



# AIR QUALITY UPDATING AND SCREENING ASSESSMENT FOR THE BOROUGH OF WOKING

Environmental Health Service

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INVESTOR IN PEOPLE

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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 Council has previously undertaken the first round of review and assessment (R&A).

This report concerns the Updating and Screening Assessment under the second round of 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 (PM<sub>10</sub>). 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 advice given in the 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 the risk of the objectives for carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide being exceeded is not significant in the Council's area.

The updating and screening assessment for nitrogen dioxide and PM<sub>10</sub> (for 2010) has identified that the risk of the objectives being exceeded are significant. In accordance with the LAQM guidance the Council should therefore undertake a Detailed Assessment for nitrogen dioxide.

The Detailed Assessment for nitrogen dioxide should relate to Parvis Road in Byfleet.

*(Note – the new PM<sub>10</sub> objective for 2010 is not currently included within the Air Quality Regulations and therefore the Council need not undertake a detailed assessment for this pollutant at this time).*

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## Background

Woking Borough Council is sited in the centre of Surrey and located 25 miles south west of London. The Council's area extends from Byfleet in the east to Knaphill in the west. The population of the area is approximately 94,000 and the total area covered by the Council is 6,359 hectares, of which 60% is designated as Green Belt. The main employment in the area is service related, with the modern town of Woking being the main centre for employment.

The area is well served by rail links to the South West and London Waterloo. Heathrow and Gatwick airports are also readily accessible via road. The M25 runs through the eastern part of the Borough with the M3 and A3 just outside its area to the north and south respectively. Other major roads include the A245, A320, A3046 and A322.

## Progress with Local Air Quality Management (1997-2001)

As part of its Local Air Quality Management (LAQM) responsibilities, the Council has completed the first round review and assessment (R&A) of air quality (see the individual reports prepared between 1998 and 2001). These reports present a staged approach whereby the seven air pollutants in the Government's Air Quality Strategy (AQS) related to LAQM, were first assessed and screened as to their relative importance to air quality within the Council's area.

Five AQS pollutants (benzene, 1,3 butadiene, carbon monoxide, sulphur dioxide (SO<sub>2</sub>) and lead) were only considered at earliest stage of the review and assessment (Stage 1). The finding for all these pollutants was that none were found likely to lead to the air quality objectives being exceeded and therefore no further action was required in respect of these pollutants.

Particles (PM<sub>10</sub>) and nitrogen dioxide (NO<sub>2</sub>) were considered at Stages 2 and 3. The Stage 3 report was undertaken for NO<sub>2</sub> and PM<sub>10</sub> and it assessed air quality across the Council's area in accordance with Department for Environment, Food and Rural Affairs (DEFRA) guidance. The predictions in the Stage 3 report were that the statutory objectives for NO<sub>2</sub> and PM<sub>10</sub> would only be exceeded close to the M25 within the Council's area, however as there was no relevant exposure it was not necessary for the Council to designate an Air Quality Management Area (AQMA).

## Introduction to Updating Screening and Assessment

The government's 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). 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.

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 NO<sub>2</sub> and benzene and indicative limit values for PM<sub>10</sub> for 2010. In the case of NO<sub>2</sub> the 2010 limit values are the same as the 2005 objectives. This means that those areas that meet the 2005 objectives automatically meet the 2010 limit values. The guidance confirms that local authorities are not statutorily required to assess air quality against these, but it advises that it may be helpful to do so, to assist with longer term development planning.

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

The guidance requires a phased approach, requiring 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 phase 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                       |                        |
| <b>Benzene</b>                        | 16.25 µg/m <sup>3</sup> (5 ppb)  | Running Annual Mean               | 31 Dec 2003            |
|                                       | 5 µg/m <sup>3</sup>  | Annual Mean                       | 31 Dec 2010            |
| <b>1, 3 Butadiene</b>                 | 2.25 µg/m <sup>3</sup> (1 ppb)   | Running Annual Mean               | 31 Dec 2003            |
| <b>Carbon Monoxide</b>                | 10 mg/m <sup>3</sup>   | Daily Maximum Running 8 hour mean | 31 Dec 2003            |
| <b>Lead</b>                           | 0.5 µg/m <sup>3</sup>  | Annual Mean                       | 31 Dec 2003            |
|                                       | 0.25 µg/m <sup>3</sup>   | Annual Mean                       | 31 Dec 2008            |
| <b>Nitrogen Dioxide (provisional)</b> | 200 µg/m <sup>3</sup> (105 ppb) not to be exceeded more than 18 times a year | 1 hour mean                       | 31 Dec 2005            |
|                                       | 40 µg/m <sup>3</sup> (21 ppb)  | Annual Mean                       | 31 Dec 2005            |
| <b>Particles (PM<sub>10</sub>)</b>    | 50 µg/m <sup>3</sup> not to be exceeded more than 35 times a year            | 24 hour mean                      | 31 Dec 2004            |
|                                       | 40 µg/m <sup>3</sup>   | Annual Mean                       | 31 Dec 2004            |
| <b>Sulphur Dioxide</b>                | 350 µg/m <sup>3</sup> (132 ppb) not to be exceeded more than 24 times a year | 1 hour mean                       | 31 Dec 2004            |
|                                       | 125 µg/m <sup>3</sup> (47 ppb) not to be exceeded more than 3 times a year   | 24 hour mean                      | 31 Dec 2004            |
|                                       | 266 µg/m <sup>3</sup> (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  |                        |
| <b>Particles (PM<sub>10</sub>)<br/>(Except London given in brackets)</b> | 50 µg/m <sup>3</sup> not to be exceeded more than 7 (10) times a year | 24 hour mean | 31 Dec 2010            |
|  | 20 (23) µg/m <sup>3</sup>   | Annual Mean  | 31 Dec 2010            |

### Background Pollutant Concentrations

Background concentrations provide an understanding of the prevailing pollution in the absence of specific local emission sources. Mapping techniques based on the National Atmospheric Emission Inventory (NAEI) have been used to provide an understanding of future concentrations on a 1x1 km grid square for the U.K (see [www.airquality.co.uk/archive/laqm/tools.php](http://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. Interpolated background plots based on these data are given in the report for benzene (based on 2010), 1,3-butadiene (based on 2003) and PM<sub>10</sub> (based on 2010) for indicative purposes.

### 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 quality assurance and quality control (QA/QC) issues need to have been considered and the data produced also need to be properly validated and preferably ratified. The Council carries out diffusion tube monitoring for NO<sub>2</sub> and benzene. Monitoring is also undertaken in neighbouring Councils as part of 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.

### 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 (Integrated Pollution Prevention Control (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. TG03 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.

Updated lists of Part A/A2 and B processes (including petrol stations) of potential concern in Council's area are given in Appendix 3.

**Road Traffic**

Details of road traffic movements are required across the Council's area and Surrey County Council has provided the data as shown in Appendix 2.

To estimate the air quality impact in this step of R&A it is necessary to use the Design Manual for Roads and Bridges (DMRB) 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. Although DMRB is intended to provide conservative estimates, it can in some instances under predict concentrations. In these specific instances factors can be applied, as advised in TG03.

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## Carbon Monoxide

*The air quality objective for carbon monoxide (CO) has been tightened and is now 10mg/m<sup>3</sup> 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.*

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/m<sup>3</sup> at four urban background sites in 2001.

National modelling has further indicated that at the end of 2003, major roads will not exceed this objective.

No AQMAs were declared in the first round of R&A based on the previous objective of 11.6mg/ m<sup>3</sup>. Based on TG03, it is considered highly unlikely that any authority will be required to proceed beyond the updating and screening assessment.

### Carbon Monoxide – 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 R&A.

A checklist approach is used, based on: and 2).

#### *Monitoring data*

For monitoring data only, roadside data is required where there is public exposure. The data will be assumed to be applicable to 2003, and if the data indicates that the maximum daily running 8-hour concentration exceeds the objective, then the Council will be required to proceed to the Detailed Assessment stage.

#### *Data relating to very busy roads*

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/m<sup>3</sup>. 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 2mg/m<sup>3</sup> then it is necessary to proceed to the Detailed Assessment stage.

## Updating and Screening Assessment of Carbon Monoxide for the Woking B.C

The only sources screened at Stage 1 during the previous round of R&A were major roads in area. From this CO was found to pose a negligible risk in localities where there might be exposure and therefore further stages of R&A were not undertaken.

### A) *Monitoring*

No monitoring for CO is carried out across the Council's area. Monitoring of CO is undertaken nearby at the roadside sites on the London A3 site near Tolworth (part of the national network) and at Sutton 1 (operated as part of the LAQN by the London Borough of Sutton). The results for 2000 and 2001 for both sites indicate that 10mg/m<sup>3</sup> objective was met. The maximum 8 hour mean in 2000 was 7 mg/m<sup>3</sup> only at the A3 site. There was more than 90% data capture in 2000 and 2001 for the sites.

The above results confirm that current maximum daily running 8-hour concentrations are less than 10 mg/m<sup>3</sup> objective for representative sites near to Woking B.C. Hence concentrations are unlikely to exceed 10 mg/m<sup>3</sup> (running 8 hour mean) in any part of the Council's area.

### B) *Very busy roads/ junctions in built up areas*

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<sup>3</sup> (from the 2001 results). The estimated 2003 annual mean concentration can be determined from this figure and the expected reduction in future concentrations (from TG03). This is predicted as 0.35 mg/m<sup>3</sup>. It is thus less than the 1mg/m<sup>3</sup> concentration where further action is necessary.

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); dual carriageway exceeding 120,000vpd and motorways exceeding 140,000vpd (as classified by TG03). The only road/ junction of consequence from these criteria is the M25 motorway. However there is no relevant exposure within 10m of the kerb of this road and therefore no further assessment is required.

## Conclusion

The updating and screening assessment for carbon monoxide has identified there is no likely risk of the new objective being exceeded by 2003 anywhere in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for carbon monoxide.

## Benzene

*The air quality objective for benzene of  $16.25\mu\text{g}/\text{m}^3$  as a running annual mean to be achieved by the end of 2003 has been added to 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.*

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.

### Benzene - 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 R&A.

A checklist approach is used, based on:

#### *Monitoring data*

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 indicates that the objective is exceeded then the local authority will be required to proceed to the Detailed Assessment stage.

#### *Data relating to very busy roads*

This relates to 2010 only, where the 2010 annual mean background exceeds  $2\mu\text{g}/\text{m}^3$  and the annual average daily traffic flows exceed the stated flows (which are dependent on the type

of road). 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 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.

#### *Industrial sources/ petrol stations/ major fuel storage depots*

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.

For petrol stations it is necessary to identify petrol stations with a throughput of more than  $2000\text{m}^3$ , and with a road with more than 30000 vehicles per day nearby. If there is relevant exposure within 10m of the pumps it is necessary to proceed to a Detailed Assessment.

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.

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 Woking B.C**

No sources were identified as needing screening during the previous round of R&A and therefore benzene was found to pose a negligible risk in localities where there might be exposure, hence progression beyond Stage 1 R&A was not undertaken.

#### *A) Monitoring*

The Council undertakes benzene monitoring by diffusion tube at two representative locations in its area. The results are shown in Table 3 below. This monitoring indicates that annual mean levels in all areas are well below the 2003 objective. Concentrations have varied in recent years but remain less than  $3\mu\text{g}/\text{m}^3$  at both sites. As no continuous monitoring of benzene is undertaken nearby there has been no site co-location and no derivation of bias correction.

**Table 3** Results of benzene monitoring ( $\mu\text{g}/\text{m}^3$ ) in Woking (1999-2002)

| <b>Location</b> | <b>1999</b> | <b>2000</b> | <b>2001</b> | <b>2002</b> |
|-----------------|-------------|-------------|-------------|-------------|
| Sandy Lane      | 2.4         | 1.6         | 2.3         | 1.3         |

The results confirm that the current running annual mean concentrations are less than the 2003 objective of  $16.25\mu\text{g}/\text{m}^3$  and the 2010 objective of  $5\mu\text{g}/\text{m}^3$ .

Table 4 below provides an estimated annual average mean concentration for 2003 and 2010 for roadsides, based on the measured data above and using the correction factors from TG03. The estimates below are based on the concentration measured in 2001.

**Table 4** Estimated Benzene for 2003 – 2010 (using TG03 methodology) ( $\mu\text{g}/\text{m}^3$ )

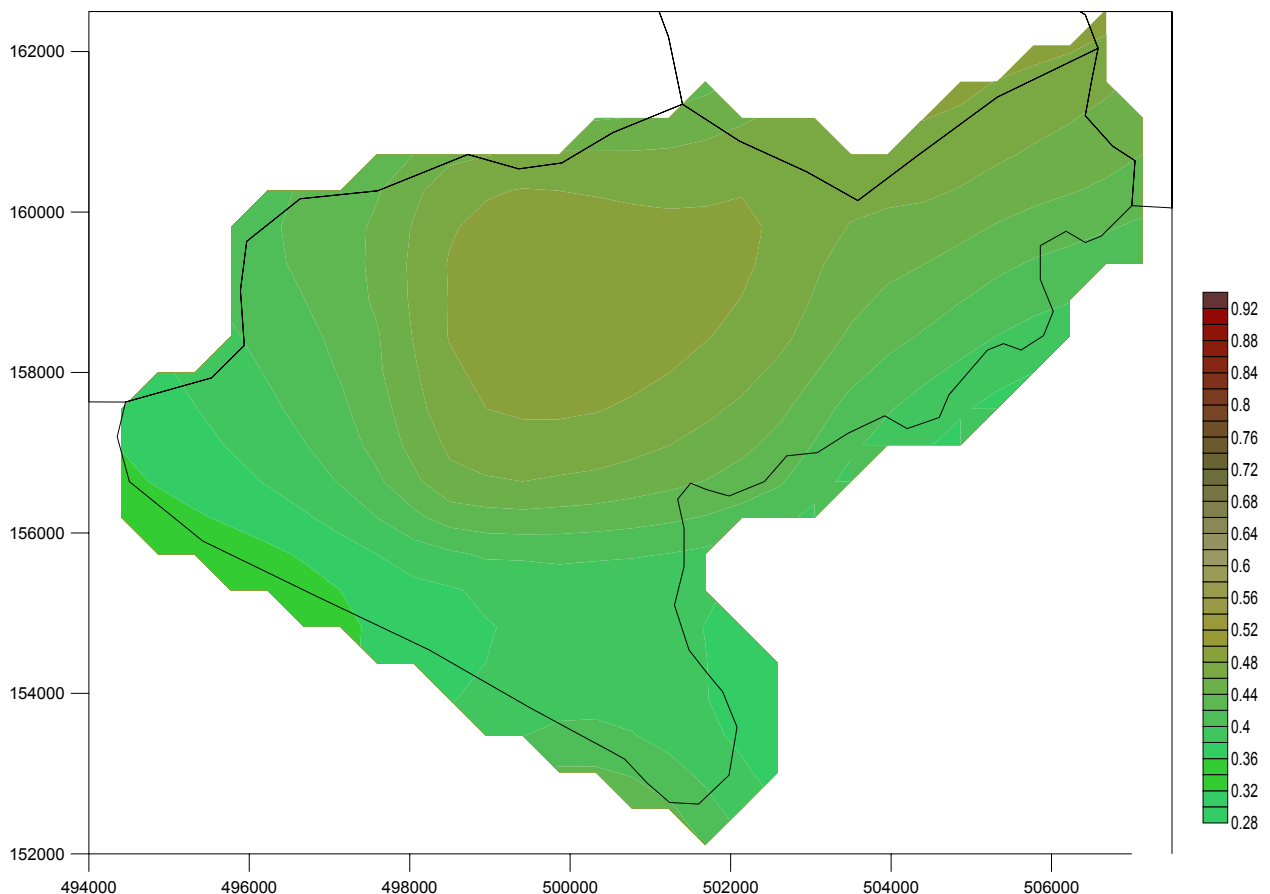
| Site       | 2003 | 2010 |
|------------|------|------|
| Sandy Lane | 2.01 | 1.52 |

The estimated 2003 and 2010 running annual mean concentrations are between 1.52 and 2.01  $\mu\text{g}/\text{m}^3$  being less than 16.25 and 5  $\mu\text{g}/\text{m}^3$  where further assessment of benzene is deemed necessary.

*B) Very busy roads/ junctions in built up areas*

The only “very busy” road/ junction in the Council’s area using TG03 guidance is the M25 motorway. However as stated earlier for carbon monoxide there is no relevant exposure within 10m of the motorway kerb. Furthermore the 2010 background from [www.airquality.co.uk/archive/laqm/tools.php](http://www.airquality.co.uk/archive/laqm/tools.php) is less than 2  $\mu\text{g}/\text{m}^3$  (see Figure 1), with the estimated background predictions vary between 0.28 and 0.5  $\mu\text{g}/\text{m}^3$  across the Council’s area. Hence using these criteria no further assessment is required.

**Figure 1** Interpolated benzene (annual mean concentration  $\mu\text{g}/\text{m}^3$ ) plot for Woking B.C (2010)



*C) Industrial sources*

There are no IPC/ IPPC petroleum, petrochemical, carbonisation processes within the Council's area.

The two Part A processes in the Council's area (see Table 21 in Appendix 3) were previously assessed as not being significant for the previous round of R&A. A re-examination of the Environment Agency's Pollution Inventory has confirmed that there are no releases of benzene from either of the Part A processes. In addition, no new sources or existing sources with significantly increased benzene emissions have been identified in neighbouring local authority areas.

There is also no Part B process for the storage and unloading of petrol at terminals in the Council's area.

*D) Petrol stations*

The list of authorised petrol stations is attached in Appendix 3; details on the exact throughput in terms of quantity of petrol are not available. However, based on a worst case assumption that all are greater than 2000m<sup>3</sup>, it is necessary to identify whether the petrol stations are close to a busy road with more than 30,000vpd. From Appendix 2 the only applicable road is Maybury Hill and there is no relevant exposure within 10m of the petrol pumps at the site.

*E) 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 identified there is no likely risk of the objectives being exceeded by 2003 and 2010 anywhere in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for benzene.

## 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.*

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 R&A.

A checklist approach is used, based on:

#### *Monitoring data*

For monitoring the data should be prioritised and for locations near industrial sites monitoring down wind from the site is recommended. If the data indicates 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).

#### *New industrial sources*

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.

#### *Existing industrial sources with significantly increased emissions*

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

## Updating and Screening Assessment of 1,3-Butadiene for the Woking B.C

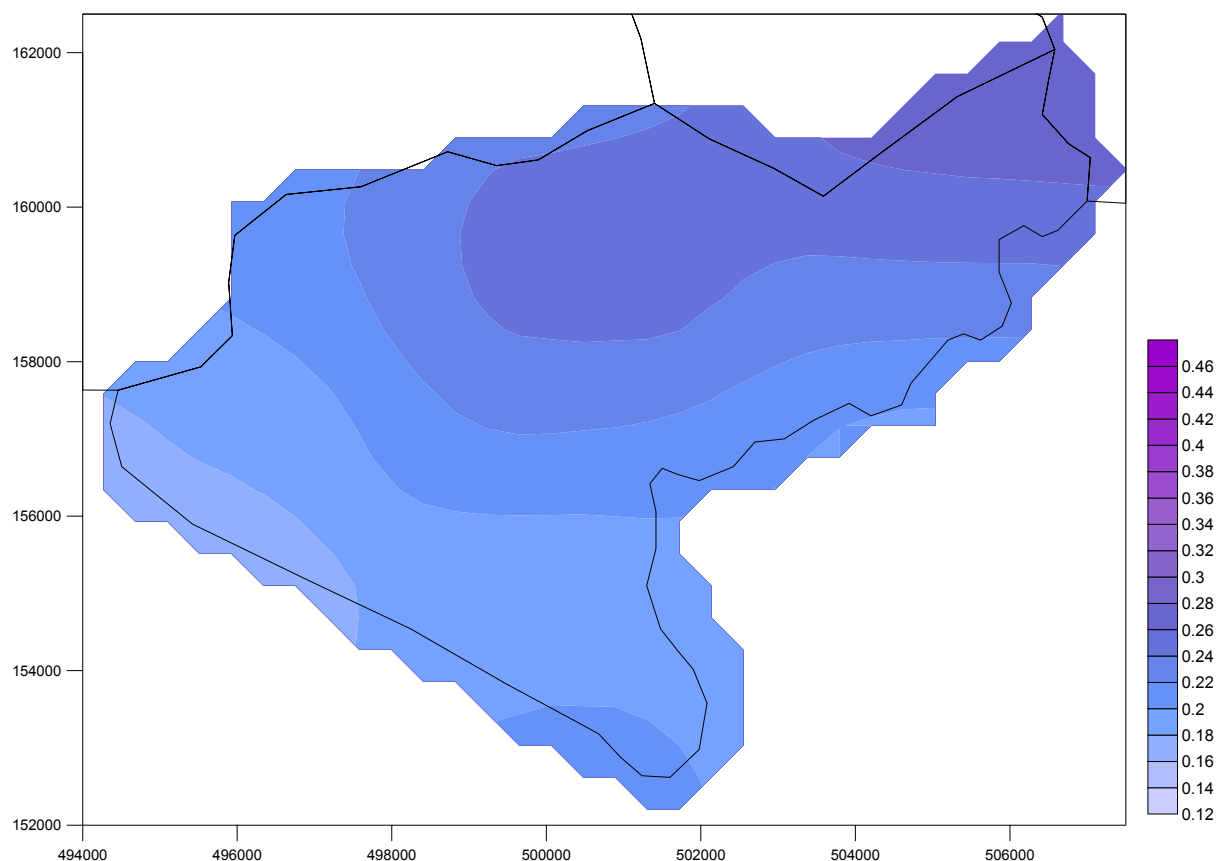
No sources were identified as needing screening during the previous round of R&A. Thus 1,3-butadiene was found to pose a negligible risk in localities where there might be exposure, and progression beyond the Stage 1 R&A was not undertaken.

### A) Monitoring

The Council has undertaken no specific monitoring of 1,3-butadiene since the last round of review and assessment. No monitoring is undertaken nearby, although some monitoring is undertaken in 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. Both of these results are less than the 2003 objective.

The 2003 background from the [www.airquality.co.uk/archive/laqm/tools.php](http://www.airquality.co.uk/archive/laqm/tools.php) site also confirms that 2003 background is less than 2  $\mu\text{g}/\text{m}^3$  (see Figure 2). The estimated background predictions vary between 0.16 and 0.28  $\mu\text{g}/\text{m}^3$  across the Council's area.

**Figure 2** Interpolated 1,3-butadiene (annual mean concentration  $\mu\text{g}/\text{m}^3$ ) plot for Woking B.C (2003)



*B) 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 and neighbouring local authority areas since the last round of R&A.

**Conclusion**

The updating and screening assessment for 1,3-butadiene has identified there is no likely risk of the objective being exceeded by 2003 anywhere in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for 1,3-butadiene.

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## 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.*

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.

Recent results of lead in air monitoring indicate that at all background and kerbside UK national network sites were significantly below the 2004 and 2008 objectives during the period between 1999 and 2001 (from TG03).

Further assessments 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 a second site the result was exceeded at 2 locations in 1999, one for the  $0.5\mu\text{g}/\text{m}^3$  objective and the other of  $0.25\mu\text{g}/\text{m}^3$ . Concentrations at this site have since dropped markedly. Thus the monitoring results generally indicated 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.

### Lead - 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:

#### *Monitoring data*

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 indicates 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).

#### *New industrial sources*

For new industrial processes listed in the guidance it is likely that an air quality assessment will be 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.

*Existing industrial sources with significantly increased emissions*

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

**Updating and Screening Assessment of Lead for the Woking B.C**

No sources were identified in the first round of R&A in the Council's area, thus lead was found to pose a negligible risk in localities where there might be exposure and a Stage 2 R&A was therefore not undertaken.

*A) Monitoring*

The Council has undertaken no specific monitoring of lead since the last round of R&A.

*B) Industrial sources*

There are no new IPC/ Part B/ A2 processes or existing processes with substantially increased emissions of lead within the Council's area since the last round of R&A.

No new sources or existing sources with significantly increased lead emissions have been identified in neighbouring local authority areas.

**Conclusion**

The updating and screening assessment for lead has identified there is no likely risk of the objectives being exceeded by 2004 and 2008 anywhere in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for lead.

## Nitrogen Dioxide

*The current air quality objectives for nitrogen dioxide are 40  $\mu\text{g}/\text{m}^3$  as an annual mean concentration to be achieved by the end of 2005, and a one hour mean concentration of 200  $\mu\text{g}/\text{m}^3$  not be exceeded more than 18 times per year. The objectives are to be achieved by the end of 2005.*

Nitrogen dioxide ( $\text{NO}_2$ ) and nitric oxide (NO) are both oxides of nitrogen, and are collectively referred to as nitrogen oxides ( $\text{NO}_x$ ). All combustion processes produce  $\text{NO}_x$  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.

### Nitrogen Dioxide - 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 R&A.

A checklist approach is used for the updating and screening assessment, based on:

#### *Monitoring data*

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 indicates that the concentration exceeds the objective then the local authority will be required to proceed to the Detailed Assessment stage.

### *Roads including narrow congested streets and junctions*

These sections focus on specific examples that may not have been fully considered in the first round of review and assessment. This 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.

### *Bus stations*

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.

### *New industrial sources and existing ones with significantly increased emissions*

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%).

### *Aircraft*

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 Woking B.C**

The main sources in the Council's area from the previous round of R&A were road transport sources and those examined are listed in Appendix 2 with the most recent traffic counts. The Council undertook a Stage 3 R&A and although areas were identified where the annual mean objective would be exceeded there was no relevant exposure and therefore the first round R&A ended at this stage.

### *A) Monitoring*

The Council did not declare an AQMA and therefore the results below refer to monitoring outside an AQMA. The results given in the Table 5 below represent the most recent years (i.e. from 1999 to 2002) for the sites monitored in the Council's area. Most of the sites represent locations relevant for public exposure. The most notable exception to this is the Parvis Road (M25 bridge) diffusion tube, which is located in the middle of a bridge over the M25 (this site has been italicised in Table 5 below).

The monitoring is undertaken by diffusion tube, with the analysis undertaken by Lambeth Scientific Services. The method of preparation is 50% TEA in acetone. Other Surrey local authorities use the same analysts and method of preparation. The Council does not operate a continuous analyser and therefore a co-location study has not been undertaken to determine a specific local bias adjustment factor to determine whether the diffusion tubes are under or over reading. The Elmbridge Borough Council is currently undertaking a co-location study with their continuous analyser but the results from this are not available yet. A default bias adjustment factor of 1.06 has therefore been applied in this instance (as derived by Laxen et al. (IAPSC paper 2002)). This indicates that the tubes underestimate concentrations by approximately 6%.

**Table 5** NO<sub>2</sub> monitoring in Woking B.C area (1999 – 2002) (µg/m<sup>3</sup>)

| Location                                    | Type         | 1999        | 2000        | 2001        | 2002        |
|---|--------------|-------------|-------------|-------------|-------------|
| Cotteridge 1, Constitution Hill, Woking     | k            | 34.4        | 30.4        | 38.5        | 48.1        |
| Cotteridge 2, Guildford Rd, Woking          | k            | 54.7        | 44.5        | 34.4        | 30.2        |
| <i>Parvis Rd (sited on bridge over M25)</i> | <i>Other</i> | <i>72.9</i> | <i>50.6</i> | <i>40.5</i> | <i>58.3</i> |
| Church Rd, Byfleet                          | b            | 40.5        | 32.4        | 26.3        | 30.4        |
| Roseberry Crescent, Old Woking              | k            | 24.3        | 22.3        | 22.3        | 20.6        |
| Anchor Hill, Knaphill                       | k            | 52.6        | 36.4        | 42.5        | 37.8        |
| Lincoln Drive, Pyrford                      | k            | 32.4        | 28.3        | 22.3        | 22.6        |
| Victoria Way, Woking                        | k            | 56.7        | 40.5        | 46.6        | 43.4        |
| Bittern Drive, Goldsworth Park              | b            | 28.3        | 22.3        | 24.3        | 18.9        |
| Bagshot Rd, Brookwood                       | k            | 40.5        | 36.4        | 30.4        | 29.2        |
| Parvis Rd, Byfleet                          | r            | 60.7        | 54.7        | 56.7        | 55.0        |
| Woodham Lane, Woking                        | k            | 48.6        | 36.4        | 38.5        | 33.7        |
| Goldsworth Rd, Woking                       | k            | n.o         | 32.4        | 32.4        | 37.5        |
| Monument Rd, Maybury                        | k            | n.o         | 38.5        | 42.5        | 37.5        |

(n.o indicates not in operation, italics indicate site does not have relevant exposure)  
(k: indicates kerbside, b: background, r: roadside)

The monitoring results from two background sites (Church Road, Byfleet and Bittern Drive, Goldsworth Park) since 2000 have been consistently below the annual mean objective.

The results for the kerbside sites at Goldsworth Road, Woking; Roseberry Crescent, Old Woking; Lincoln Drive, Pyrford; Woodham Lane, Woking and Bagshot Road, Brookwood are also consistently below the annual mean objective for the years 2000 to 2002.

The Parvis Road (Byfleet) and Victoria Way (Woking) kerbside site are the only locations monitored where the annual mean results have been consistently greater than the 40 µg/m<sup>3</sup> standard for all the years 1999 to 2002.

The other sites monitored all have years where the objective has been exceeded these include: the kerbside site at Constitution Hill, Woking (exceeded in 2002 only); Anchor Hill, Knaphill (1999 and 2001); Monument Road, Maybury (2001 only) and Guildford Road, Woking (1999 and 2000). In recent years most of the monitoring results for these sites indicates that concentrations have dropped below the objective.

The Parvis Road site over the M25 has recorded exceedences for all years other than 2001, however as referred to earlier this site does not represent relevant exposure.

An estimated future concentration for the roadside site (based on 2001 results only) has been derived using TG03 correction factors; the result is given in Table 6.

**Table 6** Estimated NO<sub>2</sub> for 2005 (using TG03 methodology) (µg/m<sup>3</sup>)

| Location             | 2005 |
|----------------------|------|
| Parvis Rd, Byfleet   | 50.6 |
| Victoria Way, Woking | 41.5 |

This indicates that these sites will exceed the 2005 objective and need to be investigated further by the Council in a Detailed Assessment. Closer examination of the monitoring locations revealed that these two sites are not fully representative of relevant exposure (see maps of the two sites in Appendix 1). To further investigate the sites a DMRB assessment was undertaken in the next section.

Although the Council has not carried out any continuous monitoring in its area, there are continuous sites in neighbouring authorities that can be used for indicative purposes. The most recent results for 1999-2001 from these sites confirm that the background and suburban sites did not exceed the objective (see Table 7 below). The roadside site however on the busy A3 (in North Surbiton) failed to meet the annual mean NO<sub>2</sub> objective. (The data capture rate for these all nearby sites are given in Table 19 of Appendix 1).

**Table 7** NO<sub>2</sub> monitoring in neighbouring areas (2001) (µg/m<sup>3</sup>)

| Site          | Type             | 1999 | 2000 | 2001 |
|---------------|------------------|------|------|------|
| A3            | Roadside         | 59   | 55   | 53   |
| Mole Valley 2 | Suburban         | 29   | 27   | 28   |
| Teddington    | Urban Background | 33   | 29   | 29   |

*B) 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 details of the traffic flows used for this updating and screening assessment are given in Appendix 2.

An examination of the Council's roads has been made to identify those roads which are less than 10m wide, with residential properties within 5m of the kerb, daily flows of more than 10,000vpd and with average speed of 50kph or less. These roads are defined as narrow congested streets using the TG03 guidance. This re-assessment has confirmed that there are no such roads within the Council's area.

An examination to identify busy junctions within the Council's area (i.e. roads with combined flows greater than 10000vpd and where there is relevant exposure within 10m) has found only one junction. The junction identified as meeting these criteria is the junction of

Maybury Road and Monument Road in Maybury. A DMRB assessment was undertaken for this junction at a receptor location on the west side of the junction. The junction is a T-junction and the result of the assessment are given in following table:

**Table 8** Results of DMRB assessment of a busy junction for NO<sub>2</sub> (2005)

| Road                               | Annual mean $\mu\text{g}/\text{m}^3$ |
|------------------------------------|--------------------------------------|
| Junction Maybury Rd/ Monument Road | 39.6                                 |

The above result indicates that the annual mean objective will not be exceeded at this location. This assessment based on TG03 guidance has combined the traffic flows for the two roads to provide a precautionary estimate. The recent diffusion tube results given earlier also confirm that this road did not exceed the objective.

An assessment has been made of busy streets in the Council's area i.e. where people may regularly spend more than one hour. The busiest road based on the traffic information obtained and where there may be likely exposure is the High Street in Woking. The DMRB assessment is for the annual mean concentration. TG03 advises that if the annual mean objective is not exceeded then the one-hour mean objective should also not be exceeded.

**Table 9** Results of DMRB assessment of a busy street for NO<sub>2</sub> (2005)

| Road                | Annual mean $\mu\text{g}/\text{m}^3$ |
|---------------------|--------------------------------------|
| High Street, Woking | 33.4                                 |

This assessment confirms that the concentration of NO<sub>2</sub> is not predicted to exceed the annual mean objective and therefore the one-hour mean is not likely to be exceeded at this site.

A comparison of forecast 2006 traffic data with traffic data from 1999, also supplied by SCC, has confirmed that the only road with a traffic flow has increased by more than 25% that is significant is the A324 Connaught Road, with an almost 31% increase in traffic flow. A DMRB assessment has therefore been undertaken and the result for this is given in the following table:

**Table 10** Results of DMRB assessment of a street with more than 25% increased traffic for NO<sub>2</sub> (2005)

| Road                | Annual mean $\mu\text{g}/\text{m}^3$ |
|---------------------|--------------------------------------|
| Connaught Road A324 | 29.3                                 |

A re-assessment using DMRB of that road has confirmed the annual mean objective will not be exceeded at this location.

A number of roads were close to the objective in Stage 3 of the previous R&A and these roads have been re-assessed using DMRB and the traffic information in Appendix 2. The results of the DMRB assessment incorporating new emission factors confirm that the roads are not predicted to exceed the annual mean NO<sub>2</sub> objective (see Table 12 below).

**Table 11** DMRB NO<sub>2</sub> (µg/m<sup>3</sup>) prediction for roads in Woking B.C for 2005

| Road | Road name       | Annual mean µg/m <sup>3</sup> |
|------|-----------------|-------------------------------|
| A247 | Kingfield Road  | 35.3                          |
| A320 | Guildford Road  | 34.9                          |
| A324 | Lockfield Drive | 33.6                          |
| C144 | Maybury Hill    | 35.7                          |
| M25  | J10-11          | 31.9                          |
| A247 | Wych Hill Lane  | 36.7                          |

No roads were identified from the traffic information obtained as having less than 20000vpd and a proportion of greater than 25% HGVs.

No 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.

For the two diffusion tubes at Parvis Road in Byfleet and Victoria Way in Woking, traffic details and predicted background concentrations for both 2001 and 2005 were obtained. The following table gives DMRB predictions for both 2001 and 2005 at the diffusion tube locations, plus the 2005 prediction at the nearest façade (representing relevant exposure) closest to each diffusion tube location. Maps of the locations are given Appendix 1.

**Table 12** DMRB assessment for Parvis Road and Victoria Way

| Road         | Receptor       | Distance (m) | Year | NO <sub>2</sub> prediction |
|--------------|----------------|--------------|------|----------------------------|
| Parvis Road  | D/T site       | 7.7          | 2001 | 51.1                       |
| Parvis Road  | D/T site       | 7.7          | 2005 | 43.8                       |
| Parvis Road  | Nearest façade | 12.2         | 2005 | 42.7                       |
| Victoria Way | D/T site       | 15.7         | 2001 | 40.0                       |
| Victoria Way | D/T site       | 15.7         | 2005 | 34.6                       |
| Victoria Way | Nearest façade | 18.2         | 2005 | 34.2                       |

For the 2001 predictions, DMRB under predicts compared to the diffusion tube results. The results for both sites indicate a large drop between 2001 and 2005. The 2005 DMRB prediction for Victoria Way indicates that the objective will be met at the nearest façade. The prediction for Parvis Road indicates that the objective will be exceeded and thus a Detailed Assessment is required for this road link only.

### C) *Bus stations*

The main terminus for buses in the Council's area is located along The Broadway next to Woking railway station. The number of buses estimated to operate from there, based on the scheduled timetable, is less than 300 buses each day. Thus the numbers of buses do not meet the TG03 criteria of 1000 per day and therefore no further assessment need be made.

*D) Industrial sources*

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

*E) Aircraft*

There is not an airport within the Council's area and therefore no assessment need be made.

**Conclusion**

The updating and screening assessment for nitrogen dioxide has identified a risk of the objectives being exceeded by 2005 in the Council's area, in relation to the Council's monitoring data for Parvis Road in Byfleet.

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## Sulphur Dioxide

*The current air quality objectives for sulphur dioxide are a 15 mean concentration of 266  $\mu\text{g}/\text{m}^3$  not 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 be exceeded more than 24 times per year and a 24 hour mean concentration of 125  $\mu\text{g}/\text{m}^3$  not 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.*

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 sulphur dioxide.

A small number of AQMAs were declared during the first round of R&A. These relate to a number of coal-fired boilers, domestic coal burning and shipping at a major port.

### Sulphur Dioxide - 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 R&A.

A checklist approach is used, based on:

#### *Monitoring data*

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 indicates that the concentration exceeds the objective then the local authority will be required to proceed to the Detailed Assessment stage.

#### *New industrial sources and existing ones with significantly increased emissions*

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%).

### *Areas of domestic coal burning*

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.

### *Boilers burning coal or oil*

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.

### *Railway locomotives*

Both diesel and coal fired locomotives emit sulphur dioxide 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 Woking B.C**

The main sources examined during the previous round of R&A were the large commercial boilers in the Council's area. No Part A processes in the area and no Part B process was identified as a significant emission source of SO<sub>2</sub>. Furthermore no boilers were identified as needing screening, similarly domestic solid fuel burning and other transport sources were also examined but found not need further screening. The assessment of sulphur dioxide therefore ended at the Stage 1 R&A.

### *A) Monitoring*

Continuous monitoring of SO<sub>2</sub> is not undertaken by the Council, but is undertaken in neighbouring areas including Sutton 1 (part of the LAQN) and Teddington (an urban site part of the national network). The data capture for the both sites was 97%. The 2001 results for these sites confirm that there were no occurrences when the SO<sub>2</sub> standards were exceeded and thus the SO<sub>2</sub> objectives were met.

### *B) 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.

### *C) Domestic sources*

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

*D) Boilers*

The Council undertook an assessment of large institutions in the previous round of R&A where there may be boilers greater than 5MW(thermal) operating. No specific boilers were identified. No additional boilers have been identified in the updating and screening assessment.

*E) 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 identified there is no likely risk of the objectives being exceeded by 2004 and 2005 anywhere in the Council's area. The Council need not therefore proceed beyond this updating and screening assessment for sulphur dioxide.

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## Particles (PM<sub>10</sub>)

*The current air quality objectives for PM<sub>10</sub> are an annual mean concentration of 40 µg/m<sup>3</sup> and a 24 hour mean concentration of 50 µg/m<sup>3</sup> 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. They are an annual mean concentration of 20 µg/m<sup>3</sup> and a 24 hour mean concentration of 50 µg/m<sup>3</sup> not to be exceeded more than 7 times per year. The government has adopted these as provisional objectives, although it has not brought them into regulation for the purposes of LAQM. 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.*

There is a wide range of emission sources that contribute to PM<sub>10</sub> 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 SO<sub>2</sub> and NO<sub>x</sub> 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 PM<sub>10</sub> 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 PM<sub>10</sub> 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.

### **PM<sub>10</sub> - 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 R&A.

A checklist approach is used, based on:

#### *Monitoring data*

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 indicates that the concentration exceeds the 24-hour objective then the local authority will be required to proceed to the Detailed Assessment stage.

#### *Roads including junctions and new roads*

These sections focus on specific examples that may not have been fully considered in the first round of review and assessment. This relates 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 of 50 µg/m<sup>3</sup> 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.

#### *New industrial sources and existing ones with significantly increased emissions*

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%).

#### *Areas of domestic coal burning*

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.

*Quarries, landfill sites, opencast coal, handling of dusty cargoes at ports, etc*

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.

*Aircraft*

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 PM<sub>10</sub> for the Woking B.C**

The main sources examined during the previous round of R&A were road transport sources and these are listed in (Appendix 2).

*A) Monitoring*

The Council does not undertake continuous monitoring in its area, however the following table provides results for the period 1999 – 2001 for representative sites in neighbouring Council areas. The sites all use Tapered Element Oscillating Microbalance (TEOM) instruments for monitoring PM<sub>10</sub>. (Note - PM<sub>10</sub> monitoring is fundamentally different from gaseous monitoring and the methods are generally less accurate as a result. The AQS objective is based on measurements made by gravimetric samplers operated to a specified quality assurance procedure. TEOM instruments are considered suitable for Detailed Assessments, although the results need to be presented as a gravimetric equivalent, i.e. the TEOM result times 1.3). The data capture rates are given in Table 20 in Appendix 1.

The results confirm that the 2004 annual mean objective is being met, with the number of days exceeding the 24-hour mean standard not greater than 35 times in a year.

**Table 13** PM<sub>10</sub> monitoring at sites in neighbouring areas (1999 – 2002) (µg/m<sup>3</sup>)

| Site          | Type       | 1999<br>Days> 50<br>µg/m <sup>3</sup> | 1999<br>Annual<br>mean | 2000<br>Days> 50<br>µg/m <sup>3</sup> | 2000<br>Annual<br>mean | 2001<br>Days> 50<br>µg/m <sup>3</sup> | 2001<br>Annual<br>mean |
|---------------|------------|---------------------------------------|------------------------|---------------------------------------|------------------------|---------------------------------------|------------------------|
| A3            | Roadside   | 22                                    | 29                     | 16                                    | 26                     | 15                                    | 27                     |
| Mole Valley 2 | Suburban   | 1                                     | 22                     | 3                                     | 21                     | 5                                     | 22                     |
| Heathrow      | Urban      | na                                    | na                     | 14                                    | 28                     | 21                                    | 29                     |
|               | Background |                                       |                        |                                       |                        |                                       |                        |
| Sutton 1      | Roadside   | 4                                     | 25                     | 10                                    | 25                     | 12                                    | 26                     |

An estimated concentration for the monitoring sites has been derived using TG03 methodology; the results are given in the following table.

**Table 14** Estimated PM<sub>10</sub> daily means greater than 50 µg/m<sup>3</sup> for 2004 (using TG03)

| <b>2004</b>   | <b>No. of days &gt; 50ug/m<sup>3</sup></b> |
|---------------|--|
| Heathrow      | 20   |
| A3            | 15   |
| Mole Valley 2 | 5  |
| Sutton 1      | 13   |

These results in Table 14 are based on a relationship for the years 1997-2001 and thus do not represent worst-case meteorology. These estimates also do not indicate an exceedence of the 2004 objective.

The details of the estimated PM<sub>10</sub> concentrations in 2010 are given in the following table:

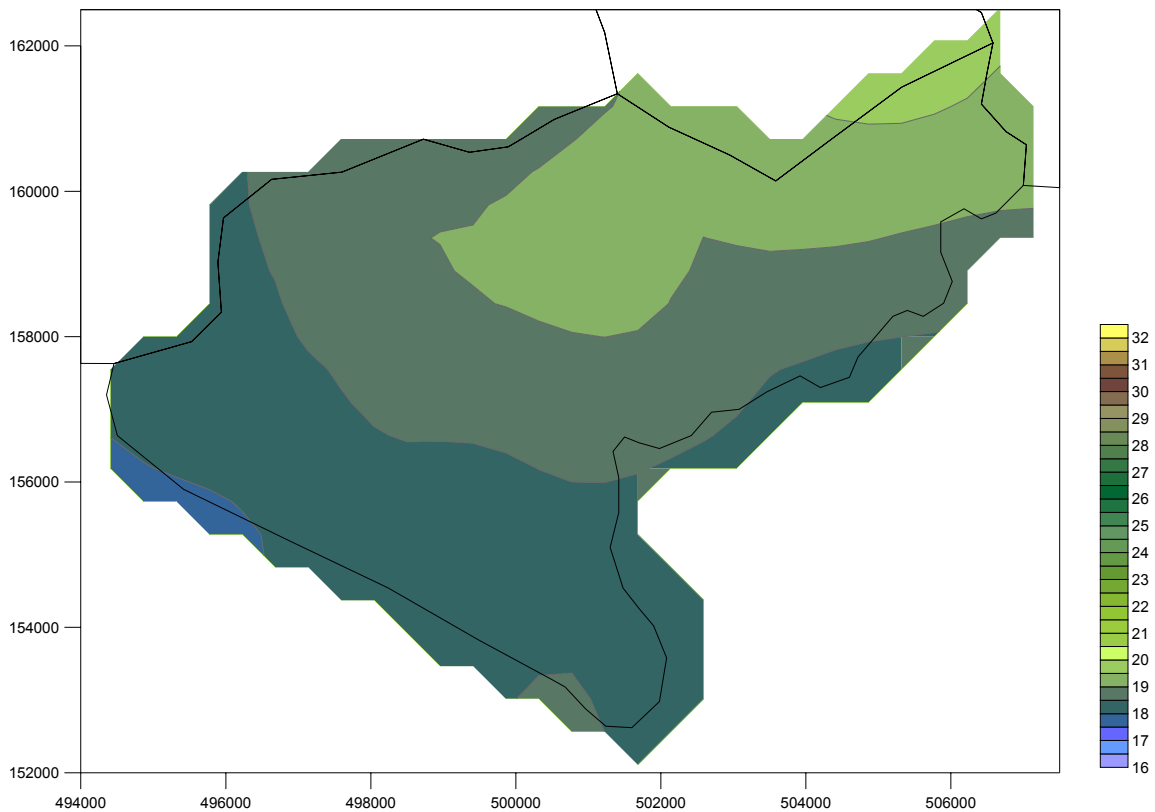
**Table 15** Estimated PM<sub>10</sub> concentrations in 2010 (using TG03 methodology)

| <b>2010</b>   | <b>Annual mean µg/m<sup>3</sup></b> |
|---------------|-------------------------------------|
| Heathrow      | 25.4                                |
| A3            | 23.8                                |
| Mole Valley 2 | 19.7                                |
| Sutton 1      | 23.0                                |

The estimate from the above sites indicates that the 2010 annual mean objective is likely to be either approached or exceeded at similar background and roadside locations in the Council's area.

Figure 3 is a plot of the Council's area, based on an interpolation of the national projections (from the [www.airquality.co.uk/archive/laqm/tools.php](http://www.airquality.co.uk/archive/laqm/tools.php) site) for the predicted annual mean concentrations in 2010. The estimated background predictions vary between 18 and 20 µg/m<sup>3</sup>, with the highest concentrations in the northern tip of the Council's area. Care however is needed with this interpretation as the map of background concentrations has been calculated for the whole of the UK at a 1 km x 1 km square resolution. It therefore does not represent locations (and emissions) other than on a general scale.

**Figure 3** Interpolated 2010 PM<sub>10</sub> (annual mean concentration  $\mu\text{g}/\text{m}^3$ ) plot for Woking



*B) Roads*

Details of the traffic flows for roads in the Council’s area are given in Appendix 2.

An assessment incorporating the effects at junctions where there is exposure within 10m of the kerb has been undertaken using DMRB. Following TG03 methodology flows at junctions have been added. The results indicate that the daily mean objective will be met (see Table 16 below):

**Table 16** DMRB predictions for assessing road junctions (2004)

| Road Junction                  | Annual mean $\mu\text{g}/\text{m}^3$ | Days > 50 $\mu\text{g}/\text{m}^3$ |
|--------------------------------|--------------------------------------|------------------------------------|
| Maybury Road/<br>Monument Road | 27.5                                 | 19                                 |

The A324 Connaught Road, with an almost 31% increase in traffic flow is the only road identified where the traffic count flow has increased by more than 25% (based on 1999 and 2006). This road has been assessed using DMRB and the results are given below:

**Table 17** Results of DMRB assessment of a street with more than 25% increased traffic for PM<sub>10</sub> (2004)

| Road name           | Annual mean $\mu\text{g}/\text{m}^3$ | Days>50 $\mu\text{g}/\text{m}^3$ |
|---------------------|--------------------------------------|----------------------------------|
| Connaught Road A324 | 22.6                                 | 7.3                              |

This re-assessment has confirmed the daily mean and annual mean objectives will not be exceeded at this location.

The road assessed identified as being closest to the objective during the first round R&A have been re-assessed using DMRB. The results confirm that the roads are not predicted to exceed the 2004 PM<sub>10</sub> objectives

**Table 18** DMRB 2004 PM<sub>10</sub> prediction for roads in Woking B.C area

| Road | Road name       | Annual mean $\mu\text{g}/\text{m}^3$ | Days>50 $\mu\text{g}/\text{m}^3$ |
|------|-----------------|--------------------------------------|----------------------------------|
| A245 | Parvis Road     | 26.3                                 | 15.7                             |
| A247 | Kingfield Road  | 25.0                                 | 12.4                             |
| A320 | Victoria Way    | 25.2                                 | 12.9                             |
| A320 | Guildford Road  | 24.5                                 | 11.2                             |
| A324 | Lockfield Drive | 24.7                                 | 11.7                             |
| C143 | Maybury Road    | 25.2                                 | 12.9                             |
| C144 | Maybury Hill    | 26.2                                 | 15.4                             |
| M25  | J10-11          | 22.0                                 | 6.3                              |
| A247 | Wych Hill Lane  | 26.9                                 | 17.4                             |

No roads were identified from the traffic information obtained as having a proportion of greater than 20% HGVs.

No 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.

#### C) *Industrial sources*

No new relevant processes have started in 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 PM<sub>10</sub> within the Council's or neighbouring local authority areas since the last round of review and assessment.

#### D) *Domestic sources*

From local knowledge and professional judgement, significant domestic burning of solid fuels is not undertaken across the Council's area.

#### E) *Quarries/ landfill sites/ handling of dusty cargoes, etc*

There are no licensed landfill sites or quarries within the Council's area.

*F) 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 PM<sub>10</sub> has identified there is unlikely to be 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.

## 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, 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 nitrogen dioxide and PM<sub>10</sub> (for 2010) will be exceeded at locations with relevant public exposure. The TG03 guidance advises that a Detailed Assessment against these objectives is required to determine with reasonable certainty whether or not there is a likelihood of the objectives not being achieved

The Council is recommended to undertake the following actions, in respect of the findings relating to annual mean nitrogen dioxide and PM<sub>10</sub>:

1. Undertake consultation on the findings arising from this report with the statutory and other consultees as required.
2. Undertake a Detailed Assessment against the nitrogen dioxide objective for the identified locations at Parvis Road in Byfleet to determine with reasonable certainty whether or not there is a likelihood of the objectives not being achieved.
3. The Council are not required to undertake a detailed assessment for PM<sub>10</sub> at this stage. 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 2004 and 2005, prior to undertaking the next updating and screening assessment by the end of April 2006.

## References

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DEFRA, 2003. Air Quality Strategy Addendum for England, Scotland, Wales and Northern Ireland. DEFRA, London.

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Woking Borough Council, 2001. Air Quality Review and Assessment for the Borough of Woking.

London Air Quality Network Annual Reports 1997 – 2000.

## Glossary

|                   |   |
|-------------------|---|
| AADT              | Annual Average Daily Traffic (vehicles per day)     |
| APEG              | Airborne Particles Expert Group                     |
| AQMA              | Air Quality Management Area                         |
| 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                                |
| LAQM              | Local Air Quality Management                        |
| mg/m <sup>3</sup> | Milligrams of the pollutant per cubic metre of air  |
| µg/m <sup>3</sup> | Micrograms of the pollutant per cubic metre of air  |
| ppb               | Parts per billion                                   |
| ppm               | Parts per million                                   |
| NAEI              | National Atmospheric Emissions Inventory            |
| AQS               | Air Quality Strategy                                |
| NO                | Nitric oxide  |
| NO <sub>2</sub>   | Nitrogen dioxide                                    |
| PM <sub>10</sub>  | Particles with diameter less than 10µm              |
| QA/QC             | Quality Assurance / Quality Control                 |
| R&A               | Review and Assessment                               |
| SO <sub>2</sub>   | Sulphur dioxide                                     |
| TEOM              | Tapered Element Oscillating Microbalance            |
| USA               | Updating and Screening Assessment                   |
| DEFRA             | Department for Environment Food and Rural Affairs   |

## Appendix 1

**Table 19** Data capture rates (%) for the NO<sub>2</sub> continuous monitoring sites (1999-2001)

| Data capture  | 2001 | 2000 | 1999 |
|---------------|------|------|------|
| A3            | 97   | 96   | 99   |
| Mole Valley 2 | 98   | 97   | 95   |
| Teddington    | 94   | 98   | 99   |

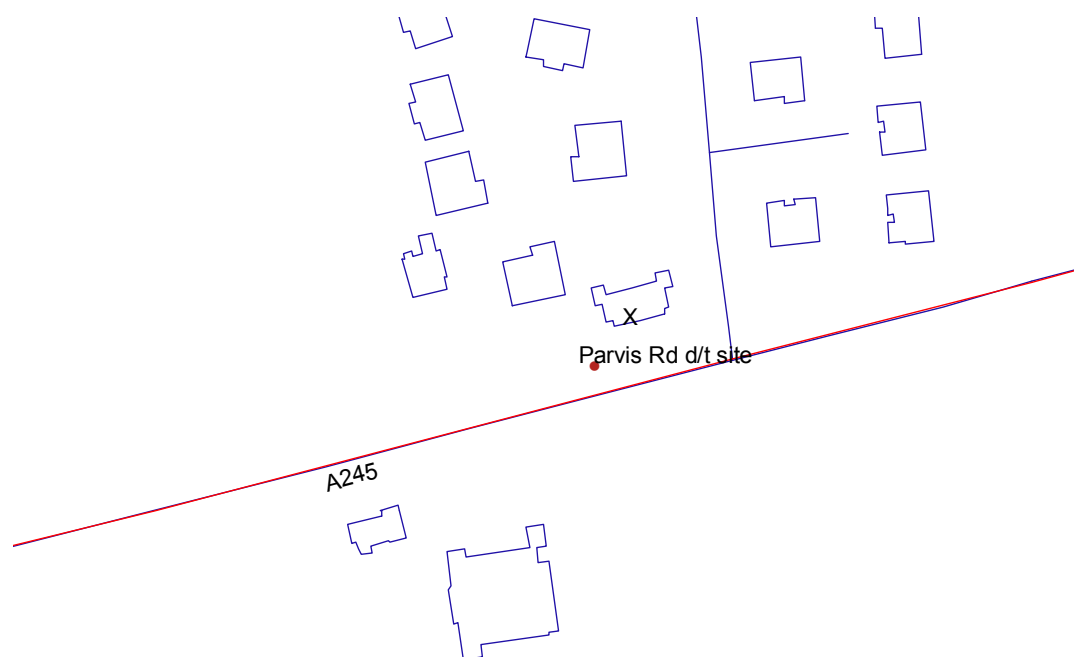
(na means not available)

**Table 20** Data capture rates (%) for the PM<sub>10</sub> continuous monitoring sites (1999-2001)

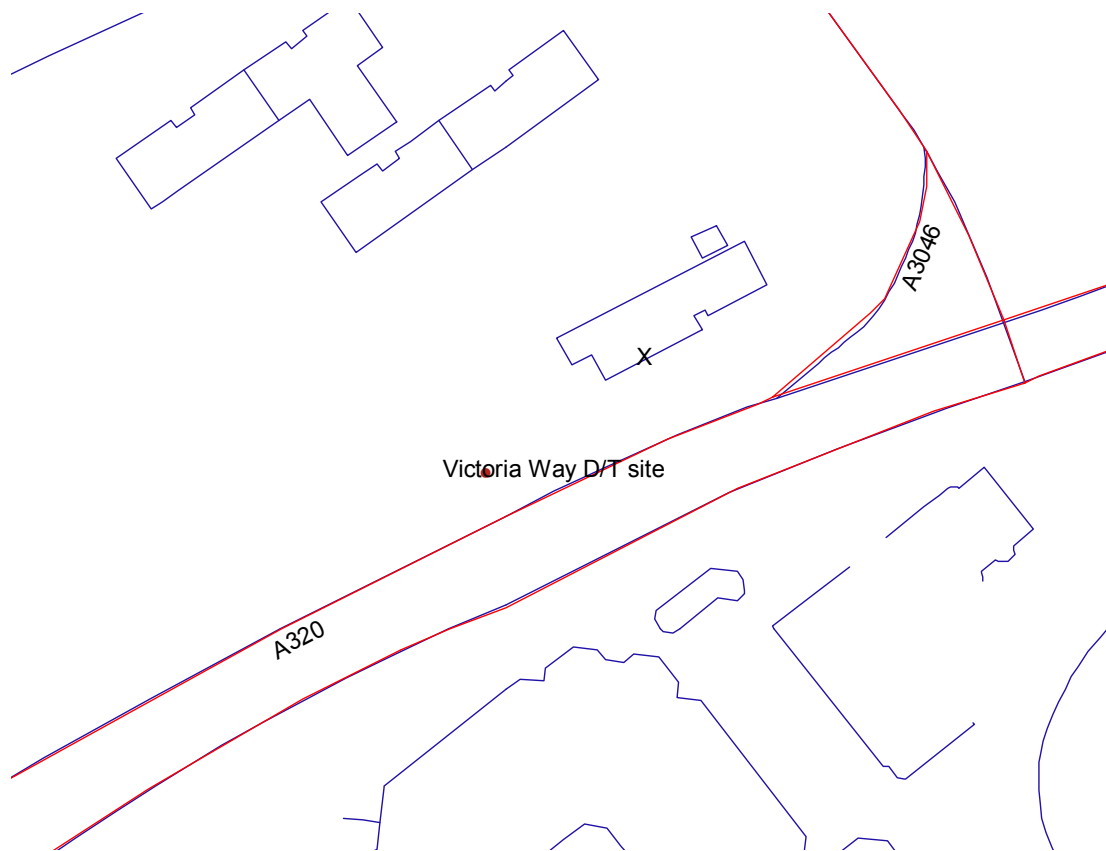
| Data capture  | 2001 | 2000 | 1999 |
|---------------|------|------|------|
| A3            | 97   | 98   | 98   |
| Mole Valley 2 | 98   | 90   | 99   |
| Heathrow      | 93   | 97   | na   |
| Sutton 1      | 86   | 91   | 98   |

(na means not available)

**Figure 4** Location of Parvis Road, Byfleet diffusion tube site



**Figure 5** Location of Victoria Way, Woking diffusion tube site



**Appendix 2****Table 21** Estimated 2006 traffic count data for Woking Borough Council's roads

| <b>Road</b> | <b>Description</b> | <b>AADT</b> | <b>%HDVS</b> | <b>SPEED<br/>(kph)</b> | <b>Distance from<br/>road centre (m)</b> | <b>Easting</b> | <b>Northing</b> |
|-------------|--------------------|-------------|--------------|------------------------|--|----------------|-----------------|
| A245        | Parvis Road        | 44595       | 8.75         | 42                     | 17                                       | 506500         | 161500          |
| A247        | Kingfield Road     | 23812       | 7.35         | 51                     | 7  | 501500         | 157500          |
| A320        | Victoria Way       | 39383       | 4.33         | 56                     | 10                                       | 500500         | 158500          |
| A320        | Guildford Road     | 32613       | 5.22         | 56                     | 13                                       | 500500         | 158500          |
| A324        | Lockfield Drive    | 47199       | 2.19         | 37                     | 12                                       | 498500         | 158500          |
| C143        | Maybury Road       | 7641        | 2.97         | 48                     | 11                                       | 501500         | 158500          |
| M25         | J10-9              | 183476      | 10.36        | 84                     | 100                                      | 506500         | 161500          |
| A247        | Wych Hill Lane     | 26885       | 6.3          | 28                     | 15                                       | 500500         | 157500          |
| B382        | High Street        | 14074       | 5.73         | 54                     | 5  | 501500         | 156500          |
| C144        | Monument Road      | 19101       | 7.06         | 48                     | 6  | 501500         | 158500          |
| C12         | High St. Woking    | 20367       | 3.54         | 35                     | 5  | 501500         | 158500          |
| A324        | Connaught Road     | 23430       | 1.15         | 23                     | 8  | 495500         | 157500          |

(Supplied by the Surrey County Council)

### Appendix 3

**Table 22** Part B processes in the Woking B.C area

| <b>PROCESS</b>                         | <b>NAME</b>                             | <b>ADDRESS</b>  |
|--|---|---|
| CONCRETE BATCHING                      | Tarmac Quarry Products Ltd.             | Monument Way Industrial Estate, Woking, Surrey, GU21 5EN                              |
| COATING RESPRAYING                     | P & T Repairs                           | Unit 1, Dorset Way, Byfleet, Surrey, KT14 7LB   |
| TIMBER                                 | Jewsons Timber & Building supplies Ltd. | Arthurs Bridge Warf, Horsell, Woking, Surrey, GU21 4NP                                |
| PAINTWORKS                             | De La Rue Global Services - Byfleet     | Canada House, Canada Road, Byfleet Industrial Estate, Byfleet, Surrey                 |
| COATING RESPRAYING                     | VGL Accident repair Centre Ltd          | 228 Connaught Road, Brookwood, Surrey, GU24 0AH                                       |
| COATING RESPRAYING                     | S.T.J. Motors                           | Unit 20, Goldsworth Park Trading Estate, Woking, GU21 3BA                             |
| FABRIC COATING AND FINISHING (TEXTILE) | James Walker & co Ltd.                  | Hoe Bridge Works, Old Woking Road, Old Woking, Surrey, GU22 8JL                       |
| RUBBER                                 | James Walker & co Ltd.                  | Hoe Bridge Works, Old Woking Road, Old Woking, Surrey, GU22 8JL                       |
| CREMATORIUM                            | Woking Crematorium                      | Hermitage Road, St Johns, Woking, GU21 1TJ  |
| COATING RESPRAYING                     | Tag Mc Laren                            | Paragon Research And Development Centre, Chertsey Road, Woking, Surrey, GU21 4YH.     |
| COATING RESPRAYING                     | STJ Motors                              | STJ House, Octimum Business Park, Albert Drive, Sheerwater, Woking, Surrey, GU21 5SA. |

**Table 23** Authorised petrol stations in the Woking B.C area

| <b>Name</b>                    | <b>Address</b>   |
|--------------------------------|--|
| Jet Conoco Ltd                 | Oyster lane S/S, Oyster Lane, Woking, Surrey KT14 7JH          |
| Tesco ESSO Express             | 77 Old Woking Rd, West Byfleet, KT14 6JA                       |
| BP Express Shopping Ltd        | Goldsworth Park S/Centre, Denton Way, Woking, Surrey, GU21 3LG |
| Goldsworth Service Station     | 131-139 Goldsworth Road, Woking, surrey GU21 1LS               |
| Sainsbury's Supermarket Ltd    | Redding Way, Knaphill, Woking, Surrey, GU21 2QT                |
| Total Convenience (Knaphill)   | 23 High St, Knaphill, Surrey, GU21 2PP                         |
| Safeway Petrol Station         | 82 Goldsworth Road, Woking, Surrey, GU21 1LL                   |
| College Service Station        | College Rd, Maybury, Woking, Surrey GU22 8BT                   |
| Maybury Hill Service Station   | Maybury Hill, Woking, Surrey, GU22 8AA                         |
| Total Convenience (Old Woking) | 65 High St, Old Woking, Surrey, GU22 9LN                       |
| Jet Garage                     | 161 Goldsworth Road, Woking, Surrey                            |
| Connaught Service Station      | Bagshot Rd, Brookwood, Woking, Surrey, GU24 OHH                |

**Table 24** Part A processes in the Woking B.C area

| <b>Authorisation ID</b> | <b>Operator name</b> | <b>Process name</b>          | <b>Site Address</b>   | <b>Post code</b> |
|-------------------------|----------------------|------------------------------|---|------------------|
| AO2469                  | GBL LTD              | INORGANIC CHEMICAL PROCESSES | CANADA ROAD, BYFLEET, WEST BYFLEET, SURREY                    | KT14 7JL         |
| AO7452                  | WALKER AEC LTD       | INORGANIC CHEMICAL PROCESSES | UNIT 3,CANADA ROAD, OYSTERLANE, BYFLEET, WEST BYFLEET, SURREY | KT14 7JL         |