Reigate & Banstead
BOROUGH COUNCIL
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Progress Report on Air Quality within the Borough of Reigate and Banstead.

July 2005

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Abbreviations and Definitions

AADT	Annual Average Daily Traffic Flow.
AQMA	Air Quality Management Area.
DEFRA	Department of the Environment, Food and Rural Affairs (formerly DETR).
DETR	Department of the Environment, Transport, and the Regions.
DMRB	Design Manual for Roads and Bridges.
EU	European Union.
HA	The Highways Agency.
HGV	Heavy Goods Vehicle.
m^3	cubic metre.
NETCEN	National Environmental Technology Centre, UK.
NO_2	Nitrogen Dioxide.
NO_x	Oxides of Nitrogen (mainly NO and NO_2 expressed as NO_2 equivalent).
PM	Particulate Matter.
PM_{10}	Essentially particles under 10 µm in diameter. Officially defined as the size fraction below 10µm in aerodynamic diameter, which has a cut off point at 50% of the particles which are 10µm in aerodynamic diameter.
ppb	part(s) per billion.
µg	microgram (1 millionth of a gram).
µg m^{-3} (µg/m^3)	microgram(s) per cubic metre.
USA	Updating and Screening Assessment.

Definition of Sampling Sites
(from DETR, 1998)

Urban Centre	A non kerbside site located in an area representative of typical population exposure in town or city centres (e.g. pedestrian precincts and shopping areas). This is likely to be strongly influenced by vehicle emissions, as well as other general urban sources of pollution. Sampling at or near breathing zone heights will be applicable.
Urban Background	An urban location distanced from sources and therefore broadly representative of city wide background conditions e.g. elevated locations, parks, and urban residential areas.
Urban Industrial	An area where industrial sources make an important contribution to the total pollution burden.
Suburban	A location type situated in a residential area on the outskirts of a town or city.
Rural	An open country location, in an area of low population density, distanced as far a possible from roads and polluted industrial areas.
Remote	A site in open country, located in an isolated rural area experiencing regional background pollutant levels for much of the time.
Special	A special source orientated category covering monitoring studies undertaken in relation to specific emission sources such as power stations, garages, car parks or airports.

Executive Summary

E.1 Part IV of the Environment Act 1995 requires local authorities to periodically review air quality in their area against current and future air quality objectives as set out in the Air Quality Strategy (2000), the Air Quality Regulations (England) 2000, the Air Quality (Amendment) Regulations 2002, and the Air Quality Strategy Addendum document (2003).

E.2 As part of the above act the council is required to produce a progress report detailing any new developments within the borough that may affect air quality, the results of any air pollution monitoring to date, and where an air quality management area (AQMA) has been declared an update on any action plans the council may have aimed at reducing air pollution within that area.

E.3 Within Reigate and Banstead the concentration of six of the seven pollutants that are assessed when examining air quality i.e. carbon monoxide, benzene, 1,3 butadiene, lead, sulphur dioxide, and particulate matter (PM_{10}), continue to meet and in most cases are considerably lower than the UK Government objective values, as there have been no new developments either within or in the immediate vicinity of the borough that would affect the concentration of these pollutants.

E.4 The one pollutant of concern within the borough is nitrogen dioxide, and five locations within the borough have been declared air quality management areas as the concentration of nitrogen dioxide within all or part of these areas is predicted to breach the 2005 UK annual average objective value for this pollutant.

E.5 The current monitoring data from the Horley and M25 air quality management areas indicates that the concentration of nitrogen dioxide within these AQMAs is likely to breach the 2005 UK annual average objective, with the magnitude of the concentrations and the number of properties in breach of the objective in line with previous modelling studies. Forward modelling of this data to 2010 indicates that the 2010 EU annual average limit value for nitrogen dioxide will be met within the M25 AQMA, but not within the Horley AQMA.

E.6 At a further two air quality management areas, the property at the south east corner of the junction of the A23 and Dean Lane, and on the south east corner of the junction of the A217 and Rushworth Road, the monitoring data indicates that the prevailing weather conditions will ultimately determine if a breach of the 2005 annual average objective for nitrogen dioxide will occur, as the concentrations are close to the objective value. Nevertheless, forward projections of the monitoring data to 2010 indicate that both sites will meet the 2010 EU annual average limit value for nitrogen dioxide.

E.7 The fifth air quality management area on the M23 to the south of the M25 is projected to meet the 2005 annual average objective and 2010 EU annual average limit value for nitrogen dioxide, based on the limited monitoring data to date. However, the AQMA will be retained until further data has been collected to confirm this projection.

E.8 Routine monitoring of nitrogen dioxide concentrations elsewhere within the borough has identified a further three sites where the concentrations of this pollutant are likely to breach the 2005 UK annual average objective:

i) Two properties backing onto the A240 Reigate Road near the junction of the A2022 (Drift Bridge), and a single property located immediately due north of the A2022 / A240 junction.

ii) Reigate High Street and the part of Church Street between the High Street and Bancroft Road.

iii) A property on the A217 near Blackhorse Lane and the M25 junction 8 interchange.

E.9 The residences affected on Reigate High Street and at Drift Bridge are projected to meet the 2010 EU annual average limit value for nitrogen dioxide, but the A217 property near Blackhorse lane is unlikely to meet the 2010 annual average limit value.

E.10 The air quality action plans for the A217 / Rushworth Road and A23 / Dean lane air quality management areas are due for completion in the next six to twelve months. The action plan for the M23 is on hold pending a more detailed data set, as based on the data to date an action plan for this site will not be required.

E.11 The action plan for the Horley AQMA is currently in development and due for completion in the next six to eight months. The action plan for the airport itself is due for completion in November 2005, and it is envisaged that this will be incorporated into any agreement between the airport and the local planning authority.

E.12 The M25 action plan was completed in April 2004, and as part of this the Highways Agency will be installing new road markings and signage aimed at improving traffic flow between junction 8 and 7 in the current financial year. A recently completed study in Rotterdam has also shown that a fixed reduction in speed limits to 50 mph on a motorway grade road leads to significant reductions in air pollution – including nitrogen dioxide – in practice, confirming the modelling done by the council in the further assessment of the M25, and contrary to the views expressed by the Highways Agency.

1.0 Introduction

1.1 Part IV of the Environment Act 1995 requires local authorities to periodically review air quality in their area against current and future air quality objectives as set out in the Air Quality Strategy for England, Scotland, Wales and N. Ireland (The Air Quality Strategy, January 2000), the Air Quality Regulations (England) 2000, the Air Quality (Amendment) Regulations 2002, and the Air Quality Strategy Addendum document (2003). The air quality objectives set out in these documents (Table 1.1) are derived from health based standards recommended by the Governments' Expert Panel on Air Quality Standards (EPAQS), but the objectives also take into account the costs, benefits, feasibility, and practicality of reaching such standards.

1.2 Under these regulations the council was required to undertake an updating and screening assessment of air quality, which was completed in May 2003 (RBBC, 2003). This report identified a need to proceed to a detailed assessment of certain areas within the borough, and this was completed in April 2004 (RBBC, 2004), with the declaration of two new air quality management areas (AQMAs):

- at the junction of the A217 and Rushworth Road in Reigate,
- and at the junction of Dean Lane and the A23 in Hooley,

as the concentration of nitrogen dioxide was predicted to breach the 2005 UK annual average objective at these sites.

1.3 These new air quality management areas were in addition to the councils existing AQMAs:

i) along the M25
ii) on the M23 to the south of the M25
iii) in Horley near to Gatwick Airport

which were also predicted to breach the 2005 annual average objective for nitrogen dioxide in the first round of the review and assessment process (AQC, 2001).

1.4 This 'Progress Report' is a further requirement under these regulations and is essentially an update on the current monitoring results from around the borough, and on measures aimed at reducing the concentration of pollutants within the AQMAs to below the objective concentrations.

1.5 The current report contains data from monitoring in 2003 and 2004 (the last year for which a complete data set was available), as the production of the detailed assessment in 2004 meant that the majority of the non AQMA data for 2003 was not formally reported in 2004.

	Limit	Exceedences	Measure	Annual Mean Limit	Reach By
CO	10 mg m^{-3}	-	maximum daily running 8 hour mean		31/12/03
NO_2	200 µg m^{-3} (105 ppb)	18 x $year^{-1}$	1 hr mean	40 µg m^{-3} (21 ppb)	31/12/05
SO_2	350 µg m^{-3} (132 ppb)	24 x $year^{-1}$	1 hr mean	-	31/12/04
	125 µg m^{-3} (47 ppb)	3 x $year^{-1}$	24 hr mean	-	31/12/04
	266 µg m^{-3} (100 ppb)	35 x $year^{-1}$	15 min mean	-	31/12/05
Benzene	16.25 µg m^{-3} (5 ppb)	-	running annual mean		31/12/03
	5 µg m^{-3} (1.54 ppb)	-	annual mean	-	31/12/10
1,3 Butadiene	2.25 µg m^{-3} (1 ppb)	-	running annual mean		31/12/03
Pb	-	-	-	0.5 ng m^{-3}	31/12/04
	-	-	-	0.25 ng m^{-3}	31/12/08
PM_{10}	50 µg m^{-3}	35 x $year^{-1}$	24 hr mean	40 µg m^{-3}	31/12/04
	50 µg m^{-3}	7 x $year^{-1}$	24 hr mean	20 µg m^{-3}	31/12/10

Table 1.1: Air Quality Objectives for the Purposes of Local Air Quality Management.

2.0 Methodology

2.1 The methodologies used throughout this work are drawn from DEFRAs technical guidance - LAQM TG(03) (DEFRA, 2003), the frequently asked questions on the DEFRA website (DEFRA, 2005), and reference has also been made to the progress report guidance - LAQM PRG(03) (DEFRA, 2003a).

2.1 Road Traffic

2.2 The road traffic data used in this report is derived from the Surrey Road Traffic model. This is based on the JAM model, and is updated annually with the aid of 118 automatic counters around the county, supplemented by a series of manual counts. There has been no independent evaluation of the accuracy / precision of the traffic model, that this author is aware of, although a comparison of three model sample points on the motorway network to measured data, while hardly conclusive, did show good agreement (RBBC, 2003).

2.3 A more recent comparison of road traffic data from a modelling study for BAA Gatwick by Mott McDonald and the Surrey model (unpublished) also showed broad overall agreement, although there were localised differences in the volumes of traffic predicted. Thus while there is a lack of sufficient data to do a rigorous analysis of the accuracy / precision of the Surrey Traffic Model, there is no reason to believe that the model is any better (or worse) than any other county wide transport model in operation around the UK.

2.4 The projection of roadside / kerbside monitoring data back to the relevant receptor was performed using the Design Manual for Roads and Bridges (DMRB) spreadsheet version 1.02 November 2003, with background pollutant concentrations obtained from the LAQM website (DEFRA, 2005), and projected forward using the method set out by Brown (2003).

2.5 Distance measurements throughout this report were obtained from the councils GIS system (ArcView 8), using a mastermap base layer supplied by Ordnance Survey, or are from field measurements.

2.2 Monitoring

2.2.1 Real Time Monitoring

2.6 The council operates a total of three real time monitors as set out in Table 2.1 below.

Site	Location	Location Type	Pollutant	Instrument	Installed
RG1	Horley	Suburban	NO_x / PM_{10}	Monitor Labs / R&P TEOM	July 2000
RG2	Horley	Suburban	NO_x	Environnment (AC32M)	Sept 2003 (in current form)
RG3	Crawley	Rural	NO_x / O_3	Both Monitor Labs	Feb 2005

Table 2.1: Real Time Monitors Currently in Operation within Reigate and Banstead.

All sites are operated to UK AURN standards, with data management by ERG Kings College London, and bi-annual audits by the National Physical Laboratory (NPL).

2.7 Data for 2003 is fully ratified, but data for 2004 is ratified to 20/9/04 for RG1, and 23/11/04 for RG2. Data after these dates is provisional, although it is not expected to change significantly. No data from RG3 was available for this report.

2.2.2 Diffusion Tubes

2.8 The councils diffusion tube programme is operated in accordance with the practices and exposure periods of the UK diffusion tube network. All of the diffusion tubes used within the borough are supplied by Lambeth Scientific Services, with the NO_2 diffusion tubes using 50 % triethanolamine in acetone.

2.9 The NO_2 diffusion tube data presented in this report has had a correction factor applied based on tubes co located in triplicate at the councils chemoluminescent real time monitoring site (RG1), using the methodology set out by DEFRA (DEFRA, 2003; AQC, 2004). The correction factor applied is stated on the relevant graphs, and in the appendix (Appendix C) with the individual tube values. The correction factor for 2004 was:

$$\frac{\text{Mean of 12 monthly periods of real time data (12 months matched to tubes}^{*1})}{\text{Mean of 12 months of tube data}^{*2}\ (30/12/03 \text{ to } 04/01/05)} = \frac{30.44}{23.04} = 1.32$$

(Equation 2.1)

and for 2003:

$$\frac{\text{Mean of 11 monthly periods of real time data (04/02/03 to 30/12/03)}}{\text{Mean of 11 months of tube data}^{*2}\ (04/102/03 \text{ to } 30/12/03)} = \frac{31.18}{24.15} = 1.29$$

(Equation 2.2)

[*1] Data capture for year 99.6 %, lowest data capture in any one month 97.3 %.

[*2] The monthly data is the mean of three co-located tubes.

2.10 The council uses correction factors calculated form its own monitoring equipment in preference to the 'national average' for Lambeth Scientific, to ensure:

- a consistency in the data between years as often the national average is from less than four sites which vary from year to year.
- traceability of QA/QC for the real time site.
- as data from the real time site is often used to calculate tube correction factors for periods of less than one year.

2.11 Comparison of the 2004 correction factor to the national diffusion tube spreadsheet produced by AQC on behalf of DEFRA (AQC, 2005), demonstrates reasonable agreement with two of the local authorities using Lambeth Scientific, who have correction factors of 1.29. Nevertheless, two other authorities have correction factors ranging from 0.91 to 1.45 in 2004. However, the correction factor applied to the 2003 data is considerably higher than that used in the spreadsheet, 1.05 versus the 1.29 used in this study, although the 1.05 figure was obtained from just two local authorities.

2.12 Comparisons have also been made at a local level between councils within the Surrey air quality group, although only Spelthorne BC operates a real time monitor in a comparable setting and with comparable QA/QC to our own site. Nevertheless, they obtained a correction factor of 1.3 for 2003 and 2004. This is in agreement with our own data, and suggests that:

- the 2003 correction factor used in this report is not unrealistically high.
- for the last two years there has been a consistent 'bias' to the diffusion tubes when exposures have taken place in Surrey.

2.13 One important point to note is that the data in this report for 2002 has a different correction factor applied (1.17) compared to 0.995 in the 2003 updating and screening assessment, as an additional two months of diffusion tube data became available after the completion of the 2003 USA. The updated data set was used in all work relating to the air quality management areas in place at that time after the publication of the USA i.e. the Stage 4 assessments (AQC, 2003 and 2004b). However, it does mean that the corrected diffusion tube data in this report is not the same as in the 2003 updating and screening assessment (RBBC, 2003), although had this additional data been available at the time it would have made no difference to the overall conclusions of the 2003 updating and screening assessment.

2.2.2.1 Nitrogen Dioxide Diffusion Tube Blanks

2.14 Each month two diffusion tubes are left 'capped' and thus unexposed at the council offices, as part of the diffusion tube survey within the borough. This is to give an indication of the 'blank' values of the diffusion tubes. The results for 2003 and 2004 are shown in Table 2.2.

	2003	**2004**
RB91	8	17
RB92	9	12
Mean[*]	8	14
Limit of Detection [*2]	10.6	25.1
[*]based on unrounded values [*2]LOD = mean + 3* standard deviation 2004 correction factor 1.32 2003 correction factor 1.29		

Table 2.2: Blank Nitrogen Dioxide Diffusion Tube Concentrations (µg m^{-3}).

2.15 Table 2.2 indicates that any nitrogen dioxide concentration below 11 µg m^{-3} in 2003 is potentially no different from the blank, and that the concentration of nitrogen dioxide in 2004 would need to be over 25 µg m^{-3} before the concentration can be regarded as different from the blank values with any confidence. Thus the diffusion tube data does need to be interpreted bearing in mind the limits of the technique.

3.0 New Developments

3.1 There have been no new industrial developments within the borough, nor in the immediate vicinity of the borough, that would have an adverse impact on air quality within the borough.

3.2 Two new major residential areas have been proposed to the north west and to the north east of Horley, within the borough, comprising around 1600 homes in the north west sector, and 700 homes in the north east sector. These sites are around 1.5 km to the north of the northern edge of the Horley air quality management area near to Gatwick Airport. Development of these areas is due to begin in late 2006 / early 2007, with completion of the entire programme up to 10 years later around 2015/16.

3.3 A study examining the impact of the development on air quality in the vicinity of the major (and minor) roads in the area was undertaken by the developer, and while this did show that the annual average nitrogen dioxide concentration would increase at some properties, there were no predicted breaches of either the 2005 objective or 2010 limit values for nitrogen dioxide.

3.4 The impact of the development on the major junctions outside of the immediate area of the development were not assessed in detail in terms of air quality, although the impact on traffic congestion was examined and this work indicated that congestion would not get significantly worse. In the 2003 updating and screening assessment the annual average concentration of nitrogen dioxide at these junctions was predicted to be around 30 to 32 $\mu g\ m^{-3}$ in 2005, falling to 26 to 28 $\mu g\ m^{-3}$ in 2010, and therefore it is unlikely that the development would lead to a breach of the EU nitrogen dioxide limit values in 2010. However, it does mean that the predicted falls in the annual average concentration of nitrogen dioxide are likely to be lower than might otherwise be the case without the development.

4.0 Monitoring Data

4.1 The main pollutant of concern within Reigate and Banstead is nitrogen dioxide primarily from road traffic, in common with many other local authorities within the UK, with the exception of the Horley AQMA where aircraft rather than road traffic are a major source of this particular pollutant.

4.2 However, the council does monitor the concentration of benzene and sulphur dioxide using passive diffusion tubes supplied by Lambeth Scientific at a couple of sites within the borough, as part of a long term 'watching brief'. This is to identify any major changes in the concentrations of these pollutants between the main towns within the borough, either within a given year or between years.

4.3 The concentration of particulate matter (PM_{10}) is also measured in Horley, as part of a long term program to ensure that the PM_{10} concentrations in the vicinity of the airport are comparable to those that might be expected within a typical suburban area in the UK.

4.1 Benzene

4.4 Benzene concentrations are measured at three sites within the borough, on the High Street in Reigate (RB1), at a residential property in Horley close to Gatwick airport (RB11), and on the A23 near to the M25 (RB20) in Merstham. The Merstham site has no relevant receptors in the immediate vicinity of the tube, unlike the other sites, and essentially represents a 'worst case' location.

4.5 There are predicted to be no breaches of the UK objectives / EU limit values for benzene anywhere within the borough (RBBC, 2003), but the purpose of these sites is to keep a 'watching brief' on this pollutant, and to ensure that the concentration of benzene at the site in Horley remains similar to that measured at other sites due to the frequent, though short lived, smell of aviation kerosene at the Horley site.

4.6 The monitoring is undertaken using passive BTEX diffusion tubes supplied by Lambeth Scientific, with the tubes changed monthly with the NO_2 diffusion tubes. The results from these tubes are shown in Table 3.1.

	2003		2004	
	Conc. (µg m^{-3})	**n**	**Conc. (µg m^{-3})**	**n**
RB1	2.5	12	2.1	12
RB11	2.4	11	1.7	10
RB20	2.2	11	1.8	12

Table 3.1: Annual Mean Benzene Concentrations (µg m^{-3}).

4.7 The results in Table 3.1 need to be interpreted with a degree of caution when comparing them to the national standards, as the tubes in the borough have not been calibrated against a real time monitor, and the concentration of benzene is around double that expected based on the concentrations of ethyl benzene and ortho xylene (Appendix A) regardless of whether the tubes are measuring benzene concentrations in the vicinity of the airport or simply road traffic.

4.8 A study examining the concentration of benzene in the vicinity of petrol stations (Jones, 2000) demonstrated that BTEX tubes tend to underestimate the concentration of benzene compared to real time analysers, although this was based on two week sampling periods rather than the 4 to 5 week periods used in the councils current monitoring programme. Conversely, the technical guidance from DEFRA (DEFRA, 2003) states that diffusion tubes over read by 30 % compared to gas chromatography analysers, although no exposure period is given.

4.9 Nevertheless, even assuming that the values from the BTEX tubes are correct and are not 'over reading' the benzene concentrations based on the ethyl benzene and ortho xylene concentrations, but that they are an underestimate compared to a real time monitor by a factor of two, the benzene concentrations at these sites would still meet the 2010 annual objective value for benzene of 5 µg m^{-3}, as expected from the modelling (RBBC, 2003).

4.10 Table 3.1 also demonstrates that residents exposure to benzene in Horley, despite the frequent smells of aviation kerosene, is no greater than that in Reigate High Street or Merstham on an annual basis.

4.2 Sulphur Dioxide

4.11 The review and assessment process (RBBC, 2003) indicated that all of the sulphur dioxide objectives (Table 1.1) were being met in 2003, and would continue to be met in 2005 and beyond. As there have been no new developments, either within or in the immediate vicinity of the borough, this assessment remains unchanged.

4.12 The council does monitor sulphur dioxide at four points within the borough - Reigate, Merstham, Horley, and Banstead, using diffusion tubes supplied by Lambeth Scientific. This is to ensure that the background concentrations of sulphur dioxide within each of these areas are broadly comparable with one another on a year to year basis, and also in the longer term although this assumes that the errors associated with the diffusion tubes remain constant from year to year.

4.13 The data from these tubes is presented in Appendix B for information, and while the annual averages obtained from these tubes are not suitable for assessing against the UK objective and EU

limit values, in general terms if the annual average exceeds 18.6 µg m^{-3} then the 15 minute mean standard for sulphur dioxide (Table 1.1) is likely to be in breach (Lambeth Scientific, 2004).

4.14 As the highest annual average sulphur dioxide concentration from any site is 14 µg m^{-3}, and is typically 8 - 10 µg m^{-3} it suggests, as expected, that breaches of the sulphur dioxide objectives are unlikely.

4.3 Nitrogen Dioxide

4.15 The council monitors nitrogen dioxide concentrations at a total of 68 sites around the borough using diffusion tubes. The majority of these sites are within the various air quality management areas (AQMAs) around the borough, but monitoring is also undertaken at a further 19 sites that are not AQMAs in order to:

- provide an informed response to residents concerns about pollution in their immediate area.
- to put the concentrations measured within the AQMAs into a wider context.
- to monitor long and short term trends in nitrogen dioxide concentrations for comparison purposes to those within the AQMAs.
- to obtain further information on areas identified by screening assessments or professional judgement, as having nitrogen dioxide concentrations that may be close to the objective values.

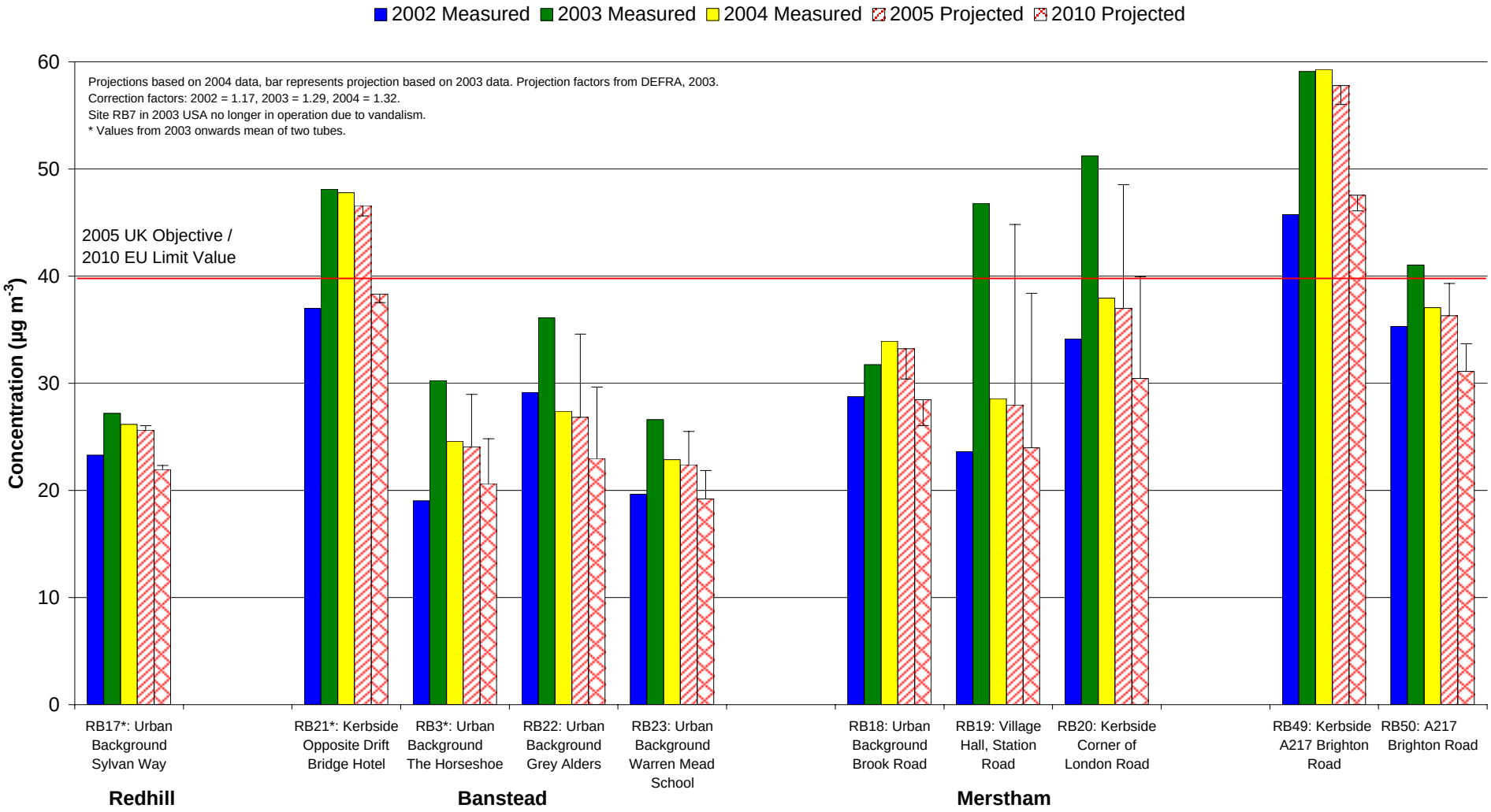
4.16 All of the nitrogen dioxide diffusion tube data has been corrected using an appropriate correction factor, to allow direct comparison to the UK / EU objective and limit values. Details of the tube type, laboratory used, and calculation of the correction factors is discussed in section 2.2.2. Individual tube results can be found in Appendix C.

4.3.1 Non Air Quality Management Area Monitoring Results

4.17 Diffusion tube results from around the borough for 2002, 2003, and 2004, are shown in Figure 4.1. Projected values are shown for 2005 and 2010 based on the 2004 values, with the bar representing the 2005 and 2010 projections based on the 2003 data. This gives an indication of the potential range of concentrations that might be present in 2005 and 2010 depending on the prevailing weather conditions.

4.18 The higher concentrations of nitrogen dioxide in 2003, in general, were due to the prevailing weather conditions, which favoured the formation of nitrogen dioxide and limited its dispersion, rather than a sudden increase in emissions from a given source.

Figure 4.1: Annual Mean Nitrogen Dioxide Concentrations around Reigate and Banstead (Measured 2002 - 2004, Projected 2005, 2010).



4.19 Figure 4.1 also demonstrates that 2002 was a year of relatively low nitrogen dioxide concentrations compared to 2003 and 2004. This is an important point to bear in mind as the majority of the updating and screening assessment of 2003 was based on the 2002 monitoring data, and so projections based on this data for 2005 and 2010 are likely to represent a 'best case' scenario.

4.20 The site RB20 (Figure 4.1) has no relevant receptors within 50 m, and is simply used as a 'worst case' site within Merstham.

4.21 The RB19 site is representative of properties located along this street, although the tube is located outside of the village hall. Despite the high concentrations of nitrogen dioxide at RB19 in 2003, the site does meet the 2010 EU limit value when the 2003 concentration is projected forward to 2010, and under 'normal' weather conditions the site will also meet the 2005 UK annual mean objectives for nitrogen dioxide, and is comparable to other background sites in Redhill and Banstead.

4.22 The kerbside tube sites RB21 and RB49 (Figure 4.1) are not located at relevant receptors, but there are residential premises close by, as shown in Figure 4.2 and 4.3. The kerbside concentrations were therefore extrapolated back to the relevant receptors using the DMRB model (Table 4.1 and 4.2).

	Predicted DMRB[a] Concentration		Measured Concentration		Measured : Predicted Ratio		Extrapolated Concentration		Projected[b] Concentration (2005)		Projected[b] Concentration (2010)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
RB21	41.8	39.9	48	48	1.15	1.20	-	-	-	-		
Relevant Receptor	37.6	36.0	-	-	-	-	43	43	41	42	35	36

All values except ratio μg m^{-3}.
[a] Version 1.02 November 2003.
[b] Projection based on background correction factors by DEFRA (DEFRA, 2003).

Table 4.1: Extrapolated Annual Average NO_2 Concentration in 2003 and 2004 at the Relevant Receptor on the A240 Drift Bridge and Projected 2005 and 2010 Concentration.

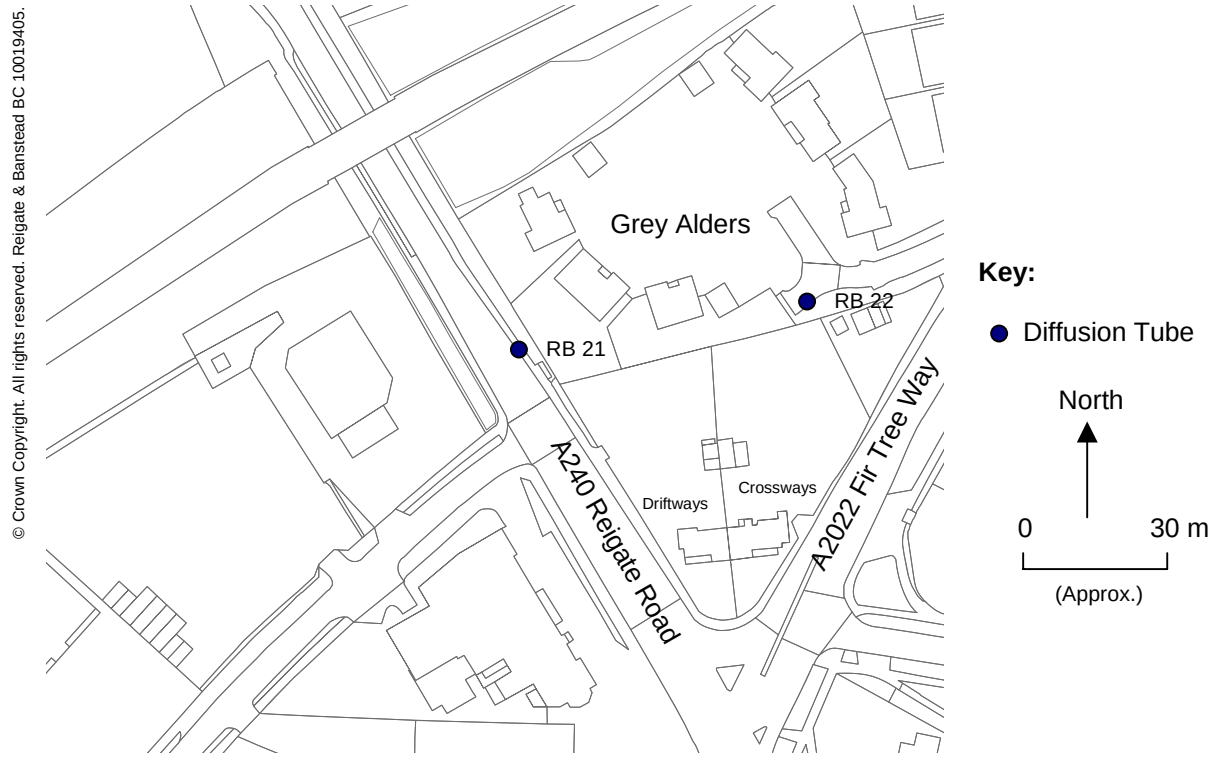


Figure 4.2: Location of A240 Reigate Road (Drift Bridge) Diffusion Tubes.

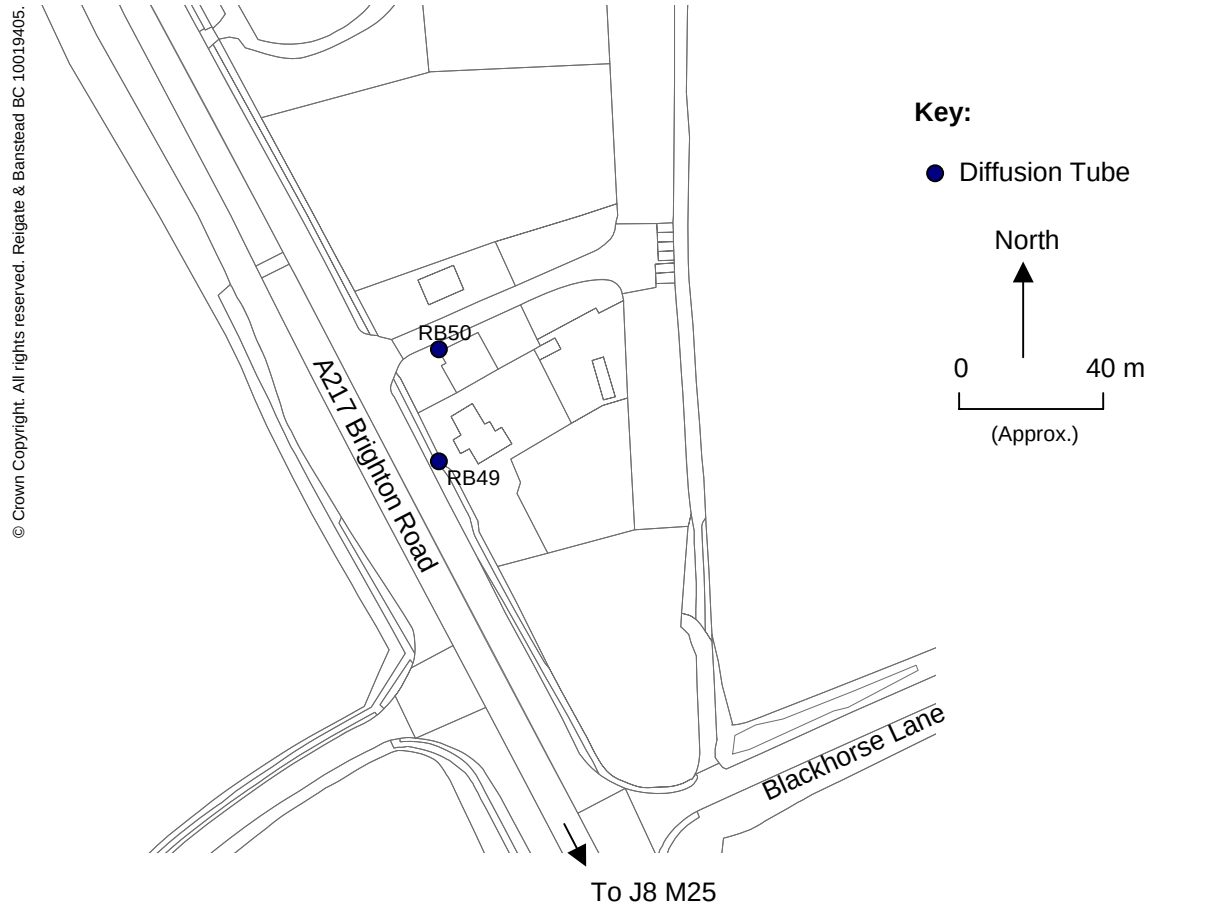


Figure 4.3: Location of A217 Brighton Road Diffusion Tubes.

	Predicted DMRB[a] Concentration		Measured Concentration		Measured : Predicted Ratio		Extrapolated Concentration		Projected[b] Concentration (2005)		Projected[b] Concentration (2010)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
RB49	34.9	33.6	59	59	1.69	1.75	-	-	-	-		
Relevant Receptor	32.9	31.8	-	-	-	-	56	56	53	55	46	47

All values except ratio μg m^{-3}.
[a] Version 1.02 November 2003.
[b] Projection based on background correction factors by DEFRA (DEFRA, 2003).

Table 4.2: Extrapolated Annual Average NO_2 Concentration in 2003 and 2004 at the Relevant Receptor on the A217 and Projected 2005 and 2010 Concentration.

4.23 This extrapolation of the kerbside tube data indicates that the property in Grey Alders immediately behind the RB21 (Drift Bridge) tube site is likely to breach the 2005 annual average nitrogen dioxide objective of 40 μg m^{-3}, with a concentration of 42 μg m^{-3}. Given the high concentration of nitrogen dioxide measured by RB21, the property at the junction of the A2022 / A240 known as Crossways (Driftways is a vacant business premises) may also breach the 2005 annual average objective for nitrogen dioxide given its proximity to the junction.

4.24 In the 2003 updating and screening assessment the concentration at Crossways was calculated to be 36 μg m^{-3} in 2004, coincidentally similar to the DMRB receptor value calculated in Table 4.1. However, given the higher concentrations suggested by the extrapolated diffusion tube measurement compared to the DMRB result, which is most likely due to traffic queuing at the junction, the concentration of nitrogen dioxide may well be higher than that indicated by the results of the DMRB assessment of Crossways. Thus a detailed assessment will be needed for this area, examining the nitrogen dioxide concentrations at both the Grey Alders and Crossways properties.

4.25 A detailed assessment will also be needed for the two properties on the A217 near to junction 8 on the M25. This site is of particular importance as the measured concentrations are among the highest in the borough, and the site is unlikely to meet the 2010 EU annual average limit value for nitrogen dioxide unlike most other sites within the borough. Despite the high annual average concentrations of nitrogen dioxide at this site, there is unlikely to be a breach of the 1 hour objective as the annual average concentration is not in excess of 60 μg m^{-3} (AQC, 2003a).

4.3.1.1 Reigate High Street

4.26 The monitoring results from Reigate High Street are shown in Figure 4.4, along with the results from the background site in a residential area of Reigate, and the locations of the diffusion tubes on the High Street are shown in Figure 4.5. It should be noted that parts of the High Street form a street canyon i.e. the height of the surrounding buildings is greater than the width of the road.

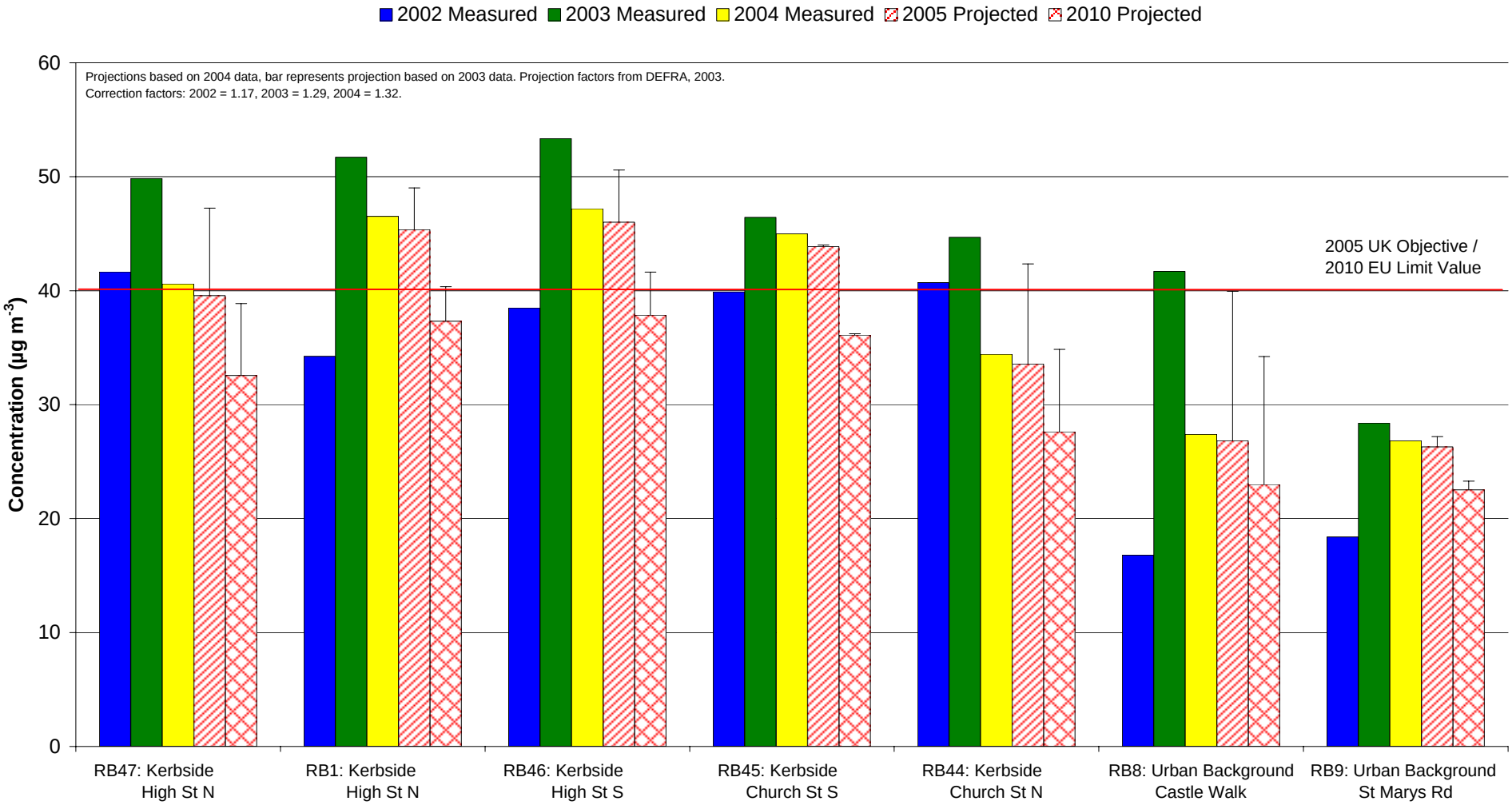
4.27 The monitoring sites in the High Street and Church Street, with the exception of RB8, are all located kerbside and less than 1 m from the edge of the road. However, there are residential properties above the shops along High Street and Church Street (Figure 4.6).

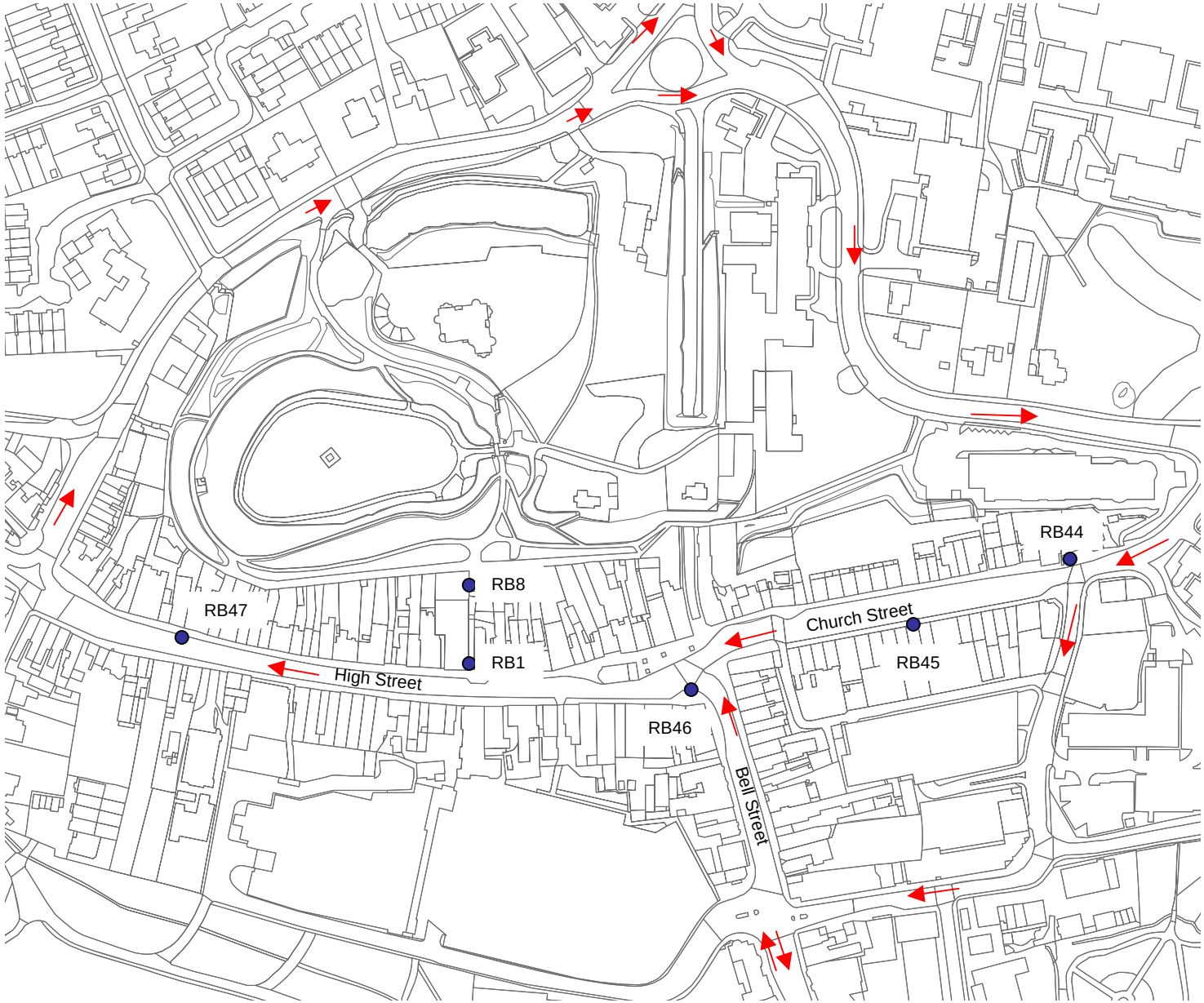
4.28 The monitoring results from the High Street follow a similar pattern to that seen elsewhere in the borough, with elevated concentrations in 2003 compared to 2002 and 2004. The highest measured concentration in 2003 was 53 µg m^{-3} at RB46 (Appendix C), which indicates that the 1 hour objective for nitrogen dioxide is unlikely to be breached, as the annual mean concentration is below 60 µg m^{-3} (AQC, 2003a).

4.29 The concentrations of nitrogen dioxide in 2002, even with the additional data not available for the 2003 updating and screening assessment, are still quite low in many cases compared to 2004. Based on the 2002 data alone the High Street would be predicted to meet the 2005 annual average objective for nitrogen dioxide, and the 2010 EU limit value, as stated in the 2003 updating and screening assessment.

4.30 However, data from the monitoring sites from 2003 and 2004 projected forward to 2005 suggests that the annual average concentration of nitrogen dioxide along part of the High Street and Church Street is likely to breach the 2005 UK annual average objective for nitrogen dioxide. Although the residential properties 'the relevant receptors' are set back from the road and elevated, the short distance from the edge of the road to the building façade means there is a negligible fall in the concentration of nitrogen dioxide based on the DMRB model (Table 4.3), while the decline in nitrogen dioxide concentration with height is likely to be no more than around 1 µg m^{-3} to a first floor flat (Heal, 2005).

Figure 4.4: Annual Mean Nitrogen Dioxide Concentrations along Reigate High Street (Measured 2002 - 2004, Projected 2005, 2010).





Key:

NO_2 Diffusion Tube

Traffic Flow (One way System)

Scale (Approx.)

0 70 m

N

Figure 4.5: Location of Diffusion Tubes in Reigate High Street.

Figure 4.6: Location of Residential Flats over Shops in Reigate High Street.

	DMRB modelled Concentration (Kerbside Tube Site)		DMRB modelled Concentration (Building Façade)		Ratio (Façade : Tube Site)	
	2003	**2004**	**2003**	**2004**	**2003**	**2004**
RB47	35.9	34.7	35.5	34.3	0.99	0.99
RB46	35.9	34.7	34.8	33.6	0.97	0.97
RB45	33.0	32.4	32.8	32.1	0.99	0.99
RB44	33.0	32.4	32.5	31.9	0.98	0.98

Table 4.3: DMRB modelled Kerbside and Building Façade Nitrogen Dioxide Concentrations, and Kerbside to Façade ratios. (All figures µg m^{-3} except ratios).

4.31 However, the predicted concentration of nitrogen dioxide in 2010 based on the monitoring data (Figure 4.4), indicates that the High Street and Church Street are likely to meet the 2010 EU annual average limit value for nitrogen dioxide at the residential properties.

4.32 Nevertheless, as a breach of the 2005 UK annual average objective is predicted from the monitoring data, a detailed assessment of the High Street and Church Street in Reigate will be required. As a consequence of the monitoring results to date an additional series of tubes has been installed at the building façades, and this data along with that collected during 2005 will inform the detailed assessment.

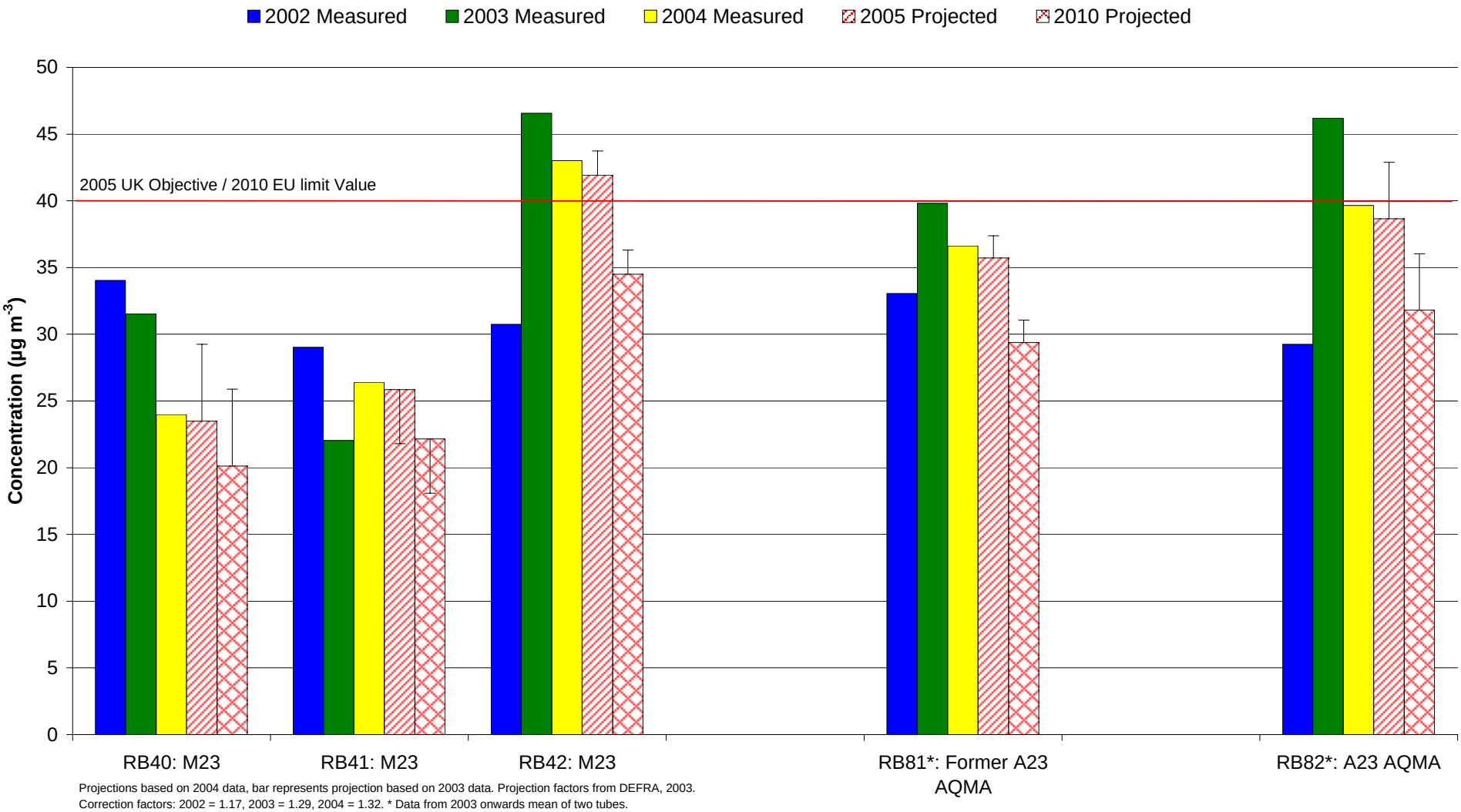
4.3.2 Monitoring Data from Former and Current AQMAs.

4.33 The purpose of continuing to monitor nitrogen dioxide concentrations within former AQMAs is to confirm the findings of the further assessment that revoked the AQMA, and to ensure that the concentrations of nitrogen dioxide continue to remain below the annual average objective value, particularly as the concentration of nitrogen dioxide can vary considerably from year to year depending on the prevailing weather conditions as seen in section 4.3.1.1 on Reigate High Street.

4.3.2.1 Former AQMA: M23 to the north of the M25

4.34 The results from the former M23 AQMA to the north of the M25 are shown in Figure 4.7 (RB40, 41, and 42). Here RN42 is a kerbside site on the B2031 Shepherds Hill, with the nearest relevant receptor to this site at RB40. The relevant receptors in this area (RB40 and 41) are unusual in that the nitrogen dioxide concentrations at these sites were at there highest in 2002, compared to 2003 for nearly every other site within the borough. Whether this reflects a localised effect or, more likely, is simply a function of the errors associated with diffusion tubes is unclear. However, the results do demonstrate that the concentration of nitrogen dioxide at properties within this former AQMA have remained consistently below the annual mean objective for nitrogen dioxide, and that the projected 2005 and 2010 values meet the relevant objective and limit values, confirming the decision to revoke this AQMA.

Figure 4.7: Annual Mean Nitrogen Dioxide Concentrations in Current and Former AQMAs.



Projections based on 2004 data, bar represents projection based on 2003 data. Projection factors from DEFRA, 2003.
Correction factors: 2002 = 1.17, 2003 = 1.29, 2004 = 1.32. * Data from 2003 onwards mean of two tubes.

4.3.2.2 Former AQMA: Flying Scud A23 Brighton Road

4.35 The results from this site are shown in Figure 4.7 (RB81), and its location in Figure 4.8. The annual average nitrogen dioxide concentrations at this site have followed a similar pattern 2002 to 2004 to those seen at most other sites within the borough. Although the measured concentration in 2003 was just under 40 µg m^{-3}, the projected concentrations for 2005 and 2010 indicate that the site is unlikely to breach the UK objective in 2005 or the EU limit value in 2010, confirming the decision to revoke the AQMA.

4.3.2.3 Current AQMA: Junction of the A23 and Dean Lane, Hooley.

4.36 The location of the Dean Lane AQMA is shown in Figure 4.9, and the monitoring results from 2002 to 2004 in Figure 4.7 (RB82). The site was originally declared an AQMA in April 2002, but the order was subsequently revoked following the Stage 4 (Further) assessment in 2003 (AQC, 2003), which was based on the monitoring data from 2002.

4.37 As can be seen from Figure 4.9 the tube is located closer to the road than the building façade, but even at the tube site in 2004 the concentration of nitrogen dioxide is at / slightly below the proposed 2005 annual average objective value, while the projected concentrations for 2005 and 2010 are below the UK objective and EU annual mean limit value respectively, based on the 2004 data.

4.38 The extrapolated nitrogen dioxide concentration at the residential property in 2003 and 2004 (Table 4.4), indicates that the site would be likely to meet the 2005 objective, based on the 2004 monitoring data, but not on the 2003 monitoring data.

	Predicted DMRB[a] Concentration		Measured Concentration		Measured : Predicted Ratio		Extrapolated Concentration		Projected[b] Concentration (2005)		Projected[b] Concentration (2010)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
RB82	38.2	37.0	46	40	1.21	1.07	-	-	-	-		
Relevant Receptor	37.3	36.2	-	-	-	-	45	39	43	38	37	32

All values except ratio µg m^{-3}.
[a] Version 1.02 November 2003.
[b] Projection based on background correction factors by DEFRA (DEFRA, 2003).

Table 4.4: Extrapolated Annual Average NO_2 Concentration in 2003 and 2004 at the Relevant Receptor on the A23 / Dean Lane Junction and Projected 2005 and 2010 Concentration.

4.39 However, the projected 2010 nitrogen dioxide concentrations will meet the 2010 annual mean EU limit value, regardless of the year used.

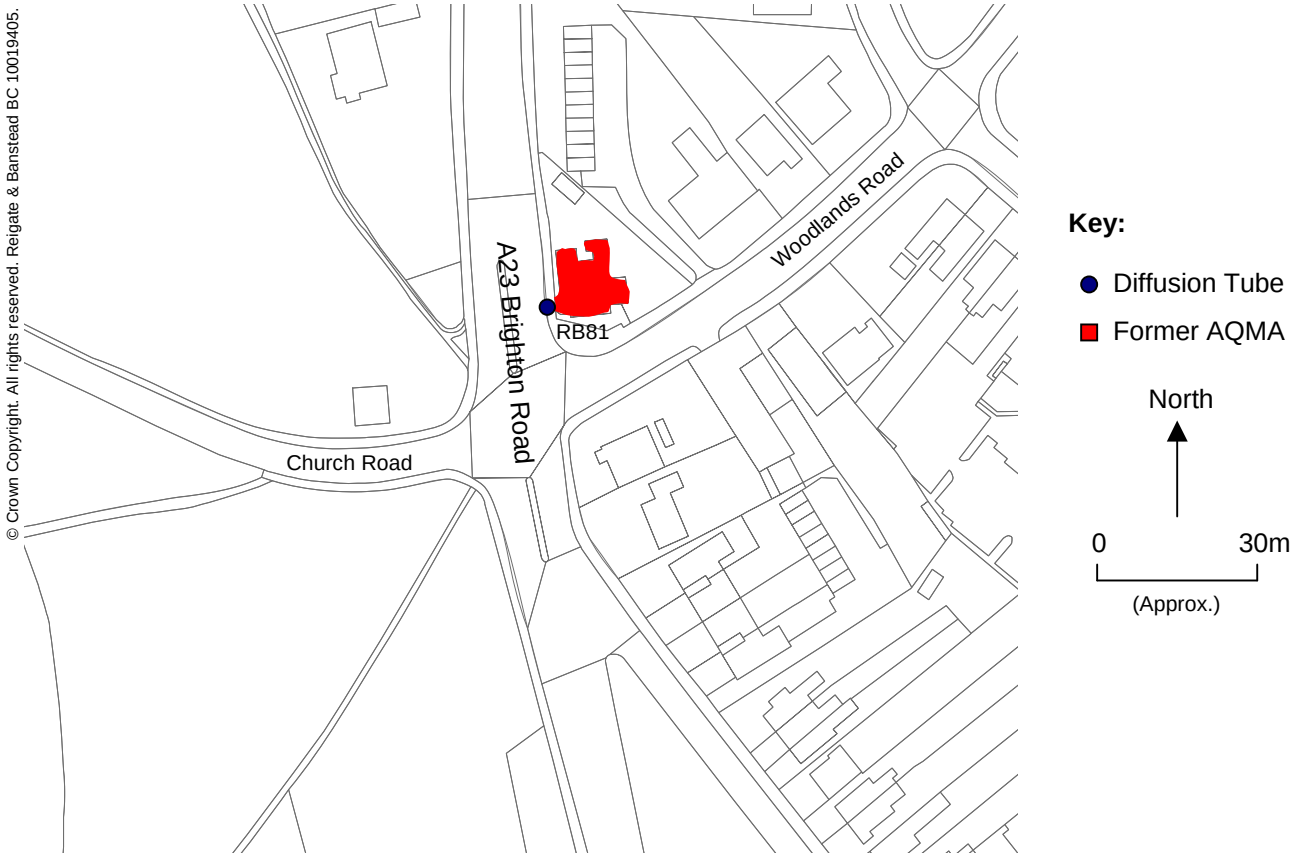


Figure 4.8: Former AQMA (Flying Scud) on the A23 Brighton Road.

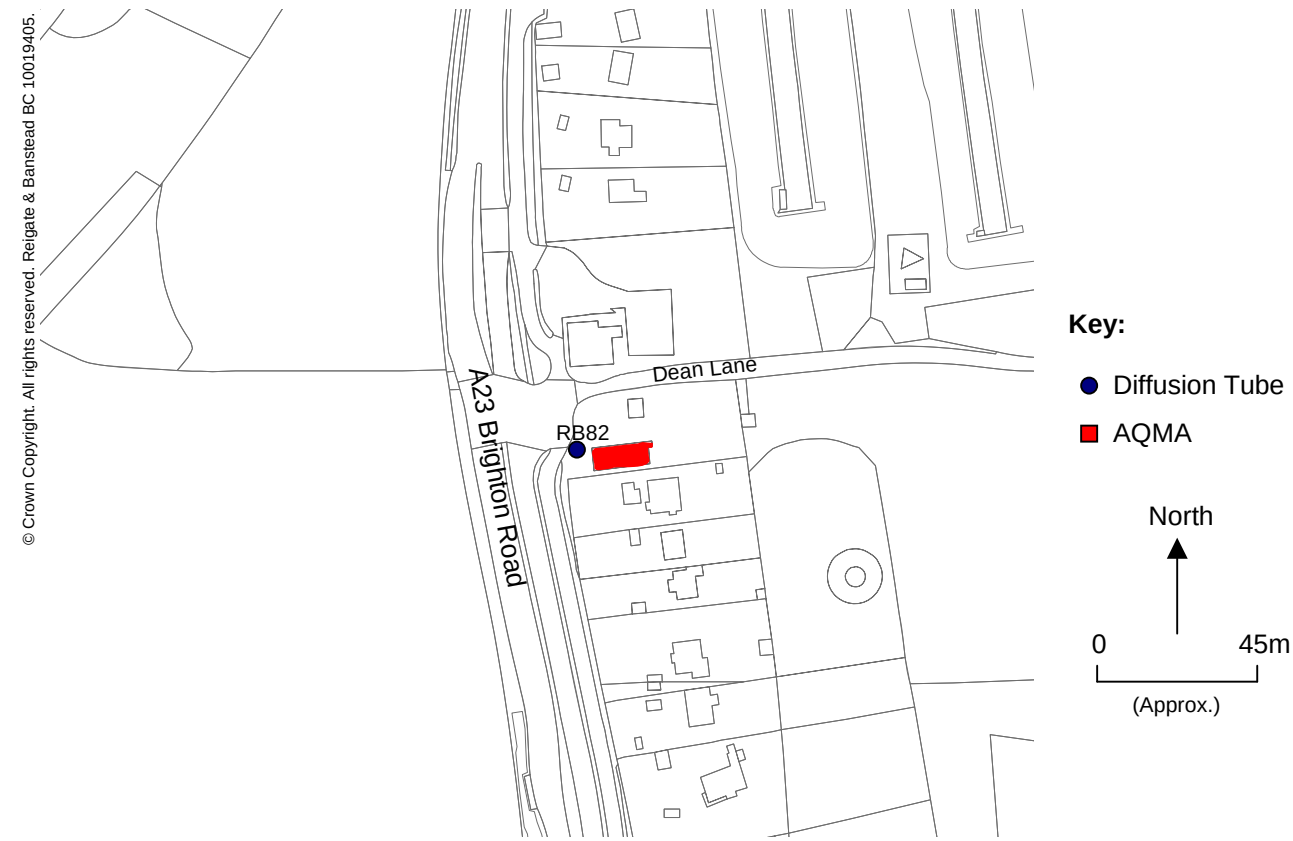


Figure 4.9: A23 / Dean Lane AQMA, Hooley Surrey.

4.40 Nevertheless, the AQMA at this site will remain for now as a precautionary measure given the predicted breach of the 2005 objective based on the 2003 data, and the small margin for error (less than 5 %) for the projected 2005 concentration based on the 2004 monitoring data, but this decision will be reviewed in subsequent updating and screening and progress reports.

4.3.2.4 Current AQMA: M23 to the south of the M25

4.41 This AQMA was declared in April 2002, and affects a single property near to the M23 to the south of the M25. A further assessment of this site in April 2004 (AQC, 2004b), recommended that the AQMA should be retained until some definitive monitoring data could be obtained, as there was a 'higher than normal' degree of uncertainty associated with the modelling of this particular site (AQC, 2004b).

4.42 Monitoring began in June 2004 but only five out of a possible seven months of tube data was collected due to tubes being removed. Therefore, the tube data was 'converted' to an annual average concentration (Appendix D) using the methodology recommended by DEFRA (DEFRA, 2003). This approach indicates that the annual average concentration of nitrogen dioxide at the property within the M23 AQMA was likely to have been 25 $\mu g\ m^{-3}$ in 2004.

4.43 However, this period to annual conversion is not necessarily that accurate, and may lead to an underestimate of the 'true' concentration in this case, as the example in Appendix D shows. Nevertheless, despite the errors associated with the period to annual conversion, it is unlikely that the concentration of nitrogen dioxide in 2004 at the property on the M23 was any higher than 30 to 34 $\mu g\ m^{-3}$. Consequently, there is unlikely to be a breach of the 2005 annual average objective, or the 2010 annual average limit value for nitrogen dioxide at this site.

4.44 Despite the low concentration of nitrogen dioxide, the limited amount of monitoring data to date from this site means that the AQMA will remain in place until at least a further twelve months of data has been collected from this site.

4.3.2.5 Current AQMA: Junction of the A217 and Rushworth Road

4.45 The AQMA at the junction of Rushworth Road and the A217 (Figure 4.10) was declared in July 2005, following the detailed assessment of April 2004 (RBBC, 2004). Two diffusion tubes are collocated at Rushworth Road, and the annual average concentrations measured by these tubes were 34 and 38 $\mu g\ m^{-3}$ in 2004. This compares to an annual average of 45 $\mu g\ m^{-3}$ in 2003, based on 8 months data extrapolated to one year (RBBC, 2004).

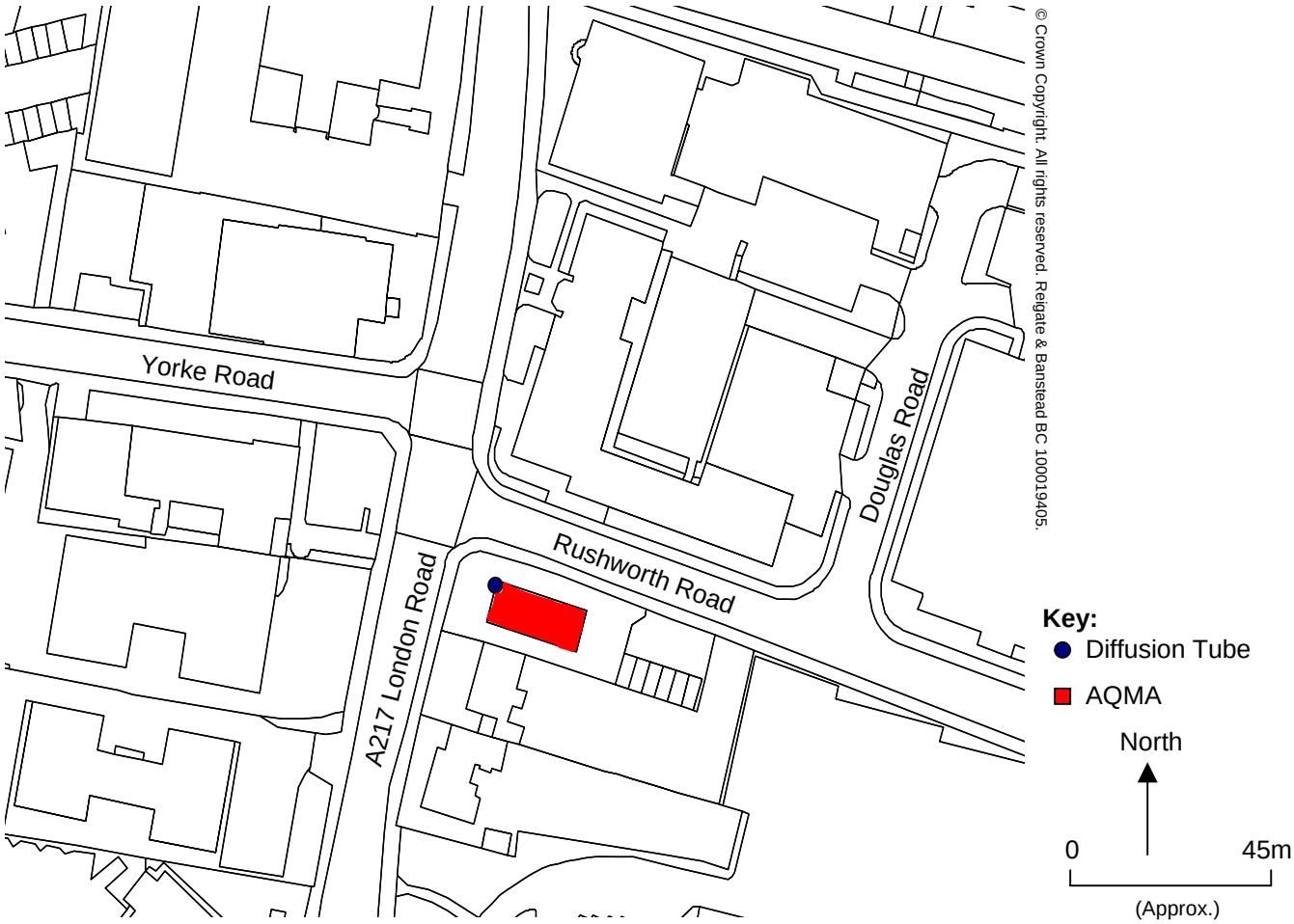


Figure 4.10: Rushworth Road Air Quality Management Area (AQMA).

4.46 The high concentration in 2003 compared to 2004 is consistent with that seen elsewhere in the borough (Figure 4.1), and projections based on the 2004 data indicate that the site would meet the 2005 annual average objective, and 2010 annual mean EU limit value for nitrogen dioxide.

4.47 However, given the limited data from the site so far the AQMA will remain, but subject to review in future updating and screening assessments and progress reports.

4.3.2.6 Current AQMA: The M25

4.48 The M25 AQMA consists of a 30 m strip either side of the edge of the M25 carriageway. The AQMA was declared in April 2002, and confirmed by the Further Assessment (Stage 4) of May 2003 (AQC, 2003).

4.49 Monitoring takes place at a series of properties that are close to the motorway (Figure 4.11), with diffusion tubes located on the building façades. There is also a perpendicular transect from the motorway (RB37 to RB39) along Ashcombe Road, with a further three properties closer to the motorway than the RB39 site.

4.50 The results of the monitoring data are shown in Figure 4.12, and in general follow the same pattern seen elsewhere in the borough of higher concentrations of nitrogen dioxide in 2003 compared to 2002 or 2004. The concentrations in 2004 were above 40 μg m^{-3} at one property - RB27. The concentration of nitrogen dioxide is unlikely to have been over 40 μg m^{-3} at the properties closest to the motorway on Ashcombe Road, as the worst case receptor has been shown in previous modelling studies (AQC, 2003) to be around 4 μg m^{-3} higher than the RB39 monitoring site. Thus at the worst case receptor on Ashcombe Road the annual average nitrogen dioxide concentration would have been around 37 μg m^{-3}.

4.51 The concentration of nitrogen dioxide at RB27 at around 42 μg m^{-3} is within the expected range of concentrations for a property this close to the motorway based on previous studies (AQC, 2003). The fact that this site is predicted to breach the 2005 annual average objective for nitrogen dioxide (Appendix C), merely confirms the decision of the Further (Stage 4) assessment (AQC, 2003) to retain the M25 AQMA.

4.52 However, projections of the current monitoring data to 2010 (Appendix C) indicate that the EU annual mean limit value of 40 μg m^{-3} will be met, which is in agreement with the findings of the M25 air quality action plan (RBBC, 2004a).

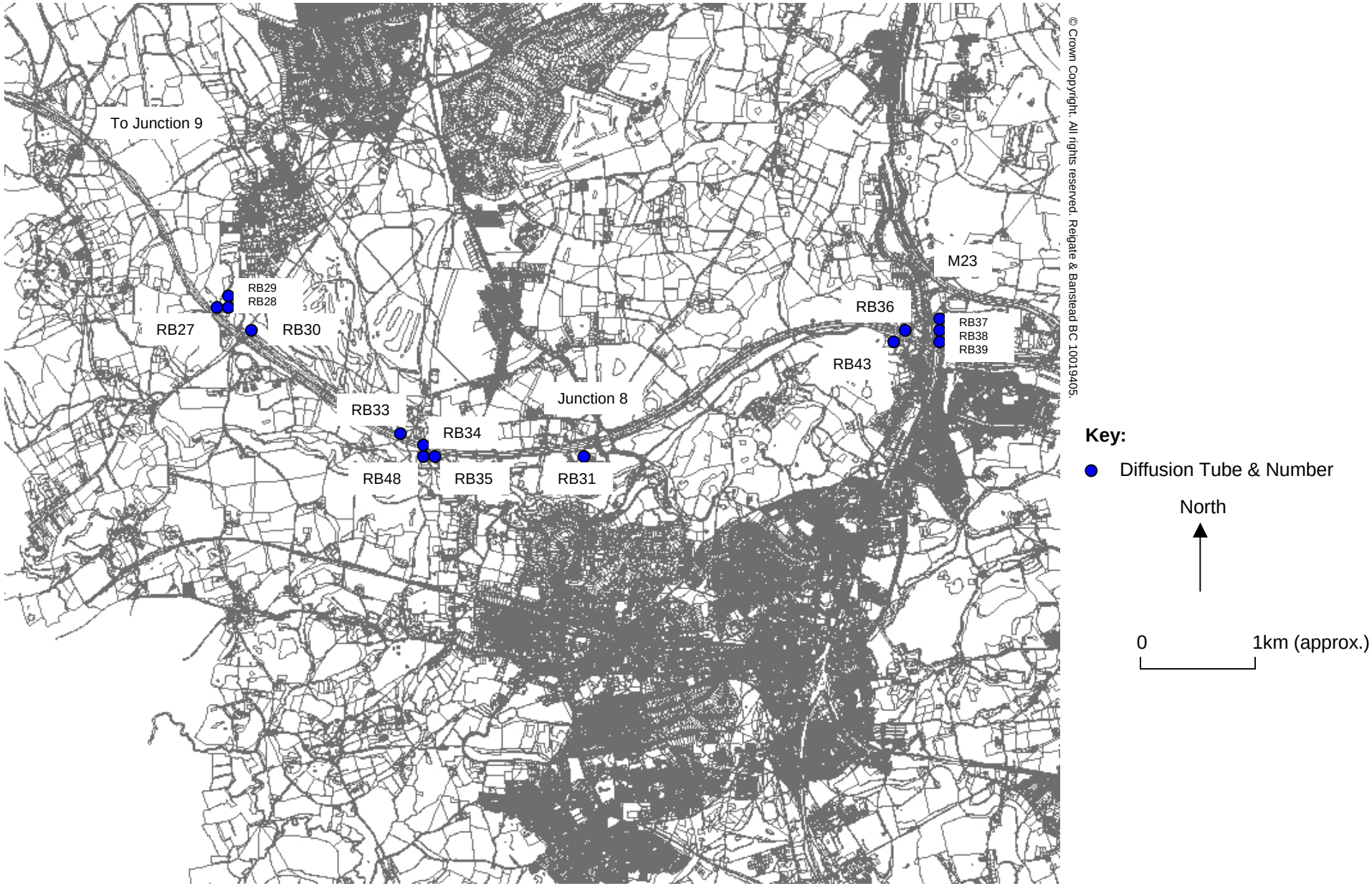
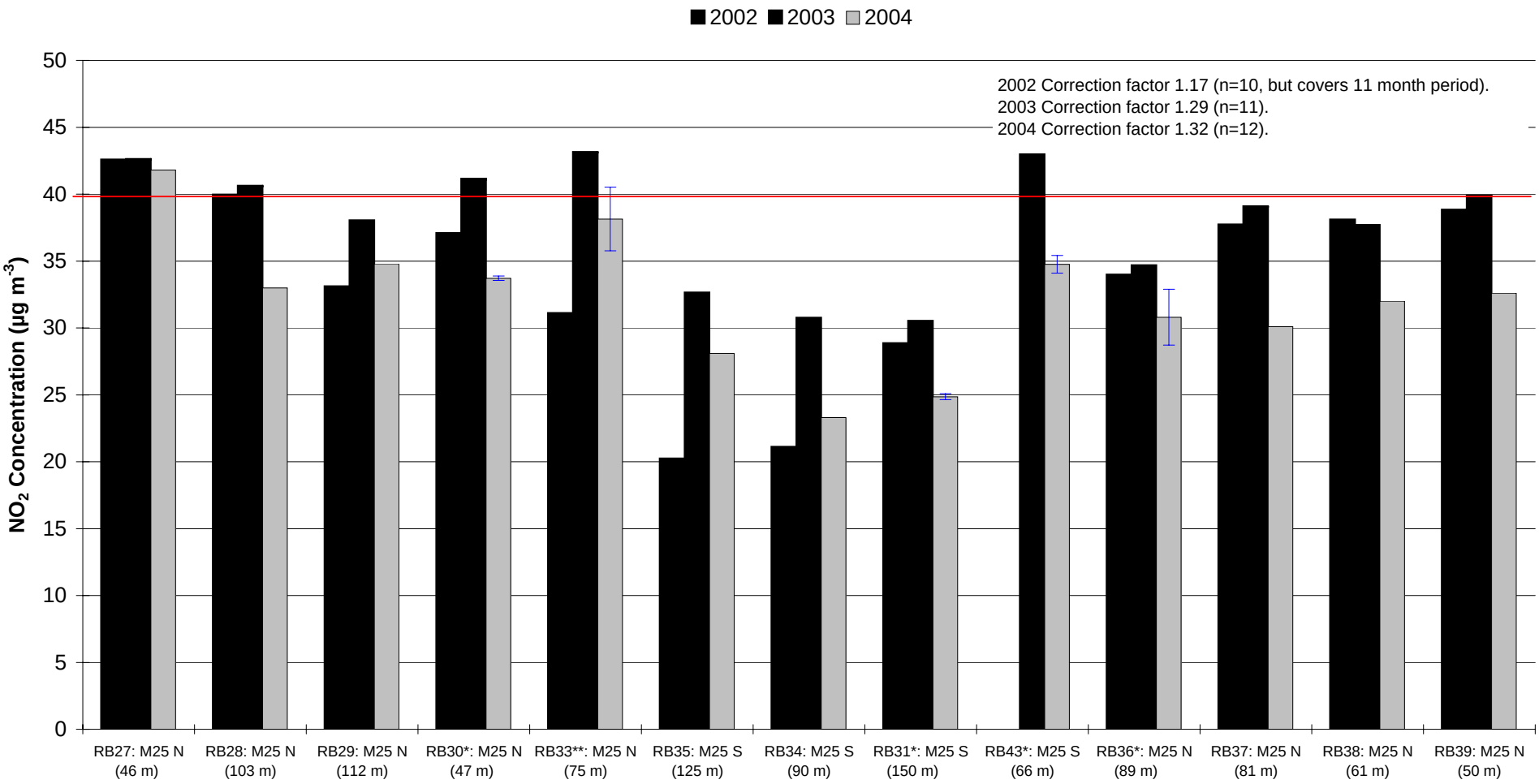


Figure 4.11: Location Map of M25 Diffusion Tubes.

Figure 4.12: Annual Mean Nitrogen Dioxide Concentrations along the M25 (Corrected Diffusion Tube Data).



* Average of more than one tube. Max. and Min. values shown on graph.

** Site moved November '04 c.100 m west of building façade but still same perpendicular distance from the motorway.

Note: RB43 no data for 2002. (xx m) Distance from building façade to centre of carriageway.

4.3.2.7 Current AQMA: Horley

4.53 The Horley air quality management area (Figure 4.13) was declared in April 2002, and monitoring takes place at 27 locations within the AQMA (Figure 4.14) using diffusion tubes in addition to two real time monitors. The purpose of the large number of diffusion tubes is to delineate the spatial extent of the pollution problem for nitrogen dioxide, and how it grows / contracts with time.

4.54 The Horley AQMA is unusual in that a large and growing proportion of the pollution is from aircraft rather than road traffic, and so unlike all of the other AQMAs within the borough the concentrations of nitrogen dioxide will not fall of their own accord with time as a consequence of improved road vehicle engine technology. Although there will be reductions in the concentration of nitrogen dioxide from road traffic, these falls are off set by increasing emissions from the aircraft at the airport, leading to no overall improvement in air quality around the airport by 2010 (RBBC, 2005).

4.55 The monitoring results from the two real time sites RG1 (located at RB26) and RG2 (RB78) are shown in Appendix E. The data capture from RG1 over the year has been consistently good, with overall data capture for the year at 99.6 %. Data capture at the RG2 site was lower at 89.9 %, and so falls outside of the 90 % data capture required for a valid one year data set. The loss of the data at RG2 was due to a one off equipment failure, which meant that the majority of the data loss occurred in 'one go'.

4.56 One of the problems identified in the 2003 updating and screening assessment was that the RG2 site, run in conjunction with BAA Gatwick, was measuring lower concentrations of nitrogen dioxide nearer to the airport than the 'background' RG1 site. This contradicted the pattern seen with the diffusion tubes, and was not what would have been expected given the proximity of the RG2 site to the airport. The original RG2 site was replaced in September 2003 and a comparison of the new monitor at RG2 with RG1, over the 11 month period for which data was available (Figures 4.15 and 4.16), clearly demonstrates that the concentration of nitrogen dioxide at RG2 is higher than at RG1 as would be expected. This suggests that the original monitor used at the RG2 site may well have been under reading the concentrations of nitrogen dioxide in the vicinity of the airport until September 2003.

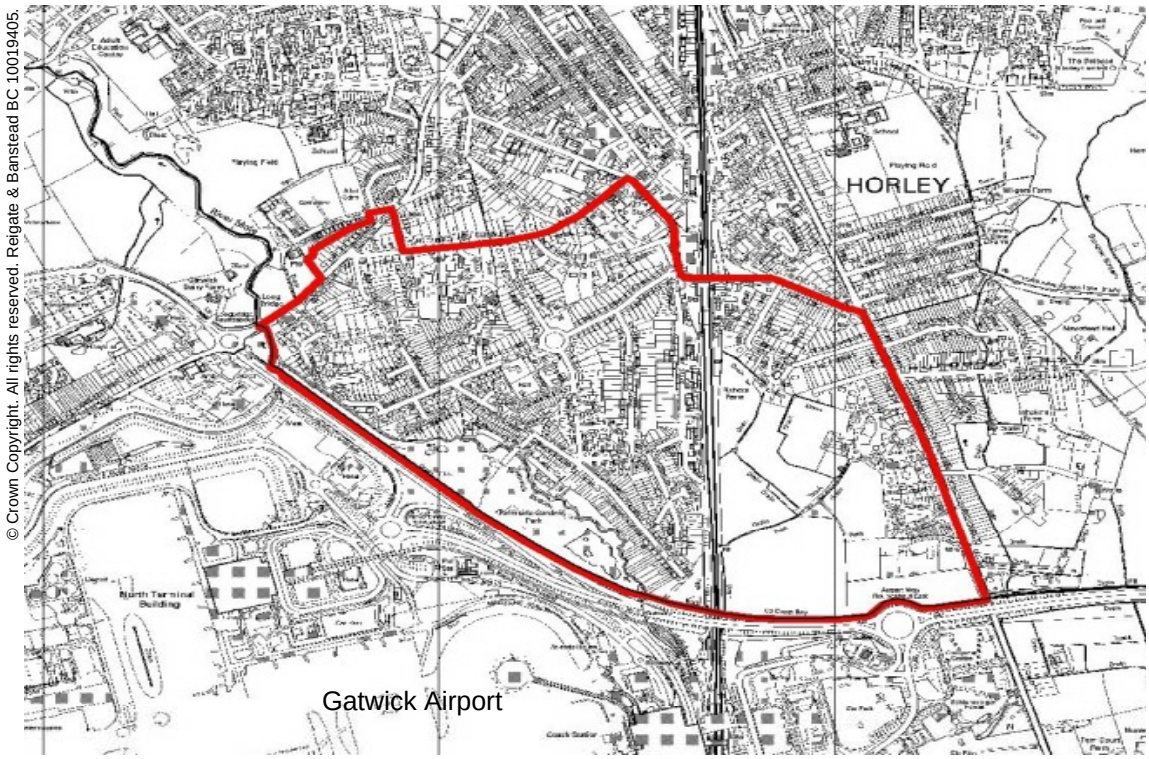


Figure 4.13: Horley Air Quality Management Area near to Gatwick Airport.

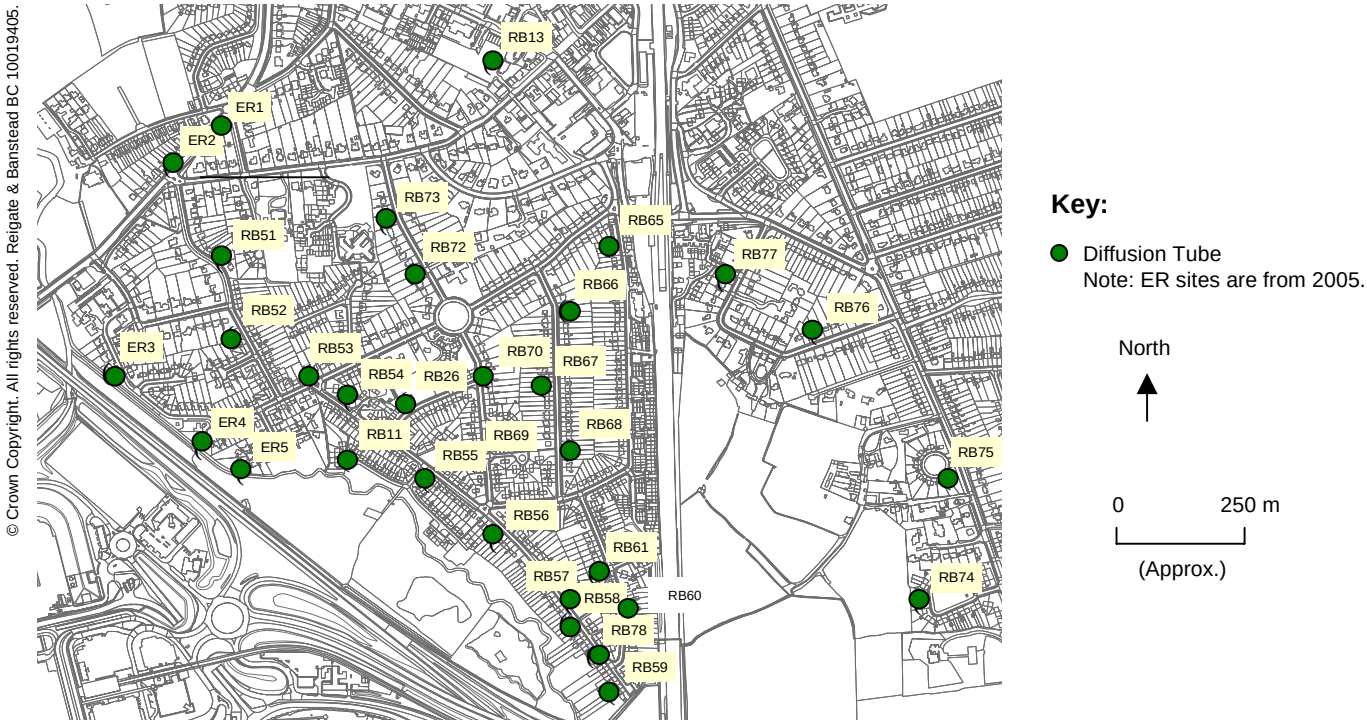


Figure 4.14: Location of Diffusion Tubes within the Horley AQMA.

Figure 4.15: Correlation between Hourly NO_2 Concentrations at the Horley Monitoring Sites (2004 data).

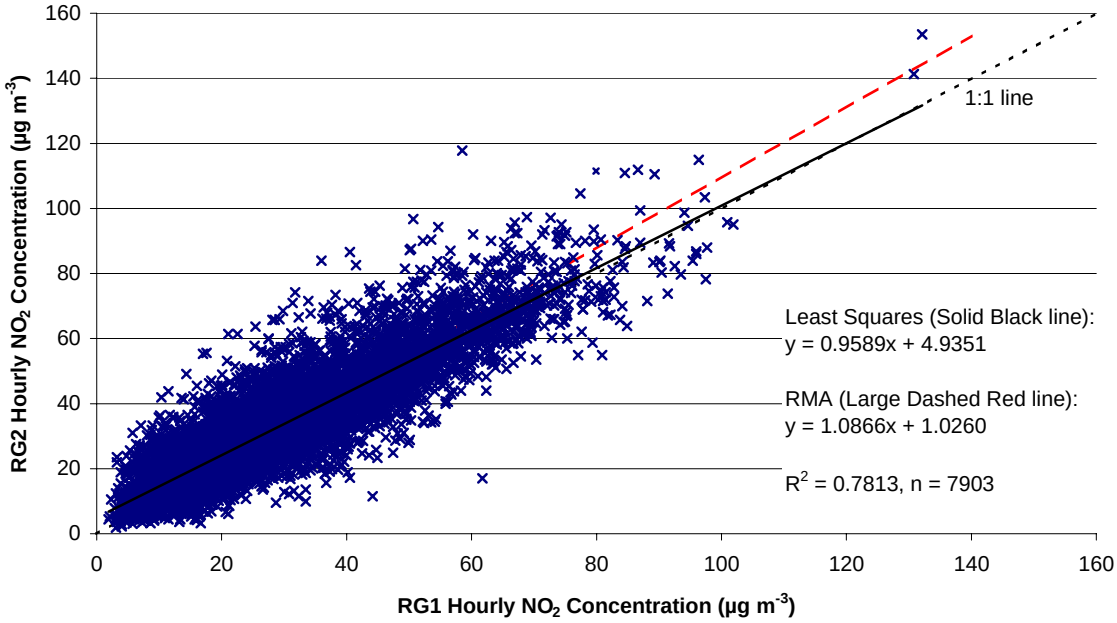
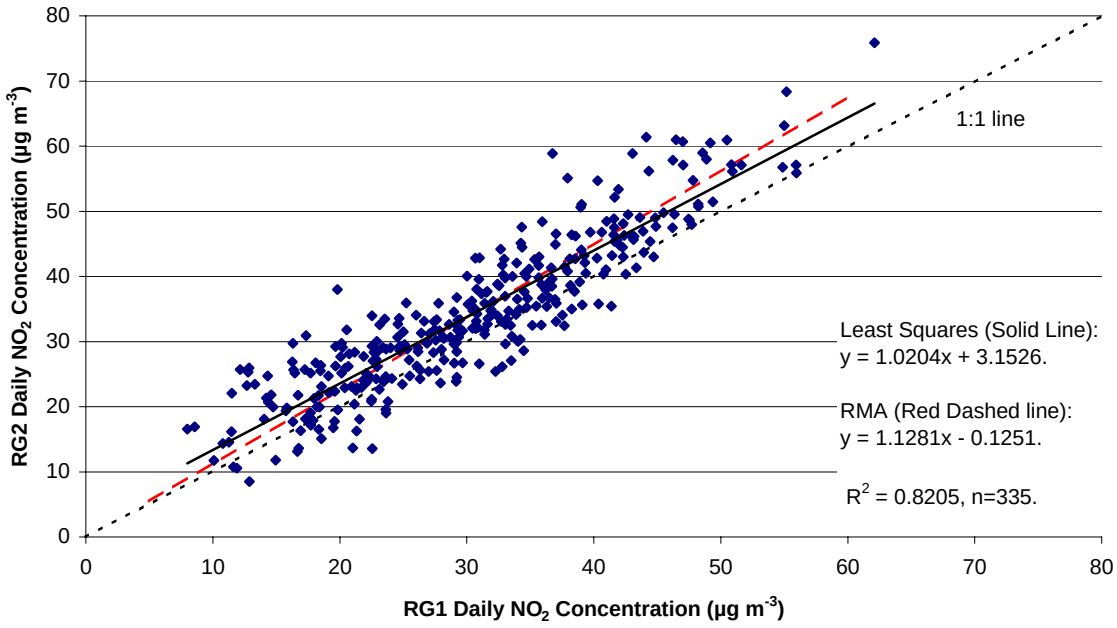


Figure 4.16: Correlation between Daily NO_2 Concentrations at the Real Time Sites in Horley (2004 Data).



4.57 An analysis of the 11 month data set from RG2 based on wind direction (Figure 4.17) clearly shows statistically significantly higher concentrations of nitrogen dioxide when the wind is from the southwest, south, and southeast. The concentration of nitrogen dioxide is also elevated when winds are from the north, compared to winds from the north east, east, and west, but this is still statistically significantly lower than when the wind is from the south west, south, or south east i.e. off airport.

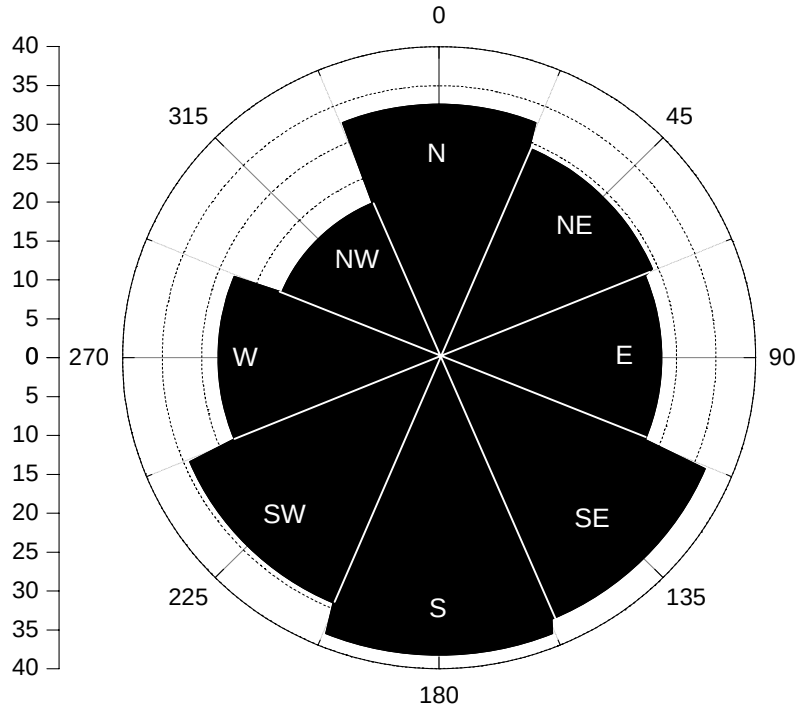
4.58 The diffusion tube monitoring results for 2003 are shown in Figure 4.18, for 2004 in Figure 4.19, with the predicted concentrations based on dedicated airport modelling (AQC, 2004b) in Figure 4.20 for 2005 and Figure 4.21 for 2010.

4.59 As can be seen from the 2003 and 2004 monitoring data, the higher concentrations of nitrogen dioxide seen elsewhere within the borough in 2003 are also present in the vicinity of Gatwick airport. This demonstrates that the emissions from the airport coupled with 'unfavourable' weather conditions can lead to a far greater number of properties (80 +) being affected by poor air quality, than modelling using 'average' weather conditions might suggest.

4.60 The 2004 monitoring data indicates that the concentration of nitrogen dioxide was below 40 $\mu g\ m^{-3}$ across the AQMA, although concentrations in The Crescent (RB59, 58, and 78) were 39 $\mu g\ m^{-3}$, 38 $\mu g\ m^{-3}$, and 37 $\mu g\ m^{-3}$ respectively (Appendix C).

4.61 However, as the predicted concentrations for 2005 (Figure 4.20) and 2010 (Figure 4.21) show breaches of the 2005 UK annual average nitrogen dioxide objective, and the 2010 EU annual average limit value respectively, the Horley AQMA is to remain. The spatial extent of the AQMA will also remain unchanged at the present time, as the predicted 2010 concentrations of nitrogen dioxide may well be an under estimate of the 'true' concentrations given that BAA Gatwick has yet to undertake a full dispersion model of 2010, and as the current 2010 projections do not take account of the disproportional increase in air traffic using the north terminal in the coming years which is closer to the residential properties.

Figure 4.17: Average (Median) Nitrogen Dioxide Concentrations by wind sector in 2004 at RG2, The Crescent, Horley.



Data Summary:

	Median NO_2 ($\mu g\ m^{-3}$)*
E	28.1
N	32.6
NE	29.3
NW	21.6
S	38.2
SE	36.5
SW	34.2
W	27.9

*Median NO_2 Concentration ($\mu g\ m^{-3}$) based on hourly mean data.

Note: Data capture 89.95 % in 2004. No data was collected from 23/10/04 to 23/11/04.

Kruskal-Wallis Test Output Data:

	n	Median	Ave Rank	Z
E	897	28.11	3509.9	-5.59
N	602	32.6	3991.4	0.97
NE	465	29.25	3534.1	-3.66
NW	1254	21.61	2875.5	-17.66
S	1081	38.24	4759.8	13.42
SE	407	36.52	4749.2	7.75
SW	1681	34.22	4438.9	10.95
W	1423	27.92	3627.2	-5.15
Overall	7810		3905.5	

H = 630.76 DF= 7 P = 0.000

H = 630.76 DF= 7 P = 0.000 (adjusted for ties)

Multiple Comparison Analysis Test Results:

	E	N	NE	NW	S	SE	SW	W
E		P < 0.001	No Sig. Dif.	P < 0.001	P < 0.001	P <0.001	P < 0.001	No Sig. Dif.
N	P < 0.001		P < 0.05	P < 0.001	P < 0.001	P <0.001	P < 0.001	P < 0.05
NE	No Sig. Dif.	P < 0.05		P < 0.001	P < 0.001	P <0.001	P < 0.001	No Sig. Dif.
NW	P < 0.001	P < 0.001	P < 0.001		P < 0.001	P <0.001	P < 0.001	P < 0.001
S	P < 0.001	P < 0.001	P < 0.001	P < 0.001		No Sig. Dif.	P < 0.05	P < 0.001
SE	P < 0.001	P < 0.001	P < 0.001	P < 0.001	No Sig. Dif.		No Sig. Dif.	P < 0.001
SW	P < 0.001	P < 0.001	P < 0.001	P < 0.001	P < 0.05	No Sig. Dif.		P < 0.001
W	No Sig. Dif.	P < 0.05	No Sig. Dif.	P < 0.001	P < 0.001	P < 0.001	P < 0.001	

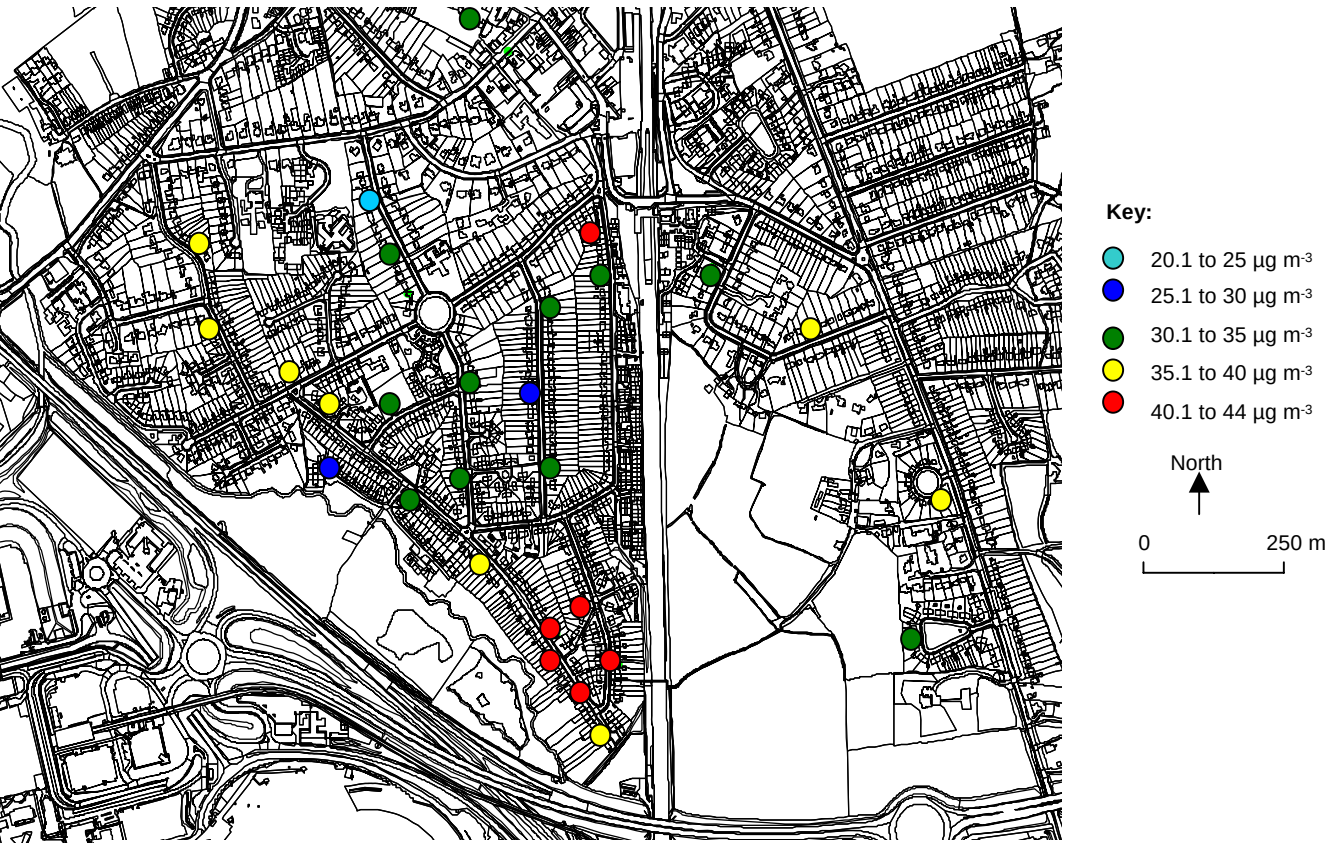


Figure 4.18: 2003 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Measured values from diffusion tubes and real time monitoring. Tube correction factor = 1.29 (n=11), for details see RBBC, 2004.

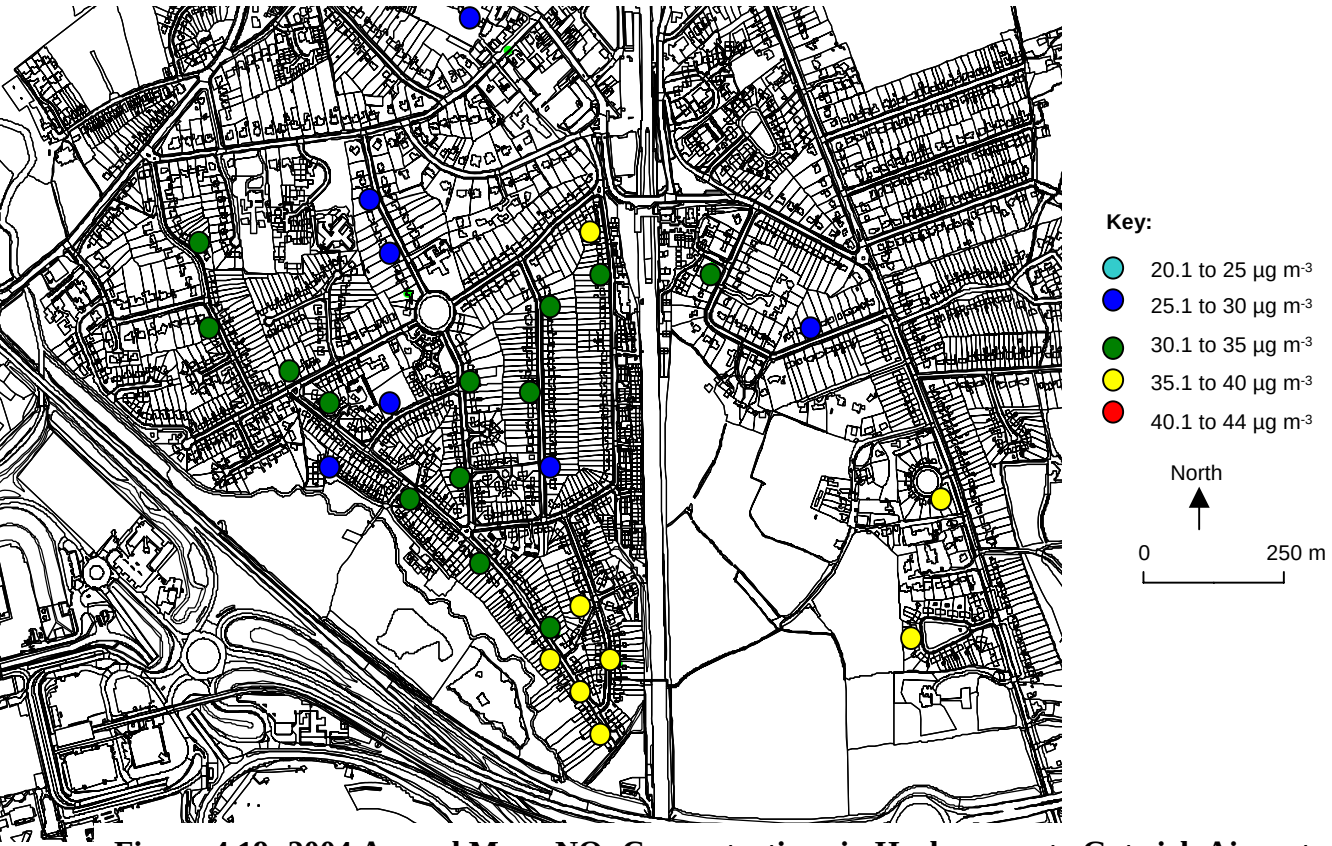


Figure 4.19: 2004 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Measured values from diffusion tubes and real time monitoring. Tube correction factor = 1.32 (n=12).

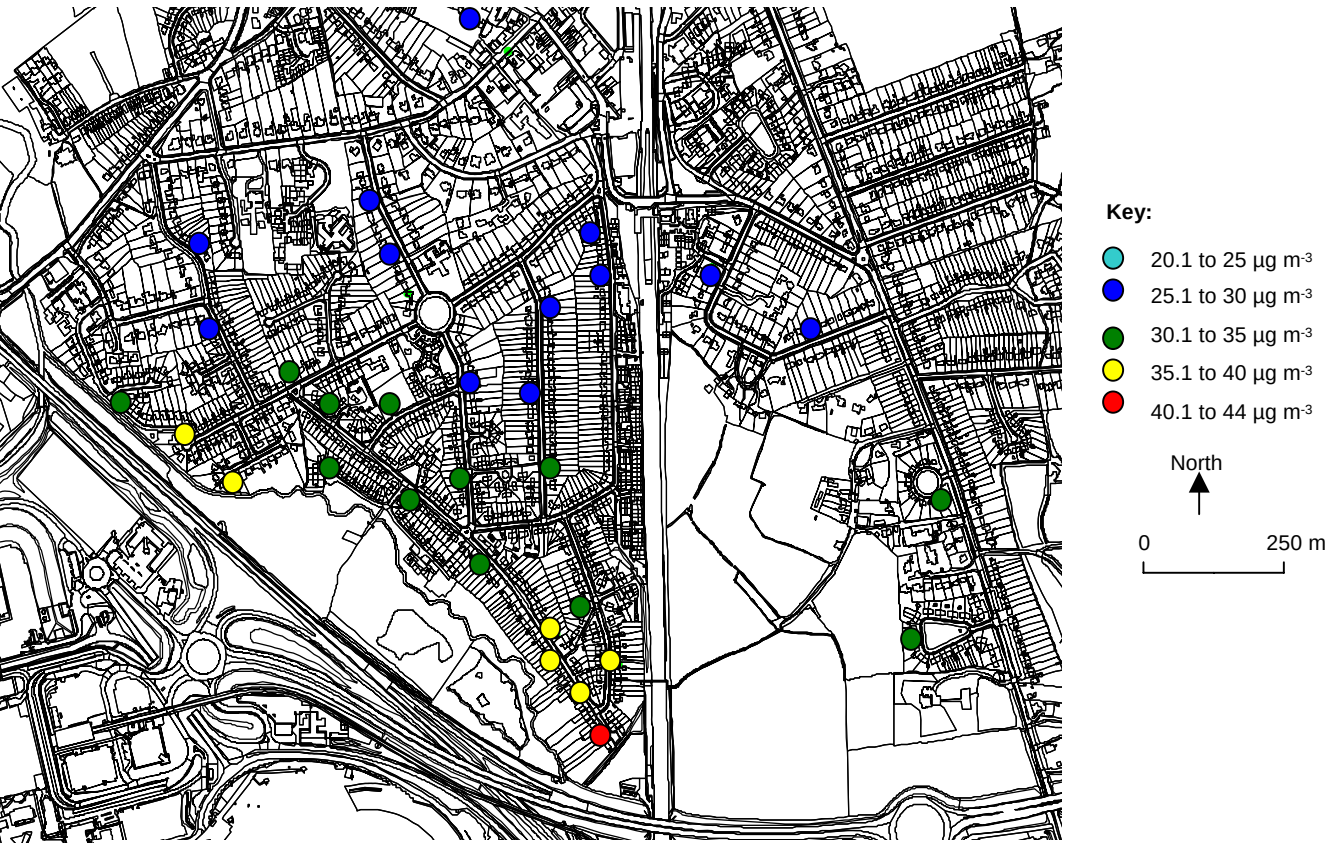


Figure 4.20: 2005 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Values based on dispersion modelling. For full methodology see AQC, 2004b.

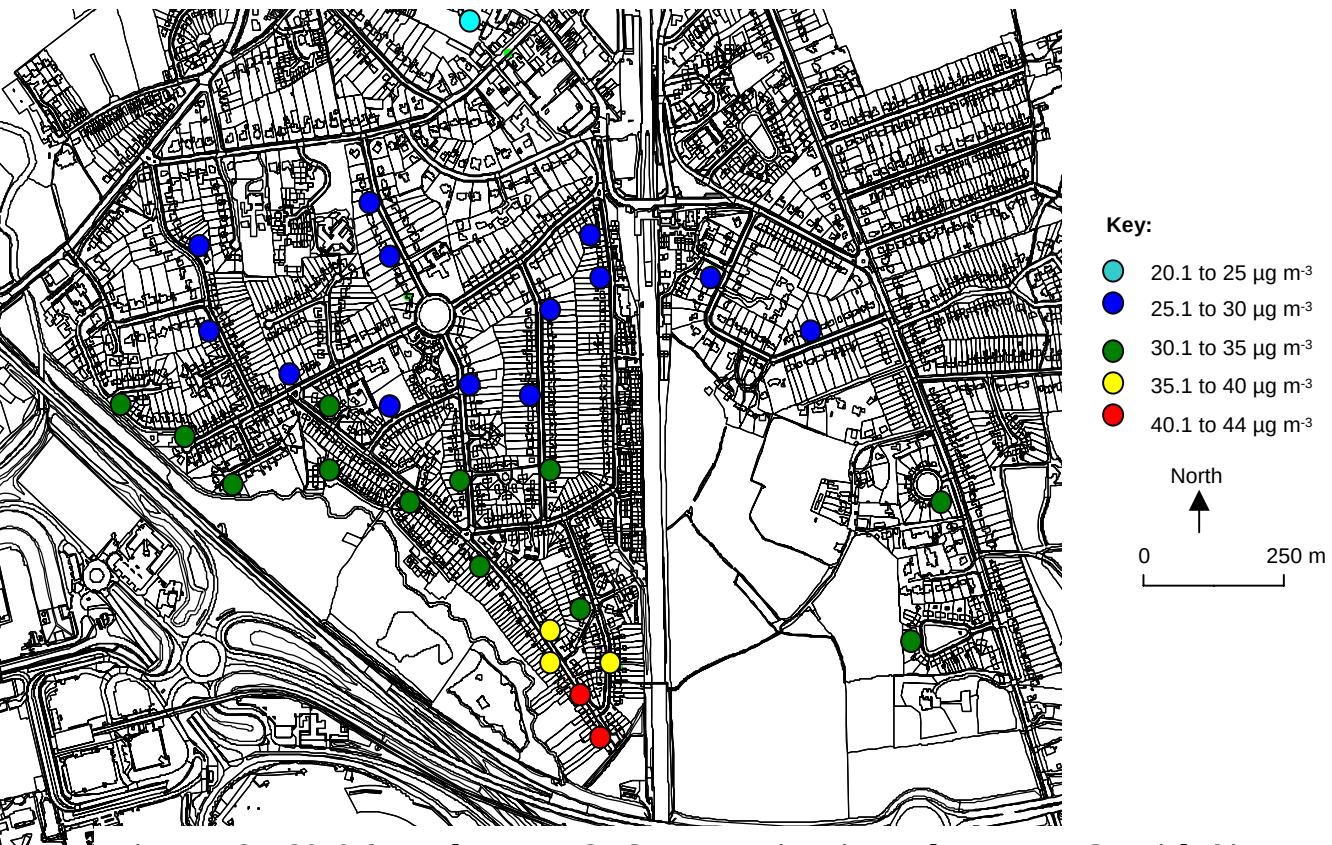


Figure 4.21: 2010 Annual Mean NO_2 Concentrations in Horley near to Gatwick Airport.

Values based on scaled 2002/3 dispersion modelling and 2010 Emissions Inventory. For full methodology see NETCEN, 2004.

4.4 Particulate Matter (PM_{10})

4.62 The council has a single monitor (R&P TEOM) to examine trends in the suburban background concentration of PM_{10}, which is located at the RG1 NO_x monitoring site in Michael Crescent, Horley. A further site at the RG2 NO_x monitor in The Crescent has since been removed, as there were no indications that the PM_{10} concentrations in the vicinity of the airport were likely to breach the 2004 UK/EU objectives (Table 1.1) for PM_{10}.

4.63 The results from the TEOM located in Michael Crescent (Figure 4.22) also indicate that the PM_{10} concentrations were below the 2004 objectives both in terms of the annual average and with no days during 2004 over 50 $\mu g\ m^{-3}$.

4.64 The historical data (Table 4.5) demonstrates the impact of the prevailing weather on the recorded PM_{10} concentrations, with higher concentrations measured during 2003 compared to the other years, a trend also seen with nitrogen dioxide. However, despite the higher concentrations of PM_{10} in 2003 these were still below the 2004 objective values for PM_{10}.

4.65 The PM_{10} data set is still too limited to identify long term trends in the data in any detail at present, but with the exception of 2003 it would appear that daily PM_{10} concentrations are fluctuating within a narrower range of values as time goes on i.e. the maximum daily values year on year are falling.

4.66 Projection of the 2004 monitoring data forward to 2010 (Table 4.6) using the method proposed by DEFRA (DEFRA, 2003), indicates that the PM_{10} concentrations at this site will be close to the proposed 2010 annual average objective for PM_{10} of 20 $\mu g\ m^{-3}$, and may well breach this standard if it were introduced.

	2001	**2004**	**2010**
Secondary Component	8.42[a]	7.85	6.69
Primary Component	-	3.95	3.46
Coarse Component	-	10.5	10.5
Overall PM_{10} Concentration	-	22.3	20.6
[a] From DEFRA 2005. Year Projection factors from DEFRA, 2003.			

Table 4.6: Projected PM_{10} Concentration in 2010 at The Scout Hut, Michael Crescent, Horley.

4.67 It also needs to be borne in mind with this projection that there will be a small contribution to the PM_{10} concentration at this site from the airport, and that the predicted falls in the primary component of the PM_{10} may not fall in line with the national projections, which are based mainly on road traffic emissions.

Figure 4.22: 2004 Daily PM_{10} Concentrations (TEOM x 1.3) - Michael Crescent Horley, Surrey.

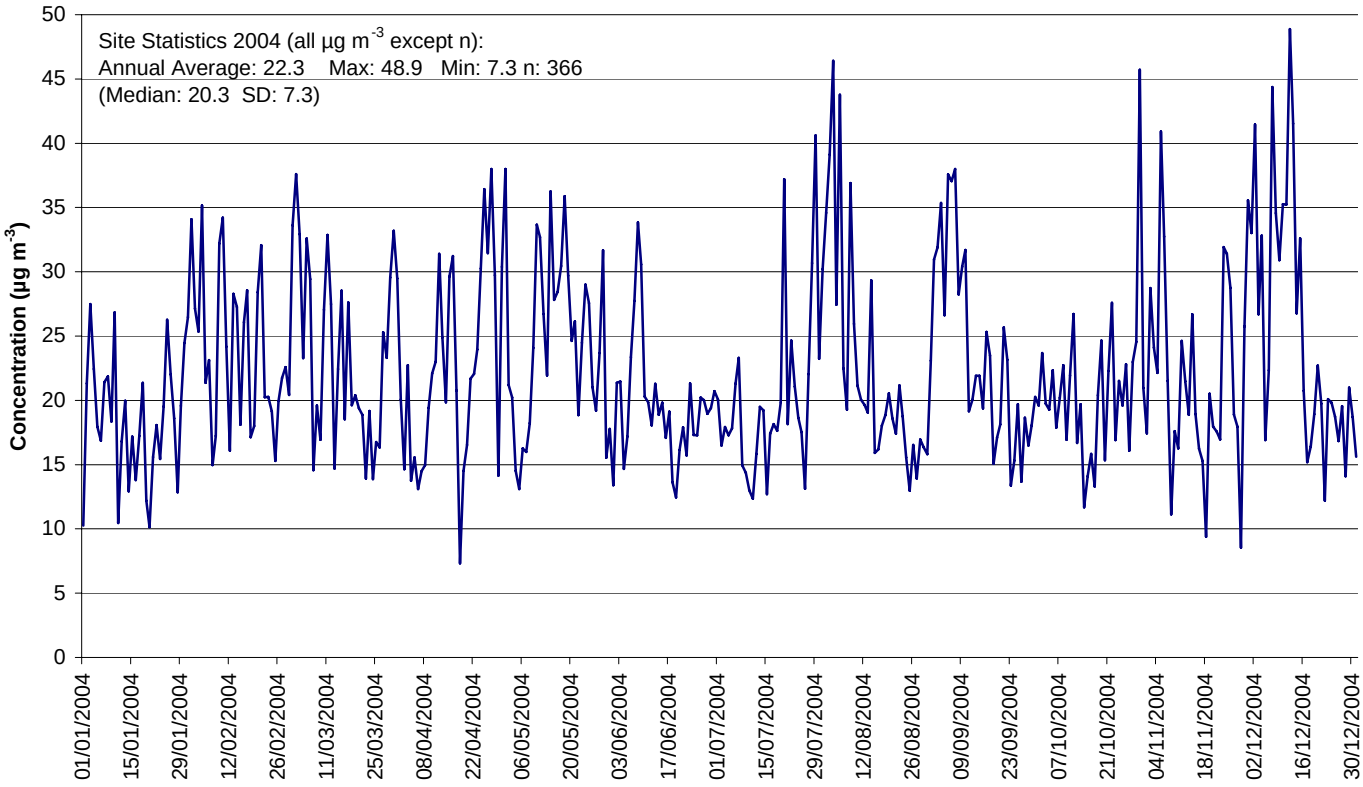


Table 4.5: Historical PM_{10} (TEOM x 1.3) Concentrations 2001 to 2004 at Michael Crescent, Horley, Surrey (RG1).

	Annual Average	Days > 50 µg m^{-3}	Max.	Min.	Median	SD	n (days)	% Data Capture
2001	22.8	6	73.0	8.5	20.4	9.4	364	99.7
2002	23.2	6	63.9	6.8	21.3	8.3	365	100.0
2003	25.7	16	75.8	6.4	21.9	11.4	363	99.5
2004	22.3	0	48.9	7.3	20.3	7.3	366	100.0
Objective	40 (or less)	< 35	-	-	-	-	-	90.0

All values µg m^{-3} unless stated otherwise.

4.5 Non Criteria Pollutants: Ozone

4.68 Ozone is a regional pollutant and as such does not fall under the remit of local air quality management. However, the UK government has set a national objective (Table 4.7) in its own air quality strategy (DETR, 2000), but this is a policy aim and there is no requirement for the Secretary of State to meet this objective value.

4.69 The third EU daughter directive relating to air quality also includes target values for ozone for 2010 and 2020 (Table 4.7), but there is no legal obligation on member states to achieve these targets.

Year	Standard	Measure	Source
2005	100 μg m^{-3} to be exceeded no more than 10 x per year.	8 hour running mean	UK Air Quality Strategy (DETR, 2000)
2010	120 μg m^{-3} to be exceeded no more than 25 x per year.	8 hour running mean	EU 3rd Air Quality Daughter Directive
2020	120 μg m^{-3} with no exceedences.	8 hour running mean	EU 3rd Air Quality Daughter Directive

Table 4.7: UK / EU Ozone Objectives.

4.70 Although there is no requirement for the council to examine the concentration of ozone with regard to these objectives, ozone is an important pollutant not only in its own right but also in that the concentration of ozone will in part determine the concentration of nitrogen dioxide within the borough as:

$$NO + O_3 \rightarrow NO_2 + O_2$$

Ozone Nitrogen Dioxide (Equation 4.1)

4.71 As nitrogen dioxide is a pollutant of concern within the borough, especially within the Horley AQMA, it was considered important that some preliminary data was collected on the trends in the ozone concentrations.

4.72 Therefore ozone concentrations were monitored at a single residential property in the vicinity of Gatwick Airport (RB11, Figure 4.14) during 2003 and 2004. The monitoring was undertaken using a single ozone diffusion tube changed monthly with the NO_2 diffusion tubes, and supplied by Lambeth Scientific.

4.73 The purpose of the site is to examine how ozone concentrations vary in the long term, rather than for direct comparison to the national objectives, although this approach assumes that any errors associated with the diffusion tubes remain constant from year to year. The annual average concentrations from 2003 and 2004 are shown in Table 4.8.

	Annual Mean Concentration ($\mu g\ m^{-3}$)
2003	45
2004	40

Table 4.8: Annual Mean Ozone Concentrations 2003 - 2004.

4.74 Assuming that the errors in the tubes are consistent from year to year, then the ozone concentrations were higher in 2003 compared to 2004, a pattern seen with both the PM_{10} and nitrogen dioxide concentrations. The fact that the nitrogen dioxide concentrations were elevated in 2003 compared to 2004, suggests that the differences in the ozone concentration are 'genuine', as it would have been the elevated ozone concentrations in 2003 (as a result of the prevailing weather conditions) that caused the elevated nitrogen dioxide concentrations as per Equation 4.1.

5.0 Action Planning

5.1 To date the council has declared the following areas air quality management areas (AQMAs), due to a predicted exceedance of the 2005 annual average objective for nitrogen dioxide:

i) A property on the south east corner of the junction of the A217 with Rushworth Road in Reigate.

ii) A property at the south east corner of the junction of the A23 and Dean Lane in Hooley.

iii) A 30 m strip either side of the M23 within the borough, to the south of the M25.

iv) An area of Horley in the vicinity of Gatwick Airport.

v) A 30 m strip either side of the M25 within the borough.

5.2 The council has completed one formal action plan to date, for the M25 AQMA, and progress on this action plan is reported later in this section.

5.3 An action plan for the Rushworth Road and Dean Lane properties is due for completion in the next six to twelve months, while the M23 action plan is on hold until a complete year of monitoring data has been obtained, as based on the data to date the AQMA may well be unnecessary.

5.4 The action plan for the Horley AQMA will rely in part on Gatwick Airports own action plan to reduce pollution, given that by 2010 58 % of the pollution at the worst case receptor within the Horley AQMA will originate from the airport. BAA Gatwick are due to complete their action plan for the airport by November 2005, and at present the Horley AQMA action plan will be completed within six to eight months of the BAA study.

5.5 BAA Gatwick is currently involved in preliminary negotiations with Crawley BC over the renewal of its section 106 agreement, its sustainable development strategy, and on bringing this work into the airport masterplan, and it is envisaged that the air quality action plan will form a component of the final agreement.

5.1 M25

5.6 The M25 action plan (RBBC, 2004a) was completed in its current form in April 2004. A summary of the proposed actions is set out in Table 5.1, and a summary of the actions to date in Table 5.2. As the status and actions to date are summarised in Table 5.2, it is not proposed to go into further detail on these. However, the suggested speed reduction measures on the M25, and possible improvements in HGV emissions do warrant further comment.

5.7 As part of the original action planning process a meeting was held with the Highways Agency in November 2003. At this meeting the potential introduction of a 50 mph (85 kph) speed limit on this section of motorway within the borough or on the whole M25 was discussed. At the meeting and in a subsequent report (HA, 2003) the Highways Agency argued that:

i) a blanket speed reduction may not necessarily produce the reductions in air pollution that are predicted by modelling especially for NO_x.

ii) it is not within the Highways Agency's power (an agency of the Department of Transport) to cap speed limits for environmental reasons alone, only for safety reasons and / or to reduce congestion.

5.8 However, following the meeting and after the Highways Agency report was published, it was noted that in the air quality documents supporting the Governments Aviation White Paper (produced by the Department of Transport), that speed reductions were felt to have a valuable role to play in improving air quality, and that it proposed the use of a 40 mph speed limit on the spur road to Heathrow as a means of improving air quality (specifically nitrogen dioxide) in the vicinity of Heathrow (DfT, 2004). A view somewhat at odds with the Highways Agency's own view at the end of 2003.

5.9 At the meeting in November 2003 with the Highways Agency it was agreed that it was possible that all of the modelled air quality benefits of a fixed reduction in speed limits may not be achieved in practice. However, the point was made that it was important to test the modelling results in practice on a trial basis, and the Highways Agency confirmed that a study was on going in Sheffield. This work in Sheffield is still 'on going' (HA, 2005), and no definite completion date has been given.

Table 5.1: Summary of Proposed Actions for the M25 Air Quality Management Area.

Action	Responsible	Start Date	Completion Date	Cost (£)	Potential Benefits	Potential Problems	Comments
Safety and lane discipline review of J7 M25.	HA	End 2003	April 2004	£40 to 50K	- Identification of possible safety improvements. - Identification of possible improvements in road signage to minimise flow breakdown.	None.	There is the possibility that no cost effective improvements will be identified. Thus from an air quality perspective no change. However, this action is not critical to improving air quality.
Improve Signing / Road markings on anticlockwise approach to J7 M25.	HA	After April 2004[a]	April 2005? subject to confirmation	£40 to 50K	If implemented: - Improved safety. - Potential for improved traffic flow. - If traffic flow improved potential reduction in NO_x emissions.	None. - All works are on an existing site, and the motorway is in a cutting at this point. - Any changes in the location of the signs will not be noticeable away from the motorway itself.	Recognised that (if) any change in NO_x emissions may have no detectable impact on measured concentrations at the affected properties. However this action is not critical to improving air quality.
Continue with Diffusion Tube Survey.	RBBC (Pollution Team)	June 2002	Dec. 2010 (minimum)	£1K (+ officer time of 1-2 hours per month for Ashcombe road sites).	- The most cost effective method of demonstrating that compliant with EU limit value. - Over two to three years will give an indication of the general trend in concentrations. - Used to inform the HA about general trends.	Sites for tubes are in place. - Possible continuity problems if residents no longer wish to participate in the study, and so sites have to be moved.	This is the most important part of the action plan, as this is the only method of ensuring that the projected improvements in vehicle emission factors, and thus concentrations of NO_2, actually happens in practice.
On going review of the Sheffield study into reduced speed limits on M'ways, and practical impact on air quality.	RBBC (Pollution Team)	2003	?	£0 to RBBC but + officer time.	- Might indicate if a fixed 50 mph limit does reduce emissions in practice, as suggested by modelling. - If it does, such a limit will also reduce CO_2 emissions, and noise pollution.	- Study may need to continue for several years to differentiate between improvements due to lower vehicle emission factors, changes in traffic flow, and weather variations.	This study could be critical if the improvements in vehicle emission factors do not occur in practice, or if traffic growth is far faster than predicted. Most models show that a reduced speed results in a significant reduction in pollution, as the higher emissions associated with speeds over 50 mph are no longer present. Lower speeds also tend to lead to improved traffic flow, and so the very slow speeds also associated with high emissions also occur less often.
Make central Government aware of the disproportionate emissions from articulated vehicles.	RBBC / HA	2003	on going	£0	- Tighter Euro standards for heavy duty diesel engines associated with articulated vehicles. - In the longer term would lead to lower emissions on this section of the M25, and providing that the emissions were lower under all engine operating conditions this would have benefits across the UK, Europe, and to a lesser extent other parts of the world.	- Long time frame - will not help at this stage to meet the 2010 EU limit value. - Risk that government goes for a simple tax on these vehicles, which does not encourage any improvement in emissions. - Risk of road pricing for these vehicles on motorways, resulting in greater use of A-roads. Thus a greater number of residents are affected by poor air quality than at present, and even higher overall emissions due to the greater amount of stop / start driving. Plus potential increase in accident risk, and greater number of people affected by increased noise.	Important that improvements are made in the emission factors of the engines used in these vehicles, rather than other measures.

HA: Highways Agency; RBBC: Reigate and Banstead Borough Council; [a] dependant on findings of above survey, and confirmation of financial budget for 2004/5.

Table 5.2: Summary of Actions to Date for the M25 Air Quality Management Area.

Action	Responsible	Start Date	Original Completion Date	Actual Completion Date / or Progress	Outcome	Comments
Safety and lane discipline review of J7 M25.	HA	End 2003	April 2004	Information finally received 2nd Quarter 2005	Complete. Conclusion of review is that existing signage and road markings can be improved, with new signage J8 to 7 proposed, along with new road markings.	None.
Improve Signing / Road markings on anticlockwise approach to J7 M25.	HA	After April 2004[a]	April 2005? subject to confirmation	Now due to complete April 2006.	None - awaiting work to begin.	Work still subject to final financial approval. At time of writing (July 05) work has yet to commence.
Continue with Diffusion Tube Survey.	RBBC (Pollution Team)	June 2002	Dec. 2010 (minimum)	Tube study on going	Results for 2004 included in this report. NO_2 concentrations broadly in line with expectations.	Survey will continue.
On going review of the Sheffield study into reduced speed limits on M'ways, and practical impact on air quality.	RBBC (Pollution Team)	2003	?	Proposed completion Feb 2005.	At a meeting on 13/4/05 (HA, 2005) it was said that the study was running a 'few months' late. Studies elsewhere e.g. Rotterdam (AQM, 2005) indicate that a fixed speed limit of 50 mph does give a significant reduction in NO_x in practice.	See section 5.1.1 for full commentary.
Make central Government aware of the disproportionate emissions from articulated vehicles.	RBBC / HA	2003	on going	Letter sent to DfT 17/3/04. Response 8/4/04.	Response from DfT stated that unlikely that there would be any new measures to address HGV emissions before 2011. (See Appendix F for letter and response).	Lack of action unfortunate, as HGVs a major source of NO_x on this section of the motorway, plus targeting this source has wider benefits for the UK and EU. Also cost effective. (See section 5.1.2).

HA: Highways Agency; RBBC: Reigate and Banstead Borough Council.

5.10 In the meantime a fixed reduction in speed limits has been implemented in Rotterdam, and this has demonstrated that noticeable improvements in air quality do occur in practice with such a scheme. In Rotterdam a blanket 50 mph speed limit was introduced, as proposed for the M25, on the city ring road which is of motorway standard, and carries over 150 000 vehicles AADT (comparable to that on the M25 within the borough). The road originally had an 80 mph speed limit, but the introduction of a blanket 50 mph limit lead to an improvement in air quality of 5 μg m^{-3} for nitrogen dioxide 50 m from the roadside, in addition to a reduced accident rate and less noise pollution from the road.

5.11 The project also aimed to reduce the number of heavy goods vehicles on the road, although at present there is no information on whether this part of the program was implemented. However, this scheme demonstrates that a permanent reduction in the speed limit to 50 mph on a motorway does result in reduced accidents (a criteria under which the HA can introduce a reduced speed limit), and that it does lead to a significant and measurable improvement in nitrogen dioxide concentrations in practice, contrary to what was suggested by the Highways Agency.

5.2 Improvements in Engine Technology

5.12 The Department of Transport was informed of our findings in the Further Assessment, of the disproportionate amount of NO_x pollution arising from HGVs on the M25 compared to cars. The response to the letter (Appendix F) suggests that there is unlikely to be any further action to reduce emissions from heavy goods vehicles until 2011 at the earliest.

5.13 This is unfortunate as one of the biggest sources of NO_x pollution from the M25 is from heavy goods vehicles, and with increasing numbers of HGVs from across Europe using this section of the M25, it means that the emissions from this vehicle sector are unlikely to improve as significantly as emissions from private cars. In addition any improvement in emissions from this vehicle category would not only benefit the small section of the motorway within the borough, but would also lead to an improvement in nitrogen dioxide concentrations on roads around the UK and across Europe by one of the most cost effective means.

6.0 Summary and Conclusions

6.1 The concentrations of benzene, 1,3 butadiene, carbon monoxide, lead, particulate matter (measured as PM_{10}), and sulphur dioxide within Reigate and Banstead remain below the UK Government objectives for these pollutants, as there have been no new developments either within the borough or in the vicinity of the borough that will affect the concentration of these pollutants.

6.2 Nitrogen dioxide concentrations within the borough, in general, also meet or are below the Government objectives for the appropriate year and in all cases, except near to Gatwick Airport, show a downward trend in the coming years.

6.3 Despite the overall downward trend in nitrogen dioxide concentrations, the monitoring data demonstrates that there are marked year to year variations depending on the prevailing weather conditions, with the concentrations of nitrogen dioxide measured in 2002 in general lower than those in 2004, which in turn were lower than those measured in 2003.

6.4 Routine monitoring of the nitrogen dioxide concentrations around the borough has identified three new areas of the borough that are likely to breach the 2005 annual average objective for nitrogen dioxide and which will require a detailed assessment. These are:

i) Two properties backing on to the A240 (Drift Bridge) near to the junction with the A2022, and a single property immediately to the north of the A240 / A2022 junction.

ii) A property on the A217 just before Blackhorse Lane, on the approach to the M25 J8 interchange.

iii) Reigate High Street, and the part of Church Street between the High Street and Bancroft Road.

6.5 Although the properties on the A240 and on Reigate High Street are likely to breach the 2005 annual average objective for nitrogen dioxide, they are likely to meet the 2010 EU limit value. However, the property on the A217 is unlikely to meet either the 2005 UK annual average objective or the 2010 EU annual average limit value for nitrogen dioxide.

6.1 The M25 Air Quality Management Area

6.6 The measured concentrations of nitrogen dioxide within this AQMA when projected forward to 2005 will breach the UK annual average objective for this pollutant, but the properties affected and the expected concentrations are in agreement with previous modelling and monitoring work.

6.2 The Horley AQMA near to Gatwick Airport

6.7 The measured annual average concentrations of nitrogen dioxide within this AQMA were over 40 µg m^{-3} (the 2005 objective value) at a number of points in 2003, but none of the monitoring sites recorded concentrations over 39 µg m^{-3} in 2004. Nevertheless, the predicted concentrations for 2005 are over the 2005 annual average objective for nitrogen dioxide, and the concentrations recorded in 2003 and 2004 are in line with what might be expected within this AQMA.

6.3 The M23 AQMA (to the south of the M25)

6.8 The limited data collected to date indicates that the concentration of nitrogen dioxide will be below the 2005 annual average objective. However, the limited data set to date means that the AQMA will be retained until more information has been collected during 2005.

6.4 The A23 / Dean Lane AQMA

6.9 Concentrations of nitrogen dioxide within this AQMA are predicted to breach the 2005 annual average objective based on the 2003 monitoring data, but meet the objective when based on the 2004 monitoring data. Given the borderline nature of this site the AQMA will remain in place.

6.5 The A217 / Rushworth Road AQMA

6.10 Monitoring data from this site in 2004 indicates that the site is likely to meet the 2005 annual average objective value for nitrogen dioxide, despite the predicted breach of this objective based on the 2003 data. As with the A23 / Dean Lane AQMA this site is a borderline case, but with a more limited data set on which to base decisions. Therefore the AQMA will remain in place for now, but subject to review in future updating and screening assessments and progress reports.

6.6 Action Planning Progress

6.11 Action plans for the A217 / Rushworth Road and he A23 / Dean Lane will be drawn up in the next six to twelve months, while a plan for the M23 is on hold until more data is collected as the AQMA may well be revoked.

6.12 Preliminary work on the action plan for the Horley AQMA is currently underway, and the action plan itself is likely to be completed in the next six to eight months. The airport action plan aimed at reducing emissions from the airport alone is due for completion in November 2005, and it is envisaged that this will be incorporated into any future arrangements between the airport and the local planning authority.

6.13 Improvements in road signage and road markings are due to take place on the M25 this financial year, as part of the M25 action plan, although the Highways Agency has yet to confirm this. The aim of this work is to improve traffic flow on part of the M25 where the elevated nitrogen dioxide concentrations are thought in part due to flow breakdown on the motorway.

6.14 A recent study in Rotterdam has also demonstrated that a fixed reduction in the speed limit to 50 mph on a road comparable to the M25, does lead to reductions in air pollution including nitrogen dioxide in practice. This is in addition to improved road safety and reduced road noise, suggesting that such a measure on the M25 would lead to a definite improvement in air quality if the Highways Agency were to implement such a scheme.

Appendix A.

BTEX Diffusion Tube Data 2002 to 2004.

BTEX Passive Diffusion Tube Results 2002 to 2004.

RB1

	Benzene	Toluene	Ethyl Benzene	P/M Xylenes	Ortho Xylene	n
2002	0.8	2.4	0.5	0.9	0.6	9
2003	0.8	2.0	0.5	1.0	0.4	12
2004	0.7	1.6	0.5	1.1	0.4	12
	Ratios					
2002	1.0	2.9	0.5	1.1	0.7	
2003	1.0	2.7	0.6	1.4	0.6	
2004	1.0	2.5	0.7	1.7	0.6	
Ideal*	*1*	*3.5*	*1*	*2*	*1*	

RB11

	Benzene	Toluene	Ethyl Benzene	P/M Xylenes	Ortho Xylene	n
2002	0.6	1.2	0.2	0.4	0.3	10
2003	0.7	1.3	0.3	0.5	0.3	11
2004	0.5	1.0	0.5	0.8	0.3	10
	Ratios					
2002	1.0	2.1	0.4	0.7	0.5	
2003	1.0	1.8	0.4	0.7	0.4	
2004	1.0	1.9	0.9	1.5	0.6	
Ideal*	*1*	*3.5*	*1*	*2*	*1*	

RB20

	Benzene	Toluene	Ethyl Benzene	P/M Xylenes	Ortho Xylene	n
2002	0.7	1.5	0.4	0.6	0.4	10
2003	0.7	1.5	0.4	0.8	0.5	11
2004	0.6	1.5	0.5	1.1	0.5	12
	Ratios					
2002	1.0	2.3	0.5	0.9	0.7	
2003	1.0	2.2	0.5	1.2	0.7	
2004	1.0	2.6	0.9	1.9	0.9	
Ideal*	*1*	*3.5*	*1*	*2*	*1*	

Note all values except ratios and 'n' are ppb NOT µg m^{-3}.

* DEFRA 2003.

Appendix B.

Sulphur Dioxide Diffusion Tube Data 2002 to 2004.

	2002		2003		2004	
	Conc. µg m^{-3}	n	Conc. µg m^{-3}	n	Conc. µg m^{-3}	n
RB1	7.0	9	8.8	12	11.8	12
RB11	6.3	10	14.4	11	10.8	12
RB12	6.4	10	9.0	12	10.5	11
RB20	8.9	10	8.5	12	10.2	12
RB21	12.4	10	10.3	11	13.3	12

Annual Mean Sulphur Dioxide Concentrations around Reigate and Banstead 2002 to 2004.
Values from passive diffusion tubes.

Appendix C.

Nitrogen Dioxide Diffusion Tube Data 2002 to 2004.

Site Ref.	All values µg m^{-3} except n. Location	2002 Conc. x 1.17	2002 n	2003 Conc. x 1.29	2003 n	2004 Conc.x 1.32	2004 n	Projections[1]: 2005 Conc. using 03	2005 Conc. using 04	2010 Conc. using 03	2010 Conc. using 04
	Reigate:										
RB47	Kerbside: Outside Nationwide, 78 High St	42	10	50	11	41	12	*47*	*40*	*39*	*33*
RB1	Kerbside: Boots, 34-36 High Street	34	11	52	11	47	12	*49*	*45*	*40*	*37*
RB46	Kerbside: Outside Gerrards, 5 High St	38	10	53	11	47	12	*51*	*46*	*42*	*38*
RB45	Kerbside: Outside 14-18 Church St	40	9	46	9	45	11	*44*	*44*	*36*	*36*
RB44	Kerbside: Outside Gunshop, 45 Church St	41	10	45	11	34	12	*42*	*34*	*35*	*28*
RB8	Urban Background: Castle Walk	17	11	42	9	27	12	*40*	*27*	*34*	*23*
RB9	Urban Background: St Marys Rd	18	11	28	10	27	12	*27*	*26*	*23*	*23*
	Redhill:										
RB17*	Urban Background: Sylvan Way	23	11	27	11	26	12	*26*	*26*	*22*	*22*
	Banstead:										
RB21*	Kerbside: Opposite Drift Bridge Hotel	37	11	48	10	48	12	*46*	*47*	*38*	*38*
RB3*	Urban Background: The Horseshoe	19	11	30	11	25	12	*29*	*24*	*25*	*21*
RB22	Urban Background: Grey Alders	29	11	36	10	27	12	*35*	*27*	*30*	*23*
RB23	Urban Background: Warren Mead School	20	10	27	11	23	12	*25*	*22*	*22*	*19*
	Merstham:										
RB7**	Urban Background: Radstock Way										
RB18	Urban Background: Brook Road	29	7	32	10	34	10	*30*	*33*	*26*	*28*
RB19	Kerbside: Village Hall, Station Road	24	11	47	11	29	11	*45*	*28*	*38*	*24*
RB20	Kerbside: Corner of London Road	34	11	51	10	38	12	*49*	*37*	*40*	*30*
	Horley:										
RB12	Kerbside: Police Station, Massetts Road	34	11	39	11	34	12				
RB13	Public Car Park, Massetts Road	24	10	32	9	28	12				
	A217 Brighton Road (North J8 M25):										
RB49	Kerbside: A217 Brighton Road	46	11	59	11	59	12	*56*	*58*	*46*	*48*
RB50	Off A217 Brighton Road	35	11	41	11	37	12	*39*	*36*	*34*	*31*
	M23 North of the M25 (Former AQMA):										
RB40	Shepherds Hill	34	11	32	11	24	12	*30*	*23*	*26*	*20*
RB41	Shepherds Hill	29	11	22	11	26	12	*21*	*26*	*18*	*22*
RB42	Kerbside: Shepherds Hill	31	11	47	11	43	12	*44*	*42*	*36*	*35*
	A23 Brighton Road (Former AQMA):										
RB81*	A23 Flying Scud Public House	33	4	40	11	37	12	*38*	*36*	*31*	*29*

Site Ref.	All values µg m^{-3} except n. Location	2002 Conc. x 1.17	2002 n	2003 Conc. x 1.29	2003 n	2004 Conc.x 1.32	2004 n	Projections[1]: 2005 Conc. using 03	2005 Conc. using 04	2010 Conc. using 03	2010 Conc. using 04
	M25 AQMA:										
RB27	Sturts Lane	41	11	43	11	42	12	*41*	*41*	*35*	*35*
RB28	Sturts Lane	42	11	41	11	33	12	*39*	*32*	*33*	*28*
RB29	Sturts Lane	34	11	38	11	35	11	*36*	*34*	*31*	*29*
RB30	Chequers Lane	39	11	41	11	34	12	*39*	*33*	*34*	*28*
RB33*/***	Margery Grove	30	11	41	11	38	10	*40*	*37*	*34*	*32*
RB35	Merrywood Grove	22	11	33	11	28	12	*31*	*27*	*27*	*24*
RB34	Merrywood Grove	23	11	31	11	23	11	*29*	*23*	*25*	*20*
RB31*	Reigate Hill	30	11	30	11	25	12	*29*	*24*	*25*	*21*
RB43	Quality Street	N/A		43	11	35	12	*42*	*34*	*36*	*29*
RB36	Gatton Bottom	33	11	35	11	31	12	*33*	*30*	*28*	*26*
RB37	Ashcombe Road	38	10	39	11	30	12	*37*	*30*	*32*	*25*
RB38	Ashcombe Road	39	11	38	11	32	12	*36*	*31*	*31*	*27*
RB39	Ashcombe Road	42	11	40	9	33	12	*38*	*32*	*33*	*27*
	A23 / Dean Lane AQMA:										
RB82*	A23 AQMA Site	29	5	46	11	40	12	*44*	*39*	*36*	*32*
	A217 / Rushworth Road AQMA:										
RB95	Rushworth Road					34	12		*33*		*27*
RB96	Rushworth Road					38	12		*37*		*30*
	Controls:										
RB91	Office Control			8	11	17	12				
RB92	Office Control			9	11	12	12				
	Horley AQMA										
RB11	Riverside	36	11	30	11	26	12				
RB25	Urban Background Michael Crescent	30	10	31	11	28	12				
RB74	Meadowcroft Close			32	11	37	12				
RB75	Roundabout, The Coronet			37	11	37	12				
RB76	Limes Avenue			36	11	30	11				
RB77	Staffords Place			32	11	31	12				
RB56	Outside 8/10 The Crescent, Horley			37	10	33	12				
RB57	Outside 29/31 The Crescent, Horley			42	11	34	12				
RB58	Outside 39/41 The Crescent, Horley			40	11	38	12				
RB59	Outside 92/94 The Crescent, Horley			40	11	39	12				
RB60	Outside 120/122 The Crescent, Horley			43	11	36	12				

Site Ref.	Location (All values µg m^{-3} except n.)	2002		2003		2004		Projections[1]: 2005		2010	
		Conc. x 1.17	n	Conc. x 1.29	n	Conc.x 1.32	n	Conc. using 03	Conc. using 04	Conc. using 03	Conc. using 04
RB61	Outside 79/81 The Crescent, Horley			43	11	36	12				
RB78,79,80	Outside 74 The Crescent Horley			41	11	37	12				
RB64	Outside 16/22 The Drive, Horley			33	11	34	11				
RB65	Outside 4/6 The Drive, Horley			41	11	39	12				
RB69	Outside 61 Upfield, Horley			33	11	30	12				
RB70	Outside 58/60 Upfield, Horley			33	11	35	12				
RB71	On Large Roundabout, Upfield, Horley			34	11	31	12				
RB72	Outside 25/27 Upfield, Horley			34	10	28	12				
RB73	Outside 9/11 Upfield, Horley			24	9	29	12				
RB53	Outside 66/68 Cheyne Walk, Horley			37	10	31	12				
RB66	Outside 3a/3b Fairfield Avenue, Horley			32	11	32	12				
RB67	Outside 30/32 Fairfield Avenue, Horley			28	10	34	12				
RB68	Outside 57 Fairfield Avenue, Horley			33	11	27	11				
RB51	Outside 17 Wolverton Gardens, Horley			38	11	30	12				
RB52	Outside 20 Wolverton Gardens, Horley			35	11	31	12				
RB54	Outside 7/9 Crescent Way, Horley			35	9	33	12				
RB55	Outside 40a Crescent Way, Horley			34	11	34	12				

* Average of two tubes from 2003 onwards.

** Site discontinued from 2003 due to vandalism.

*** Site moved 1/11/04.

RB33 Value in 2004 detailed assessment 43 µg m^{-3} as single value not average.

[1] Projections made using appropriate kerbside or background factors from DEFRA (2003).

No projections have been made for Horley due to the influence of the airport. For 2005 and 2010 projections for Horley see RBBC (2005).

For Rushworth Road 2003 figures see RBBC (2004).

Appendix D.

Period Mean to Annual Mean Calculation for the M23 AQMA.

Conversion of Period Mean NO_2 Concentration to Annual Mean NO_2 Concentration at the M23 Monitoring Site (South of the M25).

A correction factor was first calculated for the five months of tube data, to correct for differences between the real time monitor and the diffusion tubes over this five month period (Equation D.1).

$$\frac{\text{Mean of 5 monthly periods of real time data (5 months matched to tubes}^{*1})}{\text{Mean of 5 months of tube data (}^{*2}\text{)}} = \frac{29.1}{23.7} = 1.22$$

(Equation D.1)

*1 Data capture for period 99.9 %).
*2 Monthly data is the mean of three tubes. Dates are 1/6/04 to 29/6/04, 4/8/04 to 28/9/04, 2/11/04 to 4/1/05.

The five month 'tube to real time' correction factor was applied to the mean NO_2 concentration measured using diffusion tubes at the M23 site.

Mean NO_2 concentration (5 months) near M23 = 20 µg m^{-3}
Mean NO_2 concentration (5 months) near M23 adjusted = 20 x 1.22 = 24.4 µg m^{-3}.

To convert the five month mean to an annual mean for 2004, four long term real time background monitoring sites within 80 km of Reigate and Banstead were selected in addition to the councils own site (RG1) in Horley. The annual mean concentration for 2004 for each of these sites was then calculated, together with the period mean for the five months for which diffusion tube data was available at the M23 site. A ratio of annual mean to period mean was then calculated, and the mean of these five ratios taken.

	Period Mean (µg m^{-3})	Data Capture (%)	Annual Mean (µg m^{-3})	Data Capture (%)	Annual / period ratio*
Reigate & Banstead (RG1)	29.1	99.9	30.5	99.6	1.05
Mole Valley (Lower Ashstead)	25.5	96.4	25.5	98.4	1.00
Mole Valley (Dorking)	23.2	97.5	23.9	98.7	1.03
Tunbridge Wells (Town Hall)	25.1	98.9	24.9	96.8	0.99
Sevenoaks (Greatness)	21.4	88.8	21.6	88.7	1.01
Mean of the five annual : period ratios					**1.016**[a]

*based on unrounded data.
[a] without the Sevenoaks site the ratio is 1.017
Note: the data from sites outside of Reigate and Banstead is fully ratified. Mole Valley (Dorking) is provisional, though not expect to change significantly to affect the results.

Table D.1: Ratio of annual to period mean concentrations at selected background monitoring sites within 80 km of Reigate and Banstead.

Although the data capture from the Sevenoaks site was less than 90 % the presence or absence of the site makes little difference to the overall ratio, 1.017 without the Sevenoaks site compared to 1.016 with it present.

Using the annual to period ratio in Table D.1 gives an annual mean concentration at the relevant M23 receptor of:

$$24.4 \times 1.016 = 24.8 = 25\ \mu g\ m^{-3}.$$

The approach used here is recommended by DEFRA, but to give an indication of the potential errors involved the above process was repeated for site (RB36) on the M25 where a full 12 months of tube data was also available. Here:

Corrected 5 month mean NO_2 concentration = $22 \times 1.22 = 26.8\ \mu g\ m^{-3}$.
5 month period mean to annual mean (26.8×1.016) = $27.3\ \mu g\ m^{-3}$.
Actual annual mean based on 12 months data (and corrected) = $31\ \mu g\ m^{-3}$.

The higher measured concentration in this case suggests that the above approach can lead to an underestimation (in this example) of the 'true' value.

Appendix E.

1 hour Real Time Nitrogen Dioxide Concentrations in 2004 at RG1 and RG2.

Figure E.1: Hourly Mean Nitrogen Dioxide Concentrations at the Scout Hut (RG1), Michael Crescent, Horley, Surrey in 2004.

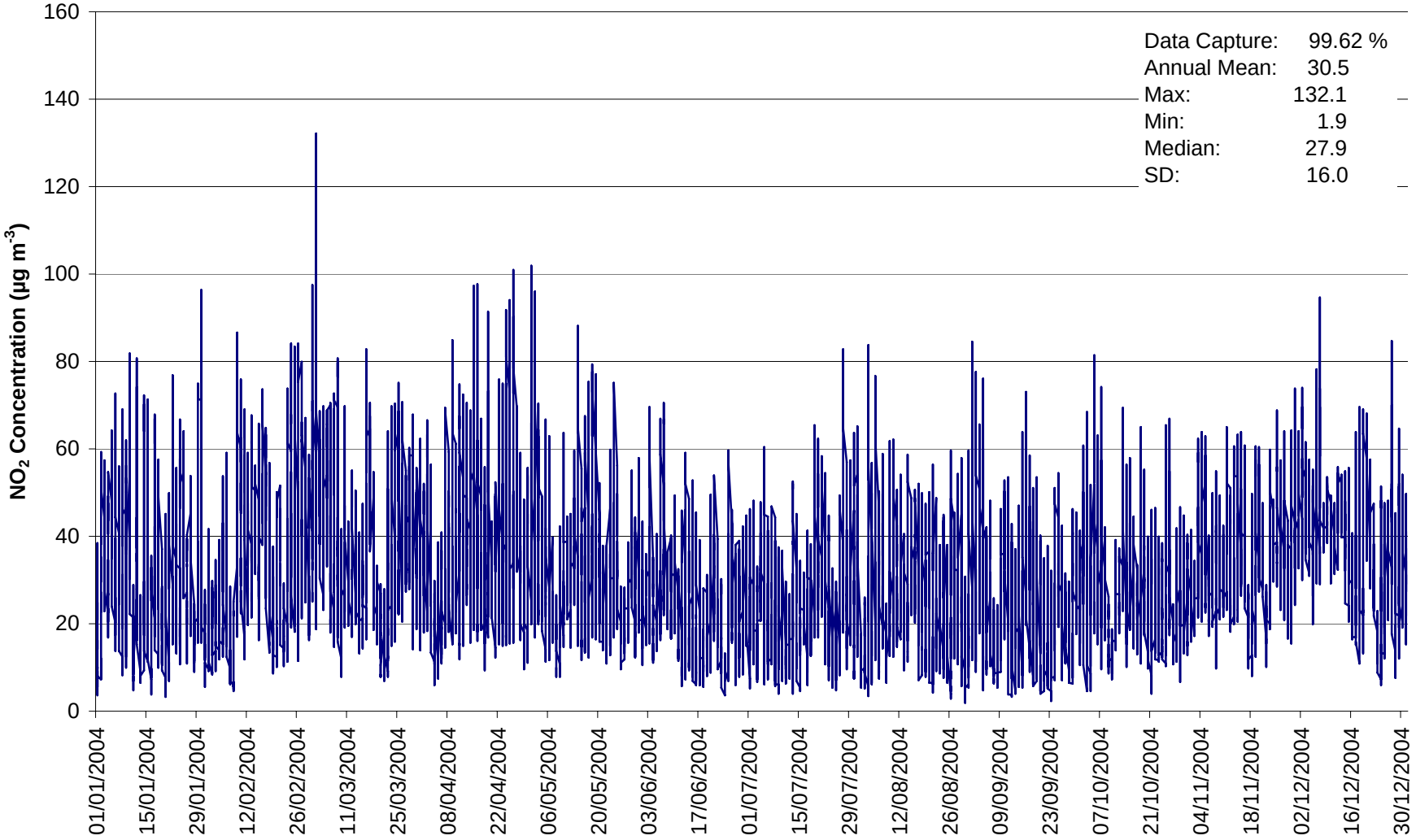
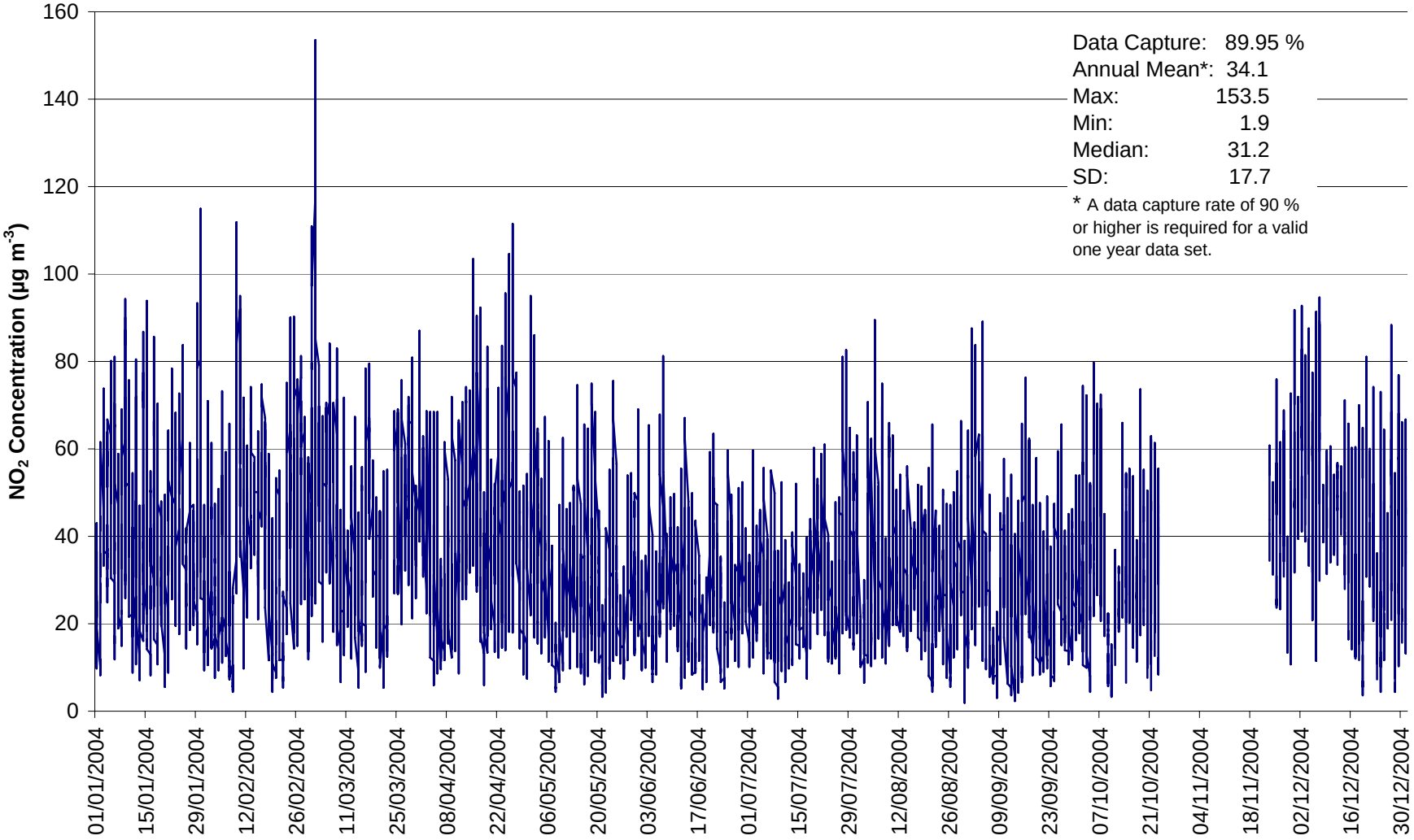


Figure E.2: Hourly Mean Nitrogen Dioxide Concentrations at RG2, The Crescent, Horley, Surrey in 2004.



Appendix F.

DfT Correspondence relating to Vehicle Emissions.

Policy & Environment Department

TOM CROWLEY
Director

Reigate and Banstead Borough Council

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Mr. Matthew Webb,
Cleaner Vehicles – Fuels and Technology,
Department for Transport,
Great Minster House,
76 Marsham Street,
London,
SW1P 4DR.

Our Ref: DES/AQ/Action Plan/HGVs
Your Ref:

Date: 17 March, 2004
Contact: Leon Hibbs
Direct Line: 01737 276403

Dear Mr. Webb,

RE: HGV VEHICLE EMISSIONS

The council recently completed its action plan and Stage 4 assessment of air quality within the M25 air quality management area (AQMA). The Stage 4 assessment clearly identified that articulated heavy goods vehicles are one of the main traffic sources of air pollution (NO_x) within the M25 AQMA (Table 1), and that their contribution to NO_x concentrations is disproportionate to the numbers of vehicles on the road.

	Contribution to Total NO_x of 134 $\mu g\ m^{-3}$ (%)	Vehicle fleet composition based on 170 100 AADT (%)
Artic. HGV	33.3	7.1
Rigid HGV	9.5	4.2
Bus	2.1	0.8
Car	19.5	76.9
LGV	5.4	11.0
Background	30.2	-

Table 1: M25 Fleet composition and contribution to NO_x Concentrations with the Reigate and Banstead M25 AQMA in 2005.

I understand from the draft version of the Governments report to the EC (*Report to the European Commission Plans and Progress to meet limit values under the First Air Quality Daughter directive 1999/30/EC)*, that the Government is currently evaluating proposed new euro standards, and suggesting that tighter emissions standards are required particularly for diesels.

However, does the Government have any plans to emphasise the need for tighter standards especially in the 'heavy duty' diesel market i.e. engine sizes over 10 litres, and if not I would be interested to obtain your views on whether such a measure would be worth considering together with any details of actions you propose to take.

I look forward to hearing from you shortly.

Yours sincerely,

Leon Hibbs
Air Quality Officer.

Department for
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Your Ref: DES/AQ/Action Plan/HGVs

8 April 2004

Leon Hibbs Esq.,
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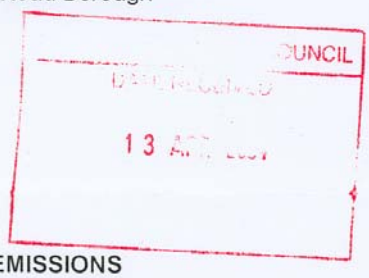

Dear Mr Hibbs,

HGV VEHICLE EMISSIONS

Your letter of 17 March to Matthew Webb has been passed to me for reply as this branch has responsibility for negotiating European Standards.

I confirm that, in response to current air pollution concerns, the Government is considering what further measures are necessary to meet its health and air quality aspirations. This includes consideration of what contribution the road transport sector can make, what reductions in emissions are technically feasible and what the cost impact of these might be

On the particular subject of NOx emissions from heavy vehicles which you mention, it does seem likely at present that air quality targets will not be met in a number of locations and that further measures to tackle NOx emissions at source may well be necessary. In respect of heavy vehicles, as you will be aware, mandatory measures are in place to tighten NOx limits for all new vehicles over 3.5 tonnes or over 9 seats from October 2006 with a further reduction from October 2009. Nevertheless on present forecasts heavy vehicles will constitute almost 50% of road traffic NOx emissions after 2015.

Further measures to address this problem will require setting new vehicle emissions standards at European level and I confirm that the Government is playing a full part in the current EU-wide consideration of the potential for further reductions, focussing particularly on heavy vehicles where it seems possible that reductions might be achieved with technology currently being introduced to meet existing measures. It is unlikely, however, that any further measures could be introduced before 2011 at the earliest and would take some time to have effect while the heavy vehicle fleet is being replaced.

Yours sincerely,

Tony Baker

td5reigate.doc

RCVD 13/04/04 → LH.

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