Local Air Quality Management

Progress Report:

Air Quality in Bristol: 2008

Project	Local Air Quality Management
Document Title	Progress Report: Air Quality in Bristol

1.0	Draft – submission to DEFRA and statutory consultees	D Muir	DM	SEC	30/04/2008
Revision	**Purpose Description**	**Originated**	**Checked**	**Reviewed**	**Date**

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1 Executive Summary

This report finds that air quality in Bristol is continuing to improve in many respects, but there are still problems with certain pollutants. Nitrogen dioxide, principally from road traffic, is likely to be present at higher concentrations than the objectives set by the UK government. It was for this reason that Bristol declared an Air Quality Management Area (AQMA) in 2001. The boundaries of the AQMA were revised in 2003 and again in 2008 as shown in Figure 1 following the publication of the detailed assessment in 2007. The 2008 revisions, which are due to come into effect from 1 May 2008 unless challenged, remove the Avonmouth AQMA and extend the City Centre AQMA to the City boundary on the A432 Fishponds Road. The objective for nitrogen dioxide will generally only be breached at locations within a few metres of busy road and junctions but, disturbingly, concentrations of nitrogen dioxide especially, but not exclusively, at roadside sites appear to be rising slightly rather than falling. Bristol should comply with the objectives for all other pollutants.

The monitoring network will continue to be improved and efforts will focus monitoring at the most vulnerable and polluted locations to protect public health.

The basic principles of the Air Quality Action Plan (AQAP) were incorporated into the Joint Local Transport Plan (JLTP). Air Quality is one of the four key 'shared priority' areas for transport. This should result in a higher profile and greater degree of integration of air quality initiatives with other JLTP policy areas. The JLTP was produced jointly with the three surrounding authorities (Bath & North East Somerset, South Gloucestershire and North Somerset).

It is not yet clear what level of resources will be available or how these will be prioritised between the four authorities and between the four key LTP areas, so it is difficult at this stage to predict what impact LTP2 will have on the delivery of the AQAP. Although the inclusion of the additional AQAP measures in LTP will ensure a better level of integration it is unlikely that this on its own will result in sufficient levels of funding to fully implement the package of AQAP measures.

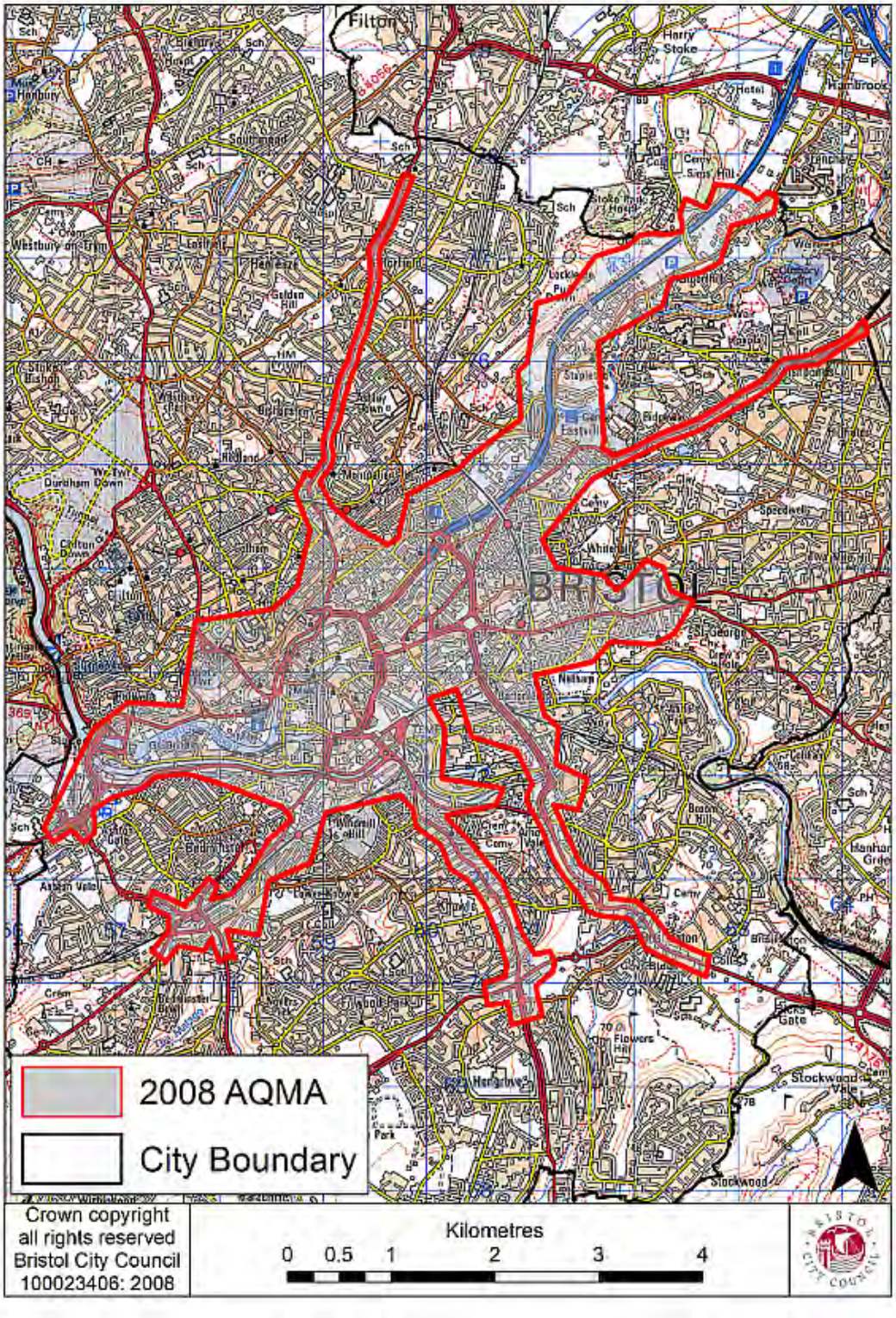

Figure 1 Bristol's Air Quality Management Area (AQMA), 2008 (provisional)

2 Introduction

The aim of this document is to report progress on implementing Local Air Quality Management (LAQM) in Bristol. This entails reporting the progress towards achieving and maintaining ambient concentrations of relevant pollutants below the objectives prescribed by government. To this end, new monitoring data are presented and new and proposed local developments with the potential to affect air quality are described and assessed.

Progress in implementing the measures laid out in the Air Quality Action Plan for Bristol, published in April 2004, and incorporated into the JLTP in 2007, is also reported here. Recent guidance requires integration of air quality action plans into regional Local Transport Plans and Bristol's progress towards this will be detailed here. Section 7 provides an update on implementation of Action Planning measures.

Reference is made to previous review and assessment reports which are available on the city council's website at www.bristol.gov.uk/airquality

3 Air Quality Objectives

Pollutant	Objective	Measured as	To be achieved by
Benzene	16.25 µg m^{-3}	Running Annual Average	31 December 2003
	5 µg m^{-3}	Annual Average	31 December 2010
1,3-Butadiene	2.25 µg m^{-3}	Running Annual Average	31 December 2003
Carbon monoxide (CO)	10.0 mg m^{-3}	Maximum daily running 8 Hour Average	31 December 2003
Lead	0.5 µg m^{-3}	Annual Average	31 December 2004
	0.25 µg m^{-3}	Annual Average	31 December 2008
Nitrogen dioxide (NO_2)	200 µg m^{-3} Not to be exceeded more than 18 times per year	1 Hour Average	31 December 2005
	40 µg m^{-3}	Annual Average	31 December 2005
Particles (PM_{10}) (gravimetric)	50 µg m^{-3} Not to be exceeded more than 35 times per year	24 Hour Average	31 December 2004
	40 µg m^{-3}	Annual Average	31 December 2004
	18 µg m^{-3}	Annual Average	31 December 2010
Sulphur dioxide (SO_2)	266 µg m^{-3} Not to be exceeded more than 35 times per year	15 Minute Average	31 December 2005
	350 µg m^{-3} Not to be exceeded more than 24 times per year	1 Hour Average	31 December 2004
	125 µg m^{-3} Not to be exceeded more than 3 times per year	24 Hour Average	31 December 2004

Table 1 UK National Air Quality Strategy (NAQS) objectives

Notes:

The objectives for nitrogen dioxide are provisional.
µg m^{-3} - micrograms per cubic metre
mg m^{-3} - milligrams per cubic metre

4 New Monitoring Data

The previous review and assessment report (Detailed Assessment 2007) reported data for the calendar year 2006. This report covers the calendar year 2007 unless otherwise stated.

4.1 Benzene

Objective	16.25 µg m^{-3} as a running annual mean, to be achieved by the end of 2003, and 5.0 µg m^{-3} annual mean to be achieved by the end of 2010.
Comment	An additional objective has been set to be achieved by the end of 2010.
National Perspective	The main sources of benzene in the UK are petrol engined vehicles, petrol refining and distribution. A number of policy measures already in place or planned for the future will continue to reduce emissions. National mapping suggests these policy measures will achieve the 2003 objective at most background and roadside location's but there may be a few exceedances of the 2010 objective.
Local Perspective	At a local level no local authorities have declared any AQMAs for the 2003 benzene objective. Local authorities will need to assess whether any exceedances of the new 2010 objective are likely.

Table 2 Summary table for benzene objective

The monitoring network for benzene in Bristol has been reduced considerably since the last report. This is because all the monitoring has shown that there are now no areas where there may be a real risk of exceeding the objectives for benzene. The residual network comprises eight BTX (Benzene, Toluene and Xylene) diffusion tubes, co – located with NO_2 diffusion tubes. Triplicate passive tubes are collocated with the national network pumped tube site at Bristol Old Market. This site is operated primarily for QA/QC purposes. The other tubes are located at sites where previous reports have identified the possibility of exceedences of the objective for benzene. This is a precautionary measure in case concentrations of benzene do increase again in future years. The data for 2007 are summarised in Table 3.

Site	**Benzene (µg m^{-3})**
Newfoundland Way	2.5
Stokes Croft	2.2
16 Ashley Road	3.9
Parson Street	2.4
Whitehall Rd/Easton Rd	4.3
Old Market	1.2
Exclusively Yours, Ashley Road	3.9
Teohs, Ashley Road	3.6

Table 3 Annual average benzene concentrations 2007

In previous reports it was suggested that an AQMA might be have had to be declared for benzene in the Ashley Road area on the basis of the 2010 objective. The more recent monitoring data have shown that concentrations of benzene in this area have fallen to such an extent that such a declaration is not now justified.

Figure 2 shows the locations of BTX diffusion tubes and annual mean concentrations of benzene in the city for 2007. Concentrations reported are bias adjusted with the 2007 bias adjustment factor for benzene of 0.846. It can be seen that all the tubes record concentrations well below the 2010 objective of 5μg m^{-3}.

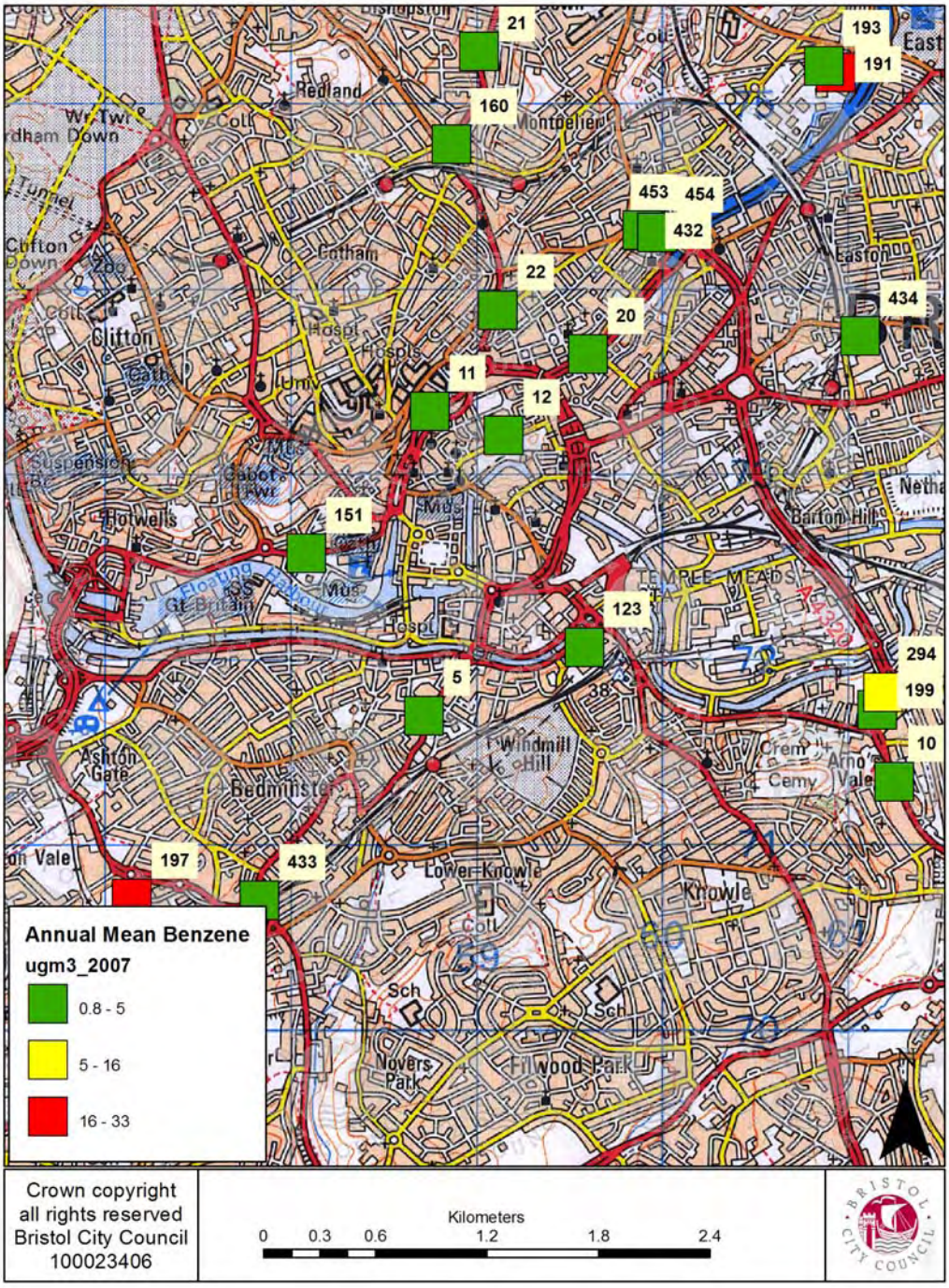

Figure 2 Locations and annual mean concentrations of benzene at all BTX diffusion tube sites: 2007.

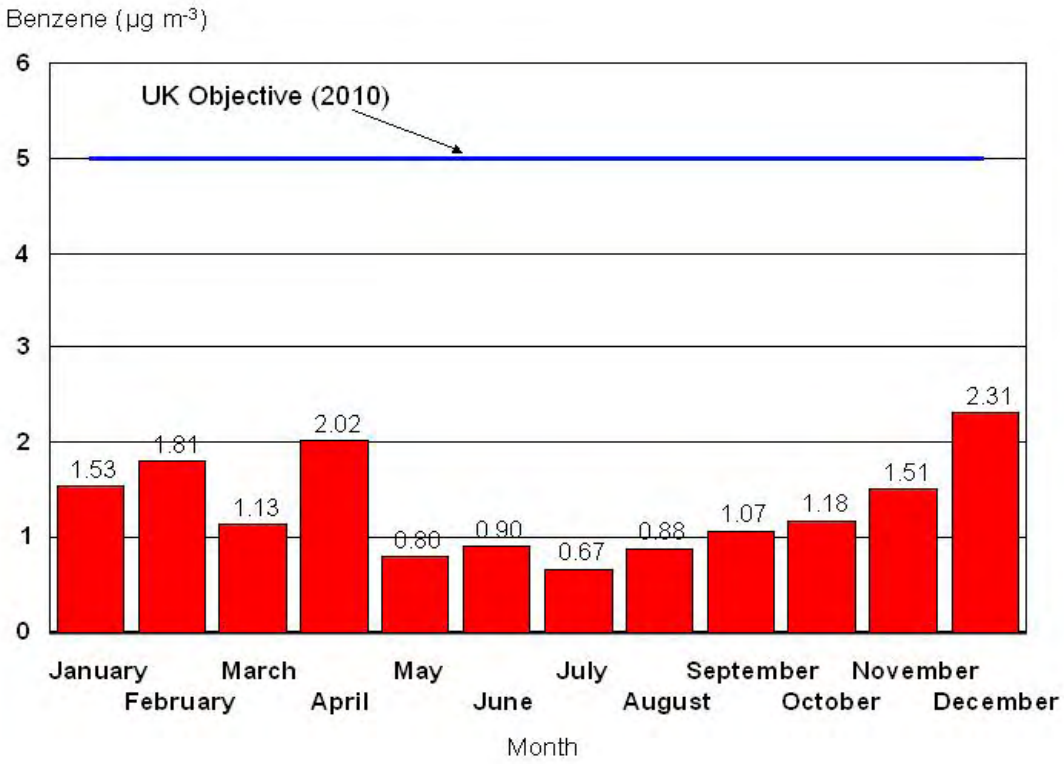

Figure 3 Monthly mean pumped tube benzene at Bristol Old Market, 2007

4.2 1,3 Butadiene

Objective	2.25 μg m^{-3} as a maximum running annual mean to be achieved by the end of 2003.
National Perspective	The main source of 1,3 – Butadiene in the UK is emissions from motor vehicle exhausts. It is also an industrial chemical and is handled in bulk at a small number of industrial premises. 1,3 – Butadiene is measured at a limited number of UK national network sites. Measured concentrations at these sites are already well below the 2003 objective. Increased use of 3-way catalysts on vehicles and improvements in fuel quality will continue to reduce emissions in the future.
Local Perspective	At a local level, no local authorities have declared an AQMA for 1,3 – butadiene. Only locations in the vicinity of major industrial processes which handle, store or emit 1,3 – butadiene are expected to need to do detailed assessments for this pollutant.

Table 4 Summary table for 1,3 butadiene objective

1,3 butadiene was monitored continuously at one location in Bristol, the AURN hydrocarbons network site at Hannah More School in east Bristol. This site was closed at the end of 2000. The data from the last year of monitoring indicated that concentrations at this background location were well below the statutory objective of 2.25 μg m^{-3} at 0.289 μg m^{-3} (measured as a maximum running annual average).

1,3 butadiene was also measured at the AURN affiliate Old Market site using diffusion tubes as part of the national 1,3 butadiene survey. This survey was terminated in September 2007. The results for 2007 are shown below in Figure 4 and indicate that, even at this very heavily trafficked site, concentrations are well below the objective. The average concentration for this site between January and September 2007 was 0.14 μg m^{-3}.

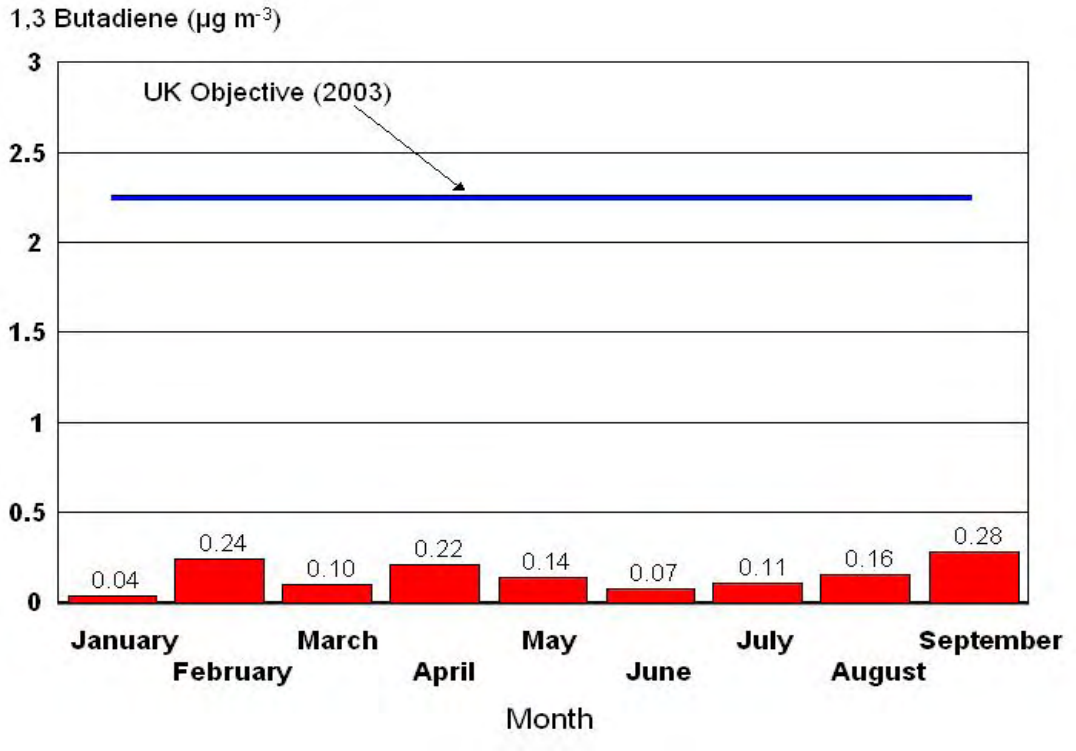

Figure 4 Monthly mean 1,3 butadiene at Bristol Old Market, January – September 2007

4.3 Carbon Monoxide

Objective	10.0 mg m^{-3} as a maximum daily running 8-hour mean to be achieved by end 2003.
Comment	Slightly tighter target, has now been set to bring it in to line with the second European Air Quality Daughter Directive limit value.
National Perspective	The main source of carbon monoxide is road transport. Annual emissions have been falling steadily since the 1970's and are expected to continue to do so. Current projections indicate emissions will decline further between 2000 and 2005. Modelling of concentrations adjacent to major roads at a national level suggest that existing policies will be sufficient to achieve the new objective.
Local Perspective	At a local level, no authorities have declared any AQMAs for carbon monoxide following the first Review and Assessment. Bristol City Council has refocused monitoring away from carbon monoxide.

Table 5 Summary table for carbon monoxide objective

Carbon monoxide (CO) is now only measured at two sites in Bristol. These are both part of the AURN, Bristol Old Market and Bristol St Pauls. The Old Market site represents exposure at the roadside whilst the Bristol St Pauls site is further away from major carriageways and represents urban background. Both sites report concentrations very much lower than the NAQS objectives.

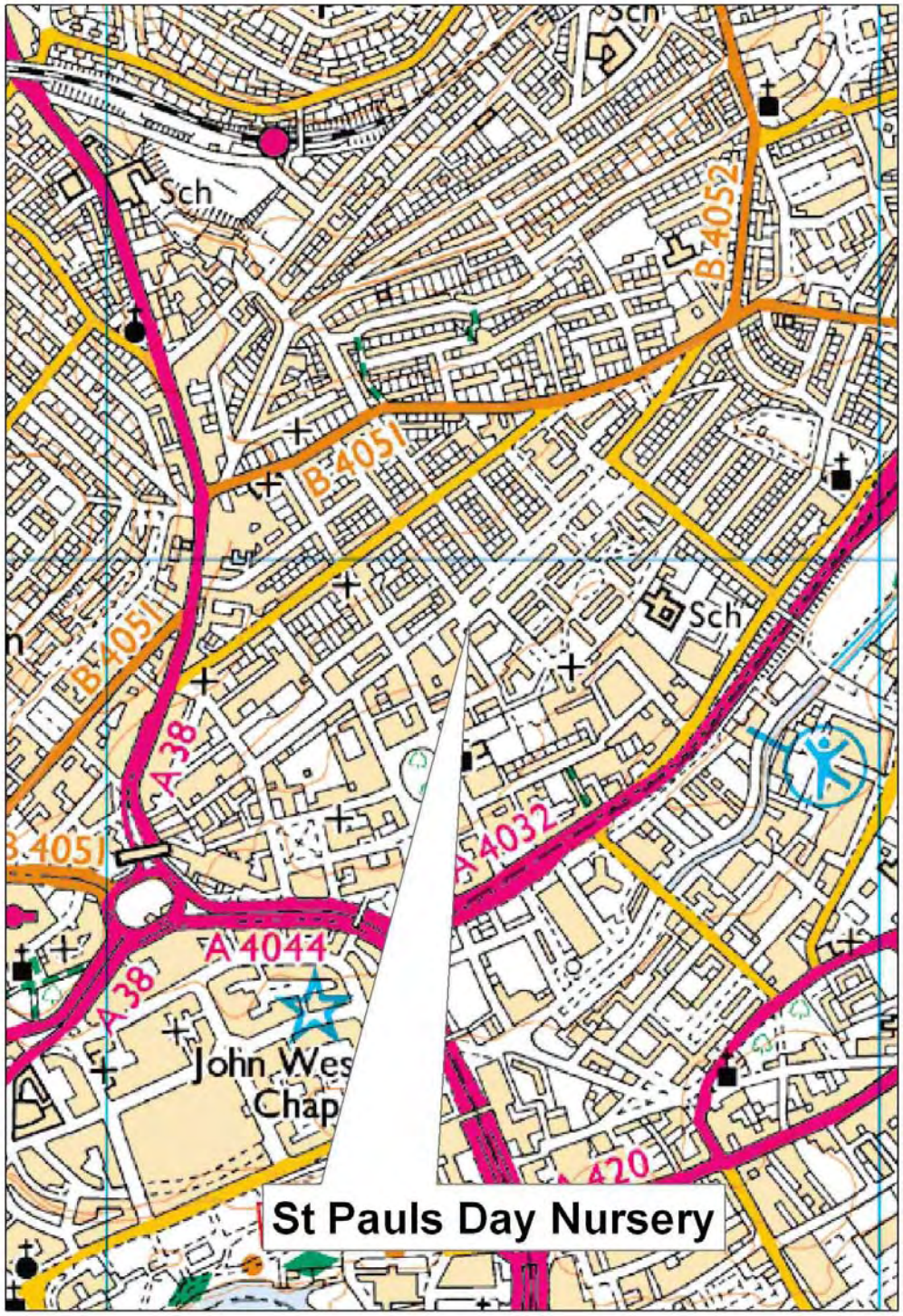

Figure 5 Location of Bristol St Pauls AURN site

Figure 6 Photograph of location of Bristol St Pauls AURN site

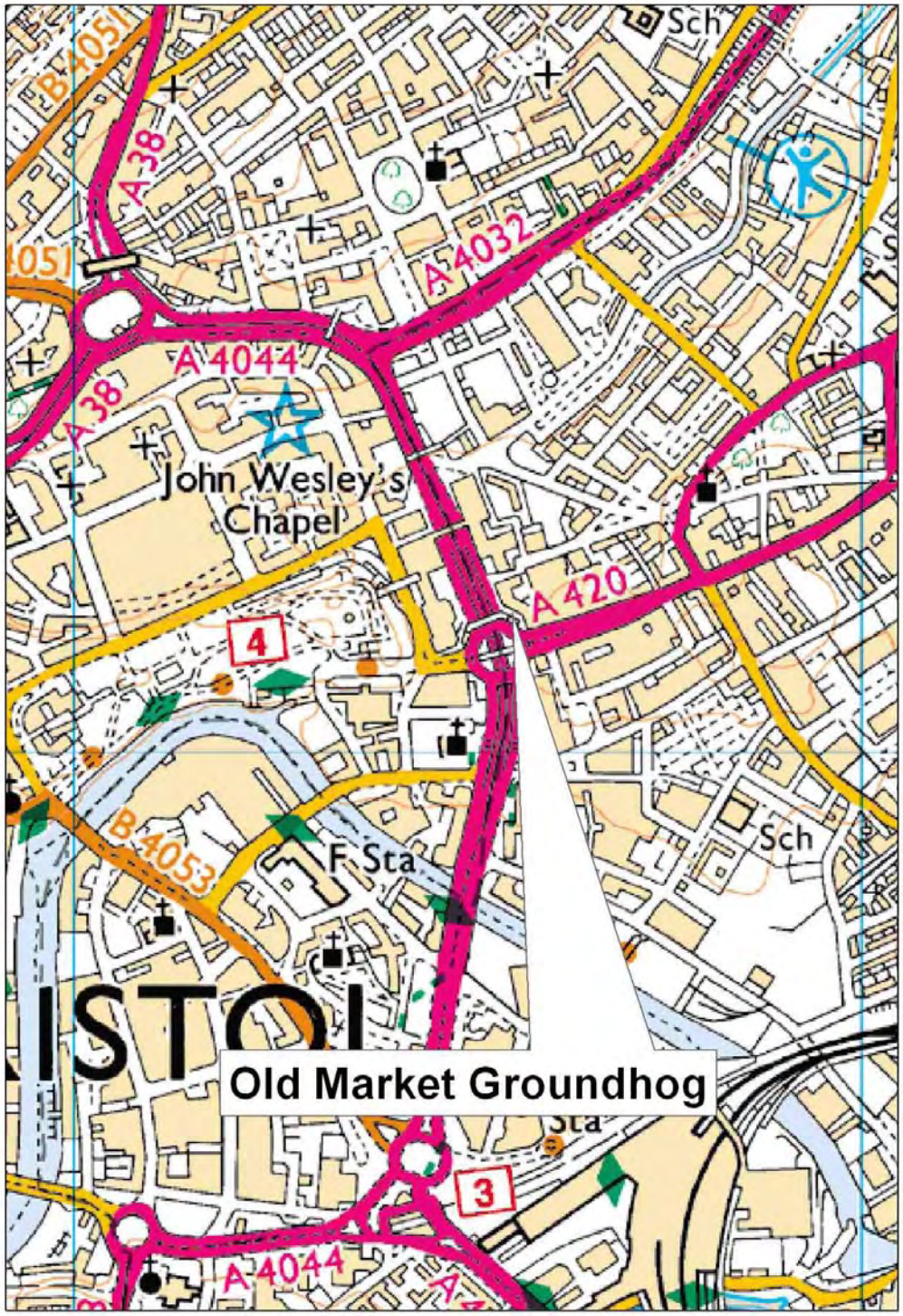

Figure 7 Location of Bristol Old Market AURN affiliate site

Figure 8 Photograph of location of Bristol Old Market AURN affiliate site

Data capture was good at both sites during 2007 being 96.7% at Bristol St Pauls and 98.2% at Bristol Old Market. Figure 9 and Figure 10 illustrate the running 8 hour average concentrations of CO at Old Market and St Pauls respectively. All data are fully ratified.

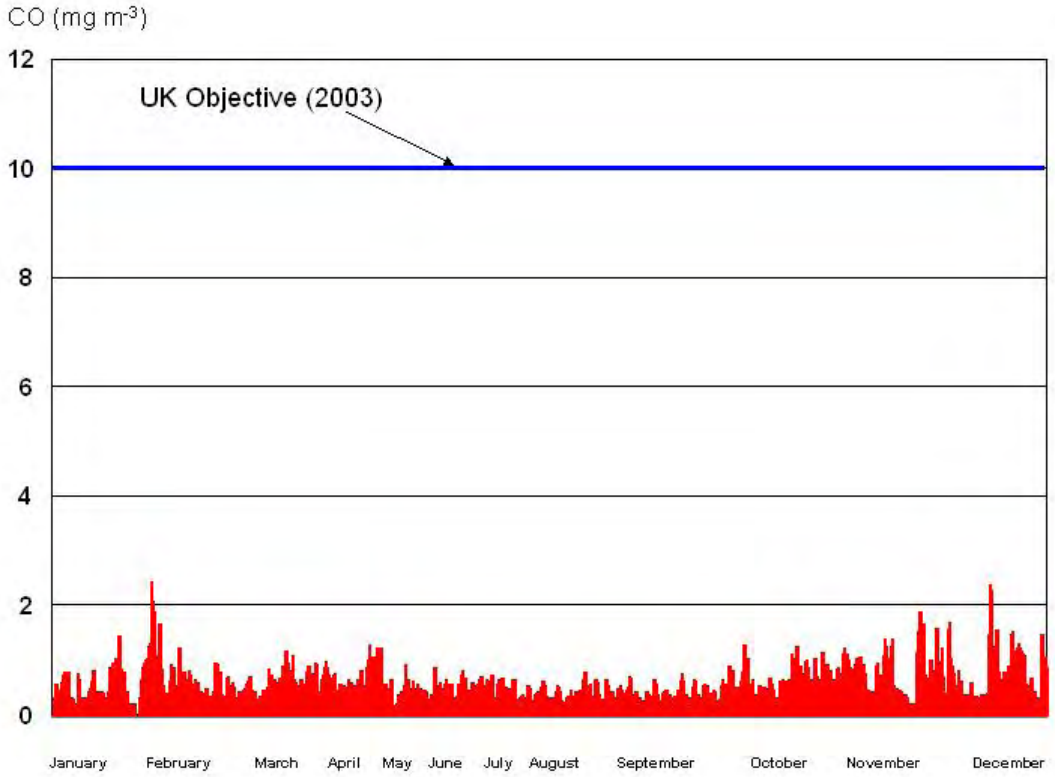

Figure 9 Running 8 hour mean carbon monoxide concentrations at Bristol Old Market AURN affiliate site: 2007

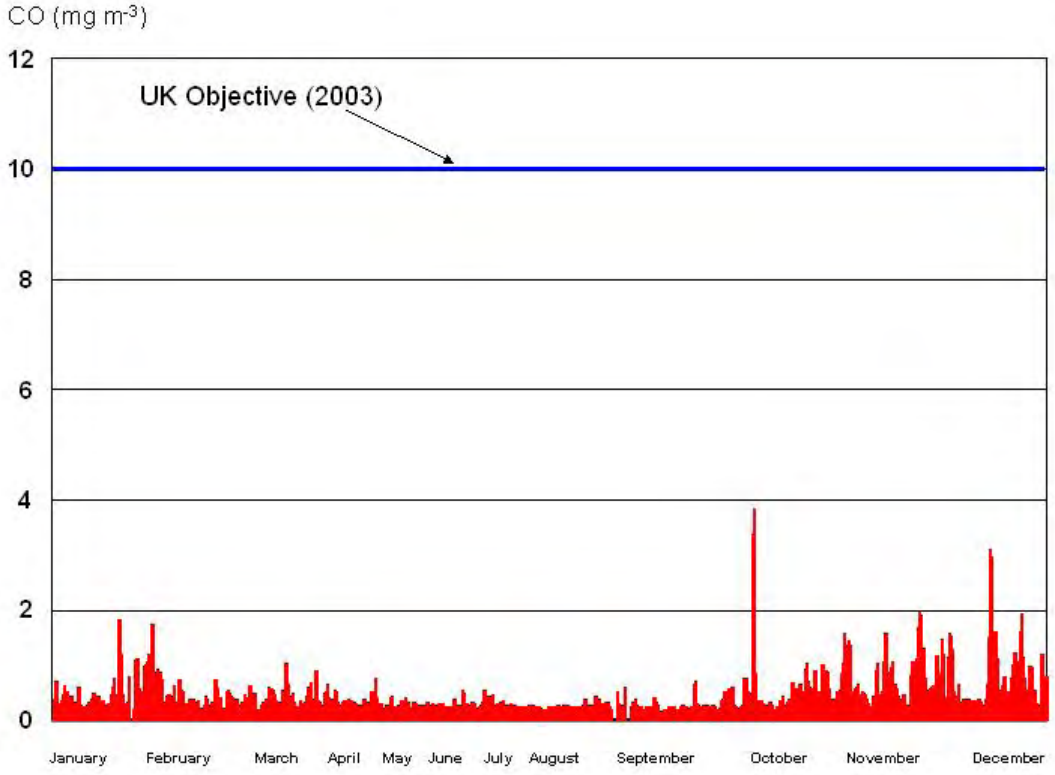

Figure 10 Running 8 hour mean carbon monoxide concentrations at Bristol St Pauls AURN: 2007

Site	Annual Average	Maximum hourly average	Maximum 8 hour running average	Data Capture
Bristol Old Market	0.4 mg m^{-3}	4.2 mg m^{-3}	2.4 mg m^{-3}	98.2%
Bristol St Pauls	0.3 mg m^{-3}	6.3 mg m^{-3}	3.8 mg m^{-3}	96.7%

Table 6 Summary of monitored carbon monoxide data: 2007

Even at the most polluted roadside locations the 8 hour running mean concentration of carbon monoxide is currently below the NAQS objectives and is likely to remain so.

4.4 Lead

Objective	0.5 µg m^{-3} annual mean to be achieved by the end of 2004, and 0.25 µg m^{-3} annual mean to be achieved by the end 2008.
Comment	An additional objective has been made for 2008.
National Perspective	The sale of leaded petrol was banned in the UK with effect from 1st January 2000. Emissions of lead are now restricted to certain industrial activities.
Local Perspective	No local authorities have declared AQMAs for lead as a result of the first review and assessment. The only major source of lead emissions was closed in 2003

Table 7 summary table for lead objectives

Britannia Zinc Ltd. (BZL) in Avonmouth and Sheldon Bush in the city centre were the only significant industrial lead sources in the Bristol area. Both have now closed, so ambient concentrations near the sites will fall rapidly as fugitive emissions diminish and stack emissions cease.

Lead, and other heavy metals, have been monitored in the Avonmouth district for many years, due to the presence of the BZL smelting plant. Both BZL and BCC operated volume samplers in the area independent of one another and information is frequently exchanged between the two organisations.

BCC operated a heavy metal volume sampler at St. Matthias College in Fishponds for many years. This was initially to establish a background concentration of ambient lead from vehicular sources and then purely as a background heavy metals monitor. This site has now been discontinued as has the site located at Avonmouth Primary School.

In 2002 Defra initiated two additional sites measuring heavy metals in the Avonmouth area, again principally to monitor emissions from BZL. National Physical Laboratory (NPL) manage this monitoring under the UK lead and heavy metals monitoring programme. The instruments used in this survey are Partisol 2000 samplers fitted with PM_{10} heads.

The map below indicates the locations of the lead and heavy metals monitoring sites in Avonmouth.

Figure 11 Heavy metals monitoring sites: Avonmouth

4.4.1 Bristol City Council Lead Monitoring Data

The Wessex Water monitoring site is within 200 metres of the site boundary of BZL and was set up to represent “worst case” concentrations of lead. Table 8 shows that concentrations have fallen since the closure of the nearby smelting works in 2003.

Year	Annual average concentration of lead (µg m^{-3})
2000	1.2
2001	1.5
2002	1.2
2003	0.4
2004	0.5
2005	0.3
2006	0.4
2007	0.4

Table 8 Lead concentrations at Wessex Water monitoring site

The pre-2003 values were significant exceedences of both the 2004 and 2008 NAQS objectives although the location does not represent exposure for the relevant period. The more recent concentrations are within the 2004 objective but are higher than the 2008 objective. The monitoring method used, however, is the old M-type sampler rather than one sampling in the PM_{10} fraction and so there are questions as to whether these data can be reliably compared to the objectives. In addition to this the Wessex Water site does not represent truly relevant exposure of the population, as it is some distance from any residential properties. Data reported are unratified.

4.4.2 DEFRA Lead and Heavy Metals UK Monitoring Programme

Lead monitoring restarted at the Avonmouth Docks site in September 2004 but data for the BZL Hallen Village site are available from 2002. Concentrations at both sites for 2007 are given in Table 9 and are well below the objectives for lead for 2004 and 2008 and represent exposure for the objective. These data are fully ratified.

Site	Lead concentration 2007 annual mean (µg m^{-3})
BZL Hallen	0.0103
Avonmouth Docks	0.0177

Table 9 Lead concentrations for 2007 at Defra HM sites

The 4th Air Quality Daughter Directive Fourth Air Quality Daughter Directive 2004/107/EC, transposed into UK law by the Air Quality Standards Regulations 2007, sets target values for three other heavy metals although these are not applicable for the purposes of LAQM. For the purposes of completeness the target values and concentrations recorded during 2007 at the two sites are given in Table 10. Although, as stated above, these metals are not subject to the LAQM process, there are some grounds for examining the data as there is a large fragmentiser in the Avonmouth Docks complex which has the potential to inluence concentrations of metals in the area. In addition the smelter, when operating,was a significant source of cadmium and there is the potential for re-entrainment from spoil tips. As can be seen the concentrations of all three metals are well below

the target values. The concentrations of arsenic and cadmium are similar at both sites but the nickel concentration at Avonmouth Docks is markedly higher, possibly reflecting the influence of the fragmentiser.

Metal	Target value	BZL Hallen	Avonmouth Docks
Arsenic	6 ng m^{-3}	0.92 ng m^{-3}	0.96 ng m^{-3}
Cadmium	5 ng m^{-3}	0.33 ng m^{-3}	0.34 ng m^{-3}
Nickel	20 ng m^{-3}	1.75 ng m^{-3}	3.91 ng m^{-3}

Table 10 Arsenic, cadmium and nickel concentrations for 2007 at Defra HM sites.

4.5 Nitrogen dioxide

Objective	40 µg m^{-3} (21 ppb) measured as an annual mean by the end of 2005. And 200 µg m^{-3} (105 ppb) measured as a 1-hour mean not to be exceeded more than 18 times per year by the end of 2005.
Provisional non-Statutory Objectives for 2010	The Government have brought in provisional objectives to be achieved by the end of 2010, however these will not be incorporated into UK regulations until after the review of the first EU Air Quality Daughter Directive, due for completion in 2004. 40 µg m^{-3} measured as an annual mean by the end of 2010. And 200 µg m^{-3} measured as a 1-hour mean not to be exceeded more than 18 times per year by the end of 2010.
National Perspective	The main sources of nitrogen oxide emissions (nitrogen dioxide, nitric oxide) are road transport. Motorways and primary roads are predominant sources, along with areas of congested traffic.
Local Perspective	Most of the AQMAs declared by local authorities have been in relation to the annual mean objective for nitrogen dioxide.
Areas to Screen	Outside major conurbations exceedences of the annual mean are only likely to occur within about 10 metres of the kerb of single carriageway roads. Within congested town centres this may occur with relatively low flows of 10,000 to 20,000 vehicles per day. Outside major conurbations, even on high flow roads, exceedences of the annual mean are only likely within about 5 metres of the kerb/hard shoulder of dual carriageways and motorways.

Table 11 Summary table for nitrogen dioxide objectives

Continuous Instruments

4.5.1.1 AURN and Affiliated Sites

Oxides of nitrogen (NO_X) are measured at both AURN sites in Bristol. These sites are at St Pauls Day Nursery and at Old Market roundabout. The details for Bristol Old Market remain the same as in previous review and assessment reports but Bristol St Pauls has replaced the Bristol Centre site. The latter was closed in September 2005 as a consequence of the Broadmead redevelopment and the new site opened in June 2006. During 2008 the escalator housing alongside the Bristol Old market site is due to be demolished. It is not clear what, if any, effect this will have on the data from this site.

4.5.1.2 Bristol City Council Sites

Bristol City Council has eight sites measuring NO_X in addition to the AURN sites, six of these are in the central area of Bristol and one in Avonmouth. All sites use European reference chemiluminescent analysers and are operated under the QA/QC regime for continuous analysers. All the sites currently operating are shown in Figure 12 and Figure 13. Most of these sites are described in previous review and assessment reports but there are two new additions to the network that were commissioned during 2004

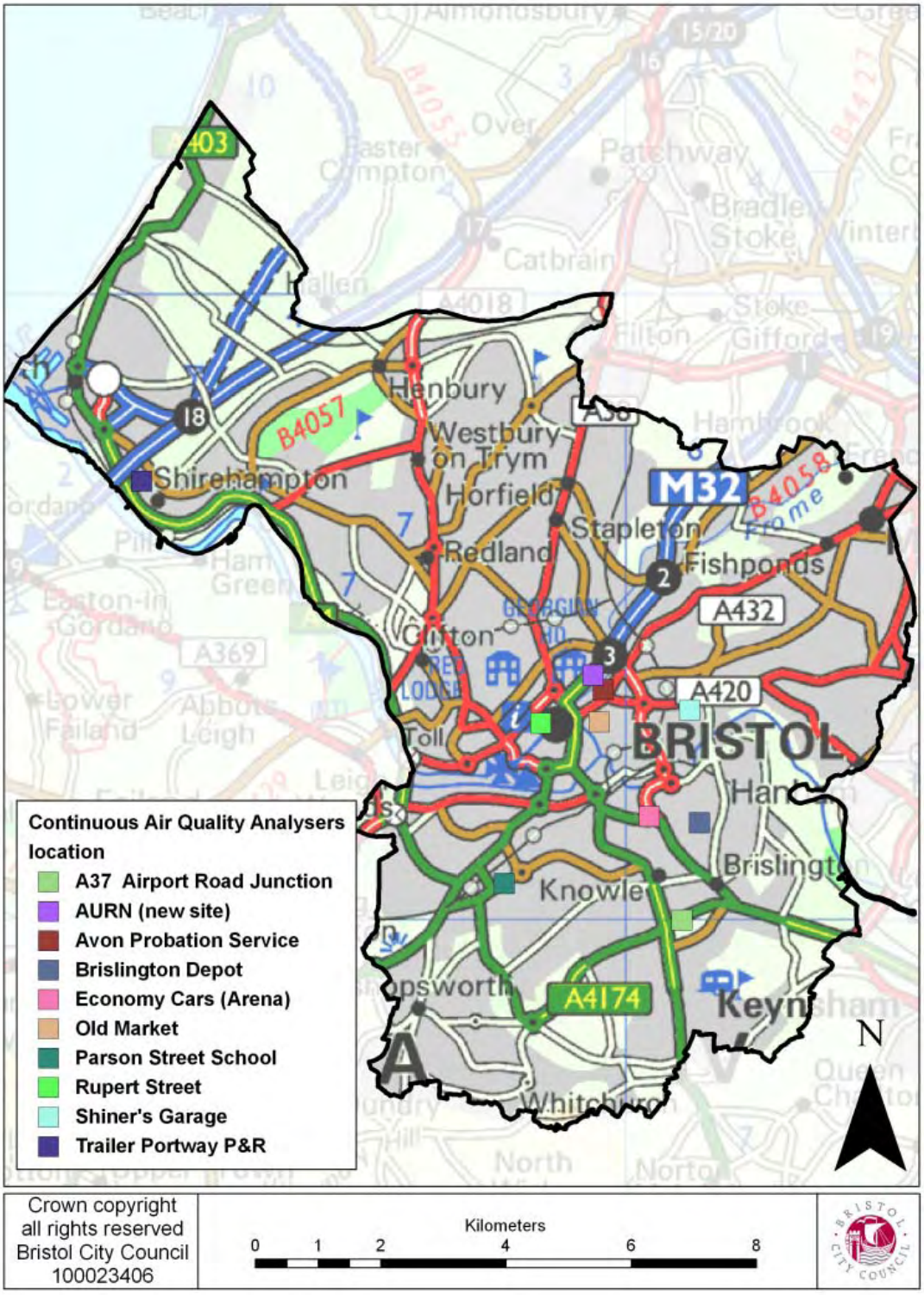

Figure 12 Locations of continuous analysers: city centre: see Table 12 for site locations.

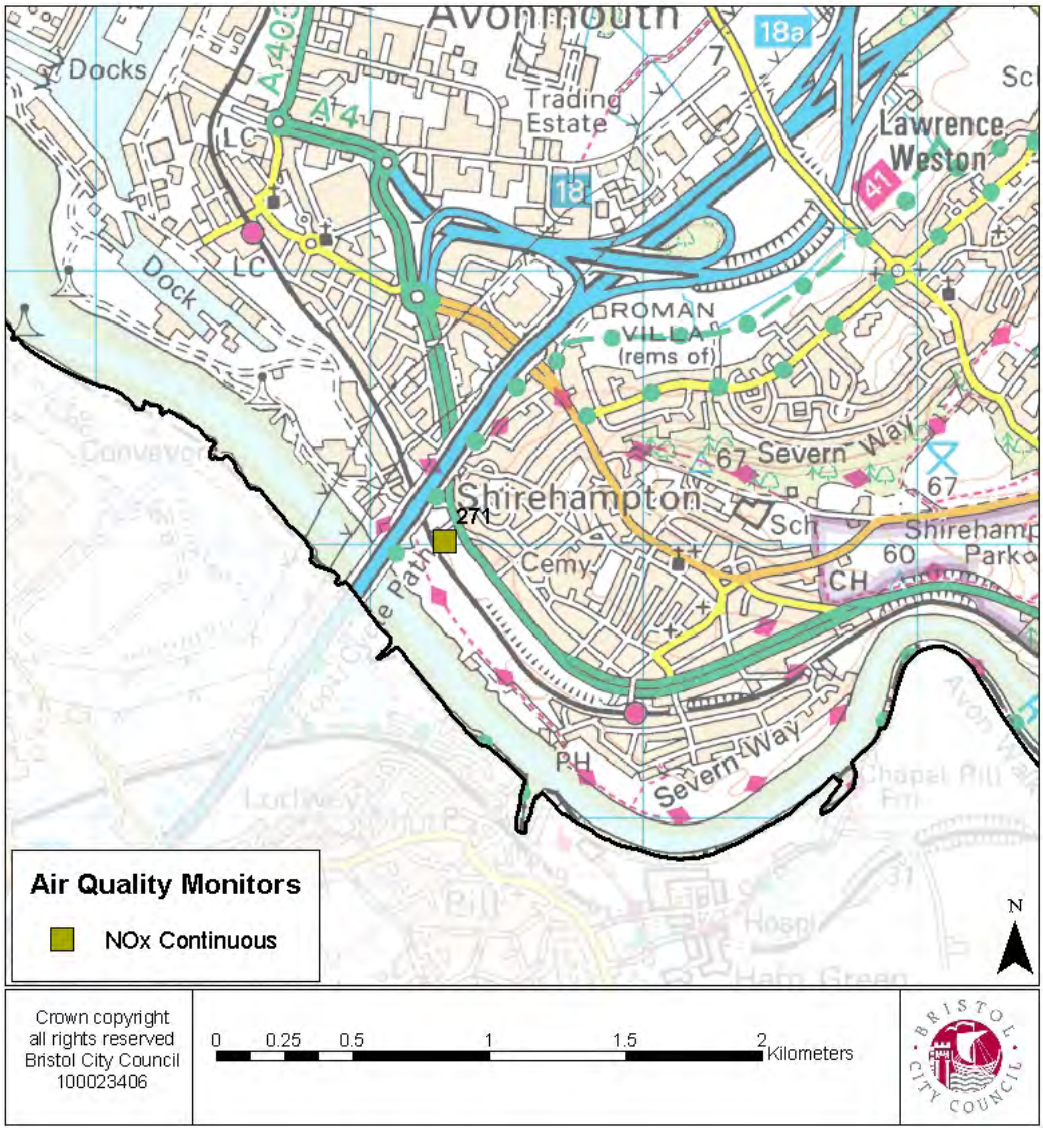

Figure 13 Location of mobile lab (trailer) analyser

Site ID	location	Site Classification	Dates of operation
206	Rupert Street	Kerbside	1999 – Present
215	Parson Street	Roadside	1998 – Present
203	Brislington Depot	Urban Background	1997 – Present
375	Avon Probation Service	Roadside	November 2004 – Present
395	Shiner's Garage	Roadside	July 2004 - Present
271	Trailer Portway P&R	Urban Background	2002 - Present
270	Wells Road	Roadside	June 2003 - Present
213	Old Market	Roadside	1990 - Present
188	AURN	Urban Background	June 2006 - Present

Table 12 Site ID numbers and locations of analysers

Statistic/Site	Annual mean NO_2 µg m^{-3}	Data Capture (%)	99.8 percentile µg m^{-3}	Exceedences of 200 (287) µg m^{-3}
Arena	39.0	99.9	109.3	0
AURN (Bristol St Pauls)	31	91.5	105	0
Avon Probation Service	**56.3**	98.9	162.8	0
Brislington	34.5	99.7	126.6	0
Bristol Old Market	**61**	97.2	183	8 (0)
Parson Street	**49.8**	99.3	137.6	0
Rupert Street	**99.5**	90.0	**254.7**	238 (5)
Shiners Garage	**41.3**	99.7	105.4	0
Trailer Portway	26.3	99.5	94.6	0
Wells Road	**49.6**	99.5	150.8	2

Table 13 Summary ratified data: continuous analysers 2007: exceedences in bold red type.

The data shown in Table 13 are fully ratified. The 99.8 percentile figure is the hourly mean concentration which has been exceeded eighteen times in the calendar year. To comply with the hourly mean objective, this should be below 200µg m^{-3}.

The Rupert Street monitoring site continues to report the highest concentrations of all the sites. This is not surprising as the site was located to provide "worst case" monitoring for traffic generated NO_X. The site is located on the central reservation of a dual carriageway junction in the city centre. This site reports the only exceedence of the hourly objective for nitrogen dioxide. Rupert Street does not, however, represent exposure for the purposes of assessing the annual mean objective. Assuming the new EU Air Quality Directive is approved by the Commission it will, however, have to be considered in more detail in future assessments as it will then represent relevant exposure in relation to the hourly average concentrations of NO_2.

Old Market reports an exceedence of the annual average objective, but this site, too does not represent relevant exposure for the annual mean objective. The hourly average objective was exceeded in 2005 with 22 hourly average concentrations in excess of 200 µg m^{-3} but this fell to 13 exceedences of this concentration in 2006 and 8 in 2007, both within the objective allowances. It is believed that the 2005 exceedence was mainly the result of extreme traffic congestion caused by the Broadmead redevelopment.

Avon Probation Service, Parson Street, Shiner's Garage and Wells Road are the only sites representing exposure for the annual mean objective and with an

adequate monitoring period where the annual mean concentration was above the 40 $\mu g\ m^{-3}$ objective.

The relatively low annual average concentrations at Brislington, the trailer at Portway Park and Ride and the AURN Bristol St Pauls site reflect their locations in areas relatively remote from pollution sources.

The data from the network of continuous analysers continue to support the view that the annual mean objective is likely to be breached at residential properties at roadside locations near busy roads and junctions. The hourly mean objective is also likely to be breached in a few locations close to heavily trafficked roads.

4.5.1.3 Avon and Somerset Police.

As part of the Broadmead Expansion development a site was commissioned to monitor the effects of both the construction and operation phase of the development. The developers have predicted an increase in traffic flows and congestion in the area around Newfoundland Way. A site was identified in the covered car park of the, then, Avon Probation Services offices (which have subsequently been taken over by Avon and Somerset Police) and monitoring for NO_2 commenced in November 2004. The location of the analyser is shown in Figure 14 and the site itself in Figure 15. The hourly data for the site for 2007 are shown in Figure 16. The sample inlet for this site is approximately eight metres from the roadside.

Although the site is not as close to the development site or roadside as would be desired, it is suitable for monitoring the effect on air quality of the development.

The site includes a facility for remote calibration of the instrument, a feature which reduces the resources needed to support the site.

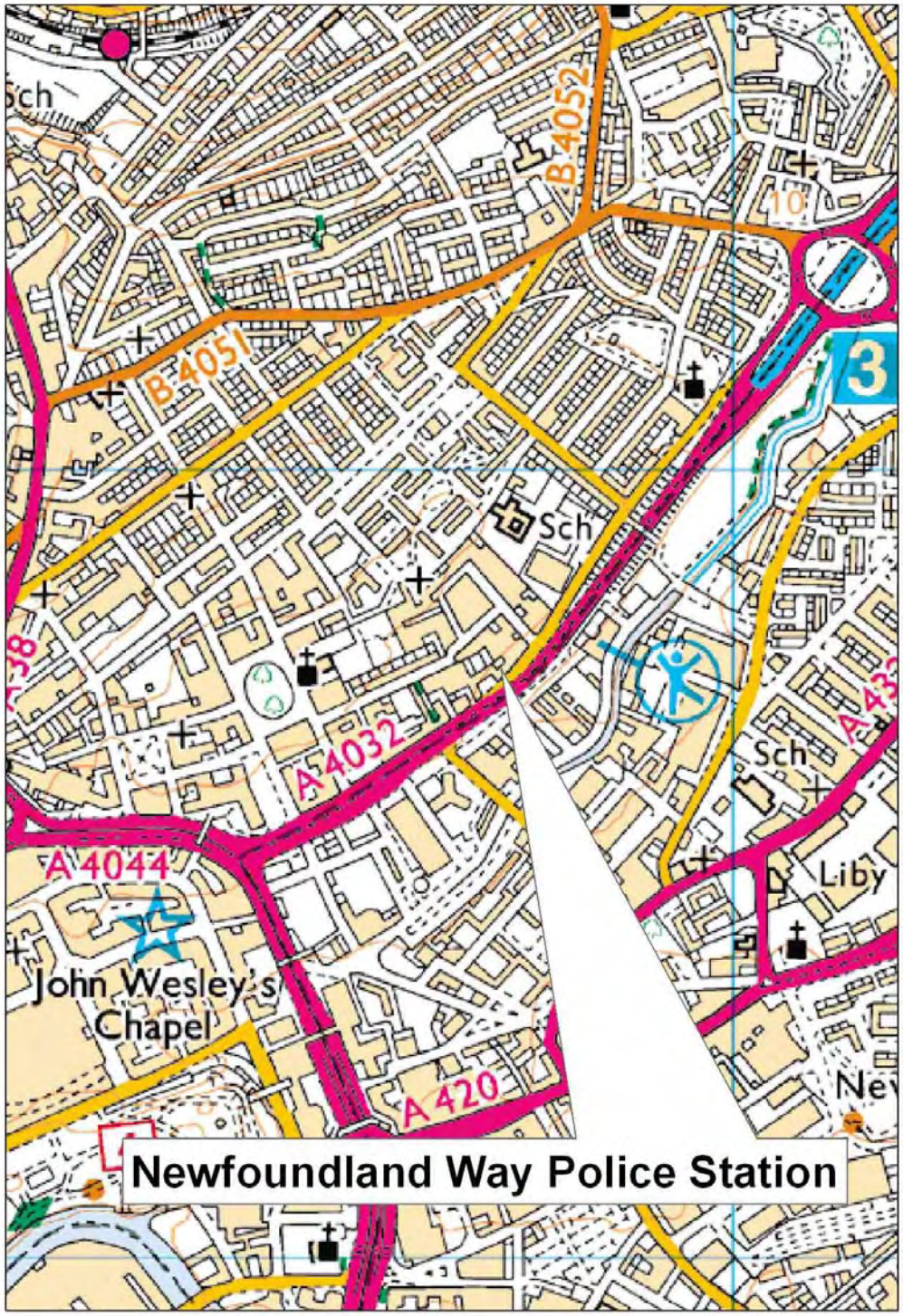

Figure 14 Location of Avon and Somerset Police NO_X analyser

Figure 15 Photograph of location of Avon and Somerset Police NO_X analyser

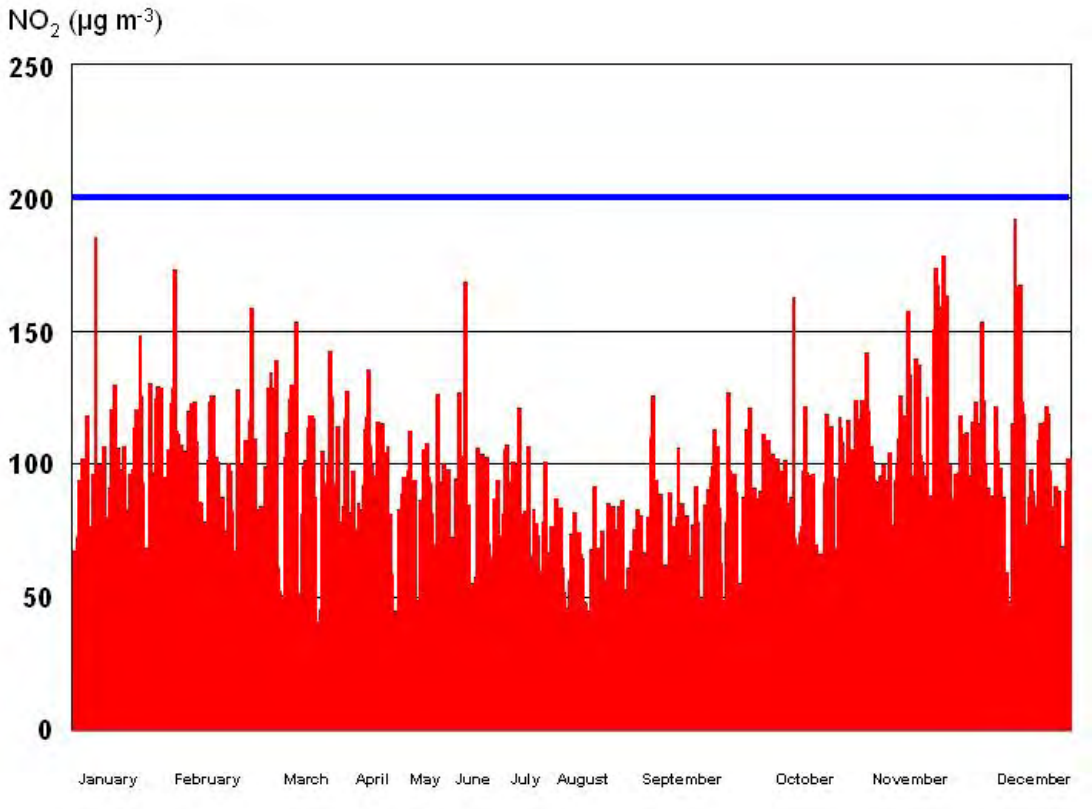

Figure 16 Hourly mean ratified NO_2 concentrations at Avon and Somerset Police: 2007

4.5.1.4 Bristol Arena.

This site was established on the A4 Bath Road to monitor the effects of a proposed Arena development (see 6.1 below). The location is shown in Figure 17 and the site itself in Figure 18. The hourly data for the site for 2007 are shown in Figure 19.

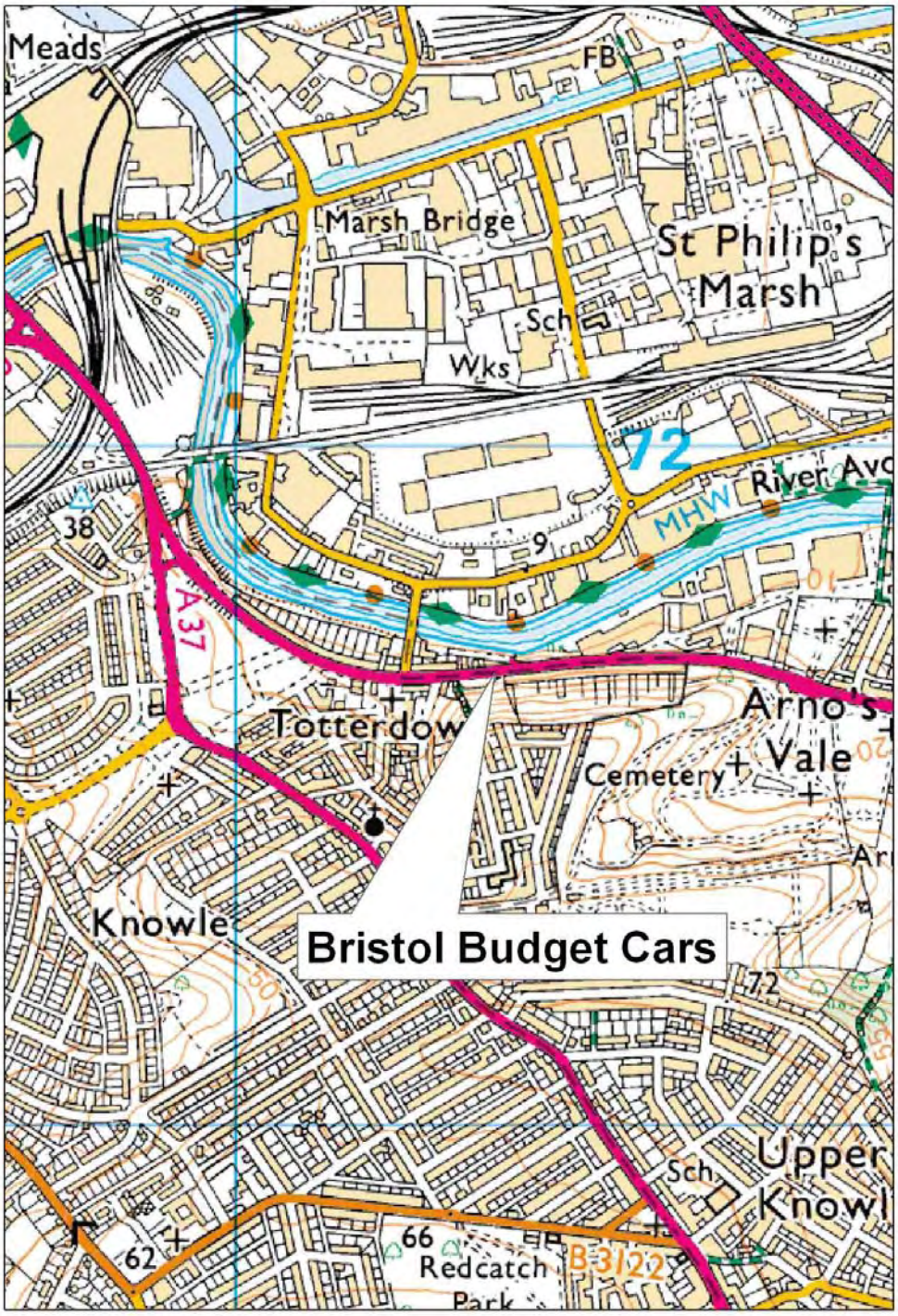

Figure 17 Location of Bristol Arena NO_X analyser

Figure 18 Photograph of location of Bristol Arena NO_X analyser

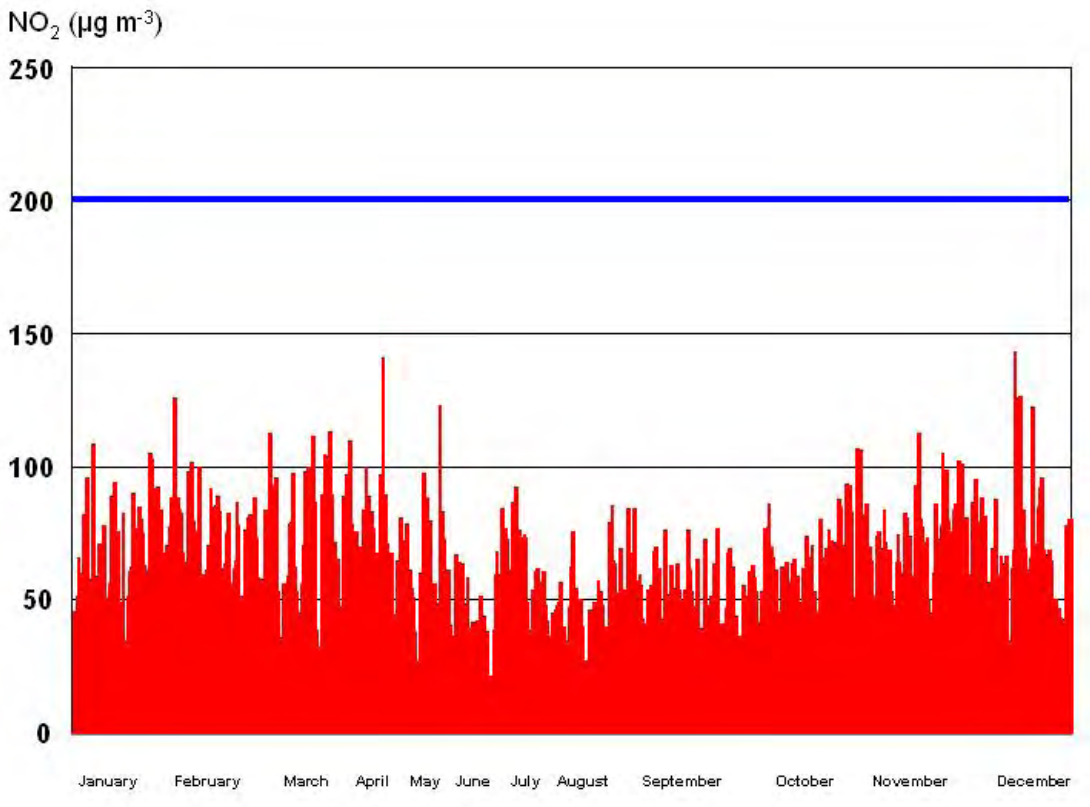

Figure 19 Hourly mean ratified NO_2 concentrations at Bristol Arena: 2007

4.5.1.5 Parson Street School.

This site has been operated since 1999 and is located in the grounds of a junior school adjacent to a busy road. The location of the analyser is shown in Figure 20 and the site itself in Figure 21. The hourly data for the site for 2007 are shown in Figure 22. .

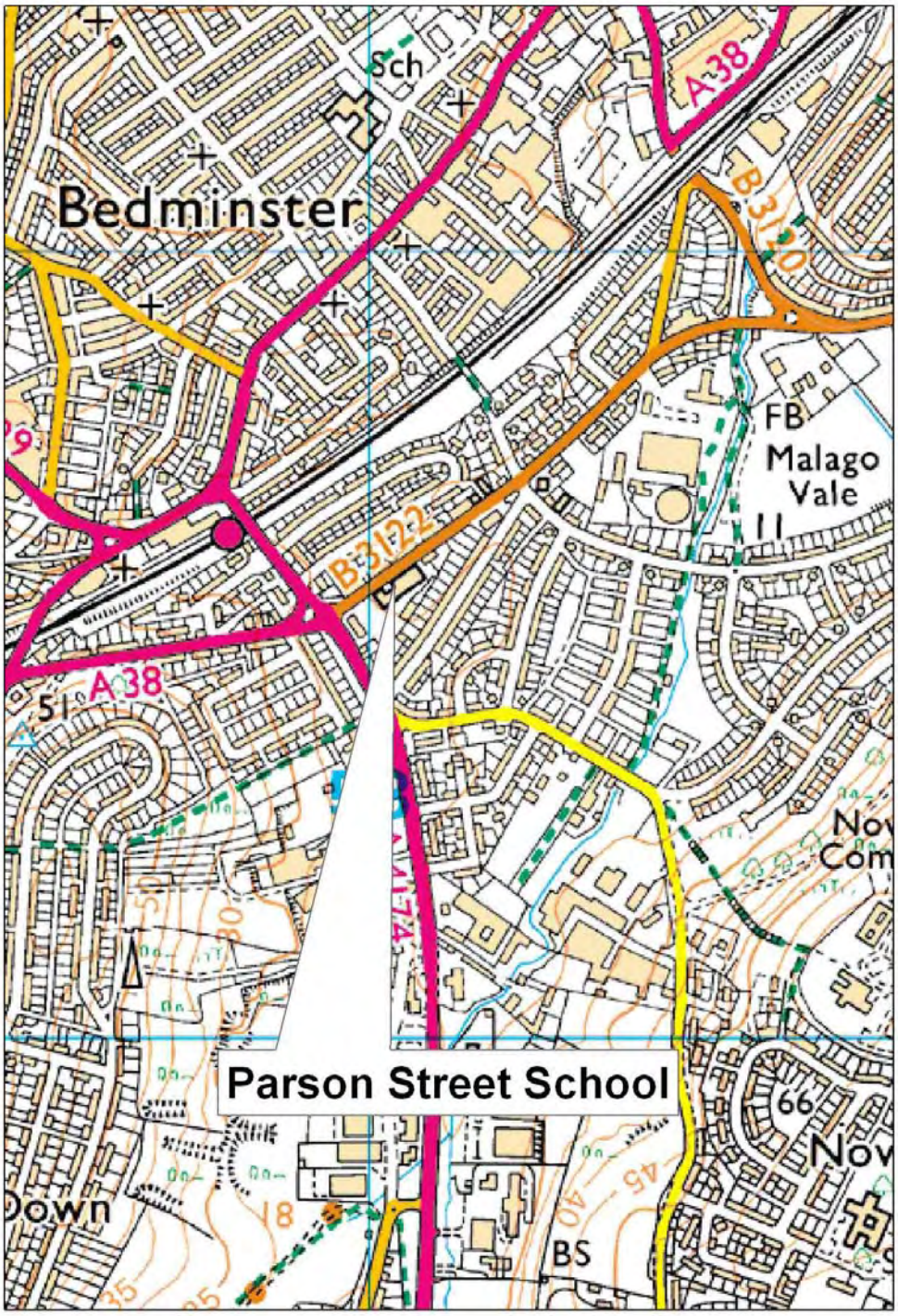

Figure 20 Location of Parson Street School NO_X analyser

Figure 21 Photograph of location of Parson Street School NO_X analyser

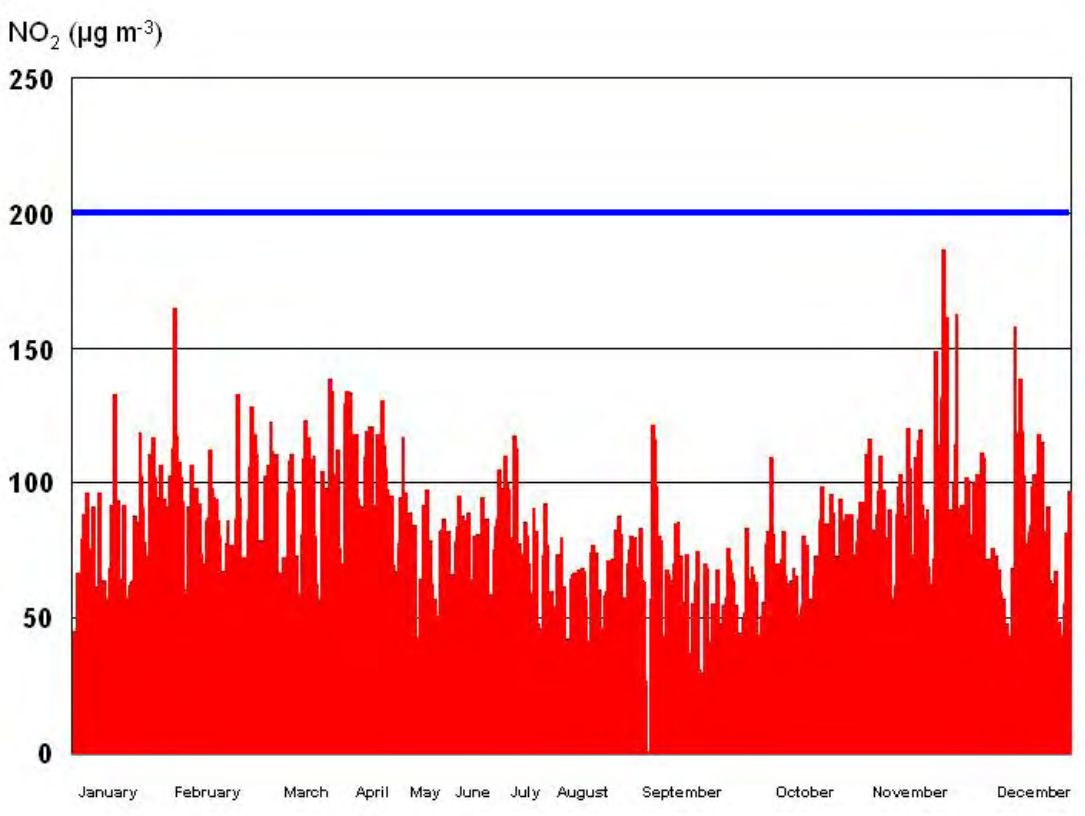

Figure 22 Hourly mean ratified NO_2 concentrations at Parson Street School: 2007

4.5.1.6 Shiners Garage

A “showcase” bus route has recently opened along the A420 corridor. In order to monitor the effect of this development on air quality, a monitoring site was commissioned at a busy junction, which is congested at peak times. The site is located on the roadside at the junction of Russell Town Avenue with Church Road, see Figure 23 and Figure 24.

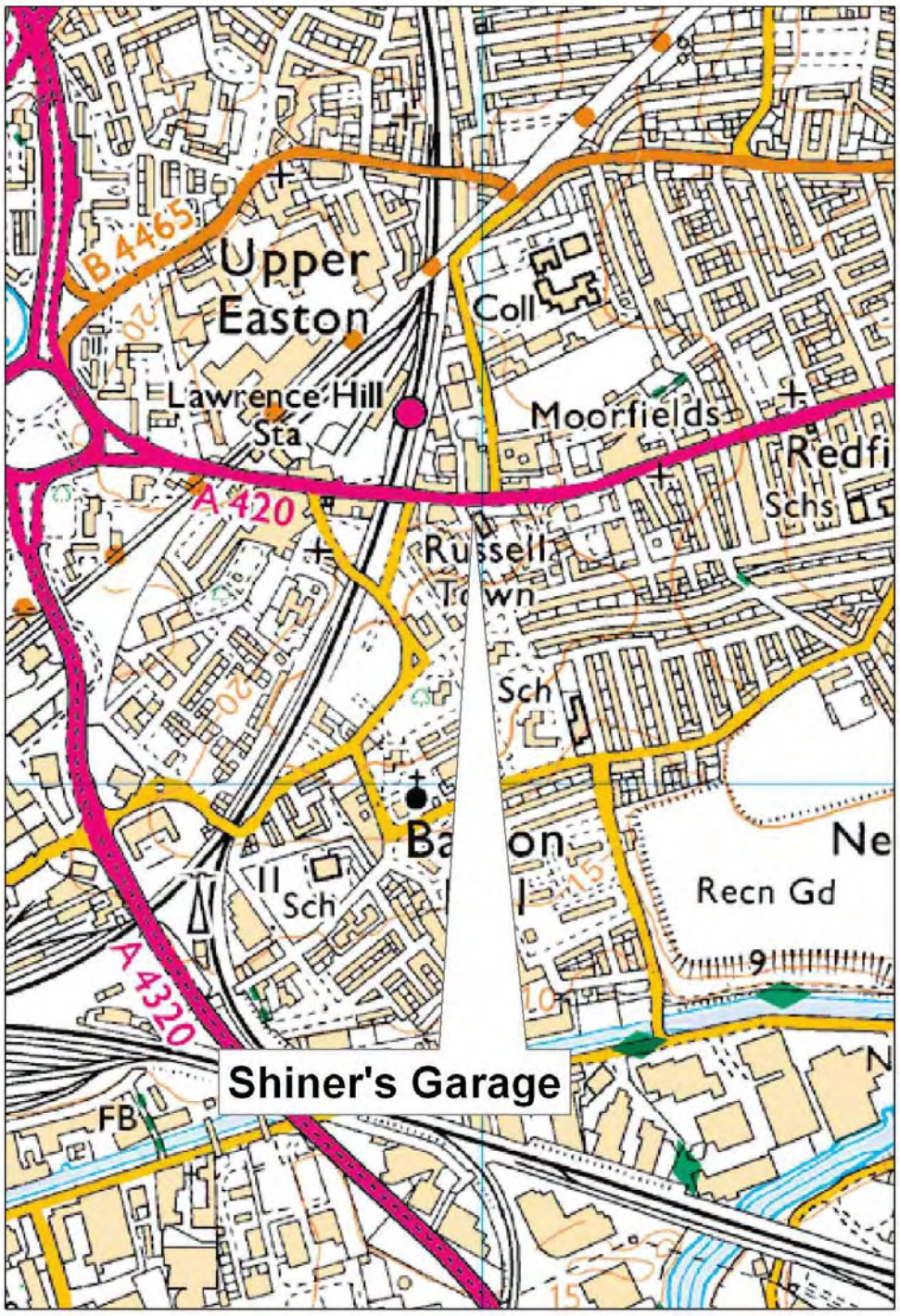

Figure 23 Location of Shiners Garage NO_X analyser

The monitor enclosure is located on the forecourt of Shiner's Garage and the sample inlet is approximately two metres from the roadside. This site represents exposure for the annual mean in this location. The location of the site is also within the former Neighbourhood Renewal Area in Lawrence Hill. The hourly data for the site for 2007 are shown in Figure 25.

Figure 24 Photograph of location of Shiners Garage NO_X analyser

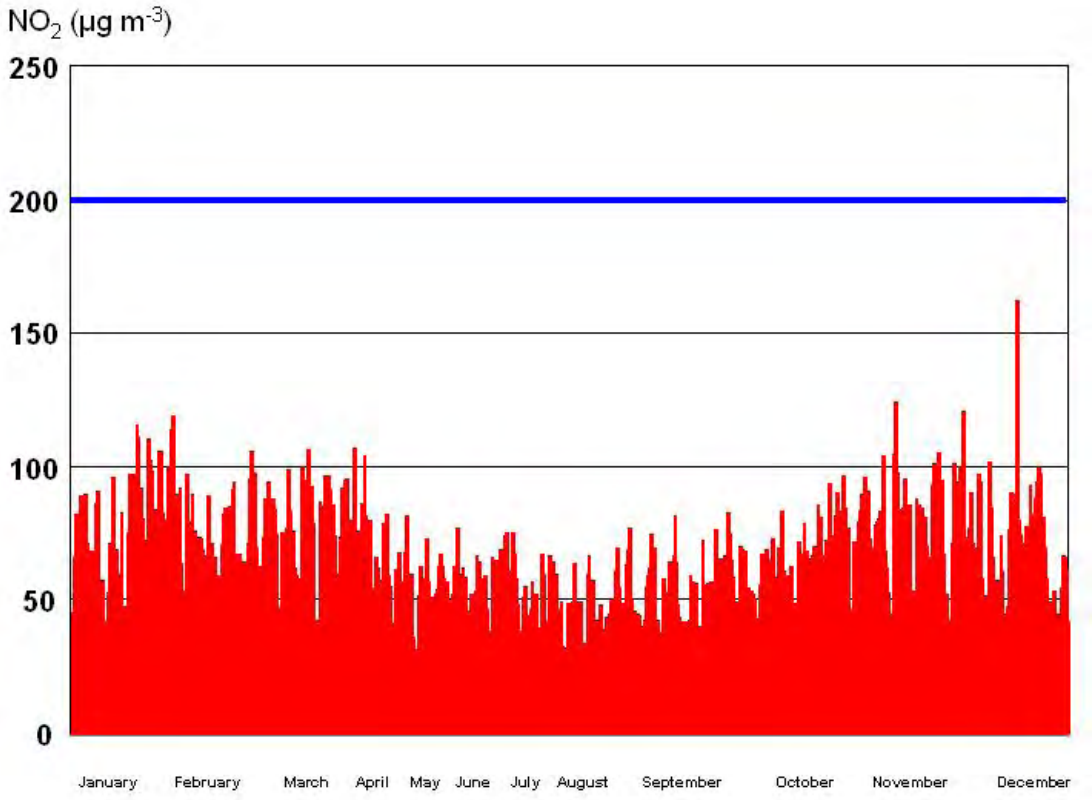

Figure 25 Hourly mean ratified NO_2 concentrations Shiners Garage 2007

4.5.1.7 Wells Road.

This site has been operated since 2002 and is located by a busy traffic light controlled junction on the A37 Wells Road. The location of the site is shown in Figure 26 and Figure 27. The data for 2007 are shown in Figure 28.

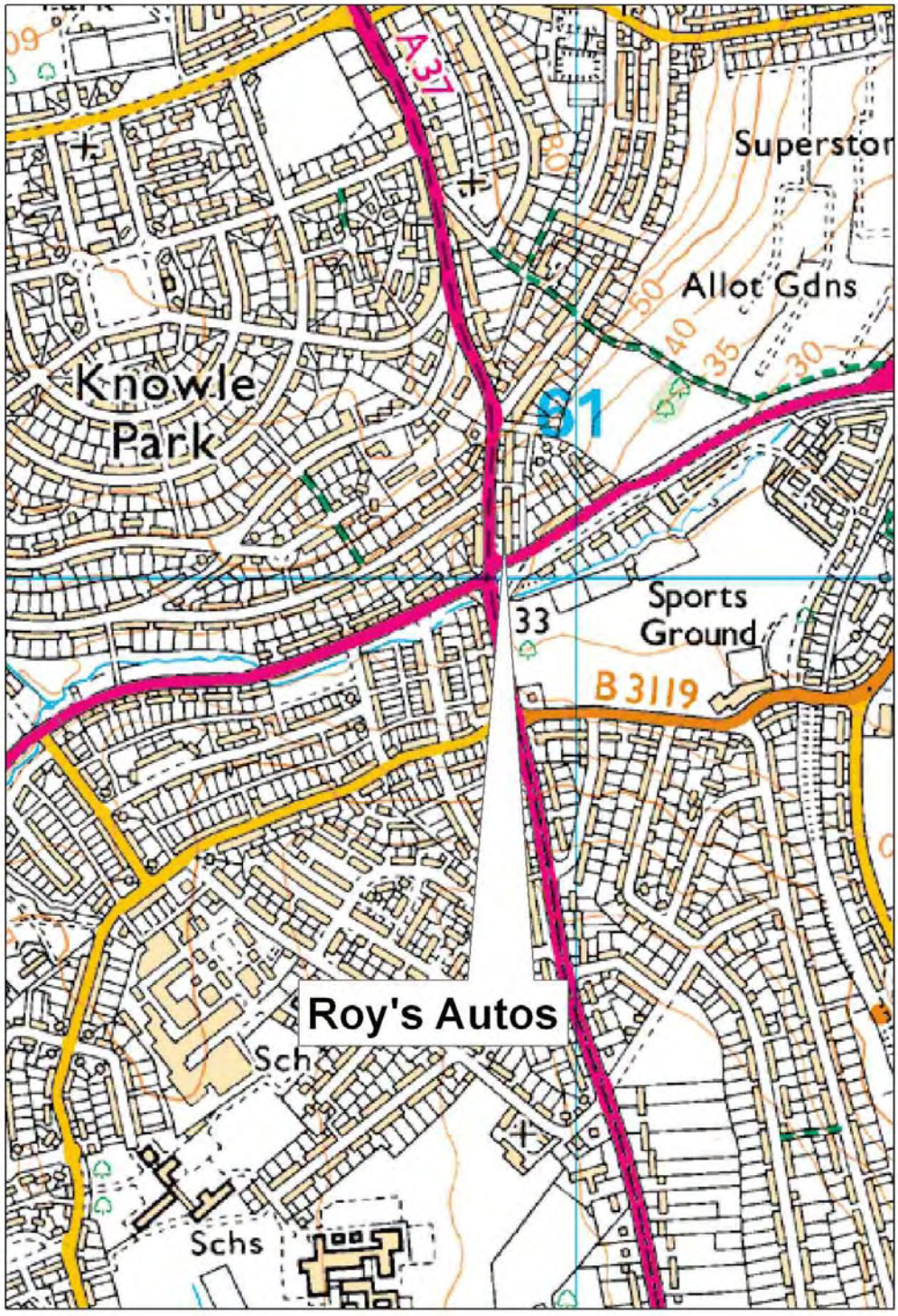

Figure 26 Location of Wells Road NO_X analyser

Figure 27 Photograph of location of Wells Road NO_X analyser

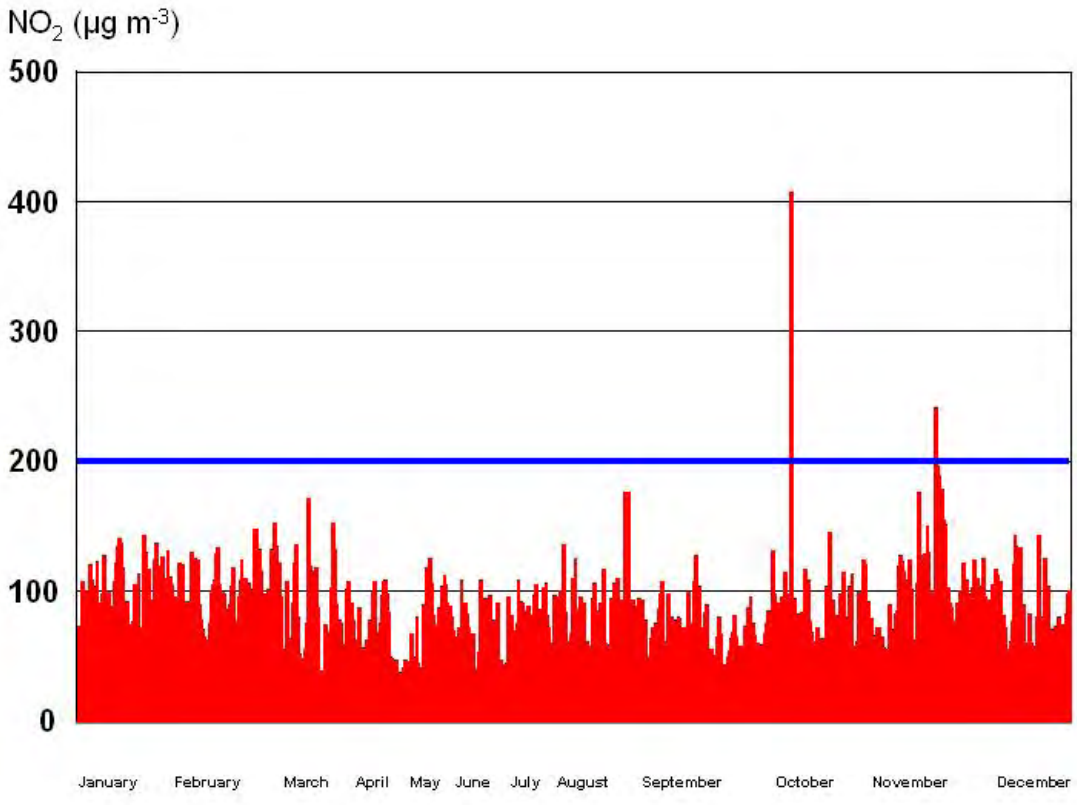

Figure 28 Hourly mean ratified NO_2 concentrations at Wells Road: 2007

4.5.1.8 Rupert Street.

As has already been stated this site does not represent relevant exposure for the current purposed of LAQM but, assuming the EU Air Quality Directive as passed by the European Parliament is agreed by the Council, it will have to be considered in the future as it is located by a pedestrian crossing. For this reason data from this site for 2007 are shown in Figure 31. The location of the site is shown in Figure 29 and Figure 28. Data capture for 2007 was just acceptable at 90% mainly due to data being lost for a substantial period in May and June because of an equipment fault. Although the UK hourly average objective of 200 µg m^{-3} was exceeded on 238 occasions air quality due to nitrogen dioxide at this site only entered the "Moderate" category on 5 occasions and then only in Band 4. This reflects the anomaly between the objective, which is based on the European Limit Value, and the information threshold which is based on the original EPAQS recommendation for a standard of 287 µg m^{-3} (150 ppb) as an hourly average with no allowances for exceedences.

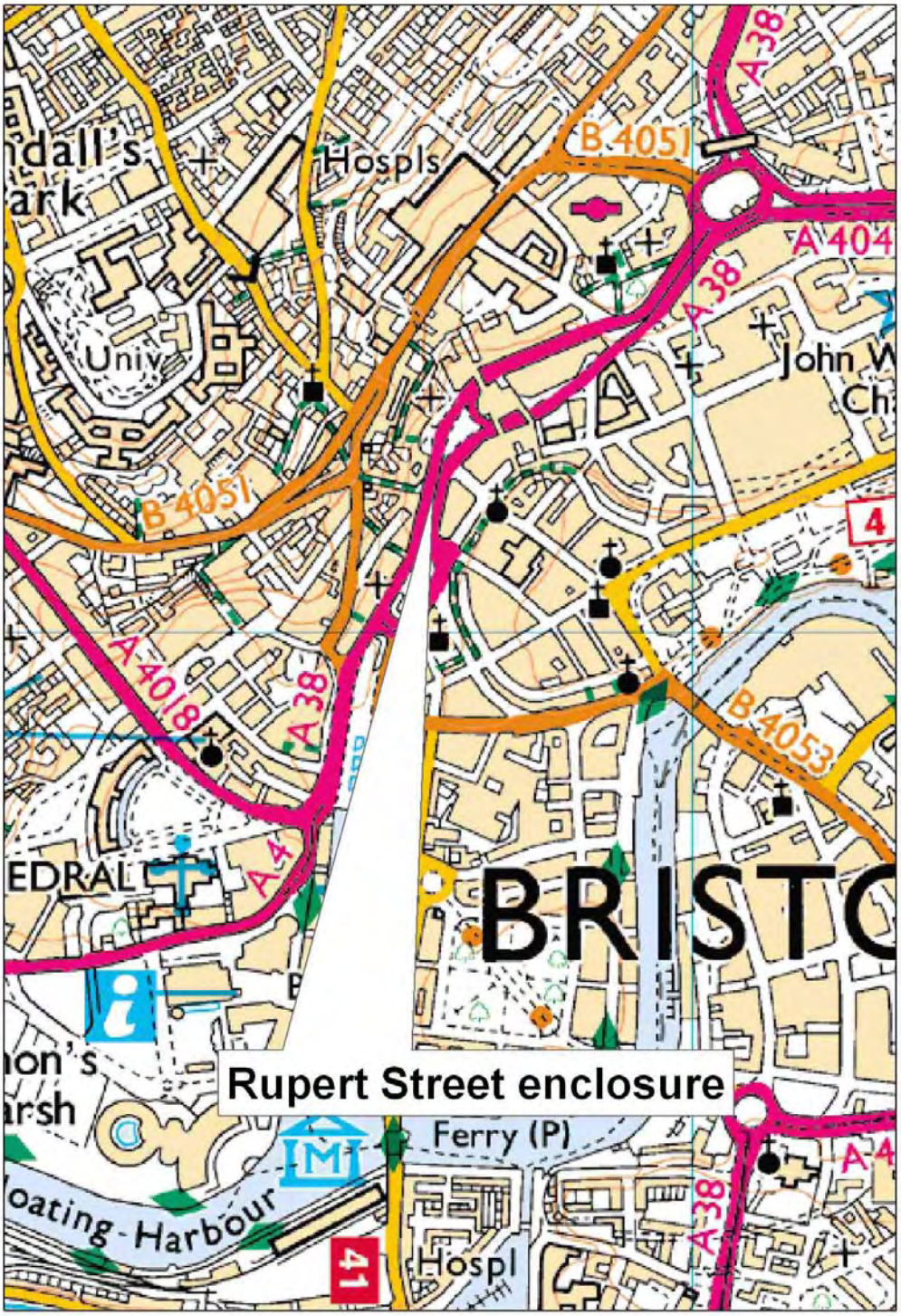

Figure 29 Location of Rupert Street School NO_X analyser

Figure 30 Photograph of location of Rupert Street NO_X analyser

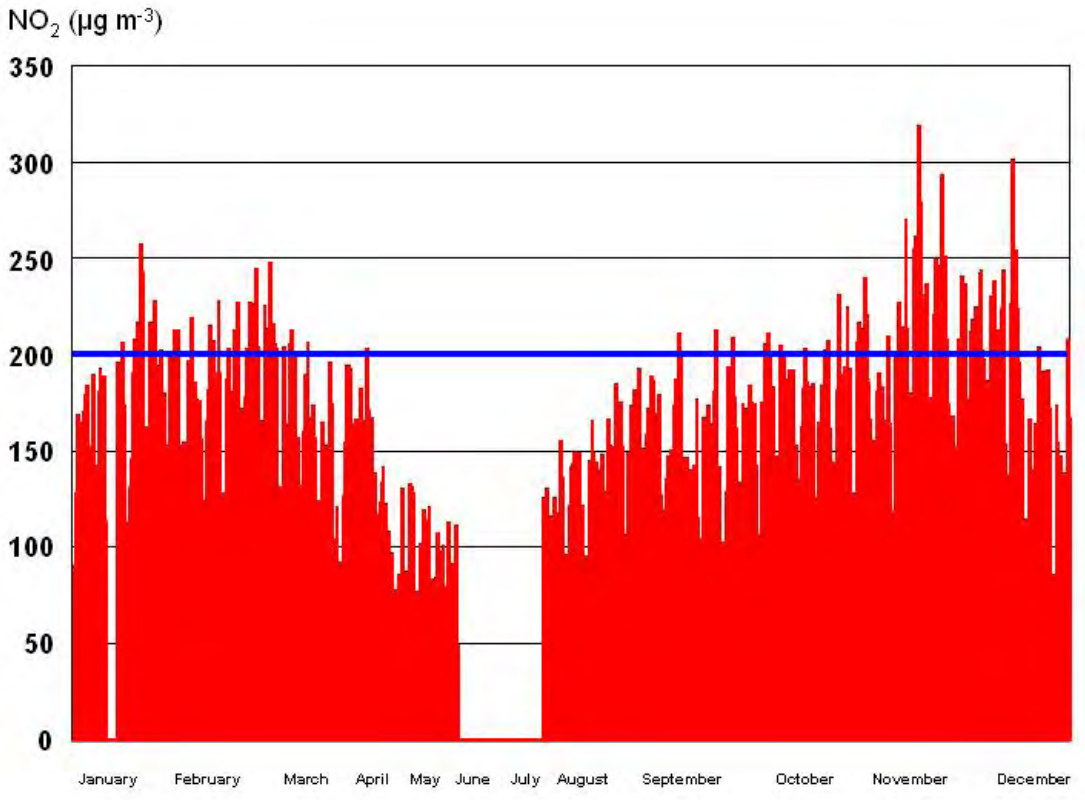

Figure 31 Hourly mean ratified NO_2 concentrations at Rupert Street: 2007

4.5.1.9 Trailer (Portway Park & Ride)

This site was established to assess the impact of a new Park & Ride site. The location of the site is shown in Figure 32 and Figure 33 and the data for 2007 is shown in Figure 34.

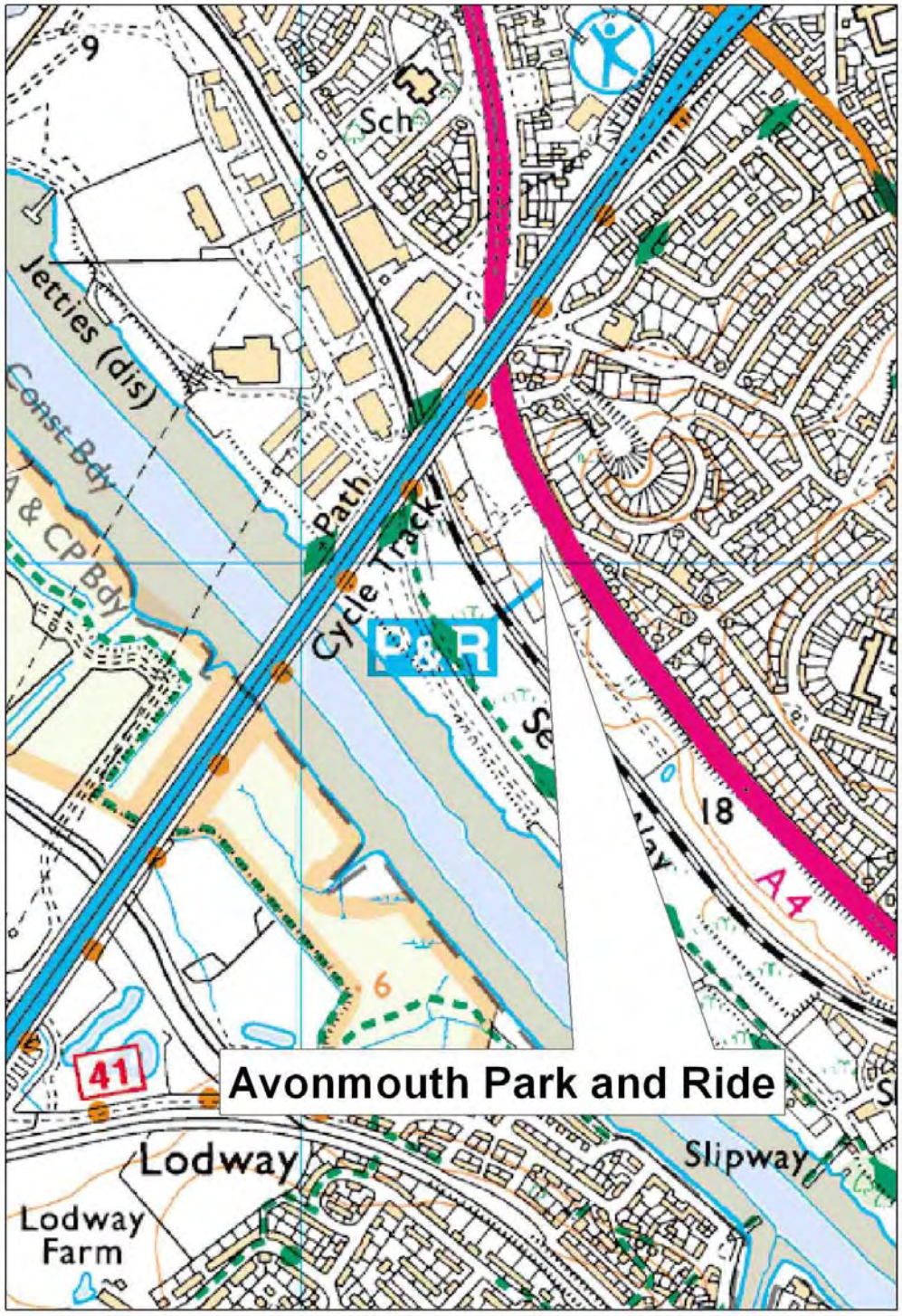

Figure 32 Location of Trailer, Portway NO_X analyser

Figure 33 Photograph of location of Trailer, Portway NO_X analyser –

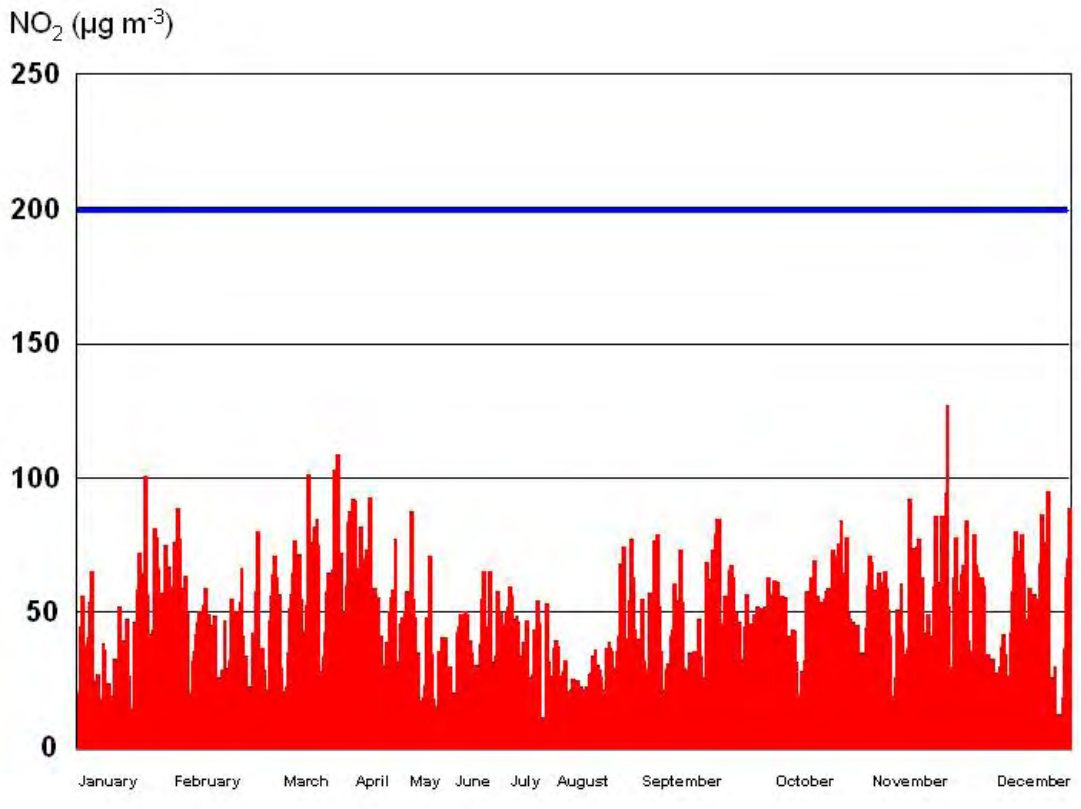

Figure 34 Hourly mean ratified NO_2 concentrations at Trailer, Portway: 2007

4.5.1.10 AURN sites.

Figure 35 shows the hourly average concentrations of nitrogen dioxide at Bristol Old Market and Figure 36 shows the comparable data for Bristol St Pauls. These clearly demonstrate the differences between the roadside and the background site but also that there are instances where both sites experienced higher than usual concentrations of nitrogen dioxide simultaneously. One instance of this occurred in mid-December and was part of a widespread episode with elevated concentrations of nitrogen dioxide and PM_{10} and $PM_{2.5}$ being observed across the UK.

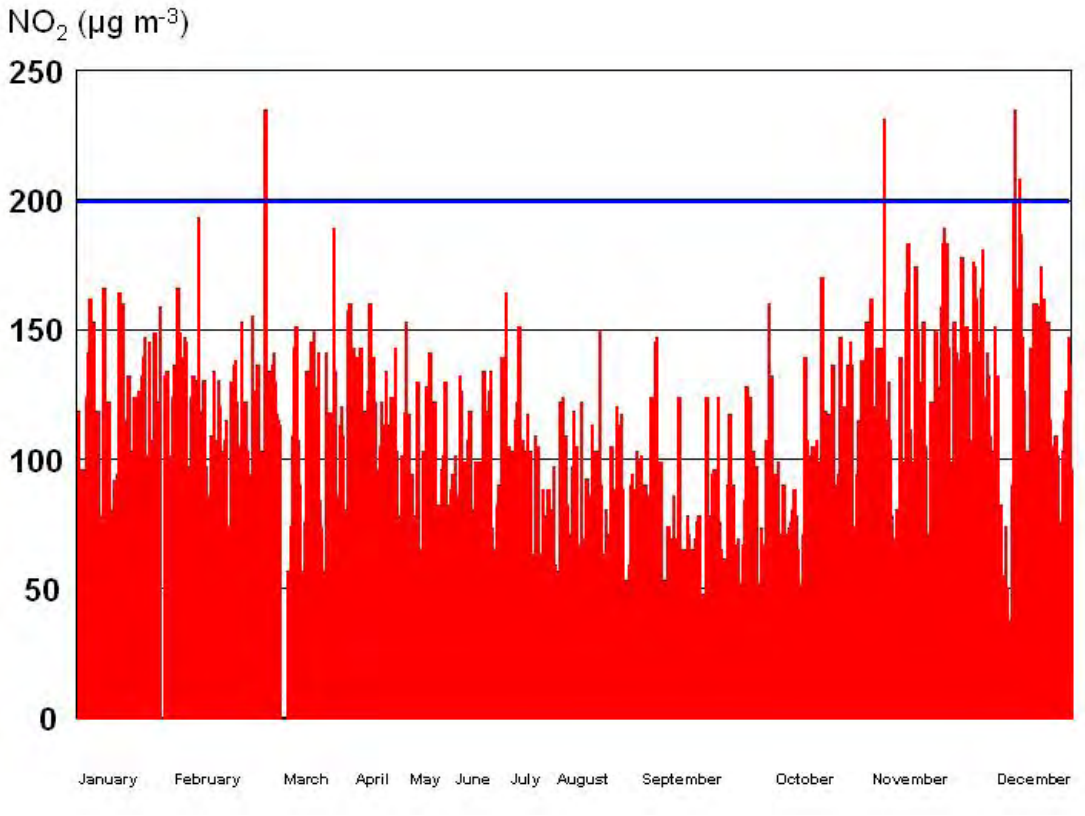

Figure 35 Hourly mean ratified NO_2 concentrations at Bristol Old Market: 2007.

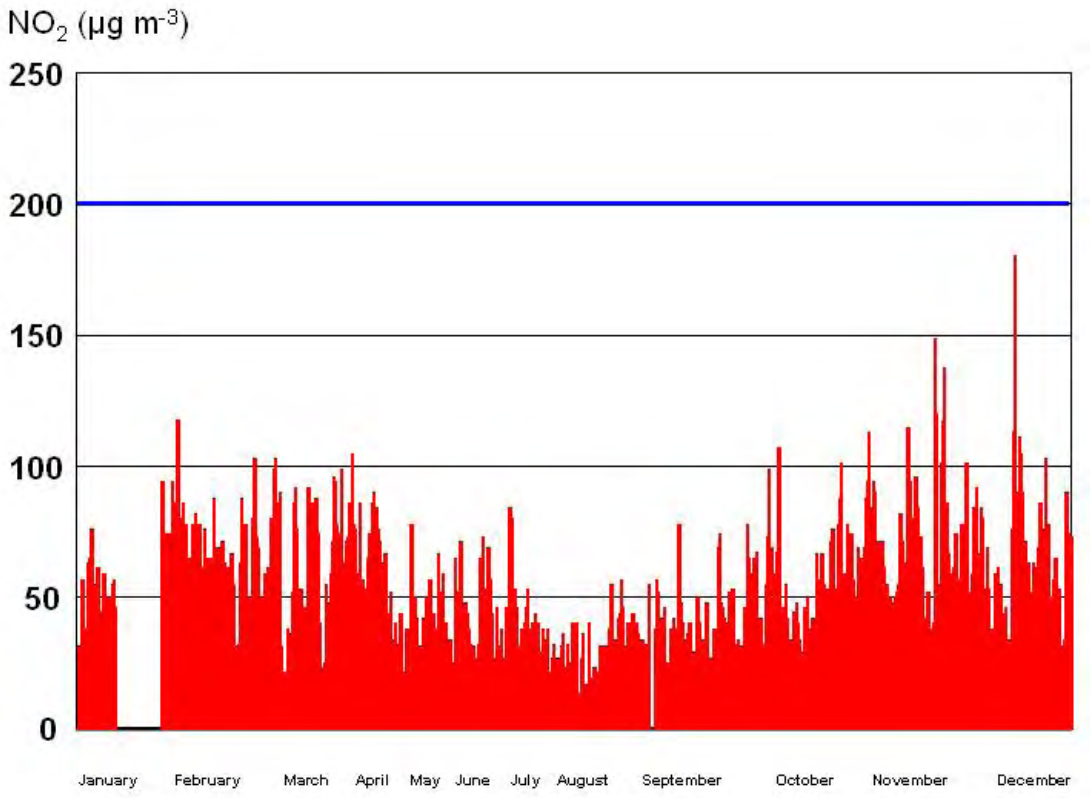

Figure 36 Hourly mean ratified NO_2 concentrations Bristol St Pauls: 2007

4.5.2 Diffusion Tubes

Bristol has a large and extensive network of diffusion tubes that covers the whole city. The majority of these monitoring sites are designed to assess ambient concentrations of at roadside and residential locations. Some of the surveys have been initiated to assess specific developments, e.g. traffic calming measures.

Concentrations from diffusion tubes reported in this report are all bias adjusted using the latest bias adjustment factor unless otherwise stated.

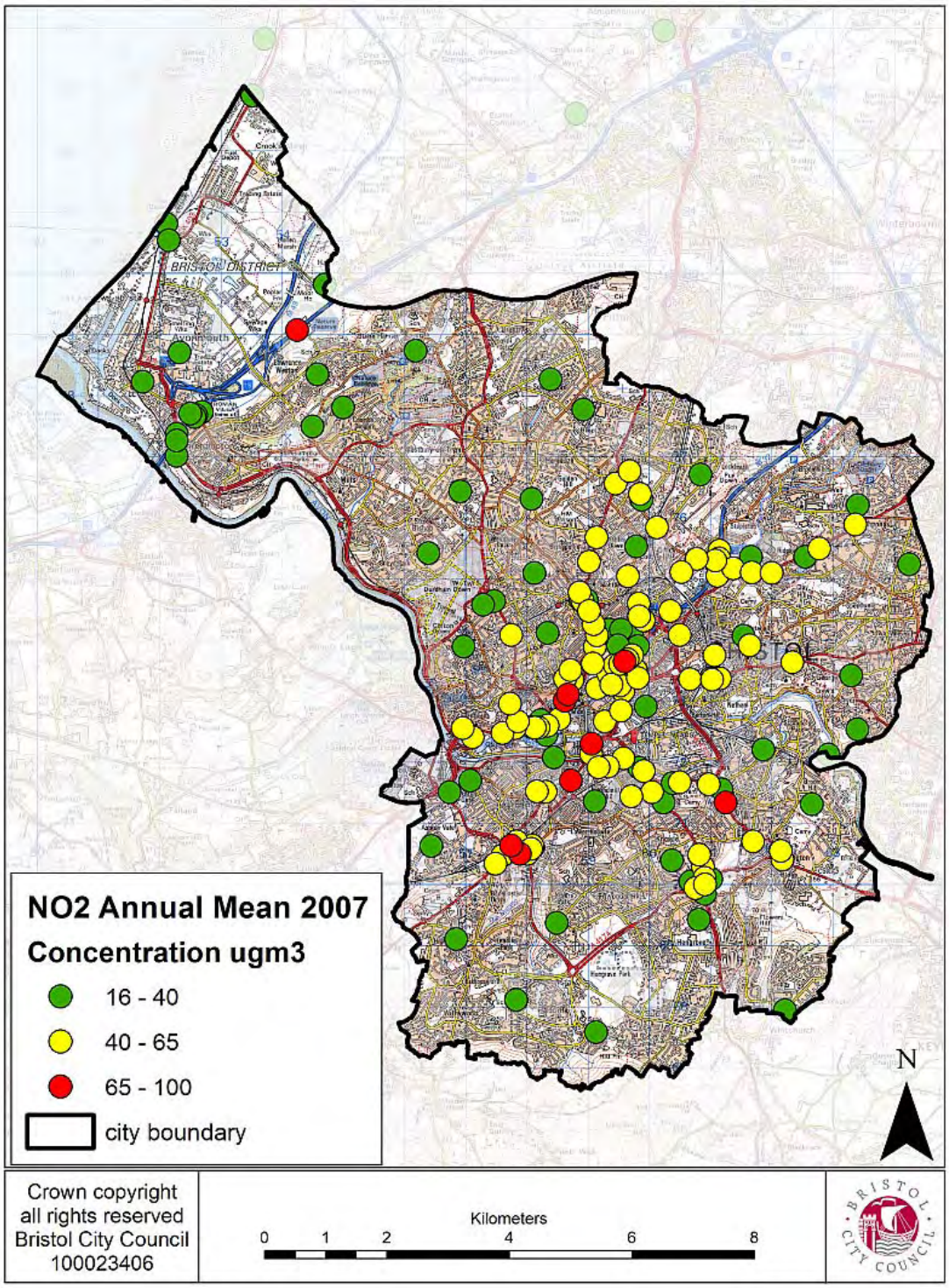

Figure 37 Locations of NO_2 diffusion tubes and annual mean concentrations for 2007

As can be seen from Figure 37 there are still a large number of diffusion tube sites where the annual mean objective for NO_2 was breached in 2007. The scale of the exceedence is such that a breach of the objective is still likely by the end of 2010.

4.5.3 Trends in nitrogen dioxide.

Diffusion tube data provide an opportunity to compare long term concentrations across a wide area. Figure 39 shows the annual average concentrations at 59 roadside diffusion tube sites that have been running since at least since 2002 and Figure 40 shows comparable data for 160 background sites.

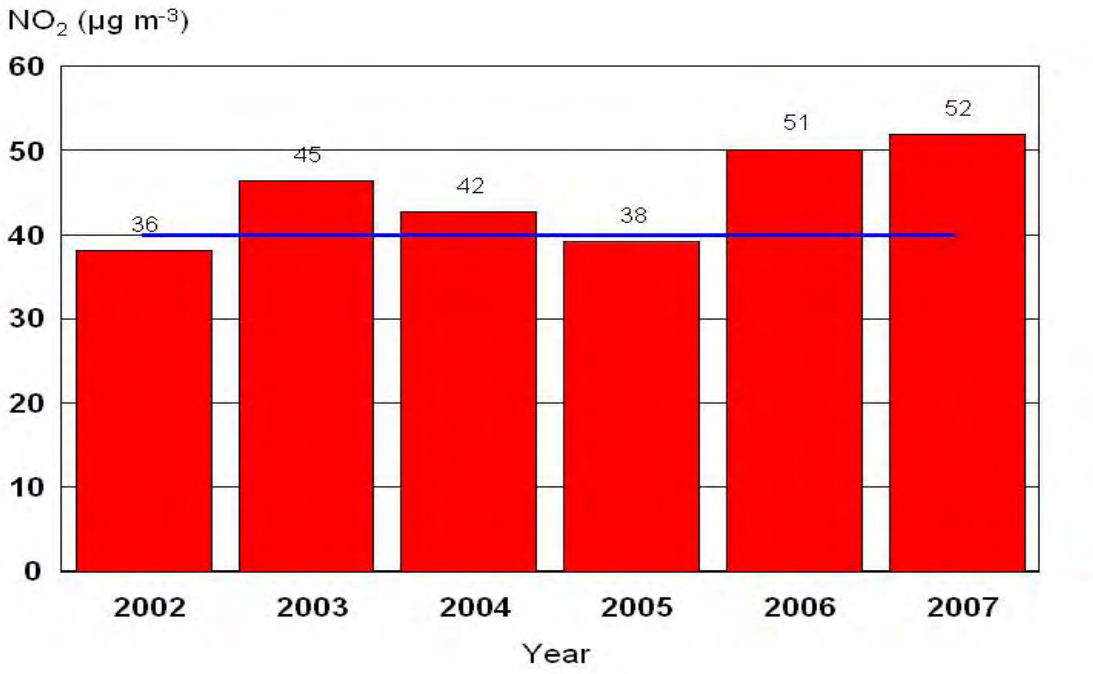

Figure 39 Annual average NO_2 for roadside diffusion tube sites 2002 - 2007

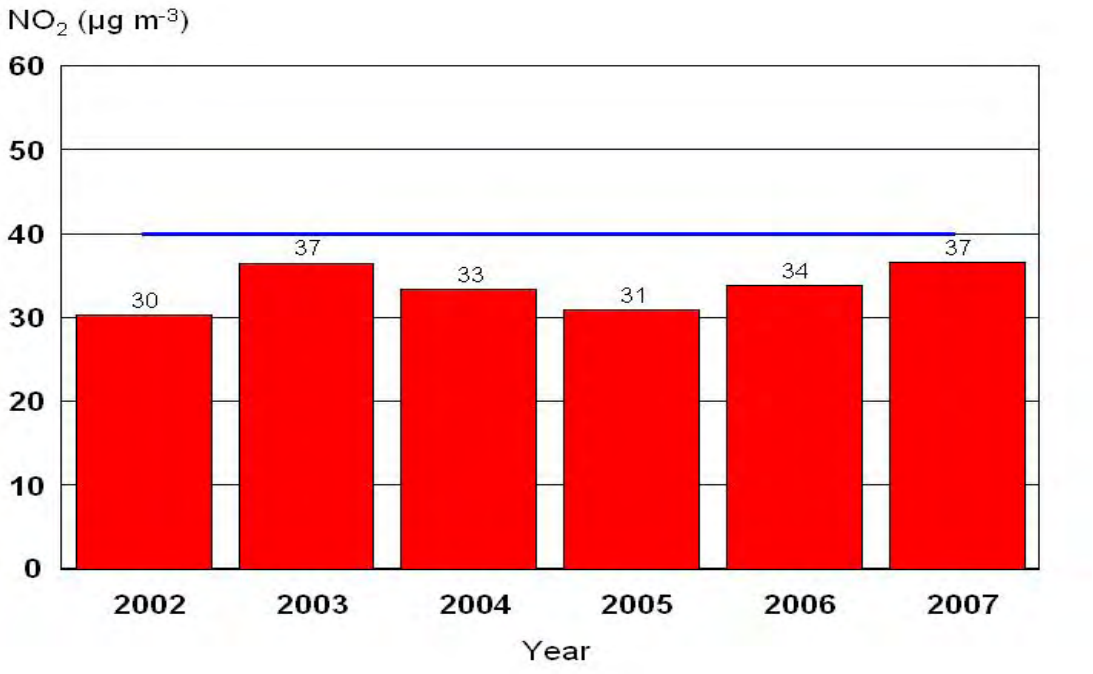

Figure 40 Annual average NO_2 for background diffusion tube sites 2002 - 2007

These figures show that over this 6 year period there has been a definite increase in the concentrations of nitrogen dioxide at roadside sites and that there is evidence to suggest that this is may be being matched by a slight increase in nitrogen dioxide concentrations at background sites.

The increase in concentrations at the roadside sites is, perhaps, not totally unexpected in the light of the recent AQEG report (Trends in primary nitrogen dioxide in the UK, Defra, 2007) but the increases at the background sites, if real, are less expected.

Figure 41 shows the annual average concentrations of nitrogen dioxide at eight continuous monitoring sites in Bristol from 2002 (or the year of commissioning where later) to 2007. In this Bristol AURN refers to the old Bristol Centre site to 2005 and the new Bristol St Pauls site from 2006. It should also be noted that the data captures for 2005 and 2006 were 69% and 53% respectively due to the relocation of the site and that the two sites are not strictly comparable as Bristol Centre was classified as Urban Centre whereas Bristol St Pauls is classified as Urban Background. In addition the data capture for Bristol Old Market in 2003 was 64% due to problems with the sampling system. This figure shows that the trends in the diffusion tube data are broadly reflected in the continuous data.

Figure 42 shows the comparable data for total oxides of nitrogen (as NO_2). This shows that, in contrast to nitrogen dioxide, there has been a steady reduction in concentrations over this period. Although AQEG concluded that London may be particularly sensitive to primary emissions of nitrogen dioxide, that more analysis of the data for London has been untaken and that there are more monitoring data for London than for other cities in the UK it appears to be the case that, at least for Bristol, the proportion of oxides of nitrogen present as nitrogen dioxide is steadily increasing.

AQEG have suggested a number of possible reasons for this phenomenon, some relating especially to London. These include the increasing penetration of Euro III diesel vehicles with oxidation catalysts into the vehicle fleet and the fitting of catalytically regenerating particle traps to buses. Increasing background ozone concentrations were ruled out as a causative factor but it was not possible to eliminate direct emissions of nitrous acid.

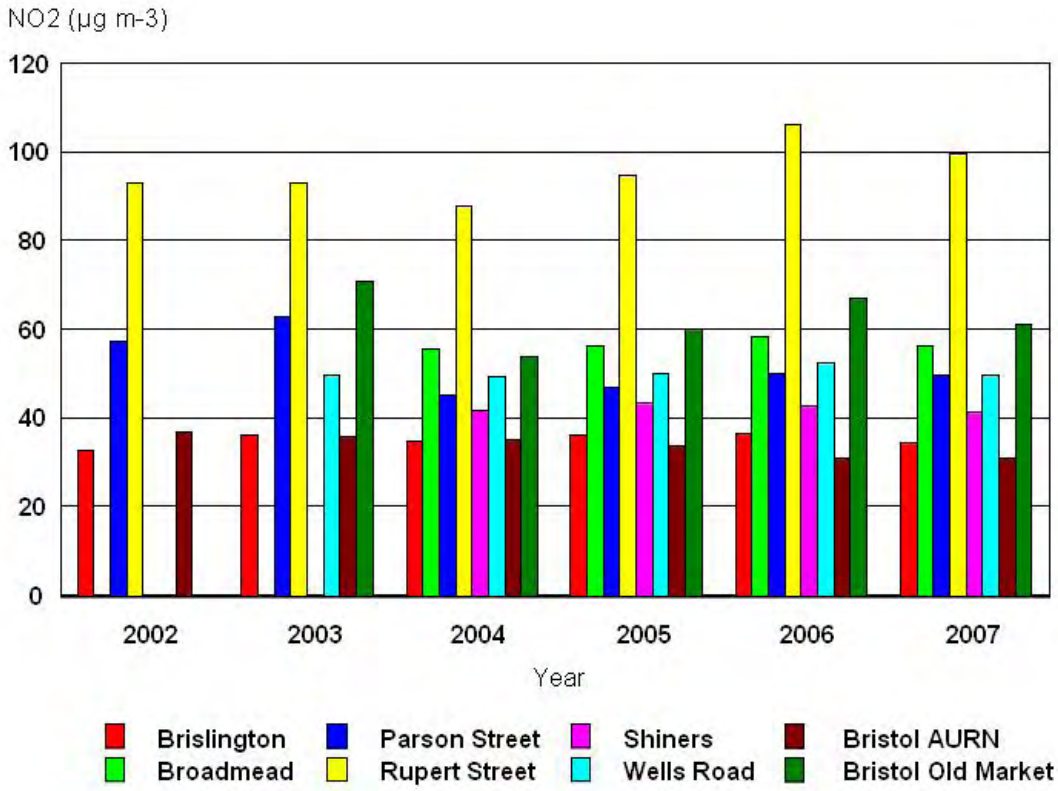

Figure 41 Annual average NO_2 for continuous sites 2002 - 2007

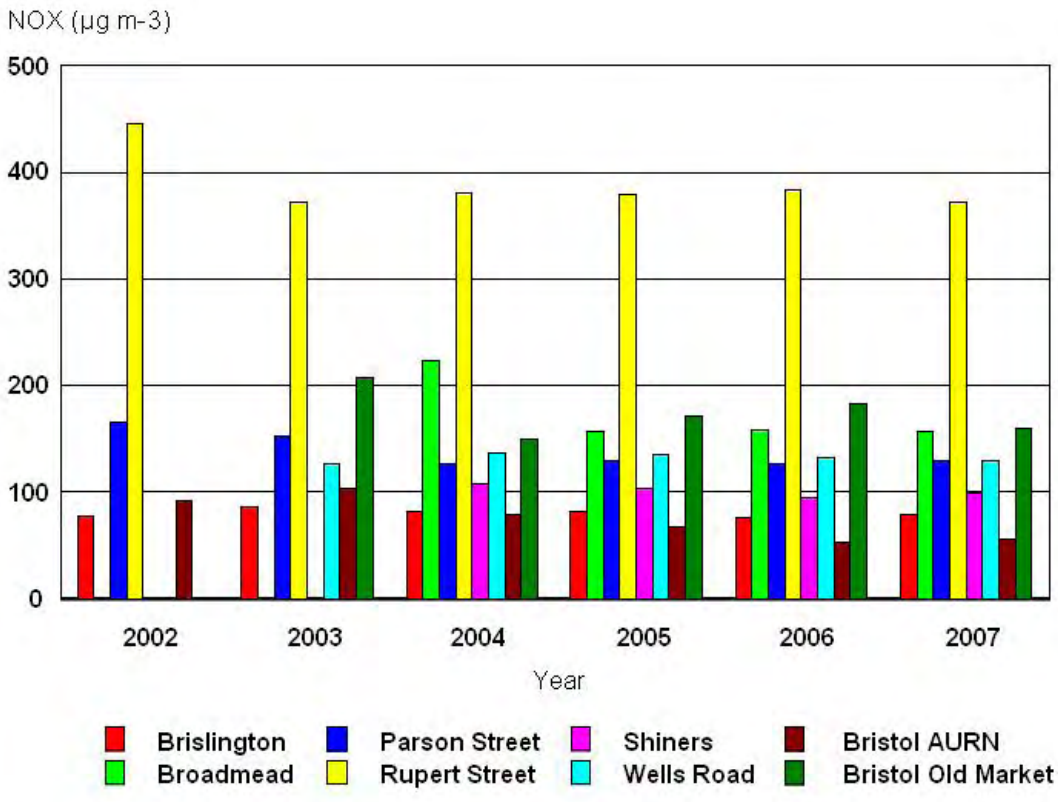

Figure 42 Annual average NO_X for continuous sites 2002 - 2007

4.6 Particles (PM_{10})

Objective	40 μg m^{-3} annual mean by the end of 2004. And 50 μg m^{-3} measured as a 24-hour mean not to be exceeded more than 35 times per year by the end of 2004
Provisional non-Statutory Objectives for 2010 for England (Except London)	The Government have brought in provisional objectives to be achieved by the end of 2010, however these will not be incorporated into UK regulations until after the review of the first EU Air Quality Daughter Directive, due for completion in 2004. These provisional objectives are:- 20 μg m^{-3} annual mean by the end of 2010. And 50 μg m^{-3} measured as a 24-hour mean not to be exceeded more than 7 times per year by the end of 2010.
National Perspective	There are a wide range of emission sources that contribute to PM_{10} concentrations in the UK. Exceedences of the 2004 objective may be found near busy roads; in areas which have significant emissions from domestic burning of solid fuels; and near industrial plant with significant uncontrolled/fugitive emissions e.g. quarrying and materials handling facilities.
Local Perspective	More than half the AQMAs declared in the UK have included exceedences of the 24-hour mean objective for PM_{10}. Most are associated with road traffic in conjunction with exceedences of the annual mean objective for nitrogen dioxide.

Table 14 Summary table for PM_{10} objectives

4.6.1 AURN Bristol St Pauls

There are now three PM_{10} samplers operating in Bristol. One is at the AURN Bristol St Pauls site. The instrument operated as a TEOM until 12 February 2007 with concentrations reported as gravimetric equivalent. From this date it was converted to operate on the Filter Dynamic Measurement System (FDMS) principle. In the 2005 equivalence trials this method was shown to produce data that were equivalent to the European Reference method and so in early 2007 23 TEOM units at AURN sites were upgraded (18) to or replaced (5) by FDMS units. Bristol St Pauls was upgraded on 13 February 2007. Figure 43 shows the daily mean concentrations at that site. It can be seen that the daily mean concentrations exceeded the absolute 50 μg m^{-3} objective for 2007 on 13 occasions but this number is below the 35 maximum permitted exceedences. The annual mean is also well below the 40μg m^{-3} statutory objective. It is not, however, possible to compare these data directly with the "Moderate" banding in the UK Air Quality Information Service as the banding was devised for TEOMs and the relevant bodies have not yet published a banding for the FDMS samplers.

The exceedences of 50 μg m^{-3} as a daily average can be attributed to a number of sources. At least five of these (March/April) were most probably due to a combination of particles from forest fires in the Ukraine and Western Russia and Sahara Sand with a possible secondary contribution (Cook A, Willis P, Webster H and Harrison M, AEAT/ENV/R/2566 Issue 1, January 2008). Another two can be attributed to Bonfire Night activities. All but one of the remainder (November/December) are most probably the result of "normal" winter conditions (see also 4.5.1.9 above). The one remaining exceedence can be safely attributed to the St Pauls Carnival which took place on Saturday 15 September 2007. The high concentrations of particles (hourly maximum 438 μg m^{-3}) were accompanied by elevated concentrations of carbon monoxide, oxides of nitrogen and sulphur dioxide but not ozone. As an open grill

for cooking food was situated within 20 metres of the monitoring station the probability is very high that the simultaneous increased concentrations of these pollutants was caused by the cooking activities. As such they do not reflect a citywide situation but they do give an indication as to how localised emissions can cause exceedences of the objectives within a small area.

For the purposes of comparison with previous reports the data from 2007 have been assessed against the provisional objectives in Table 15. If the 2007 data were observed in this year the annual average objective would just be met but the daily average objective would not. This is, however, no longer significant as the 2010 objectives are due to be superseded by new objectives for $PM_{2.5}$. In addition previously reported data relate to the former Bristol Centre site which was classified as "Urban Centre" whereas the current data relate to the Bristol St Pauls site which is classified as "Urban Background" and, as such might be expected to record slightly lower concentrations of anthropogenic pollutants.

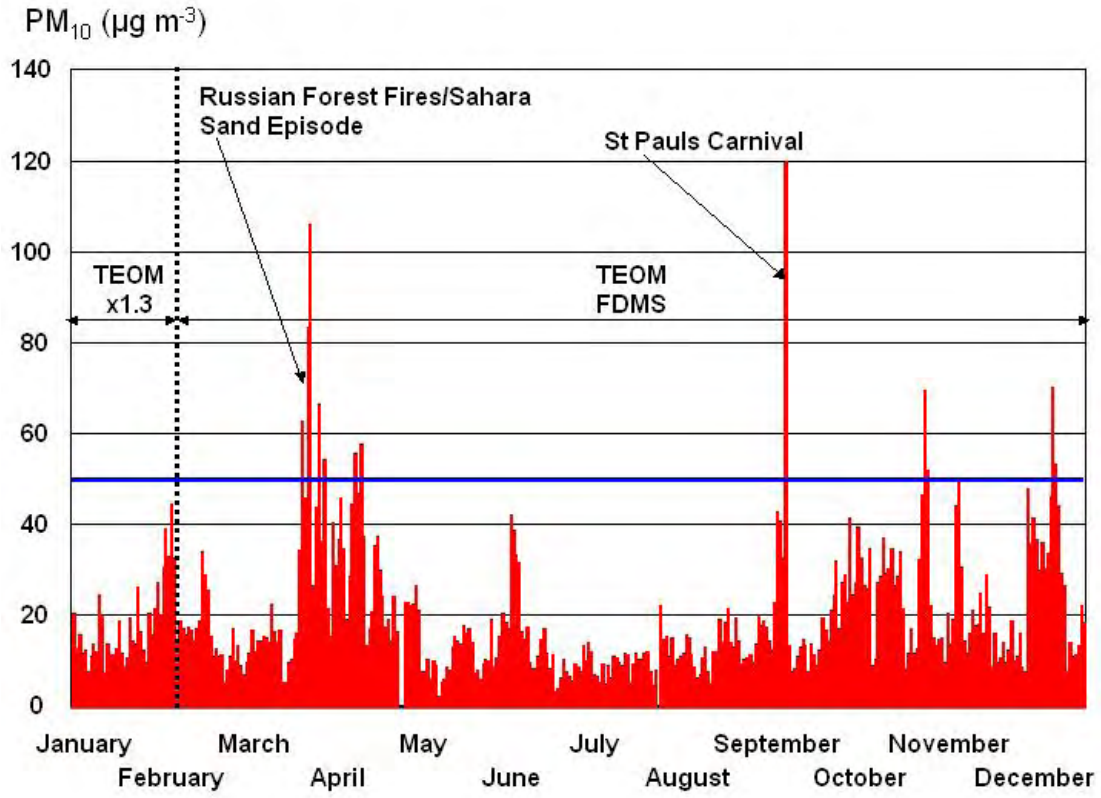

Figure 43 Daily mean PM_{10} concentrations at AURN Bristol St Pauls 2007 (µg m^{-3} gravimetric)

Statistic	PM_{10} µg m^{-3} gravimetric	Compliance with provisional objective
Average	19.5	Yes
Data Capture (%)	97.1	N/A
90.4th percentile daily mean	37.1	N/A
98th percentile daily mean	57.3	No

Table 15 Summary PM_{10} data from AURN Bristol St Pauls 2007

4.6.2 Bristol Old Market

A Met One Beta Attenuation Monitor (BAM) was installed at the Bristol Old Market AURN Affiliate site in January 2007. Initially data capture was relatively poor due to a number of minor problems but this improved after the equipment was overhauled. Figure 44 shows the daily average concentrations for both the raw BAM data and the gravimetric equivalent ([BAM] x 0.8333) for 2007 compared with the daily average objective value. All data are fully ratified. As was the case with the AURN site at St Pauls the Russian forest fire episode stands out as being an instance of high concentrations over a period of over one week. It is also evident that there are more instances of daily average concentrations in excess of 50 µg m^{-3} than is the case for Bristol St Pauls. This reflects the roadside nature of this site and the contribution of road traffic related particles is demonstrated by the fact that the majority of the higher concentrations of PM_{10} are reflected in higher concentrations of both carbon monoxide and, more strongly, oxides of nitrogen.

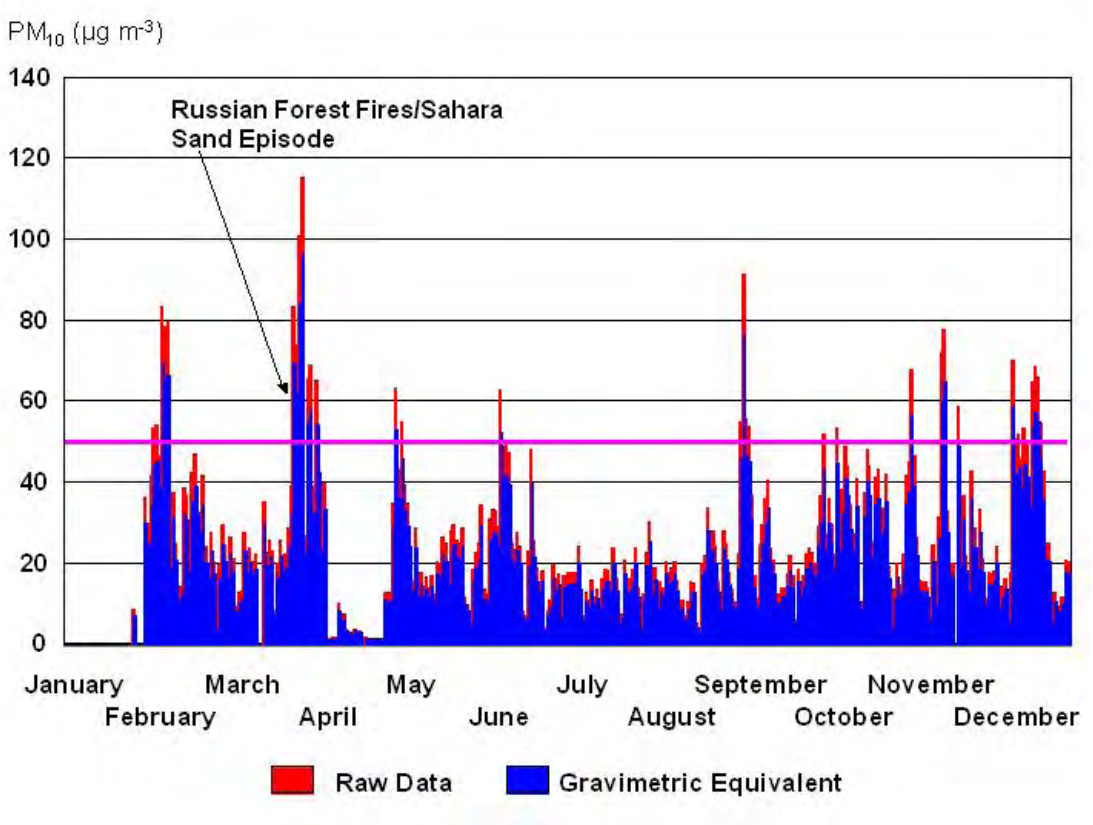

Figure 44 Daily average PM_{10} concentrations at AURN Bristol Old Market 2007 (µg m^{-3} BAM and gravimetric equivalent)

Statistic	PM_{10} µg m^{-3} gravimetric	Compliance with provisional objective
Average	22.0	No
Data Capture (%)	83.4	N/A
90.4th percentile daily mean	46.1	N/A
98th percentile daily mean	82.1	No

Table 16 Summary PM_{10} data from Bristol Old Market 2007

4.6.3 Wessex Water

A PM_{10} monitor was installed at No. 6 Borewell at the Wessex Water site in Avonmouth. This is an Opsis SM200 gravimetric/BAM sampler which is capable of reporting hourly data automatically and daily data through filter weighing. .

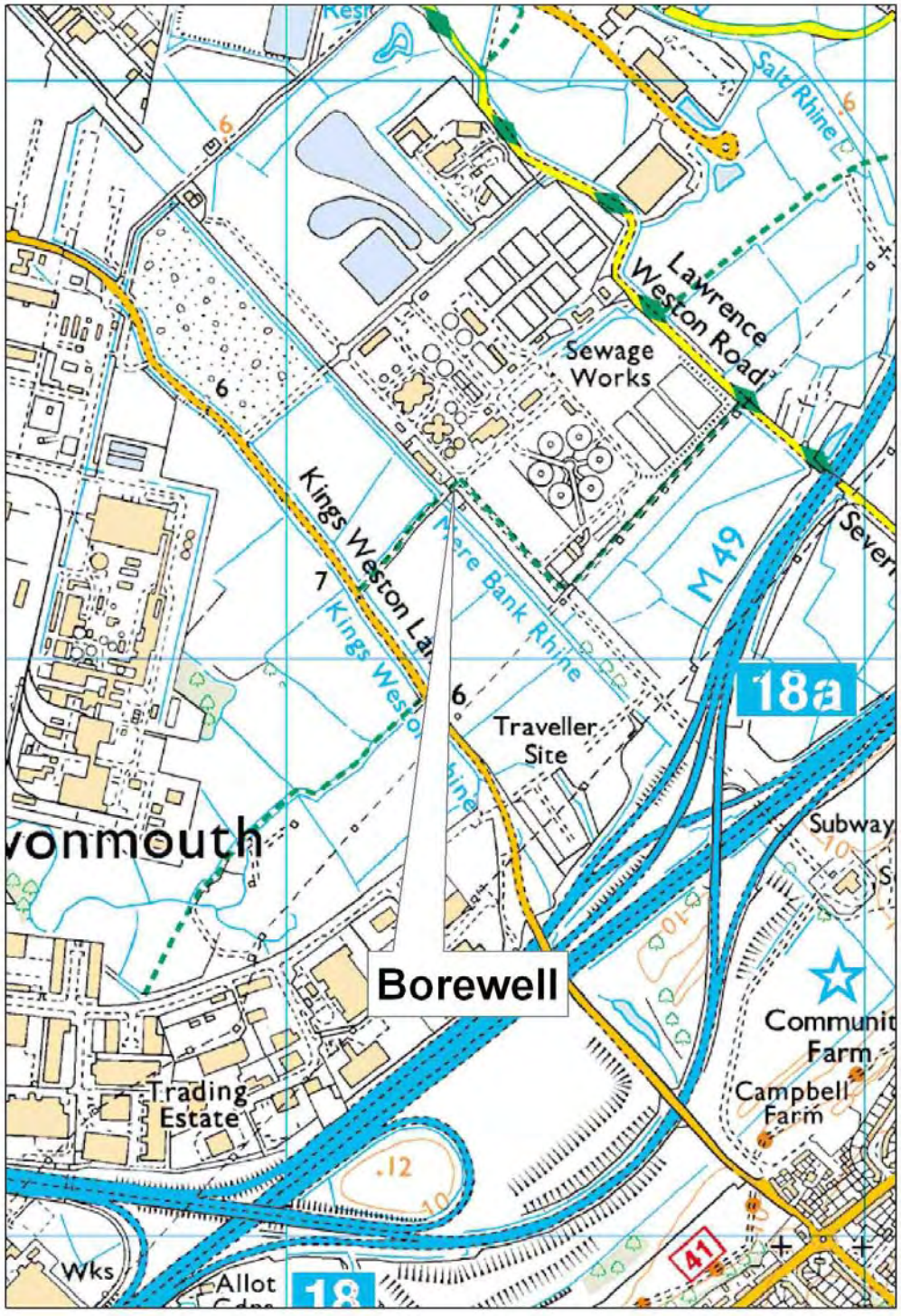

Figure 45 Location of analyser – No 6 Borewell

Figure 46 Photograph of location of analyser – No 6 Borewell

There were a number of operational problems with this site during 2007 which means that there are no meaningful data for this year that can be reported. These problems have now been resolved and future reports will contain data from this site.

4.7 Sulphur Dioxide

Objective	266 µg m^{-3} measured as a 15-minute mean not to be exceeded more than 35 times per year by the end of 2005. And 350 µg m^{-3} measured as a 1-hour mean not to be exceeded more than 24 times per year by the end of 2004. And 125 µg m^{-3} measured as a 24-hour mean not to be exceeded more than 3 times per year by the end of 2004.
National Perspective	The main sources of sulphur dioxide in the UK are power stations and other industrial combustion sources.
Local Perspective	A few AQMAs have been declared by local authorities for sulphur dioxide, mostly in relation to industrial or domestic combustion of coal.

Table 17 Summary for SO_2 Objectives

In the past monitoring for SO_2 has been carried out at locations where there was potential for exceedences of the objective whether from industrial sources (Sevalco carbon black works on Severnside) or from a heritage railway in the centre of Bristol. These periods of monitoring showed that there were no problems that could be identified from these sources. As no other significant sources of have been identified no further monitoring has been carried out by the City Council.

The only location where SO_2 is monitored on a continuous basis is the AURN site at Bristol St Pauls. The highest hourly average concentration recorded in 2007 was 59 µg m^{-3} and the maximum 15 minute average was 106 µg m^{-3}. From this it is concluded that, unless any new industrial source or sources are identified, there is no need for any further monitoring for in Bristol.

There is a proposal for a new deep sea container handling facility at Avonmouth Docks (see 6.5) which may have implications for SO_2. These will be addressed in future reports.

5 Data Quality Control

5.1 Continuous Analysers

The Council's monitoring network is operated and run by officers trained in all aspects of the monitoring processes including routine site operations, field calibrations and data ratification.

The QA/QC for the AURN Bristol St Pauls site and the affiliated site at Bristol Old Market is carried out by NETCEN. Environment & Sustainability Unit staff are trained as Local Site Operators for these sites.

5.1.1 Routine site operations

The Council's monitoring sites have a programme of routine operational checks and programmed fortnightly site visits including:

- Daily communications checks on lines, data transfer and analyser operation;
- Daily checks of data quality;
- Repairs of faulty equipment under arrangements with outside contractors;
- Fortnightly site inspections of equipment operational status, site safety, security and calibration checks;
- Planned six monthly servicing and re-calibration of analysers by equipment suppliers under contract to the Council.

5.1.2 Equipment servicing and maintenance regimes

Analysers have planned maintenance schedules that broadly follow those assigned to the AURN and affiliated site network. All analysers are maintained following manufacturers' instructions and have six monthly full service and re-calibration conducted under servicing contract. This contract has now been awarded to SupportingU until December 2010. Results of the servicing, calibrations and repairs are fully documented and stored centrally. Routine maintenance of equipment is also conducted during regular two-weekly site visits where all associated equipment such as sample lines, modem, and electrical system are examined and sample inlet filters are changed. Any faults, repairs or changes made to the equipment are also recorded and stored centrally and at analyser locations.

5.1.3 Calibration methods

The calibration procedures are similar for all the Council's continuous analysers including the AURN affiliated site, with a two point zero/span calibration check being performed at regular intervals of two weeks. The methodology for the calibration procedure being derived from the manufacturers' instruction handbooks and from the AURN Site Operator's Manuals, as follows:

- Pre-calibration check - the site condition and status of the analyser is recorded prior to the zero/span check being conducted;
- Zero check – the response of the analyser to the absence of the gas being monitored;
- Span check – the response of the analyser to the presence of the gas of a known concentration;
- Post calibration check - the site condition and status of the analyser upon completion of all checks.

Each analyser zero/span check is fully documented with records being kept centrally and at the analyser locations. Calibration factors are kept on spreadsheets and used in the scaling and ratification process.

5.1.3.1 Analyser Calibration

A two point calibration is conducted on Bristol City Council analysers with a reference NO mixture at a concentration of approximately 470ppb. Gases are supplied and certified by BOC.

5.1.3.2 Zero Air Generation

The contents of the portable scrubber (hopcalite, activated charcoal, purafil and drierite) are changed when necessary or at least every six months.

5.1.4 Data Scaling, Validation and Ratification

Since November 2004, the Airviro system has been decommissioned and all data from continuous analysers is now collected by Opsis Enviman Comvisioner software. The raw data from the machines is stored as monthly binary packed logger data files. These data are then converted to ASCII format files stored on a network drive, which is covered by the normal data recovery routines used on the council's network. On a monthly basis the ASCII files from all sites are inspected in a purpose built spreadsheet and the calibration factors applied. Spurious or doubtful data is removed and the time period is flagged with a number representing the reason why the data were removed, e.g. machine faults. Some data, in particular those from background sites, are also subject to a secondary rescaling to take account of minor zero drift. These ratified data files are then saved in the same folder as the original ASCII data file and are accessed through the Opsis Enviman Reporter software.

A set of guidelines is being written to assist in identifying the appropriate response to different problems with data quality. This will ensure that data is dealt with in a consistent, rational and traceable way.

5.2 Diffusion Tubes

Bristol City Council Scientific Services carries out the placement and analysis of its diffusion tubes for both BTX (Benzene, Toluene and Xylene) and nitrogen dioxide. The laboratory is accredited to UKAS for a variety of tests in areas such as food, consumer safety, microbiology and asbestos. The lab is not currently accredited to UKAS for the analysis of diffusion tubes. The current policy of the lab is to seek accreditation only when absolutely necessary. This is due not only to the expense of accreditation but also the lack of flexibility encountered in the other areas.

Bristol City Council Scientific Services participates in the Workplace Analysis Scheme for Proficiency (WASP) for both nitrogen dioxide and BTX tubes.

In the case of nitrogen dioxide the laboratory also analyses a solution supplied by AEA Technology Environment as part of the QA/QC scheme that they run. Results are returned to AEA Technology on a monthly basis. The laboratory also participates in occasional field comparison exercises again run by AEA Technology Environment.

Reference materials and equipment are obtained from suppliers who are approved to BS EN 9001. All reference materials are of at least analytical grade or equivalent. Standards are prepared using equipment that is all within the normal quality system.

5.2.1 Bias Adjustment (NO_2)

The bias adjustment factor (BAF) calculated in 2003 was updated with data from collocation studies in 2007. Ratified scaled data from BCC and national network sites was compared with annual mean raw diffusion tube data measured as close as possible to the sample inlets of the continuous analysers. Triplicate tubes were used for all sites. Only sites where data capture was greater than 90% were used in the study. The data used for the calculations is shown in Table 18 and Table 19.

The bias adjustment factor for 2007 was found to be 0.88. This was an improvement on the previous years factor and reflects the close agreement between the continuous analyser and the diffusion tubes at Rupert Street.

The annual (2007) BAF will be used when reporting current diffusion tube data.

Site	Diffusion tube concentration µg m^{-3} (raw)	Ratified continuous analyser concentration µg m^{-3}	Data capture (%)
Rupert Street	120	99	90.0
Brislington	40	34	99.7
Trailer	35	26	99.5
Shiners Garage	51	41	99.7
Parson Street School	51	50	99.3
Avon Probation Service	78	56	98.9
Economy Cars	46	39	99.9
St. Pauls Day Nursery	37	31	91.5
Old Market	63	61	97.2

Table 18 Data used for calculation of 2007 Bias Adjustment Factor

Average bias for sites where data capture > 90%	Average BAF 2007	Average BAF 2003	Composite locally derived BAF 2003 - 2007
0.13	0.88	0.85	0.87

Table 19 Summary data for composite Bias Adjustment Factor

5.2.2 Bias Adjustment (Benzene)

In order to update the Bias Adjustment Factor for benzene, the annual mean benzene concentrations from the pumped BTX tube at Old Market were compared with the concentrations from the BTX diffusion tube co - located at the continuous analyser site. The pumped tube is analysed by NPL, while the BTX diffusion tube is analysed by Bristol Scientific Services in the same way as all other BTX diffusion tubes.

The pumped tube is assumed to be the reference method for the purposes of this analysis.

	Annual mean benzene concentration µg m^{-3}
BTX Tube	1.60
Pumped Tube	1.34

Table 20 Summary data for BAF calculation (benzene)

The bias was calculated as 0.04, and the Bias Adjustment Factor is therefore 0.84. This is lower than the previous BAF for benzene of 0.967 but still higher than an earlier factor of 0.6.

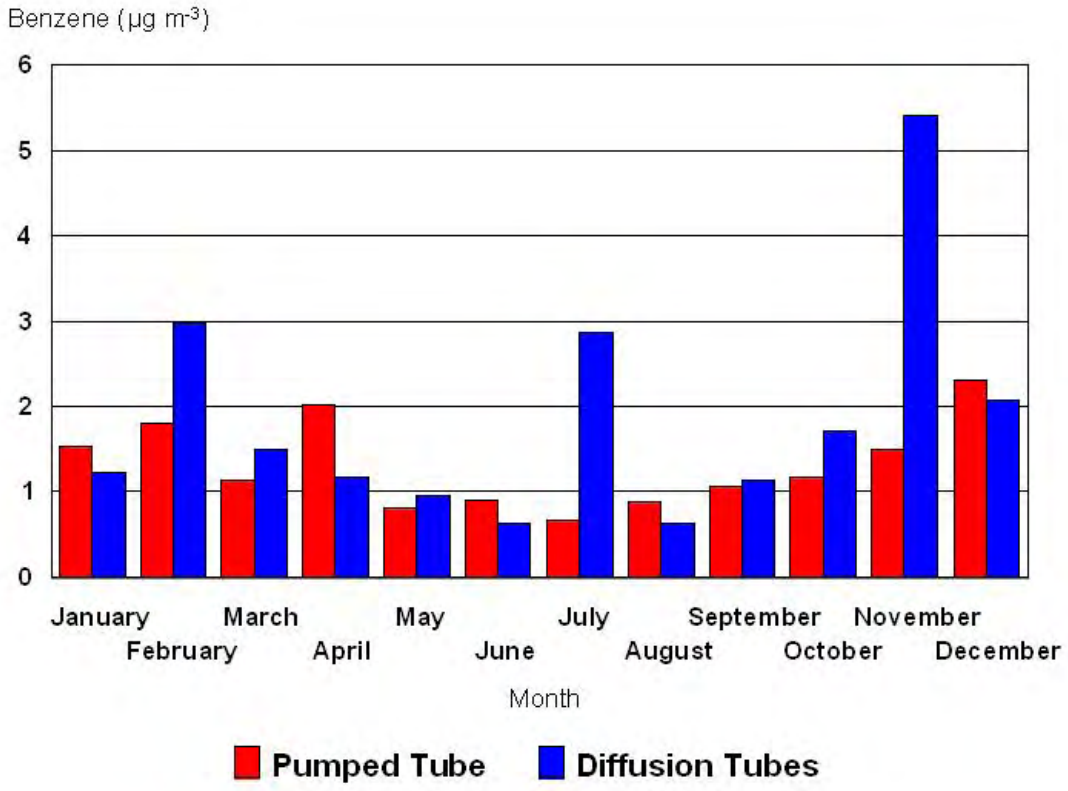

Figure 47 Comparison of monthly mean pumped tube and BTX diffusion tube benzene concentrations at Old Market, Bristol: 2007

6 New Local Developments and Progress on Previously Reported Developments

Appendix 1 lists all the “super major” planning applications that have been received or which have been the subject of pre-application discussions with those that have either identified or potential air quality issues highlighted in bold red type.

6.1 Bristol Arena

In previous reports this area was reported as being proposed for development in part as 10,000 seat multi-purpose indoor arena for sports, music conferences and other events and in part as a mixed-use development providing a leisure and entertainment destination. This proposal has now been withdrawn and the future of the site is now uncertain.

A continuous NO_X analyser monitoring site was established in 2005 to monitor the impact of the proposed development (see 4.5.1.4 above). It is proposed that this monitoring should continue for the time being to assess the impact of any future proposed development. The site is illustrated in Figure 48 below.

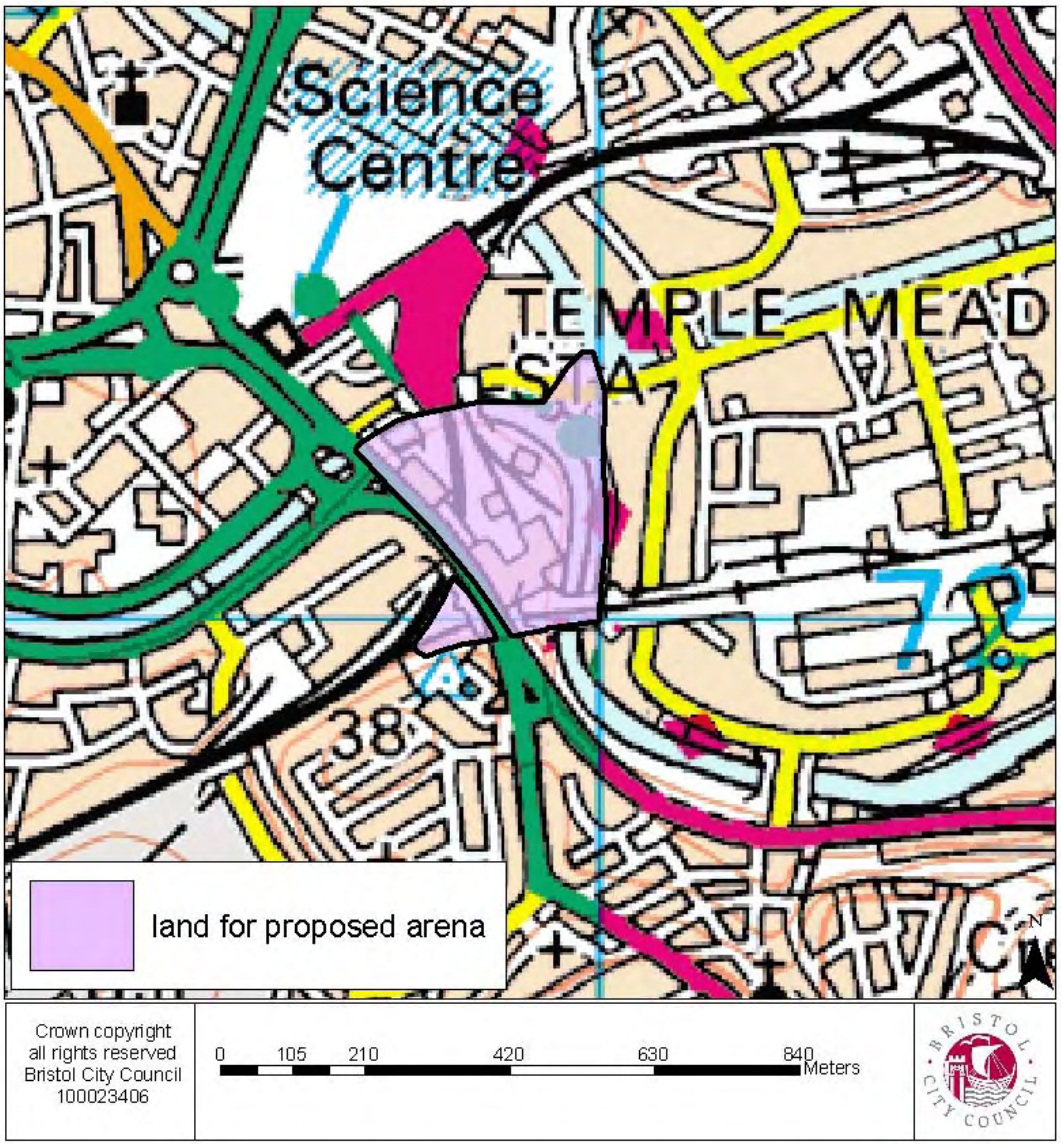

Figure 48 Land originally earmarked for proposed Bristol Arena Project

6.2 Broadmead Expansion (Cabot Circus)

In 2002 a planning application was received for a major expansion of the central shopping area in Bristol, Broadmead. This involved major changes to the road network at the south end of Newfoundland Way and its junction with the inner ring road, Bond Street. Further details are available from the official application (No. 02/02929/P/C) and the associated Environmental Statement. A full air quality assessment was conducted for the development, including dispersion modelling of the proposed new road layout.

As it was likely that air quality would deteriorate as a result of this development within the AQMA with residential development in close proximity to the major roads approval of the application was subject to a number of conditions. Substantial funds were secured from the developer by the Environmental Quality Unit to provide comprehensive monitoring of air quality within the development area before, during and after development.

Monitoring of the "before" phase using a continuous NO_X analyser commenced in late 2004 and is covered in section 4.5.1.3. In addition a comprehensive network of diffusion tubes has also been established to monitor ambient before, during and after construction.

The development was originally due to commence in late 2004 and some of the road realignment was carried out in that period. Although there were hopes that at least some parts of the development might be completed by late 2007 it is now anticipated that the development will open in September 2008. During the construction phase, and in particular the highway realignment, there were periods of severe congestion in the central part of Bristol and it is believed that this contributed to the exceedence of the hourly average objective for at the Bristol Old market site in 2005 and possibly to the generally high concentrations of recorded at the Rupert Street site.

Funds have been secured under a section 106 agreement with the developer to assist in funding Air Quality Action Plan measures within the development area. In particular, attention will be given to any changes in air quality following the opening of the development. Initial thinking on the use of this funding centres around options for improvements in the Frome corridor, travel plans for workers in the Broad mead area as a whole, walking and cycling provision in the Cabot Circus area and provision of signs on the approaches to the Broadmead area relating to both air quality and noise. These need to be worked up into a project plan. An application has been made for Air Quality Grant funding to support a community consultation and prioritisation exercise to assist in this process.

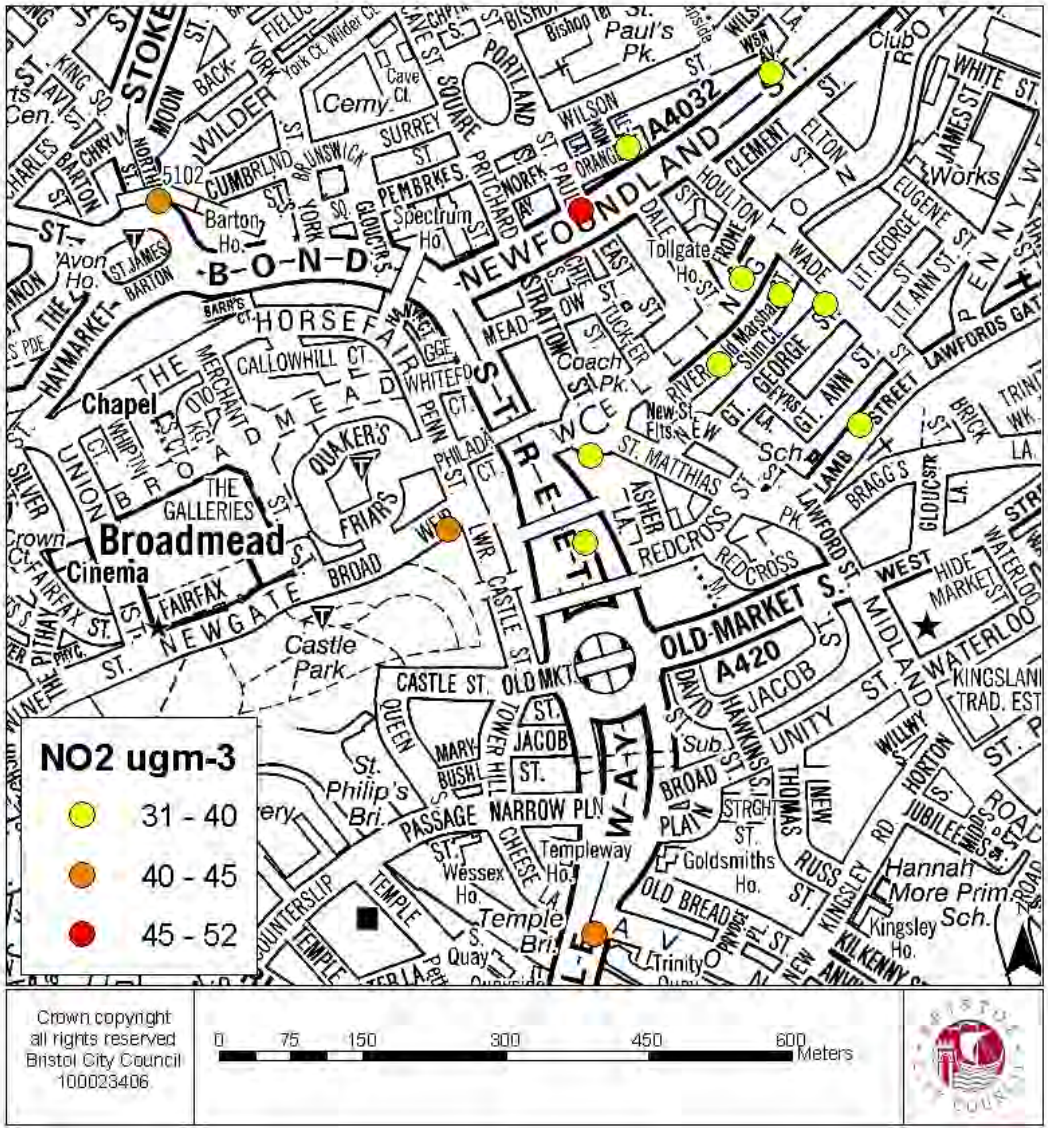

Figure 49 Locations and annual mean concentrations of Broadmead expansion diffusion tubes: 2007

6.3 Temple Quay North.

This development is part of a comprehensive redevelopment of the Temple Quay area, a considerable proportion of which has already been completed. Originally proposals were put forward in 2003 but were then deferred. The application has now been resubmitted. Given the level of monitoring already in place in this area it is unlikely that any further monitoring will be required if this development is approved but it is likely that a section 106 agreement will be sought to mitigate any adverse air quality impacts.

6.4 Memorial Stadium.

This development lies just outside the boundaries of the AQMA along the A38 Gloucester Road but does have the potential to have an impact on air quality. Currently the stadium has a capacity of 12,000 with seated accommodation for 2,837. The proposal is for an expansion of capacity to 18,000 seated (total 18,500). The Air Quality Assessment concluded that the impact of the increased capacity on annual average concentrations of NO_2 would be negligible. This assessment, however, makes a number of assumptions in relation to the effectiveness of a number of measures designed to discourage the use of private cars and encourage the use of other modes of transport by people attending matches.

6.5 Proposed Deep Sea Container Terminal at Avonmouth Docks.

In 2007 the Bristol Port Company submitted an application to DfT for a new deep sea container terminal in Avonmouth Docks. At present the Environmental Impact Assessment has not been completed but it is known that it will address the main areas of concern. The first of these is mitigation of emissions during the construction phase. The second is emissions of sulphur dioxide from shipping using the terminal and the third is this impact of movements of the containers to and from the terminal. The intention is to encourage the use of rail transport and this is one reason for preferring the Avonmouth Docks for the terminal as the rail facilities and especially connections here are far superior to those at Royal Portbury Docks. It is inevitable, however, that a considerable proportion of the containers will be transported by road and, again, this is a reason for preferring the Avonmouth Docks as access to the motorway network is superior to that at Royal Portbury Docks.

This development will be kept under review and future reports will detail progress. Although the Avonmouth AQMA has been undeclared and the specific area under consideration did not lie inside the boundaries of that AQMA it is important to ensure that the development does not result in the declaration of a new AQMA. The City Council has only limited influence over this, however, as the proposal is being made as a Harbour Revision Order under the Harbours Act 1964 and will be determined by the Secretary of State for Transport.

6.6 PPC processes.

Since the Detailed Assessment in 2006 there have been no new Part A1 or A2 processes authorised in the Bristol City Council area. 27 new Part B applications have been processed but as 20 of these were for dry-cleaning processes and related to solvent use, 4 for petrol filling stations and 3 for mobile crushing plant there are no LAQM implications.

7 Progress in Implementing Action Plan Measures

	AQAP Measure	Progress	Comments
1	Information & Awareness	Continued promotion of driver behaviour materials and integration of air quality issues into wider BCC publicity and transport awareness work. Improved Air Quality web pages on Council's web site. Real-time bus information now available on web site. Continued promotion of Thank You for Not Driving and Switch Off campaigns including new signs at schools and other locations. New journey planner currently being developed.	There will be an increased focus on Smarter Choices measures including information and awareness provision. Environmental information will continue to be integrated into other initiatives but there are insufficient resources to introduce a widespread and sustained campaign specifically focussed on air pollution.
2	Travel Plans	Continued progress being made on workplace travel plans through LTP and Planning process. Sustainable Schools Strategy being developed. Additional focus on school travel plans to increase the take-up rate and achieve the target of all schools having a travel plan by 2010. 118 schools now have travel plans.	Air Quality elements to be included in Healthy Schools Initiative (Heels and Wheels) and do not require additional AQAP funding. Additional resources allocated to continue work with a further set of schools in 2008/09. There are insufficient resources for additional workplace travel plan measures.
3	Safer Routes to School (SRS)	SRS approach being integrated into the Health Schools initiative described in 2 above and delivered through LTP.	
4	Personalised Travel Planning (PTP)	7th PTP project completed in Bristol in 2007. The project was extended to promote the newly completed showcase bus route through a nearby area. Changing driver behaviour to reduce emissions was an integral part of this project. Previous projects have achieved around a 10% decrease in car trips among participating households. Further areas planned for 2008/09.	PTP is now an integral element of the Councils Smarter Choices programme and will be delivered to a further areas of Bristol over the next three years.
5	Walking & Cycling	Progress being made through LTP with an 12% increase in cycling since 2006 and 80% increase since 1998, and a 16%	Pedestrian and cycle improvements to be incorporated into Greater Bristol Bus Network Major Scheme (GBBN) programme of works now

		increase in walking last year and a 38% increase since 2001. No additional AQAP measures introduced.	due to commence in 2008/09. Submitted bid for Cycle England Cycle City Demonstration Pilot, outcome expected September 2008. Connect2 cycle route from Nailsea to Bristol to be developed in partnership with Sustrans. Pilot city centre bike rental scheme (Hour Bike) to commence in 2008. Internet cycle trip planner to go live in 2008.
6	Car Clubs	The Bristol Car Club has continued to expand and now has 39 cars and 600 members. Since the pilot project ended in 2006 the club has continued to operate without Council subsidy. Growth of the club continues to be boosted by funding secured by the Council through Section 106 contributions from planning applications.	Continue to expand the number of dedicated on-street parking bays, and include bays in other schemes e.g CPZs, City Car Club aim to have 100 bays in Bristol by the end of 2009.
7	Reallocation of road space	Implementation of bus priorities through LTP Showcase Bus Routes programme. Works on the A420 corridor were completed in 2007. Greater Bristol Bus Network design work is continuing with on-street works due to commence in 2008/09. Revised Bristol Road Hierarchy to sign through-traffic away from polluted areas of central Bristol.	Additional AQAP funding for this measure not currently required. City Centre Review to investigate allocation of road space in central Bristol and options for conversion of road space to major public transport interchange. Road reclassification application to be submitted in 2008.
8	Improved enforcement of existing speed limits	Some progress through LTP but no additional AQAP measures introduced.	Measure currently not funded through AQAP but continued support for Safety Camera Partnership from the Council.
9	Area based speed reduction	Progress on 20 mph zones around schools and adjacent to Showcase bus routes delivered through LTP but no additional AQAP measures introduced. Draft Road Hierarchy Review proposes 20 mph speed limit in all residential areas.	This AQAP measure is currently not funded. Area based speed limits could be rolled out as part of other schemes e.g. Residents Parking Zones.
10	UTMC	Major upgrade of Bristol's UTMC system is underway including a new traffic control room, expansion of the SCOOT network and automatic number plate recognition (ANPR) and CCTV systems, which will enable better management of traffic and handling of road incidents.	In addition to improved network management, new systems such as ANPR will enable better monitoring of changes in the environmental performance of vehicles and enable more accurate air quality modelling.

11	Traffic Management at pollution hotspots	Scheme being progressed to alleviate traffic problems at one of the worst polluted junctions in Bristol (adjacent to Junction 3 of M32). No further Switch Off signs will be installed following DfT's decision not to authorise their use as permanent highway signs.	Other measures may be considered at hot-spot locations as part of core traffic management programme.
12	Parking enforcement and management of delivery times	Review of Council's parking strategy and enforcement programme is completed. Targeted enforcement remains a core activity of the Council's parking management strategy and Showcase bus route programme. Plans to introduce extensive Controlled Parking Zones are being drawn up. A significant number of older vehicles have been removed from the roads and scrapped as a result of the Council's tow-away scheme.	Anticipated that new regulations allowing use of CCTV for traffic enforcement will enable more effective enforcement of main traffic routes.
13	Motorway speed management	Speed limits to be reduced on southern end of M32 as part of bus lane scheme (see below). More extensive speed limit reductions likely if further bus lanes are introduced as part of M32 Park & Ride. Following detailed monitoring and modelling it is proposed to remove the AQMA designation alongside the M5 at Avonmouth.	Any further proposals to change speed limits will be part of bus priority / Park & Ride proposals (see 14 below)
14	M32 Management	Proposals for a new 1250m bus lane and reduced speed limits through junction 3 of the M32 are awaiting final completion of Greater Bristol Bus Network funding agreements with DfT. The scheme is scheduled to commence in July 2008 and will deliver substantial benefits to bus passengers on this congested section of the M32 which serves central Bristol. Further bus priority measures, speed management measures and Park & Ride on this corridor are being considered. Further measures will be dependent on the co-operation of the Highways	Work is continuing on developing proposals for further bus priority measures and a Park & Ride site on the M32.

		Agency who is responsible for the management of this Motorway.	
15	Freight consolidation centres	The Bristol freight consolidation scheme now serves 63 retailers in central Bristol and will be integrated in to the new £500m shopping centre (Cabot Circus) from September 2008. Delivery vehicles movements among participating firms have been reduced by 73% Consolidation vehicles are also to be granted permission to use the inbound bus lane on the A4 Portway. A 9 tonne electric delivery vehicle was successfully trialled in 2007 and it is anticipated that a similar electric truck will be introduced for full time operation in late 2008.	The scheme continues to receive financial assistance from the Council but it is hoped that the operation will become commercially viable in the future.
16	Reduce emissions from poorly driven vehicles	Continued promotion of better driving through 'Cut your car costs' information and eco-driving courses. Pilot project resulted in an average 7% improvement in fuel consumption. A second phase of eco-driver training and monitoring are currently underway. Eco-driving materials are included it the Council's Personalised Travel Planning projects. (See also lorry driver training – no. 24 below)	Further development of eco-driving materials and driver training planned for 2008/ 09.
17	Vehicle maintenance / roadside testing	Pilots of vehicle pollution sensing equipment to detect and identify grossly polluting vehicles in motion were undertaken on major traffic routes in 2006 and 2007. The pilots revealed that there are a number of technical issues than need to be resolved before it can be widely utilised. .	Not considered cost-effective until costs of equipment reduces and technical issues are resolved. .
18	Encouragement of more efficient vehicles	Advice on vehicle choice is included in the Council's eco-driving booklets and driver training and personalised travel planning programmes. A wider promotion strategy has not yet been developed. Initiatives for new vehicle purchases will build on the new environmental labelling scheme for new cars.	Vehicle choice information to be included in wider promotional materials where possible but there is currently insufficient funding to resource specific campaigns / materials for this AQAP measure.
19	Promote / pilot	Bristol City Council maintains a	Termination of the EST Clean-Up

	alternative fuel vehicles	large fleet of alternative fuel fleet vehicles, which totals over 100 LPG and hybrid vehicles. New fuels / technologies will be evaluated when they become viable.	programme and the end of the EU-supported VIVALDI project have reduced the resources available for this work area. Work will continue where funding is available e.g. securing an electric truck for the freight consolidation centre, and potential trial of electric charging points in Council car park. As part of Council's green Capital Initiative, further promotion of more efficient vehicles will be carried out both corporately and with partners outside the Council.
20	Advice / incentives for cleaning up large vehicles	No further vehicles fitted with pollution reduction devices owing to termination of the Energy Savings Trust grant funding, reliability issues reported by operators and concerns over particulate filters resulting in an increase in direct NO_2 emissions.	Tackling emission from buses remains a key element of the AQAP. Financial assistance to bus operators to re-engine vehicles may be considered if the use of the Traffic Commissioner's powers are progressed (see action 23 below).
21	Retrofitting smaller vehicles	Low Emissions Strategy study calculated that this action was not cost-effective. More than 97% of Pre-Euro vehicles have been already been scrapped and more recent vehicles are technically more difficult and costly to retrofit.	There are currently no plans to progress this measure.
22	Scrappage incentives	A significant increase in vehicle scrappage rates has occurred as a result of removing untaxed vehicles through more targeted parking enforcement and police activity. Less than 3% of cars on the roads are pre-Euro 1 compared with 30% 5 years ago,	With limited resources the focus of the AQAP will be on more cost-effective measures. Concerns that improvements in Euro standards are not translating into improved air quality raise questions over the cost effectiveness of scrappage schemes.
23	Bus emissions standards	Actions to clean up the bus fleet were the most cost effective measure in the Low Emissions Strategy study (see action 25 below). A strategy to clean up buses is still being considered and may result in a formal approach to the Traffic Commissioner regarding the use of new powers to regulate emissions from buses. GBBN, Showcase 2 and other matched investment will result in a significant modernisation of the bus fleet in Bristol over the next few years.	Strategy to clean up buses was reassessed following experience of operators with retrofit systems. Re-engining is being examined as an alternative to retrofitting. Negotiations have been delayed by senior management changes at the major bus company.
24	Promote / assist	Age of local HGV fleet is turning	Further SAFED lorry driver training

	freight emissions agreements	over relatively quickly with over 80% of HGVs in central Bristol meeting Euro 3 or better emissions standard, Assistance has been focused on driver training with Safe and Fuel Efficient Driving training (SAFED) being delivered by the Council as part of the EU supported START Project.	will be provided in 2008/09
25	Low Emission Zone	As reported in 2007 Low Emission Strategy feasibility study concluded that the costs of setting up and running an LEZ would be prohibitive but these costs could be potentially be reduced if linked to other infrastructure (e.g. congestion charging). The study recommended bus emissions management measures as the most cost-effective method of reducing NOx emissions in Bristol.	Work will continue to develop a strategy for managing bus emissions (see 23 above).
26	Road User Charging	Development work on a Transport Innovation Fund (TIF) package incorporating a congestion charging scheme with associated complementary measures (including Bus Rapid Transit) has continued during 2007 and the Outline Business Case will be submitted to DfT in Summer 2008.	Work will continue on the TIF submission during 2008/09.

Table 21 Summary Table: progress on Air Quality Action Plan (AQAP) measures

7.1 Delivering AQAP Measures

7.1.1 2008/09 Programme

The programme for 2008/09 has been limited by financial constraints. The proposed de-trunking of the M32 which would have enabled the implementation of lower speed limits and other measures with the potential to improve air quality has been withdrawn. In spite of this there have been a number of successful initiatives as listed above.

7.1.2 2007/08 Programme

The AQAP programme for 2007/08 focussed primarily on retrofitting buses as the most cost-effective short-term measure to reduce emissions. It was planned to fit

130 CRT systems and 20 De-NO_X systems. However a combination of the lack of availability of EST funding, the reduction in levels of CleanUP grant and the reluctance of the major bus operator to participate in voluntary retrofit programmes severely curtailed the planned retrofitting programme. The CRT programme was scaled down to 60 vehicles, however difficulties with the administration of the grant system by EST resulted in only 27 vehicles being fitted despite a willingness of operators to participate in a larger programme. A trial of 6 EGR De-NO_X systems has also commenced.

Work continued on awareness initiatives and a number of innovative projects through the EU-supported VIVALDI project.

8 Local Air Quality Strategy

In line with government recommendations on regional efforts to improve both air quality and transport planning, a regional air quality strategy has been developed. This strategy addresses the need to integrate transport policies across the former Avon authorities to deliver clean air.

The strategy can be viewed online at
http://www.uwe.ac.uk/aqm/centre/region/index.html

9 Integration of Air Quality in Development Control Process

Air quality impacts of new developments are fully integrated into the planning process through a protocol for liaison between the environmental quality team, providing the expertise on air quality issues, and the development control team who co-ordinate the planning process.

The protocol details the extent of the roles of each team and provides an outline of the relevant legislation and guidance for this issue. There is also a step by step guide for planners and developers which includes examples of previous developments and how these were handled in terms of their impacts on air quality.

The full protocol is not reproduced here, but copies are available on request and a revised version will shortly be available via the city council website.

10 Emissions Inventory

An emissions inventory has been constructed for Bristol for the calendar year 2005. This will be updated for 2006 and 2007 during 2008 and 2009 subject to grant approval from DEFRA.

11 APPENDIX 1: SUPER MAJOR PLANNING APPLICATIONS

SITE	PROPOSED DEVELOPMENT
Replacement PRCS	N& HS proposal to replace lots of sick buildings with new ones, and increase the density, take away 560 houses bring back 900. Four sites in Sea Mills, Lockleaze, Lawrence Weston and Henbury.
St Mary le Port site, High St/Wine St.	Mixed use retail, residential, office and hotel
Filwood Broadway	Mixed use redevelopment. Part of the Knowle West Regeneration Area
Former Bridewell Police & Fire Station	Mixed use development
M32 Park & Ride Site, Frenchay Park Road	New Park & Ride site.
Land at Ashton Vale	New Stadium for Bristol City FC plus new housing
Silverthorne Lane, St Phillips	Mixed Use Development 600 Residential units and 4,000m2 commercial
Land at Stapleton Road	Mixed use – retail, residential, office and hotel.
Bristol General Hospital	To be decided
Staples, Houlton Street	Unknown
New Bridewell	Unknown
Union St/Silver St.	Retail / residential mixed use.
Southmead Hospital	Redevelop site to combine Frenchay with Southmead. EIA development.
Hewlett Packard	Site part in S Glos and part in Bristol. 1250 No houses plus employment land Local Centre. Includes Romney Avenue. Bus link to UWE. EIA development.
Avonmouth Wind Turbines	Three Sites (a) Wessex Water (b) BCC Land, Severn Road (c) Smoke Lane All need EIA's
Bristol University Building	Bio/Geo Building. Within area of SPD12
103 Temple St / 111	Office development (>10,000 sq m)

SITE	PROPOSED DEVELOPMENT
Victoria St, Redcliffe	
Arena Site (Former Diesel Depot site), Bath Rd, Temple Meads	To be established.
JV Land / Plot 6, Temple Meads	Mixed use redevelopment incl. Reprovision of station car parking
Hengrove Park (i) PFI Leisure Centre (ii) Computershare (iii) Constellation Europe	Phase 1 proposals (i) PFI Leisure Centre (ii) New HQ office building (iii) New HQ office building
R/o 171-179 Coronation Road	Proposed residential development (133 units)
Union Street/Wine St	Discussions regards a new masterplan (office/ retail) for this street block.
Cotham School	Part of Building Schools for the Future "Wave 4" Project – remodelling
St Mary Redcliffe School	Part of Building Schools for the Future "Wave 4" Project – remodelling
Ashton Park School	Part of Building Schools for the Future "Wave 4" Project – remodelling
Florence Brown Special School, Knowle West	Part of Building Schools for the Future "Wave 4" Project – remodelling
Hengrove Academy	Part of Building Schools for the Future "Wave 4" Project – remodelling
St Bernadette School	Part of Building Schools for the Future "Wave 4" Project – remodelling
Dove Lane, St Pauls	Mixed Use redevelopment (700 resi units, 20000 sq m employment, 5-8000 sq m retail, comm facs & hotel)
Redcliffe Village	Mixed use masterplan proposal (residential/business/community facilities/road narrowing).
Central Trading Estate, Paintworks Site - phase 3	15,535 square metres of commercial/employment floorspace, 4,510 square metres of live-work floorspace to replace the existing 10,200 square metres of employment floorspace, 234 dwellings consisting of 70x 1-bedroom flats, 140 two-bedroom flats and 24 3-bedroom flats, a restaurant and creche covering a combined floorspace of 455 square metres.
Imperial Park	5.3 hectare site. Mixed use development proposed including commercial and residential development.
Bristol Deep Sea Container Port	Land reclamation of part of Severn Estuary and Extension of Bristol Port to service existing large container ships and future generations of Ultra Large Container Ships (to Port Capacity of 1.5 million containers a year). Capital Dredge of River Severn. Harbour Revision Order to cover majority of works.
Carlton Court, Westbury-on-Trym	Existing 1960's low-rise shopping centre, loading bays and surface parking to be demolished and mixed use redevelopment of site (A1 & C3).

SITE	PROPOSED DEVELOPMENT
Elizabeth Shaw, Greenbank	Conversion from existing factory use. Erection of new-build residential led mixed-use development.
Garage Strategy Project	Redevelopment of numerous (up to 300) garage sites
Dorian Road – Prefabs	BCC proposed replace prefabs with 300 houses.
Bonnington Walk	Up to 154 houses – allocated housing site, and a wildlife network site. Applicant is (BCC) N&HS.
Westmoreland House, Stokes Croft	Part refurbishment/part demolition of existing Listed buildings to provide 200 flats and an arts complex with associated basement car parking. (Running alongside CPO process)
80 Stokes Croft (Finance House)	Conversion and extension of existing B1 office building to provide 68 flats, retail/café unit and 90 sq.m office floorspace with construction of 15 new residential units.
Former petrol filling station on land between Totterdown Bridge and Bath Road.	Redevelopment of the former Esso petrol filling station with the erection of four residential buildings (one block containing a 12-storey tower) to comprise of 108 self-contained apartments (mix of 1 & 2 bedroom), 3 live-work units and five terraced town houses. The provision of 3 vehicular access points from Bath Road, 121 car parking spaces and 116 cycle parking spaces (to include two levels of under croft car parking), a riverside walkway, amenity areas and associated landscaping.
St Matthias Campus, Oldbury Court Road,	Outline application also including the detail matters of 'Layout', 'Scale', 'Access' and 'Landscaping' for the Phased Development of the campus including new 3, 4 and 5 storey buildings for Administration, Teaching, Student Facilities and Student Residences, and an extension to the Chapel building; extend the existing car park off Oldbury Court Road; provide new car parking areas towards College Road including new vehicular access and internal road to serve a car park on the disused tennis courts site; provision of internal walkways and landscaped areas.
Nestle, Avonmouth	Residential Development of 89 houses and apartments.
Urban Splash, Imperial Park	Application for increase in units from 358 to 402 resi and 17 live/work units from approved scheme.
Memorial Stadium, Filton Avenue	Regeneration of existing stadium to provide a new 18,000 seated (18,500 capacity) stadium and ancillary accommodation, hotel (84 rooms), 105 student flats (546 rooms), restaurant, convenience store, conference facilities, offices, associated car, coach and cycle parking, landscaping and associated works.
Redcliffe Wharf	Residential & other uses

Table 24 Current "Super Major" planning applications: developments with potential air quality impacts highlighted in red