

DUBLIN PORT TUNNEL
AIR QUALITY MONITORING
ANNUAL REPORT 2004

Introduction

This report presents the results of air quality monitoring at the Northern and Southern Portals of the Port Tunnel for the period January - December 2004. This monitoring is being carried out as a result of the public inquiry in relation to this project, which specified the following:

1. Continuous monitoring of particulates (PM₁₀) at the nearest residential receptor to the Northern Portal
2. Continuous measurement of total volatile organic compounds (VOCs) in the vicinity of the Northern Portals
3. Monitoring to be carried out prior to and during construction, and also for a period of five years following completion of the Dublin Port Tunnel

As this monitoring was required in addition to commitments in relation to air quality monitoring as specified in the Environmental Impact Statement, Dublin City Council undertook to establish monitoring sites in order to comply with the conditions specified at the formal public inquiry. This years report does not include results for Sulphur Dioxide (SO₂), Lead and Carbon Monoxide (CO). These pollutants have been continuously measured at very low levels and at this stage it is clear that they do not pose a threat to public health or are likely to cause a nuisance. As such monitoring of these pollutants have been discontinued.

Report Summary

- Particulate levels (PM₁₀) and volatile organic compounds measured in the vicinity of the Northern Portal in 2004 complied with the relevant statutory limits for these pollutants.
- Pollutant measurements in the vicinity of the Southern Portal (nitrogen dioxide, ozone and PM₁₀) indicate compliance with the relevant statutory limits for these pollutants.
- Particulate levels (PM₁₀) in the vicinity of the Southern Portal showed a decrease for the first time in four years. This was anticipated in last years report as a likely outcome of the decrease in construction activity.

The Legal Framework

Air quality is an issue locally, nationally and internationally. Internationally, the European Union (E.U.) sets regulations for managing air quality, which are transposed into Irish law by the Air Quality Standards Regulations 2002, from which the relevant limit levels are presented in Table 1. The limit values established for air pollutants are based on the protection of human health. The results presented in this report are compared with the relevant limit values.

Table 1: Air Quality Standards Regulations 2002

Pollutant	Limit Value*	Permitted Exceedances	Attainment Date
Nitrogen Dioxide (NO ₂)	40 µg/m ³ 200 µg/m (1-Hour)	Annual Mean 18 per year	2010
Particulate Matter (PM ₁₀)	50 µg/m ³ (24-Hour) 40 µg/m ³	35 per year Annual Mean	2004 Margin of Tolerance 10% 2005
Benzene	5 µg/m ³	Annual Mean	2010
Ozone (O ₃)**	180µg/m ³ (1-hour)	Population Threshold	2010

* microgrammes per cubic metre/ milligrams per cubic metre

** EU Framework Directive on Air Quality

Southern Portal – East Wall

The main air pollutants of concern both nationally and at a local level are currently being measured at East Wall Road and the results presented in this report are representative of the contribution of all road and rail traffic, residential, commercial and construction activities in the local environment. Since there are multiple activities occurring at this site (including heavy traffic on East Wall Road) it is difficult to determine PM₁₀ impacts caused by project-related activities alone. Monitoring is carried out within the confines of the construction site and therefore, comparison with EU Directives and Irish Regulations is not appropriate, as the location does not represent average background conditions or siting criteria as specified in the Directives. However, given the proximity of residential property on East Wall Road, monitoring is carried out on a 24-hour basis for the pollutants detailed in Table 1.

Nitrogen Dioxide

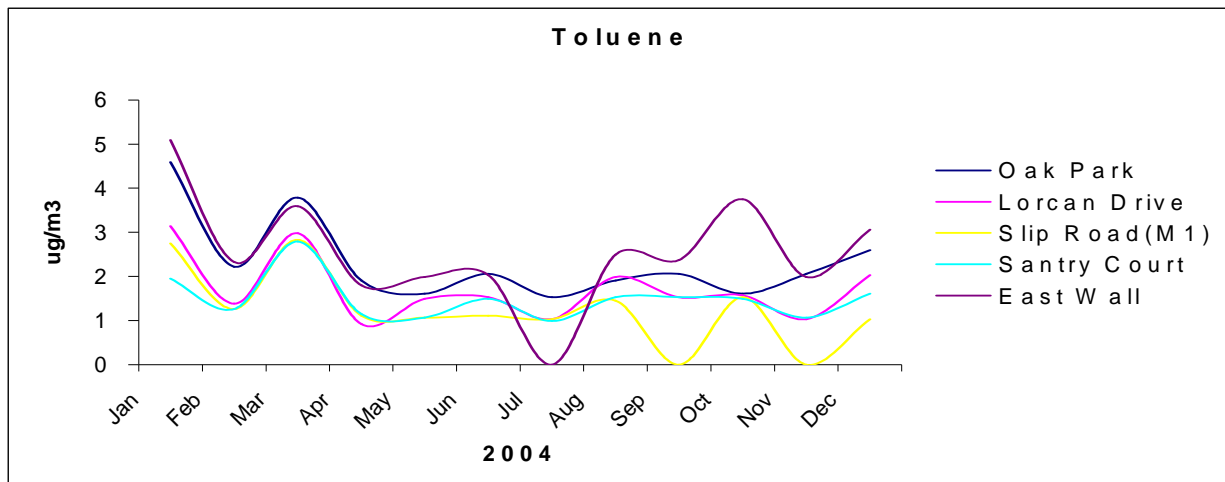
This pollutant is thought to increase the lung's vulnerability to infection. The main source of NO₂ is motor vehicles, although gas use for building heating is also a significant contributor. Statutory limits were complied with at the East Wall Road location over the monitoring period.

Mean Monthly and Maximum Hourly NO₂ Levels

Limit Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
200 µg/m ³ (1-Hour)	69	132	153	89	102	61	62	76	151	264	220	197
40 µg/m ³ Annual Mean	15	35	27	35	36	24	24	30	21	22.0	29	28

The annual mean of 27.0 µg/m³ recorded at East Wall Road in 2004 was 2µg/m³ lower than the 2003 value and complied with the statutory annual mean limit value of 40 µg/m³. The hourly limit value of 200µg/m³ was met, with only 3 exceedances of this value against the statutory limit of 18.

Figure 1 : Mean and Maximum Monthly NO₂ Levels



Ozone

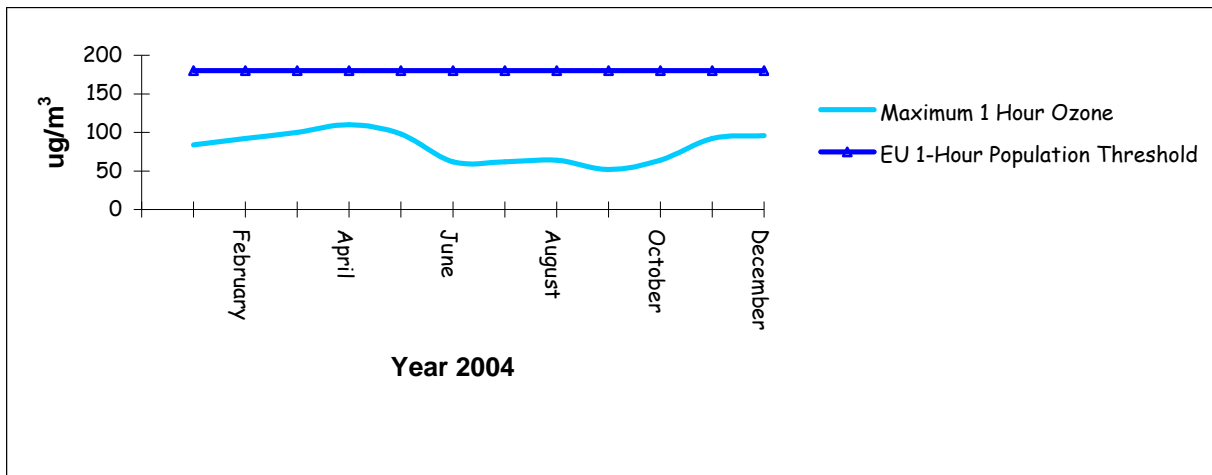
The Air Quality Standards Regulations do not set limit values for Ozone, recognising that it is a secondary pollutant and has a transboundary dimension. A threshold is set, however in the EU Directive on Air Quality, above which there may be effects on human health and vegetation. Ozone levels in 2004 did not exceed this threshold.

Maximum 1-Hour Ozone Levels

Limit Value*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
180 $\mu\text{g}/\text{m}^3$ (1-Hour)	84	92	100	110	98	62	62	64	52	64	92	96

*EU population threshold

Figure 2 : Maximum Hourly O₃ Levels



Particulate Matter (PM₁₀)

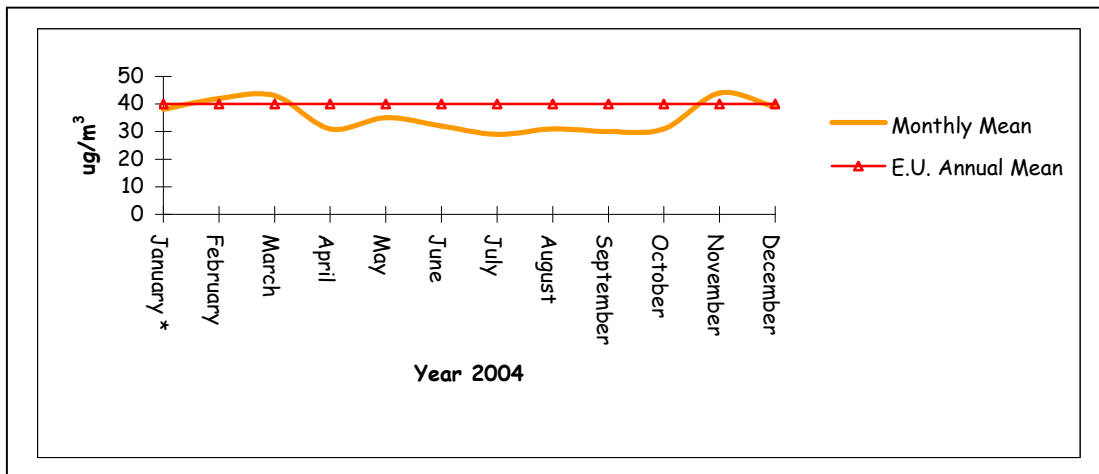
Inhalation of airborne particulate matter can increase the risk, frequency and severity of respiratory disorders. PM₁₀ in the atmosphere results from direct emissions (primary PM₁₀) or from secondary emissions of precursors (nitrogen dioxide, sulphur dioxide and ammonia) which are transformed by chemical reaction in the atmosphere. The main source of this pollutant is road transport, especially diesel vehicles, although a significant proportion at the Eastwall site is from airborne dust emissions.

The Annual Mean recorded at East Wall Road was 35µg/m³ compared to 62µg/m³ for 2003. This is below the statutory annual mean limit of 40µg/m³. The maximum 24-hour limit of 55 µg/m³, not to be exceeded for more than 35 days was not exceeded in 2004. There were 33 exceedences of this limit. This is a slight improvement on previous years figures.

Mean and Maximum Monthly PM₁₀ Levels

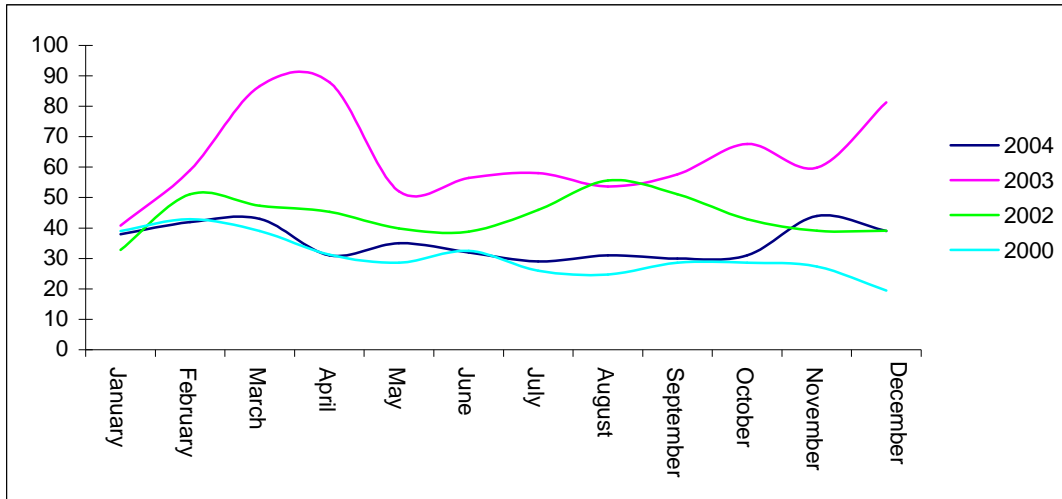
Limit Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Annual Mean 40 µg/m ³	38	42	43	31	35	32	29	31	30	31	44	39
Maximum 24-hour 50 µg/m ³	38	78	84	52	71	57	48	61	54	88	84	63

Figure 3 : Mean Monthly PM₁₀ Levels



For comparative purposes, PM₁₀ levels for 2000, 2002 and 2003 are compared with 2004 levels in Figure 4 below. Figure 4 shows an overall decrease in local levels over the past year with levels more in line with those of 2000. It is anticipated that air quality in the East Wall Road area will probably further improve on full completion of the Port Tunnel.

Figure 4 : Comparison of Average Monthly PM₁₀ Levels at East Wall Road



Northern Portal – Oak Park, Santry

In accordance with the requirements of the public inquiry, particulate monitoring commenced at Oak Park, Santry in November 2001. Prior to the commencement of construction of the Northern Portal, background monitoring of a number of pollutants (sulphur dioxide, nitrogen dioxide, lead, particulates, carbon monoxide) was carried out at Ellenfield Park for a two-year period and this data represents average background conditions for the locality prior to construction activities.

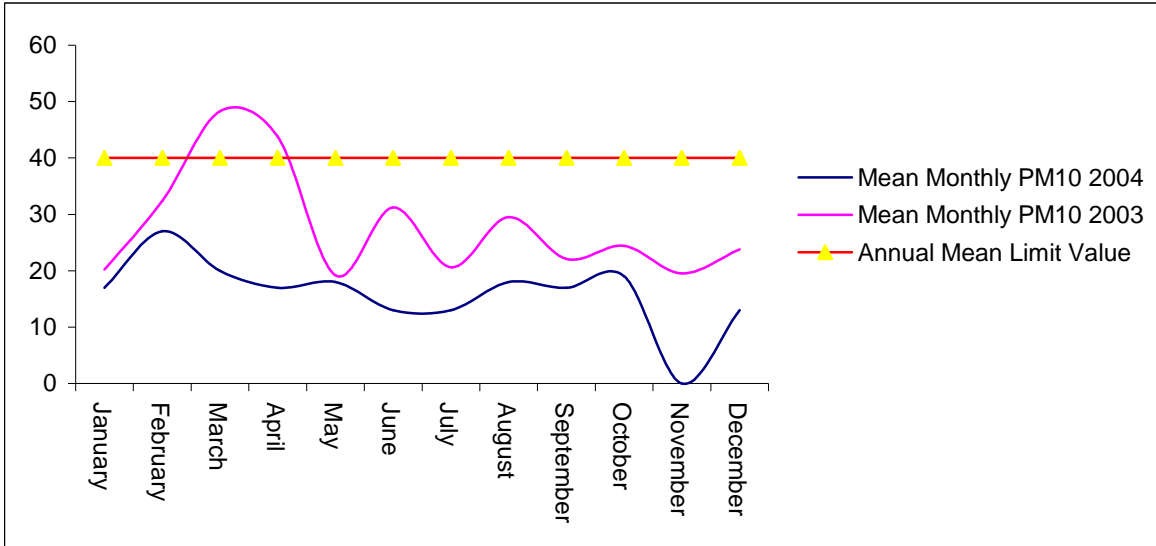
Particulates (PM₁₀) and volatile organic compounds (VOCs) were again measured in 2004 in the vicinity of the Northern Portal. PM₁₀ levels recorded in 2004 are presented below and are compared with the annual mean limit of 40 µg/m³. The annual mean PM₁₀ level measured at Oak Park was 18µg/m³ compared to 27.9µg/m³ in 2003. There were four days during 2004 when the 24-hour limit of 50 µg/m³ (to be attained by 2005) was exceeded, compared to 40 in 2003. The statutory limit is 35 times in a calendar year.. Overall, particulate levels recorded at Oak Park are similar to average urban residential levels recorded in the Dublin area.

Mean Monthly and Maximum 24-hour PM₁₀ Levels

Limit Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Annual Mean 40 µg/m ³	17	27	20	17	18	13	13	18	17	19	No Data	13
Max 24-Hour 50 µg/m ³	28	65	45	63	50	21	32	38	41	42	0	54

Figure 5. compares PM₁₀ levels at Oak Park between 2003 and 2004 and indicates a decrease in mean levels in the vicinity of the Northern Portal. It is anticipated that local particulate levels will reduce further in 2005 as dust-generating activities will be significantly reduced in the vicinity of the monitoring location.

Figure 5: Monthly Mean Particulates (PM₁₀)



Volatile Organic Compounds (VOCs)

As previously indicated, the measurement of volatile organic compounds (VOCs) is required as a result of the public inquiry in the vicinity of the northern portal. While not legally required, monitoring of VOCs is also carried out at East Wall Road in order to determine average background levels in the vicinity of the southern portal. The results of VOCs measured at five sites in the vicinity of the northern and southern portals of the Port Tunnel and at other local residential locations are presented in this report.

Monitoring for a number of compounds is currently being carried out using diffusive samplers, which are exposed for a fixed period of time and analysed at an approved laboratory. While there is a statutory limit in relation to benzene, it is anticipated that standards will be finalised for other potentially toxic compounds shortly. Levels measured at the portals are compared with occupational standards for comparative purposes in the absence of statutory limits for toluene, xylene, and butadiene. Over the 12-month monitoring period, several diffusion tubes were reported missing or damaged due to vandalism and loss due to construction activities in the vicinity.

The current VOC monitoring locations include:

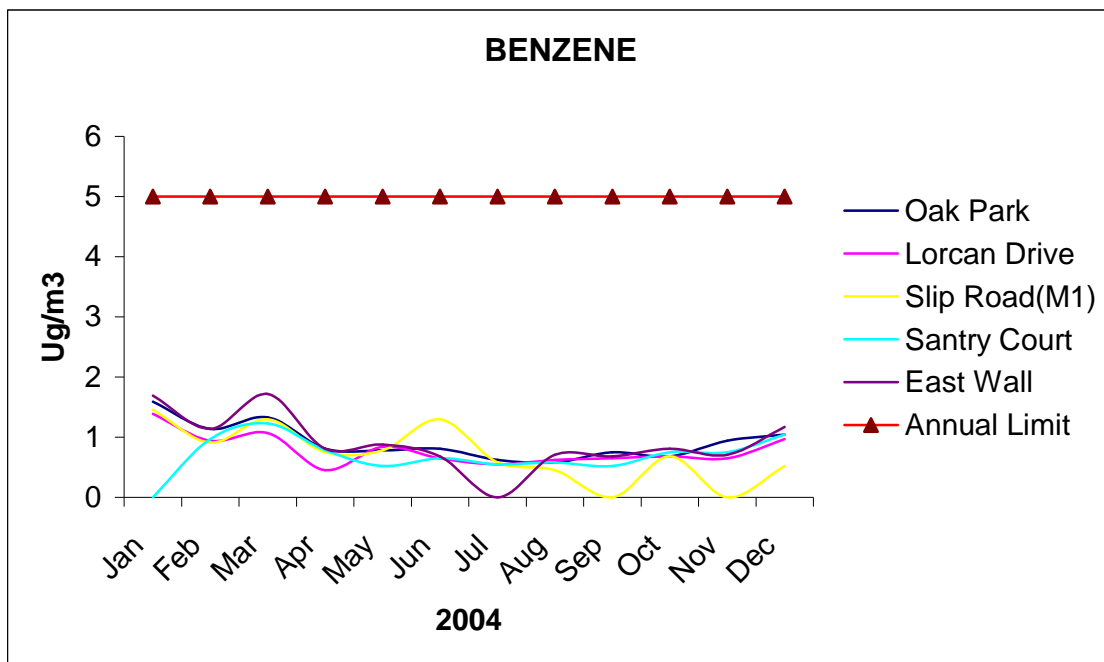
- Oak Park
- Santry Court
- Lorcan Drive
- East Wall Road
- M1 Sliproad at Santry

BENZENE

Benzene is an organic chemical which is a constituent of crude oil and is present in unleaded petrol. The main source of exposure for the general population is from vehicle exhaust emissions, where benzene is produced by chemical reactions occurring during the combustion of petrol. A further source of exposure, which contributes a significant proportion of an individual's total intake of benzene is cigarette smoking. Passive smoking may also contribute to benzene intake.

The annual average benzene levels measured at the five sites ranged from 0.75 – 1.01 $\mu\text{g}/\text{m}^3$ which are within the relevant statutory limit of 5 $\mu\text{g}/\text{m}^3$.

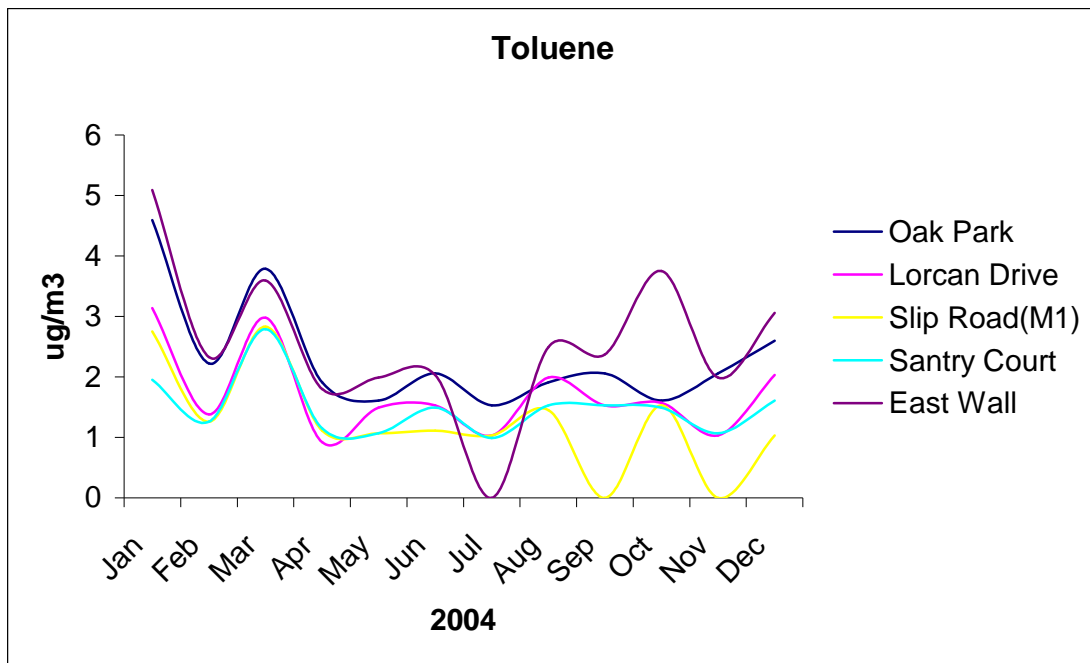
Figure 6 : Average Benzene Levels



TOLUENE

Vehicle emissions are the principal source of emissions of toluene to the atmosphere. Other forms of environmental exposure to toluene usually occurs from exposure to paints, adhesives, cigarette smoke. Health effects of exposure through inhalation to toluene include decreased resistance to respiratory infections and cardiac problems. Toluene is not however a human carcinogen. Average background levels are compared, which range from 2.06 to 3.21 ug/m³, with a World Health Organization 24-hour average value of 7.5 milligrams per cubic metre. Figure 9 shows this comparison.

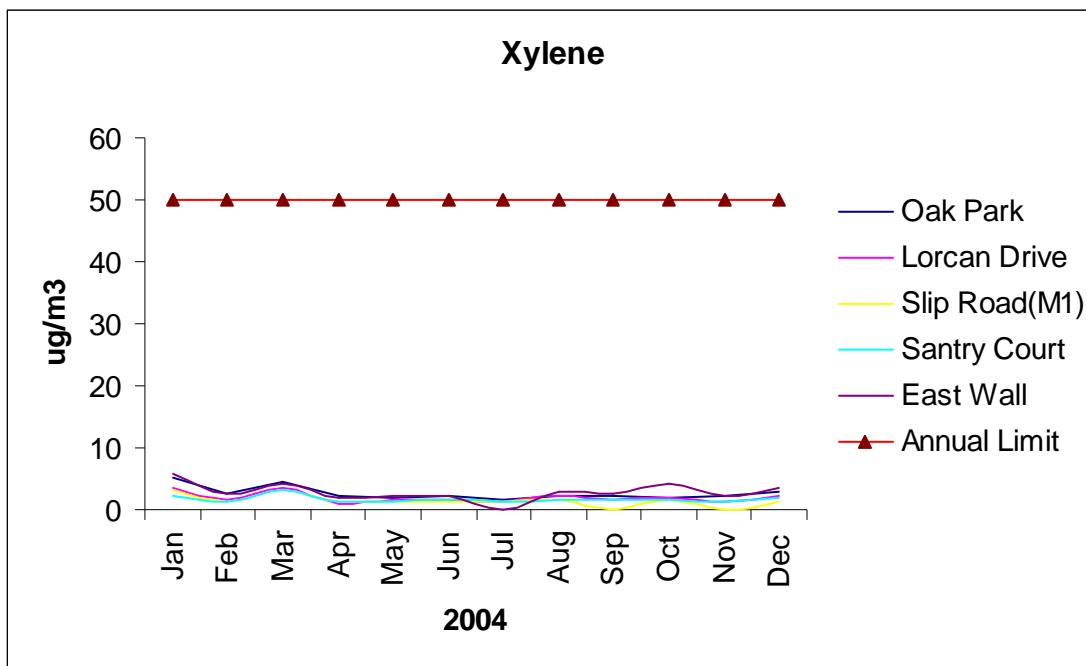
Figure 7 : Average Toluene Levels



XYLENES

Environmental exposure to xylenes occurs through inhalation from paints, solvents and petrol. Similar to toluene, xylenes have not been associated with an increased risk of cancer in humans. Xylenes are also distributed throughout the environment – they have been detected in air, rainwater, and soils. Average background levels of xylenes are compared with an EU Indicative Occupational Exposure Limit Value (IOELV) adopted under Council Directive 98/24/EC. This limit value of 50µg/m³ relates to indoor exposure and is used for comparative purposes only. Figure 8 indicates that xylene with levels between 1.7 – 3.17 were not significant at the five monitored locations in 2003.

Figure 10 : Average Xylene Levels



1,3 BUTADIENE

Motor vehicle exhaust is a constant source of 1,3 butadiene. Although it breaks down quickly in the atmosphere, 1,3 butadiene is usually found in ambient air at low levels in urban and suburban areas. Butadiene levels have fallen rapidly with the introduction of catalytic converters on vehicles. Epidemiological studies have reported a possible association between this compound and cardiovascular disease. Other sources include manufacturing and processing facilities, cigarette smoke and fires. This pollutant has been classified as a probable human carcinogen.

Average 1,3 butadiene levels at the five monitored locations were less than 0.34ppb. These levels compare favourably with a standard of 1.0ppb (annual mean) as established by the U.K. Expert Panel on Air Quality Standards.