LONDON BOROUGH OF
RICHMOND UPON THAMES

Air Quality Progress Report
And Action Plan Progress Report
London Borough of Richmond Upon Thames

2005

Abstract
The Borough was initially designated an Air Quality Management Area in December 2000, on the basis that the air pollutants of PM10 Particulates and nitrogen dioxide were expected to exceed the objective limits set for 2004 (PM10) and 2005 (NO_2). More recently, the Borough's Updating and Screening Assessment (USA) in 2004 again predicted that there would still be exceedences of the same air quality objectives in the Borough. The monitoring results in this Air Quality Progress Report indicate that the air quality did exceed the objectives at some locations across the Borough, but has improved at other locations. Over recent years, considerable effort has been made to address the air quality issue in the Borough, with good success in many aspects but clearly with more work still to do. A further predictive USA is due to be completed by the end of April 2006, to assess whether the air quality is likely to improve enough to meet the objectives. Some tighter air quality objectives are being prepared for 2010, which, if approved, will again require greater focus on local action.

Executive Summary
This progress reports the Borough's air quality monitoring data from over the last three years, for all the pollutants monitored, namely for NO_2, PM10, SO_2, CO, O_3, PAH, BTEX. The results indicate that both PM10 Particulates (PM10) and nitrogen dioxide (NO2) exceeded the air quality objectives for 2004/2005.

In 2002, the detailed Stage 4 modeling assessment indicated that the objectives would be exceeded, mainly along the major road transport corridors. This was again confirmed by the USA assessment in 2004. The USA report identified that:

1) There was <u>a risk</u> of exceeding the objectives for nitrogen dioxide (NO_2) across the Borough.
2) There was <u>a risk</u> of exceeding the objectives for PM10 particles in parts of the Borough.
3) For carbon monoxide (CO), benzene (C_6H_6), sulphur dioxide (SO_2), ozone (O_3), lead (Pb) and 1,3-butadiene the risk of exceeding the objectives were not significant.

The results, reported here, from the monitoring of NO2, shows that the levels <u>were</u> exceeded at Castelnau (roadside) for each of the last 3 years. Also, in 2004, the majority of the NO2 diffusion tube monitoring sites exceeded. This was expected, as the tubes are mainly located at roadsides, representing residents who live near busy roads.

Both the modeling and the monitoring results confirm that there is still a need for the Borough of Richmond to be designated as an 'Air Quality Management Area' (AQMA).

This progress report also contains the Air Quality Action Plan Progress Report, as recommended in the Progress Report Guidance document LAQM.PRG(03).

The Action Plan Progress Report shows that good progress is being made, with the majority of the measures in the process of being implemented.

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CHAPTER 1: INTRODUCTION

1.1 The Borough of Richmond Upon Thames as part of London

The London Borough of Richmond Upon Thames is situated in the SW corner of Outer London. In air quality terms, this means that the prevailing southwesterly wind (roughly 75% of the year) brings in relatively fresh air to the Borough, before it blows towards the centre of London. In practice, the wind blows from all points of the compass and this includes receiving polluted air blowing out from the centre of London. This explains why the Barnes end of the Borough receives a higher proportion of London air, with consequent higher background pollution levels. As a result, the Borough is keen for the air quality to be improved not just in the Borough, but also across the whole of London. Some of the Action Plans actions are cross-Borough, with the West London neighbours, or are cross-London initiatives.

***Fig 1**: Location of Borough of Richmond Upon Thames within Greater London*

1.2 The statutory requirement for a Progress Report

Local Authorities have duties in respect of local air quality management (LAQM) and delivering the national air quality objectives set out in the Air Quality Strategy for England, Wales and Northern Ireland, plus associated Regulations. This report takes account into guidance contained in LAQM.PRG (03) 'Progress Report Guidance' (DEFRA, 2003).

1.3 Air Quality Action Plan History

Summary of Air Quality progress to date:

1. Stage 1,2 and 3 assessments confirmed a need to tackle air quality in the Borough
2. Air Quality Management Area declared for whole Borough, December 2000
3. Stage 4 assessment, May 2002, confirmed that air quality improvements were needed
4. Air Quality Action Plan consulted on and published 2002
5. Updating and Screening Assessment 2004 confirmed continuing exceedence of the objectives

6. Air Quality Review and Assessment Progress Report 2005 to give updated monitoring results
7. Action Plan Progress Report 2005 to give update on actions to improve air quality
8. Updating and Screening Assessment & Action Plan Progress Report due April 2006

The Borough's Local Air Quality Action Plan (AQAP) was required under Part IV of the Environment Act 1995. The Council decided to declare the whole Borough as a single Air Quality Management Area. This was declared in a formal notice dated 31st December 2000 following a review and assessment of air quality in the Borough 'Stage 3'. The Review concluded that the National Air Quality Strategy objectives for 2005 would not be met for two pollutants, namely nitrogen dioxide and fine particles. The standards in the objectives are health based. The objectives and relevant health effect are found in Appendices 1 and 2.

The purpose of the AQAP is to ensure that the Council can plan and manage appropriate actions to improve air quality within the Borough. It is not a legal requirement to actually achieve the national air quality objectives, however the action must be in pursuit of achieving the objectives.

Under the Act, local authorities that have declared an Air Quality Management Area are required to undertake a further 'Stage 4' assessment, to refine the detail of the previous assessment and to assist with targeting the action required to improve the air quality. The 'Stage 4' review was completed in May 2002, following a revision of the traffic forecasts and using a new emissions inventory for London.

The Stage 4 report confirmed the Stage 3 findings that the statutory objectives for both nitrogen dioxide (NO_2) and fine particles (PM10) would still be exceeded in 2005. The areas predicted to exceed the targets are mainly adjacent to the major through traffic routes. The next phase was to produce an Update and Screening Assessment.

Even though the compliance dates have passed for PM10 (2004) and NO_2 (2005), the Borough is still obliged to try to meet those objectives. New, more stringent PM10 objectives have not been adopted yet, so we are not yet required to be taking additional action to meet those, although we need to be bear them in mind, as we carry out our various assessments. The NO_2 target for 2010 is likely to remain at 40ug/m^3, so the existing focus remains the same.

Progress on the Air Quality Action Plan is reported as Appendix 6 to this report.

CHAPTER 2 AIR QUALITY MONITORING IN RICHMOND

The monitoring data in this report comes from monitoring surveys undertaken across the Borough. The monitoring results confirm that air pollution in the Borough still exceeds the 2004/2005 objectives and that therefore there is still a need for the Borough to be designated as an Air Quality Management Area and consequently there is still a need to pursue improvements in air quality.

In order to assess the air quality against the National Air Quality Objectives, Richmond Council routinely monitors against annual average objectives and against shorter period objectives, as indicated for the pollutants below:

Nitrogen dioxide NO_2 (1-hour averages)
Particulates PM10 (24-hour averages)
Sulphur dioxide SO_2 (15-minute averages)
Ozone O_3 (8-hour averages)
Carbon Monoxide CO (8-hour averages)
Benzene BTX (2-week monitoring averages – annual average limit only)
Poly Aromatic Hydrocarbons PAH (2-week monitoring averages – annual average limit only)

Table 1 and Fig. 4 show the locations of the NO_2 diffusion tube monitors in the Borough. The tubes are a relatively cheap way of monitoring, which therefore allows samples to be taken across the whole Borough and give a Borough-wide view. The results obtained give monthly averages, and are not precise but do provide an indication of NO_2 pollution levels. The accuracy of the diffusion tube readings can be increased when their results are compared, and the bias adjusted, with data from the more accurate continuous monitors. Richmond Council has a network of 63 diffusion tubes to monitor nitrogen dioxide (NO_2) at 57 locations (Table 1) across the Borough and a further 5 sites to monitor for benzene (Table 8) and 1 site to monitor for polycyclic aromatic hydrocarbons (PAH) (Table 9).
At three locations in the Borough there are air pollution analysers running continuously. (Locations in Table 2). The continuous monitors reduce the real time data to various averages (as above). This type of equipment provides accurate readings of pollution levels but is expensive, so using them for a large coverage of the Borough is not possible on cost grounds.

2.1 Air Quality Modelling

2.1.1 Stage 4 Air Quality Report. Current and Future Trends

The Fig. 2 'Pollution Hotspot' map was compiled from the Stage 4 modelling results. It identifies the areas where people will be exposed to pollution in excess of the limits, according to the modeled assessment carried out for the year 2005 (Fig 5 and Fig. 6).

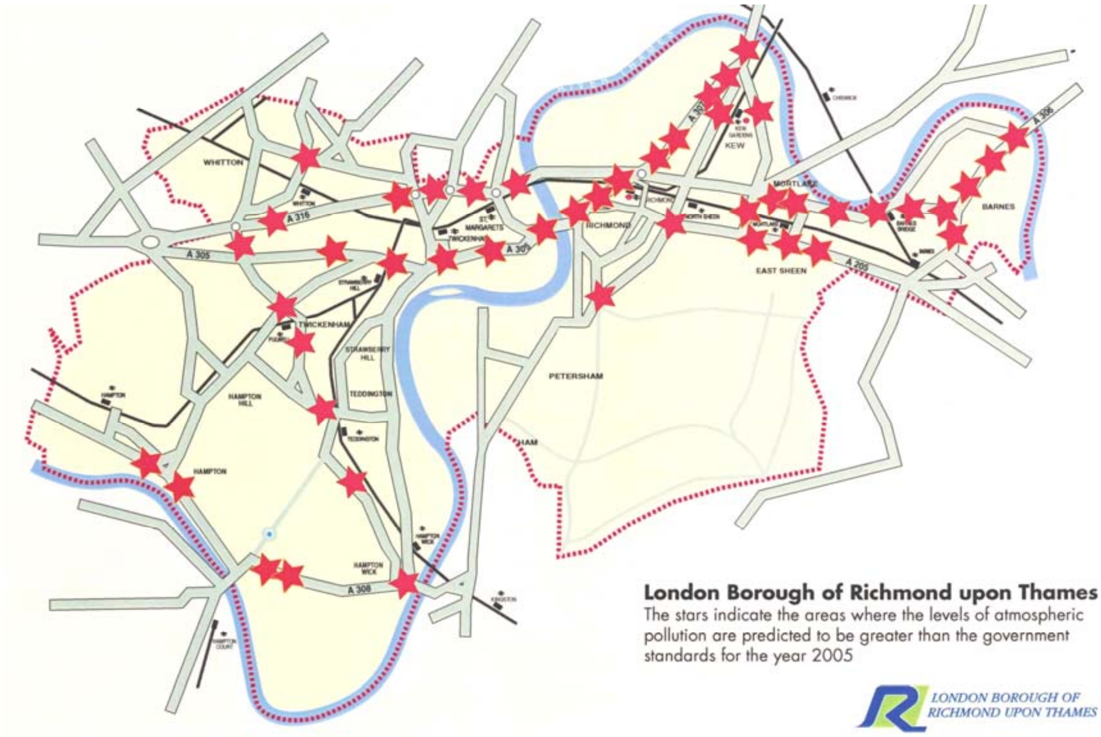

***Fig 2**: Air Pollution Hotspots in LBRU, modeled for exposure to residents, for 2005*

The Stage 4 Air Quality Report, as well as some other reports on monitoring and air quality data can be accessed on the Council web site at: http://www.richmond.gov.uk/depts/env/envplanning/health-special/airquality.htm

A ‘source apportionment’ assessment was made, at ten selected locations in the Borough and it indicated the proportion of pollution coming from heavy goods vehicles, light goods vehicles, and cars and also from the general background. Generally speaking, the results show that roughly half of the pollution at roadside sites comes from road traffic and the other half from background sources. The background sources include aircraft, all more distant roads, other areas of Britain and the air mass blowing over from continental Europe. Cars are the main source of NO_2 road traffic emissions in the Borough. They account for more than half of them (52%).

2.2 Nitrogen Dioxide (NO_2) in the Borough

The following Table (Table 1) shows the NO_2 diffusion tube monitoring results, with bias corrected values for 2002, 2003 and 2004. The results in bold indicate an exceedence of the Air Quality Objective. Most of the monitors are located on lamp posts at the kerbside of the road, so that the nearest relevant exposure is residential properties set back between 5m to 10m from the kerb. The monitoring site at Holly Lodge in Richmond Park (No. 28) and the Wetlands monitor (No. 37) are Background sites, set well away from roads.

It is widely acknowledged that diffusion tubes can have inaccuracies of up to 20-30%. However, by comparing the diffusion tube data with that from the Borough’s more accurate continuous monitors, it is possible to calculate an adjustment factor for the diffusion tubes, and hence end up with a more accurate result.

In accordance with Government guidance LAQM.PG(03) on air quality monitoring, a yearly bias adjustment factor has been produced for the 2002, 2003 and 2004 results. The bias factor for 2002 is 1.44, 2003 is 1.23 and 2004 is 0.97. See Appendix 3 for the Diffusion Tube methodology and Appendix 4 for the calculation of bias.

Figure 4 is a map of the Borough, showing all the monitoring locations, other than for the mobile unit.

Table1 Annual concentration in micrograms per cubic metre of NO_2, by diffusion tube sampling . The data is ranked using the 2004 data, with the most polluted sites at the top. The two following graphs (Fig 3a and Fig 3b) chart the same data.

Site Code	**Location**	**Distance from Roadside (metres)**	**Bias Corrected 2002**	**Bias Corrected 2003**	**Bias Corrected 2004**
RUT 02	George Street, Richmond.	0.2	**90.61**	**130.09**	**107.10**
32	Kings Street, Twickenham.	0.2	**77.50**	**95.76**	**83.52**
36	URRW Sheen Lane.	0.2	**61.04**	**87.65**	**67.71**
18	Lower Mortlake Road Richmond. (Nr Trinity Road)	0.2	**67.65**	**78.57**	**65.01**
39	Richmond Road, Richmond Bridge, East Twick.	0.2	**61.36**	**73.25**	**60.85**
7	Broad Street, Teddington. (Tesco)	0.2	**55.37**	**85.86**	**60.15**
19	Kew Road Kew. (Nr Walpole Road)	0.2	**64.63**	**75.01**	**57.29**
31	A316	1.5	**56.98**	**68.76**	**55.63**
43	Hill Street, Richmond	0.2	**58.21**	**66.82**	**53.59**
42	The Quadrant, Richmond	0.2	**58.70**	**73.85**	**53.26**
50	URRW Nr Clifford Avenue, Sheen.	0.2	**53.61**	**69.67**	**52.37**
25	URRW near Sheen School.	0.2	**54.54**	**64.64**	**51.54**
52	Clifford Avenue, Chalker corner.	0.2	**59.55**	**64.37**	**51.30**
9	Hampton Road, Twickenham.	0.2	**49.15**	**59.43**	**50.64**

35	High Street, Hampton Wick.	1.6	**47.56**	**67.98**	**49.79**
RUT 01	Civic Centre, York Street, Twickenham.	1.2	**51.56**	**61.22**	**49.69**
15	Richmond Road, Twickenham. (oppo Marble Hill Park)	0.2	**46.38**	**58.25**	**48.42**
22	Castelnau, Barnes. (Nr Hammersmith Bridge)	0.2	**46.45**	**61.50**	**48.06**
6	Kingston Road Teddington. (Nr Woolfingdon Close)	0.2	**49.23**	**53.93**	**46.78**
20	Mortlake Road, Kew. (Nr Kent Road)	0.2	**49.98**	**64.73**	**46.69**
44	Sheen Road Richmond, (Shops)	0.2	**47.17**	**60.49**	**45.76**
33	Heath Road, Twickenham.	0.2	**47.88**	**65.41**	**45.34**
48	Stanley Road, Teddington (junc Strathmore Road)	0.2	**50.15**	**51.22**	**45.27**
49	URRW War Memorial, Sheen Lane, Sheen.	0.2	**47.78**	**60.57**	**45.11**
4	Hampton Road, Teddington. (Nr Bushy Park Gardens)	0.2	**46.56**	**58.18**	**44.97**
1	Hampton Court Road, Hampton.	1.2	**43.72**	**58.52**	**44.05**
26	Upper Richmond Road West, Sheen. (Nr Courtland Estate)	2.5	**49.14**	**58.44**	**44.05**
13	Whitton Road, Whitton, (oppo Rugby ground)	0.2	**42.26**	**59.83**	**43.61**
12	Hanworth Road, Whitton.	0.5	39.52	**50.24**	**43.25**
16	St Margarets Road, St Margarets. (Nr Bridge Road)	0.2	**46.84**	**55.23**	**43.14**
45	High Street, Teddington, (post office)	0.2	**51.75**	**58.05**	**42.89**
3	Uxbridge Road, Hampton. (Nr Arundel Close)	1.2	**46.93**	**55.56**	**42.82**
21	Lower Richmond Road, Mortlake. (Nr Kingsway)	1.2	**46.50**	**55.14**	**41.99**
47	Causeway, Teddington	0.2	**41.86**	**47.52**	**41.68**
27	Queens Road, Richmond. (Nr Russell Walk)	1.2	**49.13**	**55.58**	**41.42**
10	Twickenham Road Twickenham. (oppo Fulwell golf course)	0.2	38.82	**51.95**	**40.78**
11	Percy Road, Whitton. (Nr Percy Way)	0.2	**41.63**	**54.44**	**40.33**
41	Paradise Road Richmond	0.2	**44.81**	**55.33**	39.95
34	Thames Street, Hampton.	1.6	36.74	**47.61**	39.06
40	Staines Road, Twickenham	0.2	**42.02**	**50.05**	38.64
29	Petersham Road, Ham. (Nr Sandy Lane)	0.2	**43.85**	**50.75**	37.88
8	Strawberry Vale, Teddington. (Clive Road)	0.2	**41.07**	**43.47**	37.08
46	15 Queens Road, Teddington	0.2	38.57	**53.05**	36.54
24	Lonsdale Road, Barnes. (Nr Suffolk Road)	0.2	39.34	**52.52**	36.34
51	Sheen Lane, Railway crossing. Sheen	0.2	**44.34**	**47.99**	36.06
38	Queens Road, Teddington (park rd end)	0.2	**42.95**	**50.29**	35.63
5	Sandy lane, Teddington. (Shafe Way)	0.2	**40.68**	**47.37**	34.07
23	Castelnau Library, Barnes.	1.5	**44.07**	**44.94**	33.79
2	Percy Road, Hampton. (Nr Oldfield Road)	1.2	37.66	**40.85**	32.76

14	Cross Deep, Twickenham. (Nr Poulett Gardens)	0.2	**44.77**	**57.91**	32.52
53	Mobile Air Quality Site				32.08
30	German School Petersham Road	2	**43.12**	**44.73**	31.79
RUT 04	Elmfield House, Waldergrave Road, Teddington.	15	30.16	36.58	30.67
RUT 03	Alexandra Hall, Cromwell Place, Mortlake.	50	38.78	**41.52**	29.33
17	Parkshot, Richmond. (Court)	150	34.49	34.35	26.83
37	Wetlands Static Site, Barnes.	590	35.02	32.02	26.06
28	Holly Lodge, Richmond Park.	300	31.70	28.75	23.26

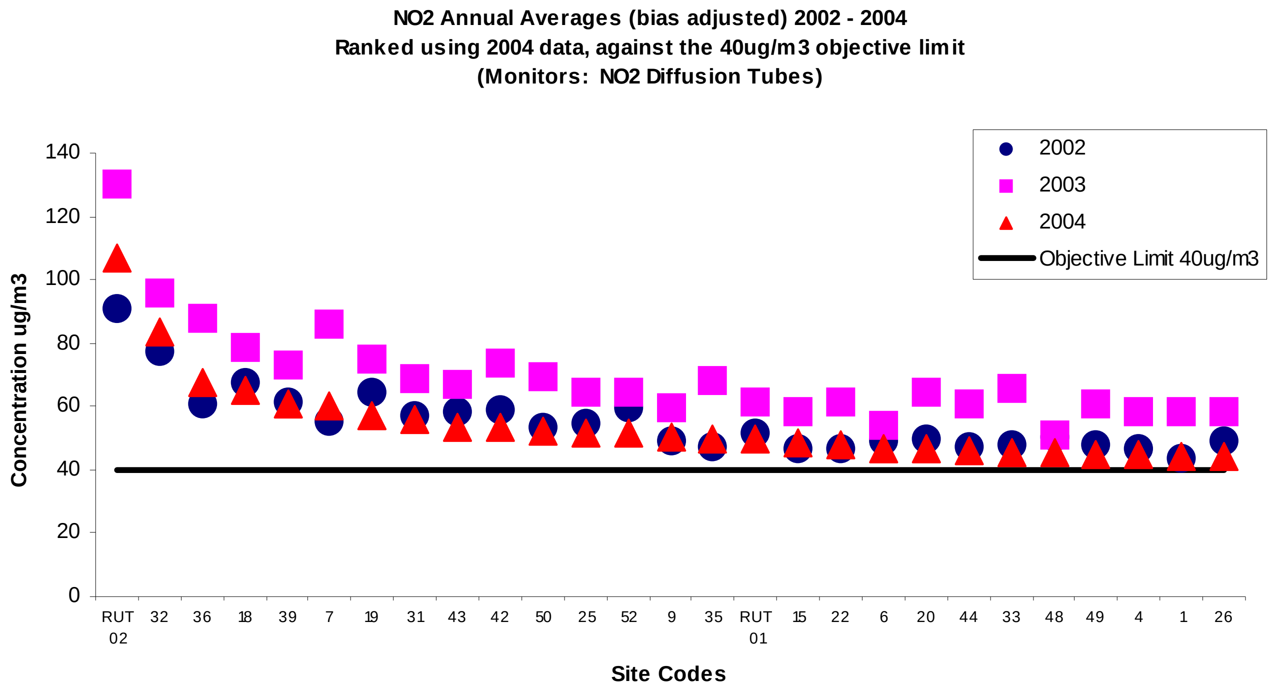

Figure 3a Graph showing the comparison of 2002, 2003 and 2004 Diffusion Tube Annual Averages

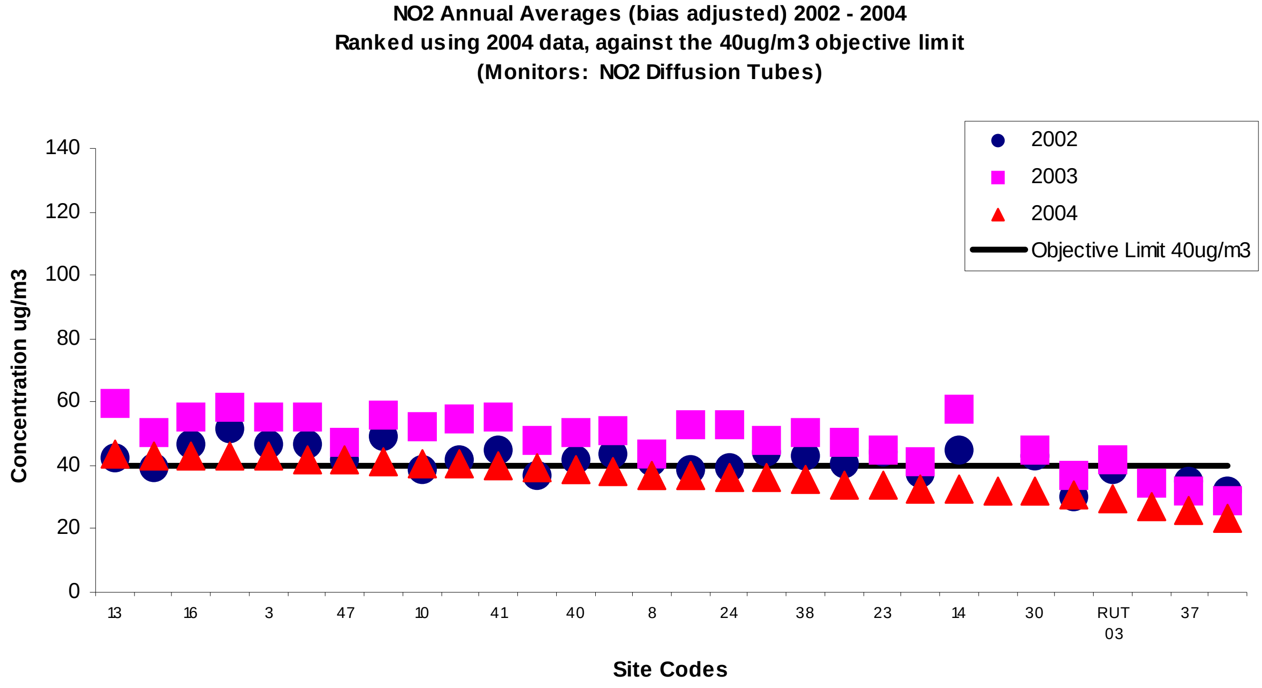

Figure 3b Graph showing the comparison of 2002, 2003 and 2004 Diffusion Tube Annual Averages

From the diffusion tube results in Table 1 and Figs 3a & 3b, we can see that 2003 was the worst of the 3 years. 2002 and 2004 were similar, with some improvements showing in 2004. Out of the 57 sites, 20 of the less polluted ones met the 40ug/m^3 objective limits. Fig 4 shows the longer terms trends at just 4 sites in the Borough. These sites were part of a long-term nation-wide monitoring programme. After relatively lower concentrations in 2000/2001, all the sites have demonstrate increases in NO_2. The greatest increase was at George Street, with a bias corrected result of 107ug/m^3. An even higher bias corrected result of 130ug/m^3 was recorded at George Street in 2003. However, it is generally known that 2003 was a year in which we generally had higher pollution levels, due to the meteorological conditions that year.

Table 2 Nitrogen Dioxide annual average diffusion tube sampling 1993-2004 in ug/m^3 (not bias corrected)

	Twickenham (RUT01)	Richmond (RUT02)	Mortlake (RUT03)	Teddington (RUT04)
1993	39	39	33	29
1994	46	39	32	33
1995	43	41	30	30
1996	42	37	29	32
1997	37	37	25	29
1998	40	35	25	25
1999	38	34	27	28
2000	35	29	34	25
2001	38	52	24	18
2002	36	63	27	21
2003	50	106	34	30
2004	51	110	30	32

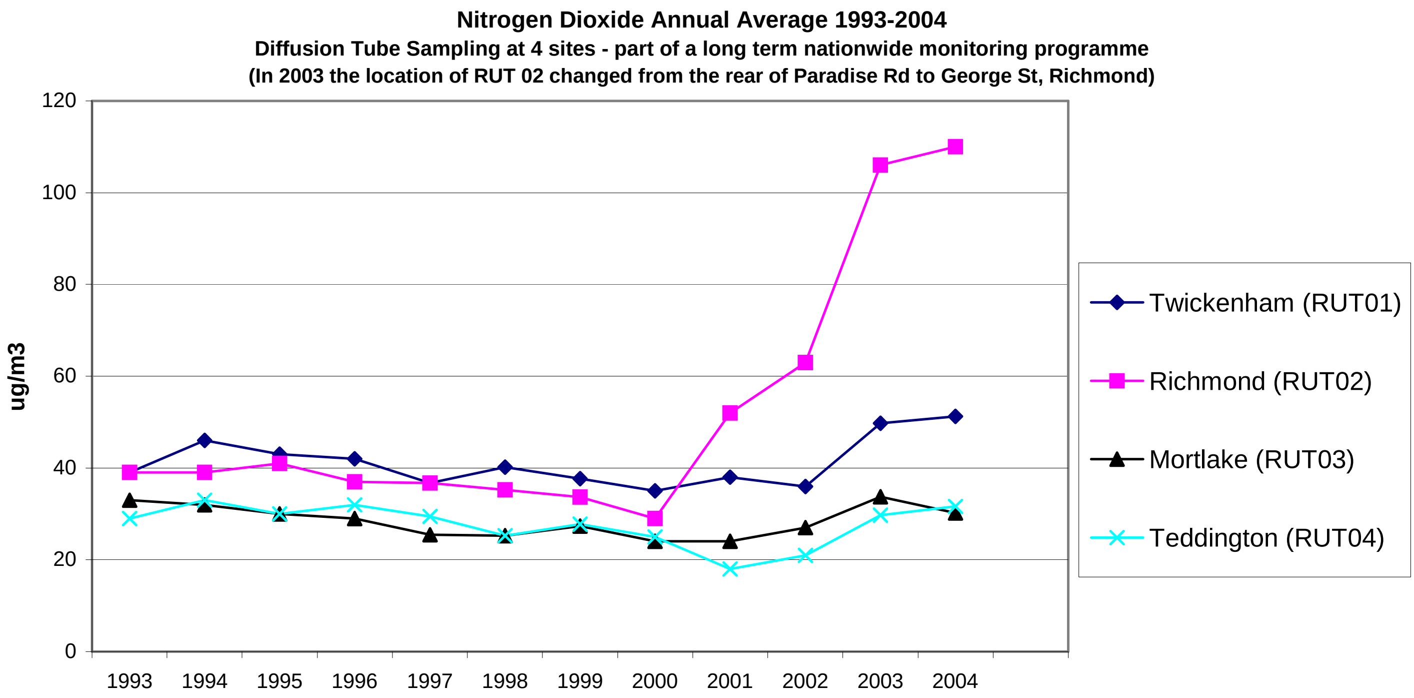

Figure 4 *Nitrogen Dioxide Annual Average 1993-2004 (Chart of Table 2 data. Bias not corrected, as no bias correction data was available for the earlier years) Note: the Richmond site moved from Paradise Road to George Street in 2001. The higher concentrations demonstrate the impact of local traffic movements at the new site.*

***Figure 5**: Map showing location of diffusion tubes and the continuous monitors*

2.3 Continuous Monitoring sites

Table 2 below, shows which pollutants monitored continuously at each of the four sites (1 mobile and 3 fixed). Richmond Council has three monitoring sites, and the National Physics Laboratory, (NPL) also undertakes monitoring in the Borough at Teddington, as part of the National ‘Automatic Urban and Rural Network’ (AURN).

Table 3 Locations of Automatic Monitoring Sites

Monitoring Sites	Operational Since	Pollutants Monitored
Castelnau Library, Barnes (static). 2m from kerb, with bus lane	2000	NOx, NO_2, NO, O_3 and PM10
Wetlands Centre, Barnes (static) Background site - well away from roads.	2000	NOx, NO_2, NO and PM10
Mobile Unit. Mostly roadside monitoring	1995	NOx, NO_2, NO, CO, SO_2 and PM10
NPL (static) Background site - well away from roads.	1996	NO_2, SO_2 and O_3

The results given below show the annual average data, for the pollutants monitored, for the years 2002 – 2004. Each set of results is given in turn, starting with NO_2, then PM10, ozone, SO_2, CO, benzene and PAH. Results in **bold** are ones which exceed the Objective limits. Details on the relevant Objective limits are given in Appendix 1.

For Quality Assurance/Quality Control (QA/QC) purposes, all the continuous analyzers are manually checked and calibrated every two weeks. They are also serviced every six months and also audited by an independent auditor (the National Physics Laboratory) every six months. The analytical methods used by the analysers are: NO_2 (chemiluminescence); PM10 (TEOM); ozone (UV absorption); SO_2 (fluorescence); CO (infrared); benzene (Gas chromatography/mass spectrometry) and PAH (both particle and vapour phase analysis). The relevance of quoting the percentage data capture is to demonstrate compliance with the minimum 90% required for a valid comparison with the short-term objective limits. All the data in the report has been ratified. We are not aware of any abnormal pollution making activity during the sampling periods.

Table 4 NO_2 results from the continuous analysers, compared with the annual average limit of 40ug/m_3 and the number of times the levels exceeded the hourly average limit of 200ug/m^3.

Castelnau	2002	2003	2004
Annual Mean NO_2 (ug/m^3)	**44**	**48**	**41**
Number of exceedences of hourly mean	0	0	0
Data Capture (%)	98%	96%	96%

Wetlands	2002	2003	2004
Annual Mean NO_2 (ug/m^3)	32	37	31
Number of exceedences of hourly mean	0	0	0
Data Capture (%)	Not available	99%	97%
NPL	**2002**	**2003**	**2004**
Annual Mean NO_2 (ug/m^3)	25	28	25
Number of exceedences of hourly mean	0	0	0
Data Capture (%)	98%	95%	94%

Table 3 shows that the annual mean for Castelnau exceeded the objective (40ug/m^3) over the last three years, but there were no exceedences of the 1-hour air quality objective. The objective was not exceeded at the Wetlands site.

The results from both diffusion tube sampling and the continuous analysers correlate with the modeling predictions calculated by Environmental Research Group ERG (consultants) for the year 2005. The following maps (Fig 5 and Fig 6) were taken from the 2002 Stage 4 Review and Assessment report. They indicate that the AQ objectives will not be met in 2005 in the main road traffic corridors and junctions, and therefore premises close to these areas will be affected by the pollution:

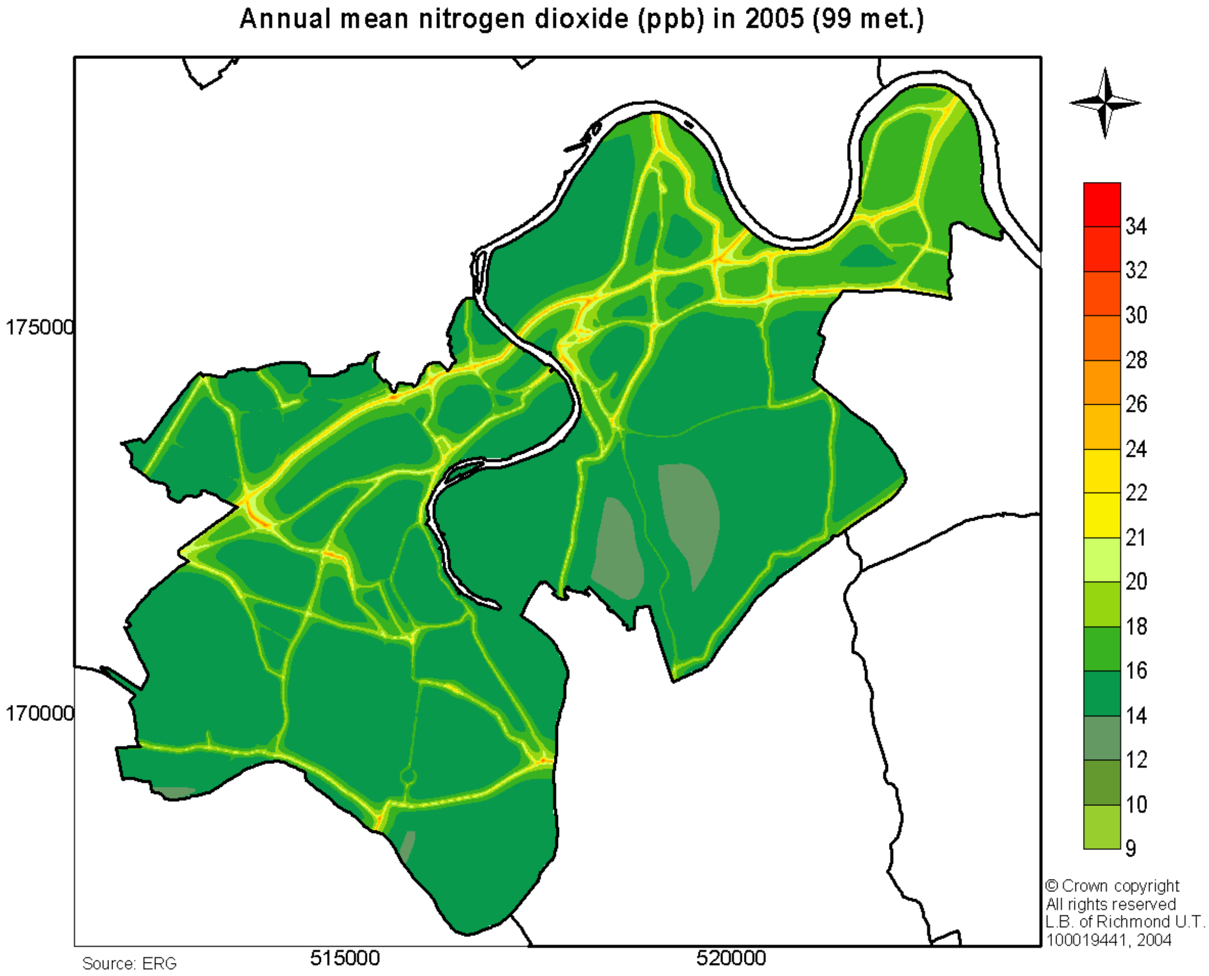

***Fig 6**: Modelled NO2 concentrations (in ppb) for 2005. Yellow and above indicates an exceedence of the air quality objectives. It assumes that the weather in 2005 would be the same weather as the year 1999. Note: do not compare the NO_2 concentrations on this map with any other data in this report which is reported in ug/m^3. To convert ppb to ug/m^3 multiply ppb by 1.9.*

2.4 Particulate Matters (PM_{10}) in the Borough

The London Borough of Richmond uses a Tapered Element Oscillating Microbalance (TEOM) to monitor PM10's. The monitoring is continuous.

Table 5 Annual average PM10 results against the Objective limit of annual average 40ug/m^3 and the number of single days permitted over 50ug/m^3 not to exceed 35 days a year.

Castelnau	**2002**	**2003**	**2004**
Annual Mean PM10	25	28	26
Number of exceedences of the 24- hour mean	4	29	10

Data Capture %	91%	96%	94%
Wetlands	**2002**	**2003**	**2004**
Annual Mean PM10	24	28	22
Number of exceedences of the 24- hour mean	6	34	5
Data Capture %	Not available	97%	96%

From Table 4 we can see that there were no exceedences of either of the objective limits, at either Castelnau or the Wetlands. However, if the data is judged against the possible new tighter objectives for Greater London, with an annual mean limit of 23ug/m^3 and the 24 hour mean of 50 µg/m^3 not to be exceeded more than 10 times per year, then the PM10 levels at Castelnau in 2004 would exceed the 2010 objective limit, but Wetlands site would not.

Environmental Research Group (ERG) modeled PM10 concentrations in the Borough, which are displayed in the following map, Fig 6.

Number of days exceeding the PM10 concentration of 50 ug/m3 in 2004 (96 met.)

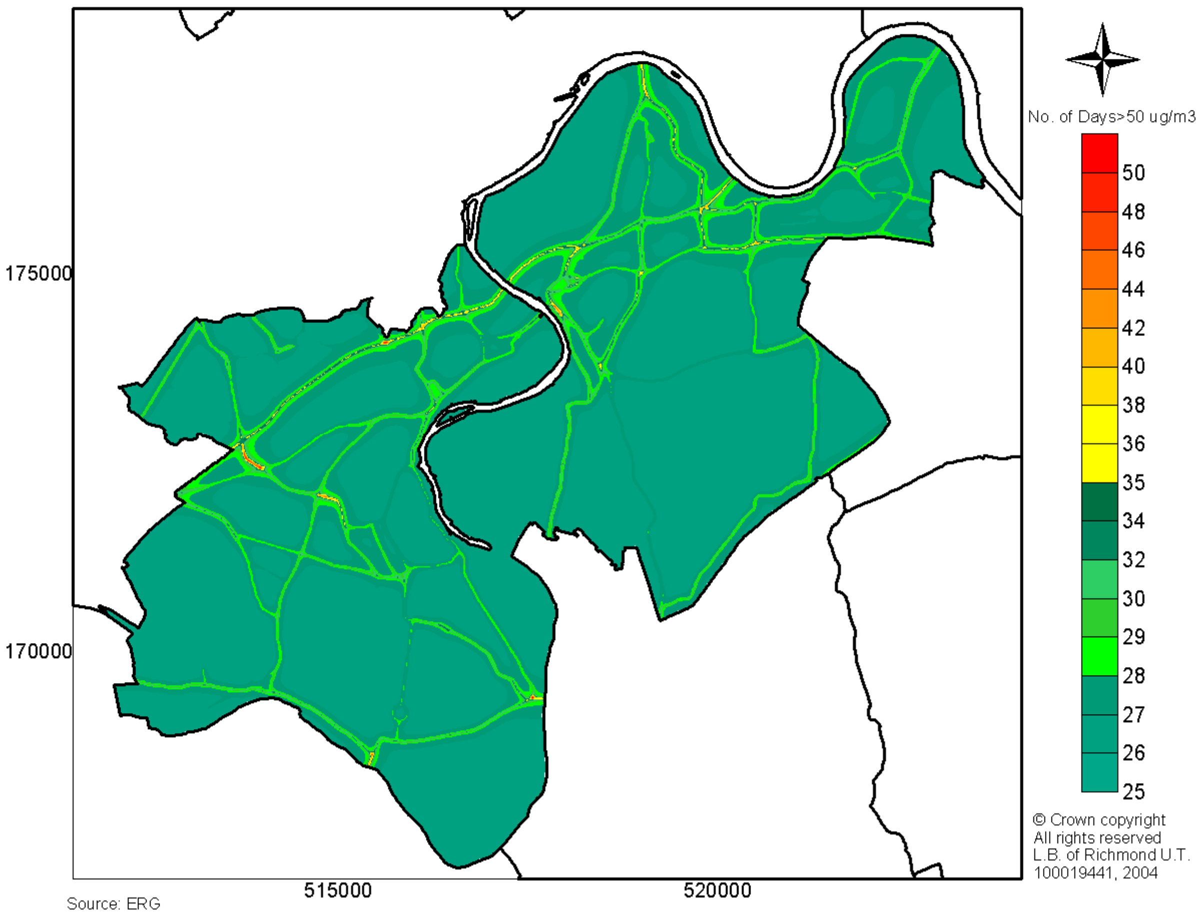

Fig 7: *Modelled PM10 concentrations in LBRUT in 2004*

2.5 Other Pollutants Monitored

2.5.1 Ozone

Currently ozone is monitored in the mobile air quality unit and the static site at the Wetlands Centre. The results for 2002, 2003 and 2004 are shown in Table 5 below. The monitoring is continuous.

Table 6 Ozone Levels at Wetlands Centre and the Air Quality Mobile and at NPL
The non-legal objective limit is 10 exceedences above 100ug/m3, measured over 8 hours.

Wetlands	**2002**	**2003**	**2004**
Number of exceedences of the 8 hour mean	5	**49**	**24**
Data Capture %	Not available	99%	97%
Mobile Unit	**2002**	**2003**	**2004**
Number of exceedences of the 8 hour mean	3	8	2
NPL	**2002**	**2003**	**2004**
Number of exceedences of the 8 hour mean	**25**	**49**	**25**
Data Capture %	98%	98%	95%

From Table 5 the ozone levels at the Wetland and NPL sites did exceed the suggested objective (not more than 10 exceedences of $100ug/m^3$ in a year). The high levels in 2003 were due to the extremely hot summer. Ozone levels monitored at our mobile complied with the objective. Possibly due to the mobile being situated at roadside locations which are generally more polluted, and the other pollutants remove the ozone.

2.5.2 Sulphur Dioxide

Sulphur Dioxide SO_2 is monitored at our mobile air quality unit and at NPL. The monitoring is continuous.
From the Table 6 below we can see that SO_2 monitored within the Borough did not exceed the Government 15 minute average objective (ie not to exceed 266ug/m3 on more than 35 times a year).

Table 7 SO_2 Monitoring

Mobile Unit	2002	2003	2004
Number of exceedences of 15 minute mean	0	0	0
NPL	**2002**	**2003**	**2004**
Number of exceedences of 15 minute mean	0	0	0
Data Capture %	98%	98%	95%

2.5.3 Carbon Monoxide

The London Borough of Richmond currently monitors carbon monoxide at its mobile air quality unit. The monitoring is continuous. The following Table shows that the CO limit has not been exceeded over the past three years.

Table 8 CO Monitoring. The 8 hour average limit is 10mg/m3

Mobile Unit	2002	2003	2004
Number of exceedences of 8 hour mean	0	0	0

2.5.4 Benzene

The Borough has 5 locations were it monitors for benzene. The monitoring regime is to collect a two week sample every month.

Table 9 Annual Average Benzene Concentrations (parts per billion) Current limit = 5ppb.

Site Code	Location	2002	2003	2004
7	Broad St, Teddington	1.4	0.9	0.8
32	Kings St, Twickenham	1.8	0.9.	0.8
35	High St, Hampton Wick	1.8	1.0	0.9
36	Upper Richmond Rd West / Sheen Lane	1.4	0.8	0.7
RUT 01	Civic Centre, York St, Twickenham	1.4	1.5	0.9

From the benzene results in the above Table we can see that there is a general decrease in the levels on benzene from 2002 to 2004. The current objective of an annual mean of 5 parts per billion (ppb) was met at all the sites. The new objective for 2010 will reduce the limit to a tougher 1.5ppb. However, if the concentrations continue to fall or remain at the 2004 levels then the 2010 objective will be met at all five monitoring locations.

2.5.5 Polycyclic Aromatic Hydrocarbons (PAH)

PAH is currently monitored at Castelnau Library, Barnes. The site is located 2m from a busy road. Analyses are made of both the vapour phase and particlate phase of PAHs in the air. As the sample is taken from the TEOM head, only particles up to 10um diameter are collected. This is representative of the particle size that is breathed in to the human lung. The monitoring regime is to collect a two week sample every month.

Table 10 Annual Average PAH and B(a)P levels - B(a)P as an annual average limit of 0.25ng/m^3

	2002	2003	2004
PAH (ng m^{-3})	11.53	15.23	20.15
B(a)P (ng m^{-3})	0.11	0.16	0.18

There are currently no national guidelines for total PAH in the UK. The UK Air Quality Strategy has now adopted the Expert Panel on Air Quality Standards (EPAQS) recommendation for a limit based on just one of the PAH family called benzo(a)pyrene (B(a)P, which is used as an indicator of the rest. The EPAQS annual average limit for B(a)P is for 0.25ng/m^3 by 2010.

From the monitoring results above we can see that the recommended EPAQS B(a)P standard is being met in the Borough.

CHAPTER 3: NEW DEVELOPMENTS

3.1 Industrial Processes

One Part B process has closed and there are now 4 Part B processes in the London Borough of Richmond. There are 15 petrol stations operational in the Borough, as 2 have now ceased operating.

3.2 New Developments

There have been no developments within the Borough that would have any significant harmful impact on the air quality e.g. by having significant increases in traffic flows. There are, however, concerns for the future, if there is significant expansion at Heathrow airport, with either the building of 3rd runway and/or and increase in aircraft movements above the current 480,000 limit. The concern is that an increase in activity at the airport will result either directly or indirectly in increases in local road traffic and hence increases in local air pollution. The Borough will resist any developments at Heathrow that appear likely to increase pollution levels within the Borough.

No landfills, quarries or minerals etc works have commenced operation.

CHAPTER 4: AIR QUALITY ACTION PLAN – PROGRESS REPORT

4.1 ACTION PLAN TABLE

The Borough's Air Quality Action Plan was approved by the Environment Cabinet, following a consultation process, and was published in November 2002. The Table in Appendix 6 was in the original Action Plan, but has been updated to show what progress has been made with each action. The layout has also been modified to comply with the guidance on format given in Guidance LAQM.PRG(03). Implementation of the plan has involved liaison with several Council department including, Transport Planning Service, Environmental Health, Traffic & Transport, Private Sector Housing and Planning Policy & Design. Not all actions are the responsibility of the London Borough of Richmond. Actions such as the implementation of the Low Emission Zone (LEZ) are being led by the GLA, and are a London wide action. Continued progress will be dependant on the collaboration of these organization and all the London Boroughs.

A major linkage is with the work activity of the Transport Planning Service. The work involves schemes that are identified within the Borough's Local Implementation Plan for Transport and the annual Borough Spending Plans for Transport. Many transport measures have been identified which promote joint traffic/air quality benefits such as enhancing public transport to reduce congestion, improved parking schemes and school travel plans, amongst others.

CHAPTER 5: CONCLUSIONS

Many of the pollution 'hotspots' identified my modeling and monitoring are situated on the TfL road network within the Borough, indicating a clear need to work with the TfL network management, the surrounding Boroughs and the Mayor of London.

On the local road network, there are also a number of 'hotspots' that need to be considered. Efforts to improve air quality will be assisted if there is sufficient public awareness of the issues. If people understand where pollution comes from, they will be able to take greater personal responsibility for their contribution to clean air.

The Council continues to seek the support of residents and other stakeholders, to help it in the development of the Borough's Action Plan, to enable cleaner air in the Borough. To that end, the Action Plan programme has been developed to include schools, businesses and the business of the Council itself.
The benefits of clean air are many. Although the assessment has been based mainly on the need to protect human health, the benefit of less traffic congestion and the benefits for the local economy are also important aspects.

The next Update and Screening Assessment and Action Plan Progress report is due in April 2006.

Appendix 1

National Air Quality Objectives

Pollutant	**Objective**		**Date to be achieved by**
	Concentration[a]	**Measured as**	
Benzene	16.25µg/m^3 (5ppb) 5µg/m3 (1.5ppb)	running annual mean annual mean	31December 2003 31 December 2010
1,3-Butadiene	2.25µg/m^3 (1ppb)	running annual mean	31 December 2003
Carbon monoxide	10mg/m^3 (8.6ppm)	running 8 hour mean	31 December 2003
Lead	0.5µg/m^3	annual mean	31 December 2004
	0.25µg/m^3	annual mean	31 December 2008
Nitrogen dioxide[b]	200µg/m^3 (105ppb) not to be exceeded more than 18 times a year	1 hour mean	31 December 2005
	40µg/m^3 (21ppb)	annual mean	31 December 2005
Particles (PM10)	50µg/m^3 not to be exceeded more than 35 times a year	24 hour mean	31 December 2004
	40µg/m^3	annual mean	31 December 2004
Sulphur dioxide	350µg/m^3 (132ppb) not to be exceeded more than 24 times a year	1 hour mean	31 December 2004
	125µg/m^3 (47ppb) not to be exceeded more than 3 times a year	24 hour mean	31 December 2004
	266µg/m^3 (100ppb) not to be exceeded more than 35 times a year	15 minute mean	31 December 2005

[a] Conversions of ppb and ppm to µg/m^3 and mg/m^3 at 20ºC and 1013mb.
[b] The objectives for nitrogen dioxide are provisional. ppb = parts per billion; ppm = parts per million; µg/m^3 = microgrammes per cubic metre; mg/m^3 = milligrammes per cubic metre

Appendix 2

Possible Health Effects From Poor Air Quality

Poor air quality can have significant adverse impacts on the society, the environment and the economy. According to DEFRA and the EPAQS (Expert Panel on Air Quality Standards), high levels of air pollutants can have the following effects on human health.

POLLUTANT	HEALTH EFFECTS AT HIGH LEVELS
Nitrogen dioxide	Irritation of the airways of the lungs, increasing the symptoms of those suffering from lung diseases.
Sulphur dioxide	
Ozone	
Particles	Fine particles can be carried deep into the lungs where they can cause inflammation and a worsening of heart and lung diseases.
Carbon monoxide	Prevention of the normal transport of oxygen by the blood. This can lead to a significant reduction in the supply of oxygen to the heart, particularly in people suffering from heart disease.
Lead	Very high levels can cause damage on central nervous system. Lower concentrations can harm various organs including the kidneys and cause colicky intestinal pains
1-3 Butadiene	Short-term human exposures to very high concentrations can cause irritation of the eyes, nose, throat and skin. Long term exposure to very high levels can possibly cause cancers of the lymphoid system and blood-forming tissues, lymphomas and leukemia
Benzene	The effect of long-term exposure to very high concentrations of benzene can possibly be leukemia
Poly Aromatic Hydrocarbons (PAH's)	Possible cause of lung cancer

Table 1: Possible health effects from poor air quality

With the exception of Carbon monoxide, very high levels of all these pollutants can irritate the lungs and cause inflammation. People with lung diseases, especially the elderly, may feel less well than usual. In some cases their symptoms may increase to such an extent that they need a change in treatment, or admission to hospital. In addition to these effects, ozone and green house gases can have significant adverse effects on ecosystems and, thus, indirect effects on human health and quality of life, through their degradation. More information can be found in
http://www.defra.gov.uk/environment/airquality/aqs/index.htm#fr and
http://www.defra.gov.uk/environment/airquality/airpoll/01.htm.

Appendix 3

Nitrogen Dioxide Diffusion Tube Bias Correction

Bias Adjustment A is calculated as follows:

A=Cm/Dm

Cm is the annual mean of the chemiluminescence concentration
Dm is the annual mean diffusion tube concentration

2002

Cm = 44ug/m^3
Dm = 30.61 ug/m^3

A = 44/30.61 = 1.44

Therefore all the monthly diffusion tube results for 2002 were multiplied by a factor of 1.44

2003

Cm = 48ug/m^3
Dm = 38.87ug/m^3

A = 48/38.87 = 1.23

Therefore all the monthly diffusion tube results for 2003 were multiplied by a factor of 1.23

2004

Cm = 41ug/m^3
Dm = 42.34ug/m^3

A = 41/42.34 = 0.97

Therefore all the diffusion tube results for 2004 were multiplied by a factor of 0.97

Appendix 4

Nitrogen Dioxide Diffusion Tube – Method of analysis

Diffusion tubes are passive monitoring devices. They are made up of a Perspex cylinder, with 2 stainless steel mesh discs, coated with triethanolamine held inside a polythene cap, which is sealed onto one end of the tube. Diffusion tubes sample NO_2 when ambient concentrations enter and pass through the tube and are absorbed by the triethanolamine (TEA), which is present on the coated discs[1]. There are three main preparation methods for diffusion tubes involving triethanolamine. The diffusion tubes employed in the LWEP programme are prepared by UKAS accredited Gradko International Ltd. using the 50% v/v triethanolamine with acetone method.

Prior to and after sampling, an opaque polythene cap is placed over the opposite end of the diffusion tube to prevent further adsorption onto the discs.

The diffusion tubes are labelled and kept refrigerated in plastic bags prior to and after exposure.

Gradko International Ltd additionally undertakes the analysis of exposed diffusion tubes, on behalf of Casella Stanger, by ultra violet spectrophotometry.

Quality Assurance and Quality Control

The EU Daughter Directive sets data quality objectives for nitrogen dioxide along with other pollutants. Under the Directive, annual mean NO_2 concentration data derived from diffusion tube measurements must demonstrate an accuracy of $\pm$25 % to enable comparison with the Directive air quality standards for NO_2.

In order to ensure that NO_2 concentrations reported are of a high caliber, strict performance criteria need to be met through the execution of quality assurance and control procedures. A number of factors have been identified as influencing the performance of diffusion tubes including the laboratory preparing and analysing the tubes and the tube preparation method. [2] Quality assurance and control procedures are therefore an integral feature of any monitoring programme, ensuring that uncertainties in the data are minimised and allowing the best estimate of true concentrations to be determined.

Gradko International Ltd conducts rigorous quality control and assurance procedures in order to maintain the highest degree of confidence in their laboratory measurements. These are discussed in more detail below.

Workplace Analysis Scheme for Proficiency (WASP)

Gradko International Ltd participates in the Health and Safety Laboratory WASP[3] NO_2 diffusion tube scheme on a monthly basis. This is a recognised performance-testing programme for laboratories undertaking NO_2 diffusion tube analysis as part of the UK NO_2 monitoring network. The scheme is designed to help laboratories meet the European Standard EN482[4]. The laboratory performance for all months in 2003 was rated 'good' which signifies a high level of accuracy for laboratory measurements.

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[1] Source: Chemistry and Microbiology - 'Determination of Nitrogen Dioxide in Environmental Samples'; Stanger Science and Environment. 1991.

[2] Compilation of diffusion tube collation studies carried out by local authorities, prepared by Professor Duncan Laxen and Penny Wilson, 2003

[3] Health and Safety Executive, Workplace Analysis Scheme for Proficiency

[4] European Committee for Standardisation (CEN) Workplace Atmospheres, General requirements for the performance of procedures for the chemical measurement of chemical agents, EN482, Brussels, CEN 1994.

Network Field Inter-comparison Exercise

Gradko International Ltd also takes part in the Network Field Inter-comparison Exercise, operated by NETCEN, which complements the WASP scheme in assessing sampling and analytical performance of diffusion tubes under normal operating conditions. This involves the regular exposure of a triplet of tubes at an Automatic Urban Network site (AUN) site. NETCEN have established performance criteria for participating laboratories. Of particular interest is the bias relative to the chemiluminescent analyser that gives an indication of accuracy. In conjunction with this, a measure of precision is determined by comparing the triplet co-located tube measurements. This value is useful for assessing the uncertainty of results due to sampling and analytical techniques. The performance targets can be seen in Table 3.

The Field Inter-comparison Exercise has historically generated the bias and precision results for each laboratory on an annual basis. This has recently been changed to the results being reported on a monthly basis. This enables a full year's inter-comparison against performance criteria.

Gradko International Ltd perform their own blank exposures that serve as a quality control check on the tube preparation procedure**.** All results are blank subtracted before they are issued to the relevant Borough.

Appendix 5

Useful Air Quality Links on Richmond Council Website

- To see the current air quality levels in the London Borough of Richmond and in London. Please follow this link. You can use the postcode option e.g. TW1 3BZ to find your nearest monitoring station or go to the list of local authorities.
http://www.londonair.org.uk/london/asp/home.asp

- This link will allow you to calculate air quality statistics for each monitoring location. Choose a site e.g. Castelanu, then click on the statistics page, click on basic statistics, choose a year and click on fetch.
http://www.londonair.org.uk/london/asp/PublicStats.asp?region=12&site=RI1&la_id=&postcode=

- Please use the following link to visits the Council's air quality page:
http://www.richmond.gov.uk/home/environment/pollution.htm

- To view the Council's historical air quality data
http://www.richmond.gov.uk/home/environment/pollution/air_pollution/air_quality/historical_air_quality_monitoring_data.htm

- To view the Council's Air Quality Report 2003
http://www.richmond.gov.uk/home/environment/pollution/air_pollution/air_quality/air_quality_monitoring_report_2003.htm

- To view the Council's Stage 3 Air Quality Report
http://www.richmond.gov.uk/home/environment/pollution/air_pollution/air_quality/stage_three_air_quality_report.htm

- To view the Council's Stage 4 Air Quality Report and the Air Quality Action Plan 2002
http://www.richmond.gov.uk/home/environment/pollution/air_pollution/air_quality/air_quality_action_plan_and_stage_four_report.htm