



*LONDON BOROUGH OF
RICHMOND UPON THAMES*

**Updating and Screening Assessment for the
London Borough of Richmond upon Thames**

March 2004

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Executive Summary

The role of the local authority review and assessment process is to identify the areas where it is considered that the government's air quality objectives will be exceeded. The London Borough of Richmond upon Thames has previously undertaken the first round of review and assessment (R&A) of local air quality management.

This report concerns the Updating and Screening Assessment under the second round of review and assessment (R&A). Local authorities are now required to review and assess air quality against the objectives in the Air Quality Regulations 2000 and the amendment regulations. The air quality objectives to be assessed are for the following seven pollutants: carbon monoxide, benzene, 1,3-butadiene, lead, nitrogen dioxide, sulphur dioxide and particles (PM₁₀). This report provides a new assessment to identify those matters that have changed since the last review and assessment, and which might lead to a risk of the objective being exceeded.

The report follows the latest prescribed guidance given in technical guidance LAQM. TG (03), which replaced that produced for the previous round of R&A. It gives guidance on the use of background pollutant concentrations, monitoring results, industrial sources, and road traffic. It also requires both a phased approach and that local authorities only undertake a level of assessment that is commensurate with the risk of an air quality objective being exceeded.

The report identifies that:

- For carbon monoxide, benzene, 1,3-butadiene, lead, and sulphur dioxide the risk of the objectives being exceeded is not significant in the Council's area.
- For NO₂ the screening assessment confirms that there is a risk of the air quality objectives being exceeded across the borough. This is consistent with the Council's existing AQMA and Action Plan.
- For particles PM₁₀ (for 2004 and 2010 only) there is a risk of the objectives being exceeded across parts of the borough. The Council however is not required to undertake actions at this time in respect of the 2010 objective, other than to note it for longer term planning purposes.

For pollutants not requiring detailed assessments the LAQM guidance requires the production of annual air quality progress reports by the end of April 2005, prior to undertaking the next updating and screening assessment by the end of April 2006.

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Progress with Local Air Quality Management (1997-2003)

As part of its Local Air Quality Management (LAQM) responsibilities, the London Borough of Richmond upon Thames (“the Council”) has completed the first round review and assessment (R&A) of air quality (see the individual reports prepared between 1999 and 2003). These reports present a staged approach whereby the seven air pollutants in the Government’s Air Quality Strategy related to LAQM, were first assessed and screened as to their relative importance to air quality within the Council’s area.

Benzene, 1,3 butadiene, carbon monoxide, lead and sulphur dioxide (SO₂) were considered at the earliest stage of the first round of review and assessment; and found not likely to lead to the air quality objectives being exceeded. As a result no further action was required.

The Stage 3 report assessed air quality across the whole of the Council’s area in accordance with DEFRA guidance. The Stage 3 report predicted areas to exceed the NO₂ annual mean objective and 24 hour mean PM₁₀ objective only, with these areas relating to roads across the borough. As a consequence an Air Quality Management Area (AQMA) was designated for both pollutants for the whole of the borough.

The Stage 4 report subsequently examined these areas only and remodelled them with the revised vehicle emission factors. The Stage 4 modelling predictions confirmed the Stage 3 findings that the AQS objectives for NO₂ and PM₁₀ will be exceeded. However the area where the annual mean NO₂ objective is predicted to exceed was larger than that for PM₁₀. Following the Stage 4 report the Council maintained its AQMA as originally designated.

Introduction to Updating Screening and Assessment

The government’s Air Quality Strategy (AQS) establishes the framework for air quality improvements, including international and national improvements. However it is recognised that despite these improvements, areas of poor air quality will remain and that these are best dealt with using local measures implemented through the LAQM regime. The role of the local authority review and assessment process is to identify the areas where it is considered that the objectives will be exceeded. Experience has shown that such areas may range from single residential properties to whole town centres.

This report concerns the second round of LAQM review and assessment (R&A) and is part of a three yearly cycle for review and assessment that ends in 2010. It follows the latest prescribed guidance given in Technical Guidance LAQM. TG (03), which replaced the guidance produced for the previous round of R&A. TG03 is designed to help local authorities undertake their duties under the Environment Act 1995 to review and assess air quality in their area from time to time.

The most important changes since the last round of review and assessment relate to the air quality objectives. Local authorities are now required to review and assess air quality against the objectives in the Air Quality Regulations 2000 and the 2002 amendment regulations. In addition the EU has set limit values for NO₂ and benzene and indicative limit values for PM₁₀ for 2010. In the case of NO₂ the 2010 limit values are the same as the 2005 objectives, hence meeting the latter automatically means that the former are met. The guidance confirms that local authorities are not statutorily required to assess air quality against these, but it advises that they may find it helpful to do so, to assist with longer term development planning.

Tables 1 and 2 below provide details of the objectives for this round of R&A.

The guidance requires a phased approach, as with the previous guidance. This requires local authorities to undertake a level of assessment that is commensurate with the risk of an air quality objective being exceeded. It is considered that not every authority will need to proceed beyond the first step of the second round of review and assessment.

The first step is the Updating and Screening Assessment (USA), which all local authorities are required to undertake. TG03 gives guidance on the use of background pollutant concentrations, monitoring results, industrial sources, road traffic, as well as the specific AQS pollutants to be examined for both the USA and the subsequent step, i.e. the Detailed Assessment.

Table 1 Air quality objectives (from Air Quality Regulations 2000 and Amendment Regulations 2002)

Pollutant	Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$ (5 ppb)	Running Annual Mean	31 Dec 2003
	5 $\mu\text{g}/\text{m}^3$	Annual Mean	31 Dec 2010
1, 3 Butadiene	2.25 $\mu\text{g}/\text{m}^3$ (1 ppb)	Running Annual Mean	31 Dec 2003
Carbon Monoxide	10 mg/m^3	Daily Maximum Running 8 hour mean	31 Dec 2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual Mean	31 Dec 2003
	0.25 $\mu\text{g}/\text{m}^3$	Annual Mean	31 Dec 2008
Nitrogen Dioxide (provisional)	200 $\mu\text{g}/\text{m}^3$ (105 ppb) not to be exceeded more than 18 times a year	1 hour mean	31 Dec 2005
	40 $\mu\text{g}/\text{m}^3$ (21 ppb)	Annual Mean	31 Dec 2005
Particles (PM₁₀)	50 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 35 times a year	24 hour mean	31 Dec 2004
	40 $\mu\text{g}/\text{m}^3$	Annual Mean	31 Dec 2004
Sulphur Dioxide	350 $\mu\text{g}/\text{m}^3$ (132 ppb) not to be exceeded more than 24 times a year	1 hour mean	31 Dec 2004
	125 $\mu\text{g}/\text{m}^3$ (47 ppb) not to be exceeded more than 3 times a year	24 hour mean	31 Dec 2004
	266 $\mu\text{g}/\text{m}^3$ (100 ppb) not to be exceeded more than 35 times a year	15 minute mean	31 Dec 2005

Table 2 Proposed new particle objectives (from Air Quality Strategy Addendum (2003))

Pollutant	Objective		Date to be achieved by
	Concentration	Measured as	
Particles (PM₁₀) (NB the objective for London is given in brackets)	50 µg/m ³ not to be exceeded more than 7 (10) times a year	24 hour mean	31 Dec 2010
	20 (23) µg/m ³	Annual Mean	31 Dec 2010

London Atmospheric Emissions Inventory

The Greater London Authority (GLA) has required London Boroughs to use the London Atmospheric Emission Inventory (LAEI). The latest version, released during November 2003, incorporates the latest updates and changes relating to atmospheric emissions across the Greater London area. The total area covered by the LAEI is 2,466 km², covering all 32 London boroughs and the City of London and parts of 19 districts that lie between the M25 and GLA boundary. The LAEI incorporates all major and minor sources, including roads.

The development of the revised road traffic part of the LAEI for 2001 has followed closely the methodology laid out in the 1999 version. However a number of key areas have been enhanced, these include

- A revised road network and complete update of vehicle flow, which includes roads up to and including the M25;
- Use has been made of a new version (b 2.1) LTS model;
- Recalculation of the minor road vehicle km totals;
- Updated speed estimates on all roads;
- Revision and use of the most recent speed related emissions estimates;
- Estimates of the performance of the national vehicle stock model compared to on-road vehicle stock using 2002 VED data;
- Use of GPS positioning in estimating taxi flows on roads around Heathrow;
- Improvements made to the taxi and bus stock in London using specific data from the Public Carriage Office (PCO) and TfL Buses.

The vast majority of the road network is identical to the previous 1999 inventory. The most significant change is that the road links now include those up to and including the M25. The total number of links has increased from 18201 (1999 LAEI) to 21944.

The traffic flows have been updated using approximately 1700 manual count flows obtained from TfL, TfL automatic traffic count data, and counts supplied by the London Boroughs. Full details are given in the methodology report of the LAEI 2001.

Background Pollutant Concentrations

Background concentrations provide an understanding of the prevailing pollution in the absence of specific local emission sources. Future background concentrations have been

modelled on a 40m-grid square using the LAEI for NO₂, NO_x and PM₁₀ (for 2004). The methodology used can be seen at www.london.gov.uk/approot/mayor/air_quality/model.jsp.

Mapping techniques based on the National Atmospheric Emission Inventory (NAEI) have been used to provide an understanding of future concentrations of benzene (based on 2010), 1,3-butadiene (based on 2003) and PM₁₀ (based on 2010). These are produced on a 1x1km grid square for the U.K (see www.airquality.co.uk/archive/laqm/tools.php). It is important to note that the NAEI (incorporates all major sources, including roads) within each grid square.

Monitoring Data

The monitoring of air quality in a local authority's area provides an important source of information for understanding air quality in its area. This benefit can be further enhanced if the monitoring is undertaken as part of a wider e.g. regional network. It is however important to ensure that there is confidence in the data being produced and used. Hence QA/QC issues need to have been considered and the data produced also need to be properly validated and preferably ratified.

Monitoring of air quality in the Council's area takes place 24 hours a day. Currently the Council has one mobile monitoring unit and two permanent sites. One of the permanent sites is located in Castelnau (RI1) outside the Public Library (roadside site) and the other is at the Wetlands site (RI2) in Barnes (suburban site). The mobile unit is moved around the borough to different locations. The Council has carried out continuous monitoring of CO, SO₂, NO₂ and PM₁₀ (plus ozone, which is classed as a regional pollutant and has not been included within the LAQM process) at its sites and the results from these are given in this report. All of the sites are affiliated to the London Air Quality Network (LAQN). This network provides a regional focus and the standards of QA/QC adopted meet those stipulated in TG03 guidance.

Mobile monitoring has been undertaken at the following sites:

Site code	Location	Type
RI5	St. Margarets	Kerbside
RI7	Holly Lodge, Richmond Park	Suburban
RI9	George Street, Richmond	Kerbside
RI11	Kew Road	Kerbside
RI13	Richmond Road, Twickenham	Roadside
RI15	Upper Teddington Road	Roadside
RI17	Somerset Road, Teddington	Kerbside

For details of the Council's monitoring using its mobile unit see the Council's website (see <http://www.richmond.gov.uk/depts/env/envplanning/health-special/airqualitymonitoringdata.htm>).

The Council also undertakes diffusion tube monitoring of NO₂ and benzene across the borough.

Industrial Sources

Both the Environment Agency and the Council regulate industrial sources under the Pollution Prevention and Control Act 1999 and Environmental Protection Act 1990. The Environment Agency is responsible for the largest industrial processes (IPPC/ Part A processes), whilst the Council is mainly responsible for smaller Part B and A2 processes. Those small industrial processes that fall outside of Part B/A2 Process control are also of interest to LAQM. The TG03 guidance requires details of boilers with a thermal rating of greater than 5 MW that burn coal or fuel oil (e.g. in universities, hospitals, etc) to be obtained and examined.

There is no relevant Part A process in the borough. Updated lists of Part B and other processes of potential concern in Council's area are given in Appendix 3.

Road Traffic

To estimate the air quality impact of those roads that need examining in this latest step of the review and assessment process it is necessary to use the DMRB screening methodology produced by the Highways Agency. The version used (i.e. version 1.01) was released in February 2003 and incorporates the most recent emission factors. It is intended to provide conservative estimates, however in some instances it can under predict concentrations. In these specific instances factors can be applied, as advised in TG03.

Relevant exposure

The objectives relate to public exposure to the pollutants. More specifically any areas that may exceed them should relate to "the quality of air at locations which are situated outside of buildings or other man made structures above or below ground, and where members of the public are regularly present" (from the Air Quality regulations). TG03 advises further that the assessment should focus on those locations where members of the public are likely to regularly present and are likely to be exposed over the period of the objective.

Carbon Monoxide

The air quality objective for carbon monoxide (CO) has been tightened and is now 10mg/m³ as a maximum daily running 8-hour concentration to be achieved by the end of 2003, which is in line with second Air Quality Daughter Directive limit value.

Perspective

The main source of CO remains road transport (nationally about 67% based on 2000), although annual emissions are declining mainly as a result of uptake of abatement technologies.

Current monitoring indicates that none of the UK national network sites exceeded the objective during the period between 1999 and 2001, with kerbside/ roadside sites having higher concentrations than urban background sites (see TG03). Despite this the guidance highlights that under certain meteorological conditions the objective was approached within 2mg/m³ at four urban background sites in 2001.

Current projections are that emissions will reduce by a further 42% between 2000 and 2005. National modelling has further indicated that at the end of 2003, major roads will not exceed the objective.

No AQMAs were declared in the first round based on the previous objective of 11.6mg/m³.

Based on TG03, it is considered highly unlikely that any authority will be required to proceed beyond the updating and screening assessment.

Methodology Overview

Full details of the methodology employed can be found in TG03. The following represents a summary of the methods used. To undertake this it is necessary to draw on the first stage report of the first round of review and assessment. Only monitoring data and very busy roads need be considered. (The TG03 guidance does not require the screening of industrial sources).

A checklist approach is used, based on 1) monitoring data and 2) traffic data relating to very busy roads.

1. For monitoring data only, roadside data are required where there is public exposure. The data will be assumed to be applicable to 2003 and if the data indicate that the maximum daily running 8-hour concentration exceeds the objective then the Council will be required to proceed to the Detailed Assessment stage.
2. This relates to annual average daily traffic flows exceeding stated flows (which are dependent on the type of road) for areas where the 2003 annual mean background is expected to be greater than 1mg/m³. If there is relevant exposure within 10m of the kerb then it will be necessary to obtain additional traffic information relating to average speeds and the HGV/LGV split. The DMRB screening model can be used to predict 2003 concentrations. (Note if junctions occur along any of the roads then the flows from the

roads should be added together). If the predicted annual mean concentration is greater than $2\text{mg}/\text{m}^3$ then it is necessary to proceed to the Detailed Assessment stage.

Updating and Screening Assessment of Carbon Monoxide for the London Borough of Richmond upon Thames

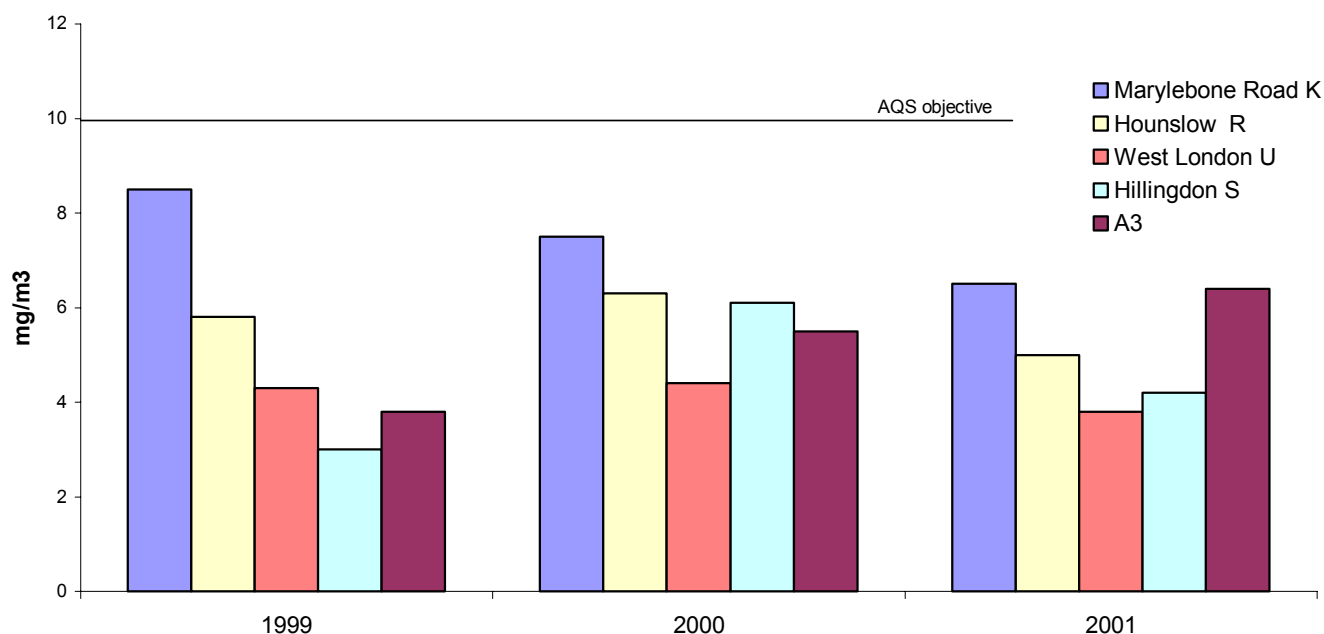
The Council considered the following sources during the previous round of R&A: industrial processes, a combination of low level combustion sources and roads, and planned sources including major roads in the Council's area. Based on this screening, CO was found not likely to exceed the AQS objective where there might be exposure and hence no further action was undertaken.

1. Monitoring

The Council undertakes CO continuous monitoring in the borough for short campaigns using its mobile monitoring unit. This monitoring has been undertaken since 1999 and it has not exceeded the AQS objective at any of the locations assessed (see Council's website).

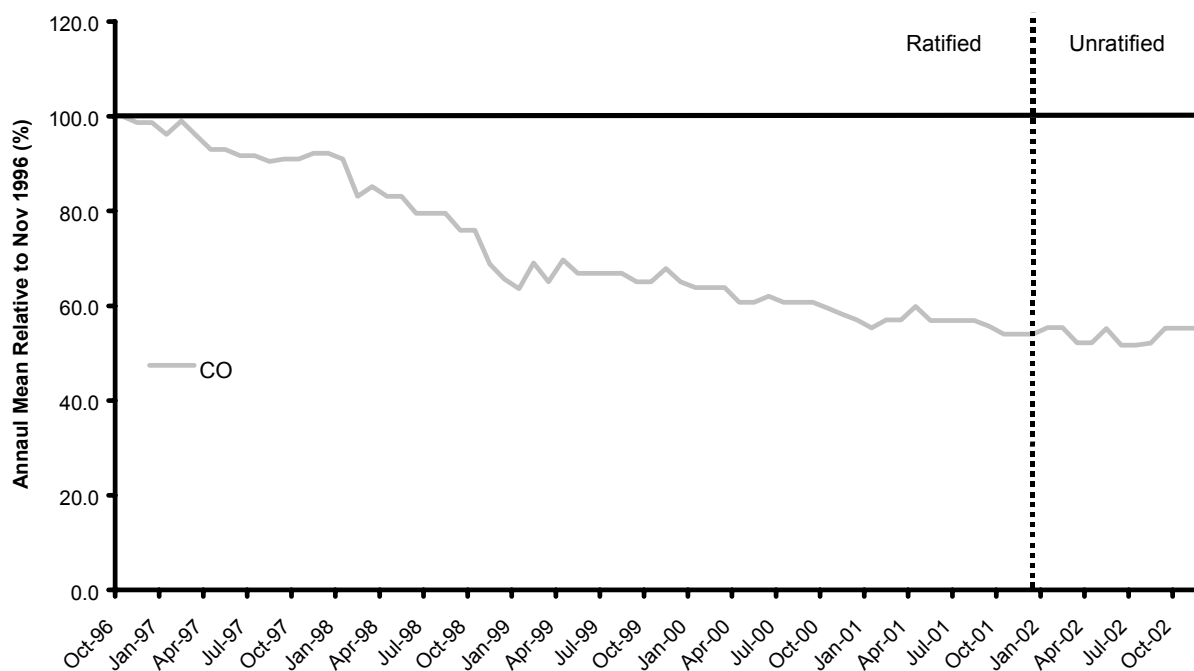
Continuous monitoring of CO is also undertaken at other London Air Quality Network (LAQN) sites across London, including the very busy kerbside site at Marylebone Road in central London. The results for these sites for the period between 1999 and 2001 confirm that the objective was not exceeded. In all the above instances the data capture rates were greater than 90% and the data have been scaled and ratified.

Figure 1 Maximum daily running 8 hour mean CO at selected London sites (1999-2001)



(Note – K- kerbside site; R – roadside site; U – urban background site; S – suburban site)

The above concentrations do not exceed the $10\text{mg}/\text{m}^3$ (maximum daily running 8 hour mean) objective at any of the sites.

Figure 2 Relative annual mean for CO from LAQN sites

An analysis of annual mean concentrations since 1996 for LAQN sites is given above in Figure 2. This indicates a downward trend over time, although it is important to appreciate that the AQS objective for CO is averaged over shorter time periods, which are not necessarily represented by annual mean concentrations.

These results of monitoring by the Council and elsewhere in London are considered representative of the Council's area. These indicate that the objective is being met and therefore a Detailed Assessment of CO based on monitoring is not required.

2. *Very busy roads/junctions in built up areas*

Traffic flows in the area are given in Appendix 2 and this indicates 'very busy' roads with single carriageways exceeding 80,000 vehicles per day (vpd) and dual carriageway exceeding 120,000vpd are not found in the Council's area (as classified by TG03). There are similarly no junctions of the busiest roads where these traffic flows are exceeded in the Council's area.

Based on the results from the urban background sites in the LAQN, the background in the Council's area can reasonably be assumed at approximately 0.4 mg/m^3 (from the 2001 results). Using the factor in TG03 the estimated 2003 annual mean concentration can be determined as 0.35 mg/m^3 , which is thus less than the 1 mg/m^3 concentration where further action is deemed necessary by TG03. This also indicates that the objective is being met and therefore a Detailed Assessment of CO based on very busy roads and junctions is not required.

Conclusion

The updating and screening assessment for carbon monoxide has not identified a risk of the new 2003 objective being exceeded in the Council's area. The Council therefore need not proceed beyond this updating and screening assessment for carbon monoxide for this round of review and assessment.

Summary of LBRUT Council's USA conclusions for carbon monoxide

Source, location and data assessed	Action required
Monitoring data	No further action required
Very busy roads/junctions	No further action required

Benzene

The air quality objective for benzene is $16.25\mu\text{g}/\text{m}^3$ as a running annual mean to be achieved by the end of 2003, with an additional objective of $5\mu\text{g}/\text{m}^3$ as an annual mean concentration to be achieved by the end of 2010. This is in line with second Air Quality Daughter Directive limit value.

Perspective

Petrol engine vehicles, petrol refining and the uncontrolled emissions from petrol filling stations without vapour recovery systems are the main sources of benzene.

Current monitoring indicates that all of the UK national network sites were significantly below the 2003 objective during the period between 1999 and 2001 (from TG03). Since 2001 the concentrations were also below the 2010 objective, with kerbside/ roadside sites having higher concentrations than urban background sites.

National mapping has indicated that for most areas the 2003 objective will not be exceeded. However for 2010 there is the possibility that some areas will exceed.

No AQMAs were declared in the first round of R&A. Therefore traffic emissions need not be considered. It is also considered that only those local authorities with relevant locations close to major industrial processes involving benzene will be required to proceed beyond the updating and screening assessment for the 2003 objective.

For the 2010 objective however it is necessary to consider both petrochemical processes and busy roads, as monitoring from the first round indicates that this objective has recently been exceeded.

Methodology Overview

Full details of the methodology employed can be found in TG03. The following represents a summary of the methods used. To undertake this it is necessary to draw on the first stage report of the previous round of review and assessment.

A checklist approach is used, based on 1) monitoring data 2) data relating to very busy roads 3) industrial sources/ petrol stations/ major fuel storage depots.

1. For monitoring the data should be prioritised, based on locations near busy roads and the results at building facades. Where monitoring relating to industrial and other sources is undertaken then monitoring down wind from the site is recommended. If monitoring is undertaken by diffusion tube, suitable QA/QC procedures should be used and the tubes validated and bias corrected. The results will need to be corrected to 2003/ 2010. If the data indicate that the objective is exceeded then the local authority will be required to proceed to the Detailed Assessment stage.
2. The assessment of very busy roads relates to 2010 only. In the instance, where the 2010 annual mean background exceeds $2\mu\text{g}/\text{m}^3$, plus the annual average daily traffic flows exceed stated flows and there is relevant exposure within 10m of the kerb then, it will be

necessary to obtain additional traffic information relating to average speeds and the HGV/LGV split. The DMRB screening model is then used to predict 2010 concentrations. (Note if junctions occur along any of the roads then the flows from the roads should be added together). If the predicted concentration is greater than $5\mu\text{g}/\text{m}^3$ then it is necessary to proceed to the Detailed Assessment stage.

3. a) For new industrial and other sources listed in TG03 it is likely that an air quality assessment will have been undertaken as part of planning or authorisation process. The results from this should be cited. Authorities are also asked to check information from the first round of R&A if there were doubts about their validity. Where it is necessary to check industrial sources then the annual emission of benzene is needed along with the height of discharge to calculate whether the relevant threshold in the guidance has been exceeded.
- b) For petrol stations it is necessary to identify petrol stations with a throughput of more than $2,000\text{m}^3$, and with a road with more than 30,000 vehicles per day nearby. If there is relevant exposure within 10m of the pumps it is necessary to proceed to a Detailed Assessment.
- c) For major petrol storage depots it is necessary to identify relevant exposure and annual emissions to calculate whether the relevant threshold in the guidance has been exceeded.
- d) For combined sources the 2010 objective need only be considered. The methodology relies on an assessment based on the establishment of emission rates for the industrial/fugitive source combined with DMRB for busy roads.

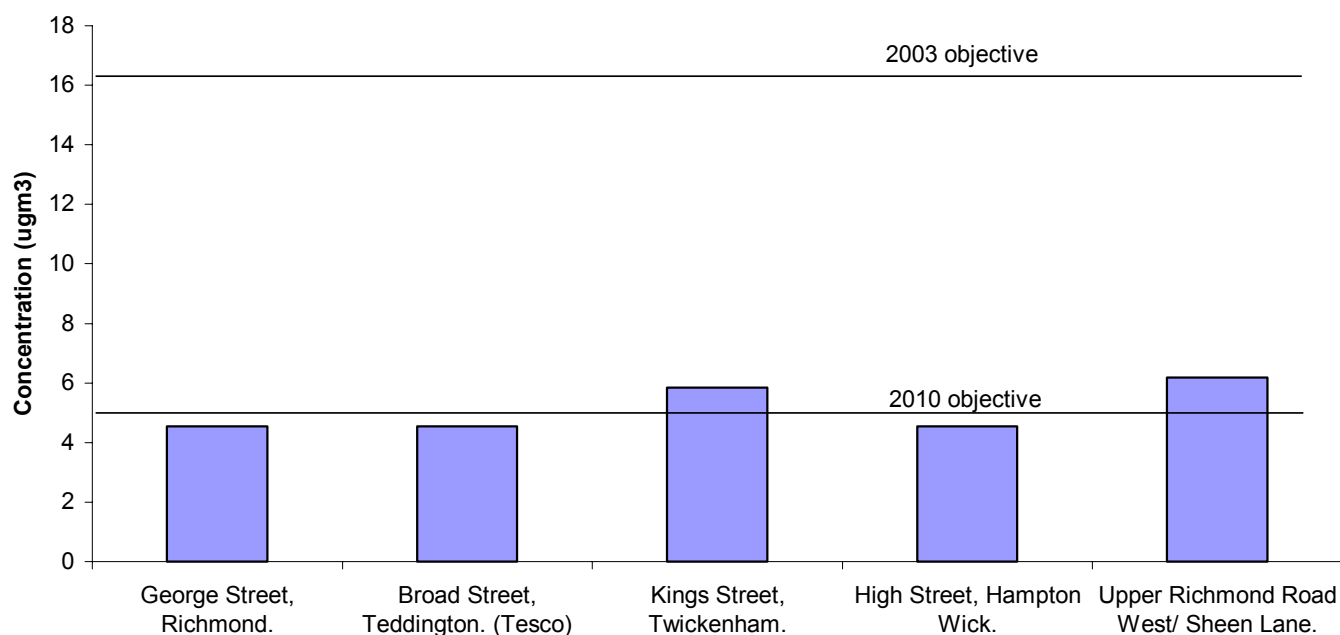
Updating and Screening Assessment of Benzene for the London Borough of Richmond upon Thames

Sources were screened during the previous round of R&A and found to pose a negligible risk in localities where there might be exposure, hence progression beyond Stage 2 R&A was not undertaken.

1. Monitoring

The Council undertakes benzene monitoring in its area using diffusion tubes. The monitoring started in 2001 and the first complete years results for 2002 are given below for the five roadside sites monitored. No tubes have been co-located with continuous analyser; hence no local bias adjustment factors have been used.

All the results for the period monitored are less than $7\mu\text{g}/\text{m}^3$ and thus they indicate that the 2003 annual mean objective of $16.25\mu\text{g}/\text{m}^3$ will be met. The monitoring from the two roadside locations at the busy King Street, Twickenham and Upper Road Richmond West/Sheen Lane sites have the highest concentrations, exceeding the 2010 annual mean objective of $5\mu\text{g}/\text{m}^3$.

Figure 3 Benzene monitoring in the Council's area (2002)

To consider the results for 2010 it is necessary to correct the data using factors from TG03. The factors used are based on the continuing reductions in emissions arising from petrol and its use. The estimates for the two roadside sites (with highest concentrations) using these factors are:

King Street, Twickenham	4.07 $\mu\text{g}/\text{m}^3$
Upper Richmond Road West/ Sheen Lane	4.29 $\mu\text{g}/\text{m}^3$

The estimates are thus less than the 2010 objective.

Continuous monitoring of benzene is also undertaken in other areas of London. These sites include the busy kerbside site at London Marylebone Road. The annual mean results for this site for the period 1999 to 2001 were 12.8, 10.8 and 6.29 $\mu\text{g}/\text{m}^3$. Based on the 2001 data, the predicted concentration for this site is 4.06 $\mu\text{g}/\text{m}^3$, which is below the 2010 objective. The annual mean results for the suburban site at London Eltham (this site was part of the government's AURN until monitoring stopped in 2000). The results for the site in 1999 and 2000 were 2.81 and 2.52 $\mu\text{g}/\text{m}^3$ respectively, i.e. below both 2003 and the more stringent 2010 objectives.

These monitoring results are considered representative of the Council's area. They indicate that the concentrations will not exceed the benzene objectives for 2003 and 2010 and therefore a detailed assessment based on monitoring is not required.

2. *Very busy roads/junctions in built up areas*

Traffic flows in the area are given in Appendix 2; from this no roads in the Council's area need be identified as a 'very busy road' using the TG03 definition.

The www.airquality.co.uk/archive/laqm/tools.php site gives the 2010 background for the Council's area and from this the estimated background predictions vary between 0.56 and 0.82 $\mu\text{g}/\text{m}^3$. This is less than the 2 $\mu\text{g}/\text{m}^3$ referred to in the TG03 guidance for further assessment. Based on these findings there is no need to carry out a Detailed Assessment in connection with very busy roads.

3a. Part A processes

There were no industrial processes that were found in or near to the Council's area to emit significant quantities of benzene during the previous R&A. Since then no significant new industrial sources of benzene or existing ones with increased emissions have been identified in either the Council's area or neighbouring local authority areas.

3b. Petrol stations

The list of authorised petrol stations is attached in Appendix 3. A petrol station is only considered important for 2010 objective, if the throughput is greater than 2000 m^3 and if it is close to a busy road with more than 30,000vpd. Full details on the throughput are not available, although all petrol stations are known to have a throughput of greater than 1000 m^3 . Those petrol stations in the Council's area, close to busy roads (as defined by TG03), do not have relevant exposure within 10m of the petrol pumps. Thus a Detailed Assessment based on petrol stations is not required.

3c. Major fuel storage depots

There are no major fuel storage depots within the Council's area (as listed in TG03).

Conclusion

The updating and screening assessment for benzene has not identified a risk of the 2003 and 2010 objectives being exceeded in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for benzene.

Summary of LBRUT Council's USA conclusions for benzene

Source, location and data assessed	Action required
Monitoring data	No further action required
Very busy roads/junctions	No further action required
Part A processes	No further action required
Petrol stations	No further action required
Major fuel storage depots	No further action required

1,3-Butadiene

The air quality objective for 1,3-butadiene remains $2.25\mu\text{g}/\text{m}^3$ as a maximum running annual mean concentration to be achieved by the end of 2003.

Perspective

Emissions from road vehicle exhausts and a small number of industrial sites handling bulk quantities are the main sources of 1,3-butadiene.

Current monitoring indicates that all of the UK national network sites were significantly below the 2003 objective during the period between 1999 and 2001 (from TG03) apart from the Marylebone Road site in London in 1999. This site is a very busy kerbside site and concentrations at this site appear to have tailed off since. Reductions in emissions from road vehicles is continuing as a result of the uptake of abatement technology hence only locations close to industrial sites are expected to proceed beyond the updating and screening assessment for this objective.

National mapping has indicated that for all areas the 2003 objective will not be exceeded. No AQMAs were declared in the first round of R&A.

1,3-Butadiene - Methodology Overview

Full details of the methodology employed can be found in TG03. The following represents a summary of the methods used. To undertake this it is necessary to draw on the first stage report of the first round of review and assessment.

A checklist approach is used, based on 1) monitoring data 2) new industrial sources or existing industrial sources with significantly increased emissions.

1. For monitoring the data should be prioritised and for locations near industrial sites monitoring down wind from the site is recommended. If the data indicate that the objective is exceeded then the local authority will be required to proceed to the Detailed Assessment stage (as there is no need to correct it for future years).
2. For new industrial processes listed in the guidance it is likely that an air quality assessment will have been undertaken as part of planning or authorisation process. The results from this should be cited. Authorities are also asked to check information from the first round of R&A if there were doubts about their validity. Where it is necessary to check industrial sources then annual emission of 1,3-butadiene is needed along with the height of discharge to calculate whether the relevant threshold emissions rate in the guidance has been exceeded.

A substantial increase in emissions is one where the increase is greater than 30%.

Updating and Screening Assessment of 1,3-Butadiene for the London Borough of Richmond upon Thames

No significant sources were screened during the previous round of R&A and so relevant exposure was considered unlikely. As a result progression beyond Stage 2 R&A was not undertaken.

1. *Monitoring*

The Council has not undertaken specific monitoring of 1,3-butadiene since the last round of review and assessment. Continuous monitoring however is undertaken in other parts of London.

The annual mean results at the national network sites at the roadside site at London UCL (in central London) and the suburban site at Eltham for 1999 and 2000 (when monitoring stopped) are approximately 0.5 and 0.4 $\mu\text{g}/\text{m}^3$ respectively. These monitoring results are both less than the 2003 objective. The results are considered representative of the Council's area and they indicate that the concentrations will not exceed the 1,3-butadiene objective. In view of this a detailed assessment is not required.

The 2003 background from the www.airquality.co.uk/archive/laqm/tools.php site also confirms that 2003 background is less than 1 $\mu\text{g}/\text{m}^3$. The estimated background predictions vary between 0.28 and 0.39 $\mu\text{g}/\text{m}^3$ across the Council's area.

2. *Industrial sources*

As for benzene, there is no new IPC/ Part B/ A2 process or existing process with substantially increased emissions of 1,3-butadiene within the Council's area since the last round of review and assessment. Similarly the Council has not identified significant new industrial sources or existing ones with increased emissions in neighbouring local authority areas.

Conclusion

The updating and screening assessment for 1,3-butadiene has not identified a risk of the 2003 objective being exceeded in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for 1,3-butadiene.

Summary of LBRUT Council's USA conclusions for 1, 3-butadiene

Source, location and data assessed	Action required
Monitoring data	No further action required
Part A processes	No further action required

Lead

The current air quality objective for lead is $0.5\mu\text{g}/\text{m}^3$ as an annual mean concentration to be achieved by the end of 2004, with a lower air quality objective of $0.25\mu\text{g}/\text{m}^3$ as an annual mean concentration to be achieved by the end of 2008.

Perspective

Emissions of lead are now restricted to a small number of industrial processes, including battery manufacture, pigments in paint, alloys, radiation shielding tank lining and piping.

Current monitoring indicates that lead in air at all background and kerbside UK national network sites was significantly below the 2004 and 2008 objectives during the period between 1999 and 2001 (from TG03).

Further assessments however have been undertaken nationally at specific sites near industrial processes. For one industrial site in 2000 the result exceeded the $0.5\mu\text{g}/\text{m}^3$ objective, followed in 2001 by an exceedence of the $0.25\mu\text{g}/\text{m}^3$ objective. For the other site the result was exceeded at 2 locations in 1999, one of the $0.5\mu\text{g}/\text{m}^3$ objective and one of $0.25\mu\text{g}/\text{m}^3$ objective. Concentrations at this site however since have dropped markedly. Thus the monitoring results indicated generally no exceedences of the 2004/ 2008 objectives although locations in proximity to non-ferrous metal production and foundry processes were deemed to be at risk.

No AQMAs were declared in the first round of R&A.

Methodology Overview

Full details of the methodology employed can be found in TG03. The following represents a summary of the methods used. To undertake this it is necessary to draw on the first stage report of the first round of review and assessment.

A checklist approach is used, based on 1) monitoring data 2) new industrial sources and existing industrial sources with significantly increased emissions.

1. For monitoring the data should be prioritised and for locations near industrial sites monitoring down wind from the site at the nearest residential property is recommended. If the data indicate that the objective is exceeded then the local authority will be required to proceed to the Detailed Assessment stage (as there is no need to correct it for future years).
2. For new industrial processes listed in the guidance it is likely that an air quality assessment will have been undertaken as part of planning or authorisation process. The results from this should be cited. Authorities are also asked to check information from the first round of R&A if there were doubts about their validity. Where it is necessary to check industrial sources then the annual emission of lead is needed along with the height of discharge to calculate whether the relevant threshold in the guidance has been exceeded. (A substantial increase in emissions is one where the increase is greater than 30%).

Updating and Screening Assessment of Lead for the London Borough of Richmond upon Thames

No sources were identified in the first round of R&A in the Council's area to pose a risk to air quality and hence progress beyond the Stage 1 R&A was not needed.

1. *Monitoring*

The Council has not identified a need to undertake the specific monitoring of lead anywhere in its area since the last round of review and assessment. The results from the national network in London (between 1999 and 2001) have confirmed that concentrations do not exceed the objectives for 2003 and 2008. The highest annual mean concentration was 0.068 $\mu\text{g}/\text{m}^3$ at the kerbside site at Cromwell Road in West London in 1999, although concentrations at the London sites have since reduced markedly.

These monitoring results are considered representative of the Council's area. The results indicate that the concentrations will not exceed the 2004 and 2008 lead objectives and therefore a detailed assessment is not required.

2. *Industrial sources*

There is no new IPC/ Part B/ A2 process or existing process with substantially increased emissions of lead within the Council's area since the last round of review and assessment. Similarly the Council has not identified significant new industrial sources or existing ones with increased emissions of lead in neighbouring local authority areas.

Conclusion

The updating and screening assessment for lead has not identified a risk of the 2004 and 2008 objectives being exceeded in the Council's area. The Council therefore need not proceed beyond this updating and screening assessment for lead for this round of review and assessment.

Summary of LBRUT Council's USA conclusions for lead

Source, location and data assessed	Action required
Monitoring data	No further action required
Industrial processes	No further action required

Nitrogen Dioxide

The current air quality objectives for nitrogen dioxide are 40 µg/m³ as an annual mean concentration and a one hour mean concentration of 200 µg/m³ not to be exceeded more than 18 times per year. The objectives are to be achieved by the end of 2005.

Perspective

Nitrogen dioxide (NO₂) and nitric oxide (NO) are both oxides of nitrogen, and are collectively referred to as nitrogen oxides (NO_x). All combustion processes produce NO_x emissions, largely in the form of nitric oxide, which is then converted to nitrogen dioxide, mainly as a result of reaction with ozone in the atmosphere. It is nitrogen dioxide that is associated with adverse effects upon human health.

The principal source of nitrogen oxides emissions is road transport, which accounted for about 49% of total UK emissions in 2000 (from TG03). Major roads carrying large volumes of high-speed traffic are a predominant source, as are conurbations and city centres with congested traffic. The contribution of road transport to nitrogen oxides emissions has declined significantly in recent years as a result of various policy measures. At a national level, urban traffic nitrogen oxides emissions are estimated to fall by about 20% between 2000 and 2005, and by 46% between 2000 and 2010 (Stedman et al, 2001).

Other significant sources of nitrogen oxides emissions include the electricity supply industry and other industrial and commercial sectors. Emissions from both sources have also declined dramatically, due to the fitting of low nitrogen oxides burners, and the increased use of natural gas. Industrial sources make only a very small contribution to annual mean nitrogen dioxide levels.

More than 100 AQMAs were declared in the first round of R&A across the country, the vast majority of which related specifically to road transport emissions, where the attainment of the annual mean objective is considered unlikely. The annual mean objective is more demanding than the one-hour mean objective and areas predicted to exceed include parts of major conurbations, town centres with congested traffic and dual carriageways and motorways.

Methodology Overview

Full details of the methodology employed can be found in TG03. The following represents a summary of the methods used. To undertake this it is necessary to draw on the first stage report of the first round of review and assessment.

A checklist approach is used for the updating and screening assessment, based on 1) monitoring data 2) roads including narrow congested streets and junctions 3) bus stations 4) new industrial sources and existing ones with significantly increased emissions 5) aircraft.

1. Monitoring data are to be considered both outside an AQMA and within an AQMA. The data will be corrected to 2005 using factors in TG03 and if the data indicate that the concentration exceeds the objective then the local authority will be required to proceed to the Detailed Assessment stage.

2. The section on roads focuses on specific examples that may not have been fully considered in the first round of review and assessment, these include: narrow congested streets; junctions; busy streets where people may spend an hour or more close to traffic; roads with high flows of buses or HGVs; new roads; and roads close to the objective during the first round of review and assessment. The assessment relates to annual average daily traffic flows exceeding stated flows (which are dependent on the type of road) for different locations. If the indications arising from these assessments are greater than $40 \mu\text{g}/\text{m}^3$ in 2005 then a detailed assessment is necessary. For any new roads a specific assessment is required based on the DMRB screening model. Similarly roads close to the objective at the last review and assessment or roads with significantly changed flows should be re-assessed.
3. Bus stations should be assessed specifically based on the numbers of bus movements and the proximity of relevant exposure (in this instance it should be judged against the 1 hour criteria). If the bus station meets or exceeds these stated levels of activity then DMRB is to be used to obtain a predicted annual mean. If the predicted concentration is greater than $40 \mu\text{g}/\text{m}^3$ in 2005 then it is necessary to proceed to the Detailed Assessment stage.
4. For new industrial sources (as listed in TG03) it is likely that an air quality assessment will have been undertaken as part of planning or authorisation process. The results from this should be cited. If no assessment were undertaken then TG03 provides nomograms for an assessment. The same approach is required where there has been a substantial increase in emissions (i.e. one greater than 30%).
5. Aircraft emissions are important if there is relevant exposure within 1000m of the airport boundary and the equivalent passenger numbers is predicted to exceed 5 million passengers per annum.

Updating and Screening Assessment of Nitrogen Dioxide for the London Borough of Richmond upon Thames

The Council undertook a Stage 3 R&A during the first round of review and assessment. This identified roads in its area with relevant exposure where the annual mean objective would be exceeded. Consequently the Council declared an AQMA across the whole of the borough.

As required a Stage 4 further review was undertaken and this used the updated emissions inventory for London from that used for the Stage 3 report. The results showed areas would still be exceeded and as a result the Council maintained its AQMA across the whole borough.

1. Monitoring

The Council undertakes continuous monitoring of NO_2 within its area at two fixed sites: Richmond 1 (RI1) is a roadside site on Castelnau in Barnes (the site is in the grounds of the library); Richmond 2 (RI2) is a suburban site at the Barnes Wetlands Centre. The sites are both part of the LAQN and the standards of QA/QC applied meet the requirements of the LAQN.

The results of the monitoring at the sites are given in Table 3 below. This indicates that the annual mean objective was exceeded in 2001 and 2002 for RI1 only (marked in bold). These

were the only years with the required data capture of more than 90%. The data capture for the sites is given in Appendix 1. There was only one hour where the hourly standard was exceeded at the sites. This was at the Richmond 9 site during 2002; the objective of more than 18 hours exceeding the hourly standard was however not exceeded.

Table 3 Annual mean NO₂ from continuous monitoring in the Council area (2000 – 2002) (µg/m³)

LAQN site	Type	2000	2001	2002
Richmond 1	R	38.2	44.0	44.0
Richmond 11	K	no	no	<i>58.0</i>
Richmond 2	S	no	<i>29.0</i>	<i>32.0</i>
Richmond 7	S	no	no	<i>20.0</i>
Richmond 9	K	no	no	<i>84.0</i>

(Note – no indicates site not in operation, italics represents < 90% data capture
Sites location can be found in the Monitoring Data sub-section of the Introduction to
Updating Screening and Assessment section)

The results of diffusion tube monitoring for the most recent year (i.e. 2002) of the 56 sites monitored in the borough are given in Figure 4 and Figure 5 below. The results given are biased adjusted, based on the results from co-location studies with the Council's two monitoring sites. The bias adjustment is undertaken to try to correct for a systematic laboratory bias arising.

The bias adjustment was obtained (in accordance with TG03) as follows:

Bias adjustment factor (based on roadside site 2002 annual means)

$$\begin{aligned}
 &= \text{Castelnau monitoring result} / \text{Average of 3 co-located diffusion tubes} \\
 &= 44 / 30.55 \\
 &= 1.44
 \end{aligned}$$

(Note - the data capture for the continuous site exceeds 90% and 12 months of diffusion tube monitoring was undertaken)

The Council's diffusion tubes are supplied by Gradko Scientifics with analysis undertaken by Casella Stanger. The method of preparation used is 50% TEA in water.

The diffusion tube survey was expanded to its present size in July 2001, so the results presented represent the first full calendar of monitoring. The sites have mostly been located to identify hot spots in the borough and all locations are considered to represent relevant for public exposure. The Council also participates in the national diffusion tube survey at four locations (RUT1 to 4). These sites include two roadside and two background sites. Both of the background sites (RUT 3 and 4) meet the objective, whereas the two roadside sites (RUT 1 and 2) exceed it. Estimated annual average NO₂ concentrations (derived using TG03 factors) are included (in purple).

Figure 4 NO₂ sites (numbered 1 to 27) across the Council’s area (µg/m³) for 2002 (lilac) and 2005 (purple)

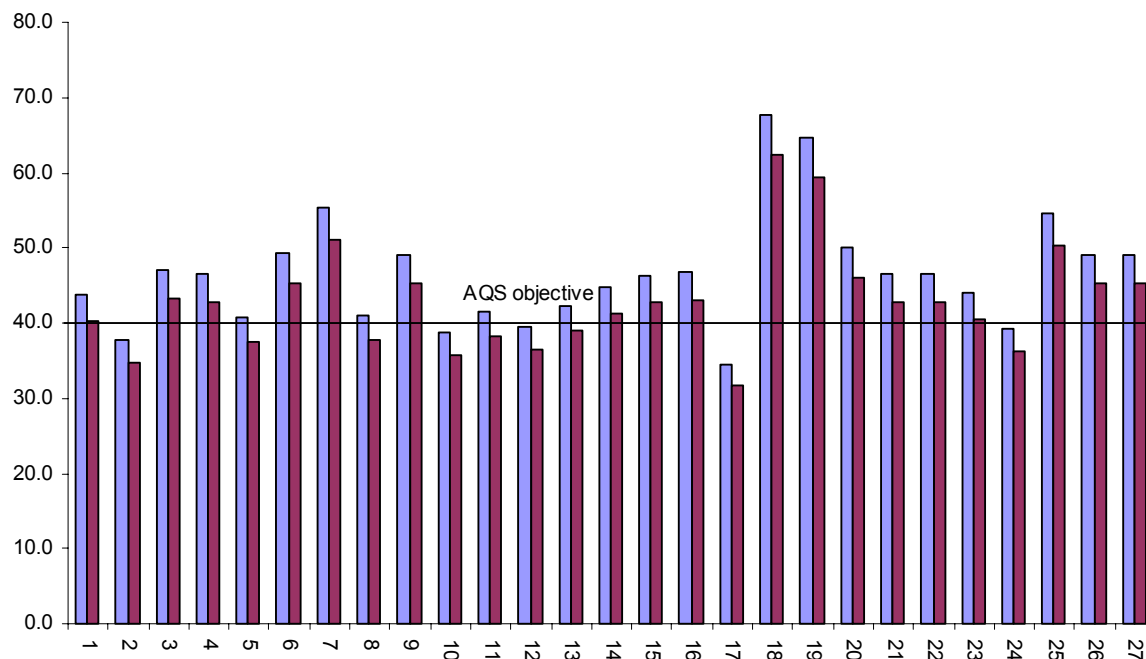
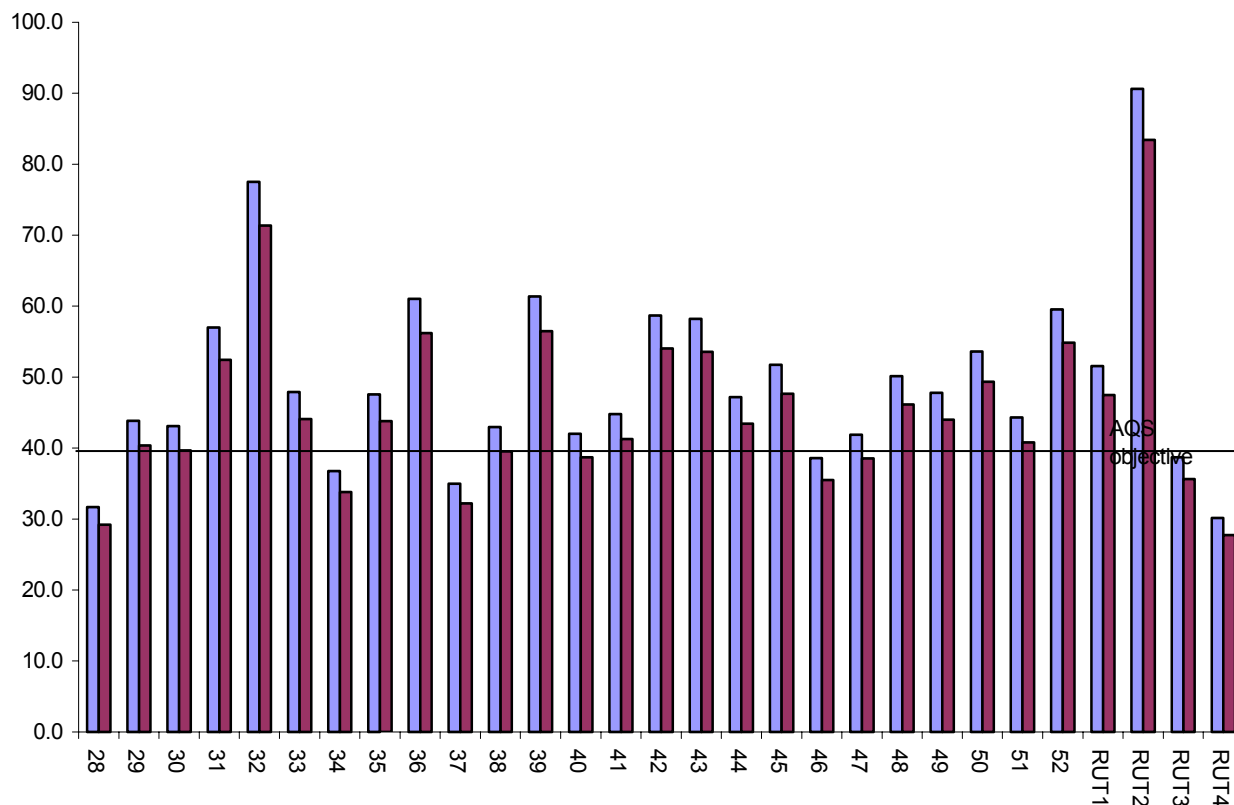


Figure 5 NO₂ sites (numbered 28 to RUT4) across the Council’s area (µg/m³) (2002/ 2005)



The results indicate that the majority of sites exceed the 40 $\mu\text{g}/\text{m}^3$ standard for 2002 and are also estimated to exceed in 2005.

The most recent results for the period 1999 to 2002 from the continuous sites in nearby authorities in the LAQN (plus the Marylebone Road site in central London, which is a kerbside with high pollution concentrations) are given in Table 4 below.

Table 4 Results of NO₂ monitoring from nearby LAQN sites (2001)

LAQN site	Type	1999	2000	2001	2002
Marylebone Rd	K	91.0	93.0	84.0	80.0
A3	R	59.0	55.4	53.0	58.0
Hammersmith & Fulham 1	R	<i>91.7</i>	<i>72.6</i>	70.0	<i>58.0</i>
Heathrow Airport	U	55.4	55.4	56.0	52.0
Hounslow 1	R	59.2	51.6	54.0	<i>58.0</i>
Hounslow 2	S	<i>38.2</i>	<i>36.3</i>	41.0	43.0
Hounslow 4	R	<i>55.4</i>	<i>53.5</i>	55.0	<i>58.0</i>
Teddington	U	<i>32.0</i>	<i>28.7</i>	<i>29.0</i>	<i>25.0</i>
Wandsworth 2	U	51.6	49.7	52.0	52.0
Wandsworth 4	R	<i>49.7</i>	45.8	53.0	44.0

(Notes – bold indicates that 40 $\mu\text{g}/\text{m}^3$ standard exceeded with more than 90% data capture; italics indicates less than 90% data capture; K: kerbside, R: roadside, S: suburban, U: urban background)

The results confirm that the kerbside site at Marylebone Road and all other roadside sites failed to meet the 40 $\mu\text{g}/\text{m}^3$ standard. The Wandsworth 2 urban background site towards inner London and the Heathrow background site also exceeded the standard. The urban background site at Teddington, which is in the borough, meets the standard, thereby suggesting that background concentrations in the Council's area are unlikely to exceed the standard. The findings for these LAQN sites are considered indicative of the findings for the Council's area, that is that high concentrations of NO₂ arise close to the busiest roads across the borough.

The assessment of NO₂ based on monitoring confirms that there are areas across the borough where the annual mean objective will be exceeded. A Detailed Assessment based on monitoring to revoke the Council's AQMA is not therefore required.

- Roads including narrow streets/ junctions/ busy streets/ high flows of HGVs and buses/ new roads/ roads close to the objective in first round of R & A/ roads with significantly changed flows.*

The Stage 3 report for the previous round of R&A provided modelling of the main roads in the Council's area. The Stage 4 updated the earlier predictions and incorporated the revised emission factors. The Stage 4 report addressed the following issues:

- Narrow congested roads, including street canyons

- Junctions
- High flows of HGVs and buses
- Roads close to the objective in first round of R & A

As a result none of the above issues have been re-examined in this report. The rest of this section focuses on roads that are defined as busy streets and roads with significantly changed flows. The changed flows have been identified from the new London Atmospheric Emissions Inventory (LAEI) referred to in the introductory chapter to the report and the busy streets have been identified using GIS and from local knowledge.

To predict concentrations close to roads an understanding of the future predicted background concentrations of both NO_x and NO_2 for 2005 is required. These details have also been derived from the LAEI as explained earlier.

Busy streets with more than 10,000vpd, where exposure can arise within 5m of the kerb, have been identified in the Council's area using GIS. These are shown in Figure 6 below. A DMRB assessment has been undertaken of these, based on potential relevant exposure arising at 5m from the kerb. The DMRB results for the busiest streets are given in the table below. Details of the traffic flows used for this updating and screening assessment are given in Appendix 2 (see Table 17).

Figure 6 Roads classified as busy streets in the London Borough of Richmond upon Thames area

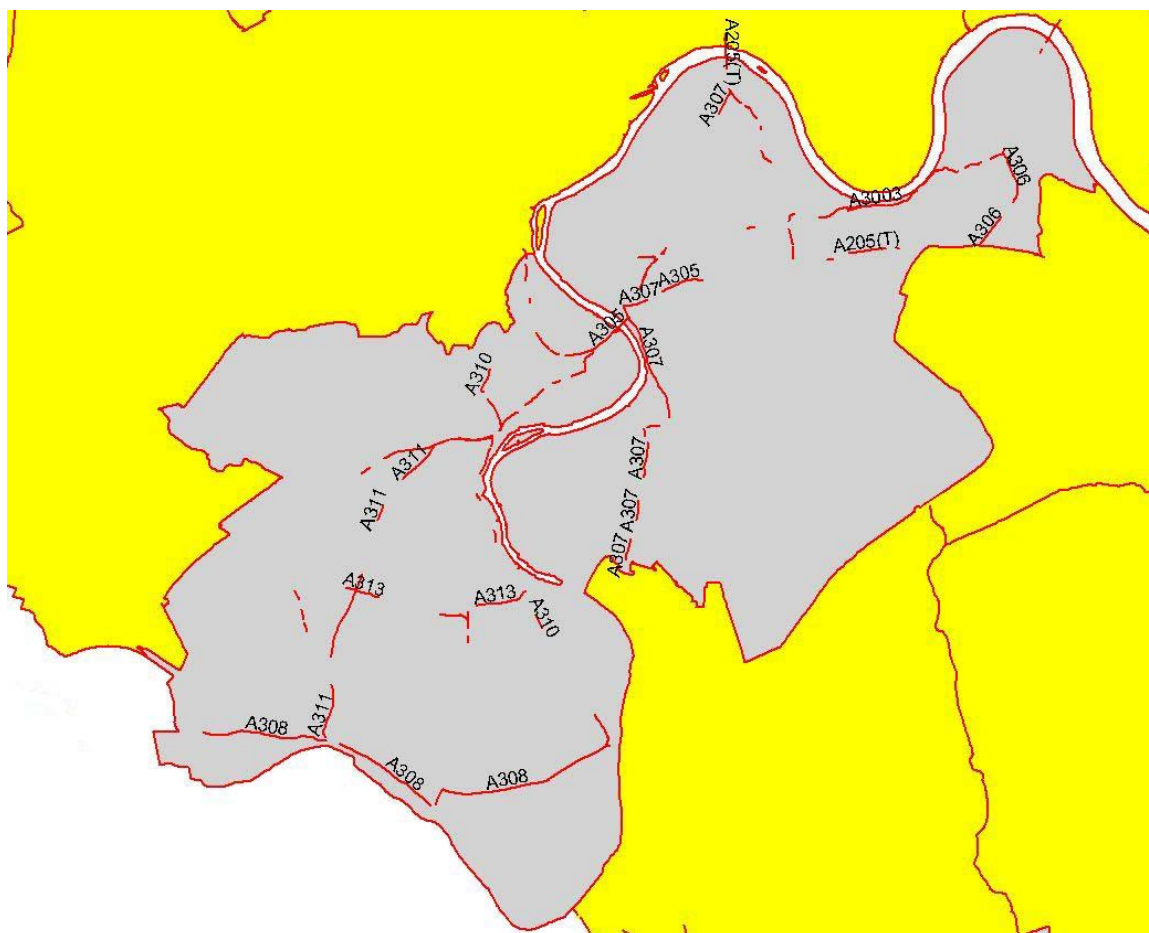


Table 5 Predicted annual mean NO₂ at busy streets for 2005 in London Borough of Richmond upon Thames area (µg/m³)

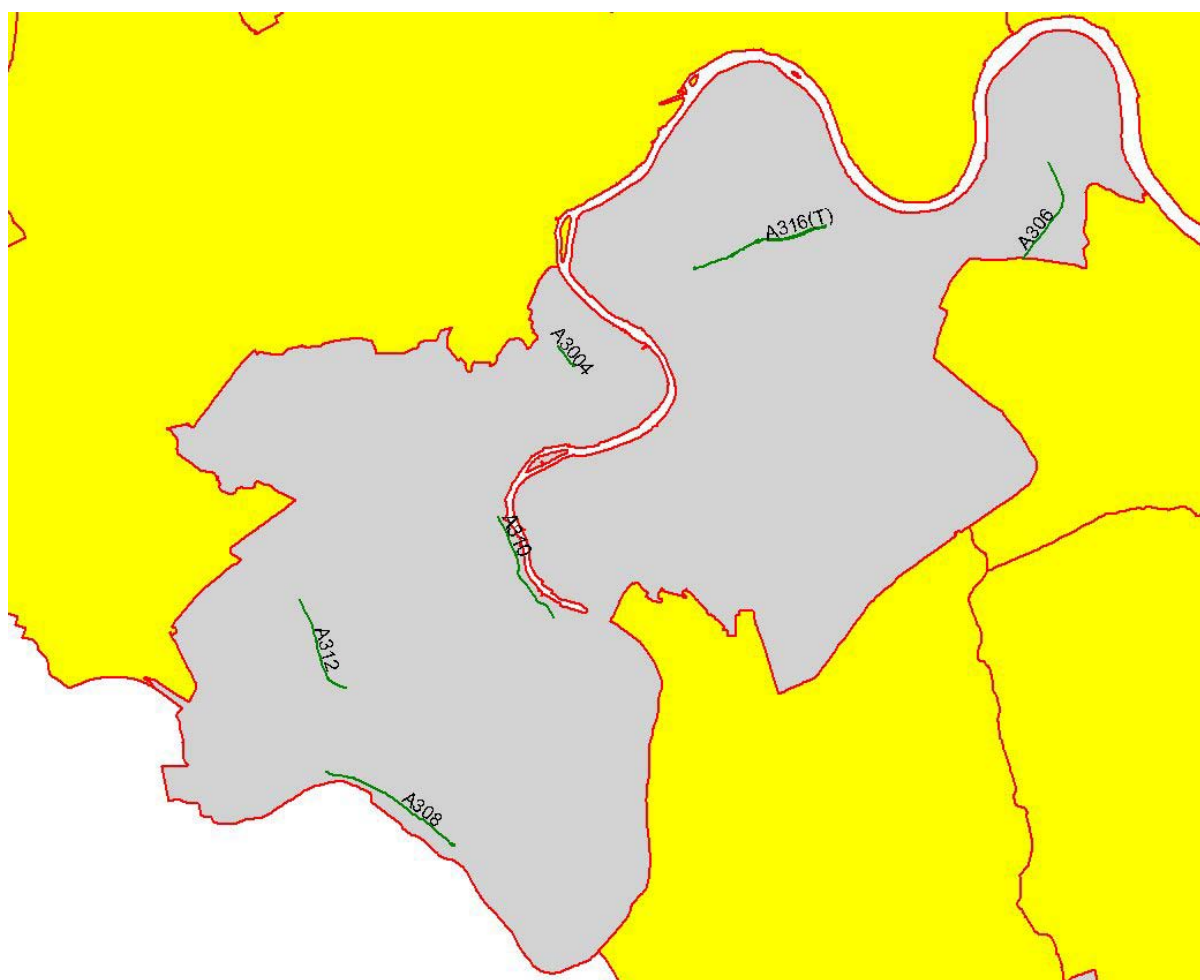
road name	road number	NO ₂	NO ₂ canyon
KEW ROAD	A205 (T)	42.3	48.5
SHEEN ROAD	A305	36.8	41.8
BARNES HIGH STREET	A3003	38.7	43.6
CHURCH ROAD	A3003	38.7	43.6
LOWER RICHMOND ROAD	A3003	38.7	43.6
MORTLAKE HIGH STREET	A3003	38.7	43.6
SHEEN LANE	A3003	38.7	43.6
THE TERRACE	A3003	38.7	43.6
UPPER RICHMOND ROAD WEST	A205 (T)	40.4	46.9
HEATH ROAD	A305	35.2	40.8
THE GREEN	A305	35.2	N/A
MORTLAKE ROAD	A205	39.8	45.3
MORTLAKE ROAD	A205 (T)	39.8	45.3
CASTELNAU	A306	47.5	N/A
HAMMERSMITH BRIDGE ROAD	A306	47.5	N/A
KEW ROAD	A307	41.1	49.3
THE QUADRANT	A307	41.1	49.3
UPPER RICHMOND ROAD	A205 (T)	42.9	48.5
LOWER RICHMOND ROAD	A316 (T)	39.0	44.1
BRIDGE STREET	A305	35.8	41.4
RICHMOND ROAD	A305	35.8	41.4
KEW ROAD	A307	37.5	41.8
TWICKENHAM ROAD	A316 (T)	35.8	N/A
CLIFFORD AVENUE	A205 (T)	41.3	N/A
ROCKS LANE	A306	44.6	N/A
KING STREET	A305	38.1	45.6
LOWER RICHMOND ROAD	A316 (T)	44.6	49.1
HILL STREET	A305	38.4	45.4
PARADISE ROAD	A307	37.6	44.0
RED LION STREET	A307	37.6	44.0

The above streets have been considered as busy streets, these represent streets that are not street canyons and others that can be considered as street canyons (as defined using TG03). The predicted concentrations for these are indicated, although it is important to note that not every case indicates that people actually spend more than one hour within 5m of the kerb. The results indicate a number of streets, which exceed the 40 µg/m³ annual mean objective, thus indicating that the hourly objective of more than 18 hours above 200 µg/m³ may be exceeded.

A comparison has been undertaken between the supplied 1999 and 2001 LAEI traffic data to identify any roads where the traffic flow has increased by more than 25%. The following roads have been identified and are shown in Figure 7 below.

THAMES STREET	A308
KINGSTON ROAD	A310
MANOR ROAD	A310
STRAWBERRY VALE	A310
TWICKENHAM ROAD	A310
ROCKS LANE	A306
LOWER MORTLAKE ROAD	A316 (T)
LOWER RICHMOND ROAD	A316
LOWER RICHMOND ROAD	A316 (T)
UXBRIDGE ROAD	A312
HAMPTON COURT ROAD	A308
ST MARGARET'S ROAD	A3004

Figure 7 Roads with substantial changes in the London Borough of Richmond upon Thames area



A DMRB assessment has been made of these roads assuming relevant exposure arises at 5m from the kerb. The results of the assessment are given in the table below.

Table 6 Predicted annual mean NO₂ of roads with substantial changes for 2005 in London Borough of Richmond upon Thames area (µg/m³)

Road name	Road number	NO ₂
THAMES STREET	A308	33.5
KINGSTON ROAD	A310	30.8
MANOR ROAD	A310	30.8
STRAWBERRY VALE	A310	30.8
TWICKENHAM ROAD	A310	30.8
ROCKS LANE	A306	44.6
LOWER MORTLAKE ROAD	A316 (T)	44.6
LOWER RICHMOND ROAD	A316	44.6
LOWER RICHMOND ROAD	A316 (T)	44.6
UXBRIDGE ROAD	A312	32.9
HAMPTON COURT ROAD	A308	32.9
ST MARGARET'S ROAD	A3004	34.4

The above results indicate that the A306 and A316 only will exceed the 40 µg/m³ annual mean objective.

No new roads with traffic flows greater than 10,000vpd have been built in the Council's area since the first round of R&A where there is relevant exposure arising.

The assessment of NO₂ based on assessing road traffic indicates that there are areas across the borough where the annual mean objective will be exceeded. The Council has previously declared the whole of the borough an AQMA based on previous reports. As a result, the Council need not undertake a Detailed Assessment to revoke or amend the Council's AQMA.

3. *Bus stations*

There is an open bus station in the Richmond town centre where there is relevant exposure. An assessment of the numbers of buses using the site has been made. This indicates 17 routes are operating through the bus station with a total of approximately 1,100 buses per day. As a result a DMRB assessment was undertaken based on this bus flow, using an estimated average speed and distance to receptor. For 2005 the predicted concentration at typical receptor positions where people may wait for an hour or more was 39µg/m³. This is less than the annual mean objective, as a result and in accordance with TG03 guidance no further assessment of the bus station is required.

4. *Industrial sources*

There is no new IPC/ Part B/ A2 process or existing process with substantially increased emissions of nitrogen oxides within or close to the Council's area since the last round of review and assessment.

5. *Aircraft*

The nearest airport is Heathrow airport and this is sited more than 1km outside borough's boundary as a result and based on TG03 guidance no assessment need be made of this source.

Conclusion

The updating and screening assessment for nitrogen dioxide has identified a risk that the 2005 air quality objectives will be exceeded in the Council's area. This is consistent with the Council's previous local air quality management findings and actions. The Council therefore need not undertake a Detailed Assessment for this round of review and assessment in respect of nitrogen dioxide.

Summary of LBRUT Council's USA conclusions for NO₂

Source, location and data assessed	Action required
Monitoring data	No further action required
Roads	No further action required
Bus stations	No further action required
Industrial sources	No further action required
Aircraft	No further action required

Sulphur Dioxide

The current air quality objectives for sulphur dioxide are a 15 minute mean concentration of 266 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 35 times per year, to be achieved by the end of 2005. Additional objectives include a one hour mean concentration of 350 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 24 times per year and a 24 hour mean concentration of 125 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 3 times per year. These latter objectives, equivalent to the EU limit values, are all to be achieved by the end of 2004.

Perspective

The main source of sulphur dioxide in the UK is power stations, which accounted for more than 71% of emissions in 2000. There are also significant emissions from other industrial combustion sources. Domestic sources now only account for 4% of emissions, but can be locally much more significant. Road transport currently accounts for less than 1% of emissions.

Measurements from the national monitoring network indicate that concentrations have fallen in recent years, with the objectives only being exceeded in Belfast (from TG03). This is associated with widespread domestic coal burning. The 15-minute objective is the most stringent for SO_2 . A small number of AQMAs were declared during the first round of review and assessment. These relate to a number of coal-fired boilers, domestic coal burning and at a major port.

Methodology Overview

Full details of the methodology employed can be found in TG03. The following represents a summary of the methods used. To undertake this it is necessary to draw on the first stage report of the first round of review and assessment.

A checklist approach is used, based on 1) monitoring data 2) new industrial sources and existing ones with significantly increased emissions 3) areas of domestic coal burning 4) boilers burning coal or oil 5) railway locomotives.

1. Monitoring data are to be considered both outside an AQMA and within an AQMA. The data will be assumed to relate to the relevant objective year and if the data indicate that the concentration exceeds the objective then the local authority will be required to proceed to the Detailed Assessment stage.
2. For new industrial sources listed in TG03 it is likely that an air quality assessment will have been undertaken as part of planning or authorisation process. The results from this should be cited. If no assessment were undertaken then TG03 provides nomograms for an assessment. The same approach is required where there has been a substantial increase in emissions (i.e. one greater than 30%).
3. For domestic sources there is the need to identify small areas (500 x 500m) where significant coal burning still takes place. If the density of coal burning premises exceeds 100 per 500 x 500m then a detailed assessment is required.

4. For boiler plant it is necessary to identify all plant >5MW(thermal) that burn coal or fuel oil and establish whether there is relevant exposure within 500m. If such boilers are found then TG03 provides nomograms for an assessment.
5. Both diesel and coal fired locomotives emit SO₂ and this is most relevant where the locomotives are stationary for periods of 15 minutes or more. It is also necessary to establish whether or not there is relevant exposure within 15m of the source. If there are more than 2 occasions when locomotives are stationary with engines running then it is necessary to go to a detailed assessment.

Updating and Screening Assessment of Sulphur Dioxide for the London Borough of Richmond upon Thames

The main sources examined during the previous round were Part A or B processes. No boilers greater than 5MW (thermal) were identified as a significant emission source of SO₂ in the Council's area. The assessment of SO₂ therefore ended at the Stage 3 R&A.

1. Monitoring

The Council undertakes SO₂ continuous monitoring campaigns using its mobile monitoring unit. The results for 2002 based on ratified data indicate that the 15-minute mean standard was not exceeded at the two kerbside and one suburban location monitored; similarly there were no periods when the one-hour and 24 hour mean standards were exceeded. The government's AUN site at Teddington is also within the borough and monitoring for the period 2000 to 2002 indicates that the objectives were not exceeded.

Monitoring is also undertaken in nearby local authorities in the LAQN. The monitoring results relating to the 15-minute mean objective and relevant data capture for these sites are given in Table 7 below for 2001. As with the Richmond sites there have been no instances where the objectives have been exceeded. The table below indicates the maximum 15-minute mean concentration monitored.

Table 7 SO₂ monitoring (maximum 15 minute mean – µg/m³) from LAQN in neighbouring areas (2001 -2002)

LAQN site	Type	2001	2002
Hammersmith & Fulham 1	R	118	132
Hounslow 2	S	111	121
Hounslow 4	R	138	123
Richmond 11	K		100
Richmond 7	S		89
Richmond 9	K		81
Teddington	U	139	80
Wandsworth 2	U	230	104
Data capture %			
Hammersmith & Fulham 1	R	54	70
Hounslow 2	S	81	96
Hounslow 4	R	93	80
Richmond 11	K		8
Richmond 7	S		35
Richmond 9	K		17
Teddington	U	98	99
Wandsworth 2	U	90	95

The results for all the above sites confirm that the SO₂ objectives were achieved and that no further assessment is needed.

2. *Industrial sources*

There are no new relevant IPC/ Part B/ A2 processes within the Council's area or nearby in neighbouring authorities since the last round of review and assessment. There are also no existing relevant IPC/ Part B/ A2 processes within the Council's area or nearby in neighbouring authorities where there have been substantially increased emissions.

3. *Domestic sources*

Local knowledge and professional judgement indicates that significant domestic coal burning is not undertaken across the Council's area.

4. *Boilers*

No specific new boilers have been identified in the Council's area since the last round of R&A.

5. *Railway locomotives*

An assessment has been made of railway activity at sites where locomotives are known to operate in the Council's area. From this it has been established that there is no relevant exposure within 15m of the sites where locomotives are stationary with engines running for two periods of more than 15 minutes per day.

Conclusion

The updating and screening assessment for sulphur dioxide has not identified a risk of the objectives being exceeded by 2004 and 2005 in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for sulphur dioxide for this round of review and assessment.

Summary of LBRUT Council's USA conclusions for sulphur dioxide

Source, location and data assessed	Action required
Monitoring data	No further action required
Industrial sources	No further action required
Domestic sources	No further action required
Boilers	No further action required
Railway locomotives	No further action required

Particles (PM₁₀)

The current air quality objectives for PM₁₀ are an annual mean concentration of 40 µg/m³ and a 24 hour mean concentration of 50 µg/m³ not to be exceeded more than 35 times per year. Both objectives are to be achieved by the end of 2004 and are based upon measurements by the European gravimetric transfer reference sampler or equivalent.

The EU has also set indicative limits (Stage 2 limit values) to be achieved by beginning of 2010. These limit values are more stringent than the existing objectives. The government has adopted these as provisional objectives for England, Wales and Northern Ireland (excluding London), although it has not brought them into regulation for the purposes of LAQM. Specific objectives have been included for London; these are an annual mean concentration of 23 µg/m³ and a 24 hour mean concentration of 50 µg/m³ not to be exceeded more than 10 times per year. The TG03 guidance suggests that local authorities however consider them as part of this second round of review and assessment as the findings will provide valuable information, particularly when assessing future local development proposals.

Perspective

There is a wide range of emission sources that contribute to PM₁₀ concentrations in the UK. Research studies have confirmed that these sources can be divided into 3 main categories (APEG, 1999): (i) Primary particle emissions are derived directly from combustion sources, including road traffic, power generation, industrial processes etc. (ii) Secondary particles are formed by chemical reactions in the atmosphere, and comprise principally of sulphates and nitrates. (iii) Coarse particles comprise of emissions from a wide range of sources, including resuspended dusts from road traffic, construction works, mineral extraction processes, wind-blown dusts and soils, sea salt and biological particles.

The expected reduction in national particle emissions in future years is different for each source type. For example, emissions from road transport will be governed by new legislation on vehicle emission standards; emissions of secondary particles will be largely governed by controls on power generation, industrial and transport SO₂ and NO_x emissions, both in the UK and in Europe; emissions of coarse particles are largely uncontrolled, and in general are not expected to decline in future years.

Measurements from the national monitoring network indicate that concentrations are generally below the current annual mean objective (TG03). The 24-hour mean objective however has been exceeded at a small number of sites, principally close to busy roads or close to industrial activities. The 2010 annual mean and 24 hour mean objectives are widely exceeded across the network.

An analysis of PM₁₀ projections for the AQS indicated that exceedences of the 2004 objectives might be found in areas adjacent to busy roads, particularly in urban areas, areas with significant emissions from domestic solid fuel burning, and areas in the vicinity of industrial plant or which have significant uncontrolled or fugitive emissions.

An analysis for 2010 indicates that, dependant on meteorological conditions; exceedences of annual mean concentrations at background locations are only likely to occur in the southeast

of England. In addition exceedences of the annual mean objectives are still expected at some busy roadsides throughout the UK.

Approximately half of the AQMAs declared during the first round of review and assessment were for the 24-hour mean PM₁₀ objective. The majority of these are in combination with nitrogen dioxide and are associated with road transport sources. Other AQMAs have declared in relation to industrial activities and fugitive sources around a quarry and from port handling activities.

Methodology Overview

Full details of the methodology employed can be found in TG03. The following represents a summary of the methods used. To undertake this it is necessary to draw on the first stage report of the first round of review and assessment.

A checklist approach is used, based on 1) monitoring data 2) roads including junctions and new roads 3) new industrial sources and existing ones with significantly increased emissions 4) areas of domestic coal burning 5) quarries, landfill sites, opencast coal, handling of dusty cargoes at ports, etc and 6) aircraft.

1. Monitoring data are to be considered both outside an AQMA and within an AQMA. The data will be corrected to 2004 using factors in TG03 and if the data indicate that the concentration exceeds the 24-hour objective then the local authority will be required to proceed to the Detailed Assessment stage.
2. The section on roads focuses on specific examples that may not have been fully considered in the first round of review and assessment including: junctions; roads with high flows of buses or HGVs; new roads; and roads close to the objective during the first round of review and assessments. These relate to busy roads with annual average daily traffic flows exceeding 10,000vpd. Any relevant exposure within 10m of the kerb needs to be determined. Then using DMRB screening model to predict the number of 24-hour exceedences more than 50 µg/m³ in 2004. If the number is greater than 35 then a detailed assessment is necessary. Similar assessments are required for roads with high numbers of HGVs and/or buses, i.e. where the proportion of this type of vehicle exceeds 20% and the HGV/ bus flow exceeds 2000vpd. For any new roads a specific assessment is required based on the DMRB screening model. Similarly roads close to the objective at the last review and assessment or roads with significantly changed flows should be re-assessed.
3. For new industrial sources listed in the guidance it is likely that an air quality assessment will have been undertaken as part of planning or authorisation process. The results from this should be cited. If no assessment were undertaken then TG03 provides nomograms for an assessment. The same approach is required where there has been a substantial increase in emissions (i.e. one greater than 30%).
4. For domestic sources there is the need to identify small areas (500 x 500m) where significant solid fuel burning still takes place. If the density of such premises exceeds 50 per 500 x 500m then the nomogram in TG03 is used to determine whether or not a detailed assessment is required.

5. For quarries, landfill sites and ports where dusty cargoes are handled then it is necessary to identify whether is relevant exposure near to any unpaved haul road, processing plant and materials handling facility. The proximity relates to distance, which is dependant on the annual mean background. For sites identified there is a need to use professional judgement based on complaints received and concerns with the facility.
6. Aircraft emissions are important if there is relevant exposure within 500m of the airport boundary and the equivalent passenger numbers is predicted to exceed 10 million passengers per annum.

Updating and Screening Assessment of PM₁₀ for the London Borough of Richmond upon Thames

Detailed modelling of sources across the Council's area was undertaken in the Stage 3 for the 2004 objectives. This showed exceedences of the 24-hour mean objective for PM₁₀ close to major roads in the borough. As a result the Council declared the whole of the borough an AQMA.

Subsequent modelling was undertaken in the Stage 4 further assessment using new emissions information and revised emission factors. This also indicated exceedences of the 24-hour mean objective for PM₁₀ close to major roads in the borough.

1. Monitoring

The Council declared an AQMA for PM₁₀ during the first round of R&A and therefore the monitoring undertaken only applies to areas inside an AQMA. The Council undertakes continuous monitoring of PM₁₀ at its two fixed continuous monitoring sites i.e. at a roadside location on Castelnau (RI1) and a suburban location at the Barnes Wetlands Centre (RI2). The Council has also undertaken monitoring campaigns using its mobile monitoring facility (although the annual data capture for the short term campaigns was obviously less than 90%).

The following table presents the results for the period 2000 – 2002. The Council uses TEOM instruments for monitoring PM₁₀; the results are therefore presented as a gravimetric equivalent, i.e. TEOM times 1.3. The data capture rates are given in Appendix 1. The results confirm that the 2004 annual mean objective of 40 µg/m³ is being met and that there were days when the 24-hour mean standard of 50 µg/m³ was exceeded. However the number of occurrences did not exceed the 2004 objective of more than 35 in a year.

Table 8 PM₁₀ monitoring at London Borough of Richmond upon Thames sites (2000 – 2002) (µg/m³)

Site	2000		2001		2002	
	Days > 50 µg/m ³	Annual mean	Days > 50 µg/m ³	Annual mean	Days > 50 µg/m ³	Annual mean
RI1 (roadside)	3	23.4	15	26	4	25
RI2 (suburban)	no	no	3	29	<i>1</i>	20
RI7 (suburban)	no	no	no	no	<i>1</i>	20
RI9 (kerbside)	no	no	no	no	<i>1</i>	29
RI1 (kerbside)	no	no	no	no	<i>0</i>	29

(Note – no indicates not operating; italics represent < 90% data capture)

Based on the above results for the Richmond 1 (RI1) site, an estimate of 2004 and 2010 concentrations and number of days greater than 50 µg/m³ can be made using the TG03 guidance. These estimates are given in Table 9 and Table 10.

Table 9 Estimated PM₁₀ results at Richmond 1 site for 2004 (using TG03)

2004	Annual mean (µg/m ³)	No. of days > 50µg/m ³
RI1	25	13

The above results do not indicate an exceedence of the 2004 objective for the 24-hour mean and annual mean objectives at the roadside monitoring site in the borough.

The details of the estimated annual mean PM₁₀ concentrations in 2010 using a similar methodology are given below:

Table 10 Estimated PM₁₀ results at Richmond 1 site for 2010 (using TG03 methodology)

2010	Annual mean (µg/m ³)	No. of days > 50µg/m ³
RI1	23	8

Despite the predicted reduction resulting from future emission changes the estimates for the RI1 roadside site indicate that the 2010 annual mean and 24 hour mean objective for London may be exceeded in the Council's area.

The following table provides results from monitoring during 2001 in nearby areas.

Table 11 PM₁₀ monitoring in neighbouring local authorities – 24 hour mean objective – number of days >50 µg/m³ (1999 to 2002) (Note - all sites use TEOMs)

LAQN site	Type	1999	2000	2001	2002
A3	R	21	16	15	3
Hammersmith & Fulham 1	R	2	31	37	24
Heathrow Airport	U	27	14	21	15
Hounslow 2	S	4	4	11	6
Hounslow 3	R	20	41	47	27
Hounslow 4	R	6	18	28	18
Wandsworth 4	R	17	19	28	17

The above table indicates that the objective has been exceeded only at roadside sites (in bold) during the period 1999 to 2002. The results for all urban and suburban locations met the objective.

Table 12 PM₁₀ monitoring in neighbouring local authorities – annual mean objective (µg/m³) (1999 - 2002)

LAQN site	Type	1999	2000	2001	2002
A3	R	29	26	27	24
Hammersmith & Fulham 1	R	22	34	35	35
Heathrow Airport	U	29	27	29	28
Hounslow 2	S	23	22	23	23
Hounslow 3	R	34	34	36	33
Hounslow 4	R	30	30	32	32
Wandsworth 4	R	26	27	28	27

The results in the above table indicate that the annual mean objective has not been exceeded at any location. Those locations with the highest concentrations are at the roadside, with suburban locations having the lowest concentrations.

2. Roads

The Stage 3 report for the previous round of R&A provided modelling of the main roads in the Council's area and addressed the following issues: junctions and high flows of HGVs and buses. The TG03 guidance also requires an assessment of roads close to the objective during the first round of R&A and this was undertaken in the Stage 4 further assessment. Hence no further examination of these issues will be undertaken in this report.

The rest of this section focuses on roads with significantly changed flows. The changed flows have been identified from the new London Atmospheric Emissions Inventory (LAEI) referred to in the introductory chapter to the report.

No roads have been identified where the actual flows have increased significantly. However there are a number of roads with significantly changed flows since the previous round of R&A. These have arisen due to a revision of traffic data in the emission inventory. To

identify these roads a comparison has been undertaken between the supplied 1999 and 2001 LAEI traffic data where the traffic flow has increased by more than 25%.

The traffic data for these roads is given in Appendix 2. The results of the DMRB assessment for the roads are given in Table 13 below. The receptor positions are assumed at 5m from the kerb.

Table 13 Predicted number of 24 hour means of PM₁₀ exceeding 50 µg/m³ for 2004 for roads with substantial changes in the LBRUT area

Road name	Road number	No. of days > 50µg/m ³
THAMES STREET	A308	10
KINGSTON ROAD	A310	7
MANOR ROAD	A310	7
STRAWBERRY VALE	A310	7
TWICKENHAM ROAD	A310	7
ROCKS LANE	A306	11
LOWER MORTLAKE ROAD	A316 (T)	11
LOWER RICHMOND ROAD	A316	11
LOWER RICHMOND ROAD	A316 (T)	11
UXBRIDGE ROAD	A312	8
HAMPTON COURT ROAD	A308	9
ST MARGARET'S ROAD	A3004	10

The estimates for the roads with substantial changes to traffic flows indicate that the 2004 objective will not be exceeded.

There are no new roads with traffic flows greater than 10,000vpd have been built in the Council's area since the first round of R&A where there is relevant exposure arising.

3. *Industrial sources*

No new relevant processes have started in or close to the Council's area since the last round of review and assessment. An examination of the Environment Agency's Pollution Inventory and the Part B processes on the Council's Public Register has identified that there are no existing processes with substantially increased emissions of PM₁₀ within the Council's or neighbouring local authority areas since the last round of review and assessment.

4. *Domestic sources*

From local knowledge and professional judgement, significant domestic burning of solid fuels is not undertaken across the Council's area. There is therefore no need for further assessment.

5. *Quarries/ landfill sites/ handling of dusty cargoes, etc*

There are no landfill sites or quarries within the Council's area. Complaints however have been made to the Environment Agency (EA), regarding a waste transfer site at Townmead

Road site, although the complaints are mainly regarding odour. As a result the EA arranged for consultants to undertake a month long check for compliance with licence conditions through a "Waste input, dust & olfactory survey" in July 2003. The outcome of the survey was that the EA did not require that any specific action be taken. Improvements to the site are also still on going and these include the installation of a second dust suppression system a year ago. It is proposed to review this progress at the site and to undertake further monitoring.

6. *Aircraft*

As stated earlier in the section for nitrogen dioxide there is not an airport in the Council's area and no assessment is needed.

Conclusion

The updating and screening assessment for PM₁₀ has not identified any additional risk of the objectives being exceeded by 2004. The same assessment has also identified that there is a risk that the 2010 objectives will be exceeded across parts of the Council's area.

Summary of LBRUT Council's USA conclusions for PM₁₀

Source, location and data assessed	Action required
Monitoring data	No further action required
Roads	No further action required
Industrial sources	No further action required
Domestic sources	No further action required
Quarries, landfill sites, etc	No further action required
Aircraft	No further action required

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Conclusion and Recommendations

This report follows the technical guidance (TG03) produced for the updating and screening assessment of the second round of review and assessment and it therefore fulfils this part of the continuing LAQM process.

The results, from following this methodology, are that the Council has not identified a risk of the air quality objectives for carbon monoxide, benzene, 1,3-butadiene, lead, and sulphur dioxide being exceeded by the relevant years anywhere in the Council's area. Thus the Council need not therefore proceed beyond the updating and screening assessment for these pollutants.

The Council has identified a risk that the air quality objectives for particles (PM₁₀) will be exceeded at locations with relevant public exposure. The Council are not required to undertake a detailed assessment for PM₁₀ at this stage. The findings for PM₁₀ for 2010 however should be noted for longer term planning.

The Council has identified a risk that the air quality objectives for nitrogen dioxide will be exceeded at locations with relevant public exposure. The Council has previously designated the whole of the borough an AQMA for nitrogen dioxide and the findings of the updating and screening assessment is consistent with this action.

For this pollutant (and the other pollutants not requiring detailed assessments) the LAQM guidance requires the production of annual air quality progress reports by the end of April 2005, prior to undertaking the next updating and screening assessment by the end of April 2006.

The Council is therefore recommended to undertake the following actions:

1. Undertake consultation on the findings arising from this report with the statutory and other consultees as required.

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Glossary

AADT	Annual Average Daily Traffic (vehicles per day)
APEG	Airborne Particles Expert Group
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AURN	Automatic Urban and Rural Network
CO	Carbon monoxide
COMEAP	Committee on the Medical Effects of Air Pollutants
DA	Detailed Assessment
DEFRA	Department for Environment Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges Screening Model
HGV	Heavy Goods Vehicles
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
mg/m ³	Milligrams of the pollutant per cubic metre of air
µg/m ³	Micrograms of the pollutant per cubic metre of air
ppb	Parts per billion
ppm	Parts per million
NO	Nitric oxide
NO ₂	Nitrogen dioxide
PM ₁₀	Particles with diameter less than 10µm
QA/QC	Quality Assurance / Quality Control
R&A	Review and Assessment
SO ₂	Sulphur dioxide
TEOM	Tapered Element Oscillating Microbalance

Appendix 1**Table 14** Data capture rates (%) for the NO₂ continuous monitoring sites (2000-2002)

LAQN site	Type	2000	2001	2002
Richmond 1	R	46	94	98
Richmond 11	K	no	no	11
Richmond 2	S	no	60	36
Richmond 7	S	no	no	35
Richmond 9	K	no	no	17

(no means not in operation)

Table 15 Data capture rates (%) for the PM₁₀ continuous monitoring sites (1999-2002)

LAQN site	Type	1999	2000	2001	2002
A3	R	98	98	97	96
Hammersmith & Fulham 1	R	94	89	92	82
Heathrow Airport	U	95	97	93	97
Hounslow 2	S	71	97	96	92
Hounslow 3	R	72	99	98	85
Hounslow 4	R	27	78	92	70
Richmond 1	R	no	53	93	91
Richmond 11	K	no	no	no	11
Richmond 2	S	no	no	15	29
Richmond 7	S	no	no	no	24
Richmond 9	K	no	no	no	13
Wandsworth 4	R	98	99	99	97

(no means not in operation)

Table 16 NO₂ diffusion tube site details

Site code	Site Address
1	Hampton Court Road, Hampton
2	Percy Road, Hampton (Nr Oldfield Road)
3	Uxbridge Road, Hampton (Nr Arundel Close)
4	Hampton Road, Teddington (Nr Bushy Park Gardens)
5	Sandy lane, Teddington (Safeway)
6	Kingston Road Teddington (Nr Woolfingdon Close)
7	Broad Street, Teddington (Tesco)
8	Strawberry Vale, Teddington (Clive Road)
9	Hampton Road, Twickenham
10	Twickenham Road Twickenham (opposite Fulwell golf course)
11	Percy Road, Whitton (Nr Percy Way)
12	Hanworth Road, Whitton
13	Whitton Road, Whitton (opposite Rugby ground)

14	Cross Deep, Twickenham (Nr Poulett Gardens)
15	Richmond Road, Twickenham (opposite Marble Hill Park)
16	St Margarets Road, St Margarets (Nr Bridge Road)
17	Parkshot, Richmond (Court)
18	Lower Mortlake Road Richmond (Nr Trinity Road)
19	Kew Road Kew (Nr Walpole Road)
20	Mortlake Road, Kew (Nr Kent Road)
21	Lower Richmond Road, Mortlake (Nr Kingsway)
22	Castelnau, Barnes. (Nr Hammersmith Bridge)
23	Castelnau Library, Barnes
24	Lonsdale Road, Barnes (Nr Suffolk Road)
25	URRW near Sheen School
26	Upper Richmond Road West, Sheen (Nr Courtland Estate)
27	Queens Road, Richmond. (Nr Russell Walk)
28	Holly Lodge, Richmond Park
29	Petersham Road, Ham (Nr Sandy Lane)
30	German School Petersham Road
31	A316
32	Kings Street, Twickenham
33	Heath Road, Twickenham
34	Thames Street, Hampton
35	High Street, Hampton Wick
36	URRW Sheen Lane
37	Wetlands Static Site, Barnes
38	Queens Road, Teddington (Park Rd End)
39	Richmond Road, Richmond Bridge, East Twickenham
40	Staines Road, Twickenham
41	Paradise Road Richmond
42	The Quadrant, Richmond
43	Hill Street, Richmond
44	Sheen Road Richmond, (Shops)
45	High Street, Teddington, (Post Office)
46	15 Queens Road, Teddington
47	Causeway, Teddington
48	Stanley Road, Teddington (junction Strathmore Road)
49	URRW War Memorial, Sheen Lane, Sheen
50	URRW Nr Clifford Avenue, Sheen
51	Sheen Lane, Railway Crossing, Sheen
52	Clifford Avenue, Chalker Corner
53	Mobile Air Quality monitor
RUT 1	Civic Centre, York Street, Twickenham
RUT 2	George Street, Richmond
RUT 3	Alexandra Hall, Cromwell Place, Mortlake
RUT 4	Elmfield House, Waldergrave Road, Teddington

Appendix 2**Table 17** Estimated 2005 traffic count data for London Borough of Richmond upon Thames's roads

Road name	Road number	Total vehicles	Total HGV's	Percent HGVs
KEW ROAD	A205 (T)	43959	2449	5.6
SHEEN ROAD	A305	13448	1007	7.5
RICHMOND ROAD	A305	18479	1176	6.4
YORK STREET	A305	18479	1176	6.4
THAMES STREET	A308	28063	1498	5.3
STRAWBERRY VALE	A310	15803	514	3.3
HIGH STREET	A311	16633	718	4.3
BARNES HIGH STREET	A3003	25629	875	3.4
CHURCH ROAD	A3003	25629	875	3.4
LOWER RICHMOND ROAD	A3003	25629	875	3.4
MORTLAKE HIGH STREET	A3003	25629	875	3.4
SHEEN LANE	A3003	25629	875	3.4
THE TERRACE	A3003	25629	875	3.4
UPPER RICHMOND ROAD WEST	A205 (T)	33149	1773	5.3
HEATH ROAD	A305	18272	1292	7.1
THE GREEN	A305	18272	1292	7.1
LONDON ROAD	A310	16647	781	4.7
HIGH STREET	A311	18940	983	5.2
PARK ROAD	A313	16060	407	2.5
ST MARGARET'S ROAD	A3004	13429	431	3.2
RICHMOND ROAD	A3004	14984	556	3.7
ST MARGARET'S ROAD	A3004	14984	556	3.7
MORTLAKE ROAD	A205	23335	1006	4.3
MORTLAKE ROAD	A205 (T)	23335	1006	4.3
CASTELNAU	A306	26434	1224	4.6
HAMMERSMITH BRIDGE ROAD	A306	26434	1224	4.6
KEW ROAD	A307	15367	2087	13.6
THE QUADRANT	A307	15367	2087	13.6
CROSS DEEP	A310	25440	775	3.0
HAMPTON ROAD	A311	10878	836	7.7
HIGH STREET	A311	10878	836	7.7
THE GREEN	A311	10878	836	7.7
WELLINGTON ROAD	A311	10878	836	7.7
THAMES STREET	A308	22075	1240	5.6
UPPER SUNBURY ROAD	A308	22075	1240	5.6
HILL STREET	A307	18682	826	4.4
PETERSHAM ROAD	A307	18682	826	4.4
UPPER HAM ROAD	A307	18682	826	4.4
CHURCH STREET	A311	13890	726	5.2
UPPER RICHMOND ROAD	A205 (T)	22692	1389	6.1
HIGH STREET	A310	18701	1036	5.5
KINGSTON ROAD	A310	18701	1036	5.5
LOWER RICHMOND ROAD	A316 (T)	44195	1513	3.4
BRIDGE STREET	A305	25695	1483	5.8
RICHMOND ROAD	A305	25695	1483	5.8
STAINES ROAD	A305	13353	644	4.8
THE GREEN	A305	13353	644	4.8

TWICKENHAM ROAD	A305	13353	644	4.8
KEW ROAD	A307	19059	836	4.4
HORSE FAIR	A308	43373	1920	4.4
PARK ROAD	A309	12141	234	1.9
PARK ROAD	A313	12141	234	1.9
BROAD STREET	A313	20455	607	3.0
HAMPTON ROAD	A313	20455	607	3.0
MIDDLE LANE	A313	20455	607	3.0
PARK LANE	A313	20455	607	3.0
THE CAUSEWAY	A313	20455	607	3.0
TWICKENHAM ROAD	A316 (T)	52395	1492	2.8
CLIFFORD AVENUE	A205 (T)	27603	1569	5.7
ROCKS LANE	A306	20464	835	4.1
KING STREET	A305	34595	2432	7.0
LOWER RICHMOND ROAD	A316 (T)	43169	2167	5.0
UXBRIDGE ROAD	A312	20163	664	3.3
RICHMOND ROAD	A305	12182	1123	9.2
HAMPTON COURT ROAD	A308	39428	1824	4.6
	A308	24137	1274	5.3
HAMPTON COURT ROAD	A308	24137	1274	5.3
FERRY ROAD	A313	13906	745	5.4
HIGH STREET	A313	13906	745	5.4
HILL STREET	A305	19575	1617	8.3
ST MARGARET'S ROAD	A3004	21521	790	3.7
PARADISE ROAD	A307	14065	1465	10.4
RED LION STREET	A307	14065	1465	10.4
UPPER SUNBURY ROAD	A308	26887	1155	4.3
KEW ROAD	A205(T)	43959	2449	5.6
SHEEN ROAD	A305	13448	1007	7.5
RICHMOND ROAD	A305	18479	1176	6.4
YORK STREET	A305	18479	1176	6.4
THAMES STREET	A308	28063	1498	5.3
STRAWBERRY VALE	A310	15803	514	3.3
HIGH STREET	A311	16633	718	4.3
BARNES HIGH STREET	A3003	25629	875	3.4
CHURCH ROAD	A3003	25629	875	3.4
LOWER RICHMOND ROAD	A3003	25629	875	3.4
MORTLAKE HIGH STREET	A3003	25629	875	3.4
SHEEN LANE	A3003	25629	875	3.4
THE TERRACE	A3003	25629	875	3.4
UPPER RICHMOND ROAD WEST	A205(T)	33149	1773	5.3
THE GREEN	A305	18272	1292	7.1
LONDON ROAD	A310	16647	781	4.7
HIGH STREET	A311	18940	983	5.2
PARK ROAD	A313	16060	407	2.5
ST MARGARET'S ROAD	A3004	13429	431	3.2
RICHMOND ROAD	A3004	14984	556	3.7
ST MARGARET'S ROAD	A3004	14984	556	3.7
MORTLAKE ROAD	A205(T)	23335	1006	4.3
CASTELNAU	A306	26434	1224	4.6
KEW ROAD	A307	15367	2087	13.6
THE QUADRANT	A307	15367	2087	13.6
CROSS DEEP	A310	25440	775	3.0
HAMPTON ROAD	A311	10878	836	7.7

HIGH STREET	A311	10878	836	7.7
THE GREEN	A311	10878	836	7.7
WELLINGTON ROAD	A311	10878	836	7.7
THAMES STREET	A308	22075	1240	5.6
UPPER SUNBURY ROAD	A308	22075	1240	5.6
HILL STREET	A307	18682	826	4.4
PETERSHAM ROAD	A307	18682	826	4.4
UPPER HAM ROAD	A307	18682	826	4.4
CHURCH STREET	A311	13890	726	5.2
HIGH STREET	A310	18701	1036	5.5
KINGSTON ROAD	A310	18701	1036	5.5
BRIDGE STREET	A305	25695	1483	5.8
RICHMOND ROAD	A305	25695	1483	5.8
STAINES ROAD	A305	13353	644	4.8
THE GREEN	A305	13353	644	4.8
KEW ROAD	A307	19059	836	4.4
PARK ROAD	A309	12141	234	1.9
PARK ROAD	A313	12141	234	1.9
BROAD STREET	A313	20455	607	3.0
HAMPTON ROAD	A313	20455	607	3.0
MIDDLE LANE	A313	20455	607	3.0
PARK LANE	A313	20455	607	3.0
THE CAUSEWAY	A313	20455	607	3.0
TWICKENHAM ROAD	A316 (T)	52395	1492	2.8
CLIFFORD AVENUE	A205 (T)	27603	1569	5.7
ROCKS LANE	A306	20464	835	4.1
KING STREET	A305	34595	2432	7.0
UXBRIDGE ROAD	A312	20163	664	3.3
RICHMOND ROAD	A305	12182	1123	9.2
HAMPTON COURT ROAD	A308	39428	1824	4.6
	A308	24137	1274	5.3
HAMPTON COURT ROAD	A308	24137	1274	5.3
FERRY ROAD	A313	13906	745	5.4
HIGH STREET	A313	13906	745	5.4
HILL STREET	A305	19575	1617	8.3
ST MARGARET'S ROAD	A3004	21521	790	3.7
PARADISE ROAD	A307	14065	1465	10.4
RED LION STREET	A307	14065	1465	10.4
UPPER SUNBURY ROAD	A308	26887	1155	4.3

(Supplied by the GLA)

Appendix 3**Table 18** Part B processes in the London Borough of Richmond upon Thames area

Address	Location	Process	First authorised
Lance Owen 1/5 North Road Richmond Surrey	E519066 N175745	Waste oil burner	23-Sep-93
Kingwell Whitby & Mills 31 Winchester Road St Margarets Twickenham Surrey	E516649 N174374	Waste oil burner	19-Jul-94
Grimshaw & Wake Ltd. Oldfield Road Hampton Surrey	EP/M/93/02	Respraying of road vehicles	07-Oct-93
K J Garages Ltd. 56-58 Barnes High Street Barnes London SW13 9LF	E521729 N176467	Respraying of road vehicles	03-Nov-99
H & L Motors 70-72 Wellington Road Twickenham Middlesex TW2 5NX	E514729 N171809	Respraying of road vehicles	23-Jun-00
Hallite Polytek 130 Oldfield Road Hampton Middlesex	E512705 N169807	Rubber processes	02-Dec-93
Mortlake Crematorium Kew Meadow Path Richmond Surrey	E520006 N176272	Crematoria	01-Dec-92

Table 19 Authorised petrol stations in the London Borough of Richmond upon Thames area

1.	Shell Hospital Bridge Staines Road Twickenham Middlesex	E513925 N172429
2.	Esso Staines Road Service Station 110 Staines Road Twickenham Middlesex TW2 5AW	E514572 N172748
3.	Jet Service Station 208 Stanley Road Teddington Middlesex TW11 8UE	E515110 N171662
4.	BP Express Shopping Ltd. Beacon Filling Station Lower Mortlake Road Richmond TW9 2LL	E518974 n175708
5.	TOTAL Convenience Store Richmond 22-24 Popham Gardens Lower Richmond Road Richmond TW9 4LJ	E519311 N175743
6.	Tesco Express 59-167 Castelnau Barnes SW13 9EW	E522678 N177658
7.	Mortlake Service Station Texaco 16-26 Sheen Lane East Sheen SW14 5JG	E520480 N175689
8.	Sainsbury Service Station 303 Uxbridge Road Hampton Middlesex TW12 1AW	E512992 N171931
9.	Esso Palace Service Station The Green Hampton Court Road East Molesey KT8 9BW	E515095 N168909

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| 10. | Texaco
567 Upper Richmond Road West
East Sheen SW14 2SZ | E519715
N175312 |
| 11. | Black Horse Service Station
174-176 Sheen Road
Richmond
Surrey TW9 1XD | E518948
N175004 |
| 12. | Fina
Prospect Service Station
199 Lower Richmond Road
Richmond
Surrey TW9 4LN | E519673
N175813 |
| 13. | Hampton Hill Service Station
68-78 High Street
Hampton Hill
Middlesex TW12 1TY | E514403
N171020 |
| 14. | Ham Cross Service Station
297 Richmond Road
Kingston Upon Thames
Surrey KT2 5QU | E517746
N171521 |
| 15. | Shell Oak Lane
5-11 Richmond Road
Twickenham
Middlesex TW1 3AB | E516468
N173496 |
| 16. | Shell Service Station
220 Kingston Road
Teddington
Middlesex
TW11 9JF | E517007
N170395 |
| 17. | Sainsbury's Petrol Station
Manor Road
Richmond
Surrey | E519009
N175660 |