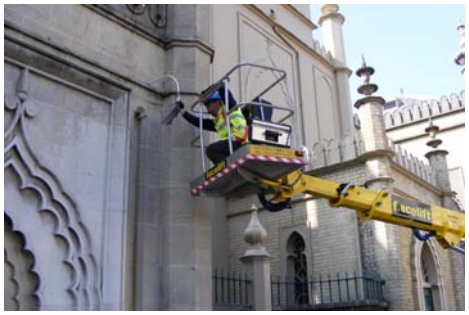
2009 Air Quality Updating and Screening Assessment for *Brighton and Hove City Council*

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

April 2009



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Executive Summary

Brighton and Hove City Council (BHCC) are required to carry out a Further Assessment for Nitrogen Dioxide (NO_2). This follows declaration of an expanded Air Quality Management Area (AQMA) in 2008 for the long and short-term NO_2 objectives. 2008 annual monitoring shows an improvement in Nitrogen Dioxide concentrations at more than 80% of passive monitoring sites. The annual mean NO_2 Air Quality Strategy (AQS) objective continues to be exceeded at a number of near to road façade locations within the AQMA (Air Quality Management Area).

Continuous analysers, record that summer 2008 was especially good for low concentrations of Nitrogen Dioxide, and the Annual Mean was the lowest concentration recorded during the past decade at Hove Roadside.

Brighton and Hove City is the majority constituent of the Brighton-Worthing-Littlehampton conurbation, accounting for 53% of the total urban population. Projections of population growth since the 2001 census estimate a total urban Brighton-Littlehampton populace to be approximately 494,000 by January 2010. This conurbation is England's tenth largest. This observation is relevant for air quality as Defra have identified the urban-zone as an agglomeration with regional target for the reduction in ultra fine particulate matter, $PM_{2.5}$. The 2008-AQMA, does not include declaration for any pollutant other than Nitrogen Dioxide.

A new monitoring location for continuous analysis of fine particulate matter is to be introduced in time for 2010. Furthermore a new triplicate co-location site has been set up at Brighton Roadside to assist with annual bias-correction of diffusion tubes. It is intended that this co-location study will compliment the existing one at Hove Roadside. BHCC currently has over eighty NO_2 diffusion tubes at; background, near-school, near-hospital, roadside and façade locations. None of the tubes are specifically characterised as industrial monitors. For 2009 the council has increased; number and geographical coverage of passive NO_2 tubes. Several of these new monitoring locations are either outside of the 2008-AQMA or near to its boundaries.

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1 Introduction

1.1 Description of Local Authority Area and Sources

Brighton and Hove City Council (BHCC) is the main constituent of the Sussex South Coast conurbation sometimes referred to as "Greater Brighton", including the West Sussex towns of Worthing and Littlehampton. The conurbations estimated population by January 2010 is approximately 494,000 with 53% residing within BHCC[1&2].

The indentified urban area has the highest population density in England outside of London estimated to be 5,000 people per 1km^2 around 2005[3]. Settlement is bounded by the South Downs Area of Outstanding Natural Beauty (AONB) to the north and the English Channel to the south. The secretary of state has decided to accept the Designation Order boundary for the South Downs National Park subject to a number of modifications as set out in his decision letter of 31st March 2009[4]. The National Park designation will provide long-term restriction on the cities development to the north. Natural England's Acting Chair, said: "The South Downs are a critical green lung for the South East". Brighton's future growth aspirations will be restricted to the existing conurbation area. It is most likely that central developments will increase population density within the 2008-AQMA (Air Quality Management Area). The AQMA is co-located with the cities densest built environment.

Commuters move to and from Brighton especially within the Sussex Coastal Conurbation. Movements are predominately by train, bus and private car. Bicycle use has shown considerable increase in recent years. Brighton & Hove has been selected as national exemplar Cycling Town from 2009 to 2011. The sea front cycle lane now sees in excess of 2,000 bicycle movements per day[5]. A significant proportion of Brighton's private traffic is attracted to the city rather than produced within it. In addition to regular car commuters, car visitor numbers swell during sunny and warm weather. Bus usage in the city continues to increase and is the highest in the UK outside of London. Brighton and Hove busses have one of the newest bus-fleets in the UK, and many engines comply with the Euro Four standard[6].

Compared to other UK conurbations of a similar size Brighton has very few combustion plants or heavy manufacturing industries. There are no IPPC; Part A1 or part A2 processes located within the council area. The nearest industrial process regulated by the Environment Agency (EA) under EPR (Environmental Permitting Regulations 2007) is the Shoreham Power Station on the site of the former "Brighton B-Power Station". It is 1400 m from the council's western boundary. The installation is a modern 400-MW Combined Cycle Gas Turbine (CCGT) power station, and after a brief absence it was re-connected to the national grid with a newly engineered transformer in October 2007[7]. In the past dispersion modeling has been carried out by the EA and consultants RPS. This was to assess dispersion of permitted chimney emissions from Shoreham Power Station and potential impacts on air quality in Shoreham and Portslade i.e. either side of the BHCC/ Adur Local Authority boundary. The detailed assessments suggest a very small process contribution to the short-term objective for Nitrogen Dioxide.

There are two crematorium in East Brighton, they are both surrounded by extensive green space and are a significant distance back from the Lewes Road and Vogue Gyratory (A270); identified previously as an air quality hotspot. As part of a burden sharing agreement Woodvale Crematorium has opted-out of fitting mercury abetment technology. The Downs crematorium is committed to investment and installation of this new technology in the near future.

[1] Population data from the 2001 Census; http://www.brighton-hove.gov.uk/downloads/bhcc/citystats/1_CityProfile.pdf
[2] Assumes 0.5% growth as stated http://www.adur.gov.uk/facts-figures/population.htm#totals for eight years to end 2009. BHCC proportion of total conurbation population assumed to be constant since the last census.
[3] Population density in the Brighton-Worthing-Littlehampton Conurbation reference: http://en.wikipedia.org/wiki/Brighton/Worthing/Littlehampton, Estimation based on 2001 Census data and assuming 0.5% growth since 2001.
[4] http://www.defra.gov.uk/wildlife-countryside/protected-areas/national-parks/south-downs/index.htm,
[5] http://www.brighton-hove.gov.uk/index.cfm?request=c1000145
[6] http://www.buses.co.uk/pdfs/env_report2008.pdf
[7] http://www.engineeringtalk.com/news/abf/abf150.html

Brighton and Hove City Council - England

Permission has been agreed in principal for two new wood-fuelled heating plants at mixed use developments. Developers have submitted detailed assessments, including dispersion modelling predictions of pollutants at future receptor locations and the council has made thorough comments relating to air quality. The General Hospital (outside of the AQMA) has phased out its former two-MW Heavy Fuel Oil (HFO) station to be replaced by a number of smaller natural-gas fired boilers in accordance with the Clean Air Act (1993). The more substantial County Hospital (site partially within the AQMA) as part of its continued expansion proposes to install a modernised power provision which is expected to reduce emissions to air.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

1.3 Air Quality Objectives

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

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

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

1.4 Summary of Previous Review and Assessments

1.4.1 All stages completed

A comprehensive list of BHCC Review and Assessment submissions is presented in table 1.2. The previous LAQM (Local Air Quality Management) report submitted by the council was the Progress Report, dated April 2008.

Table 1.2 Order of Brighton and Hove LAQM reports 1999 to 2008

Previous Round of Review and Assessments	Dated
Stage 1 Consultation Draft	January 1999
Stage 2 & 3 Final Report	June 2000
Updating Screening and Assessment	May 2003
Detailed Assessment	April 2004
Progress Report	April 2005
Updating Screening and Assessment	April 2006
Air Quality Action Plan	March 2007
Detailed Assessment	September 2007
Further Assessment	Final Version January 2008
Progress Report	April 2008

1.4.2 Previously identified areas of Exceedence and declared AQMAs

Exceedences of the annual mean Nitrogen Dioxide have been identified in close proximity to busy and congested roads throughout the central areas of Brighton, Hove and Portslade.

Breaches of the hourly objective for NO_2 are localised to Central Brighton within worse-case air quality hotspots. Typically the highest concentrations are in close proximity (< 25 m) to; slow-moving, frequently congested road sections, surrounded by a high density of buildings, but not necessarily within an idealised symmetrical street canyon.

BHCC's 2004 & 2008 AQMAs for NO_2 are presented together in Appendix A. The current AQMA includes the original one and is considerably larger in size. Monitors within the original 2004-AQMA continue to record some of the highest NO_2 concentrations in the city. The 2008-AQMA extends from Arundel Road in the east to Adur District Council in the west, Preston Park & the Old Shoreham Road to the north and the Sea to the south. Other than the NO_2 pollutant previous review and assessments have found no relevant breaches of the AQS objectives, cited in table 1.1.

There is limited air quality monitoring history outside of the 2008-AQMA within the bounds of BHCC. The AURN continuous analyser at Preston Park is approximately 200 metres from the A23 and consequently is characterised as a background monitor outside of the AQMA. The site records compliance with AQS-objectives over a number of years. NO_2 Diffusion tubes located outside of the AQMA consist of; two background and one school location. All three sites have records that began in 1998; a number of years prior to BHCC's first and second AQMA declarations. The three diffusion tubes outside of the current AQMA (not including 2009 introductions) show consistent compliance with NO_2 objectives.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

A map of relevant Automatic Monitoring sites relative to the 2004 & 2008 AQMA declarations is presented in Appendix 1. The former AURN Brighton-Roadside PM_{10} (fine Particulate Matter) partisol analyser was moved in June 2008 on behalf of Defra to the regional background site at Preston Park. The partisol unit now monitors $PM_{2.5}$ (ultra-fine particulate matter) instead of PM_{10}. This change is defra a decision justified by EC directive 2008/50/EC[8] and national $PM_{2.5}$ targets beyond 2010. Oxide of Nitrogen (NO_x) analysers continue to monitor at two roadside sites and one background site; BH1, BH2 and Preston Park. All Carbon Monoxide and Sulphur Dioxide monitoring has ceased as monitoring records for this pollutant show continuous improvement over a long-term duration. QA/QC, calibration, audit and ratification procedures are presented in Appendix D.

In time for 2010 it is proposed that BHCC's MAQMU (Mobile Air Quality Monitoring Unit) be connected adjacent to a busy junction in close proximity to relevant exposure within the Brighton AQMA-hotspot. The Mobile unit will be fixed for at least two years and house one PM_{10} TEOM and one NO_x analyser with co-located diffusion tube.

Table 2.1 Details of Automatic Monitoring Sites

Site Name / Code	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road (m)	Worst-case Location?
Preston Park	Urban background	530526 106218	NO_x, O_3, $PM_{2.5}$	N	N	approx 200	N
BH1	Brighton Roadside	531295 104319	NO_x,	YES	YES	7	N
BH1	Hove Roadside	528963 104731	NO_x, O_3	YES	YES	5	N
BH3	Foredown Tower Backgorund	N/A to USA	O_3	N	N	N/A	N

2.1.2 Non-Automatic Monitoring

A map of all 2008 diffusions tube locations and their bias corrected results is presented in Appendix B. Roadside concentrations of NO_2 presented in the map as $\mu g/m^3$ have not been adjusted using the kerbside calculator (see later section). NO_2 Background diffusion tubes are presented in Table 2.2. Tubes at exposure location such as residential façade or in close proximity to hospitals, clinics and schools are shown in Table 2.3. Roadside tubes are listed separately in Table 2.4. Table 2.5 lists diffusion tubes that are new for 2009. New tube monitoring locations have been introduced in order to establish with better mapping precision the extent of the NO_2 exceedence hotspots and in some cases the opportunity has been taken to relocate former roadside sites to façade at a near by exposure location. New monitoring has also been introduced in new areas such as Marine Drive and Rottingdean that have no previous history of air quality monitoring. The new monitoring sites are inside and outside the AQMA and close to its boundary.

[8] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

Table 2.2 Non- Automatic Monitoring Sites 2008 Nitrogen Dioxide Passive Diffusion Tubes Background sites

Diffusion Tube (DT) Number	Locality Name	National Grid & Height (m)			Year Monitoring started at site	In the Current AQMA?
		X	Y	Z		
DT 20	Southdown Avenue	531,284	106,215	2.9	1997	**No**
DT 26	Kingsbury Street	531,424	105,286	2.7	1994	Yes
DT 56	Ashlings Way	527,255	106,799	3.1	1993	**No**
DT 62	Titian Road	527,742	105,139	2.7	1998	Yes

Table 2.3 Non- Automatic Monitoring Sites 2008 Nitrogen Dioxide Passive Diffusion Tubes Exposure Locations – Residential Façade or School Approach

Diffusion Tube (DT) Number	Locality Name	National Grid & Height (m)			Year Monitoring started at site	In the Current AQMA?
		X	Y	Z		
DT 03	West Street	530,798	104,024	3.1	2007	Yes
DT 05	Queens Road North	530,969	104,785	2.9	2005	
DT 06	Terminus Road	530,963	104,994	3.2	2006	
DT 07	North Road	531,185	104,554	2.7	1998	
DT 08	Grand Parade South	531,396	104,344	2.8	2003	
DT 09	Marlborough Place	531,302	104,392	2.6	2005	
DT 10	Gloucester Place	531,401	104,669	3.3	2005	
DT 12	St Peters Place	531,413	104,984	2.9	2005	
DT 13	Oxford Place	531,387	105,038	3.0	2005	
DT 14	London Road Central	531,286	105,287	2.9	2001	
DT 15	St Bartholomew School	531,234	105,126	2.7	2001	
DT 16	New England Road	531,097	105,430	3.0	2005	
DT 17	London Road West	531,189	105,375	3.0	2005	
DT 18	London Road East	531,188	105,410	3.1	2005	
DT 19	Preston Road	531,021	105,577	3.2	2005	
DT 22	Beaconsfield Road	531,102	105,615	2.8	2005	
DT 23	Viaduct Road Central	531,304	105,406	3.1	2003	
DT 24	Viaduct Terrace	531,451	105,356	3.0	2005	
DT 25	Ditchling Road North	531,496	105,315	2.7	2005	
DT 28	Ditchling Road Central	531,456	105,031	2.6	1998	
DT 29	Lewes Road South	531,945	105,455	3.4	2005	
DT 30	Lewes Road Central	532,085	105,740	2.8	2003	
DT 31	Hollingdean Road	532,021	105,948	2.7	2002	
DT 32	Lewes Road North	532,409	106,370	2.9	2007	
DT 34	Upper Lewes Road	531,990	105,719	2.8	2002	
DT 35	Elm Grove School	532,254	105,234	3.1	1998	**No**
DT 36	Hanover Place	531,768	105,226	3.1	2002	
DT 37	Richmond Place	531,490	104,834	2.7	2005	
DT 38	Grand Parade North	531,463	104,621	3.2	2005	
DT 39	Old Steine	531,358	104,003	2.3	2007	
DT 40	St James Street	531,439	104,045	2.8	1998	
DT 41	Edward Street	531,731	104,164	2.9	2007	
DT 42	Eastern Road West	532,478	103,951	3.3	1998	
DT 43	Eastern Road Hospital	532,759	103,810	3.0	2007	
DT 44	Eastern Road Clinic	533,385	103,581	3.1	2007	
DT 49	Sackville Road South	528,430	105,275	3.8	2007	
DT 50	Sackville Road Central	528,440	105,586	2.8	2006	
DT 52	Sackville Road North	528,406	105,874	2.7	2007	
DT 53	Old Shoreham/Neville	528,356	105,950	2.6	1998	

DT 54	Old Shoreham Rd West	528,246	105,979	3.4	2007	Yes
DT 55	Old Shoreham Rd East	528,542	105,976	2.6	2007	
DT 65	Dyke Road South	530,572	105,090	3.1	2006	
DT 66	Dyke Road/Powis Grove	530,660	104,624	3.1	2007	
DT 67	Dyke Road North	530,539	105,151	2.9	2006	
DT 68	Dyke Road/Belmont	530,457	105,299	3.1	2007	
DT 69	Buckingham Place	530,586	105,107	3.1	2006	
DT 70	Goldsmid Road	530,511	105,122	3.2	2006	
DT 71	Vernon Terrace North	530,546	105,086	2.4	2006	
DT 72	Vernon Terrace South	530,446	105,000	2.5	2007	
DT 73	Chatham Place	530,810	105,339	3.3	2006	
DT 74	Lower Old Shoreham Rd	530,770	105,362	3.3	2006	
DT 75	Western Road West	530,045	104,468	3.1	2006	
DT 76	Western Road East	530,302	104,415	2.9	2006	
DT 77	North Street	530,947	104,284	3.1	2006	

Table 2.4 Non- Automatic Monitoring Sites 2008 Nitrogen Dioxide Passive Diffusion Tubes AQMA Roadside Locations

Diffusion Tube (DT) Number	Locality Name	National Grid & Height (m)			Year Monitoring started at site
		X	Y	Z	
DT 02	Kings Road	530,578	104,046	2.7	1998
DT 04	Queens Road South	530,893	104,486	3.0	1998
DT 11	York Place	531,400	104,878	3.1	2005
DT 27	Ditchling Road	531,476	105,203	2.6	2005
DT 33	Bear Road	532,303	105,922	3.3	2002
DT 46	Hove Triplicate 1	528,966	104,728	3.8	2002
DT 47	Hove Triplicate 2	528,966	104,728	3.8	2002
DT 48	Hove Triplicate 3	528,966	104,728	3.8	2002
DT 58	Trafalgar Road	525,783	105,478	2.8	1998
DT 59	Wellington Road	525,999	104,950	2.9	1998
DT 60	Boundary Road	526,419	105,486	2.8	1998
DT 61	Portland Road	527,425	105,390	2.8	1998
DT 63	Davigdor Road	530,134	105,114	2.9	1998

DT 59 is practically the same distance to the kerb as exposure locations further along the road section and can effectively be treated as if it were a relevant AQS exposure site. DT 27 and DT58 to 61 inclusive have been moved to near by worse-case façade locations for 2009.

Table 2.5 Non- Automatic Monitoring Sites Nitrogen Dioxide Diffusion Tubes – New for 2009

Diffusion Tube (DT) Number	Locality Name	Justification	DT Type	National Grid (m)		In the Current AQMA?
				X	Y	
DT 15a	Cheapside	Map hotspot close to developments	F	531,319	104,974	Yes
DT21	Preston Road North Junction	Sensitive receptor outside AQMA	R	530,236	106,503	No
DT 27a	Ditchling Road/Oxford Street	To help map extent of hotspot	F	531,472	105,161	Yes
DT 28a	Portland Street	Residential Façade near hotspot	F	530,974	104,386	
DT 35a	Ditchling Road School	Sensitive receptor outside AQMA	S	531,521	105,966	No
DT 45a	Church Road, Portslade	New façade exposure location	F	525,891	105,115	Yes
DT51a	Sackville Road Middle	New façade exposure location	F	528,463	105,540	

DT 54a	Old Shoreham Rd West	Facade nearer to junction	F	528,355	105,976	Yes
DT57	Wellington Rd/Basin Road	Facade near to junction, new location	R	526,248	104,857	
DT 58a	Trafalger Road	Moved from Roadside to façade	F	525,657	105,696	
DR 59a	Wellington Rd/Church Rd	Moved from Roadside to façade	F	525,931	104,961	
DT 60a	Boundary Road	Moved from Roadside to façade	F	526,404	105,500	
DT 61a	Portland Road/School Rd	Moved closer to school & development site	S	527,554	105,369	
DT 68a	Lower Dyke Road/Churchill Sq	To help map extent of hotspot	R	530,748	104,412	
DT 72a	Montpelier Road/Western Road	To help map extent of hotspot	R	530,200	104,464	
DT 78	Vicarage Lane, Rottingdean	No previous monitoring, outside AQMA	F	536,914	102,446	No
DT 79	High Street Rottingdean	No previous monitoring, outside AQMA	F	536,968	102,288	
DT 80	Marina Way	Outside AQMA near boundary	R	533,652	103,604	
DT 81	Marine Drive, Belgrave	Improve geographical coverage	F	532,737	103,583	Yes
DT 82	Coombe Road	To help map extent of hotspot	F	532,415	106,190	
DT 83	Brighton Triplicate 1	For future co-location Bias Correction	R	531,294	104,321	
DT 84	Brighton Triplicate 2	For future co-location Bias Correction	R	531,294	104,321	
DT 85	Brighton Triplicate 3	For future co-location Bias Correction	R	531,294	104,321	
DT 86	Brighton Roadside Low	Establish difference with height	R	531,294	104,321	

*Diffusion Tube Types characterised as: F = Façade location, R = Roadside and S = School. Where a new location replaces a 2008 site the suffix **a** is included.*

Table 2.6 Non- Automatic Monitoring Sites VOC BTX Diffusion Tube

Diffusion Tube	Locality Name	DT Type	National Grid (m)		In the Current NO_2 AQMA?
			X	Y	
PC 1	Preston Circus	Roadside	531,186	105,413	**Yes**

For NO_2 the laboratory used is Bristol Scientific and the method employed is 20% TEA in water. By May 2009 the Hove co-located analyser used for bias correction has been ratified (by ERG) for 100% of the 2008 calendar year. The final ratification includes the last few weeks of 2008 and references data from the April-2009 audit carried out by AEA technology. This has slightly changed the Hove analyser averages for November and December 2008, but it does not alter the local bias correction of *0.72. This is the same locally derived adjustment that was applied in 2007. It is recognised within BHCC that a roadside site closer to an air quality hotspot would also provide a valued co-location study for bias correction.

The laboratory follows procedures set out in Harmonisation Practical Guidance. Results have been corrected to 293 ˚K. Further details including Hove's 2008 bias correction co-location study, laboratory WASP results and Bristol Scientific comparison field trial are included together as part of Appendix E.

2.2 Comparison of Monitoring Results with AQ Objectives

Since the last BHCC Review and assessment in 2008 there are no new monitoring results at or near to exposure locations for pollutants other than Nitrogen Dioxide and benzene. Results for these pollutants are presented below in the relevant sections.

2.2.1 Nitrogen Dioxide

The latest bias corrected annual mean diffusion tube results are for 2008. Twenty-four out of seventy-two, tubes show an exceedence of the annual mean objective; recording concentrations between 40 and 60 µg/m^3. All of these locations can be described as sites of relevant exposure. A further eight tubes at relevant exposure locations record concentration greater than 90% of the objective i.e. 36 µg/m^3. During 2008 only one monitored site (with 92% data capture) records concentration equivalent to more than 18, 1-hour means above 200 µg/m^3. This site situated on North Street and can be described as a site where members of the public are likely to spend 1-hour for more than eighteen hours in a year. A number of other relevant exposure sites in the AQMA have recorded concentration above the short-term objective in the years prior to 2008. Appendix C compares the annual results for 2008 with 2007, 83% of sites show an improvement.

Automatic Monitoring Data

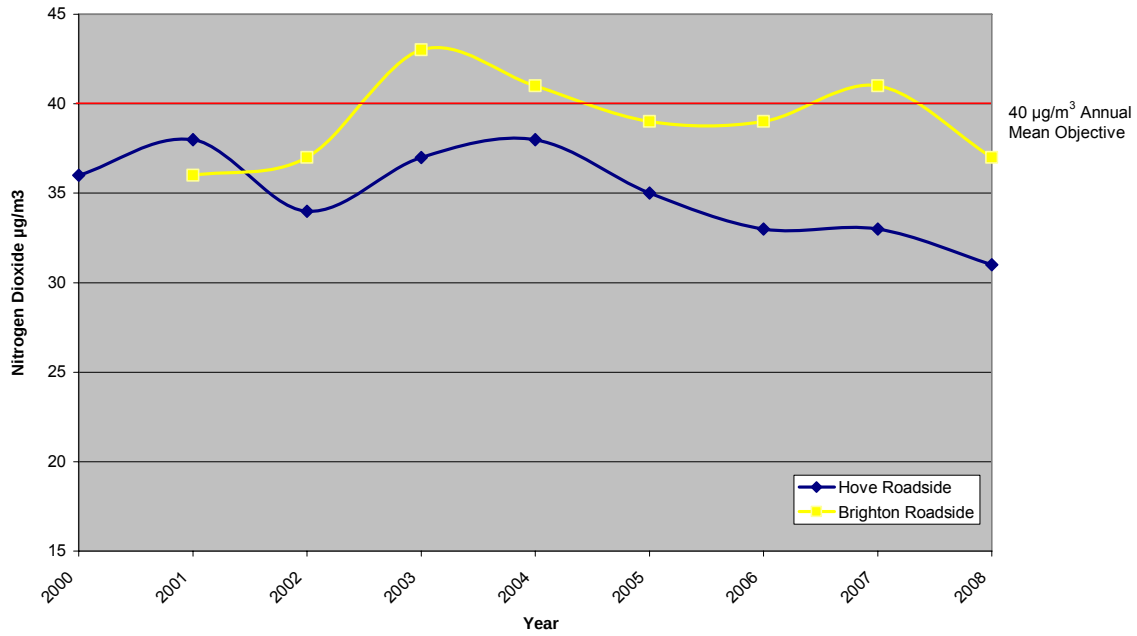
All continuous analysers for NO_2 are presented below with Sussex rural background at Lullington Heath included for comparison.

Table 2.7 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective

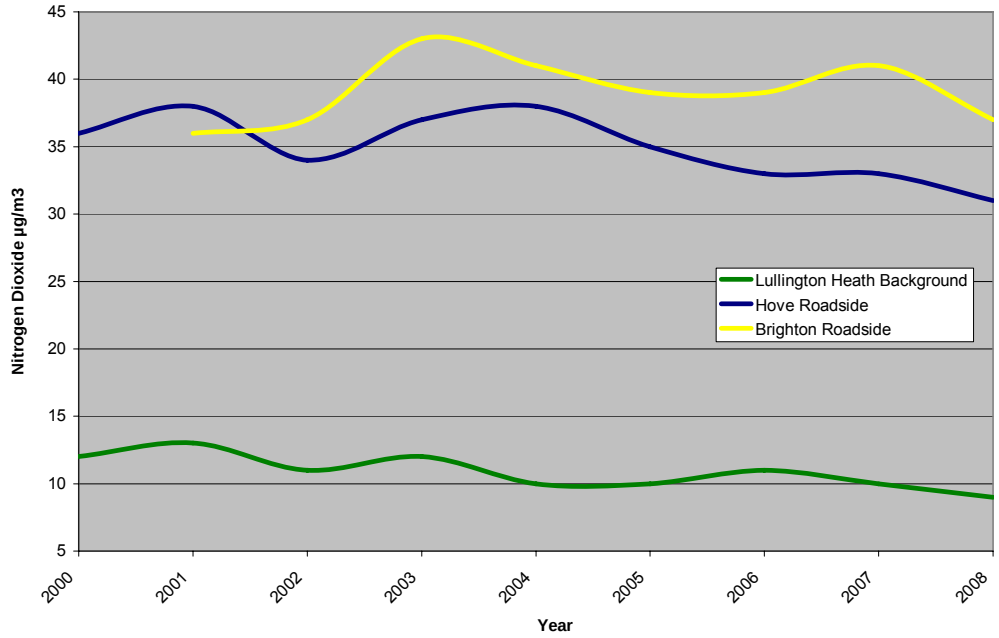
Site ID	Location	Within AQMA?	Proportion of year with valid data 2008 %	Annual mean concentrations (µg/m^3)		
				2006 *	2007 *	2008
BH1	Brighton Roadside	Yes	97.3	39	41	37
BH2	Hove Roadside		96.6	33	33	31
LL	Lullington Heath	No	>75%	11	10	9

Data Capture is above 90% for all continuous analysers for the duration of the last three years

Graph 2.1 Results of Automatic Monitoring for Nitrogen Dioxide Brighton & Hove 2000 to 2008: Comparison with Annual Mean Objective



Graph 2.2 Results of Automatic Monitoring for Nitrogen Dioxide Brighton & Hove 2000 to 2008: Comparison with Sussex Background



Diffusion Tube Monitoring Data

Where results are in exceedence of the annual mean these are highlighted in bold. In 2008 one site; DT 77 was near to the equivalent level of the 1- hour percentile objective. All Roadside tubes presented here are not adjusted for distance to receptor location. All sites are located within the AQMA with the exception of background tubes; DT20 and DT56 Southdown Avenue and Ashlings Way respectively and DT35 located at the school approach on Elm Grove.

Table 2.8a Results of 2008 Nitrogen Dioxide Diffusion Tubes

Diffusion Tube (DT) Number	Location	DT Type	Number of months Captured in the year	Percentage data capture	2008 Bias Corrected µg/m^3.
DT 02	Kings Road	R	12	100%	**42.3**
DT 03	West Street	F	11	92%	30.2
DT 04	Queens Road South	R	11	92%	**42.2**
DT 05	Queens Road North	F	12	100%	**49.0**
DT 06	Terminus Rd	F	12	100%	**49.6**
DT 07	North Road	F	10	83%	32.4
DT 08	Grand Parade South	F	10	83%	**40.3**
DT 09	Marlborough Place	F	11	92%	**46.6**
DT 10	Gloucester Place	F	11	92%	**41.5**
DT 11	York Place	R	12	100%	**53.6**
DT 12	St Peters Place	F	11	92%	36.8
DT 13	Oxford Place	F	10	83%	**41.7**
DT 14	London Road Central	F	11	92%	33.6
DT 15	St Bartholomew School	S	11	92%	27.4
DT 16	New England Road	F	11	92%	**41.8**
DT 17	London Road West	F	12	100%	**48.0**
DT 18	London Road East	F	12	100%	**38.9**
DT 19	Preston Road	F	11	92%	36.1
DT 20	Southdown Avenue	B	11	92%	18.9
DT 22	Beaconsfield Road	F	11	92%	36.5
DT 23	Viaduct Road Central	F	12	100%	38.9
DT 24	Viaduct Terrace	F	11	92%	**50.9**
DT 25	Ditchling Road North	F	11	92%	**42.1**
DT 26	Kingsbury Street	B	11	92%	24.4
DT 27	Ditchling Road Central	F	10	83%	**40.0**
DT 28	Ditchling Road South	F	11	92%	33.5
DT 29	Lewes Road South	F	12	100%	**39.2**
DT 30	Lewes Road Central	F	12	100%	**53.9**
DT 31	Hollingdean Road	F	11	92%	**43.1**
DT 32	Lewes Road North	F	11	92%	**40.9**
DT 33	Bear Road Bungalows	R	12	100%	36.0
DT 34	Upper Lewes Road	F	11	92%	32.1
DT 35	Elm Grove School	S	11	92%	30.2
DT 36	Hanover Place	F	12	100%	33.1
DT 37	Richmond Place	F	12	100%	33.4
DT 38	Grand Parade North	F	12	100%	**41.3**
DT 39	Old Steine	F	11	92%	35.2
DT 40	St James Street	F	10	83%	**43.3**
DT 41	Edward Street	F	11	92%	35.9
DT 42	Eastern Road West	F	12	100%	33.7
DT 43	Eastern Rd Hospital	F	11	92%	**40.0**

DT 44	Eastern Road Clinic	F	11	92%	36.0
DT 46-48	Hove Triplicate Average	R	10	83%	31.7
DT 49	Sackville Road South	F	11	92%	34.9
DT 50	Sackville Road Central	F	11	92%	33.7
DT 52	Sackville Road North	F	12	100%	31.9
DT 53	Old Shoreham Rd/Nevill Rd	F	10	83%	32.1
DT 54	Old Shoreham Rd West	F	11	92%	25.8
DT 55	Old Shoreham Rd East	F	12	100%	26.1
DT 56	Ashlings Way	B	11	92%	18.4
DT 58	Trafalgar Road	R	12	100%	36.2
DT 59	Wellington Road	F	11	92%	38.2
DT 60	Boundary Road	R	12	100%	34.2
DT 61	Portland Road	S	11	92%	36.7
DT 62	Titian Road	B	12	100%	20.4
DT 63	Davigdor Road	R	11	92%	31.8
DT 65	Dyke Road South	F	12	100%	33.6
DT 66	Dyke Road/Powis Grove	F	11	92%	36.4
DT 67	Dyke Road North	F	12	100%	32.8
DT 68	Dyke Road/Belmont	F	12	100%	28.2
DT 69	Buckingham Place	F	11	92%	**40.9**
DT 70	Goldsmid Road	F	12	100%	31.8
DT 71	Vernon Terrace North	F	12	100%	25.8
DT 72	Vernon Terrace South	F	10	83%	26.6
DT 73	Chatham Place	F	10	83%	**45.7**
DT 74	Lower Old Shoreham Rd	F	11	92%	**49.5**
DT 75	Western Road West	F	9	75%	**40.0**
DT 76	Western Road East	F	11	92%	**53.1**
DT 77	North Street	F	11	92%	**60.2**

Where: DT Type R = Roadside, F = Façade, S = School and B = Background

Table 2.8b Results of Nitrogen Dioxide Diffusion Tubes – above 36 µg/m^3 sorted by 2008 Concentration (Roadside tubes adjusted to exposure location)

Diffusion Tube (DT) Number	Location	DT Type	Annual mean concentrations (µg/m^3) Adjusted for bias		
			2006	2007	2008
DT 77	North Street	F	**73.4**	**45.9**	**60.2**
DT 30	Lewes Road Central	F	**56.9**	**52.6**	**53.9**
DT 76	Western Road East	F	**64.5**	**54.4**	**53.1**
DT 24	Viaduct Terrace	F	**61.5**	**54.4**	**50.9**
DT 11*	York Place	R	**51.8**	**49.2**	**49.7**
DT 06	Terminus Rd	F	**59.1**	**53.5**	**49.6**
DT 74	Lower Old Shoreham Rd	F	**52.9**	**46.7**	**49.5**
DT 05	Queens Road North	F	**57.7**	**53.4**	**49.0**
DT 17	London Road West	F	**60.9**	ND	**48.0**
DT 09	Marlborough Place	F	**52.2**	**53.0**	**46.6**
DT 73	Chatham Place	F	**46.9**	**45.0**	**45.7**
DT 40	St James Street	F	**42.3**	**41.5**	**43.3**
DT 31	Hollingdean Road	F	**53.6**	**44.4**	**43.1**
DT 25	Ditchling Road North	F	**49.1**	**43.6**	**42.1**
DT 16	New England Road	F	**52.2**	ND	**41.8**
DT 13	Oxford Place	F	**48.0**	**42.6**	**41.7**
DT 10	Gloucester Place	F	**48.3**	**45.0**	**41.5**
DT 38	Grand Parade North	F	**52.6**	**43.3**	**41.3**
DT 32	Lewes Road North	F	ND	38.9	**40.9**
DT 69	Buckingham Place	F	**47.0**	**42.2**	**40.9**

DT 08	Grand Parade South	F	**52.0**	**45.0**	**40.3**
DT 27	Ditchling Road Central	F	**45.7**	**42.3**	**40.0**
DT 43	Eastern Rd Hospital	F	ND	**41.3**	**40.0**
DT 75	Western Road West	F	**44.3**	**48.6**	**40.0**
DT 04*	Queens Road South	R	**43.3**	**49.6**	39.7
DT 29	Lewes Road South	F	**43.2**	**42.8**	39.2
DT 18	London Road East	F	**44.3**	ND	38.9
DT 23	Viaduct Road Central	F	**44.4**	**44.4**	38.9
DT 02*	Kings Road	R	**41.6**	**40.1**	38.2
DT 59	Wellington Road	R	**39.2**	38.7	38.2
DT 12	St Peters Place	F	**43.8**	**40.6**	36.8
DT 61	Portland Road	S	**41.2**	35.9	36.7
DT 22	Beaconsfield Road	F	**46.2**	**40.8**	36.5
DT 66	Dyke Road/Powis Grove	F	ND	32.7	36.4
DT 19	Preston Road	F	**45.5**	39.8	36.1
DT 44	Eastern Road Clinic	F	ND	37.2	36.0

**As there are over sixty tube records in 2008 only those exceeding 90% ile of the annual objective are included here. Roadside tubes (not in line with near road façade) have been adjusted using the LAQM (TG09) kerbside calculator this applies to 2008 values for DT02, DT04 and DT11 only.*
All tubes listed above are within the AQMA. Values in bold breach the annual mean objective
Where: DT Type R = Roadside, F = Façade, S = School and B = Background, ND=No Data

2.2.2 PM_{10}

Brighton Roadside particulate monitor ceased to operate in June 2008. There has been limited roadside PM_{10} monitoring since the last Review and Assessment was written in that same year. The former AURN site at Brighton Roadside has been moved in order to assess ultra fine particulate; $PM_{2.5}$ as part of the urban national network. Furthermore due to changes in electrical connection policy a series of permissions are required in order to certify connection of the Mobile Air Quality Monitoring Unit (MAQMU).

It is acknowledged that there is a requirement to:

- Improve Particulate Matter monitoring in the city with addition of a new monitoring station located in close proximity to a worse-case area. It is proposed that the PM_{10} TEOM monitor (BHCC has this ready) be operational at the same site for at least two years and be in place by 2010
- The council is fully licensed and trained in CERC's (Cambridge Environmental Research Consultants) EMIT pollution inventory and ADMS-Urban dispersion model[9] and these tools are to be utilised in order to advance Detailed and Further Assessments as necessary

[9] EMIT Inventory and ADMS-Urban Model Licenses are valid until October 2011

2.2.3 Sulphur Dioxide

Brighton and Hove Council no longer monitors for Sulphur Dioxide as this pollutant previously complies with all objectives.

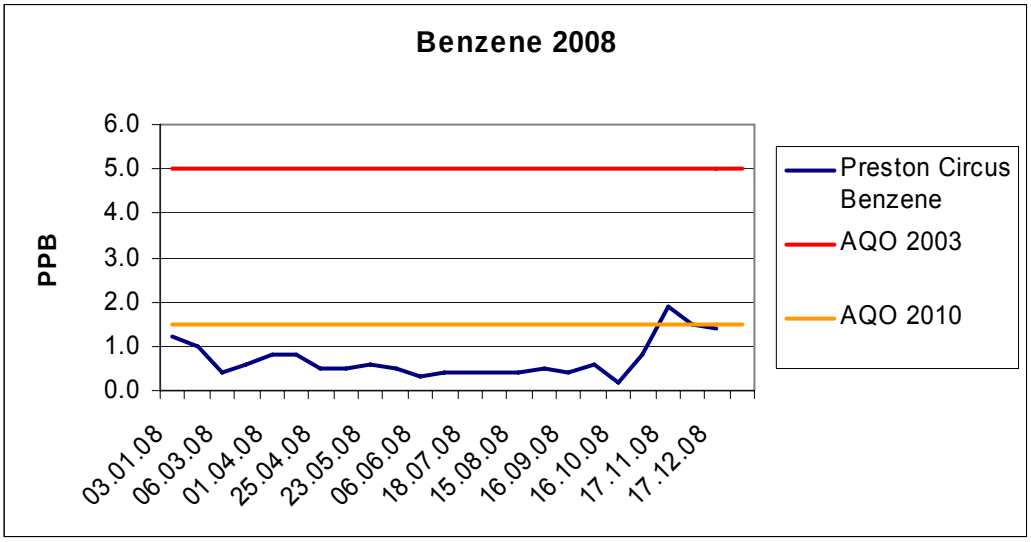
2.2.4 Benzene

The current monitoring location has been at site for a number of years. It represents a worse-case location situated on a traffic island at the heavily trafficked Preston Circus Junction. The site is approximately four metres from the nearest house/ pub facade. There are no exceedences of the 16.25 and 5 µg/m^3 annual mean. Therefore is not expected that benzene will cause a breach of the objective at any relevant exposure location within the Council.

Table 2.9 Results of 2008 VOC Diffusion Tubes - Benzene

Diffusion Tube (DT) Number	Location	Within AQMA?	Data Capture 2008 %	Annual mean concentrations 2008 (µg/m^3) Converted from ppb
PC	Preston Circus	Yes	89	2.24

Graph 2.3 Results of VOC (BTX) diffusion tube 2008



2.2.5 Other pollutants monitored

Ozone is monitored at three continuous analyser sites within the council. As this is not a statutory duty under LAQM further details are not included here.

Brighton and Hove City Council has measured concentrations of Nitrogen Dioxide above the annual mean, and 1-hour objective at relevant exposure locations and **will need to proceed to a Further Assessment**. Targeting the area of the 2008 AQMA. A Further Assessment for NO_2 is required following declaration of the expanded AQMA.

There is currently a lack of Particulate Monitoring in the City.

The council proposes to:

Connect the Mobile Monitoring Facility, including NO_x analyser and TEOM at a busy road-junction near residential receptors and keep it in situ for at least two years with first full year targeted as 2010.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Brighton & Hove confirms that there are no newly identified congested streets with a flow above **5,000 vehicles per day** and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment. Collation of all available traffic data is currently ongoing. New façade diffusion tube monitoring locations have been introduced for 2009 at newly identified busy streets where residences are close to the kerb.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

Brighton & Hove has assessed all busy streets where people may spend 1- hour or more close to traffic, in the previous rounds of Review and Assessment, and concluded that it will not be necessary to proceed to a Detailed Assessment. That said a Further Assessment for NO_2 focused on the AQMA-hotspots is required anyway following declaration of the expanded AQMA.

3.3 Roads with a High Flow of Buses and/or HGVs.

Brighton & Hove confirms that there are no newly identified roads with high flows of buses/HDVs.

3.4 Junctions

Brighton & Hove confirms that there are no new/newly identified busy junctions/busy roads. A number of busy junctions are monitored by several diffusion tubes with at least one on each feeder road of the junction within the AQMA.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

Brighton & Hove confirms that there are no new/proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

Traffic flows have changed significantly between North Street and West Street between 2007 and 2008 due to a temporary diversion. The existing NO_2 diffusion tubes have monitored changes in concentration in line with that expected as traffic flows are diverted form West Street to North Street. Both streets are within the AQMA. A reduction of traffic on West Street has caused a significant improvement and this area. The West Street tube located on façade no longer exceeds 75% of the NO_2 annual mean objective.

Brighton & Hove has assessed new/newly identified roads with significantly changed traffic flows, and concluded that it will not be necessary to proceed to a Detailed Assessment beyond that all ready being carried out

3.7 Bus and Coach Stations

Brighton & Hove has assessed new/newly identified bus stations, and concluded that it will not be necessary to proceed to a Detailed Assessment.

4 Other Transport Sources

4.1 Airports

Brighton and Hove City Council confirms that there are no airports in the Local Authority area. There is a small private and commercial airport in the adjacent local authority, i.e. Brighton International Airport at Shoreham. This airport is currently restricted to small aircraft with single or twin engines. It is over 2 km from the Council Boundary on the other side of the Adur Estuary.

4.2 Railways (Diesel and Steam Trains)

4.2.1 Stationary Trains

The majority of trains at Brighton main terminus and Hove through stations are electric drawing their power from the ground line. Practically all trains on the line to Lewes are electric. A few *SoutWest* trains approximately <10% are fuelled by diesel.

Brighton and Hove City Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

The three railways in BHCC are the Brighton to London railway running north to south. The Brighton to Portsmouth railway which runs east-west and the Brighton to Lewes railway aligned west to east. There is also a link rail from London to Hove that does not pass through the Brighton Terminus.
The railways in Brighton and Hove are not listed in Table 5.1 of TG09; Rail lines with heavy traffic of diesel passenger trains.

Brighton and Hove City Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

Brighton and Hove confirms that the port area at Portslade (partly within the councils area) is not likely to see more than 5,000 movements a day and that shipping meets the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

Brighton and Hove City Council has assessed new/proposed industrial installations, and concluded that it will not be necessary to proceed to a Detailed Assessment.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

Brighton and Hove City Council has assessed industrial installations with potentially relevant exposure in the vicinity, and concluded that it will not be necessary to proceed to a Detailed Assessment.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

Brighton and Hove City Council has assessed new/proposed industrial installations, and concluded that it will not be essential to proceed to a Detailed Assessment.

Any newly permitted boilers can potentially be considered as point sources within the atmospheric inventory and ADMS-Urban dispersion modelling assessment. Pollutant predictions can be applied to source apportionment feeding into the next Further Assessment.

5.2 Major Fuel (Petrol) Storage Depots

There are major fuel (petrol) storage depots within the BHCC area, but these have been considered in previous reports.

5.3 Petrol Stations

Brighton and Hove City Council confirms that there are no petrol stations meeting the specified criteria**.**

5.4 Poultry Farms

Brighton and Hove City Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

Brighton and Hove City Council has made sure that Detailed Assessments including dispersion modelling have been carried out for two proposed biomass combustion plant, and concluded that it will not be essential to proceed to a Detailed Assessment as part of the continued Review and Assessment.

6.2 Biomass Combustion – Combined Impacts

Brighton and Hove City Council has insured that developers assess biomass combustion plant, and concluded that it will not be essential to proceed to an LAQM Detailed Assessment.

Any newly permitted biomass boilers can potentially be considered as point sources within the atmospheric inventory and ADMS-Urban dispersion modelling assessment. Pollutant predictions can be applied to source apportionment feeding into the next Further Assessment.

6.3 Domestic Solid-Fuel Burning

Brighton and Hove City Council confirms that there are no identified areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

Brighton and Hove City Council confirms that there are no potential sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

The only pollutant with identified excedences is Nitrogen Dioxide. All excedences of NO_2 are recorded within the AQMA.

Continuous analyser and diffusion tubes show marked improvements in the concentration of NO_2 between 2007 and 2008. 83% of diffusion tube records show an improvement in the annual mean between 2007 and 2008 17% of tubes show an increase in the same period (as appendix C). In Brighton and Hove, 2008 was a relatively good year for air quality. This is partly due to cleaner summer air with higher than average rainfall during summer months. Summer 2008 was a time of repeated replenishing of city air with fresh Atlantic air. Higher concentrations of NO_x pollutants were recorded in winter months at the beginning and end of 2008. It is likely that poor summer weather will in turn attract less visitor traffic to the city between April and September. Transport trends continue to show an increase in the use of public modes and cycling.

For 2008 a number of diffusion tubes and both continuous analysers within the AQMA show concentrations below the NO_2 annual mean objective. In 2009 the number of monitoring locations has increased. A Detailed Assessment is required following expansion of the original AQMA to a larger area in 2008.

8.2 Conclusions from Assessment of Sources

No new developments during 2008 are likely to cause exceedences outside of the AQMA. The introduction of mixed use and residential developments may introduce new sensitive exposure to areas that have existing breaches of the Nitrogen Dioxide annual mean objective.

8.3 Proposed Actions

The council has requirement to carry out a Further Assessment (FA) for NO_2 independent of the finding of the USA. An FA is required for NO_2 following declaration of the expanded AQMA. Additions and improvements to monitoring including extra geographical coverage have been implemented in advance of this report and are included above.

Defra had requested a DA for particulate due to previous monitoring and the council's location within the agglomeration. This was an independent requirement not related to declaration of the AQMA and the findings of this report. It has since been confirmed that a DA for PM_{10} is not required. That said BHCC is committed to future PM_{10} monitoring near to a worse-case exposure location as soon as practically possible.

Proposed programme of BHCC LAQM actions over the next year:

- Carry out a Further Assessment for NO_2 based on monitoring and modelling with utilisation of an updated pollution inventory; target date end August 2009
- Connect the Mobile monitoring unit near to an exposure location for analysis of PM_{10} and NO_x by 2010
- Submit Action Plan on the 2008-AQMA by September 2009
- Submit Progress Report by end April 2010

9 References

[1] Population data from the 2001 Census, Brighton and Hove City Profile: http://www.brighton-hove.gov.uk/downloads/bhcc/citystats/1_CityProfile.pdf

[2] Local population growth in Adur: http://www.adur.gov.uk/facts-figures/population.htm#totals

[3] Population density in the Brighton-Worthing-Littlehampton Conurbation http://en.wikipedia.org/wiki/Brighton/Worthing/Littlehampton,

[4] Status of the South Downs National Park Designation http://www.defra.gov.uk/wildlife-countryside/protected-areas/national-parks/south-downs/index.htm,

[5] Cycling in Brighton and Hove http://www.brighton-hove.gov.uk/index.cfm?request=c1000145

[6] Brighton and Hove Buses Environmental Report 2008 http://www.buses.co.uk/pdfs/env_report2008.pdf

[7] Shoreham Power Station Transformer manufactured better than new http://www.engineeringtalk.com/news/abf/abf150.html

[8] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and clean air for Europe

Appendices Maps

Appendix A: 2004 & 2008 AQMAs

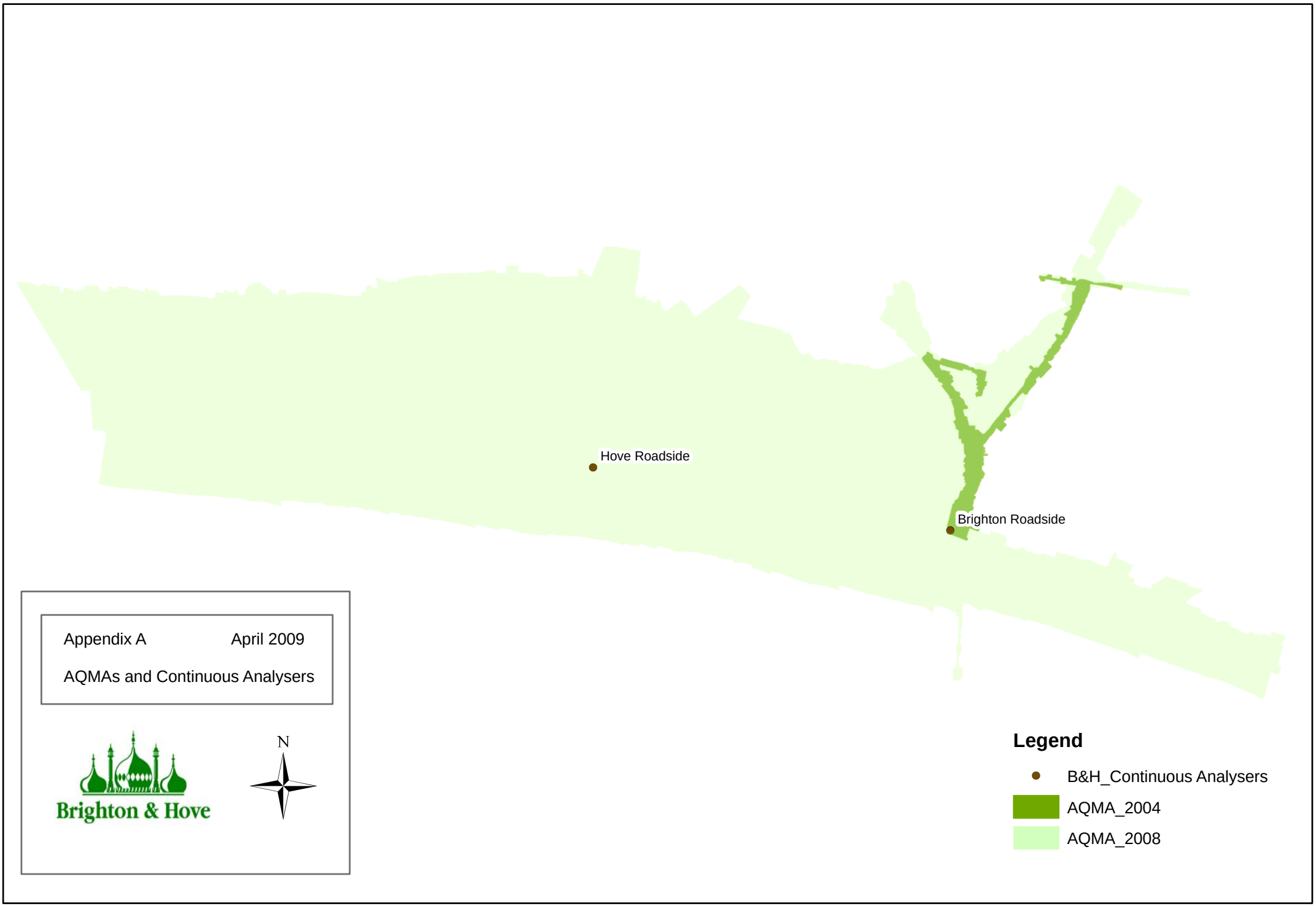
Appendix B: 2008 tubes and bias corrected results

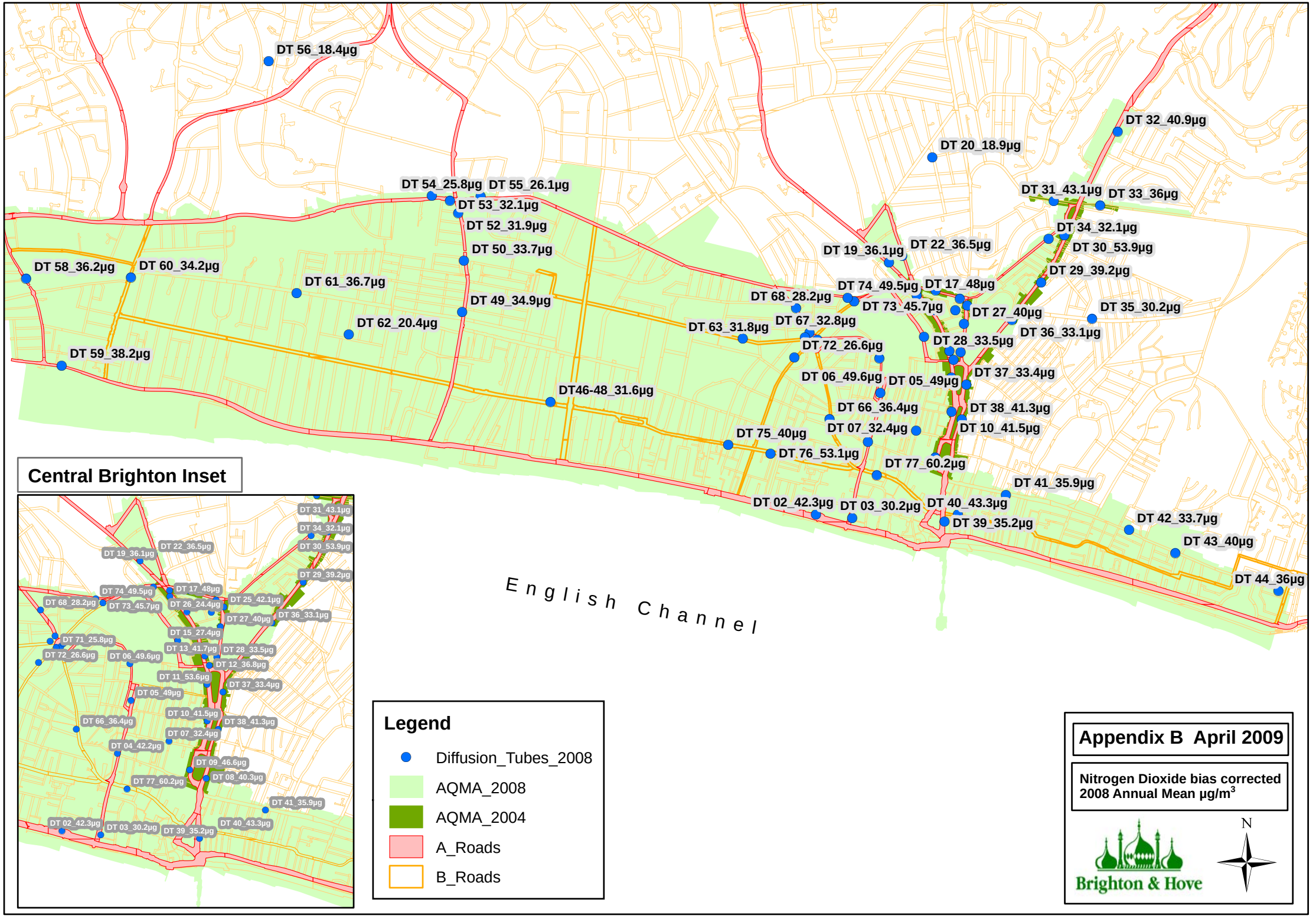
Appendices Other

Appendix C: Comparison of NO_2 tube result concentrations - 2008 with 2007

Appendix D: QA/QC Data Continuous Analyser

Appendix E: QA/QC Diffusion Tubes and audits


Hove Roadside
Brighton Roadside
Appendix A
April 2009
AQMAs and Continuous Analysers
Brighton & Hove
N
Legend
B&H_Continuous Analysers
AQMA_2004
AQMA_2008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DT 55_26.1µg
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DT 52_31.9µg
DT 50_33.7µg
DT 58_36.2µg
DT 60_34.2µg
DT 61_36.7µg
DT 49_34.9µg
DT 62_20.4µg
DT 59_38.2µg
DT46-48_31.6µg
DT 20_18.9µg
DT 32_40.9µg
DT 31_43.1µg
DT 33_36µg
DT 34_32.1µg
DT 30_53.9µg
DT 19_36.1µg
DT 22_36.5µg
DT 29_39.2µg
DT 74_49.5µg
DT 17_48µg
DT 68_28.2µg
DT 73_45.7µg
DT 27_40µg
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DT 67_32.8µg
DT 36_33.1µg
DT 72_26.6µg
DT 28_33.5µg
DT 06_49.6µg
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DT 38_41.3µg
DT 07_32.4µg
DT 10_41.5µg
DT 75_40µg
DT 76_53.1µg
DT 77_60.2µg
DT 41_35.9µg
DT 02_42.3µg
DT 03_30.2µg
DT 40_43.3µg
DT 39_35.2µg
DT 42_33.7µg
DT 43_40µg
DT 44_36µg
English Channel
Central Brighton Inset
DT 31_43.1µg
DT 34_32.1µg
DT 30_53.9µg
DT 22_36.5µg
DT 19_36.1µg
DT 29_39.2µg
DT 74_49.5µg
DT 17_48µg
DT 25_42.1µg
DT 68_28.2µg
DT 73_45.7µg
DT 26_24.4µg
DT 27_40µg
DT 36_33.1µg
DT 15_27.4µg
DT 71_25.8µg
DT 13_41.7µg
DT 28_33.5µg
DT 72_26.6µg
DT 06_49.6µg
DT 12_36.8µg
DT 11_53.6µg
DT 37_33.4µg
DT 05_49µg
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DT 38_41.3µg
DT 66_36.4µg
DT 07_32.4µg
DT 04_42.2µg
DT 09_46.6µg
DT 08_40.3µg
DT 77_60.2µg
DT 41_35.9µg
DT 02_42.3µg
DT 03_30.2µg
DT 39_35.2µg
DT 40_43.3µg
Legend
Diffusion_Tubes_2008
AQMA_2008
AQMA_2004
A_Roads
B_Roads
Appendix B April 2009
Nitrogen Dioxide bias corrected 2008 Annual Mean µg/m3
Brighton & Hove
N

Comparison of 2008 with 2007 Annual Mean for Nitrogen Dioxide at BHCC Passive Diffusion Tubes

Number	Site Name	2007 count	2007 µg/m3	2008 Count	2008 µg/m3	Change µg/m3	Status
DT 02	Kings Road	11	44.2	12	42.3	-1.9	IMPROVED
DT 04	Queens Road South	12	42.6	11	42.2	-0.4	IMPROVED
DT 05	Queens Road North	12	53.4	12	49.0	-4.4	IMPROVED
DT 06	Terminus Rd	12	53.5	12	49.6	-3.9	IMPROVED
DT 07	North Road	12	33.3	10	32.4	-0.9	IMPROVED
DT 08	Grand Parade South	10	45.2	10	40.3	-4.9	IMPROVED
DT 09	Marlborough Place	12	53.0	11	46.6	-6.4	IMPROVED
DT 10	Gloucester Place	12	45.0	11	41.5	-3.5	IMPROVED
DT 11	York Place	11	52.6	12	53.6	1.0	INCREASED
DT 12	St Peters Place	11	40.6	11	36.8	-3.8	IMPROVED
DT 13	Oxford Place	11	42.6	10	41.7	-0.9	IMPROVED
DT 14	London Road Central	12	39.6	11	33.6	-6.0	IMPROVED
DT 15	St Bartholomew School	11	29.5	11	27.4	-2.1	IMPROVED
DT 19	Preston Road	11	39.8	11	36.1	-3.7	IMPROVED
DT 20	Southdown Avenue	11	20.4	11	18.9	-1.4	IMPROVED
DT 22	Beaconsfield Road	11	40.8	11	36.5	-4.2	IMPROVED
DT 23	Viaduct Road Central	12	44.4	12	38.9	-5.5	IMPROVED
DT 24	Viaduct Terrace	12	54.4	11	50.9	-3.5	IMPROVED
DT 25	Ditchling Road North	11	43.6	11	42.1	-1.4	IMPROVED
DT 26	Kingsbury Street	11	28.2	11	24.4	-3.8	IMPROVED
DT 27	Ditchling Road Central	11	42.3	10	40.0	-2.3	IMPROVED
DT 28	Ditchling Road South	12	35.9	11	33.5	-2.4	IMPROVED
DT 29	Lewes Road South	12	42.8	12	39.2	-3.6	IMPROVED
DT 30	Lewes Road Central	12	52.6	12	53.9	1.3	INCREASED
DT 31	Hollingdean Road	11	44.4	11	43.1	-1.3	IMPROVED
DT 32	Lewes Road North	11	38.9	11	40.9	2.0	INCREASED
DT 33	Bear Road Bungalows	9	39.9	12	36.0	-3.9	IMPROVED
DT 34	Upper Lewes Road	11	34.6	11	32.1	-2.4	IMPROVED
DT 35	Elm Grove School	10	30.9	11	30.2	-0.6	IMPROVED
DT 36	Hanover Place	12	34.1	12	33.1	-0.9	IMPROVED
DT 37	Richmond Place	12	33.9	12	33.4	-0.5	IMPROVED
DT 38	Grand Parade North	12	43.3	12	41.3	-2.1	IMPROVED
DT 39	Old Steine	12	43.1	11	35.2	-7.8	IMPROVED
DT 40	St James Street	12	41.5	10	43.3	1.8	INCREASED
DT 41	Edward Street	10	35.7	11	35.9	0.2	INCREASED
DT 42	Eastern Road West	12	34.4	12	33.7	-0.7	IMPROVED
DT 43	Eastern Rd Hospital	10	41.3	11	40.0	-1.3	IMPROVED
DT 44	Eastern Road Clinic	9	37.2	11	36.0	-1.2	IMPROVED
DT 46-48	Hove Triplicate Average	12	33.7	10	31.7	-2.0	IMPROVED
DT 49	Sackville Road South	12	33.7	11	34.9	1.2	INCREASED
DT 50	Sackville Road Central	12	35.6	11	33.7	-1.9	IMPROVED
DT 52	Sackville Road North	12	35.4	12	31.9	-3.5	IMPROVED
DT 53	Old Shoreham Rd/Nevill Rd	12	32.5	10	32.1	-0.4	IMPROVED
DT 54	Old Shoreham Rd West	12	26.3	11	25.8	-0.5	IMPROVED
DT 55	Old Shoreham Rd East	12	26.4	12	26.1	-0.3	IMPROVED
DT 56	Ashlings Way	12	19.7	11	18.4	-1.2	IMPROVED
DT 58	Trafalgar Road	12	36.6	12	36.2	-0.4	IMPROVED
DT 59	Wellington Road	12	38.7	11	38.2	-0.5	IMPROVED
DT 60	Boundary Road	12	34.7	12	34.2	-0.5	IMPROVED
DT 61	Portland Road	12	35.9	11	36.6	0.7	INCREASED
DT 62	Titian Road	10	20.7	12	20.4	-0.4	IMPROVED
DT 63	Davigdor Road	12	33.4	11	31.8	-1.7	IMPROVED
DT 65	Dyke Road South	12	37.0	12	33.6	-3.4	IMPROVED
DT 66	Dyke Road/Powis Grove	11	32.7	11	36.4	3.7	INCREASED
DT 67	Dyke Road North	12	33.8	12	32.8	-1.1	IMPROVED
DT 68	Dyke Road/Belmont	10	28.9	12	28.2	-0.8	IMPROVED
DT 69	Buckingham Place	12	42.2	11	40.9	-1.3	IMPROVED
DT 70	Goldsmid Road	12	35.0	12	31.8	-3.2	IMPROVED
DT 71	Vernon Terrace North	11	28.7	12	25.8	-3.0	IMPROVED

DT 72	Vernon Terrace South	11	27.8	10	26.6	-1.2	IMPROVED
DT 73	Chatham Place	12	45.0	10	45.7	0.7	INCREASED
DT 74	Lower Old Shoreham Rd	12	46.7	11	49.5	2.8	INCREASED
DT 75	Western Road West	12	48.6	9	40.0	-8.6	IMPROVED
DT 76	Western Road East	12	54.4	11	53.1	-1.2	IMPROVED
DT 77	North Street	12	45.9	11	60.2	14.3	INCREASED

Count = Number of calender months with data

Sites with less than 9 months are excluded in accordance with TG (09)

NB: Traffic flows change on North Street, 2008 results shows an improvement compared with 2006 concentrations

Appendix D:

QA/QC of automatic monitoring

- Continuous analysers are ratified by ERG (Environmental Research Group, Kings College London) or Bureau Veritas for AURN sites
- Fortnightly Local Service Calibrations are carried out by officers from Brighton and Hove Council
- Gas bottles for span calibrations are provided by Air Liquide and supplied by Arun Welding
- AEA conduct six monthly audits
- A bi-annual service of the continuous analysers is carried out by Supporting Unit
- Local officer calibration has been audited by BSI in support of ISO best practise
- Local service operator training is provided by Supporting Unit and ERG

Appendix E:

QA:QC of Diffusion Tube Bias Adjustment Factors

The laboratory used is Bristol Scientific and the method employed is 20% TEA in water. A triplicate co-location study was carried out at Hove Town Hall and this has been verified with the University of West of England and the Defra helpdesk. It is the same site used for the last three years.
At the time of writing the co-located analyser used for bias correction has been ratified (by ERG) for 85% of the 2008 calendar year. It is not expected that ratification for the final few weeks of 2008 will influence the local bias correction of *0.72, which is the same locally derived adjustment that was applied in 2007.

The laboratory follows procedures set out in Harmonisation Practical Guidance. Results have been corrected to 293 ˚K. Further details including:

- Laboratory WASP results
- Bristol Scientific diffusion tube comparison field trial
- Hove Town Hall 2008 bias correction co-location study
- University if West of England bias-correction questionnaire relevant to BHCC's co-location study at Hove Town Hall

These are included in sequence over the final four pages:

Summary of Precision Results for Nitrogen Dioxide Diffusion Tube Collocation Studies, by Laboratory

Bristol SS		Cardiff SS		Casella Seal / GMSS / Casella CRE / Bureau Veritas Labs / Eurofins		Clyde Analytical Laboratories		Dundee CC		Edinburgh SS		Glasgow SS		Gradko 20% TEA in Water		Gradko 50% TEA in Acetone		Gradko 50% TEA in Water		Harwell SS		Jesmond Dene Labs	
2007	G	2007	G	2007	P	2007	G	2007	G	2007	P	2007	P	2007	G	2007	G	2007	G	2007	G	2007	G
2007	G			2007	P	2008	P	2007	G	2007	G	2007	P	2007	G	2007	G	2007	G	2007	G	2007	P
2007	G			2007	P			2008	G	2007	P	2007	G	2007	G	2007	G	2007	G	2007	G	2007	P
2007	G			2007	P			2008	G	2007	P	2007	G	2007	G	2007	G			2007	G	2007	P
2007	G			2007	P					2007	P	2008	P	2007	G	2007	G			2007	G	2007	P
				2007	G					2007	P	2008	G	2007	G	2007	G			2007	P	2007	G
				2007	P							2008	P	2007	P	2007	G			2007	G	2007	G
				2007	P									2007	P	2007	G			2007	G	2007	G
				2007	G									2007	G	2008	G			2007	G		
				2007	G									2007	G	2008	G			2007	G		
				2007	G									2007	G	2008	G			2007	G		
				2007	P									2007	G	2008	G			2007	G		
				2007	G									2007	G					2007	G		
				2007	G									2007	G					2007	G		
				2007	P									2007	G					2007	G		
				2007	P									2007	G					2007	G		
				2007	P									2007	G					2007	G		
				2008	P									2007	G					2007	G		
				2008	G									2007	G					2008	G		
				2008	G									2007	G					2008	G		
				2008	P									2007	G					2008	G		
				2008	G									2007	G								
				2008	G									2008	G								
				2008	G									2008	G								
				2008	G									2008	G								
				2008	G									2008	P								
														2008	G								
														2008	G								
														2008	G								
														2008	G								

Kent SS		Kirklees Council SS		Lambeth SS		Lancashire CC		Milton Keynes Council		Northampton BC		Rotherham MBC / South Yorks		Staffordshire CC SS		University of Essex		West Yorkshire Analytical Services	
2007	G	2007	G	2007	P	2007	P	2007	G	2007	G	2007	G	2007	G	2007	G		
		2007	G	2007	P	2007	G	2007	G	2007	P	2007	P	2007	G			2007	G
				2007	P	2007	P	2007	G	2007	P	2007	P	2007	G			2007	G
				2007	P			2007	G	2008	G	2007	G	2007	P			2007	P
				2007	P					2008	G	2007	G	2007	G			2007	G
				2007	P							2007	G	2007	G			2007	G
				2007	P							2007	G	2008	P			2007	G
				2007	G							2007	G					2008	G
				2007	P							2007	G					2008	G
				2007	P							2008	G					2008	G
				2007	P							2008	P					2008	P
				2008	P							2008	P					2008	G
												2008	G					2008	G

P	Poor Precision
G	Good Precision
2007	Results of Study carried out in 2007
2008	Results of Study carried out in 2008

Results from Spreadsheet 02/09

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	03/01/2008	30/01/2008	150.9	154.0	159.6	155	4.4	3	11.0	130	99.4	Good	Good
2	30/01/2008	27/02/2008	145.9	140.0	145.2	144	3.2	2	8.0	138	98.7	Good	Good
3	27/02/2008	02/04/2008	130.6	130.9	128.3	130	1.4	1	3.5	117	99.2	Good	Good
4	02/04/2008	30/04/2008	141.0	129.7	141.1	137	6.6	5	16.3	120	99.4	Good	Good
5	30/04/2008	29/05/2008	125.8	120.6	120.4	122	3.1	3	7.6	100	95	Good	Good
6	29/05/2008	03/07/2008	123.5	117.5	124.4	122	3.8	3	9.3	106	99.6	Good	Good
7	03/07/2008	01/08/2008	114.2	115.9	113.7	115	1.2	1	2.9	126	99.4	Good	Good
8	01/08/2008	03/09/2008	112.9	123.0	123.0	120	5.8	5	14.5	128	98.4	Good	Good
9	03/09/2008	01/10/2008	110.3	90.7	111.4	104	11.6	11	28.9	108	99.4	Good	Good
10	01/10/2008	29/10/2008	114.4	124.0	137.8	125	11.8	9	29.2	138	99	Good	Good
11	29/10/2008	03/12/2008	99.8	97.4	100.3	99	1.6	2	3.9	90	99.2	Good	Good
12	03/12/2008	07/01/2009	96.5	76.6	102.0	92	13.4	15	33.2	88	99.5	Good	Good
13													
												Overall survey -->	Good precision	Good Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

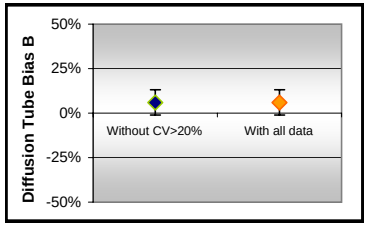
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Bristol - Field Intercomparison 2008

Precision	12 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.95 (0.89 - 1.02)
Bias B	5% (-2% - 13%)
Diffusion Tubes Mean:	122 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	116 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	116 (109 - 124) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.95 (0.89 - 1.02)
Bias B	5% (-2% - 13%)
Diffusion Tubes Mean:	122 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	116 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	116 (109 - 124) μgm^{-3}



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Version 03 - November 2006

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	01/01/2008	30/01/2008	36.6	33.9	40.0	37	3.1	8	7.6	27.3	89.9	Good	Good
2	01/02/2008	31/02/2008	60.8	64.0	57.9	61	3.1	5	7.6	49.2	94.3	Good	Good
3	01/03/2008	31/03/2008	43.1	45.0	49.4	46	3.2	7	8.0	31.6	84.9	Good	Good
4	01/04/2008	31/04/2008	49.7	42.5		46	5.1	11	45.7	34.3	99.3	Good	Good
5	01/05/2008	31/05/2008	57.9	52.7		55	3.7	7	33.0	36.3	99.6	Good	Good
6	01/06/2008	31/06/2008		35.0	25.1	30	7.0	23	62.9	22.3	99.6	Poor Precision	Good
7	01/07/2008	31/07/2008	30.4	26.8		29	2.5	9	22.9	11.2	96.9	Good	Good
8	01/08/2008	31/08/2008	25.4	24.2		25	0.8	3	7.6	17.5	97	Good	Good
9	01/09/2008	31/09/2008	39.8	39.2		40	0.4	1	3.8	31.9	99.6	Good	Good
10	01/10/2008	31/10/2008	43.3	43.4	40.2	42	1.8	4	4.5	33.6	99.6	Good	Good
11	01/11/2008	31/02/2008	55.6	50.9	51.8	53	2.5	5	6.2	34.3	99.2	Good	Good
12	01/12/2008	31/02/2008	47.6	47.4	52.5	49	2.9	6	7.2	40	96.6	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	BH2 Hove Roadside

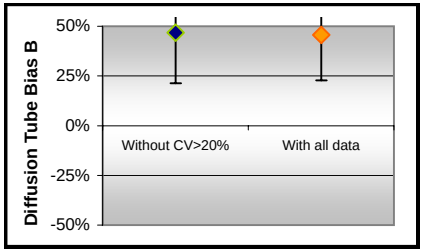
Precision 11 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 11 periods of data

Bias factor A	0.72 (0.61 - 0.88)
Bias B	39% (14% - 64%)
Diffusion Tubes Mean:	44 μgm^{-3}
Mean CV (**Precision**):	6
Automatic Mean:	32 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	32 (27 - 39) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data

Bias factor A	0.72 (0.62 - 0.86)
Bias B	39% (16% - 62%)
Diffusion Tubes Mean:	43 μgm^{-3}
Mean CV (**Precision**):	7
Automatic Mean:	31 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	31 (26 - 37) μgm^{-3}



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Version 03 - November 2006

Diffusion Tube Collocation Data Questionnaire For Local Authorities 2009

Please Read the "Notes" sheet and then fill in the white boxes of this questionnaire
Should you require assistance, email kiribrown@aqconsultants.co.uk or phone 0117 974 1086

	Date form filled in	Name of Local Authority	Your name	Phone number	Contact email
Your Details	25/03/2009	Brighton and Hove City Council	Sam Rouse	01273 292256	samuel.rouse@brighton-hove.gov.uk

	Distance from kerb (m)	Site type (e.g. roadside, background). Definitions of site types are given on the "Notes" sheet	Distance from diffusion tube(s) to continuous analyser inlet (m)	Location (site name or a brief description)	Grid Reference of Site (if available)
Site Details	**4**	Roadside	20 or 30 cm	BH2 Hove Roadside	height of tubes & CA air intake approx 4 metres

	Prepared by (if known; e.g. Harwell Scientific Services)	Analysed by (e.g. Kent Scientific Services)	Preparation method (e.g. 50% TEA in acetone; 50% TEA in water)	How are diffusion tubes deployed? (e.g. with a clip, spacer, shelter box, just tape)
Diffusion Tube Details	Bristol Scientific Services	Bristol Scientific Services	50 ul or 20% triethanolamine in water corrected to 293ºK	Wooden block and clip now due for replacement

	Analyser type	QA/QC (e.g. local or network)
Continuous Analyser Details	Confrim with Hima Chouhan: hima.chouhan@erg.kcl.ac.uk	Contract between Sussex Air Qaulity Partnership and ERG

Data from the Automatic Analyser (Matching Individual Diffusion Tube Periods)

Period	Start Date (dd/mm/yy)	End Date (dd/mm/yy)	% Data Capture	Ratified / Provisional	NOx (if available) (ug/m^3)	Nitrogen Dioxide (ug/m^3)
1	01/01/2008	30/01/2008	89.9	R		27.3
2	01/02/2008	31/02/2008	94.3	R		49.2
3	01/03/2008	31/03/2008	88	R		31.6
4	01/04/2008	31/04/2008	90.8	R		33.8
5	01/05/2008	31/05/2008	87.8	R		36.9
6	01/06/2008	31/06/2008	90.6	R		22.7
7	01/07/2008	31/07/2008	87.4	R		10.3
8	01/08/2008	31/08/2008	90.1	R		17.5
9	01/09/2008	31/09/2008	87.1	R		31.4
10	01/10/2008	31/10/2008	89.9	R		34.1
11	01/11/2008	31/02/2008	89.9	Ratified up to 06 November		34.6
12	01/12/2008	31/02/2008	86.8	P		39.8
13						

Please express NOx as NO_2 (e.g. ppb x 1.913) or alternatively note the approach / units here:

When you are identifying the automatic monitoring periods that match your diffusion tube exposure periods please be as precise as possible. It is not, however, necessary to match start times to the exact hour that you put out your tubes.

Individual Period (monthly) Mean Nitrogen Dioxide Data from the Diffusion Tubes (ug/m^3)

Period		Tube 1	Tube 2 (if available)	Tube 3 (if available)	Tube 4 (if available)
1	Jan	36.6	33.9	40.0	
2	Feb	60.8	64.0	57.9	
3	Mar	43.1	45.0	49.4	
4	Apr	49.7	42.5		
5	May	57.9	52.7		
6	Jun		35.0	25.1	
7	Jul	30.4	26.8		
8	Aug	25.4	24.2		
9	Sep	39.8	39.2		
10	Oct	43.3	43.4	40.2	
11	Nov	55.6	50.9	51.8	
12	Dec	47.6	47.4	52.5	
13					

	Are the concentrations stated in ug/m^3?	Did the diffusion tube supply or analysis method change during the monitoring period? When, from what, to what?	Were there any significant problems with the continuous analyser during the monitoring period?	Are there any other relevant issues with your data?
Other Information	Yes	Check with Bristol Scientific Stephen Pearce [stephen.pearce@bristol.gov.uk]	NO	BH2 Hove roadside records NO2 concentrations that are much lower than many roadside locations in the city. It is not at a worse case hotspot for congestion and site data shows significant improvement in recent years. Majortiy of tubes in BHCC are at 2.4 to 3.2 metres above ground i.e. lower than the co-location study, representative of worse-case exposure locations.

Please Return Completed Questionnaires to: kiribrown@aqconsultants.co.uk

This questionaire has been compiled and distributed by Air Quality Consultants Ltd on behalf of Defra and the DAs