

DUBLIN PORT TUNNEL
AIR QUALITY MONITORING
ANNUAL REPORT 2002

Introduction

One of the key challenges for the Dublin Port Tunnel project is to successfully control air pollutant emissions to avoid adverse impacts on local residents, while supporting construction milestones and ensuring that environmental commitments contained in the Project's Environmental Impact Statement are fulfilled. With pollution control measures, established policies and specifications, support from project officials, open dialog with the affected communities, the potential air quality impacts from this project can be managed successfully. This report presents the results of air quality monitoring at the Northern and Southern Portals of the Port Tunnel for the period January - December 2002. 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.

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 in the Air Quality Standards Regulations 2002. 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.

Health Effects

Clean air is essential to a good quality of life. Polluted air can adversely affect health, particularly affecting the most vulnerable in society – the very young and the very old. Individual pollutants have different impacts, many affect the heart and lungs, some severely. High levels of air pollution impact most on cardiovascular and respiratory diseases which affect the very old and the very young disproportionately.

Southern Portal – East Wall, Dublin 3

Several air pollutants 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 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 below in order to assess the contribution of tunnel-related construction activities to local air quality.

Table 1: Limit Values for Pollutants Measured at East Wall Road

Pollutant	Limit Value*	Permitted Exceedances	Attainment Date
Sulphur Dioxide (SO ₂)	125 µg/m ³ (24-Hour) 350 µg/m (1-Hour)	3 per year 24 per year	2005
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	2005
Carbon Monoxide (CO)	10 mg/m ³	Maximum daily 8-hour mean	2005
Lead (Pb)	0.5 µg/m ³	Annual Mean	2005
Benzene	5 µg/m ³	Annual Mean	2010
Ozone (O ₃)	180µg/m ³ (1-hour)	Population Threshold	2010

* Air Quality Standards Regulations 2002

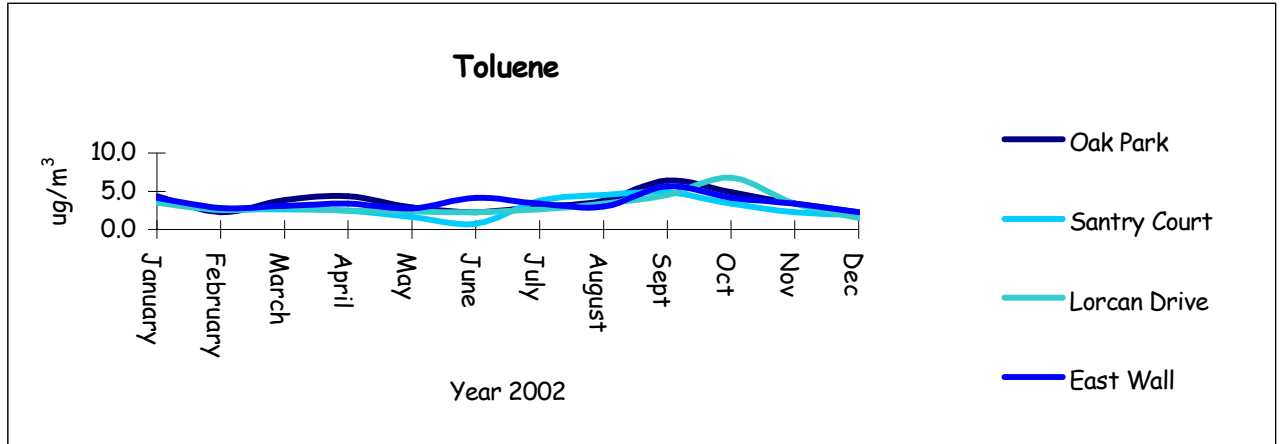
Sulphur Dioxide

This pollutant can have adverse affects on human health, vegetation and cultural heritage (protected buildings). Emissions from the combustion of fossil fuels, particularly electricity generation, account for the bulk of SO₂ emissions. Levels recorded over the year indicate compliance with the relevant statutory limits.

Maximum 1-Hour and 24-Hour SO₂ Levels

Limit Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
350 µg/m (1-Hour)	153	61.5	72.9	59.2	40	49.4	40.6	62.9	54.9	95.5	50.3	95.5
125 µg/m ³ (24-Hr)	21.4	10.7	15.4	14.2	5.6	2.9	13.4	12	16.7	24	24.3	28

Figure 1: Maximum SO₂ Levels



Lead

Monthly Average Lead Levels

Limit Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
0.5µg/m ³	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01

The annual average lead level of 0.02 µg/m³ is in compliance with the relevant statutory limit.

Nitrogen Dioxide

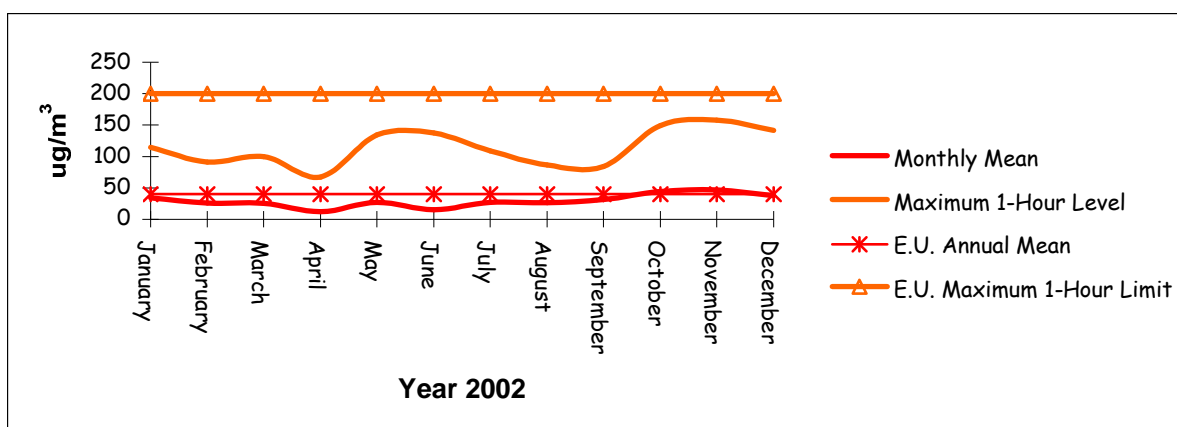
This pollutant is thought to increase the lung's vulnerability to infection. The main source of NO₂ is motor vehicles, although gas use for building heating, is also a significant contributor. Statutory limits were complied with at the East Wall Road location over the monitoring period.

Mean Monthly Levels and Maximum Hourly NO₂ Levels

Limit Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
200 µg/m (1-Hour)	114.6	91.3	100.1	67.4	134.2	137.5	108.7	86.3	84.2	149.3	158	141.7
40 µg/m ³ Annual Mean	34.0	25.7	25.3	12.0	26.7	15.3	26.7	26.3	31.5	44.2	46.7	37.5

The annual mean of 29 µg/m³ recorded at East Wall Road in 2002 complies with the statutory annual mean limit value of 40 µg/m³.

Figure 2 : Mean and Maximum Monthly NO₂ Levels



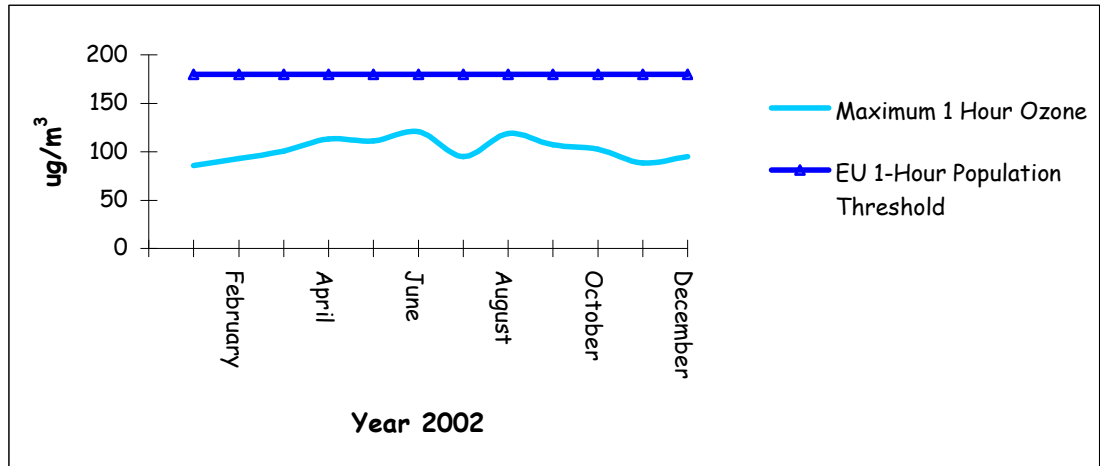
Ozone

The ozone Directive does not set limit values recognising that ozone is a secondary pollutant and has a transboundary dimension. A threshold is set above which there may be effects on human health and vegetation. Ozone is not a significant pollutant in Dublin.

EU Directive*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
180 µg/m (1-Hour)	85.6	92.8	100.6	113.2	111.2	120.6	95	119	107	102.5	88.2	95

*population threshold

Figure 3 : Maximum Hourly O₃ Levels



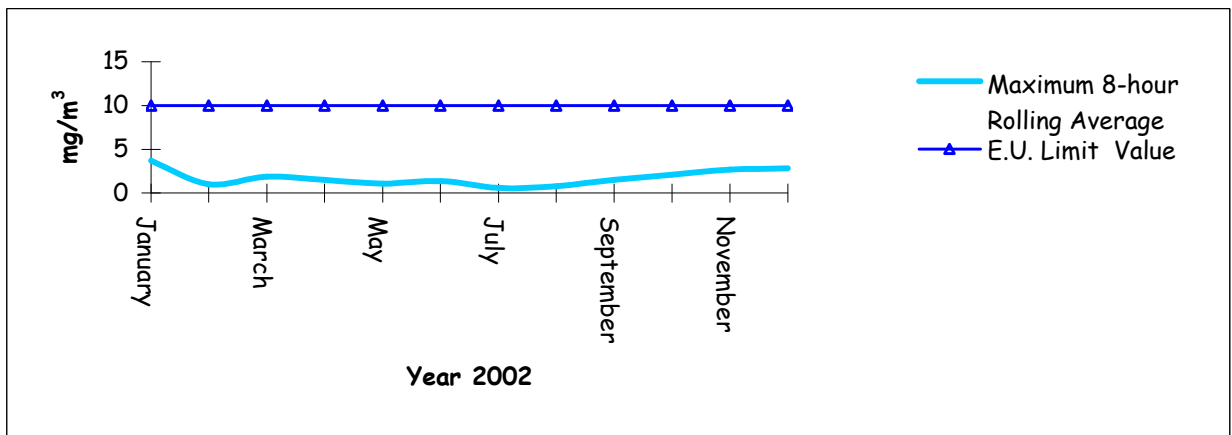
Carbon Monoxide

This pollutant can pose a significant threat to human health and the formation of ozone. Carbon monoxide principally originates from the incomplete combustion of fuel with the transportation sector being the largest contributor to emissions.

Maximum 8-Hour Rolling Average

Limit Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
10mg/m ³	3.7	1.0	1.9	1.5	1.1	1.4	0.6	0.89	1.5	2.1	2.7	2.8

Figure 4 : Maximum Monthly CO Averages



Particulate Matter (PM₁₀)

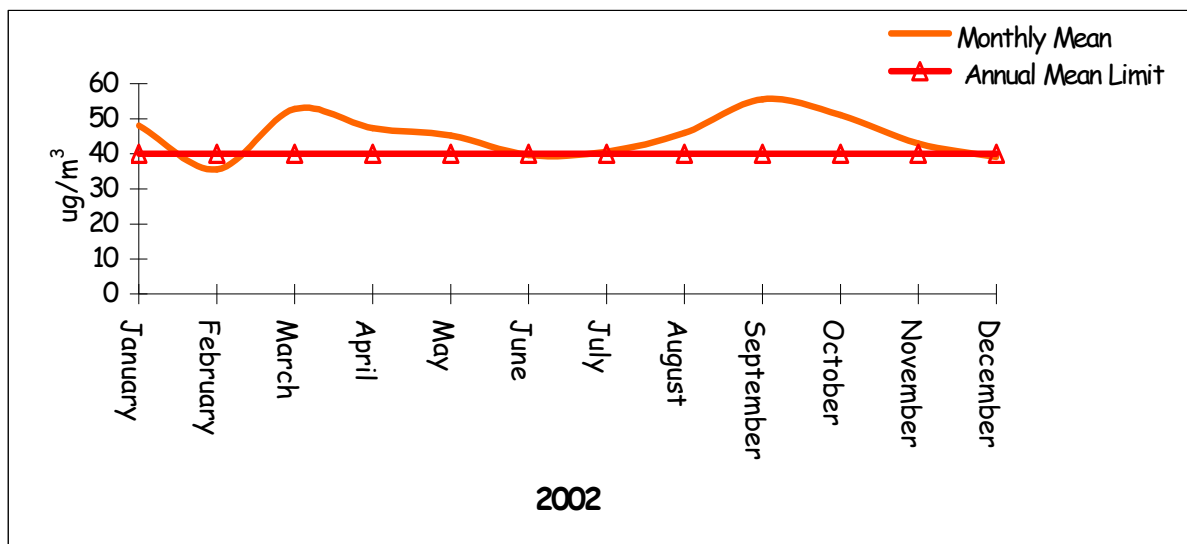
Inhalation of airborne particulate matter can increase the risk, frequency and severity of respiratory disorders. PM₁₀ in the atmosphere results from direct emissions (primary PM₁₀) or from emissions of precursors (nitrogen dioxide, sulphur dioxide and ammonia) which are transformed by chemical reaction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

The annual mean recorded at East Wall Road was 45 µg/m³ which is above the annual mean limit of 40 µg/m³. The maximum 24-hour limit of 50 µg/m³ was also exceeded during each month in 2002. However, as discussed earlier in this report, this monitoring location is within the construction site and therefore not in compliance with EU siting criteria for pollutant measurement.

Mean Monthly and Maximum 24-hour PM₁₀ Levels

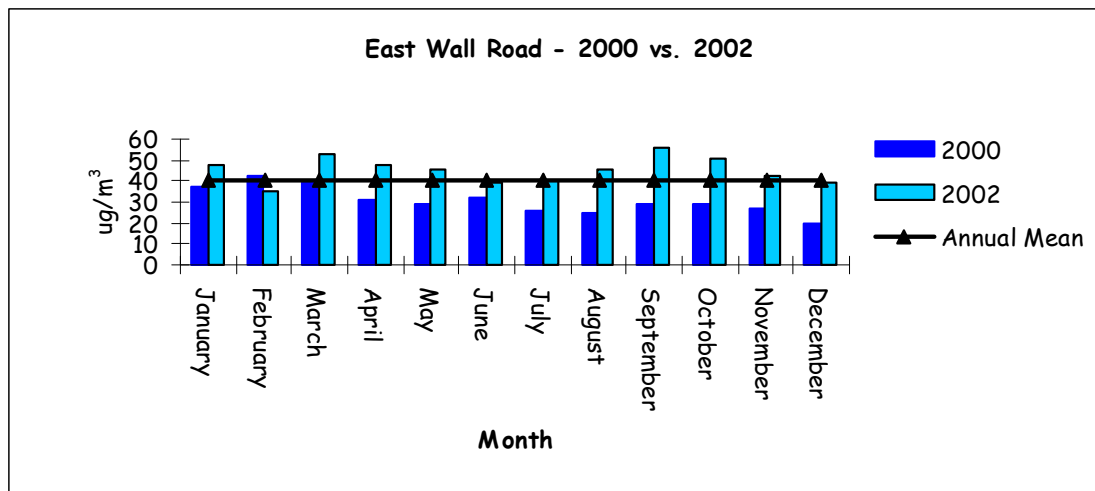
Limit Value	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Annual Mean 40 µg/m ³	48	35.5	52.8	47.4	45.3	39.7	40.6	45.9	55.6	51.1	42.9	39.1
Max 24hr Value 50 µg/m ³	88	61	136	101	111	121	86	105	134	97	94	107

Figure 5 : Mean Monthly PM₁₀ Levels



For comparative purposes, PM₁₀ levels in 2000 are compared with 2002 levels in Figure 6 below which show an overall increase in local levels over the past two years in the East Wall Road area.

Figure 6 : Comparison of 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. The Ellenfield Park data represents average background conditions for the locality prior to construction activities and will provide comparative data to show the net air quality benefit of the Port Tunnel in the vicinity of the Northern Portal on completion of the project.

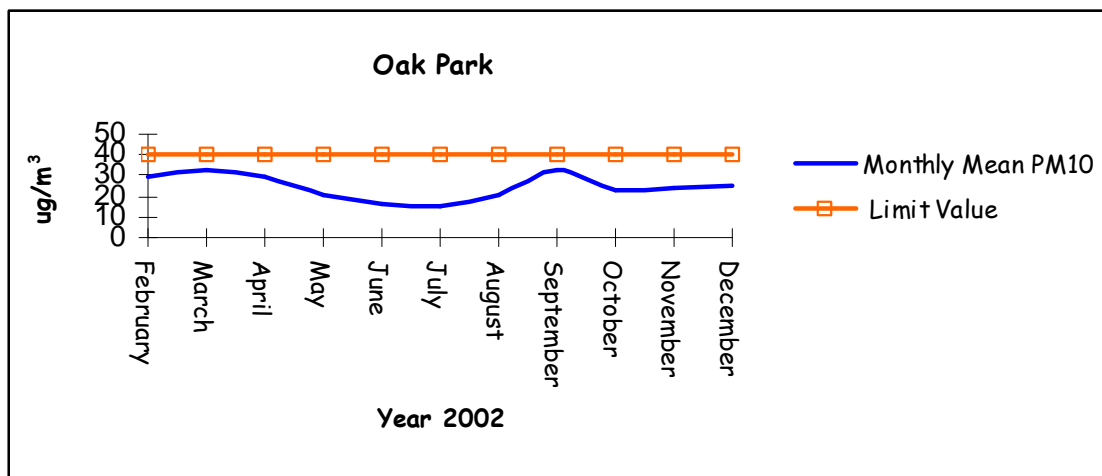
The levels recorded are compared with the annual mean limit of 40 microgrammes per cubic metre ($\mu\text{g}/\text{m}^3$). The higher levels recorded between February, March and September 2002 relate to construction works in the vicinity of the monitoring location.

There were fourteen days during 2002 when the 24-hour limit of $50 \mu\text{g}/\text{m}^3$ was exceeded. The margin of tolerance indicates that the 24-hour limit should not be exceeded more than 35 times in a calendar year. Overall, particulate levels recorded at this location are similar to average urban residential levels recorded in the Dublin area.

Mean Monthly and Maximum 24-hour PM₁₀ Levels

Limit Value	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Annual Mean 40 µg/m ³	29.7	33	29.4	20.8	16.2	15.7	20.5	32.6	23.3	23.4	24.5
Max 24hr 50 µg/m ³	43.8	76.2	76.4	37	38	25.6	41.2	111.1	62.6	58.5	43.3

Figure 7: Monthly Average Particulates (PM₁₀) Recorded at Oak Park, Santry



Volatile Organic Compounds (VOCs)

As previously discussed, the measurement of volatile organic compounds (VOCs) was 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. Thus, the results of VOCs as measured at four 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.

While there is a statutory limit in relation to benzene, it is anticipated that standards will be finalised for other potentially toxic compounds shortly. In anticipation of such standards, monitoring for a number of compounds is currently being carried using diffusive samplers, which are exposed for a fixed period of time and analysed at an approved laboratory.

The VOC monitoring locations include:

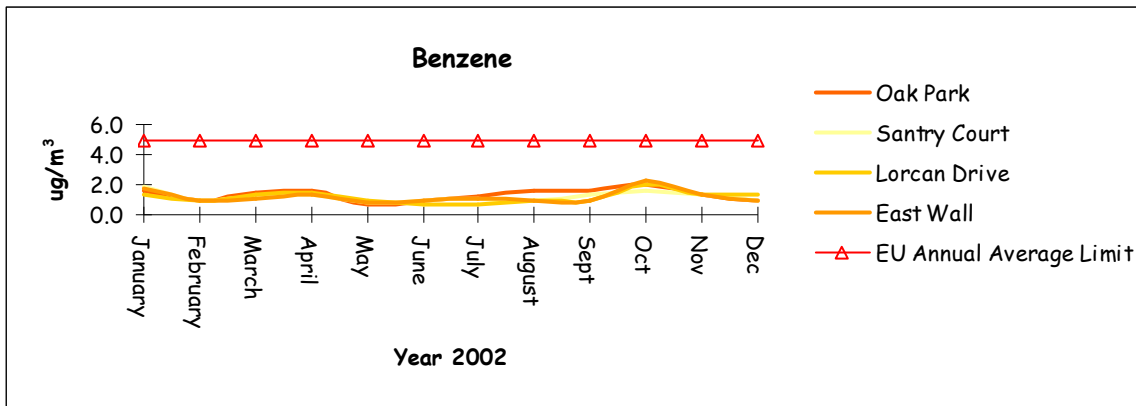
- Oak Park
- Santry Court
- Lorcan Drive
- East Wall

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 four sites ranged from 1.2 – 1.3 $\mu\text{g}/\text{m}^3$ which are within the relevant statutory limit of 5 $\mu\text{g}/\text{m}^3$.

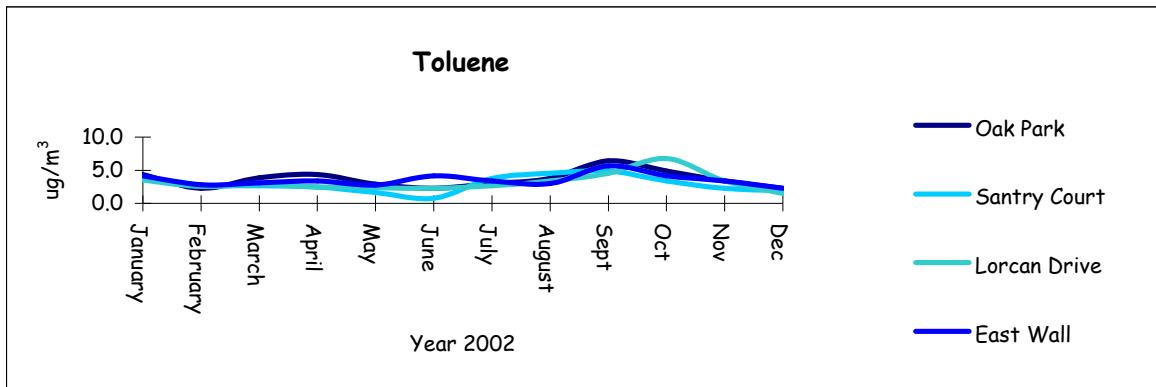
Figure 8 : Average Benzene Levels



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 with a World Health Organisation 24-hour average value of 7.5 milligrams per cubic metre.

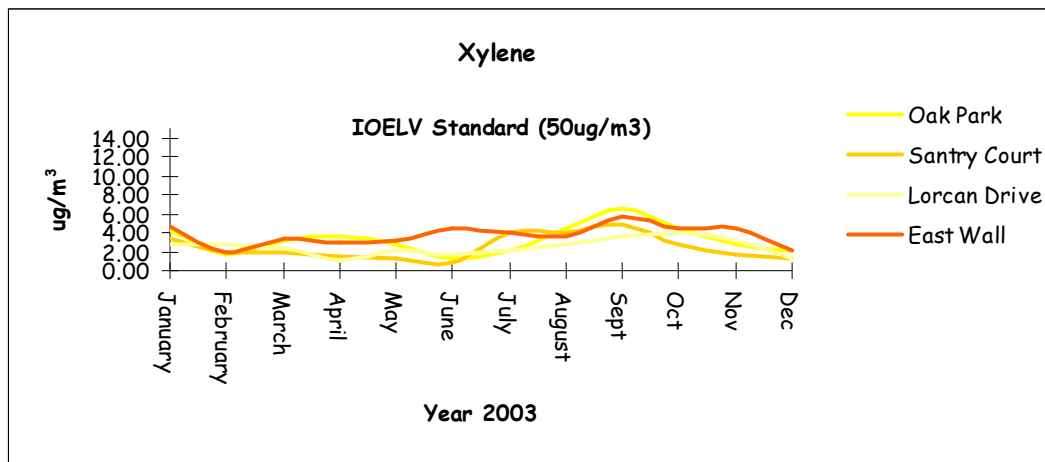
Figure 9 : Average Toluene Levels



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 adopted under Council Directive 98/24/EC. This limit value relates to indoor exposure and is used for comparative purposes only.

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 in the vicinity of the Port Tunnel are 0.5 parts per billion (ppb) at the four monitoring locations. These levels compare favourably with a standard of 1.0ppb (annual mean) as established by the U.K. Expert Panel on Air Quality Standards.