

# *Worthing*

B O R O U G H C O U N C I L

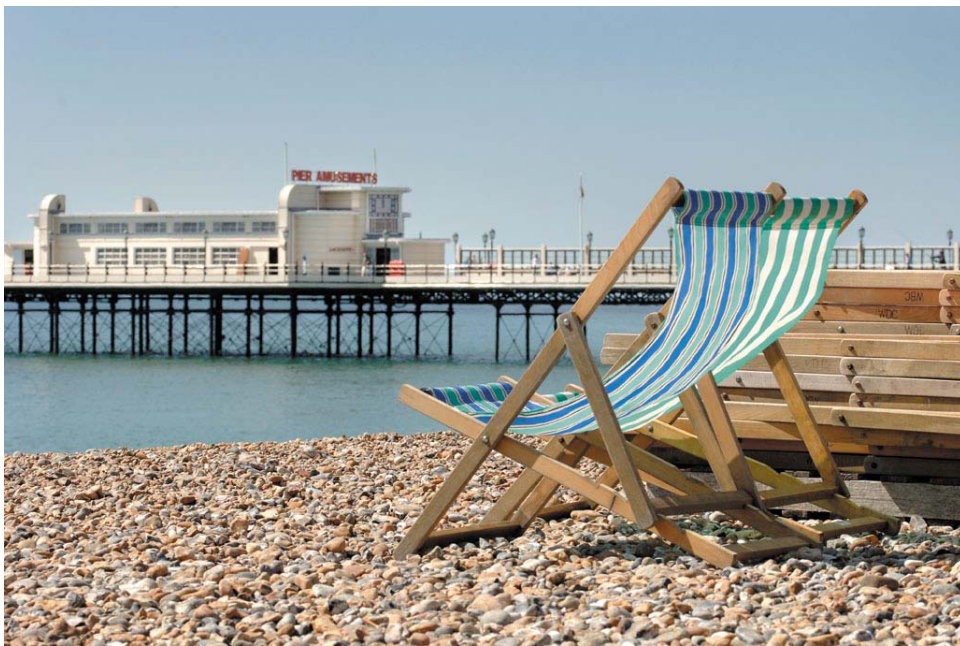


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## 2010 Air Quality Progress Report for Worthing Borough Council

In fulfillment of Part IV of the Environment Act 1995  
Local Air Quality Management

April 2010

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<b>Report Reference number</b>	WBC/AQPR/2010
<b>Date</b>	April 2010

## Executive Summary

Worthing Borough Council monitors Nitrogen Dioxide (NO<sub>2</sub>) levels within the Borough using passive diffusion tubes at 44 sites. Two automatic monitoring sites are also in operation, one at Grove Lodge on the A27 trunk road (oxides of nitrogen and PM<sub>10</sub>'s) the other at a background site in Goring (PM<sub>10</sub>'s).

The results of monitoring and modelling in 2008 confirmed that levels of NO<sub>2</sub> are exceeding and are predicted to continue to exceed, the annual average Air Quality Objective for the pollutant in the area around the Grove Lodge roundabout on the A27 Upper Brighton Road. Therefore an Air Quality Management Area (AQMA) for nitrogen dioxide must be declared. A public consultation has now been completed and the Order designating the AQMA (the *Worthing Air Quality Management Area No.1*) is due to come into effect on 13 July 2010.

Monitoring data from the Council's continuous analyser near Grove Lodge showed the NO<sub>2</sub> annual mean for 2009 was 45µg/m<sup>3</sup>. This is above the national air quality objective of 40µg/m<sup>3</sup>.

There were two recorded exceedences of the hourly mean objective of 200µg/m<sup>3</sup> - 236µg/m<sup>3</sup> and 201µg/m<sup>3</sup>, both arising in the middle of the morning rush hour. This is well within the objective of 200µg/m<sup>3</sup> not to be exceeded more than 18 times a year.

Monitoring with NO<sub>2</sub> diffusion tubes at roadside and background sites for 2009 shows a general increase over the 2008 values. Consequently there were 17 measured exceedences of the annual mean NO<sub>2</sub> air quality objective at 10 different locations - 16 diffusion tubes and 1 automatic monitoring site. Of these 10 locations all but one were roadside monitoring locations. When the measured concentrations at 9 of these sites were calculated back to the nearest residential façades representative of public exposure, the levels were below the annual mean objective of 40 µg/m<sup>3</sup>. Therefore it has been concluded that no further action is necessary for these locations.

One site - N28 at the busy junction of Chapel Road and Teville Road - is located within about 1 metre of a residential façade (a block of flats). When the measured concentration at this site was re-calculated back to the residential façade a level of 42.4 µg/m<sup>3</sup> was produced. This level is above the annual mean objective of 40 µg/m<sup>3</sup>, so this site must be subject to further assessment.

Tri-located tubes adjacent to a residential facade at first floor level on Downlands Parade on the A27 (N29 N33 and N34) reflect relevant exposure. Levels measured at this location averaged 43.7 µg/m<sup>3</sup>. As these are façade measurements no further adjustments for distance are required. This level is above the annual mean objective of 40 µg/m<sup>3</sup> and therefore this site must also be subject to further assessment.

Monitoring results for PM<sub>10</sub>'s fall below the air quality objectives and suggest that there will be no exceedance of the current air quality objectives for PM<sub>10</sub>'s within the Worthing Borough.

At the request of Defra an assessment of commercial and domestic biomass plant was undertaken in line with procedures contained within TG09. These assessments have shown that there is no requirement to undertake any further detailed assessment.

## Table of contents

<b>1</b>	<b>Introduction</b>	<b>6</b>
1.1	Description of Local Authority Area	6
1.2	Purpose of Progress Report	7
1.3	Air Quality Objectives	7
1.4	Summary of Previous Review and Assessments	9
<b>2</b>	<b>New Monitoring Data</b>	<b>12</b>
2.1	Summary of Monitoring Undertaken	12
2.2	Comparison of Monitoring Results with Air Quality Objectives	20
<b>3</b>	<b>New Local Developments</b>	<b>31</b>
3.1	Road Traffic Sources	31
3.2	Other Transport Sources	31
3.3	Industrial Sources	31
3.4	Commercial and Domestic Sources	31
3.4.1	Biomass Combustion – Individual Installations	31
3.4.2	Biomass Combustion – Combined Impacts	32
3.4.3	Domestic Solid-Fuel Burning	32
3.5	New Developments with Fugitive or Uncontrolled Sources	32
<b>4</b>	<b>Planning Applications</b>	<b>33</b>
<b>5</b>	<b>Implementation of Action Plans</b>	<b>34</b>
<b>6</b>	<b>Conclusions and Proposed Actions</b>	<b>35</b>
6.1	Conclusions from New Monitoring Data	35
6.2	Conclusions relating to New Local Developments	35
6.3	Proposed Actions	35
<b>7</b>	<b>References</b>	<b>37</b>

### Appendices

**A:** QA/QC Data

**B:** Fall-off calculations for nitrogen dioxide (with distance from the road) for Diffusion tube sites

**C:** Permitted Installations within the Worthing Borough

**D:** Diffusion Tube Monitoring data set for 2009 (not bias adjusted)

**E:** Calculation for commercial and domestic sources of biomass

**F: Combined biomass assessment**

**List of Tables**

- 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England.
- 1.2 Summary of Previous Review and Assessments
- 2.1: Sussex air quality monitoring stations and pollutants monitored (2009).
- 2.2 Details of Automatic Monitoring Sites
- 2.3 Details of Non- Automatic Monitoring Sites in Worthing Borough
- 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective
- 2.5 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective
- 2.6 Sites exceeding the annual mean objective
- 2.7 Full Results of Nitrogen Dioxide Diffusion Tubes
- 2.8 Results of PM<sub>10</sub> Automatic Monitoring: Comparison with Annual Mean Objective
- 2.9 Results of PM<sub>10</sub> Automatic Monitoring: Comparison with 24-hour Mean Objective

**List of Figures**

- 1.1 Worthing Borough Map
- 1.2 Map of AQMA No.1 – A27 Grove Lodge, Worthing
- 2.1 Map showing locations of Automatic Monitoring Sites
- 2.2 Map showing Non-Automatic Monitoring Sites within Worthing Borough
- 2.3: Graph showing trend in NO<sub>2</sub> for Grove Lodge Cottages 2006-2009 (Note: N30A and N30B began 2007)
- 2.4 Roadside Benzene Annual means 1998-2007

# 1 Introduction

## 1.1 Description of Local Authority Area

Worthing is one of the largest towns in West Sussex with a population of over 100,000, living in approximately 46,000 dwellings. Worthing Borough's administrative boundaries are largely confined to the town of Worthing itself.

The Borough is located on the south coast at the foot of the South Downs and covers an area of 3,248 hectares or 12.5 square miles. The southern half of the Borough is situated on the coastal plain while the northern wards gently slope into the South Downs. Essentially urban in nature, Worthing's separate identity from its neighbouring districts is maintained by small areas of open countryside. These neighbours are the districts of Arun to the west, Horsham to the north and Adur to the east. The Borough's northern boundary borders the South Downs National Park whilst the southern boundary is shaped by the coastline of the English Channel.

As well as being a major centre of population in the County, Worthing is also a popular tourist destination, especially for short breaks. It is also an important commercial centre, home to a number of key employers including GlaxoSmithKline, Lloyds TSB, Southern Water and the Environment Agency. The employment base is largely in the service sector with 51% of workers employed in the domains of administration, finance, business and retail distribution. Businesses are located on various sites throughout the Borough and on the town's seven trading estates.

The main retail area in the town centre is of sub-regional importance attracting people from beyond the Borough. In addition there are several important local shopping centres and an "out of town" centre at Lyons Farm in the north-east corner of the Borough, close to the boundary with Adur.



**Fig.1 Worthing Borough Map**

## 1.2 Purpose of Progress Report

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

## 1.3 Air Quality Objectives

The air quality objectives applicable to Local Air Quality Management (LAQM) **in England** are set out in the Air Quality (England) Regulations 2000 (SI 928), and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043). They are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre  $\mu\text{g}/\text{m}^3$  (for carbon monoxide the units used are milligrammes per cubic metre,  $\text{mg}/\text{m}^3$ ). Table 1.1. includes the number of permitted exceedences in any given year (where applicable).

**Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England.**

<b>Pollutant</b>	<b>Concentration</b>	<b>Measured as</b>	<b>Date to be achieved by</b>
<b>Benzene</b>	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
<b>1,3-Butadiene</b>	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
<b>Carbon monoxide</b>	10.0 $\text{mg}/\text{m}^3$	Running 8-hour mean	31.12.2003
<b>Lead</b>	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
<b>Nitrogen dioxide</b>	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
<b>Particles (PM<sub>10</sub>) (gravimetric)</b>	50 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
<b>Sulphur dioxide</b>	350 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

## 1.4 Summary of Previous Review and Assessments

**Table 1.2 Summary of Previous Review and Assessments**

<i>Report</i>	<i>Date</i>	<i>Outcomes</i>
Updating and Screening Assessment	April 2009	No new Detailed Assessment required. Confirmed that an AQMA must be declared for NO <sub>2</sub> on the A27 in the vicinity of Grove Lodge.
Progress Report and Detailed Assessment	June 2008	Air Quality Management Area (AQMA) needs to be declared regarding Nitrogen Dioxide (NO <sub>2</sub> ) levels in the vicinity of Grove Lodge on the A27.
Updating and Screening Assessment	April 2006	Detailed Assessment (DA) required for 2 sites on A27, due to high Nitrogen Dioxide (NO <sub>2</sub> )
Detailed Assessment	July 2004	Potential exceedance of annual objective for NO <sub>2</sub> in High Street and PM10 objective on A27 Lyons Farm. Further monitoring required.
Updating and Screening Assessment	November 2003	Detailed assessments required for A27 Lyons Farm (NO <sub>2</sub> and PM10), A27 Warren Road (NO <sub>2</sub> ) and A259 High Street (NO <sub>2</sub> ).
Air Quality Strategy	May 2002	'To prevent deterioration and promote the improvement of Worthing's air quality'.
Review & Assessment	2000	No exceedances predicted.
Stage 1 Review & Assessment	November 1998	Second stage review required.

The 2006 USA concluded that there were two sites on the A27 where Detailed Assessments would be required, due to high levels of Nitrogen Dioxide (NO<sub>2</sub>). The subsequent 2008 *Progress Report* included two detailed assessments for the A27 trunk road. These concluded that the NO<sub>2</sub> Annual Mean Objective was being exceeded at a site of relevant exposure on the A27 near Grove Lodge. It also predicted future exceedances of the annual mean air quality objective for NO<sub>2</sub> at residential receptors and therefore an air quality management area will need to be declared. Assessment of Downlands Parade (A27)

showed that whilst there was no exceedance measured at that time, the levels of NO<sub>2</sub> adjacent to residential properties were very close to the mean objective. Modelling predicted a potential future problem at the eastern end of the Lyons Farm Junction and the need for ongoing scrutiny at this location.

A Detailed Assessment was also carried out for a site close to the Town Centre - Teville Gate – in 2008. However this confirmed that there were no problems at that time.

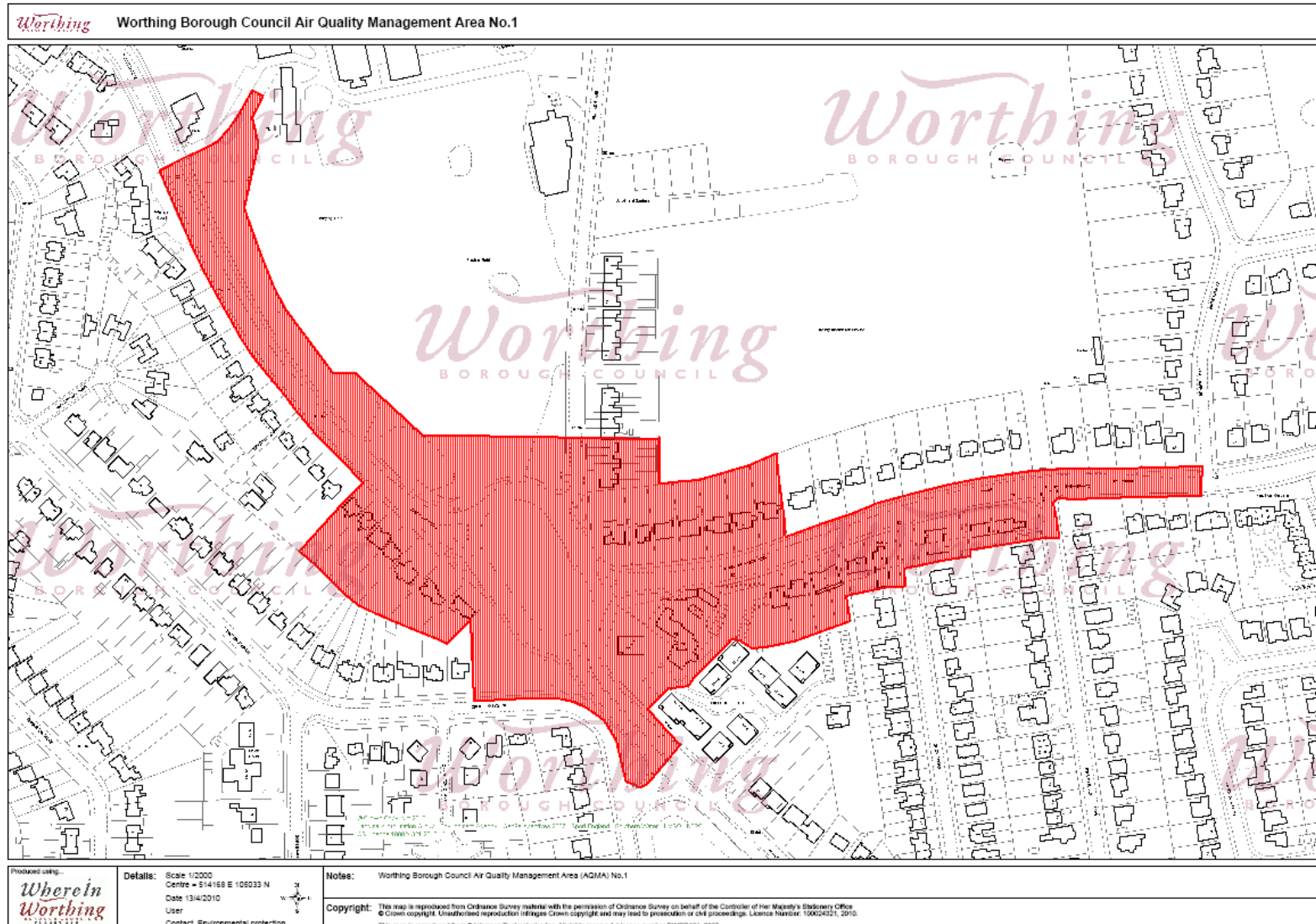
### **The Grove Lodge Air Quality Management Area (AQMA)**

The results of monitoring and modelling in 2008 confirmed that levels of nitrogen dioxide (NO<sub>2</sub>) are exceeding and are predicted to continue to exceed, the annual average Air Quality Objective for the pollutant in the area around the Grove Lodge roundabout on the A27 Upper Brighton Road. The Council must therefore declare an Air Quality Management Area (AQMA) for nitrogen dioxide.

The boundary of the AQMA has been drawn-up using the results of the modelling in the Progress Report and Detailed Assessment 2008', and is shown at Figure 1.1. The scale of the proposed AQMA is small in comparison to many in the UK and follows modelled contours for nitrogen dioxide levels (including a ±15% margin of error for the modelling).

A public consultation regarding the proposed AQMA has been completed. The Order designating the AQMA has been drafted and signed and is due to come into effect on 13 July 2010. It is known as the *Worthing Air Quality Management Area No.1*.

Figure 1.2 Map of AQMA No.1 – A27 Grove Lodge, Worthing



## 2 New Monitoring Data

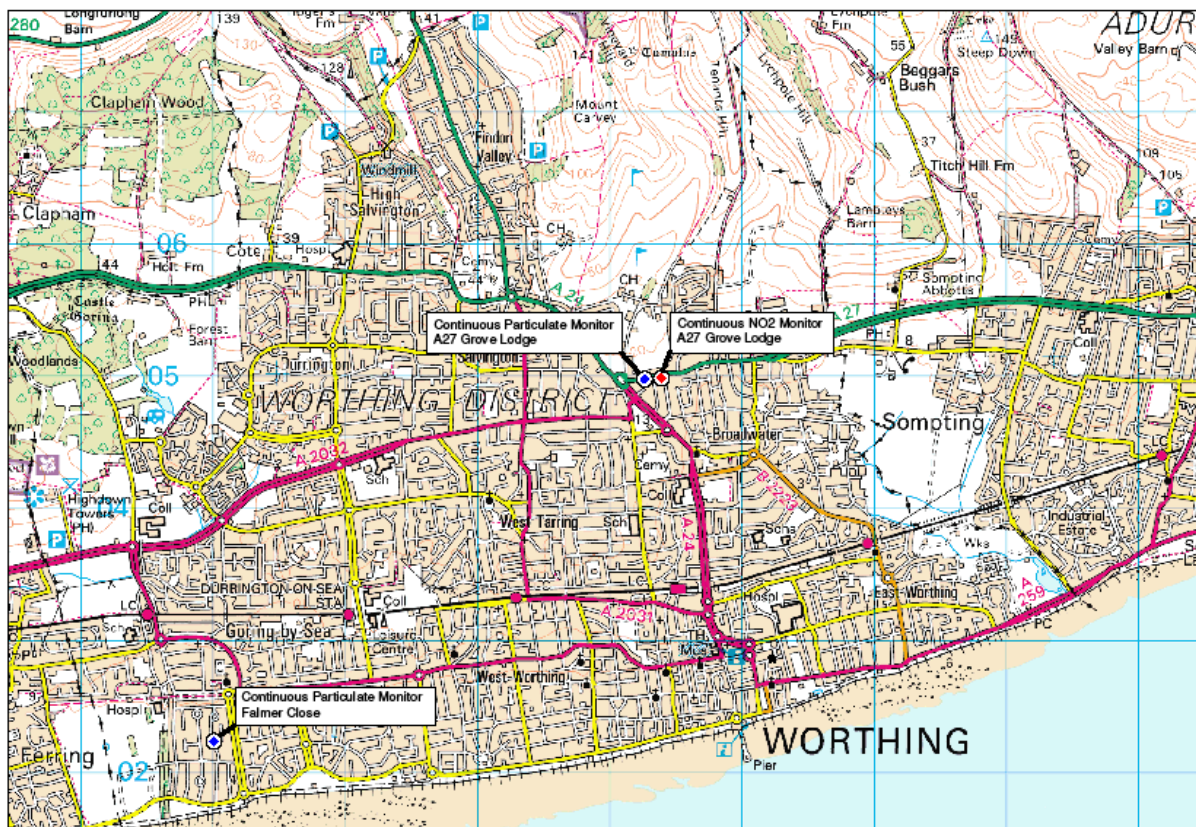
### 2.1 Summary of Monitoring Undertaken

#### 2.1.1 Automatic Monitoring Sites

Worthing Borough Council has **two** automatic monitoring sites within its boundaries.

1. A27 Grove Lodge - oxides of nitrogen (includes NO<sub>2</sub> - nitrogen dioxide); PM<sub>10</sub> - particles less than 10 microns (measured non-gravimetrically)
2. Falmer Close, Goring – PM<sub>10</sub>

**Figure 2.1 Map showing locations of Automatic Monitoring Sites**



Continuous monitoring has the advantage of taking a measurement and producing a result every 15 minutes, enabling the data to be related to events such as traffic flow and meteorology. Unfortunately, continuous monitors are expensive to purchase and operate and are often fairly sizeable, so finding a suitable location for them is often difficult.

Worthing Borough Council has operated an automatic NO<sub>x</sub> monitoring station since November 2003. This station consists of a NO<sub>x</sub> chemiluminescent analyser, data logger and modem. It is situated in a "J type" GRP street cabinet which is small enough to make siting and relocation more convenient. The relatively small fibreglass housing was selected because having only one analyser, it was felt we would need to move it to different locations from time to time. Since acquiring the unit second hand from Brighton & Hove City Council, we have sited the equipment at three locations where we were carrying out medium term

detailed investigations. The monitor has been located adjacent to the A27 at Grove Lodge since September 2007.

All automatic monitoring data is managed by TRL Ltd. and validated against operator's calibration results. See Appendix 1 for QA/QC and calibrations.

PM<sub>10</sub>'s are monitored using 'Osiris' continuous particulate monitors. The Osiris monitor uses a light scattering technique to assess quantity and size of particulates that are continually pumped through the instrument. One of these is deployed in a quiet background location where it experiences little traffic pollution (Falmer Close, Goring). The other Osiris Monitor is used to investigate particulate pollution related to traffic and is co-located with the continuous NO<sub>2</sub> analyser at Grove Lodge on the A27 (since September 2007). It is acknowledged that Osiris' are not gravimetric devices and as such the results obtained are only indicative. However, they provide an indication of levels of particulates and whether they should be monitored in greater detail.

No new automatic monitoring sites have been created and none closed since the 2009 Updating & Screening Assessment.

### **Monitoring of air quality across Sussex.**

Worthing Borough Council is a member of the Sussex Air Quality Partnership (Sussex-Air) which benefits from the co-ordinated monitoring of air pollutants across the region. The Sussex Air Quality Monitoring Network is managed and co-ordinated by King's College London ERG, on behalf of Sussex-air and they provide data calibration and ratification of results. Please visit [www.sussex-air.net](http://www.sussex-air.net) for data.

**Table 2.1: Sussex air quality monitoring stations and pollutants monitored (2009).**

	<b>Authority</b>	<b>Location</b>	<b>Pollutant</b>
1	Adur	Shoreham High St	NOx
2	Brighton & Hove/AURN	Brighton Pavilion	NOx, O3 ,
3	Brighton & Hove/AURN	Hove Roadside	NOx, O3 ,
4	Brighton & Hove CC	Foredown Tower	O3
5	Chichester D.C.	A27 Ring Road	PM10 (grav. FDMS), NOx
6	Chichester D.C.	Lodsworth	O3
7	Crawley B.C.	East Gatwick	NOx
8	Eastbourne B.C.	Devonshire Park	PM10, NOx, O3
9	Hastings B.C.	Hastings/Bexhill (A259)	PM10, NOx, O3
10	Hastings B.C.	Freshfields (A259)	PM10, NOx
11	Horsham D.C.	Horsham centre	PM10, NOx,
12	Lewes D.C.	Telscombe Cliffs	PM10, NOx, O3,
13	Lewes D.C.	Lewes Town Centre	PM10, NOx
14	Rother D.C	Rye Harbour	O3
15	Rother D.C.	Bexhill (A259)	NOx, PM10
16	Worthing B.C.	Grove Lodge, A27	NOx
17	Wealden D.C.	Isfield	O3
18	Sussex County Lab.	Mobile unit	PM10, NOx,O3, CO
19	DEFRA - AURN	Preston Park, Brighton	NOx, O3
20	DEFRA - AURN	Lullington Heath, Wealden	NOx, O3, SO2

**Key:**

CO	-	carbon monoxide
NOx	-	oxides of nitrogen (includes NO2 - nitrogen dioxide)
O3	-	ozone
PM10 (grav)	-	particles less than 10 microns (measured gravimetrically)
PM10	-	particles less than 10 microns (measured non gravimetrically)
SO2	-	sulphur dioxide

**Table 2.2 Details of Automatic Monitoring Sites**

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring Technique	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
<i>A27 Grove Lodge</i>	Roadside	514269	104970	NO <sub>2</sub> , PM <sub>10</sub>	Chemiluminescent	Y*	Y (2m)	2m	Y
<i>Falmer Close, Goring</i>	Urban Background	511008	102226	PM <sub>10</sub>	Light scattering	N	N	2m	N

\* Due July 2010

### 2.1.2 Non-Automatic Monitoring

Worthing Borough Council monitors levels of Nitrogen Dioxide (NO<sub>2</sub>) using 44 passive diffusion tubes at 36 different locations around the Borough. The survey began in 1993 with four sites established as part of a UK wide survey and has expanded ever since.

Passive diffusion tubes are an inexpensive simple sampling method. The tubes are left exposed for periods of a month at a time and are then sent away for laboratory analysis. This method has the advantage that numerous sites can be set up to indicate the spatial spread of pollution. Monitoring sites can be set up easily simply by clipping a tube to a lamp post or building façade. The disadvantage of diffusion tubes is that only long term measurements can be made such as fortnightly, monthly or annually.

No new NO<sub>2</sub> diffusion tube monitoring sites have been added to or removed from the network since the 2009 Updating & Screening Assessment.

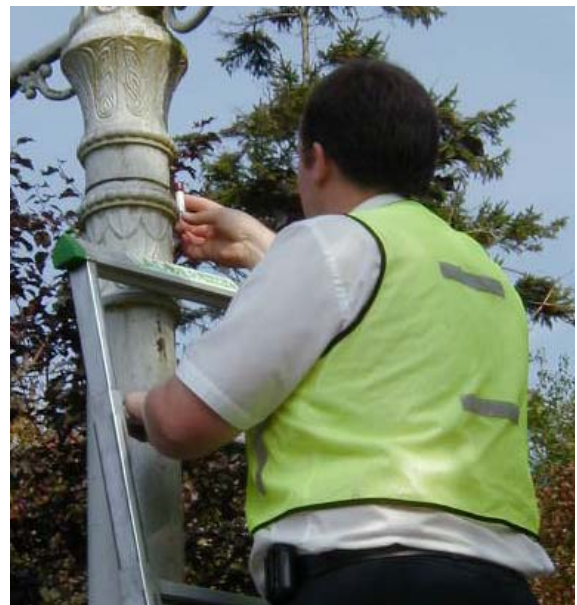
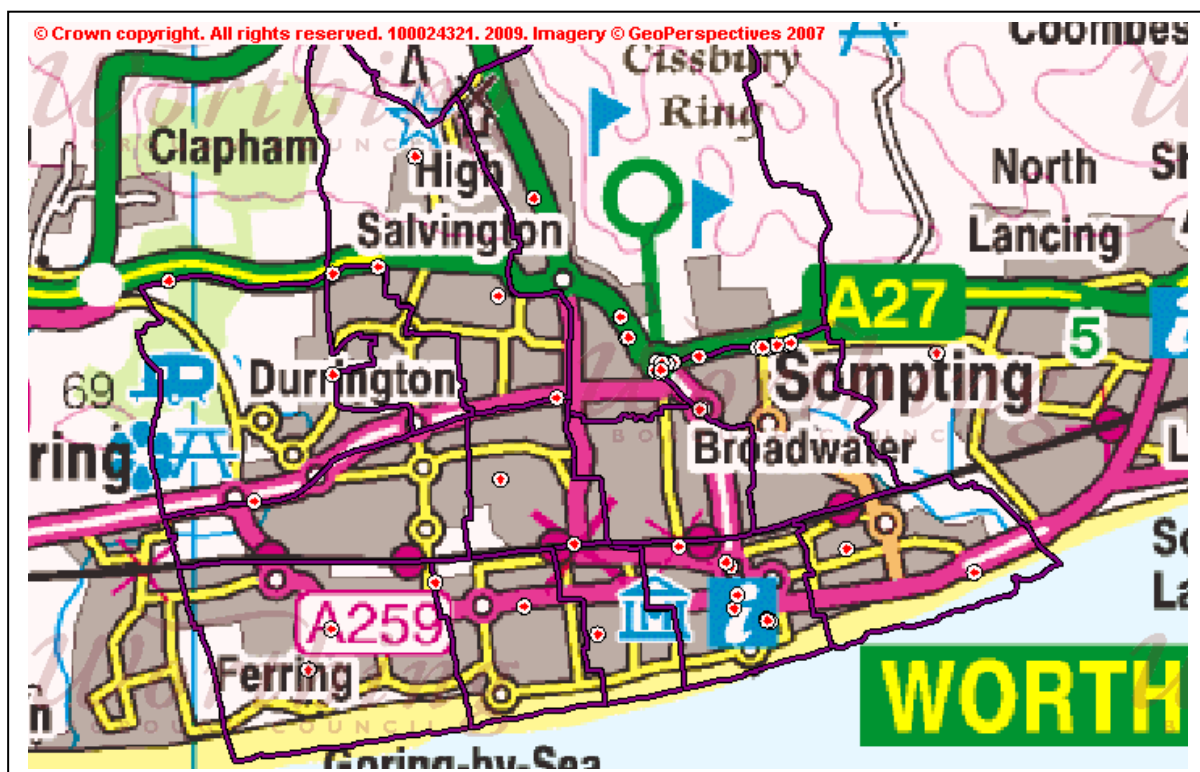


Figure 2.2 Map showing Non-Automatic Monitoring Sites within Worthing Borough



**Table 2.3 Details of Non- Automatic Monitoring Sites in Worthing Borough**

Site Name	Site Type	OS Grid Ref (TQ)	Pollutants Monitored	In AQMA ?	Relevant Exposure (Y/N with distance (m) to relevant exposure	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
1N Chapel Rd (UK04)	Roadside	514102	NO <sub>2</sub>	No	Y 9	1.5	Y
4N Heene Way (UK02)	Urban Background	513102	NO <sub>2</sub>	No	Y 4	1.5	Y
5N Cleveland Road (UK01)	Urban Background	512105	NO <sub>2</sub>	No	Y 6	2	Y
6N Gainsborough Avenue (UK06)	Roadside	515105	NO <sub>2</sub>	No	Y 11	2	Y
N3 Cricketers Pde	Roadside	514104	NO <sub>2</sub>	No	Y 16	3.5	Y
N4A Jefferson Lodge Arundel Rd	Roadside	511105	NO <sub>2</sub>	No	Y 53	1.5	Y
N5 First Avenue	Roadside	514105	NO <sub>2</sub>	No	Y 15	1.5	Y
N6A Warren Ct Warren Rd	Kerbside	513105	NO <sub>2</sub>	No	Y 15	0.5	Y
N8 Littlehampton Rd	Roadside	513104	NO <sub>2</sub>	No	Y 10	3.5	Y
N9 Honeysuckle Lane	Urban Background	511106	NO <sub>2</sub>	No	Y 13	5	Y
N11 Dawes Cl	Urban Background	515103	NO <sub>2</sub>	No	Y 8	1.5	Y
N15 Chippers Walk	Urban Background	512103	NO <sub>2</sub>	No	Y 4	0.5	Y
N16 Mill Rd	Roadside	512102	NO <sub>2</sub>	No	Y 11	2.5	Y
N17 Chapel Road, B-Dust monitor	Kerbside	514103	NO <sub>2</sub>	No	Y 5	0.5	Y
N18A Kinnall Court, Upper Brighton Road,	Façade	515105	NO <sub>2</sub>	No	Y	11.5	Y
N19 Hillside Avenue, D-Dust monitor	Kerbside	513105	NO <sub>2</sub>	No	Y 9	1	Y
N21 Greenwood Cottage, A27	Roadside	509105	NO <sub>2</sub>	No	Y 7	3	Y

Site Name	Site Type	OS Grid Ref (TQ)	Pollutants Monitored	In AQMA ?	Relevant Exposure (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
N22 Falmer Close, C-Dust monitor	Urban Background	511102	NO <sub>2</sub>	No	Y 13	1.5	Y
N24 152 Up B'ton Rd NO2 House	Façade	515105	NO <sub>2</sub>	No	Y	9	Y
N25 Warren Ct House	Façade	513105	NO <sub>2</sub>	No	Y	15	Y
N27 Tarring Road, Crossing	Façade	513103	NO <sub>2</sub>	No	Y	2.5	Y
N28 Chapel Road/Teville Road	Roadside	514103	NO <sub>2</sub>	No	Y 1	2.5	Y
N29 Downlands Parade	Façade	515105	NO <sub>2</sub>	No	Y	4	Y
N30 Grove Lodge Cottages	Roadside	514104	NO <sub>2</sub>	No*	Y	2	Y
N30A Grove Lodge Cottages	Roadside	514104	NO <sub>2</sub>	No*	Y	2.5	Y
N30B Grove Lodge Cottages	Roadside	514104	NO <sub>2</sub>	No*	Y 4	2.5	Y
N31 South Farm Road, roundabout	Roadside	514103	NO <sub>2</sub>	No	Y 3	2.5	Y
N32 Lamppost on corner of Upper Brighton Rd/ Sompting Rd	Façade	515105	NO <sub>2</sub>	No	Y 8	3	Y
N33 Downlands Parade	Façade	515105	NO <sub>2</sub>	No	Y	2	Y
N34 Downlands Parade	Façade	515105	NO <sub>2</sub>	No	Y	2	Y
N35 30 Upper Brighton Road House	Roadside	514104	NO <sub>2</sub>	No*	Y	11.5	Y

Site Name	Site Type	OS Grid Ref (TQ)	Pollutants Monitored	In AQMA ?	Relevant Exposure (Y/N with distance (m) to relevant exposure	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
N35A 30 Upper Brighton Road Poll Box	Roadside	514104	NO <sub>2</sub>	No*	Y 10	2	Y
N35B 30 Upper Brighton Road Poll. Box	Roadside	514104	NO <sub>2</sub>	No*	Y 10	2	Y
N35C 30 Upper Brighton Road Poll. Box	Roadside	514104	NO <sub>2</sub>	No*	Y 10	2	Y
N36 Corner of Hillbarn Lane	Roadside	514104	NO <sub>2</sub>	No*	Y 9	2	Y
N37 Lamorna Grove Lamppost	Suburban	514104	NO <sub>2</sub>	No*	Y 11	21	Y
N38 Bus stop lamppost at Grove Lodge	Roadside	514104	NO <sub>2</sub>	No*	Y 15	3	Y
N39 SW of Roundabout at Grove lodge	Roadside	514104	NO <sub>2</sub>	No*	Y 42	4	Y
N40 NE of roundabout at Grove Lodge	Roadside	514104	NO <sub>2</sub>	No*	Y 17	1.5	Y
N41 Down pipe on Lamorna Grove Flats	Façade	514104	NO <sub>2</sub>	No*	Y	10	Y
N1 The Steyne	Kerbside	515102	NO <sub>2</sub>	No	Y 3	0.5	Y
N1B High Street East	Façade	515102	NO <sub>2</sub>	No	Y	2	Y
N1C High Street East	Façade	515102	NO <sub>2</sub>	No	Y	2	Y
N1D High Street East	Façade	515102	NO <sub>2</sub>	No	Y	2	Y

\* within area of AQMA from July 2010

## 2.2 Comparison of Monitoring Results with Air Quality Objectives

Worthing Borough Council monitoring results have shown that there have been 17 measured exceedances of the UK air quality objectives for NO<sub>2</sub> at 10 different monitoring sites in 2009 (16 diffusion tubes and 1 automatic monitoring site). There were no measured exceedances of PM<sub>10</sub> objectives.

### 2.2.1 Nitrogen Dioxide

Worthing Borough Council has measured concentrations of Nitrogen Dioxide for many years using both diffusion tubes and a continuous analyser at various locations. Diffusion tubes deployed at a number of locations consistently yielded results in excess of the 40µg/m<sup>3</sup> NO<sub>2</sub> annual mean air quality objective. These sites were subsequently subject to a Detailed Assessment in 2008, which concluded that an area on the A27 between Grove Lodge and Downlands Parade needed to be declared an AQMA. The other sites subject to detailed assessment did not require further action at that time.

Monitoring during 2008 showed a decrease in measured NO<sub>2</sub> at most sites. However, monitoring during 2009 shows a general increase over the 2008 values and is at levels similar to those measured prior to 2008. The lower levels during 2008 could be attributed to a reduction in overall road traffic levels which was reflected nationally. Some observers accredited this to the recession and predicted it to be a temporary reduction. The figures for 2009 appear to confirm this view.

Monitoring in 2009 has shown 17 measured exceedances of the annual mean NO<sub>2</sub> air quality objective at 10 different locations - 16 diffusion tubes and 1 automatic monitoring site.

#### Automatic Monitoring Data

The continuous analyser was set up to monitor NO<sub>2</sub> at a site close to Grove Lodge roundabout in 2007, in order to gather further information relating to emissions at this location. Diffusion tubes in this area showed consistently elevated levels of NO<sub>2</sub> in excess of the annual mean objective and led to a Detailed Assessment in 2008.

The analyser is situated in a residential garden at a site adjacent to the A27, approximately 80m east of Grove Lodge Cottages. It is situated just behind a front garden wall, about 3.5 metres from the kerb and 8 metres from the property façade. It is collocated with three NO<sub>2</sub> tubes and an Osiris continuous particulate monitor.

The monitoring data included within Table 2.3a shows that the NO<sub>2</sub> annual mean for 2009 at Grove Lodge was 45µg/m<sup>3</sup>. This is above the air quality objective of 40µg/m<sup>3</sup>.

This is the second full year of monitoring data at this location. Data for 2008 showed an annual average of just 33µg/m<sup>3</sup>. This level differed considerably from the collocated diffusion tube measurements of 43µg/m<sup>3</sup>. This was questioned at the time and as a result a full service of the analyser was undertaken. This revealed a blockage in the inlet pipe which could account for the low levels recorded by the analyser during 2008 (in comparison to diffusion tube data).

For the three months of 2007 where data was available (September to December), an average of 43µg/m<sup>3</sup> was measured. As this was not a full years' data, this result has been 'annualised' to give an annual mean for 2007 of 40µg/m<sup>3</sup>.

It is clear that the data for 2009 shows a significant increase over the preceding years. This may be due to an increase in traffic levels along the A27, although at the time of writing no traffic data was available.

There were two recorded exceedances of the hourly mean objective of  $200\mu\text{g}/\text{m}^3$ .  $236\mu\text{g}/\text{m}^3$  at 8am on 11 February and  $201\mu\text{g}/\text{m}^3$  at 8am on 4 March. This is well within the objective of  $200\mu\text{g}/\text{m}^3$  not to be exceeded more than 18 times a year. It is clear however that the exceedances are likely to be related to stationary traffic, arising in the middle of the morning rush hour.

**Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )		
					2007 <sup>2</sup>	2008	2009
A27 Grove Lodge	30 Upper Brighton Road, Worthing	Y <sup>1</sup>	99.7	99.7	40.0	33.2	45.2

<sup>1</sup> AQMA No.1 due July 2010.

<sup>2</sup> Annualised mean as monitoring for 3 months only.

**Table 2.5 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for full calendar year 2009 %	Number of Exceedances of hourly mean ( $200\mu\text{g}/\text{m}^3$ )		
				2007	2008	2009
A27 Grove Lodge	30 Upper Brighton Road, Worthing	Y <sup>1</sup>	99.7	0 (143.2) <sup>2</sup>	0	2

<sup>1</sup> AQMA No.1 due July 2010

<sup>2</sup> 99.8<sup>th</sup> percentile of hourly means in brackets as period of valid data less than 90% of a full year

### Diffusion Tube Monitoring Data

Of the 44 diffusion tube sites monitored during 2009, 16 showed an exceedance of the annual mean objective at 10 different locations. Of these 10 locations all but one are roadside monitoring locations. Therefore only one site reflects relevant exposure (at the façade of residential premises).

**Table 2.6 Sites exceeding the annual mean objective**

Site ID	Location	Site Type	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ ) 2009 *
6N	Gainsborough Avenue	Roadside	43.5
N1	The Steyne	Roadside	40.7
N3	Cricketers Pde	Roadside	41.0
N6A	Warren Ct Warren Rd	Roadside	56.5
N28	Chapel Road/Teville Road	Roadside	44.7
N29 N33 N34	Downlands Parade	Facade	43.6, 43.2, 44.3 (43.7)
N30 N30A N30B	Grove Lodge Cottages	Roadside	<b>75.5, 78.2, 60.7</b> <b>(71.5)</b>
N35A N35B N35C	30 Upper Brighton Road. Poll Box	Roadside	46.1, 46.9, 49.1 (47.4)
N36	Corner of Hillbarn Lane	Roadside	43.2
N40	NE of Grove Lodge roundabout	Roadside	48.3

\* Figures in brackets are the average for all the tubes at that site

### Discussion

#### 6N Gainsborough Avenue

This tube is attached to a lamppost adjacent to the busy A27 adjacent to the Lyons Farm junction. This road is subject to high volumes of road traffic throughout the day. The measured concentration at this location was  $43.5 \mu\text{g}/\text{m}^3$ .

The nearest relevant exposure is a house some 10m to the south. When the measured concentration at this site was calculated back to the residential façade, a level of  $31.2 \mu\text{g}/\text{m}^3$

is produced, well below the annual mean objective of  $40 \mu\text{g}/\text{m}^3$  (see Appendix X for calculation), so it has been concluded that no further action is necessary.

### **N1 The Steyne**

This tube is a roadside site located approximately 10m away from a facade with relevant exposure (a domestic property). When the measured concentration at this site was re-calculated back to the closest location of relevant public exposure, the result of this calculation showed that there was no likely exceedance of the annual mean concentration of  $40 \mu\text{g}/\text{m}^3$ . The result was  $29.1 \mu\text{g}/\text{m}^3$  (see Appendix X for calculation). In fact site N1D is closest to the residential facade and the annual mean for this location was  $37.7 \mu\text{g}/\text{m}^3$ . Additionally, nearby tubes located at residential facades on the opposite side of the road and representative of relevant exposure (sites N1B and N1C) are below the objective.

### **N3 Cricketers Parade**

This tube is attached to a lamppost adjacent to a bus stop. The nearest relevant exposure is residential flats some 19m to the north east. When the measured concentration at this site was re-calculated back to this location a level of  $29.6 \mu\text{g}/\text{m}^3$  is produced, well below the annual mean objective of  $40 \mu\text{g}/\text{m}^3$  (see Appendix X for calculation).

### **N6A at Warren Court**

This is a roadside site adjacent to the busy A27. It does not reflect relevant exposure and the associated tube which does is N25 Warren Ct House, which is a facade mounted tube. The level at this site was  $26.7 \mu\text{g}/\text{m}^3$ , comfortably within the annual mean objective.

### **N28 at the junction of Chapel Road and Teville Road**

This is a busy roadside location which is also located within about 1 metre of a residential facade (a block of flats). The junction includes a roundabout and a pedestrian crossing controlled by traffic lights is located just off the roundabout in Teville Road. Standing traffic is therefore a common occurrence.

When the measured concentration at this site was re-calculated back to the residential facade a level of  $42.4 \mu\text{g}/\text{m}^3$  is produced, above the annual mean objective of  $40 \mu\text{g}/\text{m}^3$  (see Appendix X for calculation).

**This level is above the annual mean objective of  $40 \mu\text{g}/\text{m}^3$ . and therefore this site must be subject to further assessment.**

### **N29 N33 and N34 Downlands Parade (A27)**

These are tri-located tubes adjacent to a residential facade at first floor level on Downlands Parade on the A27 and is a site of relevant exposure. This is close to the busy Lyons Farm junction and is within a mile of the forthcoming Grove Lodge AQMA. Traffic congestion here is often linked to congestion at Grove Lodge. A Detailed Assessment in the vicinity of the Lyons Farm junction in 2008 concluded that whilst there was no exceedance measured at that time, the levels of  $\text{NO}_2$  adjacent to residential properties were very close to the mean objective. Modelling suggested there may be problems in the future at the eastern end of the Lyons Farm Junction and that there was a need for ongoing scrutiny at this location.

The levels measured at this location in 2009 ranged from 43.2 to 44.3  $\mu\text{g}/\text{m}^3$ , with an average of 43.7  $\mu\text{g}/\text{m}^3$ . As this is a façade measurement no further adjustments for distance are required.

**This level is above the annual mean objective of 40  $\mu\text{g}/\text{m}^3$ . Therefore this site must be subject to further assessment.**

**N30 N30A and N30B Grove Lodge Cottages (A27)**

These tubes are situated at the western end of Upper Brighton Rd with N30 about two metres from a residential façade. All are close to the busy Grove Lodge roundabout where traffic control was introduced about 3 years ago and where there is regularly a high volume of slow moving traffic particularly westbound. The results for these locations vary between 60.7 and 75.5  $\mu\text{g}/\text{m}^3$  with an average of 71.5  $\mu\text{g}/\text{m}^3$ .

These results show a large exceedance of the annual average objective and, even if a margin of error were taken into account, the levels would still exceed the objective by a fair margin. With a residential façade within 2 metres, this site can be taken to be representative of relevant public exposure.

This area was identified in the 2008 Detailed Assessment as exceeding the NO<sub>2</sub> Annual Mean Objective at a site of relevant exposure and that an Air Quality Management Area (AQMA) should be declared. The monitoring for 2008 confirmed this conclusion. This site lies within the area of the AQMA No.1 coming into force in July 2010. The monitoring results for 2009 confirm that exceedances continue. The forthcoming Action Plan for the Grove Lodge AQMA will be designed to attempt to reduce levels in this area.

A graph showing the trend for these sites over the past 4 years is below. This shows a general upward trend in NO<sub>2</sub> levels year on year.

**Figure 2.3: Graph showing trend in NO<sub>2</sub> for Grove Lodge Cottages 2006-2009 (Note: N30A and N30B began 2007)**



(Note: No data for 2006 hence zero NO<sub>2</sub> for that year)

**Table 2.7 Full Results of Nitrogen Dioxide Diffusion Tubes**

Site ID	Location	Within AQMA?	Data Capture for full calendar year 2009 %	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )		
				2007 <sup>c, d</sup>	2008 <sup>c, d</sup>	2009 <sup>c</sup>
1N	Chapel Rd	N	92	33.4	29.7	33.5
4N	Heene Way	N	100	19.2	16.3	17.0
5N	Cleveland Road	N	100	19.5	16.6	18.5
6N	Gainsborough Avenue	N	100	46.3	38.4	43.5
N1	The Steyne	N	92	39.0	35.6	40.7
N1 B	High Street East	N	92	40.3	32.8	37.7
N1 C	High Street East	N	100	37.0	30.6	36.7
N1 D	High Street East	N	92	35.7	29.4	37.7
N3	Cricketers Pde	N	100	37.5	33.2	41.0
N4A	Jefferson Lodge Arundel Rd	N	100	30.0	29	35.1
N5	First Avenue	N	100	36.3	32.5	37.3
N6A	Warren Ct Warren Rd	N	100	51.3	46.6	56.5
N8	Littlehampton Rd	N	100	27.3	27.8	33.5
N9	Honeysuckle Lane	N	100	12.4	10.1	12.6
N11	Dawes Cl	N	100	19.9	17.7	19.5
N15	Chippers Walk	N	100	18.8	15.9	17.8
N16	Mill Rd	N	100	26.9	23.6	24.8
N17	Chapel Road, B-Dust monitor	N	100	36.1	33.4	35.9
N18A	Kinnall Court, Upper Brighton Road,	N	100	28.6	24.4	27.1
N19	Hillside Avenue, D-Dust monitor	N	100	22.1	19.8	22.7
N21	Greenwood Cottage, A27	N	100	35.6	32.3	36.7
N22	Falmer Close, C-Dust monitor	N	100	18.0	14.4	15.1
N24	152 Up B'ton Rd NO2 House	N	100	25.8	23.7	28.1
N25	Warren Ct House	N	100	26.3	23	26.7
N27	Tarring Road, Crossing	N	100	33.4	27.8	31.4
N28	Chapel Road/Teville Road	N	67	43.2	36.8	44.7

N29	Downlands Parade	N	100	41.3	36.1	43.6
N30	Grove Lodge Cottages	Y <sup>1</sup>	100	<b>69.9</b>	59.4	<b>75.5</b>
N30A	Grove Lodge Cottages	Y <sup>1</sup>	100	<b>72.5</b>	<b>66.9</b>	<b>78.2</b>
N30B	Grove Lodge Cottages	Y <sup>1</sup>	100	58.9	50.9	<b>60.7</b>
N31	South Farm Road, r'bout	N	100	32.4	27.9	32.9
N32	Lamppost corner of Upper Brighton Rd/Sompting Rd	N	100	37.3	35.0	38.8
N33	Downlands Parade	N	100	43.7	38.4	43.2
N34	Downlands Parade	N	100	43.1	36.1	44.3
N35	30 Upper Brighton Road house	Y <sup>1</sup>	83	38.4	33.5	33.5
N35A	30 Upper Brighton Road. Poll Box	Y <sup>1</sup>	100	56.2	43.7	46.1
N35B	30 Upper Brighton Road. Poll. Box	Y <sup>1</sup>	92	58.9	43.6	46.9
N35C	30 Upper Brighton Road. Poll. Box	Y <sup>1</sup>	100	56.1	44.5	49.1
N36	Corner of Hillbarn Lane	Y <sup>1</sup>	100	41.5	35.7	43.2
N37	Lamorna Grove Lamppost	Y <sup>1</sup>	100	N/A	26.2	30.4
N38	Bus stop lamppost at Grove Lodge	N	100	N/A	34.1	39.9
N39	SW of Roundabout at Grove lodge	N	92	N/A	33.1	37.2
N40	NE of roundabout at Grove Lodge	Y <sup>1</sup>	100	N/A	48.2	48.3
N41	Down pipe on Lamorna Grove Flats	Y <sup>1</sup>	100	N/A	26.3	29.7

2008 Bias adjustment factor = 0.85  
2009 Bias adjustment factor = 0.99

### 2.2.2 PM<sub>10</sub>

Particulate matter is a major health concern, as it has been linked with both increased morbidity and premature mortality. There is a wide range of emission sources that contribute to PM<sub>10</sub> concentrations in the UK. Research studies have confirmed that these sources can be divided into 3 main categories (APEG, 1999):

- I. Primary particle emissions are derived directly from combustion sources, including road traffic, power generation, industrial processes etc.
- II. Secondary particles are formed by chemical reactions in the atmosphere, and comprise principally of sulphates and nitrates.
- III. Coarse particles comprise of emissions from a wide range of sources, including re-suspended dusts from road traffic, construction works, mineral extraction processes, wind-blown dusts and soils, sea salt and biological particles.

Although previous review and assessments have not indicated particulate matter to be of major concern in Worthing, we continue to monitor PM<sub>10</sub> using two "Osiris" analysers. Whilst acknowledging that these are not gravimetric devices and therefore the results obtained are only indicative, they are a reasonable indicator of the level of particulates. If the results obtained were found to be close to the air quality objectives using these devices, then further more detailed monitoring using gravimetric devices would be carried out.

One of the monitors is permanently mounted at a very quiet urban background site - Falmer Close, a cul de sac, in Goring, which receives very little influence from passing traffic. The second monitor has been moved around the borough and deployed for periods of six months or more at a variety of locations. However, since September 2007, this second Osiris Monitor has been situated at Grove Lodge, collocated with the continuous NO<sub>2</sub> analyser. This is the location of greatest concern in relation to traffic pollution. It is also within two metres of residential premises and can therefore be considered representative of relevant public exposure.

The analysers remained in Goring and Grove Lodge during 2009. Due to various problems with the analysers, the data capture for both sites was relatively poor. However the results give us an indication of PM<sub>10</sub> levels at each location.

The mean result for PM<sub>10</sub>'s at Grove Lodge was 27.3 µg/m<sup>3</sup>. For Goring the annual mean was 21.7 µg/m<sup>3</sup>. The annual mean air quality objective is 40 µg/m<sup>3</sup>.

There is also a PM<sub>10</sub> air quality objective relating to 24hr mean exceedances of 50 µg/m<sup>3</sup>, not to be exceeded more than 35 times per year. Throughout 2009 there were 6 exceedances of the 24hr mean at Grove Lodge and 10 at Goring. As the data capture for the year was less than 90%, the 90<sup>th</sup> percentile has been calculated. The results for Grove Lodge and Goring are well under the 50 µg/m<sup>3</sup> limit (see Table 2.5b),

These results strongly suggest that there will be no exceedance of the current air quality objectives for PM<sub>10</sub>. As the annual means are well below the annual average and the 90<sup>th</sup> percentiles of daily means are below the daily mean objectives, no further action is considered necessary.

Previous reports have shown that the PM<sub>10</sub> results in Worthing are largely dependent upon regional rather than local influences. The results for 2009 do not significantly alter this view.

**Table 2.8 Results of PM<sub>10</sub> Automatic Monitoring: Comparison with Annual Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Annual mean concentrations (µg/m <sup>3</sup> )		
					2007	2008	2009
A	Grove Lodge	Y	N/A	55	23.9	25.6	27.3
B	Goring	N	N/A	63	22.2	13.1	21.7

**Table 2.9 Results of PM<sub>10</sub> Automatic Monitoring: Comparison with 24-hour Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture 2009 %	Number of Exceedences of daily mean objective (50 µg/m <sup>3</sup> )		
					2007	2008 *	2009 *
A	Grove Lodge	Y	N/A	55	2	1 (38.8)	6 (40.0)
B	Goring	N	N/A	63	1	0 (21.7)	10 (38.9)

\* (90<sup>th</sup> percentile of daily means in brackets as data capture < 90%)

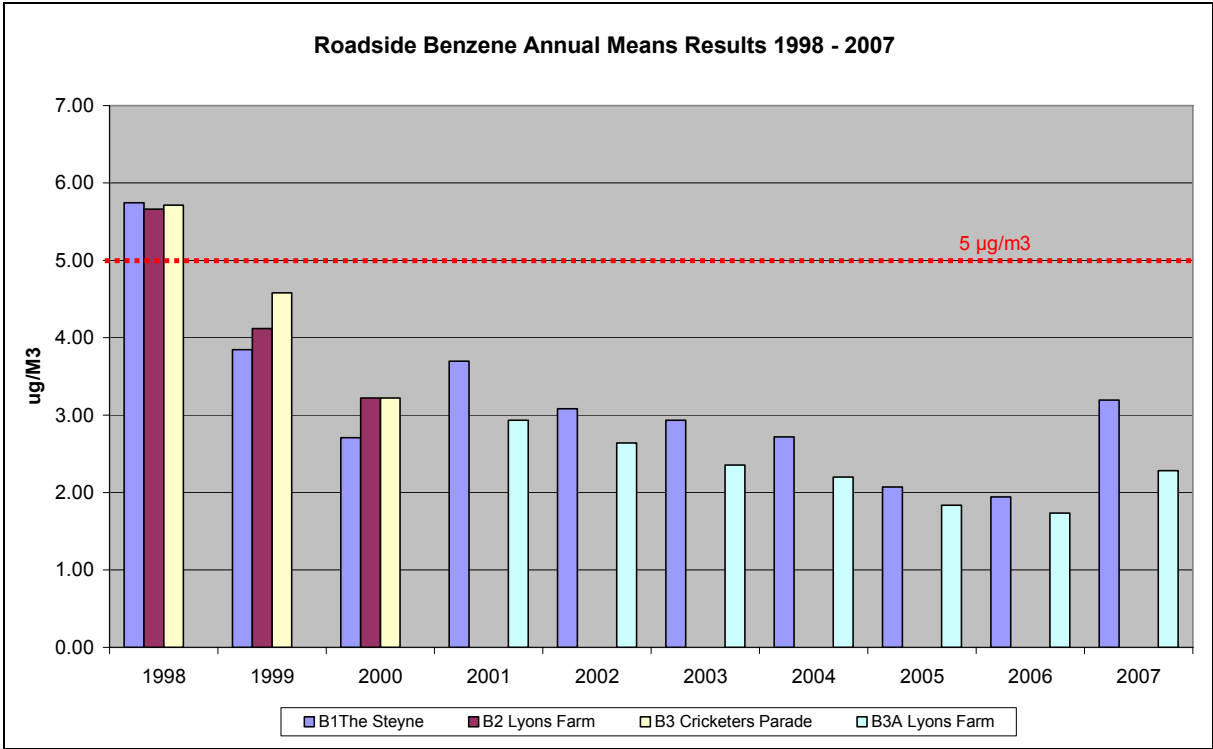
**2.2.3 Sulphur Dioxide**

We do not currently monitor for Sulphur Dioxide. There have been no significant changes to potential sources of this pollutant since the 2008 Progress Report, which concluded that no further action was required.

**2.2.3.1 Benzene**

Benzene monitoring in Worthing was stopped in mid 2008 due to very low levels being monitored (see graph below). The 2008 Progress Report concluded that it was unlikely the 2010 Air Quality Objective for benzene was exceeded in 2007 and it was unlikely to be exceeded in future years. Therefore no further monitoring has taken place since.

**Figure 2.4**



#### 2.2.4 Summary of Compliance with AQS Objectives

Worthing Borough Council has measured concentrations of NO<sub>2</sub> above the annual mean objective at relevant locations outside of the AQMA at Grove Lodge, and **will need to proceed to a Detailed Assessment, for**

- a) Teville Gate; and
- b) Lyons Farm (Downlands Parade)

## 3 New Local Developments

### 3.1 Road Traffic Sources

Worthing Borough Council confirms that there are no new or newly identified road traffic sources which may have an impact on air quality within the Local Authority area.

### 3.2 Other Transport Sources

Worthing Borough Council confirms that there are no new or newly identified transport sources which may have an impact on air quality within the Local Authority area.

### 3.3 Industrial Sources

Worthing Borough Council confirms that there are no new or newly identified industrial sources which may have an impact on air quality within the Local Authority area.

### 3.4 Commercial and Domestic Sources

#### 3.4.1 Biomass Combustion – Individual Installations

At the request of Defra an assessment of biomass plant was undertaken in line with procedures contained within TG 09. Worthing Borough Council has identified three installations with biomass combustion plants within it's area. These units burn wood in 50kW to 20MW units.

The assessments for these are detailed in Appendix E.  
**They show there is no requirement to undertake a further detailed assessment**

### 3.4.2 Biomass Combustion – Combined Impacts

- The combined impact of biomass combustion was assessed in a semi commercial area of East Worthing, refer to Appendix G:
- The emission density from the combined biomass installation is 489kg/year, this is significantly below the threshold of 7000 kg/year for the area.
- **Therefore, there is no requirement to undertake a further detailed assessment.**

### 3.4.3 Domestic Solid-Fuel Burning

No areas within the Borough were identified as having significant coal burning, defined as any area of about 500x500 with more than 50 houses burning coal/smokeless fuel as their primary source of heating.

Worthing Borough Council confirms that there are no new or newly identified commercial or domestic biomass combustion sources which may have an impact on air quality within the Local Authority area.

### 3.5 New Developments with Fugitive or Uncontrolled Sources

Worthing Borough Council confirms that there are no new or newly identified potential sources of fugitive or uncontrolled particulate matter which may have an impact on air quality within the Local Authority area.

### Conclusion

Worthing Borough Council confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

## 4 Planning Applications

Since the 2009 Updating and Screening assessment Worthing Borough Council is expecting the following large scale developments to be subject to planning applications.

### 1. Teville Gate

This site has been the subject of a number of plans in the past, but none have ever become a reality. However there are proposals to redevelop the entire site to include housing, offices, a multiplex cinema and a variety of commercial uses. An air quality impact assessment is expected to accompany a planning application. This is a major development in an area which is showing signs of exceeding the Air Quality Objective for NO<sub>2</sub> and any development will need to be closely scrutinised to ensure it does not increase congestion and therefore NO<sub>2</sub> and PM10 levels in the area. Mitigation and additional monitoring is likely to be sought if the development gains planning approval.

### 2. New community swimming pool and enabling development

A new public swimming pool is proposed, to replace the now old and outdated pool. The new pool is proposed to be built next to the current pool, with the current pool then being demolished to make way for development. The development on the site of the old pool is as yet unknown but is likely to comprise of a significant number of housing units. The combination of a new pool and additional housing may increase traffic along the A259 Brighton Road and will be watched closely. If approved, construction is expected to commence in April 2011 with anticipated completion in February 2013.

### 3. Northbrook College

Northbrook College is planning a major improvement and extension of its campus in Broadwater, which could have implications for traffic flow on the A24 Broadwater Road. Several planning applications are expected.

## **5 Implementation of Action Plans**

An Action Plan for the Grove Lodge AQMA will be drawn up following the Worthing Borough Council AQMA No.1 Order coming into force in July 2010.

## **6 Conclusions and Proposed Actions**

### **6.1 Conclusions from New Monitoring Data**

Monitoring data from the continuous analyser near Grove Lodge on the A27 (within the forthcoming AQMA) has shown the NO<sub>2</sub> annual mean for 2009 was 45µg/m<sup>3</sup>, above the national air quality objective of 40µg/m<sup>3</sup>.

There were two recorded exceedances of the hourly mean objective of 200µg/m<sup>3</sup> at this site - 236µg/m<sup>3</sup> and 201µg/m<sup>3</sup>, both arising in the middle of the morning rush hour. This is well within the objective of 200µg/m<sup>3</sup> not to be exceeded more than 18 times a year.

NO<sub>2</sub> diffusion tube monitoring at roadside and background sites for 2009 shows a general increase over the 2008 values. There were 17 measured exceedances of the annual mean NO<sub>2</sub> air quality objective at 10 different locations - 16 diffusion tubes and 1 automatic monitoring site. Of these 10 locations all but one were roadside monitoring locations. When the measured concentrations at 9 of these sites were calculated back to the nearest residential façades representative of public exposure, the levels were below the annual mean objective of 40 µg/m<sup>3</sup>. Therefore it has been concluded that no further action is necessary for these locations.

Tube site N28 at the busy junction of Chapel Road and Teville Road gave a residential façade level of 42.4 µg/m<sup>3</sup>. As this is above the annual mean objective of 40 µg/m<sup>3</sup>, this site must be subject to further assessment.

Tri-located tubes adjacent to a residential facade at first floor level on Downlands Parade on the A27 (N29 N33 and N34) reflect relevant exposure. Levels measured at this location averaged 43.7 µg/m<sup>3</sup>. This level is above the annual mean objective of 40 µg/m<sup>3</sup> and therefore this site must also be subject to further assessment.

Monitoring results for PM<sub>10</sub>'s fall below the air quality objectives and suggest that there will be no exceedance of the current air quality objectives for PM<sub>10</sub>'s within the Worthing Borough.

### **6.2 Conclusions relating to New Local Developments**

An assessment of biomass plant has concluded there is no requirement to undertake a further detailed assessment.

A watching brief will be kept on the proposed redevelopment of the Teville Gate site and comments made if and when a planning application is submitted.

### **6.3 Proposed Actions**

Monitoring by both diffusion tubes and the automatic continuous analyser within the proposed Grove Lodge AQMA has shown an exceedance of the annual mean objective for NO<sub>2</sub>. Therefore the existing monitoring regime utilising a large number of diffusion tubes in and around the AQMA and the continuous analyser will continue.

Of the 10 NO<sub>2</sub> diffusion tube monitoring locations that exceeded the annual mean NO<sub>2</sub> air quality objective all but one were roadside monitoring locations. When the measured concentrations at 9 of these sites were calculated back to the nearest residential façades representative of public exposure, the levels were below the annual mean objective of 40 µg/m<sup>3</sup>. Therefore it has been concluded that no further action is necessary for these locations.

The one remaining tube site - N28 - at the junction of Chapel Road and Teville Road gave a residential façade level of 42.4 µg/m<sup>3</sup>. As this is above the annual mean objective of 40 µg/m<sup>3</sup>, this site must be subject to further assessment.

Tri-located tubes on Downlands Parade on the A27 (N29 N33 and N34) reflect relevant exposure. The levels measured at this location averaged 43.7 µg/m<sup>3</sup>, above the annual mean objective of 40 µg/m<sup>3</sup> and therefore this site must also be subject to further assessment.

### **Worthing Borough Council shall therefore**

- 1. Submit a Progress Report in 2011;**
- 2. Proceed to Detailed Assessment for the following locations:**
  - A. Teville Gate/Chapel Road;**
  - B. A27 Lyons Farm (Downlands Parade)**

## 7 References

AEA, 2010 WASP – Annual Performance Criteria for NO<sub>2</sub> Diffusion Tubes used in Local Air Quality Management (LAQM), 2008 onwards, and Summary of Laboratory Performance in Rounds 103-107. Prepared by AEA on behalf of Defra and the Devolved Administrations. 21 January 2010. Available at [http://www.laqmsupport.org.uk/Summary\\_of\\_Laboratory\\_Performance\\_in\\_WASP\\_R103-107.pdf](http://www.laqmsupport.org.uk/Summary_of_Laboratory_Performance_in_WASP_R103-107.pdf)

UWE, 2010 National Bias Adjustment Factor Spreadsheet, available at <http://www.uwe.ac.uk/aqm/review/R&Asupport/diffusontube310310.xls>

DEFRA (2009) Local Air Quality Management Technical Guidance, (LAQM .TG (09))  
Local Air Quality Management Policy Guidance, (LAQM .PG (09))  
The Environment Act (1995)  
The Environmental Permitting Regulations 2010

EMEP/CORINAIR Emissions Inventory Guidebook 2006

DEFRA Technical Guidance: Screening assessment for biomass boilers

DEFRA Review and Assessment tool for biomass combustion stacks (Excel spreadsheet).

## **Appendices**

- A:** QA/QC Data
- B:** Fall-off calculations for nitrogen dioxide (with distance from the road) for Diffusion tube sites
- C:** Permitted Installations within the Worthing Borough
- D:** Diffusion Tube Monitoring data set for 2009 (not bias adjusted)
- E:** Calculation for commercial sources of biomass
- F:** Combined biomass assessment

## Appendix A: QA:QC Data

### Diffusion Tube Bias Adjustment Factors

NO<sub>2</sub> diffusion tubes are provided and analysed by Gradko laboratory. The NO<sub>2</sub> tube preparation method used is 50% triethanolamine TEA in Acetone.

Data from the NO<sub>2</sub> diffusion tubes gas been compared and bias corrected to the factors produced from the UK co-location data-base as produced by University of West of England (UWE) on behalf of DEFRA,

<http://www.uwe.ac.uk/aqm/review/R&Asupport/diffusiontube310310.xls>

The bias adjustment factor used for 2009, obtained from the aforementioned website, is 0.99.

### QA/QC of automatic monitoring

The automatic NO<sub>2</sub> monitoring station consists of a NO<sub>x</sub> chemiluminescent analyser, data logger and modem. It is situated in a "J type" GRP street cabinet which is small enough to make siting and relocation more convenient. All automatic monitoring data is managed by TRL Ltd. and validated against operator's calibration results. The unit is calibrated fortnightly by an Officer of the Council, the results of which are then sent directly to TRL for assessment, where it is checked for any anomalies. TRL themselves carry out six-monthly servicing of the unit and replace parts as and when required.

### QA/QC of diffusion tube monitoring

All diffusion monitoring data has been ratified following the methods described in LAQM.TG(09). A quality assurance / quality control (QA/QC) programme including field duplicates and blanks, and instrument calibration with standard gases has been followed (AEAT, 2000).

Gradko have demonstrated Good performance in the Workplace Analysis Scheme for Proficiency (WASP) for analysis of NO<sub>2</sub> diffusion tubes, October 2008 – October 2009 (AEA, 2010). WASP is an independent analytical performance testing scheme, operated by the Health and Safety Laboratory (HSL) and is an important QA/QC exercise for laboratories supplying diffusion tubes to Local Authorities for use in the context of Local Air Quality Management (LAQM). Gradko have been rated as 'Good' for performance in the WASP scheme, over rounds 103 to 107, meaning their results are on average within 13% of the assigned value.

## Appendix B: Fall-off calculations for nitrogen dioxide (with distance from the road) for Diffusion tube sites

### 6N Gainsborough Avenue

#### 1:

Local background concentration for NO<sub>2</sub> (2009) = 14.13 µg/m<sup>3</sup>

Closest background grid square reference source = 515500, 105500

Location of diffusion tube = 515190, 105121

#### 2:

Calculation:

$$CZ = ((C_y - C_b) / (-0.5476 \times \ln(D_y) + 2.7171)) \times (-0.5476 \times \ln(D_z) + 2.7171) + C_b$$

Where:

C<sub>z</sub> is the total predicted concentration (µg/m<sup>3</sup>) at distance D<sub>z</sub>;

C<sub>y</sub> is the total measured concentration (µg/m<sup>3</sup>) at distance D<sub>y</sub>;

C<sub>b</sub> is the background concentration (µg/m<sup>3</sup>);

D<sub>y</sub> is the distance from the kerb at which concentrations were measured; and

D<sub>z</sub> is the distance from the kerb (m) at which concentrations are to be predicted.

Ln(D) is the natural log of the number D.

$$CZ = ((43.5 - 14.13) / (-0.5476 \times \ln(2) + 2.7171)) \times (-0.5476 \times \ln(12) + 2.7171) + 14.13$$

$$\underline{CZ = 31.2 \mu\text{g/m}^3}$$

Where:

$$C_y = 43.5 \mu\text{g/m}^3$$

$$C_b = 14.13 \mu\text{g/m}^3$$

$$D_y = 2 \text{ m}$$

$$D_z = 12 \text{ m}$$

### N28 Chapel Road/Teville Road.

#### 1:

Local background concentration for NO<sub>2</sub> (2009) = 16.83 µg/m<sup>3</sup>

Closest background grid square reference source = 514500, 103500

Location of diffusion tube = 514735, 103170

#### 2:

Calculation:

$$CZ = ((C_y - C_b) / (-0.5476 \times \ln(D_y) + 2.7171)) \times (-0.5476 \times \ln(D_z) + 2.7171) + C_b$$

Where:

C<sub>z</sub> is the total predicted concentration (µg/m<sup>3</sup>) at distance D<sub>z</sub>;

Cy is the total measured concentration (µg/m<sup>3</sup>) at distance Dy;  
 Cb is the background concentration (µg/m<sup>3</sup>);  
 Dy is the distance from the kerb at which concentrations were measured; and  
 Dz is the distance from the kerb (m) at which concentrations are to be predicted.  
 Ln(D) is the natural log of the number D.

$$CZ = ((44.7-16.8)/(-0.5476*\ln(2.5)+2.7171))*(-0.5476*\ln(3.5)+2.7171)+16.83$$

**CZ = 42.4µg/m<sup>3</sup>**

Where:

Cy = 44.7 µg/m<sup>3</sup>  
 Cb = 16.83 µg/m<sup>3</sup>  
 Dy = 2.5 m  
 Dz = 3.5 m

## N1 The Steyne.

**1:**

Local background concentration for NO<sub>2</sub> (2009) = 13.56µg/m<sup>3</sup>  
 Closest background grid square reference source = 515500,102500  
 Location of diffusion tube = 515110,102660

**2:**

Calculation:

$$CZ = ((Cy-Cb) / (-0.5476 \times \ln(Dy) + 2.7171)) \times (-0.5476*\ln(Dz)+2.7171) + Cb$$

Where:

Cz is the total predicted concentration (µg/m<sup>3</sup>) at distance Dz;  
 Cy is the total measured concentration (µg/m<sup>3</sup>) at distance Dy;  
 Cb is the background concentration (µg/m<sup>3</sup>);  
 Dy is the distance from the kerb at which concentrations were measured; and  
 Dz is the distance from the kerb (m) at which concentrations are to be predicted.  
 Ln(D) is the natural log of the number D.

$$CZ = ((40.7-15.56)/(-0.5476*\ln(1.5)+2.7171))*(-0.5476*\ln(10.5)+2.7171)+15.56$$

**CZ = 29.1 µg/m<sup>3</sup>**

Where:

Cy = 40.7 µg/m<sup>3</sup>  
 Cb = 13.56 µg/m<sup>3</sup>  
 Dy = 1.5 m  
 Dz = 10.5 m

## N3 Cricketers Parade

### 1:

Local background concentration for NO<sub>2</sub> (2009) = 16.29µg/m<sup>3</sup>

Closest background grid square reference source = 514500,104500

Location of diffusion tube = 514500,104500

### 2:

Calculation:

$$CZ = ((C_y - C_b) / (-0.5476 \times \ln(D_y) + 2.7171)) \times (-0.5476 \times \ln(D_z) + 2.7171) + C_b$$

Where:

C<sub>z</sub> is the total predicted concentration (µg/m<sup>3</sup>) at distance D<sub>z</sub>;

C<sub>y</sub> is the total measured concentration (µg/m<sup>3</sup>) at distance D<sub>y</sub>;

C<sub>b</sub> is the background concentration (µg/m<sup>3</sup>);

D<sub>y</sub> is the distance from the kerb at which concentrations were measured; and

D<sub>z</sub> is the distance from the kerb (m) at which concentrations are to be predicted.

Ln(D) is the natural log of the number D.

$$CZ = ((41 - 16.29) / (-0.5476 \times \ln(3.5) + 2.7171)) \times (-0.5476 \times \ln(19.5) + 2.7171) + 16.29$$

$$\underline{CZ = 29.6 \mu\text{g/m}^3}$$

Where:

$$C_y = 41 \mu\text{g/m}^3$$

$$C_b = 16.29 \mu\text{g/m}^3$$

$$D_y = 3.5 \text{ m}$$

$$D_z = 19.5 \text{ m}$$

## Appendix C: Permitted Installations within the Worthing Borough (Environmental Permitting Regulations 2010)

### Part A(1) – Permitted Installations regulated by the Environment Agency

Reference	Installation	Activities
GlaxoSmithKline PLC Various  GlaxoSmithKline AK3340 – Manufacture and Use of Organic Chemicals SmithKline Beecham Plc QP3935LE - Pharmaceutical manufacture - 2006  see <a href="http://www2.environment-agency.gov.uk/epr/">http://www2.environment-agency.gov.uk/epr/</a>	Worthing Pharmaceutical Manufacturing Facility, Southdownview Way, Worthing, West Sussex, BN14 8QH	Manufacture and Use of Organic Chemicals; Pharmaceutical Manufacture

### Part B – Permitted Installations regulated by Worthing Borough Council

Reference	Installation	Activity & Defra Process Guidance (PG) Note	Grid Reference	Permit from	Variations	Last Review	Risk Rating 2010/11
LAPPC/08/01	<b>B &amp; W Group Ltd.</b> , Dale Road Worthing BN11 2BH	Coating of Metal and Plastic PG 6/23 (04)	516725 103568	20/03/08	None	20/03/08	Medium
LAPPC/06/01	<b>Seward Accident Repair Centre</b> Woods Way, Worthing, BN12 4QY	Vehicle Respray PG 6/34(04)	511228 103108	08/03/93	PP2/93/V1 – 1/4/99 PP2/93/V2 – 25/1/01 LAPPC/05/02 - 24/3/05 LAPPC/06/01- 06.01.06 (transferred from J S	06/01/06	Medium

					Arnold)		
LAPPC/05/03	<b>A E Ledger (Coachworks) Ltd.</b> , 16 Bashfords Lane, Broadwater Rd, Worthing, BN14 8AF	Vehicle Respray PG 6/34(04)	514794 103656	23/11/93	PP4/93/V1 – 31/3/99 PP4/93/V2 – 22/1/01 LAPPC/05/03 - 24/3/05	24/03/05	Low

**Permitted Installations - Petrol Stations (PG 1/14(06))**

Reference	Installation	Grid Ref.	Stage II VR?	Permit from	Variations	Last Review	Risk Rating 2010/11
LAPPC/10/PS01	Tesco Express, 182 Littlehampton Road, Worthing, BN13 1QY	512356 104506	Y	16/3/99	21/02/09	18/01/10	Low
LAPPC/10/PS02	BP Findon Connect, 183 Findon Road, Findon Valley, Worthing, BN14 0EP	512772 106846	Y	16/3/99	09/2009	25/01/10	Low
LAPPC/06/PS03	Texaco, Arundel Road, Arundel Road, Worthing, BN13 3EH	511761 105776	N	16/3/99		06/02/06	Low
LAPPC/10/PS04	Tesco West Durrington Petrol Filling Station, New Road, Worthing, BN13 3PB	511200 104856	Y	16/3/99	21/02/09	18/01/10	Low
LAPPC/06/PS05	Texaco, H.D. Steele & Son (Teville) Ltd 102 Goring Way, Worthing, BN12 4TY	510640 103038	N	16/3/99		06/02/06	Low

LAPPC/06/PS06	Findon Road Service Station, 42 Findon Road, Worthing, BN14 0AD	513223 105839	N	16/3/99		06/02/06	Low
LAPPC/06/PS07	Texaco, Heene Road Service Station, Heene Road, Worthing, BN11 3RG	513906 102295	N	16/3/99		06/02/06	Low
LAPPC/06/PS08	Murco Petroleum Ltd 68 Sompting Avenue, Worthing, BN14 8HP	515003 104365	N	16/3/99		06/02/06	Low
LAPPC/10/PS09	BP Brooklands Connect, 331 Brighton Road, Worthing BN11 2HP	517070 103155	Y	16/3/99	09/2009	25/01/10	Low
LAPPC/06/PS10	Texaco, Sea Place Garage, 67-69 Goring Road, Worthing, BN12 4AX	512271 102685	N	16/3/99		06/02/06	Low
LAPPC/06/PS11	BP/Somerfield Filling Station, The Boulevard, Worthing, BN13 1JY	511994 103599	N	16/3/99			Low
LAPPC/10/PS12	Sainsbury's Petrol Filling Station, Lyons Farm, Lyons Way, Worthing, BN14 9LA	515175 105262	Y	16/3/99	20/11/09	20/01/10	Low

## Permitted Installations - Dry Cleaning (PG 6/46(04))

Reference	Installation	Grid Reference	Permit from	Variations	Last Review	Risk Rating 2010/11
LAPPC/10/DC01	<b>Montague Street Cleaners</b> 185 Montague Street, Worthing, BN11 3DA	514349 102396	07/03/07	LAPPC/06/DC01 – 07/03/07 LAPPC/09/DC01 – 13/03/09 LAPPC/10/DC01 – 27/05/10	27/05/10	Low
LAPPC/10/DC02	<b>Kelvin Dry Cleaners</b> 4 Rectory Road, Worthing, BN14 7PA	513340 103778	12/12/06	LAPPC/06/DC02 – 12/12/06 LAPPC/10/DC02 – 06/04/10	06/04/10	Low
LAPPC/10/DC03	<b>Bonetti's Dry Cleaners</b> 182 Findon Road, Worthing, BN14 0EL	512902 106683	31/03/08	LAPPC/06/DC03 – 31/03/08 LAPPC/10/DC03 – 06/04/10	06/04/10	Low
LAPPC/10/DC04v	<b>Johnson Cleaners UK Ltd</b> 31 Goring Road, Worthing, BN12 4AR	512582 102723	07/03/07	LAPPC/06/DC04 – 07/03/07 LAPPC/10/DC04 – 06/04/10 LAPPC/10/DC04v – 21/09/10	21/09/2010	Low
LAPPC/10/DC05	<b>Quality Kwik Dry Cleaners Ltd.</b> Shop 2, Durrington Shopping Centre, Worthing, BN13 3PB	511114 104812	14/04/10			Low
LAPPC/10/DC06	<b>Richard's Dry Cleaners</b> 139 South Farm Road, Worthing BN14 7AX	514207 104071	06/03/07	LAPPC/06/DC06 – 06/03/07 LAPPC/10/DC06 – 06/04/10	06/04/10	Low

**Appendix D: Diffusion Tube Monitoring data set for 2009 (not bias adjusted)**

Site Ref.	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	An. Mean
(UK4) 1N Chapel Rd	37.6	40.88		31.75	28.08	38.08	20.77	30.83	33.46	38.78	30.81	40.67	33.79
(UK2) 4N Heene Way	23.08	29.43	21.16	16.22	12.36	12.73	6.81	10.38	13.27	19.25	14.89	26.87	17.20
(UK1) 5N Cleveland Road	24.82	28.64	18.45	19.29	12.92	15.27	9.04	12.04	15.63	20.65	16.84	30.9	18.71
(UK6) 6N Gainsborough Avenue	40.59	65.72	43.07	51.46	41.19	47.49	30.56	31.22	45.74	45.97	36.51	47.82	43.95
N1 The Steyne Con't Analyser / Lamppost	56.84	47.7	43.19		33.11	39.21	34.83	35.51	35.57	45.14	38.14	42.71	41.09
N1B High Street East	49.35	46.43	36.04	44.84	33.12	43.33	27.94	26.08	34.3	35.63		42.2	38.11
N1C High Street East	43.47	58.8	39.03	40.47	32.29	42.16	27.69	29.26	36.41	33.53	22.79	38.48	37.03
N1D High Street West	46.69	68.96	39.18	35.58	29.16	38.95	30.43		28.65	36.36	28.19	36.35	38.05
N3 Cricketers Pde	49.59	55.88	46.8	41.27	37.52	40.83	35.14	35.57	29.69	39.64	38.63	45.81	41.36
N4A Jefferson Lodge Arundel Rd	42.79	39.94	40.35	40.95	29.77	39.13	22.53	32.24	28.94	36.47	35.73	36.83	35.47
N5 First Avenue	49.41	49.68	38.16	34.68	35.7	37.55	36.1	31.08	30.98	36.92	34.4	37.53	37.68
N6A Warren Ct Warren Rd	65.17	73.48	51.81	62.09	56.17	64.3	50.74	48.4	53.01	56.76	44.72	57.73	57.03
N8 Littlehampton Rd	41.25	43.29	36.95	35.33	29.89	34.06	25.58	22.67	26.9	32.04	30.72	35.36	33.79
N9 Honeysuckle Lane	18.19	15	12.18	13.64	24.28	9.8	4.78	6.65	9.53	10.78	9.24	18.35	12.70
N10 Experimental Tube	1.08	1.14	1.13	0.41	0.59	1.52	1.25	0.4	0.66	0.49	0.64	0.5	0.82
N11 Dawes Cl	27.98	35.86	21.22	18.6	13.98	15.13	12.27	13.01	15.55	19.45	15.48	27.97	19.71
N15 Chippers Walk	26.84	29.14	20.65	17.05	9.34	13.35	6.38	9.58	15.94	20.43	15.73	31.73	18.01
N16 Mill Rd (Helen Court)	32.3	37.05	30.34	23.65	18.25	19.25	10.49	16.25	21.86	29.91	25.49	36.36	25.10
N17 Chapel Road, B-Dust monitor	40.87	46.5	38.62	40.96	30.36	38.63	25.92	24.87	31.77	40.99	28.37	46.88	36.23
N18A Kinnall Court Upper Brighton Road,	28.94	40.75	29.84	26.21	22.67	26.12	19.42	21.01	27.94	29.41	23.06	33.05	27.37
N19 Hillside Avenue, D-Dust monitor	33.1	28.86	28.36	20.63	16.72	16.88	20.42	18.37	17.55	23.79	23.01	27.65	22.95
N21 Greenwood Cottage, A27	38.26	45.12	41.24	39.13	34.76	43.43	24.97	31.67	35.44	40.23	31.88	38.8	37.08
N22 Falmer Close, C-Dust monitor	19.42	25.99	18.51	16.39	12.31	11.5	5.07	8.75	13.17	17.74	10.93	23.03	15.23
N24 152 Up B'ton Rd House	34.34	39.91	31.14	28.98	23.56	24.42	18.89	22.58	26.39	31.27	25.22	34.11	28.40
N25 Warren Ct House	36.46	35.98	31.6	28.07	21.14	24.69	21.67	20.28	21.27	29.22	24.36	29.44	27.02
N27 Tarring Road, Crossing	38.7	43.61	31.92	40.81	25.41	31.38	13.51	22.14	32.32	34.22	24.55	41.84	31.70
N28 Chapel Road/Teville Road	48.17	47.07		46.42		46.32	38.8		38.95		42.95	52.76	45.18
N29 Downlands Parade	50.24	47.61	39.97	54.8	40.37	49.66	38.03	42.44	35.6	44.23	42.93	42.98	44.07
N30 Grove Lodge Cottages	86.81	85.97	74.82	80.67	73.58	99.11	71.62	72.04	65.99	76.92	65.08	62.81	76.29

April 2010

Worthing Borough Council

N30A Grove Lodge Cottages	93.04	93.67	82.23	84.16	79.69	105.89	79.5	48.45	79.67	58.85	73.5	69.62	79.02
N30B Grove Lodge Cottages	66	78.41	65.14	58.3	53.94	72.42	51.91	53.23	68.39	57.76	55.36	55.4	61.36
N31 South Farm Road, r'bout	40.75	39.21	36.29	34.05	28.36	34.41	17.23	28.67	29.81	38.47	31.93	39.69	33.24
N32 Upr Brighton Rd/Sompting Rd	39.06	57.91	46.36	37.01	32.02	36.17	32.71	30.04	39	40.26	38.47	40.94	39.16
N33 Downlands Parade	52.48	49	40.82	52.64	41.29	47.8	41.2	38.42	36.49	46.96	39.92	37.2	43.69
N34 Downlands Parade	55.32	48.04	40.86	53.73	41.33	53.05	39.31	39.38	38.82	41.34	40.72	45.53	44.79
N35 30 Upper Brighton Road house	Not put up.	Not put up.	35.56	38.04	31.63	37.88	34.05	32.36	32.64	35.29	33.95	27.27	33.87
N35A 30 Upper Brighton Road. Poll Box	48.65	63.63	52.08	48.93	45.91	44.71	39.43	37.98	50.43	46.49	41.99	38.44	46.56
N35B 30 Upper Brighton Road. Poll. Box	54.28	65.11	51.83	47.72	41.33	53.44		36.57	43.52	47.51	42.7	37.53	47.41
N35C 30 Upper Brighton Road. Poll. Box	53.79	58.91	51.47	53.51	45.07	47.27	60.13	37.79	47.04	51.51	44.89	44.1	49.62
N36 Corner of Hillbarn Lane	48.34	54.67	46.48	45.71	43.01	46.94	44.59	39.15	33.06	40.71	42.8	38.01	43.62
N37 Lamorna Grove Lamppost	39.26	41.2	32.35	33.02	23.72	28.23	25.44	22.7	26.2	33.22	27.23	35.85	30.70
N38 Bus stop lamppost at Grove Lodge	53.03	55.9	41.37	40.41	30.59	43.04	33.21	34.92	35.09	41.66	34.03	40.08	40.28
N39 SW of Roundabout at Grove lodge	37.36		39.32	37.86	32.58	43.52	28.4	29.27	40.77	47.06	28.08	49.62	37.62
N40 NE of roundabout at Grove Lodge	54.15	52.69	49.18	58	50.79	57.27	42.18	41.38	46.81	50.83	37.97	44.6	48.82
N41 Down pipe on Lamorna Grove Flats	37.23	41.73	29.88	25.28	26.25	28.66	26.61	26.05	28.27	28.09	29.61	32.53	30.02

## **Appendix E:** This section covers the calculation for commercial and domestic sources of biomass, set out in Box 5.8: Updating and Screening Checklist.

### **Approach**

#### **Step 1:**

Identify plant burning biomass in 50kW to 20MW units.

#### **Step 2:**

Obtain information to assess emissions to air

#### **Step 3:**

Calculate background adjusted emission rates

#### **Step 4:**

Use nomograms or Biomass spreadsheet tool to determine whether the source requires further assessment

## **Commercial Biomass Combustion Installation Calculations**

### A. Biomass Boiler at Furnitureworks, Easting Close, Worthing

Grid Ref: 515835, 104338.

Make & Model: Talbot TMA, 0.389MW thermal input

Stack Diameter 0.3m

Burning wood

An exempted appliance under the Clean Air Act 1993

Stack Height =10m

Tallest building within 5x stack height = 8m

April 2010

Worthing Borough Council

B. Biomass Boiler at Wenban Smith, Dominion Way, Worthing

Grid Ref: 515886, 104103

Make & Model: CAS 600 0.175MW

Stack Diameter 0.4m

Burning untreated waste wood/offcuts

An exempted appliance under the Clean Air Act 1993

Stack Height = 12m

Tallest building within 5x stack height = 9

C. Biomass Boiler at Wenban Smith, Newlands Road, Worthing

Grid Ref: 514805, 103236

Make & Model: Talbot T500, 0.150MW

Stack Diameter 0.3m

Burning untreated waste wood/offcuts

An exempted appliance under the Clean Air Act 1993

Stack Height = 6m

Tallest building within 5x stack height = 19m

Step 1. Calculate Max Emission Rates

Site	E MEP/CORINAIR Category *	PM10 g/GJ net	NOx g/GJ net	Max Emission Rate PM10 g/s	Max Emission Rate NOx g/s
A	Advanced Automatic Boiler, with Wood as fuel.	66	150	$66 \times 389 \times 10^{-6} = 0.026$	$150 \times 389 \times 10^{-6} = 0.058$
B	Manual Feed Advanced Boiler, with Wood as fuel.	76	150	$76 \times 175 \times 10^{-6} = 0.0133$	$150 \times 175 \times 10^{-6} = 0.02625$
C	Manual Feed Advanced Boiler, with Wood as fuel.	76	150	$76 \times 150 \times 10^{-6} = 0.0114$	$150 \times 150 \times 10^{-6} = 0.0225$

\* Calculation of emission rates from EMEP/EEA Emissions Inventory Guidebook 2009 and Technical Guidance: Screening assessment for biomass boilers.

Step 2. Calculate background adjusted emission rate

	<b>Furnitureworks</b>	<b>Wenban Smith, Dominion Way</b>	<b>Wenban Smith, Newlands Road</b>
<b>Background-adjusted emission rates:</b>			
<b>PM10</b>	$\frac{E}{(32-G)}$	$\frac{E}{(32-G)}$	$\frac{E}{(32-G)}$
	G = 17	G = 17	G = 16
	= 0.026 / (32- 17)	=0.013/(32-17)	= 0.0114/(32-16)
	<b>= 0.002</b>	<b>=0.001</b>	<b>= 0.001</b>
<b>NO2</b>	$\frac{E}{(40-G)}$	$\frac{E}{(40-G)}$	$\frac{E}{(40-G)}$
	G = 20	G = 20	G = 17
	= 0.058/(40- 20)	=0.0263/(40-20)	=0.0225/(40-17)
	<b>= 0.003</b>	<b>=0.001</b>	<b>=0.001</b>
<b>NO2, 1-hour mean</b>	$\frac{40E}{(200-2G)}$	$\frac{40E}{(200-2G)}$	$\frac{40E}{(200-2G)}$
	=2.32 / (200- 60)	=1.052/(200-40)	= 0.9/(200-34)
	<b>= 0.015</b>	<b>=0.007</b>	<b>= 0.005</b>

E = emission rate g/s

G = annual average background concentration µg/m<sup>3</sup>

**Step 3:**

	<b>Furnitureworks</b>	<b>Wenban Smith, Dominion Way</b>	<b>Wenban Smith, Newlands Road</b>
<b>Effective stack height</b>	=1.66(10-8) = 3.32m	=1.66(12-8)=8m	=1.66(6-19)=0

**Step 4:**

	<b>Furnitureworks</b>		<b>Wenban Smith, Dominion Way</b>		<b>Wenban Smith, Newlands Road</b>	
	<b>Target Emission Rate (1)</b>	<b>Background-adjusted emission rates</b>	<b>Target Emission Rate (1)</b>	<b>Background-adjusted emission rates</b>	<b>Target Emission Rate (2)</b>	<b>Background-adjusted emission rates</b>
<b>PM10</b>	= 0.021 g/s	= <b>0.002</b>	= 0.034	= <b>0.001</b>	= 0.025	= <b>0.001</b>
<b>NO2</b>	= 0.082 g/s	= <b>0.003</b>	= 0.136	= <b>0.001</b>	= 0.060	= <b>0.001</b>
<b>NO2, 1-hour mean</b>	= 0.057 g/s	= <b>0.015</b>	= 0.104	= <b>0.007</b>	= 0.015	= <b>0.005</b>

(1) derived from Review and Assessment tool for biomass combustion stacks, available from

(2) in this case the stack height has been assumed to be zero and the procedure in paragraph 5.37 of TG(09) has therefore been followed.

**Conclusions**

	<b>Furnitureworks</b>	<b>Wenban Smith, Dominion Way</b>	<b>Wenban Smith, Newlands Road</b>
<b>PM10</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>
<b>NO2</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>
<b>NO2, 1-hour mean</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>	Background adjusted emission rate is lower than target emission rate = <b>No further action required</b>

## Appendix F: Combined biomass assessment

The assessment for combined biomass was completed following the guidance in TG(09).

- 1 Identify 500m x 500m area in district, which are likely to be burning biomass fuels, domestically and commercially.  
= East Worthing, adjacent to Industrial Estates in Dominion Way.
- 2 The area is urban with a commercial sector (approximately 50%).  
2x biomass installations Wenban Smith and Furnitureworks and domestic heating appliances (fireplaces), estimated at 10.
- 3 Estimate PM10 emissions for residential  
Residential area = 10 x 27.43 = 274 kg
- 4 Estimate the fraction of area within 500m x 500m square occupied by service sector solid fuel burning and estimate emissions density.
  - Area occupied by solid fuel burning = 10% (max)
  - Commercial emissions = 2 x 1074 = 2148 kg
  - Emissions density: = 2148 x 0.1 = 215 kg/year
5. Sum of service sector and residential emissions.

Residential emissions estimate = 274 kg  
 Service Sector emissions estimate = 215kg/year  
 Total = 489kg/year

- 6: Assess emissions density against background concentration to determine if contribution exceeds threshold emission density:
  - Background concentration for PM10 = 17 µg/m<sup>3</sup>
  - Threshold emissions rate for 17 µg/m<sup>3</sup> = 7000kg/year

The emission density from the combined biomass installation is 489kg/year, this is significantly below the threshold of 7000 kg/year.  
**Therefore there is no requirement to undertake a further detailed assessment.**