	1.8	0.3	1.1
September	0.3	0.8	0.4	1.2	0.4	1.2	0.4	1.2
October	0.9	3.0	1.3	4.4	0.9	2.8	1.3	4.4
November	0.9	3.0	1.5	4.7	0.6	1.9	0.8	2.7
December	0.9	3.0	1.2	3.9	-	-	1.1	3.5
Annual Mean	0.6	2.1	0.8	2.6	0.5	1.6	0.6	1.9

Benzene Concentrations 2007

London Borough of Newham

Month	Site Code 1 ppb	µg/m-3	2 ppb	µg/m-3	3 ppb	µg/m-3	4 ppb	µg/m-3
January	0.6	2.0	-	-	0.5	1.7	0.5	1.6
February	0.5	1.7	0.6	2.1	0.6	1.9	-	-
March	0.5	1.5	0.7	2.4	0.5	1.7	0.7	2.3
April	0.4	1.4	-	-	1.3	4.1	0.5	1.5
May	0.4	1.2	0.3	1.1	0.4	1.3	0.4	1.1
June	0.4	1.4	0.6	2.1	0.4	1.1	0.5	1.7
July	0.5	1.5	1.2	3.8	0.6	1.8	0.6	2.0
August	0.2	0.7	0.3	1.0	0.4	1.2	0.2	0.6
September	0.2	0.7	0.3	0.9	0.3	1.1	0.4	1.4
October	0.4	1.3	0.4	1.3	0.7	2.4	0.6	2.1
November	0.9	2.9	0.7	2.3	0.7	2.4	0.8	2.6
December	0.8	2.7	0.6	2.1	0.8	2.5	0.5	1.6
Annual Mean	0.5	1.6	0.5	1.6	0.6	1.9	0.5	1.5
Month	5 ppb	µg/m-3	6 ppb	µg/m-3	7 ppb	µg/m-3	8 ppb	µg/m-3
January	0.5	1.5	0.4	1.5	0.4	1.3	0.3	1.1
February	0.4	1.3	0.4	1.4	0.5	1.6	0.5	1.6
March	0.4	1.5	0.4	1.3	0.5	1.5	0.5	1.5
April	0.3	0.8	0.3	1.0	0.2	0.7	0.3	1.1
May	0.3	1.0	0.3	0.8	0.3	1.1	0.3	1.0
June	0.3	1.0	0.2	0.8	0.3	0.9	0.3	1.1
July	1.1	3.5	0.5	1.6	0.5	1.7	0.6	2.0
August	0.3	1.0	0.3	1.1	0.3	0.8	0.2	0.7
September	0.2	0.7	0.2	0.7	0.3	1.0	0.2	0.6
October	0.4	1.3	0.4	1.2	0.4	1.4	0.5	1.6
November	0.8	2.6	0.5	1.5	0.7	2.1	0.5	1.7
December	0.7	2.2	0.7	2.2	0.6	2.1	0.6	2.1
Annual Mean	0.5	1.5	0.4	1.3	0.4	1.3	0.4	1.3

Benzene Concentrations 2007

London Borough of Newham (continued).

Month	Site Code 9 ppb	µg/m-3	10 ppb	µg/m-3	11 ppb	µg/m-3	12 ppb	µg/m-3
January	0.4	1.2	0.3	1.1	0.3	1.0	0.4	1.3
February	0.6	1.9	0.5	1.7	0.6	1.8	0.6	1.9
March	0.6	1.9	0.4	1.4	0.4	1.4	0.4	1.4
April	0.5	1.5	0.3	1.0	0.4	1.4	0.3	1.1
May	0.5	1.8	0.3	0.9	0.3	0.9	0.3	1.0
June	0.5	1.6	0.2	0.8	0.3	0.9	0.3	0.9
July	0.5	1.7	0.7	2.3	0.4	1.3	0.4	1.3
August	0.3	1.1	0.2	0.6	0.2	0.7	0.2	0.8
September	-	-	0.2	0.7	0.1	0.4	0.2	0.8
October	0.4	1.4	0.6	2.1	0.4	1.3	0.4	1.4
November	0.5	1.8	0.5	1.7	0.5	1.6	0.7	2.2
December	0.8	2.7	0.8	2.6	0.5	1.5	0.6	1.8
Annual Mean	0.5	1.6	0.4	1.4	0.4	1.2	0.4	1.3
Month	13 ppb	µg/m-3	16 ppb	µg/m-3	20 ppb	µg/m-3	21 ppb	µg/m-3
January	0.5	1.7	1.0	3.1	-	-	0.4	1.4
February	0.8	2.5	1.1	3.5	0.8	2.7	0.6	1.9
March	0.4	1.4	0.7	2.4	0.7	2.1	0.5	1.6
April	0.4	1.4	0.8	2.7	0.5	1.7	0.6	1.9
May	-	-	0.7	2.1	0.7	2.2	0.4	1.2
June	0.6	1.8	0.7	2.2	0.5	1.5	0.5	1.5
July	0.5	1.6	1.4	4.4	0.5	1.6	0.9	3.0
August	0.4	1.3	0.5	1.5	0.3	1.0	0.3	1.1
September	0.3	0.9	0.5	1.6	0.5	1.6	0.4	1.2
October	0.7	2.2	1.0	3.1	-	-	0.5	1.8
November	0.9	3.0	0.9	3.1	0.7	2.2	0.9	2.9
December	0.8	2.7	0.9	3.0	0.5	1.7	0.7	2.1
Annual Mean	0.5	1.7	0.8	2.7	0.5	1.5	0.6	1.8

Benzene Concentrations 2007

Royal Borough of Kensington and Chelsea

Month	Site Code KC01 ppb	µg/m-3	KC02 ppb	µg/m-3	KC0X ppb	µg/m-3	KC04 ppb	µg/m-3	KC05 ppb	µg/m-3
January	0.5	1.5	0.4	1.4	0.5	1.7	0.4	1.4	0.5	1.7
February	1.0	3.2	0.7	2.4	3.2	10.4	0.8	2.7	0.8	2.4
March	0.6	2.0	0.3	1.0	0.5	1.7	0.5	1.5	0.5	1.6
April	0.7	2.2	1.1	3.5	-	-	0.3	1.1	0.4	1.2
May	0.7	2.3	0.3	0.9	0.8	2.6	0.4	1.2	0.5	1.5
June	0.7	2.4	0.4	1.4	-	-	0.4	1.3	0.5	1.7
July	0.5	1.8	0.6	1.9	0.7	2.2	0.4	1.4	0.6	1.8
August	0.4	1.4	0.3	0.9	0.8	2.7	0.3	0.9	0.3	1.1
September	0.4	1.3	0.3	0.9	1.0	3.2	0.3	0.9	0.3	0.9
October	0.8	2.7	0.4	1.3	0.6	1.9	0.4	1.4	0.5	1.6
November	1.1	3.7	0.8	2.6	1.1	3.7	0.9	2.8	1.0	3.1
December	0.4	1.4	0.4	1.4	0.7	2.3	0.4	1.4	0.4	1.4
Annual Mean	0.7	2.2	0.5	1.6	0.8	2.7	0.5	1.5	0.5	1.7

Benzene Concentration 2007

London Borough of Richmond

Month	Site Code RUT 2 ppb	µg/m-3	RUT 36 ppb	µg/m-3	RUT 35 ppb	µg/m-3	RUT 7 ppb	µg/m-3	RUT 32 ppb	µg/m-3
January	0.5	1.6	0.3	1.0	0.4	1.3	0.4	1.2	0.5	1.7
February	1.0	3.1	0.9	3.0	1.0	3.3	1.1	3.6	1.1	3.7
March	-	-	0.5	1.6	0.6	2.1	0.6	2.1	0.8	2.6
April	0.8	2.7	1.0	3.1	0.8	2.4	0.8	2.5	0.4	1.4
May	0.7	2.2	0.7	2.4	0.6	2.0	0.6	1.9	0.8	2.6
June	0.7	2.1	0.7	2.2	0.6	2.0	0.7	2.2	0.8	2.7
July	0.6	2.1	-	-	0.6	2.0	0.6	2.0	1.1	3.6
August	-	-	0.6	2.1	0.6	1.8	0.7	2.2	0.6	1.9
September	0.6	2.1	0.7	2.2	0.5	1.6	0.8	2.6	0.4	1.2
October	-	-	0.8	2.6	0.7	2.2	0.9	2.8	1.1	3.6
November	-	-	1.0	3.2	1.2	3.8	1.0	3.3	1.2	4.1
December	0.5	1.8	0.6	1.8	0.7	2.3	0.6	1.9	0.7	2.2
Annual Mean	0.5	1.5	0.6	2.1	0.7	2.2	0.7	2.4	0.8	2.6

Benzene Concentration 2007

London Borough of Sutton

Month	**Site Code** Site 1 ppb	µg/m-3	Site 2 ppb	µg/m-3	Site 3 ppb	µg/m-3	Site 4 ppb	µg/m-3	Site 5 ppb	µg/m-3
January	0.4	1.4	0.4	1.2	0.4	1.4	0.4	1.2	0.7	2.3
February	0.8	2.7	0.5	1.8	0.7	2.2	0.8	2.7	0.7	2.3
March	0.5	1.6	0.4	1.4	0.4	1.2	0.4	1.3	0.4	1.2
April	0.6	1.8	0.3	1.0	0.5	1.7	0.4	1.3	0.4	1.2
May	0.4	1.4	0.3	1.1	-	-	0.4	1.3	0.3	0.9
June	0.4	1.4	0.3	1.1	0.4	1.3	0.3	1.1	0.3	1.0
July	0.5	1.5	1.0	3.2	0.8	2.4	0.4	1.3	0.7	2.1
August	0.3	1.0	0.2	0.8	0.3	0.8	0.3	0.9	0.2	0.8
September	0.6	2.1	0.3	0.9	0.3	0.9	0.3	1.0	0.3	1.0
October	0.9	2.8	0.9	2.8	0.7	2.4	1.5	5.0	0.7	2.4
November	0.6	2.0	0.5	1.7	0.7	2.1	0.6	1.9	0.7	2.3
December	0.4	1.2	0.3	1.0	0.4	1.5	0.4	1.2	0.4	1.3
Annual Mean	0.5	1.8	0.5	1.5	0.5	1.5	0.5	1.7	0.5	1.6

Benzene Concentrations 2007

London Borough of Hillingdon

Month	**Site Code** HD31 ppb	$\mu g/m^{-3}$	HD46 ppb	$\mu g/m^{-3}$	HD48 ppb	$\mu g/m^{-3}$	HD50 ppb	$\mu g/m^{-3}$	HD58 ppb	$\mu g/m^{-3}$
January	0.4	1.4	0.4	1.2	0.5	1.6	0.3	1.1	0.4	1.3
February	0.7	2.4	1.1	3.7	0.9	2.8	0.9	3.0	0.8	2.6
March	0.4	1.3	0.5	1.6	0.3	1.1	0.7	2.4	0.4	1.3
April	0.5	1.7	0.7	2.2	0.6	2.1	0.5	1.6	0.5	1.6
May	0.5	1.7	0.5	1.7	0.5	1.5	0.4	1.4	0.4	1.2
June	0.6	1.9	0.7	2.1	0.5	1.8	0.7	2.1	0.5	1.6
July	0.6	2.0	0.9	2.9	0.9	3.1	1.1	3.6	0.8	2.5
August	0.4	1.3	0.5	1.5	0.8	2.6	0.4	1.3	0.5	1.5
September	0.3	0.9	0.3	1.1	0.4	1.1	0.3	1.0	0.3	1.0
October	0.7	2.4	1.0	3.3	1.0	3.2	0.9	3.0	0.9	2.9
November	0.7	2.4	0.8	2.6	0.8	2.6	0.7	2.2	0.7	2.2
December	0.6	2.0	0.8	2.6	0.7	2.2	0.7	2.1	0.8	2.4
Annual Mean	0.5	1.8	0.7	2.2	0.7	2.1	0.6	2.1	0.6	1.9

Benzene Concentrations 2007

London Borough of Hackney

Month	**Site Code** Cowper Road ppb	µg/m^{-3}	Green Lane ppb	µg/m^{-3}	Seven Sisters ppb	µg/m^{-3}	Hackney College ppb	µg/m^{-3}	Thorsby Street ppb	µg/m^{-3}
January	1.2	3.9	1.7	5.6	1.9	6.0	-	-	1.3	4.1
February	0.8	2.7	0.8	2.6	1.1	3.5	0.9	2.9	1.0	3.2
March	0.4	1.2	0.9	3.0	0.7	2.2	0.5	1.8	0.4	1.1
April	-	-	-	-	-	-	-	-	-	-
May	0.2	0.6	0.7	2.2	0.5	1.8	0.3	0.8	0.3	1.0
June	0.4	1.2	0.7	2.1	0.6	1.8	0.3	1.1	0.3	0.9
July	0.3	0.9	1.0	3.1	0.6	2.0	0.4	1.2	0.4	1.2
August	0.2	0.5	0.5	1.6	0.4	1.4	0.3	1.0	0.2	0.6
September	0.3	1.0	0.6	2.1	0.6	2.0	0.5	1.5	0.4	1.2
October	0.9	2.8	1.6	5.2	1.6	5.3	1.0	3.4	1.4	4.6
November	1.2	3.9	1.7	5.4	1.3	4.1	1.3	4.2	0.9	3.0
December	0.6	2.0	1.0	3.2	0.9	2.8	0.6	1.8	0.6	2.1
Annual Mean	0.5	1.7	0.9	3.0	0.8	2.7	0.5	1.6	0.6	1.9

Appendix D

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

Toluene Concentrations 2007

Royal Borough of Kensington and Chelsea

Month	**Site Code** KC01 ppb	µg /m-3	KC02 ppb	µg /m-3	KC0X ppb	µg /m-3	KC04 ppb	µg /m-3	KC05 ppb	µg /m-3
January	2.3	8.8	2.6	10.0	3.7	14.2	2.3	8.9	3.2	12.1
February	4.2	16.1	2.7	10.4	16.9	64.6	3.2	12.3	2.3	8.7
March	3.4	12.9	1.9	7.4	2.7	10.2	2.9	11.0	2.5	9.7
April	5.7	22.0	41.1	157.2	-	-	2.5	9.5	3.9	15.0
May	7.1	27.0	7.0	26.9	9.1	34.8	8.1	31.0	6.4	24.4
June	5.7	21.8	7.5	28.7	-	-	6.4	24.5	6.8	25.9
July	8.5	32.7	10.3	39.5	12.0	45.8	5.1	19.7	26.4	101.2
August	4.3	16.4	3.7	14.2	11.4	43.7	3.5	13.5	4.1	15.8
September	3.6	13.7	5.4	20.7	102.8	393.7	9.8	37.6	2.9	11.1
October	3.8	14.5	1.7	6.6	5.3	20.3	2.8	10.9	3.1	11.8
November	20.1	76.9	1.9	7.3	7.2	27.4	2.9	11.2	7.7	29.6
December	3.9	14.8	3.5	13.4	5.3	20.2	3.5	13.5	3.6	13.8
Annual Mean	6.0	23.1	7.4	28.5	14.7	56.3	4.4	17.0	6.1	23.3

Toluene Concentrations 2007

City of London

Month	**Site Code** CL1 ppb	µg/m-3	CL2 ppb	µg/m-3	CL3 ppb	µg/m-3	CL4 ppb	µg/m-3	CL5 ppb	µg/m-3
January	3.8	14.4	3.2	12.3	3.2	12.3	4.8	18.3	3.3	12.8
February	2.2	8.6	5.9	22.7	3.8	14.4	4.9	18.9	8.2	31.2
March	3.9	14.9	3.6	13.8	15.7	60.1	4.1	15.5	2.8	10.6
April	9.7	37.1	7.8	29.7	-	-	-	-	-	-
May	6.5	24.8	5.9	22.5	-	-	-	-	-	-
June	5.0	19.3	7.3	27.8	-	-	-	-	-	-
July	66.2	253.5	8.7	14.1	-	-	-	-	-	-
August	4.5	17.2	5.5	21.0	-	-	-	-	-	-
September	85.9	329.2	-	-	-	-	-	-	-	-
October	3.0	11.7	-	-	-	-	-	-	-	-
November	3.9	14.9	3.7	14.1	-	-	-	-	-	-
December	4.4	17.0	4.3	16.6	-	-	-	-	-	-
Annual Mean	16.6	63.5	4.7	16.2	1.9	7.2	1.1	4.4	1.2	4.6
Month	CL6 ppb	µg/m-3	CL7 ppb	µg/m-3	CL8 ppb	µg/m-3	CL9 ppb	µg/m-3	CL10 ppb	µg/m-3
January	4.9	18.7	5.2	19.8	4.2	16.0	3.6	13.8	4.3	16.4
February	6.0	23.2	3.6	13.9	8.8	33.6	5.9	22.6	4.3	16.5
March	2.8	10.9	3.1	11.9	4.1	15.7	2.8	10.8	18.6	71.3
April	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-
Annual Mean	1.1	4.4	1.0	3.8	1.4	5.4	1.0	3.9	2.3	8.7

Toluene Concentrations 2007

London Borough of Hounslow

Month	**Site Code** HS BTEX1 ppb	µg/m-3	HS BTEX2 ppb	µg/m-3	HS BTEX3 ppb	µg/m-3	HS BTEX4 ppb	µg/m-3
January	35.5	135.9	15.8	60.6	38.3	146.9	16.4	62.7
February	3.8	14.5	4.8	18.4	6.3	24.3	3.6	13.6
March	34.1	130.6	21.2	81.3	3.4	13.1	4.8	18.4
April	8.9	34.2	3.2	12.4	7.6	29.2	6.9	26.4
May	13.7	52.5	10.5	40.2	16.0	61.4	17.8	68.2
June	28.7	110.0	24.8	94.8	28.9	110.5	24.9	95.3
July	8.4	32.4	6.5	25.0	6.7	25.5	6.9	26.4
August	8.8	33.8	4.2	16.0	3.1	12.0	3.5	13.3
September	2.8	10.6	6.9	26.6	6.4	24.6	3.6	13.7
October	12.9	49.4	13.6	52.1	5.5	21.0	13.9	53.4
November	22.1	84.5	26.9	103.0	3.7	14.3	3.3	12.8
December	4.5	17.1	5.2	19.8	4.7	18.0	5.0	19.0
Annual Mean	15.3	58.8	12.0	45.9	10.9	41.7	9.2	35.3

Toluene Concentrations 2007

London Borough of Hounslow (continued)

Month	Site Code HS BTEX5 ppb	µg/m^{-3}	HS BTEX6 ppb	µg/m^{-3}	HS BTEX7 ppb	µg/m^{-3}	HS BTEX8 ppb	µg/m^{-3}
January	58.1	222.4	5.8	22.2	33.7	129.0	-	-
February	7.3	27.8	4.7	17.9	4.2	16.0	-	-
March	20.0	76.5	5.1	19.4	3.6	13.8	-	-
April	3.8	14.7	7.5	28.8	3.9	14.9	-	-
May	13.8	52.9	44.7	171.1	17.0	65.0	12.6	48.2
June	22.4	85.9	16.2	62.2	14.9	57.0	53.9	206.5
July	7.5	28.9	9.2	35.4	6.8	26.2	7.8	30.0
August	57.1	218.9	3.1	11.8	4.1	15.5	3.7	14.2
September	3.4	13.0	7.5	28.6	64.1	245.5	4.4	16.8
October	5.4	20.5	7.4	28.3	4.0	15.5	16.9	64.7
November	2.7	10.3	6.7	25.8	2.7	10.4	3.7	14.0
December	3.3	12.6	4.9	18.9	-	-	6.1	23.4
Annual Mean	17.1	65.4	10.2	39.2	13.2	50.7	9.1	34.8

Toluene Concentrations 2007

London Borough of Richmond

Month	Site Code RUT 2 ppb	µg/ m-3	RUT 36 ppb	µg/ m-3	RUT 35 ppb	µg/ m-3	RUT 7 ppb	µg/ m-3	RUT 32 ppb	µg/ m-3
January	5.7	21.8	2.7	10.2	3.6	13.9	4.0	15.3	4.1	15.6
February	4.0	15.3	5.1	19.4	4.8	18.4	5.3	20.2	5.5	21.2
March	-	-	3.4	13.1	3.7	14.3	13.7	52.4	3.9	14.9
April	10.4	40.0	7.9	30.2	8.4	32.3	12.2	46.6	4.0	15.2
May	10.0	38.2	10.8	41.3	8.6	33.0	13.4	51.2	11.3	43.2
June	7.2	27.4	11.7	44.9	7.0	26.7	11.5	43.9	7.8	29.8
July	6.7	25.7	-	-	3.3	12.7	17.4	66.7	7.6	29.2
August	0.2	0.8	57.7	220.8	4.3	16.6	8.3	31.8	4.7	18.1
September	4.6	17.7	6.7	25.6	3.9	15.1	13.3	51.1	3.5	13.2
October	-	-	4.2	16.1	3.0	11.5	8.2	31.3	9.7	37.1
November	-	-	4.2	16.1	5.3	20.5	13.2	50.4	4.6	17.6
December	3.8	14.6	2.8	10.8	2.9	11.2	4.8	18.4	2.6	9.9
Annual Mean	4.4	16.8	9.8	37.4	4.9	18.9	10.4	39.9	5.8	22.1

Toluene Concentrations 2007

London Borough of Sutton

Month	**Site Code** Site 1 ppb	µg/ m^{-3}	Site 2 ppb	µg/ m^{-3}	Site 3 ppb	µg/ m^{-3}	Site 4 ppb	µg/ m^{-3}	Site 5 ppb	µg/ m^{-3}
January	2.9	11.2	2.8	10.8	3.5	13.5	2.4	9.0	3.5	13.5
February	3.7	14.0	2.2	8.5	2.7	10.2	3.3	12.5	2.9	11.2
March	3.5	13.5	2.1	8.0	1.8	7.1	2.4	9.4	3.2	12.4
April	7.1	27.4	2.7	10.2	6.2	23.7	6.5	25.0	7.5	28.6
May	8.2	31.5	3.7	14.0	-	-	4.6	17.6	3.4	13.2
June	6.7	25.8	4.9	18.9	5.3	20.4	6.6	25.3	3.9	14.9
July	6.6	25.2	80.5	308.4	60.0	229.8	15.2	58.2	57.5	220.1
August	2.9	11.0	2.1	8.2	2.3	8.7	2.8	10.7	2.5	9.4
September	101.1	387.3	3.5	13.4	5.2	19.7	3.5	13.2	8.3	31.9
October	9.1	34.8	4.1	15.8	3.4	12.8	6.2	23.7	2.6	10.1
November	3.3	12.8	3.5	13.5	28.5	109.1	1.2	4.7	3.8	14.6
December	3.5	13.3	1.6	6.3	40.4	154.7	2.3	8.7	2.1	8.0
Annual Mean	13.2	50.7	9.5	36.3	13.3	50.8	4.7	18.2	8.4	32.3

Toluene Concentrations 2007

London Borough of Hackney

Month	**Site Code** Cowper Road ppb	µg/ m-3	Green Lane ppb	µg/ m-3	Seven Sisters ppb	µg/ m-3	Hackney College ppb	µg/ m-3	Thorsby Street ppb	µg/ m-3
January	6.2	23.8	8.6	32.9	18.3	69.9	-	-	7.1	27.0
February	21.7	83.1	22.4	85.8	22.4	85.8	21.8	83.4	27.3	104.7
March	1.3	0.2	1.2	0.4	2.2	0.4	1.3	0.3	1.8	0.2
April	2.9	11.1	5.0	19.1	4.5	17.4	3.2	12.3	3.0	11.3
May	-	-	-	-	-	-	-	-	-	-
June	3.7	14.4	8.5	32.6	5.6	21.4	5.5	21.0	6.1	23.4
July	2.8	10.6	14.5	55.4	11.8	45.2	3.2	12.3	13.7	52.7
August	2.0	7.5	3.3	12.8	2.9	11.1	4.1	15.5	1.8	7.0
September	4.2	16.2	4.1	15.7	7.3	27.8	5.1	19.3	4.9	18.9
October	3.7	14.0	6.7	25.8	15.3	58.4	6.3	24.0	15.4	59.2
November	4.6	17.8	7.6	29.1	5.9	22.4	5.3	20.4	3.5	13.4
December	3.5	13.5	7.2	27.4	6.0	23.1	3.9	14.8	3.5	13.3
Annual Mean	4.7	17.7	7.4	28.1	8.5	31.9	5.0	18.6	7.3	27.6

Appendix E

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

Ethyl Benzene Concentrations 2007

Royal Borough of Kensington and Chelsea

Month	Site Code KC01 ppb	µg/ m-3	KC02 ppb	µg/ m-3	KC0X ppb	µg/ m-3	KC04 ppb	µg/ m-3	KC05 ppb	µg/ m-3
January	0.2	0.9	0.2	0.9	0.3	1.3	0.2	0.9	0.3	1.2
February	0.5	2.0	0.3	1.4	2.6	11.3	0.4	1.6	0.3	1.3
March	0.7	2.9	0.4	1.9	0.6	2.7	0.5	2.4	0.5	2.3
April	1.8	7.8	9.6	42.3	-	-	0.7	3.2	1.5	6.6
May	0.9	3.9	1.0	4.5	1.1	4.8	0.9	3.9	1.3	5.8
June	1.0	4.2	1.0	4.5	-	-	0.8	3.4	0.8	3.5
July	1.0	4.5	0.9	3.9	1.4	6.2	0.7	2.9	13.9	61.5
August	1.7	7.3	1.6	7.3	2.9	12.9	0.9	3.9	16.7	73.6
September	0.7	3.1	0.8	3.4	10.5	46.1	2.0	9.0	1.3	5.8
October	0.9	4.0	0.6	2.8	1.0	4.6	1.0	4.3	1.3	5.5
November	3.0	13.1	1.2	5.4	2.8	12.5	1.1	4.9	4.8	21.4
December	1.1	5.1	1.3	5.6	1.2	5.3	1.0	4.5	1.5	6.7
Annual Mean	1.1	4.9	1.6	7.0	2.0	9.0	0.8	3.7	3.7	16.3

Ethyl Benzene Concentrations 2007

City of London

Month	Site Code CL1 ppb	µg/m-3	CL2 ppb	µg/m-3	CL3 ppb	µg/m-3	CL4 ppb	µg/m-3	CL5 ppb	µg/m-3
January	0.2	0.8	0.2	0.7	0.1	0.6	0.2	0.8	0.2	0.7
February	0.4	1.7	0.8	3.5	0.5	2.3	1.3	5.8	1.1	5.0
March	0.8	3.3	0.6	2.7	1.6	7.2	0.7	3.0	0.3	1.2
April	1.6	6.9	2.6	11.6	-	-	-	-	-	-
May	1.0	4.4	0.9	3.9	-	-	-	-	-	-
June	0.6	2.7	0.8	3.6	-	-	-	-	-	-
July	5.9	26.1	0.9	7.0	-	-	-	-	-	-
August	1.8	7.8	1.4	6.2	-	-	-	-	-	-
September	8.5	37.5	-	-	-	-	-	-	-	-
October	0.8	3.4	-	-	-	-	-	-	-	-
November	1.4	6.1	1.6	7.0	-	-	-	-	-	-
December	1.3	5.7	1.2	5.2	-	-	-	-	-	-
Annual Mean	2.0	8.9	0.9	4.3	0.2	0.8	0.2	0.8	0.1	0.6
Month	CL6 ppb	µg/m-3	CL7 ppb	µg/m-3	CL8 ppb	µg/m-3	CL9 ppb	µg/m-3	CL10 ppb	µg/m-3
January	0.2	0.7	0.2	0.9	0.3	1.4	0.2	0.7	0.2	1.0
February	1.2	5.3	1.0	4.3	3.3	14.6	1.5	6.7	0.9	4.2
March	0.5	2.1	0.5	2.1	0.7	3.2	0.4	1.6	2.1	9.2
April	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-
Annual Mean	0.2	0.7	0.1	0.6	0.4	1.6	0.2	0.8	0.3	1.2

Ethyl Benzene Concentrations 2007

London Borough of Hounslow

Month	Site Code HS BTEX1 ppb	$\mu g/m^{-3}$	HS BTEX2 ppb	$\mu g/m^{-3}$	HS BTEX3 ppb	$\mu g/m^{-3}$	HS BTEX4 ppb	$\mu g/m^{-3}$
January	0.3	1.4	0.2	0.7	0.3	1.3	0.3	1.2
February	0.8	3.4	0.8	3.6	1.7	7.5	1.2	5.3
March	1.3	5.8	2.2	9.7	0.6	2.8	0.7	3.2
April	1.5	6.6	0.7	3.0	1.0	4.3	1.0	4.5
May	1.1	5.0	0.8	3.4	1.2	5.3	1.5	6.5
June	0.9	4.2	1.0	4.4	10.8	47.7	2.1	9.1
July	2.6	11.3	2.2	9.5	1.9	8.4	2.1	9.4
August	8.1	35.6	1.4	6.1	0.7	3.1	1.4	6.3
September	1.5	6.7	1.5	6.8	19.1	84.3	0.6	2.5
October	12.5	55.0	14.2	62.5	1.7	7.6	14.5	64.1
November	1.9	8.5	2.4	10.7	1.9	8.4	2.2	9.9
December	1.4	6.0	1.1	4.7	0.7	3.3	1.2	5.3
Annual Mean	2.8	12.4	2.4	10.4	3.5	15.3	2.4	10.6
Month	HS BTEX5 ppb	$\mu g/m^{-3}$	HS BTEX6 ppb	$\mu g/m^{-3}$	HS BTEX7 ppb	$\mu g/m^{-3}$	HS BTEX7 ppb	$\mu g/m^{-3}$
January	0.4	1.9	0.1	0.5	0.5	2.2	-	-
February	2.7	12.0	1.0	4.3	1.4	6.1	-	-
March	2.2	9.6	1.5	6.8	0.5	2.2	-	-
April	1.0	4.5	1.9	8.4	1.3	5.7	-	-
May	0.7	3.2	1.7	7.4	1.0	4.4	1.0	4.3
June	1.7	7.4	1.5	6.7	1.1	4.8	3.7	16.4
July	1.0	4.3	2.8	12.3	2.3	10.2	2.4	10.4
August	3.8	16.8	1.8	7.8	1.6	7.0	1.4	6.0
September	0.6	2.7	1.0	4.6	7.2	31.8	1.0	4.3
October	1.4	6.1	2.0	8.9	1.2	5.4	16.8	74.2
November	1.8	8.1	1.5	6.5	1.4	6.0	1.7	7.5
December	1.1	4.7	1.1	5.0	0.0	0.0	1.1	5.1
Annual Mean	1.5	6.8	1.5	6.6	1.6	7.1	2.4	10.7

Ethyl Benzene Concentrations 2007

London Borough of Richmond

Month	**Site Code** RUT 2 ppb	µg/m-3	RUT 36 ppb	µg/m-3	RUT 35 ppb	µg/m-3	RUT 7 ppb	µg/m-3	RUT 32 ppb	µg/m-3
January	0.2	1.0	0.1	0.6	0.2	0.7	0.1	0.6	0.2	1.0
February	0.9	3.9	1.4	6.2	3.1	13.7	0.9	4.0	3.3	14.6
March	-	-	0.4	1.8	0.8	3.5	1.0	4.5	0.9	3.9
April	2.7	11.9	2.2	9.8	2.8	12.4	1.9	8.3	1.1	4.8
May	1.3	5.8	1.2	5.3	1.2	5.3	1.1	4.8	1.1	5.0
June	1.4	6.3	1.9	8.4	2.0	8.8	2.0	8.8	1.9	8.4
July	2.4	10.7	-	-	0.9	4.0	2.4	10.5	0.9	4.1
August	0.1	0.2	5.6	24.9	1.8	8.1	1.5	6.4	1.5	6.5
September	1.0	4.5	0.9	4.0	0.7	3.3	1.3	5.7	0.9	3.8
October	-	-	1.9	8.5	1.0	4.3	0.9	4.1	1.7	7.4
November	-	-	1.6	7.2	2.0	8.8	1.2	5.1	1.6	7.1
December	0.6	2.7	1.0	4.2	0.6	2.5	0.7	2.9	0.6	2.8
Annual Mean	0.9	3.9	1.5	6.7	1.4	6.3	1.2	5.5	1.3	5.8

Ethyl Benzene Concentrations 2007

London Borough of Sutton

Month	Site Code Site 1 ppb	$\mu g/m^{-3}$	Site 2 ppb	$\mu g/m^{-3}$	Site 3 ppb	$\mu g/m^{-3}$	Site 4 ppb	$\mu g/m^{-3}$	Site 5 ppb	$\mu g/m^{-3}$
January	0.2	0.8	0.2	0.7	0.2	0.7	0.1	0.6	0.2	1.0
February	1.2	5.1	0.8	3.6	0.8	3.5	1.0	4.5	0.9	3.9
March	0.8	3.4	0.3	1.1	0.7	3.3	0.5	2.4	0.6	2.7
April	2.4	10.7	1.3	5.7	2.2	9.5	1.4	6.3	1.4	6.2
May	1.4	6.1	0.7	3.2	-	-	0.6	2.5	0.6	2.5
June	0.8	3.3	0.7	2.9	0.8	3.5	0.7	3.1	0.5	2.1
July	2.2	9.9	7.7	34.1	4.7	20.6	4.3	19.1	5.6	24.8
August	1.1	4.7	1.1	4.7	1.3	5.8	1.1	4.9	1.6	6.9
September	10.3	45.6	1.6	7.2	2.0	8.9	0.9	3.8	1.1	4.6
October	9.6	42.5	2.3	10.1	1.7	7.3	2.3	10.3	1.3	5.9
November	2.2	9.9	1.8	7.9	2.4	10.5	0.7	3.0	1.7	7.5
December	1.3	5.6	0.7	2.9	3.0	13.2	0.9	3.8	0.6	2.7
Annual Mean	2.8	12.3	1.6	7.0	1.6	7.2	1.2	5.4	1.3	5.9

Ethyl Benzene Concentrations 2007

London Borough of Hackney

Month	**Site Code** Cowper Road ppb	µg/ m-3	Green Lane ppb	µg/ m-3	Seven Sisters ppb	µg/ m-3	Hackney College ppb	µg/ m-3	Thorsby Street ppb	µg/ m-3
January	2.0	8.8	3.0	13.0	3.3	14.5	-	-	2.9	12.9
February	0.6	2.8	0.7	3.3	0.8	3.7	0.7	3.0	0.8	3.3
March	1.1	3.7	0.9	3.0	1.2	4.0	0.8	2.7	1.3	4.2
April	1.6	7.2	1.2	5.1	1.1	4.7	1.0	4.5	1.5	6.5
May	-	-	-	-	-	-	-	-	-	-
June	1.4	6.3	1.7	7.4	2.3	10.2	1.5	6.6	1.9	8.4
July	0.5	2.4	1.8	8.0	1.6	7.3	0.6	2.7	2.0	8.8
August	0.6	2.5	0.7	3.3	0.7	3.0	1.0	4.3	0.6	2.7
September	0.6	2.8	0.9	4.0	1.2	5.2	2.4	10.8	0.8	3.5
October	2.8	12.6	2.6	11.3	3.8	16.8	4.0	17.8	4.0	17.7
November	2.5	11.0	3.6	15.9	2.7	12.1	2.5	11.1	2.3	10.1
December	1.1	5.0	1.7	7.4	1.8	7.7	1.0	4.5	0.9	4.1
Annual Mean	1.3	5.4	1.6	6.8	1.7	7.4	1.3	5.7	1.6	6.9

Appendix F

m, p-Xylene Concentrations (ppb & $\mu g/m^{-3}$)

m, p-Xylene Concentrations 2007

Royal Borough of Kensington and Chelsea

Month	**Site Code** KC01 ppb	µg/m-3	KC02 ppb	µg/m-3	KC0X ppb	µg/m-3	KC04 ppb	µg/m-3	KC05 ppb	µg/m-3
January	0.4	2.0	0.5	2.3	0.8	3.6	0.5	2.0	0.7	2.9
February	1.3	5.7	0.9	3.8	9.5	41.8	0.9	3.9	0.8	3.4
March	1.2	5.3	0.8	3.5	1.1	5.0	0.9	3.9	1.0	4.5
April	2.5	11.0	10.8	47.4	-	-	1.0	4.5	1.8	7.9
May	1.6	7.2	1.5	6.6	2.2	9.9	1.4	6.3	2.2	9.7
June	1.9	8.3	1.4	6.3	-	-	1.2	5.4	1.3	5.9
July	1.9	8.3	1.6	7.2	2.7	12.1	1.1	4.8	15.8	69.8
August	2.1	9.3	1.9	8.6	5.9	26.2	1.1	4.7	14.9	65.8
September	1.3	5.6	1.2	5.1	19.8	87.4	2.4	10.6	1.6	7.1
October	1.8	7.9	1.0	4.4	2.4	10.8	1.5	6.4	1.8	7.7
November	3.8	16.7	1.5	6.5	3.9	17.1	1.5	6.8	5.4	23.7
December	1.4	6.1	1.4	6.3	1.8	8.0	1.2	5.5	1.7	7.6
Annual Mean	1.8	7.8	2.0	9.0	4.2	18.5	1.2	5.4	4.1	18.0

m, p-Xylene Concentrations 2007

Corporation London

Month	Site Code CL1 ppb	µg/m^{-3}	CL2 ppb	µg/m^{-3}	CL3 ppb	µg/m^{-3}	CL4 ppb	µg/m^{-3}	CL5 ppb	µg/m^{-3}
January	0.4	1.6	0.4	1.8	0.3	1.4	0.4	1.8	0.4	1.8
February	0.9	4.0	1.5	6.6	1.1	5.1	1.8	8.1	2.5	11.0
March	1.3	5.6	1.1	5.0	2.5	11.0	1.1	4.7	0.7	2.9
April	2.2	9.7	3.6	15.9	-	-	-	-	-	-
May	2.0	8.9	2.0	8.7	-	-	-	-	-	-
June	1.2	5.3	2.0	8.8	-	-	-	-	-	-
July	16.1	71.0	2.1	9.9	-	-	-	-	-	-
August	2.5	10.9	2.4	10.6	-	-	-	-	-	-
September	16.6	73.0	-	-	-	-	-	-	-	-
October	1.3	5.8	-	-	-	-	-	-	-	-
November	2.3	10.1	2.3	9.9	-	-	-	-	-	-
December	1.8	8.0	1.8	7.8	-	-	-	-	-	-
Annual Mean	4.0	17.8	1.6	7.1	0.3	1.4	0.3	1.2	0.3	1.3
Month	CL6 ppb	µg/m^{-3}	CL7 ppb	µg/m^{-3}	CL8 ppb	µg/m^{-3}	CL9 ppb	µg/m^{-3}	CL10 ppb	µg/m^{-3}
January	0.3	1.5	0.5	2.0	0.9	3.8	0.4	1.8	0.6	2.5
February	1.8	7.9	1.6	7.2	4.9	21.4	2.4	10.4	1.7	7.7
March	0.8	3.3	0.8	3.6	1.5	6.5	0.8	3.6	3.6	15.7
April	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-
Annual Mean	0.2	1.1	0.2	1.1	0.6	2.6	0.3	1.3	0.5	2.2

m, p-Xylene Concentrations 2007

London Borough of Hounslow

Month	Site Code HS BTEX1 ppb	µg/m-3	HS BTEX2 ppb	µg/m-3	HS BTEX3 ppb	µg/m-3	HS BTEX4 ppb	µg/m-3
January	0.6	2.8	0.3	1.2	0.5	2.4	0.6	2.6
February	1.4	6.3	1.4	6.1	2.8	12.3	2.0	8.6
March	2.1	9.4	3.3	14.6	1.1	4.6	1.3	5.9
April	1.8	8.1	0.9	4.1	1.6	7.1	1.5	6.5
May	1.7	7.7	1.1	4.9	1.7	7.7	2.2	9.6
June	1.5	6.8	1.5	6.7	11.9	52.4	3.2	13.9
July	3.9	17.0	3.1	13.6	2.8	12.5	3.1	13.8
August	9.0	39.8	1.6	6.8	1.0	4.4	1.6	7.0
September	1.8	7.8	1.9	8.3	18.8	82.9	1.0	4.3
October	13.1	57.9	14.5	64.0	2.3	10.3	14.9	65.8
November	2.5	11.2	3.0	13.1	2.3	10.2	2.6	11.5
December	1.8	8.1	1.6	7.1	1.3	5.8	1.9	8.2
Annual Mean	3.5	15.2	2.8	12.5	4.0	17.7	3.0	13.2

Month	HS BTEX5 ppb	µg/m-3	HS BTEX6 ppb	µg/m-3	HS BTEX7 ppb	µg/m-3	HS BTEX8 ppb	µg/m-3
January	0.7	3.2	0.2	0.9	0.9	4.0	-	-
February	3.7	16.5	1.9	8.3	2.1	9.3	-	-
March	3.4	15.1	2.5	11.0	1.0	4.3	-	-
April	1.3	5.6	2.4	10.4	1.7	7.5	-	-
May	1.2	5.1	3.1	13.6	1.5	6.7	1.7	7.7
June	2.4	10.6	2.3	10.2	1.7	7.3	7.5	33.0
July	1.4	6.2	4.5	19.8	3.4	15.2	3.7	16.3
August	6.7	29.7	2.0	8.7	2.1	9.4	1.6	6.8
September	0.9	4.0	1.6	7.2	12.8	56.4	1.5	6.5
October	2.2	9.6	3.3	14.8	1.8	8.2	17.5	77.0
November	2.0	9.0	2.2	9.7	1.6	7.1	2.2	9.8
December	1.5	6.8	1.9	8.4	-	-	2.0	8.7
Annual Mean	2.3	10.1	2.3	10.3	2.6	11.3	3.1	13.8

m, p-Xylene Concentrations 2007

London Borough of Richmond

Month	**Site Code** RUT 2 ppb	µg/m-3	RUT 36 ppb	µg/m-3	RUT 35 ppb	µg/m-3	RUT 7 ppb	µg/m-3	RUT 32 ppb	µg/m-3
January	0.5	2.3	0.3	1.3	0.4	1.6	0.3	1.2	0.6	2.5
February	1.8	7.9	2.5	11.2	4.7	20.8	2.0	8.9	4.9	21.6
March	-	-	1.0	4.6	1.5	6.5	1.7	7.6	3.3	14.5
April	3.6	16.1	3.3	14.7	3.3	14.6	3.0	13.2	1.7	7.5
May	2.2	9.6	2.0	8.8	1.9	8.4	1.9	8.3	2.0	8.7
June	2.4	10.7	3.2	14.0	2.9	12.7	3.2	14.2	3.0	13.1
July	3.6	16.0	-	-	1.5	6.5	3.6	16.1	1.7	7.4
August	-	-	8.2	36.3	2.3	10.1	2.1	9.3	2.0	8.8
September	1.8	7.8	1.8	7.8	1.4	6.0	2.2	9.9	1.3	5.7
October	-	-	2.7	11.9	1.6	7.2	1.7	7.7	3.4	14.9
November	-	-	2.4	10.5	2.8	12.5	1.8	8.1	2.3	10.3
December	1.0	4.3	1.2	5.4	0.9	4.0	1.0	4.2	1.0	4.5
Annual Mean	1.5	6.8	2.4	10.5	2.1	9.2	2.1	9.1	2.3	10.0

m, p-Xylene Concentrations 2007

London Borough of Sutton

Month	**Site Code** Site 1 ppb	µg/m-3	Site 2 ppb	µg/m-3	Site 3 ppb	µg/m-3	Site 4 ppb	µg/m-3	Site 5 ppb	µg/m-3
January	0.4	1.6	0.3	1.4	0.3	1.5	0.3	1.2	0.4	1.6
February	2.0	8.6	1.3	5.7	1.4	6.1	1.7	7.5	1.5	6.7
March	1.2	5.5	0.5	2.1	1.2	5.4	0.9	3.8	1.2	5.3
April	2.8	12.2	1.4	6.3	2.5	11.1	1.7	7.4	2.0	8.6
May	2.0	9.0	1.0	4.3	-	-	0.9	3.9	0.8	3.7
June	1.2	5.4	0.9	4.1	1.1	5.1	1.1	4.7	0.8	3.5
July	3.2	13.9	19.1	84.3	11.4	50.2	6.8	29.9	13.3	58.5
August	1.3	5.5	1.2	5.4	1.6	6.9	1.4	6.2	1.7	7.6
September	19.2	84.7	1.8	8.1	2.3	10.2	1.2	5.4	1.5	6.7
October	10.2	44.8	2.6	11.5	2.1	9.3	2.8	12.2	1.7	7.5
November	2.7	11.7	2.1	9.0	3.0	13.0	1.0	4.3	2.0	9.0
December	1.4	6.3	0.7	3.2	4.5	19.7	1.0	4.3	0.8	3.4
Annual Mean	4.0	17.4	2.7	12.1	2.6	11.5	1.7	7.6	2.3	10.2

m, p-Xylene Concentrations 2007

London Borough of Hackney

Month	**Site Code** Cowper Road ppb	µg/ m^{-3}	Green Lane ppb	µg/ m^{-3}	Seven Sisters ppb	µg/ m^{-3}	Hackney College ppb	µg/ m^{-3}	Thorsby Street ppb	µg/ m^{-3}
January	0.9	3.8	1.1	4.8	1.7	7.3	-	-	1.1	4.9
February	0.5	2.4	0.8	3.3	0.8	3.5	0.6	2.6	0.6	2.9
March	0.5	2.2	0.7	3.0	0.6	2.7	0.4	1.9	0.5	2.2
April	0.5	2.2	0.7	3.0	0.6	2.7	0.4	1.9	0.5	2.2
May	-	-	-	-	-	-	-	-	-	-
June	0.4	1.9	0.7	3.1	0.8	3.6	0.5	2.2	0.6	2.7
July	0.3	1.2	1.1	5.0	0.7	3.2	0.3	1.4	1.0	4.2
August	0.3	1.1	0.5	2.2	0.4	1.9	0.5	2.2	0.3	1.3
September	0.3	1.4	0.6	2.7	0.7	3.0	2.4	10.4	0.5	2.0
October	1.2	5.1	1.4	6.1	1.9	8.3	1.6	7.1	1.8	8.1
November	1.3	5.9	2.0	8.8	1.6	6.9	1.4	6.2	1.2	5.4
December	0.5	2.0	0.8	3.4	0.7	3.1	0.4	1.9	0.4	1.8
Annual Mean	0.6	2.4	0.9	3.8	0.9	3.8	0.7	3.1	0.7	3.1

Appendix G

o-Xylene Concentrations (ppb & $\mu g/m^{-3}$)

o-Xylene Concentrations 2007

Royal Borough of Kensington and Chelsea

Month	**Site Code** KC01 ppb	$\mu g/m^{-3}$	KC02 ppb	$\mu g/m^{-3}$	KC0X ppb	$\mu g/m^{-3}$	KC04 ppb	$\mu g/m^{-3}$	KC05 ppb	$\mu g/m^{-3}$
January	0.2	0.7	0.2	0.8	0.3	1.3	0.2	0.7	0.2	1.1
February	0.5	2.1	0.3	1.3	3.6	15.7	0.3	1.3	0.3	1.2
March	0.4	1.7	0.2	1.1	0.4	1.7	0.3	1.2	0.3	1.4
April	0.8	3.6	2.9	12.8	0.0	0.0	0.3	1.4	0.5	2.4
May	0.5	2.2	0.3	1.5	0.7	2.9	0.4	1.7	0.6	2.5
June	0.6	2.8	0.4	1.7	-	-	0.4	1.6	0.4	1.7
July	0.6	2.4	0.5	2.1	0.9	3.8	0.3	1.4	4.0	17.8
August	0.7	3.3	0.7	3.0	2.2	9.7	0.4	1.7	4.9	21.5
September	0.5	2.0	0.4	1.7	5.2	22.8	0.7	3.0	0.6	2.5
October	0.8	3.5	0.4	2.0	0.9	4.2	0.6	2.4	0.7	3.0
November	1.3	5.5	0.5	2.1	1.3	5.8	0.5	2.2	1.8	7.9
December	0.5	2.0	0.5	2.0	0.6	2.8	0.4	1.8	0.5	2.3
Annual Mean	0.6	2.6	0.6	2.7	1.3	5.9	0.4	1.7	1.2	5.4

o-Xylene Concentrations 2007

Corporation of London

Month	Site Code CL1 ppb	µg/m-3	CL2 ppb	µg/m-3	CL3 ppb	µg/m-3	CL4 ppb	µg/m-3	CL5 ppb	µg/m-3
January	0.1	0.6	0.2	0.7	0.1	0.5	0.1	0.6	0.1	0.7
February	0.3	1.4	0.4	1.9	0.4	1.5	0.5	2.1	0.7	3.1
March	0.4	1.8	0.4	1.6	0.7	2.9	0.3	1.5	0.2	1.0
April	0.6	2.8	1.1	4.9	-	-	-	-	-	-
May	0.6	2.7	0.6	2.7	-	-	-	-	-	-
June	0.4	1.6	0.7	3.0	-	-	-	-	-	-
July	4.3	19.1	0.7	3.3	-	-	-	-	-	-
August	0.9	3.8	0.8	3.7	-	-	-	-	-	-
September	4.2	18.3	-	-	-	-	-	-	-	-
October	0.5	2.4	-	-	-	-	-	-	-	-
November	0.8	3.4	0.8	3.3	-	-	-	-	-	-
December	0.6	2.6	0.6	2.6	-	-	-	-	-	-
Annual Mean	1.1	5.0	0.5	2.3	0.1	0.4	0.1	0.3	0.1	0.4
Month	CL6 ppb	µg/m-3	CL7 ppb	µg/m-3	CL8 ppb	µg/m-3	CL9 ppb	µg/m-3	CL10 ppb	µg/m-3
January	0.1	0.5	0.2	0.7	0.3	1.4	0.1	0.6	0.2	0.9
February	0.4	2.0	0.4	1.7	1.0	4.6	0.5	2.4	0.5	2.2
March	0.2	1.1	0.3	1.2	0.5	2.2	0.3	1.2	1.0	4.4
April	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-
Annual Mean	0.1	0.3	0.1	0.3	0.2	0.7	0.1	0.3	0.1	0.6

o-Xylene Concentrations 2007

London Borough of Hounslow

Month	Site Code HS BTEX1 ppb	µg/m^{-3}	HS BTEX2 ppb	µg/m^{-3}	HS BTEX3 ppb	µg/m^{-3}	HS BTEX4 ppb	µg/m^{-3}
January	0.2	0.9	0.1	0.4	0.2	0.8	0.2	0.8
February	0.4	2.0	0.4	1.8	0.8	3.4	0.6	2.4
March	0.7	3.1	0.8	3.6	0.3	1.4	0.4	1.9
April	0.6	2.6	0.3	1.3	0.5	2.2	0.5	2.1
May	0.5	2.0	0.3	1.2	0.4	1.9	0.5	2.4
June	0.4	1.8	0.4	1.7	3.1	13.5	0.7	3.2
July	0.9	4.1	0.8	3.4	0.7	3.0	0.8	3.4
August	3.2	14.3	0.5	2.4	0.4	1.6	0.6	2.5
September	0.6	2.6	0.6	2.6	6.8	30.1	0.3	1.5
October	4.8	21.1	5.3	23.2	0.9	4.1	5.4	23.9
November	0.9	3.8	1.0	4.3	0.8	3.3	0.9	3.8
December	0.6	2.6	0.5	2.3	0.5	2.0	0.6	2.6
Annual Mean	1.2	5.1	0.9	4.0	1.3	5.6	1.0	4.2
Month	HS BTEX5 ppb	µg/m^{-3}	HS BTEX6 ppb	µg/m^{-3}	HS BTEX7 ppb	µg/m^{-3}	HS BTEX8 ppb	µg/m^{-3}
January	0.2	0.9	0.1	0.6	0.2	1.0	-	-
February	0.9	4.1	0.6	2.7	0.6	2.7	-	-
March	0.9	3.8	0.7	3.2	0.3	1.4	-	-
April	0.4	1.7	0.8	3.4	0.5	2.3	-	-
May	0.3	1.3	1.0	4.5	0.4	1.8	0.5	2.2
June	0.6	2.5	0.6	2.6	0.5	2.0	1.8	8.1
July	0.4	1.7	1.2	5.4	0.8	3.6	1.0	4.2
August	2.3	9.9	0.7	3.1	0.8	3.4	0.6	2.4
September	0.3	1.3	0.5	2.3	3.3	14.6	0.5	2.2
October	0.9	3.8	1.3	5.6	0.8	3.5	6.3	28.0
November	0.7	2.9	0.7	3.0	0.5	2.3	0.7	3.2
December	0.5	2.1	0.7	2.9	-	-	0.7	2.9
Annual Mean	0.7	3.0	0.7	3.3	0.7	3.2	1.0	4.4

o-Xylene Concentrations 2007

London Borough of Richmond

Month	Site Code RUT 2 ppb	µg/m-3	RUT 36 ppb	µg/m-3	RUT 35 ppb	µg/m-3	RUT 7 ppb	µg/m-3	RUT 32 ppb	µg/m-3
January	0.2	0.9	0.1	0.5	0.1	0.6	0.1	0.5	0.2	1.0
February	0.6	2.5	0.8	3.3	1.2	5.2	0.7	2.9	1.2	5.2
March	0.0	0.0	0.4	1.6	0.5	2.3	0.6	2.5	1.1	5.0
April	1.1	4.8	1.1	4.7	1.0	4.6	0.9	3.9	0.5	2.3
May	0.6	2.5	0.6	2.5	0.5	2.1	0.5	2.3	0.6	2.4
June	0.6	2.8	0.8	3.5	0.7	3.1	0.8	3.6	0.8	3.3
July	0.9	4.1	-	-	0.5	2.3	1.2	5.4	0.5	2.3
August	-	-	2.9	12.7	0.8	3.6	0.8	3.4	0.7	3.1
September	0.6	2.7	0.6	2.6	0.5	2.0	0.8	3.4	0.4	2.0
October	0.0	0.0	1.0	4.4	0.6	2.8	0.7	3.0	1.3	5.7
November	0.0	0.0	0.8	3.5	1.0	4.2	0.6	2.8	0.8	3.5
December	0.3	1.4	0.4	1.6	0.3	1.4	0.3	1.4	0.3	1.5
Annual Mean	0.4	2.0	0.8	3.4	0.6	2.9	0.7	2.9	0.7	3.1

o-Xylene Concentrations 2007

London Borough of Sutton

Month	**Site Code** Site 1 ppb	µg/m-3	Site 2 ppb	µg/m-3	Site 3 ppb	µg/m-3	Site 4 ppb	µg/m-3	Site 5 ppb	µg/m-3
January	0.1	0.6	0.1	0.5	0.1	0.5	0.1	0.4	0.1	0.5
February	0.5	2.4	0.3	1.5	0.4	1.7	0.5	2.0	0.4	1.9
March	0.4	1.7	0.2	0.8	0.4	1.6	0.3	1.2	0.4	1.6
April	0.8	3.7	0.4	1.9	0.7	3.2	0.5	2.3	0.5	2.4
May	0.5	2.0	0.2	1.0	-	-	0.2	1.0	0.2	0.9
June	0.3	1.5	0.2	1.0	0.3	1.4	0.3	1.3	0.2	1.0
July	0.8	3.4	5.0	22.1	2.8	12.4	1.6	6.9	3.4	15.0
August	0.4	2.0	0.4	1.9	0.5	2.3	0.5	2.2	0.6	2.7
September	4.9	21.5	0.6	2.8	0.8	3.4	0.4	1.8	0.5	2.1
October	3.8	16.6	0.9	3.8	0.7	3.1	0.9	4.0	0.6	2.6
November	0.9	3.8	0.7	2.9	1.0	4.3	0.3	1.4	0.7	2.9
December	0.4	1.9	0.2	1.0	1.6	7.0	0.3	1.4	0.2	1.0
Annual Mean	1.2	5.1	0.8	3.4	0.8	3.4	0.5	2.2	0.7	2.9

o-Xylene Concentrations 2007

London Borough of Hackney

Month	**Site Code** Cowper Road ppb	µg/m-3	Green Lane ppb	µg/m-3	Seven Sisters ppb	µg/m-3	Hackney College ppb	µg/m-3	Thorsby Street ppb	µg/m-3
January	0.9	3.8	1.1	4.8	1.7	7.3	-	-	1.1	4.9
February	0.5	2.4	0.8	3.3	0.8	3.5	0.6	2.6	0.6	2.9
March	0.5	2.2	0.7	3.0	0.6	2.7	0.4	1.9	0.5	2.2
April	0.5	2.2	0.7	3.0	0.6	2.7	0.4	1.9	0.5	2.2
May	-	-	-	-	-	-	-	-	-	-
June	0.4	1.9	0.7	3.1	0.8	3.6	0.5	2.2	0.6	2.7
July	0.3	1.2	1.1	5.0	0.7	3.2	0.3	1.4	1.0	4.2
August	0.3	1.1	0.5	2.2	0.4	1.9	0.5	2.2	0.3	1.3
September	0.3	1.4	0.6	2.7	0.7	3.0	2.4	10.4	0.5	2.0
October	1.2	5.1	1.4	6.1	1.9	8.3	1.6	7.1	1.8	8.1
November	1.3	5.9	2.0	8.8	1.6	6.9	1.4	6.2	1.2	5.4
December	0.5	2.0	0.8	3.4	0.7	3.1	0.4	1.9	0.4	1.8
Annual Mean	0.6	2.4	0.9	3.8	0.9	3.8	0.7	3.1	0.7	3.1

Appendix H

Marylebone Road Duplicate BTEX Data

Hydrocarbon Network Comparison, Marylebone Road Duplicate Exposure

Benzene Diffusion Tube Results

Site Code	Date On	Time On	Date Off	Time Off	Mass	Benzene	Benzene	Mass	Toluene	Toluene	Mass	Ethyl-benzene	Ethyl-benzene	Mass	M+p-Xylene	M+p-Xylene	Mass	o-Xylene	o-Xylene
					ng	ppb	ug/m3	ng	ppb	ug/m3	ng	ppb	ug/m3	ng	ppb	ug/m3	ng	ppb	ug/m3
Jan-07	17/01/2007	11:26	01/02/2007	16:15	20	0.6	2.1	159	4.7	18.1	13	0.3	1.4	35	0.8	3.7	13	0.3	1.3
	17/01/2007	11:26	01/02/2007	16:15	20	0.7	2.2	142	4.2	16.1	13	0.3	1.4	37	0.9	3.9	14	0.3	1.4
Feb-07	13/02/2007	16:15	01/03/2007	14:35	22	0.7	2.3	196	5.5	21.2	Invalid	-	-	Invalid	-	-	Invalid	-	-
	13/02/2007	16:16	01/03/2007	14:35	23	0.7	2.4	212	6.0	23.0	Invalid	-	-	Invalid	-	-	Invalid	-	-
Mar-07	15/03/2007	11:00	11/04/2007	14:15	28	0.5	1.7	Invalid	-	-	147	2.1	9.2	218	2.9	12.7	56	0.7	3.2
	15/03/2007	11:00	11/04/2007	14:15	25	0.5	1.5	Invalid	-	-	93	1.3	5.8	139	1.8	8.1	40	0.5	2.3
Apr-07	11/04/2007	14:16	25/04/2007	12:04	17	0.6	1.9	232	7.5	28.8	56	1.6	6.9	77	2.0	8.7	25	0.6	2.8
	11/04/2007	14:16	25/04/2007	12:04	15	0.5	1.8	345	11.2	42.9	75	2.1	9.2	104	2.7	11.9	33	0.8	3.6
May-07	16/05/2007	11:49	05/06/2007	10:32	20	0.5	1.6	157	3.5	13.6	27	0.5	2.3	62	1.1	4.9	20	0.4	1.6
	16/05/2007	11:49	05/06/2007	10:32	22	0.5	1.8	115	2.6	9.9	31	0.6	2.7	71	1.3	5.6	23	0.4	1.8
Jun-07	12/06/2007	12:13	26/06/2007	12:28	21	0.8	2.4	267	8.6	32.9	32	0.9	3.9	75	1.9	8.5	25	0.6	2.8
	12/06/2007	12:13	26/06/2007	12:28	22	0.8	2.5	225	7.2	27.7	34	0.9	4.2	73	1.9	8.2	24	0.6	2.6
Jul-07	10/07/2007	11:37	24/07/2007	13:34	17	0.6	2.0	Invalid	-	-	63	1.7	7.6	120	3.1	13.5	34	0.9	3.8
	10/07/2007	11:37	24/07/2007	13:34	18	0.7	2.1	Invalid	-	-	69	1.9	8.3	135	3.4	15.2	41	1.0	4.5
Aug-07	15/08/2007	11:51	29/08/2007	10:18	14	0.5	1.6	108	3.5	13.4	33	0.9	4.0	52	1.3	5.9	18	0.5	2.0
	15/08/2007	11:51	29/08/2007	10:18	12	0.4	1.4	146	4.7	18.1	44	1.2	5.3	65	1.7	7.4	23	0.6	2.5
Sep-07	11/09/2007	11:38	25/09/2007	11:58	16	0.6	1.8	88	2.8	10.9	52	1.4	6.3	78	2.0	8.9	29	0.7	3.2
	11/09/2007	11:38	25/09/2007	11:58	17	0.6	2.0	77	2.5	9.5	37	1.0	4.5	61	1.6	6.9	24	0.6	2.7
Oct-07	16/10/2007	11:30	30/10/2007	11:34	30	1.1	3.4	142	4.6	17.6	137	3.8	16.7	172	4.4	19.5	59	1.5	6.5
	16/10/2007	11:30	30/10/2007	11:34	30	1.1	3.4	100	3.2	12.3	95	2.6	11.5	123	3.2	13.9	42	1.1	4.7
Nov-07	30/10/2007	11:35	13/11/2007	11:46	29	1.0	3.3	170	5.5	20.9	89	2.4	10.7	123	3.1	13.9	42	1.0	4.6
	30/10/2007	11:35	13/11/2007	11:46	26	0.9	3.0	150	4.8	18.5	70	1.9	8.5	100	2.6	11.3	34	0.9	3.8
Dec-07	04/12/2007	11:33	18/12/2007	11:19	20	0.7	2.3	118	3.8	14.5	33	0.9	4.0	56	1.4	6.4	19	0.5	2.1
	04/12/2007	11:33	18/12/2007	11:19	21	0.7	2.4	95	3.0	11.7	21	0.6	2.5	43	1.1	4.9	15	0.4	1.7