
THE COUNTY COUNCIL OF THE CITY AND COUNTY OF CARDIFF

PART IV, ENVIRONMENT ACT 1995
LOCAL AIR QUALITY MANAGEMENT

PROGRESS REPORT
AUGUST 2007



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EXECUTIVE SUMMARY

Part IV of the Environment Act 1995 requires local authorities periodically to Review and Assess air quality in their areas for compliance with Objectives laid down in Regulations.

This report is the second in the current three-year reporting cycle and follows the 2006 Updating and Screening Assessment. This concluded that, based upon monitoring data to the end of 2005, there was need for a review of Cardiff's four Air Quality Management Areas (AQMAs) as monitoring data was tending to suggest that some were no longer required.

The AQMA Review document was published and consulted upon during the autumn of 2006 and it concluded that two of the four AQMAs, namely The Philog and Newport Road, could be revoked and that the Cardiff West AQMA should be reduced in size and renamed as the Ely Bridge AQMA.

Orders making the changes came into force on 1st February 2007, although there was some disagreement with Welsh Assembly Government with regard to whether or not a monitoring site in Llandaff should be included within an AQMA.

This report builds upon the earlier reports and gives monitoring data to the end of 2006. This indicates that the Council's decisions in respect of the AQMAs have been vindicated, particularly in respect of the monitoring site in Llandaff.

This report also details progress with respect to the Air Quality Action Plans and concludes that these need to be reviewed in light of the changes to Cardiff's AQMAs. A formal Action Plan for the St Mary Street AQMA will be published in autumn 2007, although works to address the poor air quality in the area have already commenced with the closure of the road-link to private vehicles.

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1.0 Introduction

This Progress Report is the second annual report in the three-year 2006 – 2008 Local Air Quality Management reporting cycle. The first report was the 2006 Updating and Screening Assessment (USA) published in July 2006.

The 2006 USA indicated the need for a Detailed Assessment for nitrogen dioxide to review three of the Council's four Air Quality Management Areas (AQMA) as monitoring data was tending to suggest that the AQMA in their current form were not needed.

The Detailed Assessment was published in October 2006 and consulted upon during November 2006. It concluded the following with respect to the AQMA:

AQMA	Detailed Assessment Conclusion	Outcome
Newport Road	Monitoring at relevant locations within the AQMA has shown that it is no longer necessary.	AQMA revoked by Order on 1 st February 2007
The Philog	Monitoring at relevant locations within the AQMA has showed that it is not necessary as above	AQMA revoked by Order on 1 st February 2007
Cardiff West	Monitoring at relevant locations showed that the annual Objective for nitrogen dioxide was being exceeded at one relevant location in the Ely Bridge area. Elsewhere within the AQMA the Objective was not being exceeded at relevant locations. AQMA could be replaced by a smaller one centred on the Ely Bridge area	AQMA varied by Order on 1 st February 2007 and renamed "Ely Bridge"

There are currently, therefore, two AQMA in Cardiff, i.e. the existing St Mary Street AQMA and the newly declared Ely Bridge AQMA.

This report is framed in accordance with Progress Report Guidance LAQM.PRG(03) and presents:

1. new monitoring data obtained during 2006 together with data from previous years and maps of monitoring locations
2. proposed new planning developments which might have an effect upon air quality locally

2.0 Summary of Monitoring for Pollutants other than Nitrogen Dioxide

Cardiff Council uses a variety of monitoring techniques to measure the concentration of pollutants in the air. These fall into two broad categories – automatic, real-time measurements and non-automatic measurements where laboratory analysis is required.

Data from two automatic monitoring sites is included in this report; DEFRA's Cardiff Centre AURN site and the Council's own automatic monitoring site at Briardene Road Safety Centre.

The Cardiff Centre AURN station is part of DEFRA's AUN network and there are similar stations located in other towns and cities across the UK – all sited according to similar criteria. This site is subject to regular, six-monthly QA/QC audits by NETCEN, the DEFRA's appointed contractor and calibration gases are all traceable to National Standards.

The repair and replacement of equipment has been contracted to suppliers of national repute throughout the station's working life.

Cardiff County Council has been the station's Local Site Operator (LSO) since commissioning in 1992. It has been the LSOs responsibility to calibrate the equipment during this time. Calibrations have been carried out at least fortnightly according documented procedures in use throughout the network, with the TEOM filters being changed every four weeks.

The Council's Briardene site is similar, in that fortnightly calibrations are undertaken using gases of known concentration. The site is subject to six-monthly services by the equipment manufacturers and the Council has a repair and maintenance contract with them. This site is also subject to regular, six-monthly QA/QC audits by NETCEN as part of their contract with the Welsh Air Quality Forum.

Map 1, Appendix 1, shows the location of the automatic monitoring sites.

2.1 Carbon Monoxide

The Air Quality Objective for carbon monoxide, set by The Air Quality (Amendment) (Wales) Regulations 2002, is $10\mu\text{gm}^{-3}$ expressed as the maximum daily 8-hour running mean. This was to be achieved by the end of 2003.

Carbon monoxide is monitored in Cardiff at the two automatic monitoring sites.

DEFRA's Cardiff Centre AURN monitoring station is in Frederick Street, just off Queen Street in the city centre. This site is classed as "Urban Centre" and is in a busy pedestrianised shopping area approximately 190m from the nearest kerb.

The Council's Briardene Road Safety Centre monitoring site is located on North Road close to the busy Gabalfa Interchange on the A470/North Road and A48 Eastern Avenue junction. This site is classified as "roadside" and is less than 5m from the kerb of North Road. There approximately 45,000 vehicles per day using the road adjacent to the monitoring station.

Table 1 below gives the maximum daily running 8-hour mean concentration of carbon monoxide measured at the monitoring stations in recent years.

Table 1 Maximum daily 8-hour running mean concentrations of carbon monoxide (mgm^{-3}).

Monitoring site	1999	2000	2001	2002	2003	2004	2005	2006
Cardiff Centre AURN	2.7	2.9	1.9	2.0	1.8	1.8	1.7	0.3
Briardene	3.5	4.1	2.0	5.3	2.2	3.6	2.1	1.4

There are no measurements of the maximum daily 8-hour running average for carbon monoxide that have exceeded the Objective level of 10mgm^{-3} . There continues to be very little risk of the Objective for carbon monoxide being exceeded in Cardiff.

2.2 Benzene

The Air Quality Objective for benzene is $16.25\mu\text{g}\text{m}^{-3}$ expressed as a running annual mean. This was to be achieved by the end of 2003.

There is a further Objective for benzene in The Air Quality (Amendment) (Wales) Regulations 2002 of $5\mu\text{g}\text{m}^{-3}$ expressed as an annual mean, to be achieved by the end of 2010.

Benzene has been monitored at two sites in Cardiff in recent years using a real-time, continuously recording analyser. Until the beginning of 2003 the site was located at the laboratories of Cardiff Scientific Services at Crofts Street, Roath and this site was classified as "Urban Background" and known as "Cardiff East". The monitoring equipment is now located at the Cardiff Centre AURN site in Frederick Street, a site classified as "Urban Centre."

Table 2 below gives the annual average benzene concentration measured at the monitoring stations in recent years.

Table 2 Annual average concentrations of benzene ($\mu\text{g}\text{m}^{-3}$).

Monitoring site	1999	2000	2001	2002	2003	2004	2005	2006
Cardiff East	3.62	3.24	1.79	0.7	-	-	-	-
Cardiff Centre	-	-	-	-	1.18	0.85	*	1.14

**Valid ratified data not available at time of writing. Site out of action for 5 months during year.*

This monitoring data confirms that the 2003 Objective has been comfortably achieved at both monitoring locations and that the 2010 Objective is also likely to be achieved at the current Cardiff Centre site.

The Cardiff East monitoring site represents "relevant exposure" given that the Cardiff Scientific Services laboratories are located in a residential area.

The 2006 USA confirmed the lack of significant industrial sources of benzene in Cardiff and there continues to be very little risk of the Objective being exceeded.

2.3 1,3-Butadiene

The Air Quality Objective for 1,3-butadiene is $2.25\mu\text{g}\text{m}^{-3}$ expressed as a running annual mean. This was to be achieved by the end of 2003.

1,3-butadiene has been monitored in Cardiff at two sites in Cardiff in recent years using a real-time, continuously recording analyser. Until the beginning of 2003 the site was located at the laboratories of Cardiff Scientific Services at Crofts Street, Roath and this site was classified as "Urban Background" and known as "Cardiff East". The monitoring equipment is now located at the Cardiff Centre AURN site in Frederick Street, a site classified as "Urban Centre."

Table 3 below gives the annual average 1,3-butadiene concentration measured at the monitoring stations in recent years.

Table 3 Annual average concentrations of 1,3-butadiene ($\mu\text{g}\text{m}^{-3}$).

Monitoring site	1999	2000	2001	2002	2003	2004	2005	2006
Cardiff East	0.46	0.36	0.29	0.05	-	-	-	-
Cardiff Centre	-	-	-	-	0.15	0.11	*	0.29

*Valid ratified data not available at time of writing. Site out of action for 5 months during year.

This monitoring data confirms that the 2003 Objective has been comfortably achieved at both monitoring locations.

The Cardiff East monitoring site represents “relevant exposure” given that the Cardiff Scientific Services laboratories are located in a residential area.

The 2006 USA confirmed the lack of significant industrial sources of 1,3-butadiene in Cardiff and there continues to be very little risk of the Objective being exceeded.

2.4 Lead

The air quality Objectives for lead are $0.5\mu\text{g}\text{m}^{-3}$ as an annual mean to be achieved by the end of 2004 and $0.25\mu\text{g}\text{m}^{-3}$ as an annual mean to be achieved by the end of 2008.

The council decommissioned its own monitoring sites at the end of 2003 and monitoring for lead is now carried out at just one site in Cardiff. This is the “national network” site at Waungron Road. Prior to the end of 2003, this site was part of the “Lead in Petrol” survey and monitoring was carried out using an “M-type” sampler. This was changed to an “Andersen” sampler in 2004 and the site now forms part of the National Physical Laboratory (NPL) multi-element survey. The monitoring site is classified as “roadside” and is less than 5m from the kerb of the heavily-trafficked A48 Western Avenue.

Table 4 below gives the annual average concentrations of lead in Cardiff in recent years.

Table 4 Annual average concentrations of lead ($\mu\text{g}\text{m}^{-3}$).

Monitoring site	2000	2001	2002	2003	2004	2005	2006
Cardiff (“national network”)	0.029	0.028	0.025	0.021	0.017	0.020	0.019
Western Leisure Centre	0.02	0.02	0.01	0.02	-	-	-
Pentwyn Leisure Centre	0.02	0.02	0.01	0.01	-	-	-

All of the monitored annual average concentrations are considerably below even the 2008 Objective of $0.25\mu\text{g}\text{m}^{-3}$.

2.5 Sulphur Dioxide

The air quality Objectives for sulphur dioxide (SO_2) are $266\mu\text{g}\text{m}^{-3}$ as a 15-minute mean not to be exceeded more than 35 times per year by the end of 2005, a 1-hour Objective of $350\mu\text{g}\text{m}^{-3}$ not to be exceeded more than 24 times per year and a 24-hour Objective of $125\mu\text{g}\text{m}^{-3}$ not to be exceeded more than 3 times per year.

SO₂ is measured at both of the permanently-located continuously-recording monitoring stations in Cardiff. The Cardiff Centre AURN site is located in a pedestrianised area in the City Centre and is an “Urban Centre” site. The Council’s Briardene Road Safety Centre site is located alongside the heavily-trafficked North Road at Gabalfa Interchange; this is a “roadside” site.

Data from these sites is given below in Table 5, below.

Table 5 Summary of SO₂ monitoring by real-time analyser

Monitoring site	15-minute > 266µgm ⁻³				1-hour > 350µgm ⁻³				24-hour > 125µgm ⁻³			
	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
Cardiff Centre AURN	0	0	0	0	0	0	0	0	0	0	0	0
Briardene RSC	0	0	0	5	0	0	0	0	0	0	0	0

There were 5 exceedences of the 15-min Objective of the 15-minute Objective at the Briardene Road Safety Centre site during 2006; these have been the only exceedences at either site in the last four years.

The Council ceased monitoring for SO₂ by the “bubbler method” at the end of 2005. Data from this monitoring is available in earlier reports.

With no significant industrial sources anywhere in Cardiff, there continues to be very little risk of the Objectives for SO₂ being exceeded.

2.6 Particulate Matter

The air quality Objectives for particulate matter (PM₁₀) are 40µgm⁻³ as the annual mean and a fixed 24-hour mean of 50µgm⁻³ not to be exceeded more than 35 times per year. Both of these were to be achieved by the end of 2004.

The EU has set indicative limit values for PM₁₀ which are to be achieved by 1st January 2010. These “Stage 2” limit values are considerably more stringent than the current UK air quality Objectives and are 20µgm⁻³ as the annual mean and 50µgm⁻³ as the 24-hour mean to be exceeded no more than 7 times per year.

Central government and the devolved administrations have therefore introduced “provisional Objectives” but these have not been brought into the Regulations for the purposes of LAQM at the present time.

For most of England and all of Wales, these provisional Objectives are the same as the Stage 2 limit values. There is currently no statutory Obligation upon local authorities to consider these provisional Objectives.

The particulate matter (PM₁₀) data given in this report is monitored by TEOM (Tapered Element Oscillating Microbalance) at two fixed locations in Cardiff, namely the Cardiff Centre AURN site in Frederick Street and the Council’s Briardene Road Safety Centre on North Road. The former site is classed as “Urban Centre” and the latter is a “Roadside” site.

A summary of this monitoring in recent years is given in Table 6 below.

Table 6 Particulate (PM_{10(grav)}) monitoring data (µgm⁻³)

Site	Annual mean						Number of days >50µgm ⁻³					
	2001	2002	2003	2004	2005	2006	2001	2002	2003	2004	2005	2006
Cardiff Centre AURN	27	27	35	26	26	27	12	13	53	6	3	5
Briardene Road Safety Centre	19	22	25	23	23	21	5	7	17	5	4	3

The data indicate that the 2004 Objectives have been achieved at both sites in each year save for 2003 when the 24-mean Objective of 50µgm⁻³ was exceeded 53 times compared to the 35 times that the Objective specifies at the Cardiff Centre AURN site. Given that the data for Briardene Road Safety Centre also shows an elevated number of exceedences that year, it is likely that this is not attributable to abnormal emissions local to the sites.

Table 7 below gives the data for the Cardiff Centre AURN and for the former Bristol Centre AURN, Bristol being nearest city to Cardiff geographically. The Bristol Centre site was classed as Urban Background

Table 7 Particulate (PM_{10(grav)}) monitoring data (µgm⁻³) for Cardiff Centre and Bristol Centre

Site	Annual mean				Number of days >50µgm ⁻³			
	2001	2002	2003	2004	2001	2002	2003	2004
Cardiff Centre	27	27	35	26	12	13	53	6
Bristol Centre	24	26	29	27	16	7	37	10

The data for Bristol Centre also shows an increased number of exceedences of the 24-hour Objective in 2003. This provides further evidence that the 2003 data for Cardiff Centre is not attributable to increased local emissions and that the observed increased number of exceedences that year was experienced regionally.

The air quality Objectives are set in terms of “gravimetric” monitoring at ambient temperature. Technical Guidance LAQM.TG(03) advises that PM₁₀ data derived from monitoring by TEOM instruments should be multiplied by a correction factor of 1.3 to allow for evaporative mass losses due to the instrument’s inlet tract being heated to 50°C.

However, it has come to light that tests comparing the TEOM analyser with reference gravimetric analysers have failed to demonstrate equivalence. It is not able to comply with the Data Quality Objective for overall uncertainty as defined within the relevant Air Quality Directive – in the case of PM₁₀ this is 25%. The TEOM analyser therefore cannot be considered equivalent to the European reference method within the UK, even with a correction factor applied.

Defra and the Devolved Administrations have considered options for the restructuring of the UK networks, and the TEOM analyzer at the Cardiff Centre AURN was replaced with an FDMS PM₁₀ analyser in February 2007.

There are knock-on consequences for those many local authorities, including Cardiff, which use TEOM analysers to support their LAQM work. The issue is most critical where PM₁₀ levels are slightly above or below the objectives.

Whilst local authorities are encouraged to use instruments that meet the equivalence criteria, it is recognised that local authorities have invested considerable resources in TEOM analysers, and it may not be practicable to replace these instruments in the short term. Defra and the Devolved Administrations consider that TEOM analysers remain suitable for use for the purpose of LAQM, using the current default correction factor of 1.3.

However, local authorities are also encouraged to have particular regard to those locations where concentrations are expected to be close to the objectives. It is not possible to precisely define what "close to the objectives" means, but as an approximate guide it is likely to be in the range 30 to 40 days exceedance as measured by the TEOM multiplied by 1.3.

The data in Table 6 above is TEOM data corrected by a 1.3 factor. With the exception of the data for 2003, both sites show relatively consistent data year-on-year; the annual average concentration being generally below $30\mu\text{g}\text{m}^{-3}$ which is more than 25% below the Objective indicating that neither site should be considered "critical" in light of the above discussion. Likewise for the number of days each year where the concentration is above the 24-hour Objective is very small when compared to the "allowed" 35 days.

Overall, allowing for the current uncertainties, there is little risk of the 2004 PM_{10} Objectives being exceeded at these monitoring locations.

As stated in earlier reports, there remains considerable doubt that the provisional 2010 Objectives would be achieved were they to be brought into the Regulations. Whilst the provisional 24-hour Objective might be achieved, it is unlikely that the provisional annual mean Objective would be.

3.0 Summary of Monitoring for Nitrogen Dioxide

The air quality Objectives for nitrogen dioxide (NO_2) are $40\mu\text{g}\text{m}^{-3}$ as an annual mean and a 1-hour mean of $200\mu\text{g}\text{m}^{-3}$ not to be exceeded more than 18 times per year, both to be achieved by the end of 2005.

LAQM.TG(03) advises that the annual mean Objective of $40\mu\text{g}\text{m}^{-3}$ is currently being widely exceeded at roadside sites throughout the UK, with exceedences reported at Urban Background locations in major conurbations. The number of exceedences of the 1-hour Objective show considerable year-to-year variations; these are caused by varying meteorological conditions year-on-year rather than emission changes.

In recent years, exceedences of the short-term Objective have generally only been recorded at roadside or kerbside sites in close proximity to heavily trafficked roads in major conurbations.

In common with many other towns and cities, Cardiff has localised hot-spots of nitrogen dioxide pollution which cause the Objectives to be breached and there are Air Quality Management Areas (AQMAs) declared as a result.

Table 8 below gives a summary of the history of the AQMAs in Cardiff

Table 8 AQMA History in Cardiff

AQMA name	Declared	Revoked
The Philog	01/12/00	01/02/07
Newport Road	01/12/00	01/02/07
Cardiff West	01/12/00	01/02/07*
St Mary Street	01/09/02	-
Ely Bridge	01/02/07*	-

*The area covered by the Cardiff West AQMA was varied on this date and the name changed to Ely Bridge to reflect the change in area.

Maps 3 and 4 in Appendix 1 show the geographical areas covered by the two AQMAs

3.1 Monitoring of Nitrogen Dioxide

Nitrogen dioxide continues to be monitored extensively in Cardiff. In addition to two permanently located chemiluminescent analysers (the DEFRA AURN site in Frederick Street and the Council's own site at Briardene Road Safety Centre), the Council also operates a network of around 60 nitrogen oxide diffusion tubes.

All of the monitoring currently carried out within the two AQMAs is by diffusion tube. It had been hoped to relocate the monitoring equipment from Briardene Road Safety Centre into Council-owned premises within the St Mary Street AQMA during the first half of 2004 but the premises were sold.

Map 1, Appendix 1, shows the location of the automatic monitoring sites and Map 2, Appendix 1 shows the location of the diffusion tubes during 2006.

Diffusion Tube Bias Adjustment

Measurement of nitrogen dioxide by diffusion tube can be unreliable due to a variety of preparation and analytical methodologies in use and due to errors that may occur during preparation, extraction and analysis. It is important therefore that diffusion tube measurements are validated against a properly calibrated chemiluminescent analyser and the diffusion tube measurements corrected for any systematic bias that may occur.

The Council's diffusion tubes are prepared, extracted and analysed by Cardiff Scientific Services. The tubes are prepared using the 50% TEA in acetone method.

Since February 2002, the Council has co-located three diffusion tubes with the Cardiff Centre AURN site in Frederick Street. The tubes are located on the station's sample inlet duct. The results of this monitoring from February 2002 to December 2006 inclusive are given in Tables 9, 10, 11, 12 and 13. These can be used to determine the "Bias Adjustment Factor" and "Diffusion Tube Bias" for measurements made by diffusion tube compared to the more accurate measurements made by chemiluminescent analyser.

For Tables 9, 10, 11, 12 and 13 below, data denoted "R" means that the data from the Cardiff Centre AURN site has been "ratified" for the period.

Table 9 2002 Nitrogen Dioxide Measurements at Cardiff Centre AURN

Month	Tube Number			Tube Average	AURN Average	
	101	102	103			
Jan	-	-	-	-	-	
Feb	35	36	35	35	33	R
Mar	42	39	41	41	36	R
Apr	31	29	33	31	31	R
May	24	32	26	27	27	R
Jun	22	23	24	23	25	R
Jul	23	21	19	21	24	R
Aug	37	22	16	25	27	R
Sep	32	34	31	32	32	R
Oct	39	39	40	39	40	R
Nov	39	40	40	40	37	R
Dec	63	62	56	60	41	R
Ave	35	34	33	34	32	R

Table 10 2003 Nitrogen Dioxide Measurements at Cardiff Centre AURN

Month	Tube Number			Tube Average	AURN Average	
	101	102	103			
Jan	39	32	33	35	39	R
Feb	46	59	56	54	46	R
Mar	52	54	48	51	46	R
Apr	38	37	-	-	-	R
May	31	18	28	26	28	R
Jun	30	26	22	26	27	R
Jul	35	29	27	30	27	R
Aug	25	29	23	26	30	R
Sep	43	42	38	41	34	R
Oct	46	37	45	43	35	R
Nov	57	59	62	59	34	R
Dec	57	51	54	54	34	R
Ave	42	39	40	40	35	R

AURN data missing 04/04/03 to 01/05/03.

Data for April 2003 not used in calculating tube, AURN or overall averages

Table 11 2004 Nitrogen Dioxide Measurements at Cardiff Centre AURN

Month	Tube Number			Tube Average	AURN Average	
	101	102	103			
Jan	47	43	38	43	30	R
Feb	48	51	45	48	33	R
Mar	51	51	47	50	36	R
Apr	33	35	37	35	32	R
May	33	30	30	31	27	R
Jun	27	24	27	26	20	R
Jul	31	31	22	28	21	R
Aug	28	30	27	28	22	R
Sep	36	18	37	30	27	R
Oct	35	41	43	40	30	R
Nov	46		47	47	40	R
Dec	47	39	47	44	46	R
Ave	39	36	37	37	30	R

Table 12 2005 Nitrogen Dioxide Measurements at Cardiff Centre AURN

Month	Tube Number			Tube Average	AURN Average	
	101	102	103			
Jan	38	39	36	38	32	R
Feb	34	42	41	39	33	R
Mar	36	46		41	38	R
Apr*		38	53	46	32	R
May						
Jun						
Jul						
Aug						
Sep						
Oct						
Nov*	58	57	58	58	50	P
Dec	49	51	51	50	36	P
Ave	43	46	48	44	37	P

**Please Note:
Diffusion tubes for April 2005 removed at midday on 03/05/05. Diffusion tube for November 2005 exposed from 2:30pm on 03/11/05. The AURN data for these months matches these times/dates.*

Table 13 2006 Nitrogen Dioxide Measurements at Cardiff Centre AURN

Month	101	102	103	Tube	2006 AURN	
Jan	48	48	45	47	38	R
Feb	47	46	44	46	43	R
Mar	39	27	33	33	35	R
Apr	33	34	36	34	29	R
May	29	30	27	29	28	R
Jun	26	24		25	29	R
Jul	25	25	27	26	21	R
Aug	27	25	25	26	19	R
Sep	31	31	30	31	25	R
Oct	43	43	43	43	31	R
Nov	43	45	45	44	36	R
Dec	49	47	47	48	34	R
Ave	37	35	37	36	31	

Technical Guidance LAQM.TG(03) advises that the Bias Adjustment Factor (BAF) may be calculated as:

$$\text{BAF} = \frac{\text{CAA}}{\text{DTA}}$$

The percentage Diffusion Tube Bias (DTB) is calculated as:

$$\text{DTB (\%)} = \frac{\text{DTA} - \text{CAA}}{\text{CAA}} \times 100$$

Where:

CAA = Chemiluminescent Analyser Average

DTA = Diffusion Tube Average

The calculated BAF and DTB values from 2002 to 2006 are given in Table 14.

Table 14 BAF and DTB Values Calculated from Cardiff Centre AURN Co-location Data

Year	BAF	DTB (%)	Status
2002	0.94	+6.25	R
2003	0.875	+14.29	R
2004	0.81	+23.3	R
2005	0.84	+18.9	R
2006	0.85	+17.0	R

The data indicate that the Council's diffusion tubes, prepared, extracted and analysed by Cardiff Scientific Services, tend to over-read. The figure for 2002 is considered to be a very satisfactory result whereas the figure for 2004, whilst being acceptable, is less so.

It is interesting that the BAF/DTB figures for 2005 are comparable with those for previous years despite the site being out of commission for a 5 month period which included the whole of the summer period.

All of the diffusion tube data given in this report are bias-adjusted using the above BAF values.

In the tables of diffusion tube data the "Target Concentration" for years prior to 2005 is calculated using correction factors given in LAQM.TG(03). This target concentration, when projected national changes in emissions are taken into account, is the equivalent of $40\mu\text{g}\text{m}^{-3}$ nitrogen dioxide in 2005. For 2005 onwards, the Target Concentration is that of the Objective. Concentrations of nitrogen dioxide which are above the Target Concentration for a given year are identified in bold type.

3.2 Monitoring outside of AQMAs

In addition to the monitoring of nitrogen dioxide in and around Cardiff's AQMAs, there are a number of nitrogen dioxide monitoring sites located in other areas; these are primarily used to help identify hot-spots or monitor concentrations in areas subject to redevelopment.

The monitoring is carried out by both real-time, continuous analyser and by diffusion tube.

Real-time, Continuous Measurements

There are currently two real-time continuous nitrogen dioxide analysers in Cardiff. One is the Cardiff Centre AURN site in Frederick Street and the other is the Council's own site at Briardene Road Safety Centre adjacent to North Road, Gabalfa.

Table 10 below gives the ratified annual average nitrogen dioxide concentrations at the Cardiff Centre AURN and Briardene RSC monitoring sites since 1994. The Cardiff Centre AURN site is classified as "Urban Centre" and Briardene RSC is classified "Roadside".

Table 15 Concentrations of Nitrogen Dioxide ($\mu\text{g}\text{m}^{-3}$) measured by real-time, continuous analyser outside of the AQMAs

Year	Cardiff Centre AURN	Briardene RSC
1994	42	-
1995	42	-
1996	40	-
1997	38	-
1998	40	39
1999	32	30
2000	31	25
2001	34	22
2002	32	23
2003	35	28
2004	30	24
2005	35*	28
2006	30	30

Monitored levels of nitrogen dioxide are, generally, lower at Briardene RSC than the Cardiff Centre AURN for a given year. This reflects the differing nature of the site locations (Briardene RSC is open in aspect whereas the Cardiff Centre AURN site is in an enclosed street) and that nitrogen dioxide is a secondary pollutant formed away from its precursor sources.

Overall, it continues to be unlikely that the Objectives will be breached at either site.

Monitoring by Diffusion Tube

Nitrogen dioxide is currently monitored at 59 locations both inside and outside of Cardiff's two AQMAs. Three of the diffusion tubes are used in a collocation study at the Cardiff Centre AURN site and the remainder are used both inside and outside of the AQMAs.

Table 16 Bias-Adjusted Concentrations of Nitrogen Dioxide ($\mu\text{g m}^{-3}$) outside of the AQMAs

Site number	Site Name	Classification	2002	2003	2004	2005	2006
6	Crofts St Lab	Background	22	25	22	22	21
8	Newport Road	Kerbside	39	39	41	39	43
16	167 Ninian Park Rd	Facade	35	38	34	38	37
19	Western Cemetery	Kerbside	38	44	42	42	46
33	Mitre Place	Kerbside	49	50	53	55	57
44	City Road	Kerbside	43	43	37	45	38
45	Mackintosh Place	Kerbside	36	39	37	38	37
46	Whitchurch Road	Kerbside	55	46	39	45	-
48	Western Avenue	Kerbside	38	45	41	-	40
49	Penarth Road	Facade	32	37	36	35	36
53	The Philog	Kerbside	46	53	45	55	50
55	Lansdowne Road	Kerbside	32	37	38	34	34
56	Birchgrove Village	Kerbside	39	39	35	36	37
59	Llandaff Road	Kerbside	41	32	-	-	-
62	Grand Avenue/CRW	Kerbside	35	39	35	38	-
63	The Crescent	Kerbside	40	39	38	43	45
64	Western Avenue North	Facade	23	25	23	24	26
66	Cross Inn Car Park	Kerbside	41	39	43	44	43
67	Whitchurch Common	Kerbside	24	34	-	-	-
68	Manor Way	Kerbside	26	32	-	-	-
69	Dominion's Way	Kerbside	49	-	-	-	-
70	Oakfield Street	Kerbside	39	47	40	39	41
71	Marlborough Road	Kerbside	24	32	30	31	23
73	Green Street	Facade	23	25	24	25	26
74	Station Terrace	Kerbside	36	34	34	42	41
75	Fidlas Road	Kerbside	28	-	-	-	-
77	St Fagans Road	Kerbside	27	29	-	-	-
80	Colum Road	Kerbside	36	33	40	42	39
81	Stephenson Court	Facade	43	41	41	41	43
82	104 Birchgrove Road	Facade	25	28	26	29	31
83	Cardiff Road	Kerbside	53	54	57	61	68
84	Morganstown Roundabout	Kerbside	21	-	-	-	-
85	497 Cowbridge Road West	Facade	29	27	28	26	27
86	19 Fair oak Road	Facade	39	39	41	40	42

Site number	Site Name	Classification	2002	2003	2004	2005	2006
87	Roundwood Close	Façade	29	-	-	-	-
88	Newport Road (IMO)	Kerbside	39	46	42	45	43
89	Moira Terrace	Kerbside	47	39	43	39	43
90	Bridge Road	Façade	25	31	31	31	29
91	Whitchurch Village	Façade	28	32	30	29	29
92	Rhiwbina Village	Façade	23	-	-	-	-
93	Clive Street	Façade	26	29	29	31	31
94	York Place	Façade	27	25	27	26	26
95	Croescadarn Road	Kerbside	20	-	-	-	-
96	Manor Way Junction	Façade	32	37	30	37	37
97	Newport Road (premises)	Façade	37	36	36	34	40
98	Western Avenue (premises)	Façade	25	34	29	29	-
99	Cardiff Road (Llandaff)	Façade	33	40	36	40	40
100	188 Cardiff Road	Façade	35	36	36	38	39
104	6 Fidlas Road	Façade	-	25	-	-	-
105	196 Broadway	Façade	-	36	30	34	31
106	30 Caerphilly Road	Façade	-	36	36	37	36
107	Lynx Hotel	Façade	-	37	37	36	37
108	Heol y Pavin	Kerbside	-	39	36	42	45
109	66 Cardiff Road	Façade	-	34	29	30	31
110	24 Llwyn Mallt	Façade	-	32	-	-	-
111	98 Leckwith Road	Façade	-	24	20	24	24
112	17 Sloper Road	Façade	-	29	28	29	30
113	17 The Philog	Façade	-	-	26	28	27
114	2 Thornhill Road	Façade	-	-	23	25	26
115	19 Llandaff Road	Façade	-	-	38	39	38
116	54 St Fagans Road	Façade	-	-	22	23	23
118	Manor Rise	Kerbside	-	-	28	37	32
Target Concentration			43	42	41	40	40

Of the 62 sites listed in Table 16, 19 have one or more year's data which is above the Target Concentration and 14 of these were in 2006. Of these 19 sites, 17 are kerbside sites not representative of relevant exposure, 8 of which are sites formerly in AQMAs that were revoked in 2006.

Of those sites that do represent relevant exposure, Sites 81 and 86 (Stephenson Court and 19 Fair oak Road) give an annual mean concentration of nitrogen dioxide above the Objective in 2006. At both sites the exceedence is marginal.

With regard to the Stephenson Court site, the Council's 2006 Updating and Screening Assessment said:

"Given the uncertainty with regard to the 2005 BAF used to calculate the 2005 concentrations, it is not possible to say with reasonable certainty that the Objective was being exceeded at this site in 2005. Evidence from earlier years would suggest that concentrations are close to the Objective but it would be unsound to consider an AQMA for this area based upon this single adverse result. Monitoring will continue at this site and a considered view taken once data from 2006 is available."

At the beginning of 2007 the Council commenced monitoring at an additional three sites at residential accommodation in close proximity to Stephenson Court, including a second site at Stephenson Court itself. Given that the 2005 and 2006 data for the Stephenson Court site are above the Objective it is proposed that a Detailed Assessment be carried out in early 2008 once monitoring data from 2007 is available. This report will be submitted instead of a Progress Report, but the report will include a summary of all monitoring data expected in a Progress Report.

The nitrogen dioxide concentration for 2006 at 19 Fairoak Road was above the Objective by $2 \mu\text{gm}^{-3}$. This is the first occasion that this site has given a concentration a Target Concentration. It is likely that concentrations at this site will have been affected by long-term civil engineering works in the very near vicinity affecting traffic flows and therefore traffic emissions in the area. Concentrations at the monitoring site will also have been affected by emissions from heavy plant and generators used during the civil engineering works. It is therefore proposed to continue monitoring at this site and a longer-term, more objective view taken once the civil engineering works are complete.

Following concerns expressed by the National Assembly for Wales in respect of the Council's decision to revoke that part of the former Cardiff West AQMA which included Site 99 (Cardiff Road (Llandaff)), it is pleasing to note that, for the fifth consecutive year, there has been no exceedence of the annual average Objective at that site. Monitoring continues at this site.

Much of the monitoring detailed in Table 16, particularly at sites commenced since 2000 (site number 64 and higher), has been in part of a search for hotspots of NO_2 pollution at relevant locations possibly overlooked during Phase 1 of review and assessment. The monitoring evidence, other than for the two sites discussed above, suggests that there have been no missed hotspots at relevant locations.

3.3 Monitoring inside AQMAs

The following sections discuss monitoring data within Cardiff's two AQMAs. All of this data is for monitoring by diffusion tube; there have been no measurements for NO_2 made by continuously-recording chemiluminescent analyser within either of the AQMAs. Principally, this is because the nature of the AQMAs is such that finding a suitable location for the Council's mobile monitoring station has been impossible on safety grounds; blocking footpaths with the available "groundhog" unit is not viable.

Ely Bridge AQMA

A summary of the monitoring in and around the Ely Bridge AQMA is given in Table 17 below. All values are as the annual mean.

Table 17 Bias-Adjusted Concentrations of Nitrogen Dioxide (μgm^{-3}) in and around the Ely Bridge AQMA

Site number	Site Name	Classification	2002	2003	2004	2005	2006
47	Ely Bridge	Kerbside	55	55	52	54	60
117	25 Cowbridge Road West	Façade	-	-	42	47	49
Target Concentration			43	42	41	40	40

The Ely Bridge AQMA came into force on 1st February 2007 and monitoring at both of the above sites informed the decision making at that time. Nitrogen dioxide levels at these sites are high and consistently so; concentrations are not improving with time.

As a result of the recent AQMA declaration, the Action Plan for the former Cardiff West AQMA, of which the Ely Bridge area was a small part, will be reassessed during the coming year and further measures to improve local air quality investigated.

St Mary Street AQMA

A summary of the monitoring in and around the Ely Bridge AQMA is given in Table 18 below. All values are as the annual mean.

Table 18 Bias-Adjusted Concentrations of Nitrogen Dioxide ($\mu\text{g}\text{m}^{-3}$) in and around the St Mary Street AQMA

Site number	Site Name	Classification	2002	2003	2004	2005	2006
1	Terminus Building	Kerbside	48	60	48	55	-
5	St Mary Street	Kerbside	59	61	58	62	60
58	Westgate Street	Kerbside	41	43	45	49	48
72	High Street	Kerbside	71	74	73	66	68
Target Concentration			43	42	41	40	40

The St Mary Street AQMA came into force on 1st September 2002 and monitoring at the above sites informed the decision making at that time. Sites 1 and 72 are within the AQMA.

Monitoring at Site 1 (Terminus Building) ceased mid-way through 2006 as access to the premises was lost. This was replaced with a new kerbside site in nearby Havelock Street where construction of a new office and residential development is due to commence.

The monitored NO₂ concentrations at Site 58 (Westgate Street) have been gradually increasing in recent years and concentrations at the site have been above the Target Concentration/Objective for the last four years. Site 58 is located on kerbside street furniture adjacent to traffic lights outside residential accommodation, the façade of which is 6 metres from the kerb. Monitoring on the façade of the residential accommodation commenced in January 2007 and will be assessed in the next report.

Monitoring also commenced in January 2007 at a site outside The Sandringham Hotel on St Mary Street. This site is located between the High Street and St Mary Street sites and will help inform assessment of Action Plan measures once these are implemented.

A report entitled "Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Site" was commissioned by DEFRA in order to inform the review and assessment process. This report concluded that it was unlikely that the 1-Hour Objective would be breached at roadside/kerbside sites if the annual mean nitrogen dioxide concentration is less than $65\mu\text{g}\text{m}^{-3}$ and that it would be appropriate for local authorities to base decisions with regard to the 1-Hour Objective using an annual mean threshold of $60\mu\text{g}\text{m}^{-3}$.

Given the above, it is likely that, in addition to the annual average Objective, the 1-hour mean Objective has also been breached in recent years within the AQMA.

It is clear that a significant air quality problem remains within and around the AQMA. Whilst there is currently no formal Air Quality Action Plan for the AQMA, measures have been taken to address the problem, including the very recent closure of High Street and St Mary Street to private vehicles.

4.0 Proposed New Developments with the Potential to Affect Local Air Quality

The Council's 2005 Progress Report and identified a number of potentially significant local developments which might impact upon local air quality, as follows:

St David's II (Shopping Centre)

The development covers a significant part of the city centre and works are now well under way. These involve substantial demolition and construction works, plus a new/remodelled road network through the area. The development will include residential accommodation but final location of these have yet to be decided.

The development is close to the St Mary Street AQMA and there were initial concerns that there might be an adverse impact upon it, both during the construction phase and afterwards. However, the recent closure to private vehicles of the High Street/St Mary Street link has allayed these concerns somewhat.

Ikea, Ferry Road

During 2003 a new Ikea store was built on Ferry Road, in the Grangetown area of Cardiff. This area is not part of, or close to, an AQMA. The store opened in November 2003.

Assessments made at the time that the planning application was being considered indicated that it was unlikely that the development would have a significant detrimental effect upon air quality in Cardiff and that no additional AQMAs would need to be declared as a result of this development combined with others in the area (see "International Sports Village" below).

However, it was decided to measure nitrogen dioxide levels at nearby residential premises and at residential premises adjacent to busy road junction which could be used by traffic travelling to Ikea.

Data given in Table 16 above for Sites 93 and 94 show that there is no cause for concern at relevant locations which could have been affected by the development.

International Sports Village

Development of the new International Sports Village is underway on the Ferry Road peninsula, at the Southern extreme of Ferry Road. This is a coastal site and is separated from relevant locations in the area by the A4232. This is a major mixed sports, commercial and residential development.

The traffic and air quality impact studies did not suggest that the development would on its own cause air quality problems at relevant locations in Cardiff.

The combined impact of this ongoing development together with the Ikea store (see above) is being monitored at Sites 93 and 94. There does not appear to be any measurable impact.

Cardiff City Football Stadium

Construction work is now underway for a new stadium to replace Cardiff City's Ninian Park ground. It is being built in the Leckwith area of Cardiff on the site currently occupied by the Leckwith Athletics Stadium and a replacement Athletics Stadium is being built on an adjacent site with plans for housing to be built on the site of the Ninian Park ground.

It is anticipated that most of the traffic accessing the new stadium will do so via the A4232 "Ely Link Road" and the junction of this road with Leckwith Road is being remodelled as part of the development.

Assessment at the time that the planning applications were considered showed that there no relevant locations close to A4232/Leckwith Road junction and nitrogen dioxide concentrations in the locality were low.

However, in order to monitor the impact of the development, monitoring commenced at two residential premises in the locality in May 2003. Monitoring results at Sites 111 and 112 (see Table 16 above) give no cause for concern at the present time.

There have been no new proposals for potential developments possibly significant in air quality terms since the 2006 Updating and Screening Assessment.

5.0 Conclusions

2006 was a significant year for Cardiff in terms of Local Air Quality Management; two of the four AQMAs in existence at the end of 2005, i.e. Newport Road and The Philog, were revoked and a third, i.e. Cardiff West was significantly revised to cover only a small part of its formerly large geographical area.

It is pleasing to note, therefore, that the monitoring data for 2006 presented in this report indicate that these decisions were justified and there have been no exceedences of Objectives at relevant locations which were formerly inside an AQMA.

However, it is not all good news. The monitoring data indicate that there are other areas of concern, most notably exceedences at Stephenson Court on Newport Road near the City Centre and at residential premises adjacent to the roundabout at the junction of Ninian Road and Fairoak Road. Whilst the latter may be attributable to temporary local sources the former may not and a Detailed Assessment needs to be made.

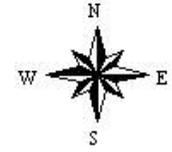
For the two remaining AQMAs, St Mary Street and Ely Bridge, significant air quality problems persist. Bringing about an improvement in the Ely Bridge AQMA will be the focus of a review of the Council's current Air Quality Action Plans following the revisions made during 2006.

2007 promises to be a significant year with regard to the St Mary Street AQMA. Whilst formal Action Plans can be expected later in the year, measures are already being taken to address the air quality issues, most notably the recent closure of the road link to all private vehicles (other than time-restricted access for deliveries).

**PROGRESS REPORT
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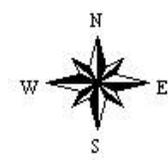
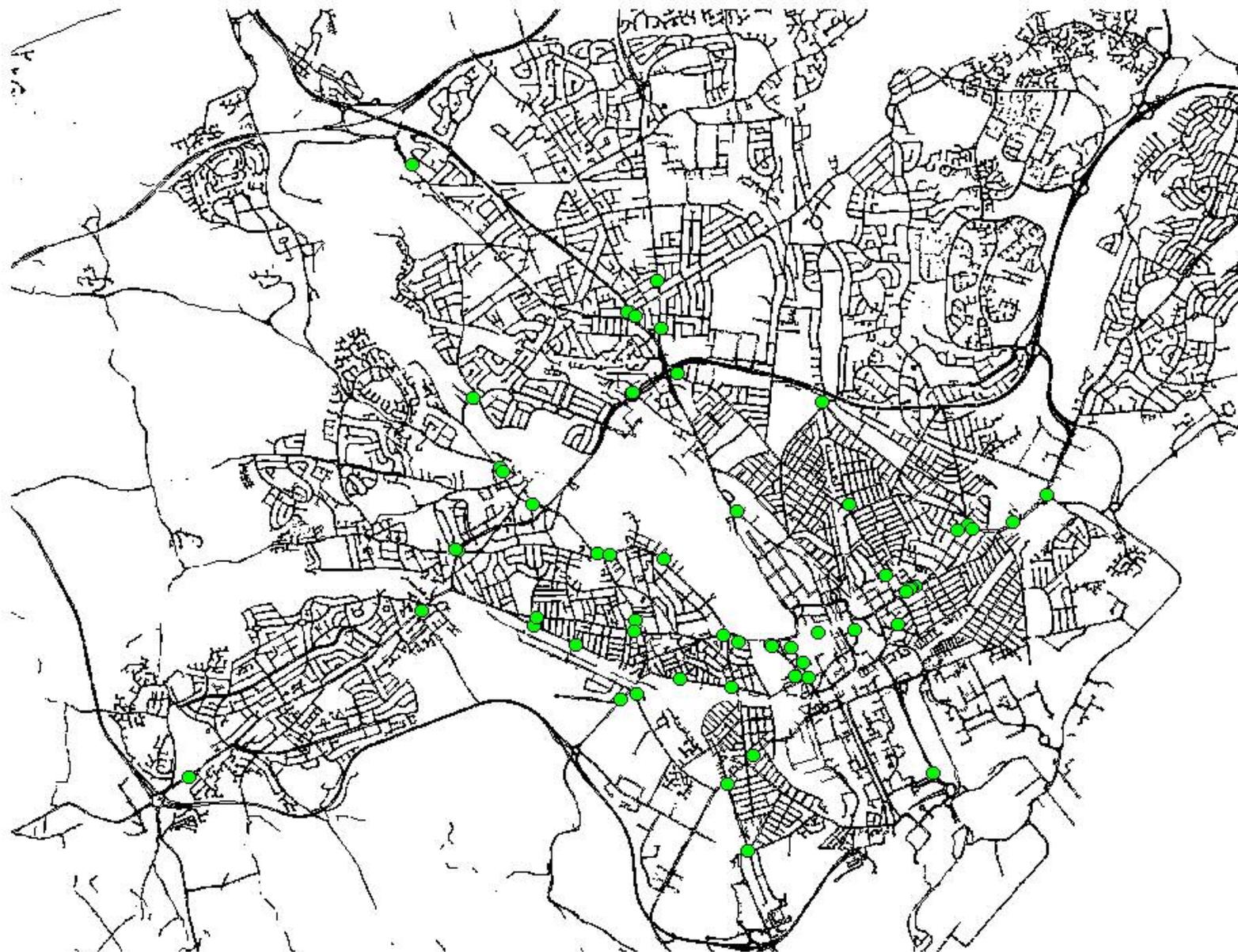
**MAPS OF MONITORING LOCATIONS
AND AIR QUALITY MANAGEMENT AREAS**

Map 1 - Automatic Monitoring Sites



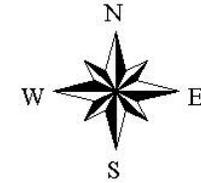
- Briardene RSC
- Cardiff Centre AURN

Map 2 - Diffusion Tube Locations 2007



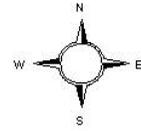
● Diffusion Tube Locations

Map 3 - St Mary Street AQMA



 AQMA Boundary

Map 4 - Ely Bridge AQMA



 Proposed
Ely Bridge AQMA

THE COUNTY COUNCIL OF THE CITY AND COUNTY OF CARDIFF

PART IV, ENVIRONMENT ACT 1995
LOCAL AIR QUALITY MANAGEMENT

ACTION PLAN PROGRESS REPORT
AUGUST 2007



1.0 Introduction

Action Plans to address the likely breaches of the nitrogen dioxide annual average Objective in The Philog, Cardiff West and Newport Road AQMAs were adopted by the Council in November 2002. There were two main groups of proposals in the Action Plans – those contained in the Councils Local Transport Plan 2000 – 2016 (LTP), and those measures which could be taken in addition to the LTP measures.

Generally, the measures in the LTP are such that their effects are not specific to any particular AQMA and the measures are more likely to influence air pollution levels city wide whereas the additional measures are specific to the AQMAs.

2.0 Progress on Implementing Action Plans

Recent progress implementing the measures contained in the Action Plans are summarised in Table 1 below.

Table 1 Progress on Implementing Action Plans

Action Plan measure/target	Original Timescale	Progress with Measure	Outcome to Date	Comments
<p><u>Bus Priority Schemes</u></p> <p>Bus priority measures at junctions</p> <p>GPS-based bus-shelter information systems</p>	<p>None given specifically – part of city-wide implementation as part of LTP.</p>	<p>More than 95% of all traffic signals in Cardiff now have selective bus priority capability. Buses appropriately equipped can trigger the priority features of the traffic control system.</p> <p>A system of Automatic Number Plate Recognition (ANPR) is now in place and is being used to help enforce motoring offences in bus lanes.</p> <p>The GPS-based bus-shelter information system is now in operation over much of the city.</p>	<p>Bus use increasing city-wide, particularly at peak times.</p> <p>New 18 metre-long “bendy-buses” have recently been introduced along some of Cardiff’s busier routes into the city centre.</p>	
<p><u>Cycling Measures</u></p>	<p>48km of cycle route in Cardiff at time of writing AQAP.</p> <p>A further 100km was expected by the end of 2002 and another 100km thereafter.</p>	<p>95km of the proposed 200km Strategic Cycle Network had been completed by the end of the 2005/6 financial year.</p> <p>The Council has also introduced “pool cycles” at County Hall</p>		<p>In conjunction with other cyclists and organisations, the Council has published a Cycle Map for Cardiff covering the cycle routes so far completed.</p>

Action Plan measure/target	Original Timescale	Progress with Measure	Outcome to Date	Comments
<p><u>Powered Two-Wheelers</u></p> <p>Investigate provision of secure parking facilities on and off street</p> <p>Evaluate opportunities for increasing priority as part of traffic management</p>	<p>None given specifically – part of LTP – but expected to have short term timescale.</p>		<p>Motorcycle parking bays currently exist around the city centre at Windsor Place, Churchill Way, Charles Street and The Hayes (to be relocated under the St David's II development)</p> <p>During the 2006/07 financial year, security rails will be added to more locations, and additional bays will be provided around the centre. The council is also considering whether to allow motorcycles to use bus lanes, a decision on this is expected imminently.</p>	<p>Use of powered two-wheelers has increased nationally, particularly in London as a result of the Congestion Charge where such vehicles are exempt from charging.</p> <p>Training schools in Cardiff and the surrounding area are very busy</p>
<p><u>ULTra (Urban Light Transport)</u></p> <p>18-month study project into feasibility of such systems underway.</p>		<p>Study completed.</p>		<p>The PRT development project ran until November 2004. Results of the study are being evaluated and additional funding is being sought for further development</p>
<p><u>Intelligent Transport Systems</u></p> <p>Implementation of SCOOT system at major junctions</p>	<p>None given specifically – part of LTP – but expected to have short term timescale.</p>		<p>A strategic management system, commissioned to improve traffic control of the highway network, is now fully operational. The system now controls over 300 junctions and more than 100 road signs.</p>	<p>In addition to controlling traffic flows and queue lengths, etc., the GPS-based bus information systems and bus priority schemes are integrated with the SCOOT system</p>

Action Plan measure/target	Original Timescale	Progress with Measure	Outcome to Date	Comments
<p><u>Air pollution monitoring integrated with SCOOT system</u></p> <p>The only viable short-term improvement measure identified in the Action Plans was the addition of air pollution monitoring equipment to the council's existing SCOOT traffic management system. The proposed system uses "Learian Streetboxes" monitoring for nitrogen dioxide which are plugged into the SCOOT system. The nitrogen dioxide concentration is used as one of the input parameters to the computer-controlled traffic management system.</p>	<p>Short-timescale project, possibly as early as the end of 2002, but more likely later</p>	<p>One unit is installed in each AQMA and fourth unit, used a reference/spare, located close to Cardiff Centre AURN</p>	<p>Streetboxes now commissioned and sending back data via the Scoot system.</p> <p>Reliable data is now being received and this will be assessed in conjunction with colleagues in traffic management to set-up the system's operational parameters for the gating of traffic during the next few months</p>	<p>There were a considerable number of "issues" with the system, most of which are related to its novel nature, hardware issues associated with long cabling runs from the Streetboxes to the UTC controllers and communication data transfer problems via the SCOOT system.</p>

3.0 Discussion

Many of the measures included in the Action Plans have reached a stage of maturity and full implementation and this, together with the revoking and varying of the three AQMAs to which the Action Plans apply in early 2007, suggests that the Action Plans should be reviewed and revised to reflect the changes made and to investigate additional measures that might be taken in respect of the Ely Bridge AQMA.

The Streetbox/Scoot system has been installed close to the Ely Bridge AQMA and it is a priority for the coming year to set the operational parameters for the system such that pollution events trigger active traffic management scenarios.

4.0 Action Plan for the St Mary Street AQMA

There is currently no formal Action Plan document for the St Mary Street AQMA, which came into force on 1st September 2002.

Development of an Action Plan was delayed due to studies into future traffic movements taking longer than expected because of the impact of the St David's II development and proposals to relocate the central bus station. Both of these developments have the potential for significant impact of traffic flows on the High Street/St Mary Street link.

The last report stated that traffic modelling for the city centre, including St Mary Street, was underway and this was taking into account impact of the proposed St David's II development, the proposed relocation of the central bus station and resultant changes to the local road network.

This work tested four scenarios for feasibility with regard to traffic movements, namely:

1. complete closure/pedestrianisation of the road link other than time-limited access for service vehicles and deliveries (much like the nearby Queen Street).
2. one-way southbound flow for buses and taxis with time limited access for service vehicles and deliveries, all private vehicles to be excluded.
3. one-way northbound flow for buses and taxis with time limited access for service vehicles and deliveries, all private vehicles to be excluded.
4. two-way flow for buses and taxis with time limited access for service vehicles and deliveries, all private vehicles to be excluded.

The modelling work was completed and this concluded that the only viable option for traffic flows in the city centre is scenario 4.

Due to the pressing need for action to improve air quality along the road link, progress has been rapid to the extent that works to implement the scenario began in March 2007. The works are being implemented in three phases as follows:

1. *Phase 1, March 2007:*
Build outs to enable improved pedestrian access to Cardiff Castle across Castle Street adjacent to the High Street/Castle Street Junction.
2. *Phase 2, August 2007:*
Experimental Traffic Order came into force on 6th August 2007. This closes the High Street/St Mary Street road link to all private vehicles at all times of day and night. Two-way flow of buses, taxis and pedal cycles remains. Delivery vehicles are permitted access to High Street/St Mary Street between 6:00pm and midday only, access being made only via Westgate Street.
3. *Phase 3, April 2008:*
Assessment of the experimental Traffic Order's effectiveness and implementation of streetworks works on High Street/St Mary Street following detailed design to build-out footpaths improve street scene.

Other works are planned at the Wood Street/Havelock Street end of Westgate Street to create a one-way gyratory system.

The Council anticipates submitting a formal Air Quality Action plan for the St Mary Street AQMA in autumn 2007.